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A
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—
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M D C C X C I.

T O

ALEXANDER MONRO, M. D.

FELLOW OF THE ROYAL SOCIETY,

OF THE COLLEGES OF PHYSICIANS AND SURGEONS,

AND PROFESSOR OF PHYSIC, ANATOMY, AND SURGERY,

IN THE UNIVERSITY OF EDINBURGH.

S I R,

THE great number and variety of books necessary for Students in Anatomy, especially as most of these books were 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 two Editions, in the space of a very few years.

MR

MR CREECH, whose indefatigable zeal for promoting literature, and the interests of this University, is well known, bought, among other valuable purchases at the late Mr Elliot's sale, the copy-right of the following Work; and the urgent demand for a third Edition induced him to put each of the volumes under 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,
how-

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, the original Publisher, Mr Elliot, had taken erroneous translations. The Editor, who directed the choice of the books, 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 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 eight 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

mer

mer 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,

S I R,

Your most obedient humble Servant,

JOHN ROTHERAM.

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INTRODUCTION.

A COMPENDIOUS VIEW of the PARTS of the HUMAN BODY.

Introduction.

THE human body is composed of firm and liquid parts, commonly called *solids* and *fluids*. Of the solid parts some are hard, others soft and flexible.

The solid parts are the chief subject of anatomy properly so called; by which term, borrowed from the Greek, we understand not only an artful decomposition of the parts of the body, but also a methodical demonstration and description of the several parts when dissected.

The history of the fluid parts comes into a system of anatomy, only occasionally; because it properly belongs to what is called *physiology*, or the *animal economy*.

Anatomists ordinarily reduce all the solid parts under certain general classes, expressed by the common or general names of *bone*, *cartilage*, *ligament*, *fibre*, *membrane*, *vessel*, *artery*, *vein*, *nerve*, *muscle*, *gland*, *fat*, *viscus*, *organ*, &c. *.

These terms are anatomical words, which express several parts that have nearly the same structure to outward appearance;

* The ancients, who settled a general division of the parts of the human body, from the mere outward appearance of the structure, called some *familiar* or *simple*, and the rest *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 *laminae*, 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 portions

tions of membranes, especially when they are very thin, are called *pelliculæ*; and some membranous laminæ are united together by the intervention of a particular substance, composed of this sort of pellicles, and called *the cellular or spongy substance*.

Vessels are tubes, ducts, or canals, more or less flexible, composed of different membranes, the strata of which are generally termed *tunicæ* or *coats*. Some of them are divided into branches, and these again into rami and ramifications, which gradually diminish, but still remain hollow.

The general design of the vessels is to contain fluids; from the diversity of which, they are distinguished into blood-vessels, *vasa lactea*, *lymphatica*, &c. The last and smallest extremities of all sorts of vessels are generally termed *capillaries*.

The *blood-vessels* are of two kinds; one of which receives the blood from the heart, and distributes 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 some of these have the name of *sinuses*.

The arteries are thicker than the veins, and may be distinguished by this mark in dissected dead bodies; and in living bodies they are known by a certain beating, called the *pulse*. The trunks of the veins lie nearer the surface of the body than the arteries, and are furnished with valves, that is, with small membranous sacculi, fixed at different distances to the sides of their cavities. The openings of these valves are broad, and turned toward the heart; but their bottoms are turned the contrary way. In some places these valves are single, in others double, triple, &c.

By *nerves*, anatomists mean the white ropes which proceed from the cerebrum, cerebellum, and spinal 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 consistences, 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 conformation, 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 part 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,

viale, by communication; ramus frontalis of the orbital 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, fides, 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 *checks* 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; sinus orbitarius.

The *nerves* of the forehead are: Nervus orbitarius five ophthalmicus; nervus maxillaris superior; 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 posterior external jugular; vena frontalis, and vena angularis, which are branches of the vena fascialis; sinus orbitarius; vena jugularis interna, by communication.

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

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

The *veins* belonging to the nose have their names corresponding with those of the arteries.

The *nerves* which go to each side of the nose are: Nervus olfactorus; nervus orbitarius five ophthalmicus, both immediately and by communication; nervus maxillaris superior; 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 duræ 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 sympathicus 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 sympathicus 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 passages 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: Arteriæ carotides internæ; arteriæ vertebrales.—The arteries of the dura mater are, the arteriæ duræ matris, mediæ maximæ, &c. The veins of the brain run to the sinuses, and these end in the venæ jugulares internæ.

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 musculli cutanei, sterno-mastoidæi, sterno-hyoidæi, thyro-hyoidæi omo-hyoidæi, splenius complexus, the musculi vertebrales, which lie upon the first seven vertebræ, and a portion of the medulla spinalis.

The *arteries* which go to the neck are: Arteriæ carotides externæ, and internæ; arteriæ vertebrales; arteriæ cervicales.

The *veins* belonging to the neck are: Venæ jugulares in

general; venæ jugulares externæ, and internæ; venæ cervicales; venæ 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 vertebræ of the back, both outwardly and inwardly.

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

The external parts of the thorax, besides the skin and membrana adiposa, are principally the mammæ, and the muscles which cover the ribs and fill the spaces between them. In the mammæ we see the papillæ 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 ancients called the *middle venter*; but the moderns name it simply *the cavity of the breast*. This cavity is lined by a membrane named *pleura*, 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: Arteriæ and venæ thoracicæ, superiores and inferiores; arteriæ and venæ mammariæ, internæ and externæ; arteriæ and venæ intercostales, superiores and inferiores; arteriæ and venæ 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 cristæ 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 spinæ, &c.

The space between the anus and the parts of generation is called *perinaum*; 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 *peritonaum*. 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: *Arteriæ epigastricæ superiores*, which are the lowest portions of the *mammariæ internæ*; *aorta inferior*; *arteria cæliaca*; *arteria mesenterica superior*; *arteriæ renales*, called formerly *emulgentes*; *arteriæ spermaticæ*; *arteria mesenterica inferior*; *arteriæ lumbares*; *arteriæ iliacæ*; *arteriæ hypogastricæ*; *arteriæ epigastricæ inferiores*; *arteriæ hæmorrhoidales*; *arteriæ pudicæ*.

The principal *veins* of the abdomen are: The inferior portions of the *venæ mammariæ internæ*; *venæ renales*; *venæ lumbares*; *venæ spermaticæ*; *venæ iliacæ*; *venæ hypogastricæ*; *vena mesaraica minor*, five *hæmorrhoidales internæ*; *vena mesaraica major*; *vena splenica*; *vena portæ ventralis*; *vena portæ 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 femi-lunar or plexiform ganglions; plexus stomachicus; plexus hepaticus; plexus splenicus; plexus renalis; plexus me-sentericus 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 latif-simus dorsi. The elbow answers to the olecranium; 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 axilla-ris; arteria humeralis; arteriæ scapulares; arteria articu-laris; arteria brachialis; arteriæ collaterales; arteria cubi-talis; arteria radialis; arteria interossea anterior; arteriæ interossee posteriores. The superficial and deep arches in the palm of the hand.

The *veins* of the upper extremity are: Areolæ ve-nosæ

nosæ dorsi manus; vena salvatella, five auricularis; vena cephalica cubiti, five radialis; venæ cubiti fatellites; vena basilica cubiti, five ulnaris; vena mediana, or major; vena mediana cephalica; vena mediana basilica; vena profunda cubiti; vena profunda superior; venæ fatellites arteriæ brachialis; vena brachii cephalica; vena brachii basilica; venæ musculares; venæ 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 glutæus maximus, two vasti, crureus, biceps, triceps, femi-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 glutæa, a branch of the hypogastrica; arteria sciatica, by communication; arteria pudica, by communication; arteria circumflexa externa; arteria circumflexa interna; arteria vasa; arteria cruralis; arteria poplitea; arteria tibialis anterior; arteria tibialis posterior; arteria peronæa; arteria plantaris.

The *veins* of the lower extremity are: Vena plantaris; vena parva saphena; vena magna saphena; venæ tibiales; venæ fibulares; vena poplitea; vena sciatica; vena glutea: venæ 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, five popliteus internus; nervus sciaticus externus, five 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
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VOL. I.

A

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 *phenomena* 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 to 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 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 reasoning 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 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 colleges 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
S Y S T E M
O F
A N A T O M Y,
WITH THE
P H Y S I O L O G Y.

P A R T I.
O F T H E
H U M A N B O N E S.

C H A P. 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. I. p. 16.

When we attempt to tear off the periosteum from bones, we see a great number of white threads produced from the membrane into them; and, after a successful injection of the arteries with a red liquor, numerous vessels are not only seen on the periosteum (*c*), but most of the fibres sent from the membranes to the bone, shew themselves to be vessels entering it, with the injected liquor in them; and when they are broken, by tearing off the periosteum, the surface of the bone is almost covered with red points.

The veins corresponding to these arteries are sometimes to be seen in subjects that die with their vessels full of blood; though such numerous ramifications of them, as of the arteries, can seldom be demonstrated, because few of them naturally contain coloured liquors, and such liquors can difficultly be injected into them. This, however, is sometimes done (*d*).

The great sensibility of the periosteum in the deep-seated species of paronychia, in exostoses, nodi, tophi, and gummata, from a lues venerea, or whenever this membrane is in an inflamed state, is a sufficient proof that it is well provided with nerves, though they are perhaps too small to be traced upon it; and therefore it is difficult to determine, whether they are sent along with the arteries in the common way, or are derived from the tendinous fibres of the muscles expanded on the periosteum (*e*).

Vessels also pass through the periosteum to the marrow; of which more hereafter. And frequently muscles, ligaments, or cartilages, pierce through the periosteum, to be inserted into the bones.

The

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

(*d*) Sue Traité d'Osteologie, traduit de l'Anglois de Mr Menro; note in page 9.

(*e*) See the dispute about the sensibility of this and of other membranes, in Zimmerman. Dissert. de irritabilit.—Act. Gotting. vol. 2.—Haller sur la nature sensible et irritable.—Whytt's Physiolog. essay 2.—Remar. Dissert. 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 fordid 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, and 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?

O F T H E C O M P O S I T O N O F B O N E S.

THE bones are the most hard and solid parts of the body; and, like all other parts where large vessels do not enter,

ter, are generally of a white colour; only in a living creature they are bluish, which is owing to the blood in the small vessels under their surface. The less therefore and fewer the vessels are, and the thicker and firmer the bony surface covering the vessels is, the bones are whiter. Hence the bones of adults are whiter than those of children; and, in both young and old, the white colour of different bones, or of the several parts of the same bone, is always in proportion to their vessels and solidities; which circumstances ought to be regarded by surgeons, when they are to judge of the condition of bones laid bare.

Bones are composed of a great many plates (*f*), each of which is made up of fibres or strings united by smaller fibrils (*g*); which being irregularly disposed, and interwoven with the other larger fibres, make a reticular work.—This texture is plainly seen in the bones of fœtuses, which have not their parts closely compacted; and in the bones of adults which have been burnt, long exposed to the weather, or whose composition has been made loose by diseases.—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, shew the greater strength of these than of the fibres which connect them.—Numerous accurate observations of the different times in which exfoliations are made from the sides or ends of similar bones, might bid fair to determine what is the proportional force of cohesion in the two sorts of fibres.

The plates are said (*b*) to be firmly joined to each other by a great number of *claviculi*, or small bony processes, which, rising from the inner plates, pierce through some, and are fixed into the more external ones. Of these nails,

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four

(*f*) Squamæ, bractææ, laminæ.

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

(*b*) Gagliard. Anatom. ossium nov. invent. illustrat. cap. 1. obs. 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 firmly 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

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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 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 tenure 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'ostecolog. 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.

Hæmorrhagies 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*).

Or

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

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

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

(*s*) Idem, ibid.

On the internal surface of the solid parts of the bones there are orifices of canals, which pass outwards through the plates to open into other canals that are in a longitudinal direction; from which other *transverse* passages go out to terminate in other *longitudinal* canals; and this structure is continued through the whole substance of bones; both these kinds of canals becoming gradually smaller as they approach the outer surface (*t*).—These canals are best seen in a bone burnt till it is white. When it is broken transversely, the orifices of the *longitudinal* canals are in view; and when we separate the plates, the *transverse* ones are to be observed. Here, however, we are in danger of believing both these sorts of canals more numerous than they really are; because the holes made by the processes connecting the plates of bones have the appearance of the *transverse* (*u*), and the passages for the blood-vessels resemble the *longitudinal* canals. I do not know how we are to keep free of error about the *transverse* canals; but think we may distinguish between the two kinds of *longitudinal* ones: for the passages of the vessels are largest near the external surface of the bone, and every transverse section of them is circular; whereas the longitudinal canals are largest near the cancelli, and their transverse sections appear to me of a flat oval figure, which may be owing to the different momentum of the fluids conveyed in them.—The situation of the larger longitudinal canals, and of the passages of the larger vessels, makes a bone appear more dense and compact in the middle of its solid sides, than towards its outer and inner surfaces, where it is spongy.

We see marrow contained in the larger transverse and longitudinal canals just now described, and from thence judge that it passes also into the smaller ones. The drops of oil which we discover with a microscope every where on
the

(*t*) Havers Osteolog. Nov. p. 43.

(*u*) Morgagn. Advers. 2. animad. 25.

the surface of a recent bone fractured transversely, and the oozing of oil through the most solid bones of a skeleton, which renders them greasy and yellow, are a confirmation of the use of these canals. Of what advantage this distribution of the marrow through the substance of bones is, will be mentioned when the nature and use of this animal oil is inquired into.

Most bones have one or more large oblique canals formed through their sides for the passage of the medullary vessels, which are to be described afterwards.

Bones exposed to a strong fire in chemical vessels, are resolved, in the same manner as the other parts of animals, into *phlegm*, *spirit*, *volatile salt*, *fetid oil*, and a black *caput mortuum*. But the proportion of these principles varies according to the age, solidities, and other circumstances of bones. Young bones yield the largest proportion of phlegm; spongy bones afford most oil; and solid ones give most salt and black residuum.—Though this residuum can scarce be changed by the force of fire while it is in close vessels; 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 salt in it (*v*). This earth seems to be the proper constituent solid part of bones, and the other principles give it firmness and tenacity: for the quantity of the earth is so great, that, after all the other principles are separated from a bone, its former shape and size remain (*w*); but it is very brittle till it is moistened with water or oil, when it recovers some tenacity.—The increase of the proportion of earth in old peoples bones, is one reason of their being more brittle than those of young people.

Left

(*v*) Later chemists have discovered this earth to be calcareous earth saturated with phosphoric acid.

(*w*) Havers Osteolog. Nov. disc. I. p. 32.

Lest 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 immediate 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 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 analyzed, 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) Ruyfch. Thesaur. 9. num. 2. et Advers. dec. III. obs. 9.

(a) Grutzmaker Dissert. de ossium medulla.—Hallcr Element. physiolog. lib. 4. sect. 4.

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

principal use is to convey and secern this oily matter. After these arteries have pierced the solid side of a bone, they are divided into several branches; which are soon distributed every where on the internal periosteum, and afterwards spread their branches inwards on the medullary cells, and outwards through the tables of the bone.

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

The general rule of the small vessels decreasing in their capacities as animals advance in age, to which many phenomena in the animal œconomy are owing, obtains here: for though the trunks of the medullary vessels enlarge as animals turn older, yet the small branches become smaller; as is evident from injections, which cannot be made to pass near so far in these vessels 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 suppurations within bones are frequently attended, we have sufficient proof that the membranes here are sensible, and consequently have nerves distributed to them. Hippocrates (*d*) might therefore say justly, that a wound penetrating into the cavity of a bone may produce a delirium.

The vessels of the marrow, wrapt up in one common coat from the periosteum, pass through the bones by proper canals; the most considerable of which are about the middle of each bone, and are very oblique. Sometimes these

C 2

vessels

(*c*) Du Verney, Memoires de l'acad. des sciences, 1700.

(*d*) Aphorism. § 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 alledged, 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 re-assumed 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. dif. 3. p. 179.

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 liquor 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 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 lead 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 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. 2.

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 semidiameter 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 semidiameter, it follows, that the total resistance of all these fibres, or the strength of the bone, is proportional to its semidiameter, 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 matter, 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 (*b*); 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:

(*b*) Ruysch. Thesaur. 2. n. 49. Mus. anat. thec. B. repos. 2. n. 2.

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

(*k*) Rostra, glandes.

(*l*) Ιτυες, σφρυες, αμβωνες, 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 surfaces 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 furrounded 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
 VOL. I. D joined

(*m*) Κοτυλίδες, οὐμβραροι, Acetabula, pyxides, buccellæ.

joined to other bones by an immoveable articulation, there are smaller ones annexed, which afterwards become scarce distinguishable from the substance of the bone itself. These are called *epiphyses* or *appendices* (*n*). Some bones have one, others have two, three, or four of those appendices annexed by the means of cartilages, which are of a considerable thickness in children, but by age become thinner, the ossification proceeding from the end of the bone on one side, and from the epiphyses on the other, till at last, in adults, the place of their conjunction can scarcely be seen on the external surface; and it is only sometimes that we can then see any mark of distinction in the cancelli (*o*).

Several processes (*e. g.* *trochanters* of the thigh, *spine* of the scapula, &c.) have *epiphyses*; and processes frequently rise out from epiphyses; for example, at the lower end of the femur, ulna, tibia, &c. (*p*).

The epiphyses are united chiefly to such bones as are destined for frequent and violent motion; and for this purpose they are wisely framed of a larger diameter than the bone they belong to: For, by this means, the surface of contact between the two bones of any articulation being increased, their conjunction becomes firmer, and the muscles inserted into them act with greater force by reason of their axes being further removed from the centre of motion. These advantages might indeed have been obtained by the expansion of the end of the bone itself to a thickness equal to that of the epiphyses; but then the constant separation of new plates to form so wide a cellular structure, must have left the solid sides of the bones so thin as to yield easily, either to the action of the muscles fixed to them and passing over them, to the weight several of them are obliged

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

(*o*) *Willow, Exposition anatomique de corps humain, traité des os secs,*
§ 116.

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

ged 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 em-

D 2

bryos

(*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 similarity 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*) Hales's Vegetable statics, p. 293.—Du Hamel. Memoires de l'acad. des sciences, 1742.

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

(*u*) Memoires de l'acad. des sciences, 1743.

The ossification of bones depends principally on their vessels being so disposed, and of such diameters, as to separate a liquor, which may easily turn into a bony substance, when it is deprived of its thinner parts; as seems plain from the observation of the callous matter separated after fractures and ulcers, where part of the bone is taken out: For, in these cases, the vessels extending themselves, and the liquors added to them, are gradually formed into granulated flesh; which fills up all the space 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 diseased bone are at a considerable distance from each other (*v*).

The induration of bones is also greatly assisted by their being exposed, more than any other parts, to the strong pressure of the great weights they support, to the violent contraction of the muscles 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 pressing force, the solid fibres and vessels of bones are thrust closer, and such particles of the fluids conveyed in these vessels as are fit to be united to the fibres are sooner and more firmly incorporated with them, while the remaining fluids are forcibly driven out by the veins, to be mixed with the mass of blood. In consequence of this, the vessels gradually diminish as the bones harden. From which again we can understand one reason why the bones of young animals sooner re-unite after a fracture than those of old, and why cattle that are put too soon to hard labour seldom are of such large size as others of the same brood who are longer kept from labour.

That

(*v*) Hildan. de vuln. gravif.—Med. essays, vol. I. art. 23.—Job a Meckren, obs. 69.—Mem. de l'acad. des sciences, 1742.—See a collection of such cases in Bochner de ossium 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 vertebræ of the back very often change into complete bones; and, being intimately united with the vertebræ, 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 is, 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.—Garengot, 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 alledged, 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, makes these prints stronger in the bones of those who had much labour and exercise, than they are in people who have led an indolent 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 their growing big. Nay, it has been observed, that much use of such spirits has occasioned

ed parts, naturally 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 (*b*).

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

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

(*c*) Philosoph. transact. n^o 442. art. 8. n^o 443. art. 2. n^o 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. — Philosoph. transf. n^o 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.

(*b*) Ruyfch. Thesaur. 2. arc. 5. thes. 3. loc. 1. n^o 5. thes. 9. n^o 2. not. 5. — Bochmer 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-

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ture,

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

(*k*) Mem. de l'acad. 1747.

(*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. 37. et cent. 6. obs. 68. — Philosoph. transact. n^o 494. § 21.

(*n*) Saltzman, Obs. decur. obs. 6. — Memoires de l'acad. de chirurgie, tom. 2. p. 155. — Bochner 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 Eyffonius (*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
moistened

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

(*p*) De ossibus fetus abortivi.

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

(*r*) Human osteogeny explained.

(*s*) Icones ossium fetus humani; accedit osteogenæ brevis historia.

moistened 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 disjoined 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 neces-

E 2

sary

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

fary to retain, since they serve to express the various circumstances of the articulations, and to understand the writers on this subject.

The ARTICULATIONS are most commonly divided into three classes, *viz.* Symphysis, Synarthrosis, and Diarthrosis.

I. SYMPHYSIS, which properly signifies the conception or growing together of parts, when used to express the articulations of bones, does not seem to comprehend, under the meaning generally given to it, any thing relating to the form or motion of the conjoined bones; but by it most authors only denote the bones to be connected by some other substance; and as there are different substances which serve this purpose, therefore they divide it into the three following species.

1. *Synchondrosis* (*u*) when a cartilage is the connecting substance: thus the ribs are joined to the sternum; thus the bodies of the vertebræ are connected to each other; as are likewise the ossa pubis.

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

3. *Syffarcosis*, when muscles are stretched from one bone to another, as they must be where there are moveable joints.

II. The second class of articulations, the SYNARTHROSIS, which is said to be the general term by which the immoveable conjunction of bones is expressed, 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
sewed

(*u*) Amphiarthrosis.

(*x*) Ὀσση.

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; so that they mutually force themselves into the intersices of each other, till, meeting with such resistance as they are not able to overcome, they are stopped from sprouting out farther, or are reflected; and therefore these indentations are very different both in figure and magnitude: thus the bones of the head are joined; thus epiphyses 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; scarce any unmoved bones being joined by plain surfaces (*y*).

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

3. *Schindylesis* or *ploughing* (*a*), when a thin lamella of one bone is received into a long narrow furrow of another: thus the process azygos of the sphenoid, and the nasal process of the ethmoid bone, are received by the vomer.

III. The third class, or *DIARTHROSIS* (*b*), is the articulation where the bones are so loosely connected as to allow large motion. This is subdivided into three kinds.

1. *Enarthrosis*, or the ball and socket, 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 superficial cavity; as in the articulation of the arm bone and scapula. These two species of diarthrosis allow motion to all sides.

3. *Gin-*

(*y*) Vesal. observ. Fallop. examen.

(*z*) Conclavatio.

(*a*) Keil's Anat. chap. 5. sect. 3.

(*b*) *Ἀρθρώσεις*, Diarticulatio, abarticulatio.

3. *Ginglimus* (*c*), which properly signifies 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 some (*d*) give the name of *contiguous* (*e*), *distant* (*f*), and *compound* (*g*).

The first kind of *ginglimus* is when a bone has several protuberances and cavities, which answer to as many cavities and processes of the other bone with which it is articulated; as in the conjunction of the femur with the tibia.

The second species is, when a bone receives another at one end, and is received by the same bone at the other end; as in the radius and ulna.

The last sort is, when a bone receives another, and is received by a third; as in the oblique processes of the vertebræ.

When I first mentioned the articulations of bones, I said there were different opinions concerning the use of their technical names; *e. g.* It has been said, that *symphysis* should be the name for the immoveable articulations, and *synarthrosis* should be understood to be the conjunction of bones by some connecting medium.—Those who have taken *symphysis* in the sense I did, of its expressing the conjunction of bones with a connecting substance, have disagreed in their definition of it; some inserting, and others leaving out, its allowing motion. When they have agreed in their definition, they have not been of the same mind concerning the species of it: for several think the *syssarcosis* and *syndesmosis* applicable to so many joints which are
universally

(*c*) *Articulatio mutua*.

(*d*) Baker, *Curs. Osteolog. demonstr. I.*

(*e*) *Proximus*.

(*f*) *Longus*.

(*g*) *Compositus*.

universally allowed to be 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

often confined or enlarged by some other cause not immediately 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; astragalus 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 (*b*), 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

(*b*) De corp. human. fabrica, lib. 1. 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 ginglymus.

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

The third sort of ginglymus 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 vertebræ by their oblique processes; of the ribs with the bodies and transverse processes of the vertebræ; of the radius with the ulna, tibia with the fibula, astragalus with the calcaneum, &c.

I would entirely throw out what is commonly called the third kind of ginglymus: 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 preserve them in a flexible state. Seeing, then, these parts are so necessary to the articulations, I shall next consider their structure, situation, and uses, so far as they are subservient to the bones and their motions.

OF THE LIGAMENTS.

LIGAMENTS (*i*) are white flexible bodies, thicker and firmer than membranes, and not so hard or firm as cartilages, without any remarkable cavity in their substance, difficultly stretched, and with little elasticity; serving to connect one part to another, or to prevent the parts to which they are fixed from being removed out of that situation which is useful and safe.

After maceration in water, the ligaments can easily be divided; and each ligamentous layer appears composed of fibres, the largest of which are disposed in a longitudinal direction.

The arteries of ligaments are very conspicuous after a tolerable injection, and the larger trunks of their veins are sometimes to be seen full of blood.

Such ligaments as form the sides of cavities, have numerous orifices of their arteries opening upon their internal surface, which keep it always moist. If we rub off that moisture, and then press the ligament, we can see the liquor oozing out from small pores; and we can force thin liquors injected by the arteries into the cavities formed by ligaments.

These exhalent arteries must have corresponding absorbents, otherwise the cavities would soon be too full of liquor.

Ligaments, then, must be subject to the diseases common to other parts, where there is a circulation of fluids, allowance

(*i*) Συνδεσμοί, νεύροι, 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 motions 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^o 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*) Χονδροί.

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^o 442. art. 8. N^o 443. art. 2. N^o 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.

(*o*) Havers Osteolog. Nov.

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

&c.—To these cartilages 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 vertebræ, &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.

O F

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

(*r*) Hildan. de ichor. et melicer. acri Celsi, cap. 5.—Ruyseh, Thef. 8. N^o 103.—Saltzman, in Act. Petropoit. 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 of 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 (*r*).

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

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

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

Upon preſſing any of theſe glands with the finger, a mucilaginous liquor may be ſqueezed out of their excretories, which ſomewhat reſembles the white of an egg or ſerum of the blood; but it is manifeſtly ſalt to the taſte. It does not coagulate by acids nor by heat, as the ſerum does; but by the latter turns firſt thinner, and, when evaporated, leaves only a thin ſalt film.

The quantity of this mucilage, conſtantly ſupplied, muſt be very conſiderable, ſince we ſee what a plentiful troubleſome diſcharge of glary matter follows a wound or ulcer of any joint: of which liquor the mucilage is a conſiderable part.

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

In a ſound ſtate, we are not conſcious of any ſenſibility in thoſe glands: but, in ſome caſes which I have ſeen, when they inflame and ſuppurate, the moſt racking pain is felt in them; a melancholy, though a ſure, proof that they have nerves.

Theſe mucilaginous glands are commonly lodged in a cellular ſubſtance; which is alſo to be obſerved in other parts of the bag formed by the ligaments of the articulation; and which contains a fatty matter, that muſt neceſſarily be attenuated, and forced through the including membranes into the cavity of the joint, by the preſſure which it ſuffers from the moving bones.

If, then, the oil is conveyed from this cellular ſubſtance; and if the attenuated marrow paſſes from the cancelli of the bones by the large pores near their ends, or in their cavities, and ſweats through the cartilages there into the articulations; which it may, when aſſiſted by the conſtant

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 a 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.

(*b*) *Mυξα*, 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 ſinuouſ ulcers, and fiſtulæ, rotten bones, immobility of the joints, marcor and atrophia of the whole body, heſtic 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*)

(*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 Celfi.

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

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

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

C H A P. II.

Of the S K E L E T O N.

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, from their common centre of gravity, falls in the middle of their com-

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(a) Cadaveris crates.

common base (*b*). On this account, we can support ourselves as firmly as if the axis of all the bones had been a straight line perpendicular to the horizon; and we have much greater quickness, ease, and strength, in several of the most necessary motions we perform. It is true, indeed, that wherever the bones, on which any part of our body is sustained, decline from a straight line, the force required in the muscles to counteract the gravity of that part is greater than was otherwise necessary: But then this is effectually provided for in such places, by the number and strength of the muscles. So long, therefore, as we remain in the same posture, a considerable number of muscles must be in a constant state of contraction; which we know, both from reason and experience, must soon create an uneasy sensation. This we call *being weary of one posture*: An inconvenience that we should not have had in standing erect, if the bearing of all the bones to each other had been perpendicular; but it is more than compensated by the advantages above mentioned.

The human skeleton 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 spheroidal part which is placed above the first bone of the neck. It therefore comprehends the cranium and bones of the face.

§ I. The CRANIUM.

THE cranium (*c*), helmet, or brain-case, consists of several pieces, which form a vaulted cavity, for lodging and defending

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

(*c*) Κεφαλος, κυτος, & δε.α, σκαυιν, calva, calvaria, cerebri galea, theca, et olla capitis, testa capitis, scutella 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.

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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

performing the operation of the trepan; 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

(*e*) Meditullium, commissura.

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

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

mon 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* (*b*) future 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 *vitræ*, *coronæ*, or garlands, this future has hence got its name.—Though the indentations of this future 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*) future 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 the 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 future to terminate at the squamous futures; and what is extended at an angle down from that on each side, where the indenta-

(*b*) Στεφανία, Arcualis, puppis.

(*i*) Laudæ, proræ, hypsuloïdes.

(*k*) Vesal. Anat. lib. I. cap. 6.

tions are less conspicuous than in the upper part of the future, they called *additamentum futura lambdoidis* (l).

This future is sometimes very irregular, being made up of a great many small futures, which surround so many little bones that are generally larger and more conspicuous on the external surface of the skull than internally. These bones are commonly called *triquetra* or *Wormiana*: but some other name ought to be given them, for they are not always of a triangular figure, and older anatomists (m) than Olaus Wormius (n) have described them.—The specific virtue which these bones were once thought to have in the cure of the epilepsy (o), is not ascribed to them now; and anatomists generally agree, that their formation is owing to a greater than ordinary number of points of ossification in the skull, or to the ordinary bones of the cranium not extending their ossification far enough or soon enough; in which case, the unossified interstice between such bones begins a separate ossification in one or more points; from which the ossification is extended to form as many distinct bones as there were points, that are indented into the large ordinary bones, and into each other.—Probably those children who have a large opening in this place at their birth, will have the largest *ossa triquetra*.—To confirm this account of the formation of these little bones, we may remark, that such bones are sometimes seen in other futures, as well as in the lambdoidal (p); and they are

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

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

(n) *Musæum, lib. 3. c. 26.*

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

(p) See examples in Vesal. *lib. 1. cap. 6. fig. 4.*—Paaw in Hippocrat. *de cap. vuln.*—Bartholin. *Hist. Anat. cent. 1. Hist. 51.*—Ruyfch, *Mus. Anat.*—Suc *Trad. d'osteolog. p. 47.*

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

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*) alledge, 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 skulls 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 alledge they are (*x*).

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

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

(*r*) Ῥαβδοειδης, οβελαια, επιζυγνυσα, Instar virgæ, 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 Celf. 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*) Λεπιδειδη, προσκολληματα, κροταφαιαι, Temporales, corticales, melofoæ; harmonialis, commissuræ in unguem.

one 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 futures (*z*); and what is commonly called the posterior part of this squamous future, always has the evident serrated form; and therefore is reckoned by some (*a*) a distinct future, under the name of *additamentum posterius futurae squamosae*.—I have seen two squamous futures on the same temple, with a semicircular piece of bone between them (*b*).

We ought here to remark, that the true squamous sort of future 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 future which are continued from the anterior end of the common squamous future just now described, of which one runs perpendicularly downwards, and the other horizontally forwards, and also the lower part of the coronal future already taken notice of, may all be justly said to pertain to the squamous future.—The manner how, I imagine, this sort of future 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

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(*x*) Columb. de re anat. lib. I. cap. 4.—Dionis, Anat. 3. demonstrat. des os.

(*a*) Albin. de ossib. § 54.

(*b*) Sue Trad. d'osteol. g. p. 48.

(*c*) Vesal. Anat. lib. I. cap. 6.—Winflow, Mém. de l'acad. des sciences,

so thin, that their edges opposed to each other are not sufficiently thick to stop the extension of their fibres in length, and thus to cause the common serrated appearance of sutures explained in p. 36.; but the narrow edge of the one bone slides over the other. The squamous form is also more convenient here; because such thin edges of bones, when accurately applied one to another, have scarce any rough surface, to obstruct or hurt the muscle in its contraction; which is still further provided for, by the manner of laying these edges on each other; for, in viewing their outside, we see the temporal bones covering the sphenoidal and parietal, and this last supporting the sphenoidal, while both mount on the frontal: From which disposition it is evident, that, while the temporal muscle is contracting, which is the only time it presses strongly in its motion on the bones, its fibres slide easily over the external edges. Another advantage of this structure is, that the whole part is made stronger by the bones thus supporting each other.

The bones of the skull are joined to those of the face, by schindylesis and sutures—The schindylesis is in the partition of the nose.—The sutures said to be common to the cranium and face are five, viz. the ethmoidal, sphenoidal, transverse, and two zygomatic.—Parts, however, of these sutures are only at the junction of the bones of the skull.

The *ethmoidal* and *sphenoidal* sutures surround the bones of these names; and in some places help to make up other sutures, particularly the *squamous* and *transverse*; and in other parts there is but one suture common to these two bones.

The *transverse* suture is extended quite across the face, from the external canthus of one orbit to the same place of the other, by sinking from the canthus down the outside of
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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 future 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* futures 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 future joining them, have been called *zygomatic*.

It must be observed, that the indentations of the futures 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 futures 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 *ferræ* run into it, and leave the contiguous edges equal, and more ready to unite; whereas the *ferræ* 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 futures are obliterated (*d*). — By this mechanism,

(*d*) Hunal. 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 cucuphæ, 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 matter may be more firmly suspended by its

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

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

its processes, which insinuate themselves into this conjunction of the bones: for doing this equally, and where the greatest necessity of adhesion is, the futures are disposed at nearly equal distances; and the large 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 futures 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 futures was of great benefit to several others who were rather thought to have been hurt by it (*b*): 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.

(*b*) 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*) Μετωπυ, Βρυγμα, 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 projects 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 superciliary ridges a protuberance may be remarked, in most skulls, where there are large cavities, called *sinuses*, within the bone; of which I 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 *orbital* 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 orbital 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 pulley of the musculus obliquus major of the eye is fixed.—Between the two orbital 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 process, the surface of the frontal bone is considerably depressed where part of the temporal muscle is placed.

The *foramina*, or holes, observable on the external surface of the frontal bone, are three in each side. — One in each superciliary ridge, a little removed from its middle towards the nose; through which a twig of the ophthalmic branch of the fifth pair of nerves passes out of the orbit, with a small artery from the internal carotid, to be distributed to the teguments and muscles of the forehead. — These vessels, in some skulls, make furrows in the os frontis, especially in the bones of children, as has also been observed of another considerable vessel of this bone near its middle (*k*); and therefore we ought to beware of transverse incisions on either side of the os frontis, which might either open these vessels, or hurt the nerves, while they are yet in part within the bone: for when vessels are thus wounded, it is difficult to stop the hæmorrhagy, because the adhesion of a part of the artery to the bone hinders its contraction, and consequently styptics can have little effect; the sides of the furrow keep off compressing substances from the artery; and we would wish to shun cauteries or escharotics, because they make the bone carious; and nerves, when thus hurt, sometimes produce violent symptoms. — But to return to the superciliary foramina, we must remark, that often, instead of a hole, a notch only is to be seen: nay, in some skulls, scarce a vestige even of this is left; in others, both hole and notch are observable, when the nerve and artery run separately. Frequently a hole is found on one side, and a notch on the other; at other times we see two holes, or there is a common hole without, and two distinct entries internally. The reason of this variety of a hole, notch, depression, or smoothness, in

in the superciliary ridge, is the different length and tension of the nerves and vessels; the shorter they are, the more they are sunk into the bone as it grows.—Near the middle of the inside of each orbit, hard by or in the transverse suture, there is a small hole for the passage of the nasal twig of the first branch of the fifth pair of nerves, and of a branch of the ophthalmic artery. This hole is sometimes entirely formed in the *os frontis*; in other skulls, the sides of it are composed of this last bone and of the *os planum*. It is commonly known by the name of *orbitarium internum*, though *anterius* should be added, because of the next, which is commonly omitted.—This, which may be called *orbitarium internum posterius*, is such another as the former; only smaller, and about an inch deeper in the orbit: Through it a small branch of the ocular artery passes to the nose.—Besides these six, there are a great number of small holes observable on the outer surface of this bone, particularly in the two protuberances above the eye-brows. Most of them penetrate no further than the sinuses, or than the diploë if the sinuses are wanting; though sometimes I have seen this bone so perforated by a vast number of these small holes, that, placed between the eye and a clear light, it appeared like a sieve.—In the orbit of the generality of skeletons, we may observe one, two, or more holes, which allow a passage to a hog's bristle through the skull. The place, size, and number of these, are however uncertain: they generally serve for the transmission of small arteries or nerves.

The internal surface of the *os frontis* is concave, except at the orbital processes, which are convex, to support the anterior lobes of the brain. This surface is not so smooth as the external; for the larger branches of the arteries of the *dura mater* make some furrows in its sides and back parts. The sinuosities from the luxuriant risings of the

brain, mentioned when describing the general structure of the cranium, are often very observable 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 surface, where always in children, and sometimes in old people, the bone is divided, either a ridge stands out, to which the upper edge of the falx is fastened, or a furrow runs, in which the upper side of the superior longitudinal sinus is lodged; on both these accounts, surgical authors justly forbid the application of the trepan here.—The reason of this difference in skulls is alledged by some authors to be this, That in thin skulls the ridge strengthens the bones, and in thick ones there is no occasion for it. To this way of accounting for the phenomenon, it may justly be objected, that, generally, very thick skulls have a large spine here, and frequently thin ones have only a furrow. Perhaps this variety may be owing to the different times of complete ossification of those parts in different subjects: for if the two sides of this bone meet before they arrive at their utmost extent of growth, they unite very firmly, and all their fibres endeavour to stretch themselves out where there is the least resistance, that is, between the hemispheres of the brain. To support this reasoning, we may remark, that those adults whose frontal bone is divided by the sagittal suture, never have a ridge in this place.

Immediately at the root of this ridge or furrow, there is a small hole, which sometimes pierces through the first table, and, in other skulls, opens into the superior sinus of the ethmoid bone within the nose. In it a little process of the falx is lodged; and a small artery, and sometimes a vein, runs (*1*); and the superior longitudinal sinus begins here.—This hole, however, is often not entirely proper to the os frontis: for, in several skulls, the lower part is
formed

(1) Morgagn. Adversar. 6. animad. 31.

formed in the upper part of the base of the crista galli, which is a process of the ethmoid 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 orbital 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 medullium 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

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

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

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

sinus commonly opens by a roundish small hole, at the 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 volatile 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 their 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 Anthropolog. 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 fore 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 (g).—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 future. From the termination of the coronal future to the external angular processes, this bone is connected to the sphenoid by the sphenoidal future. At the external canthi of the eyes, its angular processes are joined by the transverse future 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 orbital processes are connected to the sphenoidal bone by that same future.—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 orbital process is indented

(g) Paaw de ossibus, pars I. cap. 7.—Palsyne Anatom.-chir. traité 4. chap. 15. Nouvelle Osteologie, partie 2. chap. 3.

(r) Fernel Patholog. 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 future 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 orbital 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*) Κορυνη, Paria sincipitis, verticis, arcualia, uervalia, cogitationis, rationis, bregmatis, madefactionis.

rence towards a centre. From this ridge of each bone the temporal muscle rises: and, by the pressure of its fibres, occasions the furrows just now mentioned—Below these we observe, near the semicircular edges, a great many risings and depressions, which are joined to like inequalities on the inside of the temporal bone, and form the squamous future. The temporal bone may therefore serve here as a buttress, to prevent the lower side of the parietal from starting outwards when its upper part is pressed or struck (*u*).

Near the upper sides of these bones, towards the hind part, is a small hole in each, through which a vein passes from the teguments of the head to the longitudinal sinus. Sometimes I have seen a branch of the temporal artery pass through this hole, to be distributed to the upper part of the falx, and to the dura mater at its sides, where it had frequent anastomoses 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 several skulls, one of the ossa parietalia has not this hole: In others, there are two in one bone; and in some, not one in either. Most frequently this hole is through both tables; at other times the external table only is perforated.—The knowledge of the course of these vessels may be of use to surgeons when they make any incision near this part of the head; lest, if the vessels are rashly cut near the hole, they shrink within the substance of the bone, and so cause an obstinate hæmorrhagy, which neither ligatures nor medicines can stop.

On the inner concave surface of the parietal bones, we see a great many deep furrows, disposed somewhat like the branches of trees: the furrows are largest and deepest at

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 upper 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 structure 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 *uses* besides those mentioned in the description of their several parts, except what are included in the account of the general structure of the cranium.

In a child born at the full time, none of the sides of this bone are completed; and there never is a hole in the ossified part of it near to the sagittal suture.

The large unossified ligamentous part of the cranium, observable 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 serve for the evacuation of the superfluous moisture of the brain: and therefore they named it *bregma* (*y*), or the fountain; sometimes adding the epithet *pulsatilis*, or beating, on account of the pulsation of the brain felt through this flexible ligamento-cartilaginous substance. Hence the parietal bones are very frequently called *ossa bregmatis*.

The upper middle part of the head of a child, in a natural birth, being what presents itself first 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 stretched, and the pulsation of the brain is felt through it, the child is certainly alive: but if it is shrivelled and flaccid, and without any observable pulsation in it, there is some reason to suspect the child to be very weak, or dead. Those who practise midwifery should therefore examine the state of the bregma accurately.

All the bregma is generally ossified before seven years of age. Several authors (*a*) say, they have observed it unossified in adults; and physicians, who order the application of medicines at the meeting of the coronal and sa-

K 2

gittal

(*y*) Palpitans vertex, foliolum, foliunt, triangularis lacuna.

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

§ 5.

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

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

O S S A T E M P O R U M.

OSSA TEMPORUM (*b*), so named, say authors, from the hair's first becoming gray 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 *mastoïdes* 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*) Κροταφον, κορσων, κορρων, λεπιδοειδη, πολυειδη, λιθοειδη, Temporalia, lapidosa, mendosa, dura, arcualia, tympanum, armalia, saxea, parietalia.

(*c*) Albin. de ossib. scēt. 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 malæ; 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 antient *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-hyoideus*, *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 fore-part, there

(d) Paris, anfr. ossium temporum, ossa arcualia, paria, jugalia, conjugalìa.

(e) Γραιφοειδη, βελουειδη, πληκτρον, Os calaminum, sagittale, clavale, acnale, 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 styloid, 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 chimney-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.

(*g*) Hunauld. in Mem. de l'acad. des sciences, 1720.

—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* (*b*).—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-mastoidcum* (*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

(*b*) Πόρος της ακοης, οπη των αυτων, fenestra aurium.

(*i*) Aquæductus Fallopii.

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

to the temporal and occipital bones; and in several skulls there is no such hole. The use of it, when found, is for the transmission of a vein from the external teguments to the lateral sinus: But, in some subjects, a branch of the occipital artery passes through this hole, to serve the back-part of the dura mater; in others, I have seen two or three such holes: but they are oftener wanting than found. And we may, once for all, in general remark, that the largeness, number, situation, and existence of all such holes as for the most part allow only a passage for veins from without to the internal receptacles, are very uncertain.

The internal surface of the *ossa temporum* is unequal; the upper circular edge of the squamous part having numerous small ridges and furrows for its conjunction with the parietal bones; and the rest 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 surface, a larger transverse hard craggy protuberance runs horizontally inwards and forwards, with a sharp edge above, and two flat sides, one facing obliquely forwards and outwards, and the other as much backwards and inwards. To the ridge between these two sides, the large lateral process of the dura mater is fixed.

Sometimes a small bone, like the sesamoid, is found between the small end of this petrous process and the sphenoid bone (1).

Towards the back-part of the inside of the temporal bone, a large deep fossa is conspicuous, where the lateral sinus lies; and frequently on the top of the petrous ridge, a furrow may be observed, where a small sinus is situated.

The

(1) Riolan. Comment. de ossib. cap. 32.——Winflow, Exposition anatomique de corps humain. trait. des os secs, § 266.

The internal proper *foramina* of each of these bones are, first, the internal meatus auditorius in the posterior plain side of the petrous process. This hole soon divides into two; one of which is the beginning of the aqueduct of Fallopius; the other ends in several very small canals (*m*) that allow a passage to the branches of the portio mollis of the seventh pair of nerves, into the vestibule and cochlea. Through it also an artery is sent, to be distributed to the organ of hearing.—The second hole, which is on the anterior plain side of the craggy process, gives passage to a reflected branch of the second branch of the fifth pair of nerves, which joins the portio dura of the auditory nerve, while it is in the aqueduct (*n*), small branches of blood-vessels accompanying the nerves, or passing through smaller holes near it.—The passage of the cutaneous vein into the lateral sinus, or of a branch of the occipital artery, is seen about the middle of the large fossa for that sinus; and the orifice of the canal of the carotid artery is evident at the under part of the point of the petrous process.

Besides these proper holes of the temporal bones which appear on their external and internal surfaces, there are two others in each side that are common to this bone, and to the occipital and sphenoidal bones; which shall be mentioned afterwards in the description of these bones.

The upper round part of the squamous bones is thin, but equal; while the low petrous part is thick and strong, but irregular and unequal, having the distinction of tables and diploë confounded, with several cavities, processes, and bones within its substance, which are parts of the organ of hearing. That a clear idea may be had of this beautiful, but intricate organ, anatomists generally choose to demonstrate all its parts together. I think the method good; and

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therefore,

(*m*) Valsalva 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 futures and their posterior additamenta: Before, to the sphenoid bone, by the future of that name; to the cheek bones, by the zygomatic futures: Behind, to the occipital bone, by the lambdoid future 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 OCCIPTIS.

Os OCCIPTIS (*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*) Ἰνιον, Basilare, proæ, memoriæ, pyxidis, fibrosum, nervosum, lambde.

above is generally a little rounded; the two lateral angles are more finished, but obtuse; and the lower one is stretched forward in form of a wedge, and thence is called by some the *cuneiform* process.—If one would, however, be very nice in observing the several turns which the edges of the os occipitis make, five or seven sides, and as many angles of this bone, might be described.

The external surface is convex, except at the cuneiform apophyse, where it is flattened. At the base of this triangular process, on each side of the great hole, but more advanced forwards than the middle of it, the large oblong protuberances, named the *condyles*, appear, to serve for the articulation of this bone with the first vertebra of the neck. The smooth surface of each of these condyloid processes is longest from behind forwards, where, by their oblique situation, they come much nearer to each other than they are at their back-part. Their inner sides are lower than the external, by which they are prevented from sliding to either side out of the cavities of the first vertebra (*p*). In some subjects, each of these plain smooth surfaces seems to be divided by a small rising in its middle; and the lower edge of each condyle, next the great foramen, is discontinued about the middle, by an intervening notch: Whence some (*q*) alledge, that each of these apophyses is made up of two protuberances. Round their root a small depression and spongy roughness is observable, where the ligaments for surrounding and securing 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 mechanism it is evident, that the muscles which pull the head back must be in a constant state of contraction; which is stronger than

L 2

the

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

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

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 across 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

of different sides, or rather is owing to the action of the muscles depressing the bone on each side of it, while this part is free from their compression. These prints of the muscles on this bone are very strong and plain in some subjects, but are not so distinct in others. All round the great foramen, the edges are unequal, for the firmer adhesion of the strong circular ligament which goes thence to the first vertebra. One end of each lateral or moderator ligament of the head, is fixed to a rough surface 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 depressions are made in the external surface of the cuneiform process, for the insertion of the recti anteriores minores muscles, which are unjustly ascribed to Cowper: And still farther forward, near the sphenoid bone, are two other such depressions, for the reception of the recti anteriores majores. When we consider the size of the prints of muscles on the occipital bone, before and behind its condyles, and at the same time compare their distances from these centres of motion of the head, we must see how much stronger the muscles are which pull the head backwards, than those which bend it forward; and how much greater force the former acquire by the long lever they act with, than the latter which are inserted so near the condyles. This great force in the extensor muscles is altogether necessary, that they might not only keep the head from falling forward in an erect posture, but that they might support it when we bow forward in the most necessary office of social 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 surface of the os occipitis we see two *ridges*; one standing perpendicularly, the other running horizontal-
ly

ly 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 condylæ, we always find a hole, sometimes two, which soon unite again into one, that opens externally;

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

(*s*) Albin. de ossib. sect. 65.

(*t*) Rachitidis, Medullæ spinalis.

externally; 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 obtuse 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 off injuries; and the ridges and spines, which are frequent here, make it sufficiently strong to resist ordinary forces. †

The

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

The occipital bone is *joined* above to the ossa parietalia, and to the triquetra, when present, by the lambdoid suture; —laterally to the temporal bones, by the additamenta of the lambdoid suture — below to the sphenoid bone, by the end of its cuneiform process, in the same way that epiphyses and their bones are joined: For in children a ligamentous cartilage is interposed between the occipital and sphenoid bones, which gradually turns thinner as each of the bones advances, till their fibres at last run into each other; and, about sixteen or eighteen years of age, the union of these two bones becomes so intimate, that a separation cannot be made without violence.—The os occipitis is joined by a double articulation to the first vertebra of the neck, each condyle being received into a superior oblique process of that vertebra. What motion is allowed here we shall consider afterwards, where the vertebræ are described.

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

An infant, born at the full time, has this bone divided, by unossified cartilages, into four parts.—The first of these is larger than the other three, is of a triangular shape, and constitutes all the part of the bone above the great foramen. Fissures generally appear in the upper part and sides of this triangular bone, when all the cartilage is separated by maceration; and sometimes little distinct bones are seen towards the edges of it.—The second and third pieces of this bone are exactly alike, and situated on each side of the great foramen, from which the whole condyles are nearly produced; and they are extended forwards almost to the fore part of the hole for the ninth pair of nerves.—The fourth piece is the cuneiform process, which forms a small share of the great hole, and of those for the ninth pair

pair of nerves and of the condyles; betwixt it and the sphenoid bone, a cartilage is interposed.

Of the eight bones which belong to the cranium, there are only two which are not yet described, viz. the *ethmoid* and *sphenoid*. These we already mentioned, in compliance to the generality of writers on this subject, as bones common to the cranium and face, because they enter into the composition of both; but the same reason might equally be used for calling the frontal bone a common one too. I shall, however, pass any idle dispute about the propriety of ranging them, and proceed to examine the structure of the bones themselves.

OS ETHMOIDES.

OS ETHMOIDES (*u*), or the *sieve-like* bone, has got its name from the great number of small holes with which that part of it first taken notice of is pierced. When this bone is entire, the figure of it is not easily described; but, by a detail of its several parts, some idea may be afforded of the whole; and therefore I shall distinguish it into the *cribriform lamella* with its process, the *nasal lamella*, *cellulae*, and *ossa spongiosa*.

The thin horizontal lamella is all (except its back-part) pierced obliquely by a great number of small holes, through which the filaments of the olfactory nerves pass. In a recent subject, these holes are so closely lined by the dura mater, that they are much less conspicuous than in the skeleton: From the middle of the internal side of this plate, a thick process rises upwards; and being highest at the fore-part, gradually becomes lower as it is extended backwards. From some resemblance which this process was imagined to have to a cock's comb, it has been called *crista*

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M

galli

(u) Cribriforme, σπογγοειδής, spongiforme, cristatum.

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

(*x*) *Verruca prædura, septum ossis spongiosi.*

(*y*) *Palfyn, Anat. chir. tr. 4. chap. 15.*

formation of the internal orbital holes; as was remarked in the description of the frontal bone.

Below the cells of each side, a thin plate is extended inwards; and then bending down, it becomes thick and of a spongy texture. This spongy part is triangular, with a straight upper edge placed horizontally, an anterior one slanting from above, downwards and forwards, and with a pendulous convex one below. The upper and lower edges terminate in a sharp point behind. The side of this pendulous spongy part next to the septum narium is convex, and its external side is concave. These two processes of the ethmoid bone have got the name of *ossa spongiosa*, or *turbinata superiora*, from their substance, figure, and situation.

All the prominences, cavities, and meanders of this ethmoid bone, are covered with a continuation of the membrane of the nostrils in a recent subject. Its horizontal cribriform plate is lodged between the orbital processes of the frontal bone, to which it is joined by the ethmoid suture, except at the back-part, where it is connected with the cuneiform bone by a suture common to both these bones, though it is generally esteemed part of the sphenoidal.—Where the *ossa plana* are contiguous to the frontal bone within the orbit, their conjunction is reckoned part of the transverse suture.—Farther forward than the *ossa plana*, the cells are covered by the *ossa unguis*: which are not only contiguous to these cells, but cannot be separated from them without breaking the bony substance; and therefore, in propriety, those bones ought to be demonstrated as part of the ethmoid bone.—Below the *ossa unguis* and *plana*, these cells and *ossa spongiosa* 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 nasal perpendicular plate

is received into the furrow of the vomer.—Its posterior edge is joined to the fore-part of the process 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 *orbital 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 *styloid process*, 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 forms part of the
Eustachian

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

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-staphylinus 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

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

(*b*) Naviculares.

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

it joins the nasal plate of the os ethmoides, is thin and straight. These two parts have been described as two distinct processes by some writers.

The depressions, sinuosities, and fossæ, 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 orbital 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 muscoli pterygoidei interni and ptery-staphylini interni are placed—Two between the pterygoid and orbital 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 palatè 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

From the roots of the anterior clinoid processes the bone is extended on each side outwards and forwards, till it ends in a sharp point, which may have the name of the *transverse spinous processes*.—Between, but a little farther back than the two anterior clinoid processes, we see a protuberance considerably smaller than the posterior clinoid process, but of its shape.—Another process from between the transverse processes, often forces itself forwards into the os ethmoides.

Within the skull, there are two *sinuosities* in the internal part of each wing of the sphenoid bone, for receiving the middle part of the brain.—One between the transverse spinous processes, for lodging the part of the brain where the *crura medullæ oblongatæ* are.—Immediately before the third or middle clinoid process, a single pit may generally be remarked, from which a fossa goes out on each side to the holes through which the optic nerves pass. The pit is formed by the conjoined optic nerves; and in the fossa these nerves are lodged, as they run divided within the skull. Between that third protuberance and the posterior clinoid process, the larger pit for the *glandula pituitaria* may be remarked. This cavity, because of its resemblance to a Turkish saddle, is always described under the name of *fella turcica*, or *ephippium*.—On the sides of the posterior clinoid process a fossa may be remarked, that stretches upwards, then is continued forwards along the sides of the *fella turcica*, near to the anterior clinoid processes, where a pit on each side is made. These fossæ point out the course of the two internal carotid arteries, after they have entered the skull. Besides all these, several other fossæ may be observed, leading to the several holes, and imprinted by the nerves and blood-vessels.

The *holes* on each side of the os sphenoides are six proper, and three common.—The first 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 orbital 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

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protuberance

(*d*) Winflow, Exposition anatomique du corps humain, traité des artères, § 60. et de la tête, § 26.

(*e*) Ingrass. Commentar. in Galen. de ossib. lib. I. comment. 8.

(*f*) Vesal. Anat. lib. I. 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 process, and by the point of the processus petrosus of the temporal bone. Its canal is extended above the inner plate of the pterygoid process; and where it opens into the cavity of the nose, it is concealed by the thin laminous part of the palate-bone. Through it a considerable branch of the second branch of the fifth pair of nerves is reflected.—In the middle of the sella turcica, a small hole or two often pierce as far as the cellular substance of the bone; and sometimes at the sides of this sella, one or more small holes penetrate into the sphenoidal sinuses. These observations afforded some anatomists (*g*) an argument of weight in their days in defence of Galen (*b*), who asserted the descent of the pituita that way into the sinuses below.

The first of the *common holes* is that unequal fissure at the side of the sella turcica, between the extreme point of the os petrosum and the spinous process of the cuneiform bone. This hole only appears after the bones are boiled; for in a recent subject 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 Eustachian tube is placed: It was by this passage that the ancients believed the slimy matter was conveyed from the emunctory of the brain, the glandula pituitaria, to the fauces.—The second common hole is the large discontinuation of the external side of the orbit, left between the orbital processes of the cuneiform bone, the os maxillare, maxilla, and palati. In this large hole the fat for lubricating the globe of the eye and temporal muscles is lodged, and branches of the superior maxillary nerve, with small arteries from the carotid,

(*g*) Jac. Syl. Calumniæ secundæ amolitio.—Laurent. Hist. Anat. lib. ii, quest. 11.

(*b*) Galen. de usu part. lib. ix, cap. 1.

carotid, and veins, pass. — The third hole is formed between the base of this bone and the root of the orbital 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 to 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 of a middle thickness; and its middle back part surpasses the greatest share of the cranium in thickness.

The os sphenoides is joined by its wings to the parietal
 N 2 bones

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

bones above, to the *os frontis* and *ossa malarum* before, to the temporal bones behind;—by the fore part of its body and spinous processes, to the frontal and ethmoid bones;—by its back-part, behind the two sinuses, to the occipital, where it looks like a bone with the epiphyses taken off, and, as was formerly observed in the description of the occipital bone, it cannot be separated without violence in adults;—to the palate-bones, by the ends of the pterygoid processes, and still more by the fore-part of the internal plates of the pterygoid processes, and of the sinuses;—to the maxillary bones, by the fore part of the external pterygoid plates;—to the vomer and nasal plate of the *os ethmoides*, by the *processus azygos*. All these conjunctions, except the last, which is a *schindylesis*, are said to be by the suture proper to this bone; though it is at first sight evident, that several other sutures, as the transverse, ethmoidal, &c. are confounded with it.

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

The *uses* are so blended with the description, as to leave nothing new to be added concerning them.

The sphenoidal bone is almost complete in a fœtus of nine months: only the great *alæ* separate after maceration from the body of the bone.—The *processus azygos* is very large and hollow;—the thin triangular processes are not ossified;—the internal surface of the body is unequal and porous;—the sinuses do not appear.

Whoever is acquainted with each bone of the cranium, can, without difficulty, examine them as they stand united, so as to know the shapes, sizes, distances, &c. of their several parts, and the forms, capacities, &c. of the cavities formed by them; which is of great use towards understanding the anatomy of the parts contiguous to, contain-

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 maxilla* or jaws.

THE *superior maxilla* (*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 *maxilla* to the lower jaw only, and the name *mala* to this upper jaw. In complaisance 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*) Σίγγων, γένυς, 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*) Nafalis recta.

(*q*) Nafalis obliqua.

the lower part of the septum narium to between the two middle dentes incisores.

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

The transverse palate future (*s*) runs across the palate, nearer the back than the fore part of it.

Each of the two palato-maxillary is at the back-part of the side of each nostril.

The fifteenth is the spinous, which is in the middle of the lower part of the nostrils. This may perhaps be rather thought a double *schindylefis*.

The connection of the ossa spongiosa to the side of each nostril, is so much by a membrane in young subjects, by a sort of hook and afterwards by concretion or union of substance in adults, that I did not know well how to rank it: But if any chuses to call it a future, the addition of two *transverse nasal* sutures may be made to those above named.

The sutures of the face (formerly called *harmonia*) have not such conspicuous indentations as those of the skull; the bones here not having substance enough for forming large indentations, and there being less necessity for security against external injuries, or any internal protruding force, than in the cranium. — These sutures often disappear in old people, by the bones running into each other; which can do little prejudice, because the principal use of the bones being so numerous here, is to allow them to be extended into a proper form.

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

The purposes which this pile of bones serves, will be shown in the description which I am going to give of each of them.

OSSA.

(*r*) Laquearis, palataria recta.

(*s*) Arcuata, palatina postica.

O S S A N A S I.

OSSA NASI, so named from their situation at the root of the nose, are each of an irregular oblong square figure, being broadest at their lower end, narrowest a little higher than their middle, and becoming somewhat larger at the top, where they are ragged and thickest, and have a curvature forwards, that their connection with the frontal bone might be stronger. — These bones are convex externally, and thereby better resist any violence from without; and they are concave internally, for enlarging the cavity of the nose.

The lower edge of these bones is unequal, and is stretched outwards and backwards, to join the cartilages of the nostrils. — Their anterior side is thick, especially above, and unequal, that their conjunction to each other might be stronger; and a small rising may be remarked on their inner edge, where they are sustained by the septum narium. — Their posterior side, at its upper half, has externally a depression, where it is a little overlapped by the maxillary bones, while its lower half covers these bones: By which contrivance, they do not yield easily to pressure applied to their fore-part or sides.

A small hole is frequently to be observed on their external surface, into which two, three, or four holes, which appear internally, terminate for the transmission of small veins; sometimes the holes go on farther than the cancelli of the bones.

The nasal bones are firm and solid, with very few cells or cancelli in them; the thin substance of which they consist not requiring much marrow.

They are *joined* above to the frontal bone, by the middle of the transverse suture; — behind, to the maxillary bones, by the lateral nasal sutures; — below, to the cartilages

tilages of the nose;—before, to one another, by the anterior nasal suture;—internally, to the septum narium.

The *use* of these bones is to cover and defend the root of the nose.

In an infant the nasal bones are proportionally shorter, and less thick at their upper part, than in an adult; but are otherwise complete.

OSSA UNGUIS, OR LACRYMALIA.

OSSA UNGUIS, OR LACRYMALIA, are so named, because their figure and magnitude are nearly like those of a nail of one's finger, and because the tears pass upon them into the nose.

Their external surface is composed of two smooth concavities and a middle ridge.—The *depression* behind forms a small share of the orbit for the eye-ball to move on; and the one before is a deep perpendicular canal, or *fossa*, larger above than below, containing part of the lacrymal sac and duct. This is the part that ought to be pierced in the great operation for the fistula lacrymalis.—This fossa of the bone is cribriform, or has a great number of small holes through it, that the filaments from the membrane which lines it, insinuating themselves into these holes, might prevent a separation of the membrane, and secure the bone in its natural situation.—The *ridge* between these two cavities of the os unguis is the proper boundary of the orbit at its internal canthus; and beyond which surgeons should not proceed backwards in performing operations here.—The internal or posterior surface of this bone consists of a furrow in the middle of two convexities.

The *substance* of the os unguis is as thin as paper, and very brittle; which is the reason that those bones are often

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

Each of these bones is *joined*, above, to the frontal bone, by part of the transverse future;—behind to the os planum of the ethmoid bone, by the same future;—before, and below, to the maxillary bone, by the lacrymal future.—Internally, the ossa unguis cover some of the sinus ethmoidales; nay, are really continuous with the bony lamellæ 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.

These 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 orbital* 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 orbital* 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 orbital 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 orbital* 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 orbital 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 orbital processes, to the os frontis, and to the orbital process of the sphenoid bone, by the transverse fu-

ture; by the edge between the internal and inferior orbital processes, to the maxillary bone, by the internal orbital suture; by the side between the maxillary and inferior orbital process, again to the maxillary bone, by the external orbital 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 *orbital*. The edge of this orbital 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 orbital 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 orbital process, a large tubercosity or bulge of the bone appears, which is e-

stemed

steemed the fourth process. On the internal part of this we often meet with a ridge, almost of the same height with that in the nasal process, which runs transversely, and is covered by a similar ridge of the palate-bone, on which the back-part of the upper edge of the os spongiosum inferius rests.—The convex back-part of this tuberosity is rough for the origin of part of the external pterygoid muscle (*u*); and more internal is scabrous, where the palate and sphenoid bones are joined to it.—That spongy protuberance (*x*) at the lower circumference of this bone, where the sockets for the teeth are formed, is reckoned the fifth. The sixth is the horizontal plate, which forms the greater part of the base of the nostrils, and roof of the mouth: its upper surface, which belongs to the nostrils, is very smooth; but the other below is arched and rough, for the stronger adhesion of the membrane of the mouth, which is stretched upon it; and in chewing, speaking, &c. might otherwise be liable to be separated. The seventh rises like a spine from the inner edge of the last, and forms a small part of the partition of the nostrils.

The *depressions* in each maxillary bone are, 1. A sinuosity behind the orbital process, made by the temporal muscle. 2. A pit immediately before the same process, where the origin of the musculus elevator labiorum communis, and elevator labii superioris, with a branch of the fifth pair of nerves, are lodged securely. 3. The hollow arch of the palate. 4. The semicircular great notch, or entry to the lower part of the nostrils, between the root of the nasal process and spine of the palate plate.—Below this, the fore part of the bone is flatted, or sometimes hollowed, by the musculus depressor labii superioris. 5. Sockets for the teeth (*y*): The number of these sockets is uncertain; for

(*u*) Albin. de ossib. § 79.

(*x*) *φρυξια*

(*y*) *Βοθρια δελμιστοι*, Alveoli, fossulae, mortariola, fræna, locelli, cavæ, oculamenta.

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

of the orbit, described numb. 7. of the depressions. This hole is often double, and that when the nerve has happened to split before it has escaped from the bone. The second is the foramen incisivum, just 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 ascends, soon divides into two, three, or sometimes more holes; some of which open into each nostril. Through them small arteries and veins, and a twig of the second branch of the fifth pair of nerves, pass, and make a communication between, or join the lining coats of the nose and mouth. In some subjects, Steno's duct may be traced some length on the side of these passages next to the nose, and small orifices may be observed opening into the mouth.

The first common hole is that which appears at the inner side of the back part of the tuberosity and of the sockets of the teeth; and is formed by a fossa in this bone, and a corresponding one in the os palati: through it a nerve, which is a branch of the second branch of the fifth pair, runs to the palate. The other common hole is the great slit in the outside of the orbit, described already as the second common hole of the sphenoid bone.

On the nasal process holes may be often observed for the passage of vessels to the substance of the bones; and, at the back part of each tuberosity, several foramina are placed, for the transmission of nerves to the cavity within: but these are uncertain.

All the *body* of the maxillary bone is hollow, and leaves a large *sinus* like the frontal and sphenoid, which is commonly, but unjustly, called *antrum Highmorianum* (a). When the os maxillare is single, or separated from all the other bones of a skeleton, its antrum appears to have a

large

(a) Genæ.

large aperture into the nostrils; but, in a recent subject, it is so covered at its back-part by the palate bone, in the middle by the os spongiosum inferius, before by a strong membrane, that one or sometimes two holes, scarcely so large as a crow-quill, are only left at the upper part; which, after a short winding progress, open into the nostrils between the two ossa spongiosa.—At the bottom of this cavity, we may often observe some protuberances, in which the small points of the roots of the teeth are contained (*b*).—This cavern and the sockets of the teeth are often divided by the interposition 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 symptoms 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 considerable service is frequently done (*d*).

The maxillary sinuses have the same uses as the frontal and sphenoidal; and the situation of the sinuses is such, that the liquor drilling from them, from the cells of the ethmoid and palate bones, and from the lacrymal ducts, may always moisten all the parts of the membrane of the nares in the different situations of the head.

Though the membranes which line the frontal, sphenoidal, and maxillary sinuses, are continuations of the one which covers the bones within the nose; yet they are much thinner than it is, and have so much smaller vessels, that the injection which makes the membrane of the nose red all over, fills only some few vessels of the maxillary sinuses, and is scarcely observed in the frontal and sphenoidal.

(*b*) Highmore, Disquis. Anat. lib. 3. part. 2. cap. 1.

(*c*) Highmore, *ibid*.

(*d*) Cowper in Drake's Anthropol. book 3. chap. 10.—Medical Essays and Observ. 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, *ceteris 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 future;—at the sides of these processes, to the ossa unguis, by the lacrymal futures;—to the nasal bones, by the lateral nasal futures;—by their orbital processes, to the cheek-bones, by the external orbital future;—by the internal sides of the internal orbital processes, to the ossa plana, by part of the ethmoidal future;—by the back-part of the tuberosities, to the palate-bones, by the futuræ palato-maxillares;—by the posterior edges of their palatine lamellæ, to the ossa palati, by the transverse palate future;—by their nasal spines, to the vomer, by the spinous future;—by their sockets, to the teeth, by gomphosis;—by the internal edge of the palate-plate, to one another, by the longitudinal palate future, 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 mystacial future:—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.

O S S A P A L A T I.

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. Behind, this bone is somewhat in form of a crescent,

(*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 Anat. lib. 2. cap. 2. explicat. tab. 6. fig. 19.—Winflow, Memoires de l'acad. des sciences, 1720.

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 (*g*). From the middle

P 2

internal

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 *orbital*; —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 orbital process to the other. A nerve, artery, and vein, belonging to the nostrils, pass here.—The anterior of the two orbital 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 orbital process is extended along the internal side of the upper back part of the maxillary tuberosity, to 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 orbital 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 suture:— By their thin nasal plates, and part of their orbital processes, to the same bones, by the palato-maxillares sutures:—By their pterygoid processes, and back-part of the nasal plates, to the alæ vesperilionum, by the sphenoid

noid future:—By the transverse ridges of the nasal palates, to the *ossa spongiosa inferiora*, by contact; hence there frequently is an intimate union of the substance of these bones in old skulls:—By the orbital processes, to the *ossa plana* and *cellulæ ethmoidæ*, by the ethmoid future:—To the body of the sphenoid bone, by the sphenoid future:—By the internal edge of the square bones, to each other by the longitudinal palate future;—and by their nasal spines, to the vomer, by the spinous future.

The palate-bones form part of the palate, nostrils, orbits, and *fossæ pterygoideæ*; and they cover part of the *sinus maxillares*, *sphenoidales*, and *ethmoidei*.

These bones are very complete in a new-born infant, the nasal plates being then thicker and stronger than in adults; but the orbital processes have not the cells which appear in the bones of adults.

When we are acquainted with the history of these bones, the reason is evident, why the eyes are so much affected in ulcers of the palate, as to be often attended with blindness, which frequently happens in an ill-managed lues venerea; or why, on the other hand, the palate suffers from an *ægylops* (*b*).

OSSA TURBINATA.

Ossa TURBINATA, or *spongiosa inferiora*, resemble the superior *ossa spongiosa* in shape and substance, but have their anterior and upper edges contiguous to the transverse ridges of the nasal processes of the maxillary and palate-bones.—From their upper straight edge, two small processes stand out: The posterior, which is the broadest, descends to cover some of the *antrum Highmorianum*; the anterior rises up to join the *os unguis*, and to make part of the lacrymal duct.

Below

(*b*) Hoffman, in *Ephemerid. Germ.* cent. I. and 2. obs. 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.

V O M E R.

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. Anatomicæ, 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 bones. 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 nose fills up what remains of the fossa at its fore-part. The posterior edge of the vomer, which appears above the back part of the palate-bones, is broader above; but as it descends forwards, becomes thinner, though it is still solid and firm. The lower edge of this bone, which rests on the nasal spine of the palate and maxillary bones, has a little furrow on each side of a small middle ridge, answering to the spines of the bones of different sides, and the interstices between them. This and the upper edge meet in the pointed fore-end of this bone.

The body of the vomer has a smooth and solid surface, but thin *substance*; and towards its sides, where it is thickest, some cancelli may be observed when the bone is broken.

It is *joined* above to the sphenoid and ethmoid bones, and to the middle cartilage of the nose by schindylesis; below, to the maxillary and palate bones by the spinous future.

The vomer divides the nostrils; enlarges the organ of smelling, by allowing place for expanding the membrane of the nose on its sides; and sustains the palate-plates of the maxillary and palate bones, which otherwise might be in hazard of being pressed into the nostrils; while the vomer is secured from shuffling to one side or other by the double schindylesis, by which it is joined to the bones above and below.

THUS we have now described all the bones which compose the *upper jaw*, except the *teeth*, which are so much like those of the lower jaw, that I choose to make one description serve for both, in which their differences shall be remarked, after the second part of the face, (*i. e.*) the *lower jaw*, is examined; because the structure 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 into it.

This bone, which is somewhat of the figure of the Greek letter ν , is situated at the lower part of the face, so as its convex middle part is forwards, 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 genioglossi 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 under-part of the musculus buccinator is connected.—Internally, towards the upper edge of each side 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 *sides*, are a great many deep pits or sockets, for receiving the roots of the teeth. The number and magnitude of these sockets are various, because of the different number, as well of the teeth themselves, as of their roots, in different people. These sockets in this lower jaw, as well as in the upper one, are less deep as old age comes on: when freed from the teeth by any means, they are some time after filled up with an ossious net-work, which at last becomes entirely solid, and as smooth as any other part of the bone; so that, in a great many old jaws, we cannot observe a vestige of the sockets: but then the jaw becomes less, and much narrower (*q*). Hence we may know why the chin and nose of edentulous people are much nearer than before the teeth were lost; while their lips either fall in towards the mouth, or stand prominent forwards.—When new teeth are protruded, new sockets are formed (*r*). The lower edge of the chin and sides is smooth and equal, and is commonly called the base of the lower jaw. The ends of the base, where the jaw turns upwards, are called its angles; the external surface of each of which has several inequalities upon it, where the masseter muscle is inserted; as the internal surface also has, where the pterygoideus internus is inserted, and a ligament extended from the styloid process of the temporal bone is fixed.

The *processes* are two on each side.—The anterior sharp thin coronoid ones have the crotaphite muscles inserted into them. The posterior processes or condyles (*s*) terminate

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

(*r*) Fallop. Observ. Anat.

(*s*) Articulariorii.

terminate in 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 a 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

Q 2

exposed

(*t*) Weitbrecht. Syndesmolog. fig. 32. 1.

(*u*) Palfyn, Anat.-chirurg. traité 5. chap. 6.

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

The lower jaw generally receives the roots of sixteen teeth into its sockets, by *gomphosis*; and its condyloid processes, covered with 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 side 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 draw 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 maxillæ, 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. 92. fig. 7. 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 opposite

(*a*) Haver's 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*) Thefaur. 10. num. 27.

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

placed a little to a side of the extreme point of each root; sometimes, especially in old people, this hole is entirely closed up, and consequently the nerves and blood-vessels are destroyed (e).

The teeth are seen for a considerable time in form of mucus contained in a membrane; afterwards a thin cortical plate and some few ossæous layers appear within the membrane, with a large cavity filled with mucus in the middle; and gradually this exterior shell turns thicker, the cavity decreases, the quantity of mucus is lessened, and this induration proceeds till all the body is formed, from which the roots are afterwards produced.

In young subjects, different stamina or rudiments of teeth are to be observed. Those next the gums ordinarily hinder the deeper seated ones from making their way out, while these prevent the former from sending out roots, or from entering deep into the bony sockets of the jaws; by which they come to be less fixed.

Children are seldom born with teeth; but at two years of age they have twenty; and their number does not increase till they are about seven years old; when the teeth that first made their way through the gums are thrust out by others that have been formed deeper in the jaw, and some more of the teeth begin to discover themselves farther back in the mouth. About fourteen years of age, some more of the first crop are shed, and the number is increased. This shedding of the teeth is of good use: for if the first had remained, they would have stood at a great distance one from another; because the teeth are too hard in their outer crust to increase so fast as the jaws do. Whereas, both the second layer and the teeth that come out late, meeting, while they are soft, with a considerable resistance to their growth in length from those situated up-

(e) De la Hire, Histoire de l'acad. des sciences, 1699.

on them, necessarily come out 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 *syssarcofis*.

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** (*b*) 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 under jaw.

In

(*f*) Φραγμας.

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

(*b*) Γελασινιοι, τριμικοι, διχασηρες, κτινες, τομεις, προσωσδιοι, οξεις, Risorii, quaternii, primi, primores, anteriores, acuti.

(*i*) Ολμισκος.

(*l*) 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 dogs 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 sockets between them bear a

R 2

large

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

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

(*o*) Μυλιται, γομφοι, μυλοι, πλατεις, φρασγες, Maxillares, menfales, clavales, buccarum.

large share of the great pressure they suffer, and hinder it from acting on their points (*p*).

The base of the first grinder has an edge pointed in the middle, on its outside, resembling the canini; from which it slopes inwards till it rises again into a point.—It has generally but one root, which sometimes is long and crooked at its point.

The second dens molaris has two points on its base, rising nearly equally on its out and inside.—It has two roots, either separate or run together, but shorter than the root of the first. These two anterior grinders are much smaller than the three that are placed farther back in the mouth.

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

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

The incisores of the upper jaw being broader than those of the lower jaw, make the superior grinders to be placed so much farther back than the lower ones, that, when they are brought together, by shutting the mouth, the points of the grinders of the one jaw enter into the depressions of the opposite grinders, and they are all equally applied to each other, notwithstanding the inequality of their surface.

The numerous roots of the dentes molares prevent their loosening by the lateral pressure they suffer in grinding; and as the sockets in the upper jaw are more spongy, and the

(*p*) Lettre sur l'osteologie.

(*q*) Σαφρονισηρες, κραντηρες, οψιγονοι, Sensus, intellectus, serotini, ætatem complentes, genuini, moderatores.

the teeth 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

(*r*) Galen de ossib. cap. 5.

(*s*) Fauchard. Chirurg. dent. chap. 1.

more frequently in teeth pulled by art than in those which are shed by nature (*t*).

Why do these roots frequently come outwards thro' the gums?

Whence comes butter or buck teeth?

How do these teeth sometimes go into the natural row with the others, after pulling a rotten tooth near them?

How have some people got two rows of teeth in one or both jaws (*u*)?

Why do the teeth of old people loosen, and then drop out entire?

Whence arise the new sets of teeth which several old people obtain (*x*)?

Why are not the gums of toothless old people torn by the hard sockets in chewing?

Why are the teeth insensible when slightly filed or rasped?

How come they to be sensible of heat or cold, to be set on edge by acids, or to give an uneasy sensation when gritty or sandy substances are rubbed between them?

Why does a person who has a pained tooth imagine it longer than any other?

What is the reason of some persons dying convulsed, upon rasping or filing down an overgrown tooth (*y*)?

How do the teeth break and moulder away without any pain in some people, and not in others?

What parts are affected in the toothach?

What are the causes of the toothach?

May worms be reckoned among these causes (*z*)?

Why are the dentes molares most subject to that disease?

In

(*t*) Fauchard, Chirurgien, dentiste, p. 7.

(*u*) Blaf. Comment. ad Vesling. Syntagm. cap. 1, 3.

(*x*) Hoffman. in Van. Horc. Microcosm. p. 38.

(*y*) Bartholin. Anat. reformat. lib. 4. cap. 12.

(*z*) Jacob. in Act. Hafn. vol. 5. obs. 107.—Pechlin. Observ. Medic. lib. 2. obs. 36.—Bartholin. Hist. Medic. cent. 3. hist. 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. aun. 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*) Hypfyloides, lambdoides, παρασατη φαρυγγετερων, Os gutturis, os linguæ, os morsus Adami, assessor, os laude, bicornis.

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-hyoidei muscles, and a little hollowed more laterally by the basio-glossi.—Below the ridge, it is convex; but a little flattened 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 hyothyroidei 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 ceratoglossis is inserted above, and the thyro-hyoideus 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 graniformia.

rises upwards and backwards, into which the muscoli stylo-hyoidei alteri, and part of the hyo-glossi muscles, are fixed. From each of them a ligament is sometimes extended to the styloid processes of the temporal bones, to keep the os hyoides from being drawn too much forwards or downwards. The part of this ligament next to these processes sometimes forms into several cartilages, which afterwards ossify in old people. Ruysch (*f*) says, that he has seen this ossification continued as far up as the styloid processes, which were therefore joined to the os hyoides by anchylosis.

The *substance* of the os hyoides is cellular; but covered with a firm external plate, which is of sufficient strength to bear the actions of so many muscles as are inserted into it.

It is not *articulated* with any bone of the body, except by means of the muscles and ligaments already mentioned.

The *use* of the os hyoides, is to serve as a solid lever for the muscles to act with, in raising or depressing the tongue and larynx, or in enlarging and diminishing the capacity of the fauces.

At birth, this bone is in a cartilaginous state; excepting a small 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 consists of the *spine*, *pelvis*, and *thorax*.

§ I. The SPINE.

THE spine (*g*) is the long pile of bones extended from the condyles of the occiput to the end of the rump. It some-

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(*f*) Advers. Anat. dec. 3. § 9.

(*g*) Ραχις ἄσπονδα, ἰερα σπονγῆ, σάλην, Tergum hominis carina.

what resembles two unequal pyramids joined in a common base. It is not, however, straight; for its upper part being drawn backwards by strong muscles, it gradually advances forwards, to support the œsophagus, vessels of the head, &c. Then it turns backwards, to make room enough for the heart and lungs. It is next bent forwards, to support the viscera of the abdomen. It afterwards turns backwards. for the enlargement of the pelvis. And, lastly, it is reflected forwards, for sustaining the lowest great gut.

The spine is commonly divided into *true* and *false vertebra*; the former constituting the long upper pyramid, which has its base below; while the false vertebræ make the shorter lower pyramid, whose base is above.

TRUE VERTEBRÆ.

THE true vertebræ (*b*) are the twenty-four upper bones of the spine, on which the several motions of the trunk of our bodies are performed; from which use they have justly got their name

Each of these vertebræ is composed of its body and processes.

The *body* is the thick spongy fore-part, which is convex before, concave backwards, horizontal and plain in most of them above and below.—Numerous small holes, especially on the fore and back part of their surface, give passage to their vessels, and allow the ligaments to enter their substance. The edges of the body of each vertebra are covered, especially at the fore part, with a ring of bone firmer and more solid than the substance of the body any where else. These rings seem to be joined to the vertebræ in the form of epiphyses, but are alledged by some

(*b*) Στροφαίς σπονδυλός, Spondyli, ossa orbiculata, ossa vertebrata, verticula.

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 vertebræ, a substance between the nature of ligament and cartilage is interposed; which seems to consist of concentric 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 vertebral 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 ancients (*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 vertebræ, to connect them; in which it is assisted by a strong membranous ligament, which lines all their concave surface, and by a still stronger ligament that covers all their anterior convex surface.

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(*i*) Fallop. Observat. Anat.

(*k*) Blaucardi 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 vertebræ 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 vertebræ, 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 vertebræ 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 vertebræ together.

The

(*n*) Articularii, minimi.

The substance of the processes is considerably stronger and firmer, and has a thicker external plate, than the bodies of the vertebræ themselves.

The seven *processes* 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 vertebræ form a long large conduit (*o*), for continuing the spinal marrow.

— In the upper and lower edge of each lateral bridge, there is a notch. These are so adapted to each other in the contiguous vertebræ, as to form a round hole in each side between each two vertebræ, through which the nerves that proceed from the spinal marrow and its blood-vessels pass.

The *articulations*, then, of these true vertebræ are plainly double: for their bodies are joined by the intervening cartilage above described; and their oblique processes, being tipped with cartilages, are so connected by their ligaments as to allow a small degree of motion on every side. Hence it is evident, that their centre of motion is altered in different positions of the trunk: for, when we bow forwards, the upper moved part bears entirely on the bodies of the vertebræ; if we bend back, the oblique processes support the weight; if we recline to one side, we rest upon the oblique processes of that side and part of the bodies; if we stand erect, all the bodies and oblique processes have their share in our support.

Hence it follows, 1. That because the joints of which the spine is composed are so numerous, the spinal marrow, nerves, blood-vessels, &c. are not liable to such compression and over-stretching in the motion of the trunk of the body as they would otherwise be, since several vertebræ must be concerned in every motion of the spine; and therefore a very small curvature is made at the conjunction of any

(*o*) *Ιερα σπιγγξ, σωλην, Canalis.*

any two vertebræ (*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 vertebræ, 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 vertebræ 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 seeing the bulk of any part must vary according

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(*p*) Galen. de usu part. lib. 12. cap. 12.

(*q*) Paaw de ossib. part 2. cap. 2.

(*r*) Borelli de motu animal. pars I. schol. ad propos. 58. Parent, Histoire de l'acad. des sciences, 1702.

(*s*) Wasse, Philosoph. Transact. numb. 383. art. 1.

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 vertebræ, 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 vertebræ (*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 vertebræ 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 vertebræ, or their cartilages, are of unequal thickness in opposite sides,

(*t*) Abbé Fontenu. Histoire de l'acad. des sciences, 1725.

(*u*) Galen. de usu part. lib. I. cap. 16.

sides, 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 vertebræ 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 muscles 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 vertebræ, or their cartilages, or both, turn thick on that side where the vessels are free, and remain thin on the other side where the 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.

When once we understand how these crooked spines are produced, there is little difficulty in forming a just prognosis;

noſis; and a proper method of cure may be eaſily contrived, which muſt vary as to the internal medicines, according to the different cauſes on which the diſeaſe depends: But one general indication muſt be purſued by ſurgeons; which is, to counteract the bending force, by increaſing the compreſſion on the convex part of the curvature, and diminifhing it on the concave ſide. The manner of executing which in particular caſes muſt be different, and requires a very accurate examination of the circumſtances both of the diſeaſe and patient. In many ſuch caſes I have found ſome ſimple directions, as to poſtures in which the patient's body ſhould be kept, of very great advantage.

THOUGH the true vertebræ agree in the general ſtructure which I have hitherto deſcribed; yet, becauſe of ſeveral ſpecialties proper to a particular number, they are commonly divided into three claſſes, viz. *cervical*, *dorſal*, and *lumbar*.

The CERVICAL (x) are the ſeven uppermoſt vertebræ; which are diſtinguiſhed from the reſt by theſe marks.— Their bodies are ſmaller and more ſolid than any others; and flatted on the fore-part, to make way for the œſophagus; or rather this flat figure is owing to the preſſure of that pipe, and to the action of the longi colli and anterior recti muſcles. They are alſo flat behind, where ſmall proceſſes riſe, to which the internal ligaments are fixed. The upper ſurface of the body of each vertebra is made hollow, by a ſlanting thin proceſs which is raiſed on each ſide:— The lower ſurface is alſo hollowed, but in a different manner; for here the poſterior edge is raiſed a little, and the anterior one is conſiderably produced.—Hence we ſee how the cartilages between thoſe bones are firmly connected, and their articulations are ſecure.

(x) Τραχηλυ, αυχης, αυχιος, Colli.

The cartilages between these vertebræ are thick, especially at their fore-part; which is one reason why the vertebræ advance forward as they descend, and have larger motion.

The *oblique* processes of these bones of the neck more justly deserve that name than those of any other vertebræ. They are situated slanting; the upper ones having their smooth and almost flat surfaces facing obliquely backwards and upwards, while the inferior oblique processes have these surfaces facing obliquely forwards and downwards.

The *transverse* processes of these vertebræ are framed in a different manner from those of any other bones of the spine: For, besides the common transverse process rising from between the oblique processes of each side, there is a second one that comes out from the side of the body of each vertebra; and these two processes, after leaving a circular hole for the passage of the cervical artery and vein, unite, and are considerably hollowed at their upper part, with rising sides, to protect the nerves that pass in the hollow; and at last each side terminates in an obtuse point, for the insertion of muscles.

The *spinal* processes of these cervical bones stand nearly straight backwards, are shorter than those of any other vertebræ, and are forked or double at their ends; and hence allow a more convenient insertion to muscles.

The thick *cartilages* between the bodies of these cervical vertebræ, the obliquity of their oblique processes, and the shortness and horizontal situation of their spinal processes, all conspire to allow them large motion.

The *holes* between the bony crotches bridges, for the passage of the nerves from the spinal marrow, have their largest share formed in the lowest of the two vertebræ, to which they are common.

So far most of the cervical vertebræ 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 vertebræ 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 muscoli 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 spinalis in the flexions 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

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sinuosities,

sinuosities, into which the ligaments that connect this bone to the following one are fixed.

The superior oblique processes 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 *epistrophe*; 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 processes of this vertebra dentata answer exactly to the description given of those common to all the cervical vertebræ.

The transverse processes of the vertebra dentata are short, very little hollowed at their upper part, and not forked at their ends; and the canals through which the cervical arteries pass are reflected outwards about the middle substance of each process; so that the course of these vessels may be directed towards the transverse processes of the first vertebra. Had this curvature of the arteries been made in a part so moveable as the neck is, while they were not defended by a bone, and fixed to that bone, scarce a motion could have been performed without the utmost hazard of compression, and a stop put to the course of the liquids, with all its train of bad consequences. Hence we observe this same mechanism several times used, when there is any occasion for a sudden curvature of a large artery. This is the third remarkable instance we have seen of it. The first was the passage of the carotids through the temporal bones; and the second was that lately described in the vertebral arteries, turning round the oblique processes of the first vertebra, to come at the great hole of the occipital bone.

The spinal process of this vertebra dentata is thick, strong, and short, to give sufficient origin to the muscoli recti majores and obliqui inferiores, and to prevent the contusion of these and other muscles in pulling the head back.

This second vertebra consists, at the birth, of four bony pieces: For, besides the three which I have already mentioned as common to all the vertebræ, the tooth-like process of this bone is begun at this time to be ossified in its middle, and is joined as an appendix to the body of the bone.—Lest this appendix be bent or displaced, nurses ought to keep the heads of new born children from falling

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 vertebræ, 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 a 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

or

(a) See Eustach. de motu capitis.

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 and 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 of 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

supported by all the vertebræ 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 vertebræ.

The twelve DORSAL (*c*) may be distinguished from the other vertebræ 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 flattened 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 vertebræ 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

(*b*) Atlas quibusdam, maxima, magna vertebra, prominens.

(*c*) Θωρακος, μεταρρευν, νωτη, υποτραχηλιον, 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 vertebræ are thinner than in any other of the true vertebræ; 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 vertebræ.

The transverse processes of the dorsal vertebræ 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 vertebræ; 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 connection of the dorsal vertebræ to the ribs, the thinness of their cartilages, the erect situation of the oblique processes, the length, sloping, and connection of the spinal processes, all contribute to restrain these vertebræ from much motion, which might disturb the actions of the heart and lungs; and in consequence of the little motion allowed here, the intervertebral cartilages sooner shrivel, by becoming more solid: and therefore the first remarkable curvature of the spine observed, as people advance to old age, is in the least stretched vertebræ of the back; or old people first become round shouldered.

The bodies of the four uppermost dorsal vertebræ deviate from the rule of the vertebræ becoming larger as they descend: for the first of the four is the largest, and the other three below gradually become smaller, to allow the trachea and large vessels to divide at smaller angles.

The two uppermost vertebræ of the back, instead of being very prominent forwards, are flatted by the action of the muscoli longi colli and recti majores.

The proportional size of the two little depressions in the body of each vertebra for receiving the heads of the ribs, seems to vary in the following manner; the depression on the upper edge of each vertebra decreases as far down as the fourth, and after that increases.

The transverse processes are longer in each lower vertebra to the seventh or eighth, with their smooth surfaces, for the tubercles of the ribs, facing gradually more downwards; but afterwards, as they descend, they become shorter, and the smooth surfaces are directed more upwards.

The spinous processes of the vertebræ of the back become gradually longer and more slanting from the first, as far down as the eighth or ninth vertebra; from which they manifestly turn shorter and more erect.

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 surface on 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 vertebræ 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 vertebræ 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 vertebræ.

The lowest order of the true vertebræ 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 vertebræ of the back. 2. The cartilages

(*d*) Λοφία, Gutturalis.

(*e*) Μασχαλιστήρ.

(*f*) Αρρεπής, in neutram partum inclinans.

(*g*) Διαζωστήρ, Præcingens.

(*h*) Οσφυος ἰξυος, Φοιαν, Renum, lumborum.

cartilages between these vertebræ are much the thickest of any, and render the spine convex within the abdomen, by their greatest thickness being at their fore-part. 3. The oblique processes are strong and deep; those in opposite sides being almost placed in parallel planes; the superior, which are concave, facing inwards, and the convex inferior ones facing outwards: And therefore each of these vertebræ receives the one above it, and is received by the one below; which is not so evident in the other two classes already described. 4. Their transverse processes are small, long, and almost erect, for allowing large motion to each bone, and sufficient insertion to muscles, and for supporting and defending the internal parts. 5. Between the roots of the superior oblique and transverse processes a small protuberance may be observed, where some of the muscles that raise the trunk of the body are inserted. 6. Their spinal processes are strong, straight, and horizontal, with broad flat sides, and a narrow edge above and below; this last being depressed on each side by muscles. And at the root of these edges, we see rough surfaces for fixing the ligaments. 7. The canal for the numerous cords called *caudæ equina*, into which the spinal marrow divides, is rather larger in these bones than what contains that marrow in the vertebræ of the back. 8. The holes for the passage of the nerves are more equally formed out of both the contiguous vertebræ than in the other classes; the upper one furnishes, however, the larger share of each hole.

The thick cartilages between these lumbar vertebræ, their deep oblique processes, and their erect spinal processes, are all fit for allowing large motion: though it is not so great as what is performed in the neck; which appears from comparing the arches which the head describes when moving on the neck or the loins only.

The lumbar vertebræ, as they descend, have their oblique
processes

processes at a greater distance from each other, and facing more backwards and forwards.

Both transverse and spinal processes of the middlemost vertebræ of the loins are longest and thickest; in the vertebræ above and below, they are less: So that these processes of the first (*i*) and fifth (*k*) are the least, to prevent their striking on the ribs or ossa ilium, or their bruising the muscles in the motions of the spine.

The epiphyses round the edges of the bodies of the lumbar vertebræ are most raised in the two lowest; which consequently 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 spinal process of this fifth is smaller, and the oblique processes face more backwards and forwards than in any other lumbar vertebra.

AFTER considering the structure of the particular vertebræ, and their mutual connection, we may observe a solicitous care taken that they shall not be disjoined without great difficulty. For, besides being connected by strong ligaments proportioned to the forces which are to be resisted, their bodies either enter so into each other as to prevent their being displaced any way, as in the vertebræ of the neck; or they are propped on all sides, as those of the back are by the ribs; or their surfaces of contact are so broad, as to render the separation almost impracticable, as in the loins: while the depth and articulation of the oblique processes are exactly proportioned to the quantity of motion which the other parts of the bones allow, or the muscles can perform. Yet as these oblique processes are small, and therefore not capable of so secure a conjunction as the larger bodies, they may sooner yield to a disjoining force;

(*i*) Νεφριτις, Renalis.

(*k*) Αεχ'λιτις, Fulciens.

force; but then their dislocation is not of near so bad consequence as the separation of the bodies would be: for by the oblique processes being dislocated, the muscles, ligaments, and spinal marrow, are indeed stretched; but this marrow must be compressed, or entirely destroyed, when the body of the vertebra is removed out of its place.

THE FALSE VERTEBRÆ.

THE FALSE VERTEBRÆ compose the under pyramid of the spine. They are distinguished from the bones already described justly enough by this epithet of *false*; because, though each bone into which they can be divided in young people resembles the true vertebræ 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 sacrum*, and *os coccygis*.

OS SACRUM (1), is so called, from being offered in sacrifice by the ancients, or rather because of its largeness in respect of the other vertebræ.—This bone is of an irregular triangular shape, broad above, narrow below, convex behind, for the advantageous origin of the muscles that move the spine and thigh backwards; and concave before, for enlarging the cavity of the pelvis.—Four transverse lines, of a colour different from the rest of the bone which are seen on its fore-part, are the marks of division of the five different bones of which it consists in young persons.

The fore-part of the os sacrum, analogous to the bodies of the true vertebræ, is smooth and flat, to allow a larger space for the contained bowels, without any danger of hurting

(1) Ἴερον, σπονδυλος μελας, Hippocrat. υποσπονδυλον, Oribaf. Πλατυ, Latum, os clunium, clavium.

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 vertebræ 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 facer 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 glutæus 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 super-ficial

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 vertebræ 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 vertebræ 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 future: 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 vertebræ, 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.

X 2

This

(*n*) Ορρεπυγιον, ορος, Caudæ os, Spondylium, os cuculi.

This bone consists of four pieces in people of middle age:—In children, almost the whole of it is cartilage: In old subjects, all the bones are united, and become frequently one continued bone with the os sacrum.

The highest of the four bones is the largest, with shoulders extended farther to each side than the end of the os sacrum; which enlargement should, in my opinion, serve as a distinguishing mark to fix the limits of either bone; and therefore should take away all dispute about reckoning the number of bones, of which one or other of these two parts of the false vertebræ is composed; which dispute must still be kept up, as long as the numbering five or six bones in the os sacrum depends upon the uncertain accident of this broad shouldered little bone being united to or separated from it.—The upper surface of this bone is a little hollow.—From the back of that bulbous part called its *shoulders*, a process often rises up on each side, to join with the bifurcated spine of the fourth and fifth bones of the os sacrum, to form the bony bridge mentioned in the description of the os sacrum.—Sometimes these shoulders are joined to the sides of the fifth bone of the os sacrum, to form the hole in each side common to these two bones, for the passage of the twenty-ninth pair of spinal nerves.—Immediately below the shoulders of the os coccygis, a notch may be remarked on each side, where the thirtieth pair of the spinal nerves pass.—The lower end of this bone is formed into a small head, which very often is hollow in the middle.

The three lower bones gradually become smaller, and are spongy; but are strengthened by a strong ligament which covers and connects them.—Their ends, by which they are articulated, are formed in the same manner as those of the first bone are.

Between each of these four bones of young subjects a
cartilage

cartilage is interposed; therefore their articulation is analogous to that of the bodies of the vertebræ of the neck: For, as has been above remarked, the lower end of the os sacrum, and of each of the three superior bones of the os coccygis, has a small depression in the middle; and the upper part of all the bones of the os coccygis is a little concave, and consequently the interposed cartilages are thickest in the middle, to fill up both cavities; by which they connect the bones more firmly.—When the cartilages ossify, 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 sort of articulation, it is evident, that, unless when these bones grow together, all of them are capable of motion; of which the first and second, especially this last, enjoys the largest share.

The lower end of the fourth bone terminates in a rough point, to which a cartilage is appended.

To the sides of these bones of the os coccygis, the coccygæi muscles (*o*), and part of the levatores ani, and of the glutæi maximi, are fixed.

The *substance* of these bones is very spongy, and in children cartilaginous; there being only a part of the first bone ossified in a new born infant.—Since therefore the intestinum rectum of children is not so firmly supported as it is in adults, this may be one reason why they are more subject to a procidentia ani than old people (*p*).

From the description of this bone, we see how little it resembles the vertebræ; since it seldom has processes, never has any cavity for the spinal marrow, nor holes for the passage of nerves: Its connection hinders it from being moved to either side; and its motion backwards and forwards

(*o*) Douglas, Myograph. chap. 40.—Eustach. tab. 36. N^o 45. 20.

(*p*) Spigel. de humani corp. fabric. lib. 2. cap. 22.—Paaw de ossib. par. 2. cap. 3.

wards is much confined : yet, as its ligaments can be stretched by a considerable force, it is of great advantage in the excretion of the *fæces alvinæ*, and much more in child-bearing, that this bone should remain moveable ; and the right management of it, in delivering women, may be of great benefit to them (*g*). The mobility of the *os coccygis* diminishing as people advance in age, especially when its ligaments and cartilages have not been kept flexible by being stretched, is probably one reason why the women, who are old maids before they marry, have generally difficult parturition.

The *os coccygis* serves to sustain the *intestinum rectum* ; and, in order to perform this office more effectually, it is made to turn with a curve forwards ; by which also the bone itself, as well as the muscles and teguments, is preserved from any injury when we sit with our body reclined back.

§ 2. *Of the PELVIS.*

THE second part of the trunk of the skeleton, viz. the pelvis, is the cylindrical cavity at the lower part of the abdomen, formed by the *os sacrum*, *os coccygis*, and *ossa innominata* ; which last therefore fall now in course to be examined.

O S S A I N N O M I N A T A.

THOUGH the name of *ossa innominata* (*r*) contributes nothing to the knowledge of their situation, structure, or office ; yet they have been so long universally known by it, that there is no occasion for changing it. They are two large broad bones, which form the fore-part and sides of the

(*g*) Paaw, *ibid.*—Deventer, *Operat. chirurg. cap. 27.*

(*r*) *Σκελετων 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 glutæus 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 alledged, 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 *Fallopian's* or *Poupart's* ligament, is fixed to it. The inside of the posterior spinal process, and of part of the spine forward from that,

(*s*) Ακχγονον κενεων, Scaphium, lumbare, clunium, clavium, anchas.

(*t*) Winflow, Exposition anatomique du corps humain. traité des os frais, § 96.

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 vertebræ 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 tibiæ* 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*) Weizbrecht, *Synonymolog.* sect. 4. § 39. 40. 46. 47.

(*x*) Baker, *Curs. Osteolog. demonstr.* 3.

facrum, 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 glutæi 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 an 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 coccygæus 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*) Coxæ, 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 tibiæ, and feminovosus muscles; and the femimembranosus 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 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 epiphysé before this bone is fully formed.

The Os PUBIS (*a*), or *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 tuberos 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 tuberos part of the os pubis downwards and

outwards

(*a*) *ischi, 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,

trochanter, in the motions of the thigh inwards: Both which inconveniencies must have happened, had the ossa innominata been complete here, and of sufficient thickness and strength to serve as the fixed point of these muscles.—The bowels sometimes make their way through the niche for the vessels, at the upper part of this thyroid hole; and this causes a hernia in this place (*b*).

In the external surface of the ossa innominata, near the outside of the great hole, a large deep cavity is formed by all the three bones conjunctly: For the os pubis constitutes about one fifth, the os ilium makes something less than two fifths, and the os ischium as much more than two fifths. The brims of this cavity are very high, and are still much more enlarged by the ligamentous cartilage, with which they are tipped in a recent subject. From this form of the cavity it has been called *acetabulum*; and for a distinguishing character the name of the bone that constitutes the largest share of it is added; therefore *acetabulum ossis ischii* (*c*) is the name this cavity commonly bears. Round the base of the supercilia the bone is rough and unequal, where the capsular 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 else; which is very necessary to prevent the head of the femur from slipping out of its cavity at this place, where the whole weight of the body bears upon it, and consequently would otherwise be in perpetual danger of thrusting it out. As these brims are extended downwards and forwards, they become less; and at their internal lower part a breach is made in them; from the one side of which to the other, a ligament is placed in the recent subject; under which a large hole is left, which contains a fatty cellular substance and vessels. The reason of which appearance has afforded

matter

(*b*) Memoires de l'acad. de chirurgie, tom. I. p. 709. &c.

(*c*) Coxæ, coxendicis.

matter of debate. To me it seems evidently contrived for allowing a larger motion to the thigh inwards: For if the bony brims had been here continued, the neck of the thigh-bone must have struck upon them when the thighs were brought across each other; which, in a large strong motion this way, would have endangered the neck of the one bone, or brim of the other. Then the vessels which are distributed to the joint may safely enter at the sinuosity in the bottom of the breach; which being, however, larger than is necessary for that purpose, allows the larger mucilaginous gland of the joint to escape below the ligament, when the head of the thigh-bone is in hazard of pressing too much upon it in the motions of the thigh outwards (*d*). Besides this difference in the height of the brims, the acetabulum is otherwise unequal; for the lower internal part of it is depressed below the cartilaginous surface of the upper part, and is not covered with cartilage; into the upper part of this particular depression, where it is deepest and of a semilunar form, the ligament of the thigh-bone, commonly, though improperly, called the *round* one, is inserted; while, in its more superficial lower part, the large mucilaginous gland of this joint is lodged. The greatest part of this separate depression is formed in the os ischium.

From what has been said of the condition of the three bones composing this acetabulum in new-born children; it must be evident that a considerable part of this cavity is cartilaginous in them.

THE *ossa innominata* are joined at their back-part to each side of the os sacrum by a sort of suture, with a very thin intervening cartilage, which serves as so much glue to cement those bones together; and strong ligaments go from the

(*d*) Petit. Memoires de l'acad. des sciences, 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. 1. cap. 49.—Spigel. Anat. lib. 2. cap. 24.—Riolan. 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. 1. 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 coccygæi 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, (*b*), 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 wind-pipe, 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 vertebræ behind, the ribs on the sides, and the sternum before.

The vertebræ have already been described as part of the spine; and therefore are now to be passed.

THE RIBS.

THE ribs, or *costæ* (*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 vertebræ 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

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(*k*) Πλευραι, περιστερνα, σπαθαι.

(*l*) Riolani. Comment. de ossibus, cap. 19.—Marchetti, cap. 9. Cowper Explicat. tab. 93, and 94.—Morgagn. Advers. anat.

(*m*) Sue, Trad. d'osticolog. p. 141.

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 vertebræ, 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 flattened 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 vertebræ, 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 vertebræ 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 to turn broad, and conti-

(*n*) Κορυφή, Remulus.

nues 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 vertebræ.

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*) Πλατυ, Palmula.

(*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 vertebræ; for the head is received into the cavities of two bodies of the vertebræ, and the larger tubercle is received into the depression in the transverse process of the lower vertebra.—When we examine the double articulation, we must immediately see, that no other motion can here be allowed than upwards and downwards; since the transverse process hinders the rib to be thrust back; the resistance on the other side of the sternum prevents the ribs coming forward; and each of the two joints, with the other parts attached, oppose its turning round. But then it is likewise as evident, that even the motion upwards and downwards can be but small in any one rib at the articulation itself. But as the ribs advance forwards, the distance from their centre of motion increasing, the motion must be larger; and it would be very conspicuous at their anterior ends, were they not resisted there by the cartilages, which yield so little, that the principal motion is performed by the middle part of the ribs, which turns outwards and upwards, and occasions the twist remarkable in the long ribs at the place near their fore-end where they are most resisted (*r*).

Hitherto I have laid down the structure and connection which most of the ribs enjoy, as belonging to all of them; but must now consider the specialties wherein any of them differ from the general description given, or from each other.

In viewing the ribs from above downwards, their figure is still straighter; the uppermost being the most crooked of any.—Their obliquity in respect of the spine increases as they descend; so that though their distances from each other is very little different at their back-part, yet at their fore-ends the distances between the lower ones must increase.

—In

(*r*) Winslow, Memoires de l'acad. des sciences, 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 vertebræ, 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 vertebræ, gradually increases 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 sacro-lumbalis muscle (*s*)

The ribs are commonly divided into *true* and *false*.

The *true* (*t*) costæ 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 flattened 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*) Γνωστὰ, 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 expiration, 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, χονδροειδεις, ακανθαι, κλειεις, ποαι. Adulterinae, spuriae, illegitimae.

(*x*) Hippocrat. de articulo, § 51.—Paré, lib. 15. cap. 11.

(*y*) Laurent. Hist. Anat. lib. 2. chap. 29.—Paww, 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 flattened, 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 epiphyfes at birth, children muft 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 breast-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 fmall 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 whole 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

(*z*) Στήθος, Os pectoris, enfiforme, fcutum cordis.

(*a*) Ruysch, Catalog. Rar. fig. 9.

stance one from another, and, as they descend, are nearer; so that the two lowest are contiguous.

The *substance* of the breast-bone is cellular, with a very thin external plate, especially on its internal surface, where we may frequently observe a cartilaginous crust spread over it: (*b*).—On both surfaces, however, a strong ligamentous membrane is closely braced; and the cells of this bone are so small, that a considerable quantity of osseous fibres must be employed in the composition of it. Whence, with the defence which the muscles give it, and the moveable support it has from the cartilages, it is sufficiently secured from being broken: for it is strong by its quantity of bone; its parts are kept together by ligaments; and it yields enough to elude considerably any violence offered (*c*).

So far may be said of this bone in *general*; but the *three* bones, of which, according to the common account, it is composed in adults, are each to be examined.

The *first*, all agree, is somewhat of the figure of a heart, as it is commonly painted; only it does not terminate in a sharp point.—This is the uppermost thickest part of the sternum.

The upper middle part of this first bone, where it is thickest, is hollowed, to make place for the trachea arteria; though this cavity (*d*) is principally formed by the bone being raised on each side of it, partly by the clavicles thrusting it inwards, and partly by the sterno-mastoidei muscles pulling it upwards.—On the outside of each tubercle there is an oblong cavity, that, in viewing it transversely from before backwards, appears a little convex. Into these glenæ the ends of the clavicle are received.—Immediately below these, the sides of this bone begin to

Λ a 2

turn

(*b*) Jac. Sylv. in Galen de ossibus, cap. 12.

(*c*) Senac, in Memoires de l'acad. des sciences, 1724.

(*d*) Σφαγν, Jugulum, furcula superior.

turn thinner; and in each a superficial 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 furculæ 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*) Rolsinc. 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. & part. 3. cap. 3.—Borrigh. Act. Hafn. vol. 5. ob. 79.—Bonct. Sepulchret. Anat. tom. 2. lib. 3. § 5. Append. ad. obs. 8. et ibid. § 7. obs. 19.

The sternum most frequently has four round small 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 vertebræ and sternum, because the first or uppermost rib is by much the most fixed of any; and the cartilages making a great 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 vertebræ, 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 situation, 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

these causes, the cavity of the breast is diminished in all its dimensions.

Though the motions above described of the ribs and sternum, especially of the latter bone, are so small in the mild respiration of a healthy person, that we can scarce observe them; yet they are manifest whenever we designedly increase our respiration, or are obliged to do it after exercise, and in several diseases.

SECT. III. OF THE SUPERIOR EXTREMITIES.

AUTHORS are much divided in their opinions about the number of bones of which each superior extremity (*i*) should be said to consist; some describing the clavicle and scapula as part of it, others classing these two bones with those of the thorax: But since most quadrupeds have no clavicles, and the human thorax can perform its functions right when the scapula is taken away (*k*), while it is impossible for us to have the right use of our arms without these bones, I must think that they belong to the superior extremities. Each of the superior extremities may be divided into the shoulder, arm, fore-arm, and hand.

§ I. *Bones of the SHOULDER.*

The SHOULDER consists of the *clavicle* and *scapula*.

C L A V I C U L A.

CLAVICULA, or *collar bone* (*l*), is the long crooked bone, in figure like an Italic *f*, placed almost horizontally between

(*i*) *Καλα, γυια, εκρυαδες*, Enata, adnata, explantata membra, artus.

(*k*) *Philosoph. Transact. numb. 449. § 5.*

(*l*) *Os jugulare, jugulum, furcula, ligula, clavis, humerus quibusdam.*

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 sur-

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face

(*m*) Παρασφαγίς.

(*n*) Riolan. Encheirid. anat. lib. 6. cap. 13.—Winflow, 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.

face is extended outwards, where the pectoral muscle has part of its origin. Behind, the bone is made flat and rough by the insertion of the larger share of the subclavian muscle. After the clavicle begins to be bent backwards, it is round; but it soon after becomes broad and thin; which shape it retains to its external end. Along the external concavity, a rough sinuosity runs, from which some part of the deltoid muscle takes its rise; opposite to this, on the convex edge, a scabrous ridge gives insertion to a share of the cucullaris muscle. The upper surface of the clavicle is here flat; but the lower is hollow, for lodging the beginning of the musculus subclavius; and towards its back-part a tubercle rises; to which, and to a roughness near it, the strong short thick ligament, connecting this bone to the coracoid process of the scapula, is fixed.

The external end (*r*) of this bone is horizontally oblong, smooth, sloping at the posterior side, and tipped in a recent subject with a cartilage, for its articulation with the acromion scapulæ. Round this the bone is spongy, for the firmer connection of the ligaments.

The medullary arteries having their direction obliquely outwards, enter the clavicles by one or more small passages in the middle of their back-part.

The *substance* of this bone is the same as of the other round long bones.

The triangular unequal interior end of each clavicle has the cartilage above described interposed between it and the irregular cavity of the sternum.—The ligaments which surround this articulation to secure it, are so short and strong, that little motion can be allowed any way; and the strong ligament that is stretched across the upper furcula of the sternum, from the posterior prominent angle of the
one

one clavicle to the same place of the other clavicle, serves to keep each of these bones more firmly in their place.— By the assistance, 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 scapulæ, 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; that their broken parts must generally pass each other; and that they are difficultly kept in their place afterwards.

S C A P U L A.

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 vertebræ;

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and

(*s*) Ωμοπλατος, επιωστιον, Latitudo humeri, sceptulum vel scutulum operatum, spatula, ala, humerus, clypeus, scutum thoracis.

and 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 *ferratus 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 shortest 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*). *Χελευνιον*.

(*u*) *Anchoroides, figmoides, digitalis, ancistroides,*

cles and teguments. Into the oblique space the musculus patientiæ 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, 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

the infra-spinatus 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 subscapularis¹ 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 ωμοπλαταν, Eminentia scapularum.

(z) Pterigium, crista.

(a) Επαμις, αγκυροειδης, κορακοειδης, κατακλεις, Acronii os, summus armus, rostrum porcinum, processus digitalis.

(b) Sue, Trad. d'osteol. p. 160.

(c) 'Αγκυρ.ειδης, σιγμαειδης, Rostriformis.

inserted : from the external, one head of the biceps flexor cubiti rises ; and from the lower one, the coraco-brachialis has its origin. At the upper part of the root of this process, immediately before the femilunar cavity, a smooth tubercle appears, where a ligament from the clavicle is fixed. From all the external side of this coracoid apophyse, a broad ligament goes out, which becomes narrower where it is fixed to the acromion. The sharp pain, violent inflammation, and tedious cure of contusions in this part, are probably owing to these tendons and ligaments being hurt.

From the cervix scapulæ the third process is produced. The fore-part of this is formed into a glenoid cavity (*d*), which is of the shape of the longitudinal section of an egg, being broad below and narrow above. Between the brims of this hollow and the fore-part of the root of the spine, a large sinuosity is left for the transmission of the supra and infra spinati muscles ; and on the upper part of these brims we may remark a smooth surface, where the second head of the biceps flexor cubiti has its origin. The root of the supercilia is rough all round, for the firmer adhesion of the capsular ligament of the articulation, and of the cartilage which is placed on these 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 vessels enter the scapula near the base of the spine.

The *substance* of the scapula, as in all other broad flat bones, is cellular, but of an unequal thickness: for the neck and third process are thick and strong; the inferior costa, spine, and coracoid process, are of a middle thickness; and the body is so pressed by the muscles, as to become thin and diaphanous.

The

(*d*) Ωμοκοτύλις.

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, vertebræ, 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, *κατακλις*, Clausuræ.

(*f*) Jac. Sylv. *Method. Anat. lib. I. cap. 2.*

(*g*) See Winflow, *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 directions 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* (*h*); 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 smallest one, which is situated most to the

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(*h*) Ἀκρολίσσιον, ἄλινη, Os brachii, armi, adjutorium, parvum, brachium; canna brachii.

(*i*) Ἀκροκόλιον.

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 flattened 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 flattened 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 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

from 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 head of the bicondylaris, the extensor digitorum communis, extensor carpi ulnaris, anconæus, 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

C c 2

this,

(*k*) Βαδμίδης. (*l*) Winflow, Memoires de l'acad. des sciences, 1722.

this, a 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 brachiiæus 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 articulation

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 is 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 very 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 bones 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 newborn infant; and the large head with the two tubercles,
and

(*m*) Hippocrat. de articul. § 1.

and the trochlea with the two condyles, become epiphyses before they are united to the body of the bone.

§ 3. The FORE-ARM.

THE fore-arm (*n*) consists of two long bones, the *ulna* and *radius*; whose situation, in respect of each other, is oblique in the least straining or most natural posture; that is, the ulna is not directly behind, nor on the outside of the radius, but in a middle situation between these two, and the radius crosses it. The situation, however, of these bones, and of all the other bones of the superior extremity that are not yet described, is frequently altered: and therefore, to shun repetitions, I desire it may now be remarked, that, in the remaining account of the superior extremity, I understand by the term of *posterior*, that part which is in the same direction with the back of the hand; by *anterior*, that answering to the palm; by *internal*, that on the same side with the thumb; by *external*, the side nearest to the little finger; supposing the hand always to be in a middle position between the pronation and supination.

U L N A.

ULNA (*o*), so named from its being used as a measure, is the longest of the two bones of the fore-arm, and situated on the outside of the radius.

At the upper end of the ulna are two processes.—The posterior is the largest, and formed like a hook, whose concave surface moves upon the pulley of the os humeri, and is called *olecranon* (*p*), or top of the cubit. The convex

(*n*) Cubitus, πηχυς, αλενη, πυγων, Ulna, lacertus.

(*o*) Cubitus, πηχυς, τροπηχιον, 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 brachiaëus 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 (g). 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 anconæus 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 brachiaëus internus is inserted.—On the outside of that, we observe a smooth concavity,

where

(g) 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 femilunar 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*) Γεζοειδής, 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 tuberos 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

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(s) Winslow, Memoires de l'acad. des sciences, 1722.

(t) Κερκίς, παραπηχίον, Focile minus, canna minor, arundo minor.

its internal and posterior surfaces; where it is also made round by the equal pressure of the circumjacent muscles, particularly of the extensors of the thumb; but the surfaces next to the ulna are flattened and rough, for the origin of the muscles of the hand; and both terminate in a common sharp spine, to which the strong ligament extended between the two bones of the fore-arm is fixed. A little below the beginning of the plain surface, on its fore-part, where the flexor muscle of the last joint of the thumb takes its origin, the passage of the medullary vessels is seen slanting upwards. The radius becomes broader and flatter towards the lower end, especially on its fore-part, where its pronator quadratus muscle is situated.

The lower end of the radius is larger than the superior; though not in such a disproportion as the upper end of the ulna is larger than its lower end.—Its back-part has a flat strong ridge in the middle, and fossæ on each side.—In a small groove, immediately on the outside of the ridge, the tendon of the extensor tertii internodii pollicis plays. In a large one beyond this, the tendons of the indicator and of the common extensor muscles of the fingers pass.—Contiguous to the ulna there is a small depression made by the extensor minimi digiti.—On the inside of the ridge there is a broad depression, which seems again subdivided, where the two tendons of the bicornis, or extensor carpi radialis, are lodged. The internal side of this end of the radius is also hollowed by the extensors of the first and second joint of the thumb; immediately above which a little rough surface shows where the supinator radialis longus is inserted.—The ridges at the sides of the grooves, in which the tendons play, have an annular ligament fixed to them, by which the several sheaths for the tendons are formed. The fore-part of this end of the radius is also depressed, where the flexors of the fingers and
flexor

flexor carpi radialis pass.—The external side is formed into a semilunated smooth cavity, lined with a cartilage, for receiving the lower end of the ulna.—The lowest part of the radius is formed into an oblong cavity; in the middle of which is a small transverse rising, gently hollowed, for lodging mucilaginous glands; while the rising itself is insinuated into the conjunction of the two bones of the wrist that are received into the cavity.—The internal side of this articulation is fenced by a remarkable process (*u*) of the radius, from which a ligament going out to the wrist, as the styloid process of the ulna with its ligament, guards it on the outside.

The ends of both the bones of the fore-arm being thicker than the middle, there is a considerable distance between the bodies of these bones; in the larger part of which a strong tendinous, but thin ligament, is extended, to give a large enough surface for the origin of the numerous fibres of the muscles situated here, that are so much sunk between the bones as to be protected from injuries, to which they would otherwise be exposed. But this ligament is wanting near the upper end of the fore-arm, where the supinator radii brevis, and flexor digitorum profundus, are immediately connected (*x*).

Both ends of the bones of the fore-arm are first cartilages, and then epiphyses, 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 position; and, that this motion round its axis may be sufficiently 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

D d 2 part,

(*u*) Malleolus internus, processus styloides.

(*x*) Weitbrecht. Syndesmolog. 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*) Ἄκροχειρ, Summa manus.

motion in comparison of what the other has, and serves as a base to the moveable half; which can be extended back very little farther than to a straight line with the fore-arm, but can be considerably bent forwards.

As the bones that compose the hand are of different shapes and uses, while several of them that are contiguous agree in some general characters; the hand is, on this account, commonly divided into carpus, metacarpus, and fingers; among which last the thumb is reckoned.

C A R P U S.

THE carpus (z) is composed of eight small spongy bones, situated at the upper part of the hand. I shall describe each of these bones, under a proper name taken from their figure (a); because the method of ranging them by numbers leaves anatomists too much at liberty to debate very idly, which ought to be preferred to the first number; or, what is worse, several, without explaining the order they observe, apply the same numbers differently, and so confound their readers. But, that the description of these bones may be in the same order as they are found in the generality of anatomical books, I shall begin with the range of bones that are concerned in the moveable joint of the wrist, or are connected to the fore-arm, and shall afterwards consider the four that support the thumb and ossa metacarpi of the fingers.

The eight bones of the CARPUS are, Os scaphoides, lunare, cuneiforme, pisiforme, trapezium, trapezoides, magnum, unciforme.

The *scaphoides* is situated most internally of those that are articulated with the fore-arm.—The *lunare* is immediately

(z) Κρις, Brachiale, prima palmæ pars, rafetta.
(a) Lyser. Cult. Anat. lib. 5. cap. 2.

diately on the outside of the former.—The *cuneiforme* is placed still more externally, but does not reach so high up 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 femilunar 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 the 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

(b) Κορυβοειδής, Naviculare.

(c) Lunatum.

inferior cavity, 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 unciniforme, is oblong, somewhat spirral, 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 unciniform 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 scaphoïdes.—Its external side is

(d) Triquetrum.

(e) Cartilaginofum, 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 trapezium; 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 on-

ly towards the back or palm 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

(*k*) Galen. De usu part. lib. 2. cap. 8. For a particular description of these ligaments, see Weitbrecht. Syndesmolog. p. 5.—68.

to the security and easiness of which, the reception of the os magnum into the cavity formed by the scaphoides and lunare considerably contributes: And the greatest number of the muscles that serve for the motion of the wrist on the radius, being inserted beyond the conjunction of the first row of bones with the second, act equally on this articulation as they do on the former; but the joint formed with the radius being the most easily moved, the first effect of these muscles is on it; and the second row of the carpus is only moved afterwards. By this means a larger motion of the wrist is allowed than otherwise it could have had safely: for if as large motion had been given to one joint, the angle of flexion would have been very acute, and the ligaments must have been longer than was consistent with the firmness and security of the joint. The other articulations of the bones here being by nearly plain surfaces, scarcely allow of any more motion, because of the strong connecting ligaments, than to yield a little, and so elude the force of any external power; and to render the back of the wrist a little more flat, or the palm more hollow, on proper occasions. The articulations of the thumb and metacarpal bones shall be examined afterwards.

The *uses* of the carpus are to serve as a base 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 state at the time of birth.

On account of the many tendons that pass upon the lower end of the fore-arm and the carpus, and of the numerous ligaments of these tendons and of the bones, which have lubricating liquors supplied to them, the pain of sprains here is acute, the parts take a long time to recover their tone, and their swellings are very obstinate.

M E T A C A R P U S.

METACARPUS (1) consists of four bones which sustain the fingers. Each bone is long and round, with its ends larger than its body.—The upper end, which some call the base, is flat and oblong, without any considerable head or cavity; but it is however somewhat hollowed, for the articulation with the carpus: It is made flat and smooth on the sides where these bones are contiguous to each other. Their bodies are flatted on their back-part by the tendons of the extensors of the fingers. The anterior surface of these bodies is a little concave, especially in their middle; along which a sharp ridge stands out, separating the muscliculi interossei placed on each side of these bones, which are there made flat and plain by these muscles.

Their lower ends are raised into large oblong smooth heads, whose greatest extent is forwards from the axis of the bone. At the fore-part of each side of the root of each of these heads, one or two tubercles stand out, for fixing the ligaments that go from one metacarpal bone to another, to preserve them from being drawn asunder: Round the heads a rough ring may be remarked, for the capsular ligaments of the first joints of the fingers to be fixed to; and both sides of these heads are flat, by pressing on each other.

The *substance* of the metacarpal bones is the same with that of all long bones.

At the time of birth, these bones are cartilaginous at both ends, which afterwards become epiphyses.

The metacarpal bones are *joined* above to the ossa carpi and to each other by nearly plain surfaces. These connections

(1) Κτεας, προκαρπιον, στυδος, ανδρον, κτενιον, Postbrachiale, pedus, 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, flanting 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 unciniforme. 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 flanting 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 only enjoys a much larger motion than
any

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 bones 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 plays in the orbicular socket of another; only

(*m*) Ἀντιχειρ, δεικνυλος, Magnus digitus, pro manus.

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 epiphysē.

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

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F f

distinguishing

(*n*) Scyतालιδæ, internodia, scuticula, agmina, acies, condyli articuli.

(*o*) Προκοιδυλοι.

(*p*) Κενδυλοι.

(*q*) Μετακοιδυλοι, ριζανυχια.

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. *The*

(*r*) Καταπυγων, σφακελος, Infamis, impudicus, verpus, famosus, obscenus.
 (*s*) Δεικτικος, Indicator, λιχανος, demonstrativus, salutaris.
 (*t*) Ιατρικος, παραμισος, δακτυλιωτης, επιβατης, Annularis, medicus, cordis digitus.

(*u*) Μυωψ, ωτικης, Auricularis, minimus.

(*x*) Galen. de usu part. lib. I. cap. 24.

§ I. *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 cloacæ of urine and fæces, 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

F f 2

rough

(*y*) *Μυρος*, Femur, coxa, agis, anchæ os, crus, femur.

(*z*) Vertebra.

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 bone, 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 glutæus minimus; the superior one is smooth, and has the glutæus medius inserted into it; and the one behind is made flat and smooth, by the tendon of the glutæus maximus passing over it.—The upper edge of this process is sharp and pointed at its back-part, where the glutæus 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 inter-

(a) Γλυστός, Rotator natis, malum granatum testicularum.

(b) Rotator minor.

nal root. The muscles inserted into those two processes being the principal instruments of the rotatory motion of the thigh, have occasioned the name of *trochanters* to be given to those processes.—The tendons that are fixed into or pass over the great *trochanter*, cause bruises, by falls on this part, to be attended with great pain and weakness 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 muscles that move it and the leg, and for the conveniency of sitting, without bearing too much on these muscles; and probably the weight of the legs depending from the thighs in that posture contributes to this curvature. The fore-part of the thigh-bone is a little flattened above by the beginning of the *cruræus* muscle, as it is also below by the same muscle and the *rectus*.—Its external surface is likewise made flat below by the *vastus externus*, where it is separated from the former by an obtuse ridge. The *vastus internus* depresses a little the lower part of the internal surface.—The posterior concave surface has a ridge rising in its middle, commonly called *linea aspera*, into which the *triceps* is inserted, and the short head of the *biceps flexor tibiæ* rises from it.—At the upper part of it the medullary vessels enter by a small hole that runs obliquely upwards. A little above which there is a rough fossa or two, where the tendon of the *glutæus maximus* is fixed.—The lower end of the *linea aspera* divides into two, which descend towards each side.—The two *vasti* muscles have part of their origin from these ridges; and the long tendon of the *triceps* is fixed to the internal, by a part of the *fascia aponeurotica* of the thigh.—Near the beginning of the internal ridge, there is a discontinuation of the ridge, where the *crural* artery passes through the *aponeurosis*.—Between these two rough lines, the bone is made flat by the large
blood-

blood-vessels and nerves which pass upon it; and near the end of each of these ridges, a small smooth protuberance may often be remarked, where the two heads of the external gastrocnemius muscle take their rise, and where sesamoid bones are sometimes found (c); and from the fore-part of the internal tubercle a strong ligament is extended to the inside 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 side, called its *condyles*; between which a considerable cavity is found, especially at the back-part, in which the crural vessels and nerves lie immersed in fat.—The internal condyle is longer than the external, which must happen from the oblique position of this bone, to give less obliquity to the leg. Each of these processes seem to be divided into its plain smooth surface. The mark of division on the external is a notch, and on the internal a small protuberance. The fore-part of this division, on which the rotula moves, is formed like a pulley, the external side of which is highest. Behind, there are two oblong large heads, whose greatest extent is backwards, for the motion of the tibia: and from the rough cavity between them, but near to the base of the internal condyle, the strong ligament, commonly called the *cross one*, has its rise.—A little above which a protuberance gives insertion to the tendon of the triceps. The condyles, both on the outer and inner side of the knee, are made flat by the muscles passing along them. On the back-part of the internal, a slight depression is made by the tendons of the gracilis and sartorius; and on the external such another is formed by the biceps flexor cruris; behind which a deep fossa is to be observed, where the popliteus muscle has its origin. From the tubercle immediately before this cavity, a strong ligament goes

(c) Vesal. lib. I. cap. 28. & 30.

goes out to the upper part of the fibula.—Round this lower 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 newborn 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
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the thigh-bone, and its upper end being covered with very thick muscles, make greater difficulty in distinguishing between a luxation and fracture here, than in any other part of the body.

§ 2. *The LEG.*

THE leg (*d*) is composed, according to the common account, of two bones, *tibia* and *fibula*, though it seems to have a very good title to a third, the *rotula*; which bears a strong analogy to the olecranon of the ulna, and moves always with the other two.

T I B I A.

TIBIA (*e*), so called from its resemblance to an old musical pipe or flute, is the long thick triangular bone, situated at the internal part of the leg, and continued in almost a straight line from the thigh-bone.

The upper end of the tibia is large, bulbous, and spongy, and is divided into two cavities by a rough irregular protuberance (*f*), which is hollow at its most prominent part, as well as before and behind. The anterior of the two ligaments that compose the great cross one is inserted into the middle cavity, and the depression behind receives the posterior ligament.—The two broad cavities at the sides 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 superficial and rounder, for the external condyle.—In each of these two cavities of a recent subject, a femilunar cartilage is placed,

(*d*) *Κνήμη*, Crus, tibia.

(*e*) *Προκνήμιον*, *αντικνήμιον*, *Focile majus*, *arundo major*, *canna major*, *canna domestica cruris*.

(*f*) *Διαρυσίς*, *εξοχή νευροχονηράδης*, *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 these 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 capsular and other ligaments of the articulation; but so near to their rise from the tibia, that the cartilages are not allowed to change place far; while the narrow ends of the cartilages becoming almost ligaments, are fixed at the insertion of the strong cross ligament into the tibia, and seem to have their substance united with it; therefore a circular hole is left between each cartilage and the ligament, in which the most prominent convex part of each condyle of the thigh bone moves. The circumference of these 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 stand out; into the internal, the tendon of the semimembranosus muscle is inserted; and a part of the cross ligament is fixed to the external.—On the outside of this last tubercle, a smooth slightly-hollowed surface is formed by the action of the popliteus muscle.

Below the fore-part of the upper end of the tibia, a considerable rough protuberance (*g*) rises, to which the strong tendinous ligament of the rotula is fixed.—On the internal side of this, there is a broad scabrous slightly-hollowed surface, to which the internal long ligament of the joint, the aponeurosis of the vastus internus, and the tendons of the seminervosus, gracilis, and sartorius, are fixed. The lowest part of this surface is therefore the place where the tibia ought to be sawn through in an amputation, so as not to have too long and troublesome a stump,

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(*g*) Ἀντικνημίων, 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 solæus, tibialis posticus, and flexor digitorum longus, and insertion to the aponeurosis of the semimembranosus which covers the poplitæus, 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 poplitæus is inserted. The remaining body of the tibia is triangular. The anterior angle is very sharp, and is commonly called the *spine* or *shin* (*b*). 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 flattened 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 solæus. 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

(*b*) *Ακνὴ*, Spina, circa, linea prima tibiæ, 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

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(*i*) Σφυρον, πεσσος, Talus, clavicula, clavilla interior, clavilla domestica.

(*k*) Winflow, Exposition anatomique des os secs, § 865.

(*l*) Παράκνημιον, Perone, focile minus, arundo minor, canna minor, crus, 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 *solæus* 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 *peronæi*. 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 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 *solæus*, 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
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of the medullary vessels of the large bones of the extremities (*m*); because in several surgical 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 to their entry into the bone, or while they are in the oblique passage through it, an obstinate hæmorrhagy 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 of the muscles,

then

(*m*) Havers, Osteolog. Nov. disc. I. p. 59.

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 peronæi 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*) Winflow, Mem. de l'acad. des sciences, 1722.

observable.—In old subjects I have often seen the two bones of the leg grown together at their lower ends.

The principal use of this bone is to afford origin and insertion to muscles; the direction of which may be a little altered on proper occasions, by its upper part thrusting backwards and forwards.—It likewise helps to make the articulation of the foot more secure and firm.—The ends of the tibia and fibula being larger than their middle, a space is here left, which is filled up with such another ligament as I have described extended between the bones of the fore-arm; and which is also discontinued at its upper part, where the tibialis anticus immediately adheres to the *folæus* and tibialis posticus; but every where else it gives origin to muscular fibres (*o*).

Both the ends of this bone are cartilaginous in a ripe child, and assume the form of appendices before they are united to its body.

R O T U L A.

ROTULA (*p*) is the small flat bone situated at the fore-part of the joint of the knee.—Its shape resembles the common figure of the heart with its point downwards.—The anterior convex surface of the rotula is pierced by a great number of holes, into which fibres of the strong ligament, that is spread over it, enter.—Behind, its surface is smooth, covered with cartilage, and divided by a middle-convex ridge into two cavities, of which the external is largest; and both are exactly adapted to the pulley of the os femoris, on which they are placed in the most ordinary unstraining postures of the leg: but when the leg is much bent, the rotula descends far down on the condyles; and

(*o*) Weitbrecht, Syndesmolog. p. 156.

(*p*) Ἐπιμυλις, μυλαρις, κογχος, επιγονατις, πλανησιεδρον, Patella, mola, genu, scutiforme os, cartilaginofum, disciforme, oculus genu.

and when the leg is fully extended, the rotula rises higher in its upper part than the pulley of the thigh-bone.—The plain smooth surface is surrounded by a rough prominent edge, to which the capsular ligament adheres: Below, the point of the bone is scabrous, where the strong tendinous ligament from the tubercle of the tibia is fixed. The upper horizontal part of this bone is flattened and unequal, where the tendons of the extensors of the leg are inserted.

The substance of the rotula is cellular, with very thin external firm plates; but then these cells are so small, and such a quantity of bone is employed in their formation, that scarce any bone of its bulk is so strong. Besides, it is covered all over with a thick ligament, (as it was observed that this sort of bones generally is), to connect its substance, and is moveable to one side or other: therefore it is sufficiently strong to resist the ordinary actions of the large muscles that are inserted into it, or any common external force applied to it; while a fixed process, such as the olecranon, would not have been sufficient to bear the whole weight of our bodies, which frequently falls on it, and would have hindered the rotatory motion of the leg. Notwithstanding these precautions to preserve this bone from such injuries, yet I have seen a transverse fracture in it, when, by the report of the patient, and of the people about him, and by the want of swelling, discolouring, or other mark of bruise or contusion, it was plain the bone was broken by the violent straining effort of the muscles (g). Though my patient recovered the use of the joint of the knee, yet I think it reasonable to believe, that this sort of fracture is commonly attended with difficulty of motion after the broken parts of the rotula are reunited; because the callous matter probably extends itself into the cavity of the joint, where it either grows to some of the parts, or makes
such

(g) See Ruyfch. Observ. anat. chirurg. obs. 3.

such an inequality on the surface of this bone, as does not allow it to perform the necessary motions on the condyles of the femur (*r*).

At the ordinary time of birth, the rotula is entirely cartilaginous, and scarcely assumes a bony nature so soon as most epiphyses do.

The parts which constitute the joint of the knee being now described, let us examine what are its motions, and how they are performed.—The two principal motions are flexion and extension. In the former of these, the leg may be brought to a very acute angle with the thigh, by the condyles of the thigh-bones being round and made smooth 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, consequently the tibia forwards, by the extensor muscles; 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 considerable angle, act, on that account, with advantage; but they are restrained from pulling the leg farther than to a straight line with the thigh, by the posterior part of the cross ligament, that the body might be supported by a firm perpendicular column: For at this time the thigh and leg are as little moveable in a rotatory way, or to either side, as if they were one continued bone.—But when the joint is a little bent, the rotula is not tightly braced, and the posterior ligament is relaxed; therefore this bone may be moved a little to either side, or with a small rotation in the superficial cavities of the tibia; which is done by the motion of the external cavity backwards and forwards, the internal serving as a sort of axis (*s*). Seeing, then, one part of the cross ligament is situated perpendicularly,

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(*r*) Paré, liv. 15. cap. 22.

(*s*) Winflow, Exposition anatomique du corps humain, traité des os secs,

and the posterior 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 rings, 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 F O O T.

THE foot is divided, as well as the hand, into three parts, viz. *tarfus*, *metatarfus*, 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*.

T A R S U S.

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 astragalus, 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 cuneiform* 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

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play

(*t*) Raffetta.

(*u*) Ἄστρος, Talus, ballistæ os, malleolus, chaib, quatrio, os tessaræ, claviculæ, nuciforme.

(*x*) Τετραπός.

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 astragalus 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 astragalus 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 lessen 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

especially on the upper surface, a rough fossa may be remarked.

The astragalus is articulated above to the tibia and fibula, which together form one cavity. Though in this articulation the bones have prominences and cavities, so small as might allow motions in all directions, yet the flexion and extension are the most considerable, the other motions being confined by the malleoli, and, by the strong ligaments which go out from the points of these processes, to the astragalus and os calcis.—When the foot is bent, so far as it commonly is when we stand, no lateral or rotatory motion is allowed in this joint; for then the head of the astragalus is sunk deep between the malleoli, and the ligaments are tense: but when the foot is extended, the astragalus can move a little to either side, and with a small rotation. By this contrivance the foot is firm, when the weight of the body is to be supported on it; and when a foot is raised, we are at liberty to direct it more exactly to the place we intend next to step upon. The astragalus is joined below to the os calcis; and before to the os naviculare, in the manner to be explained when these bones are described.

A considerable share of this bone is ossified in a newborn infant.

Calcaneum (*w*) is the largest bone of the seven.—Behind, it is formed into a large knob, commonly called the *heel*: the surface of which is rough behind, where the tendo Achillis is inserted; and above that part it is hollow and spongy. Farther forwards, on the upper surface of the calcaneum, there is an irregular oblong smooth convexity, adapted to the concavity at the back-part of the astragalus: and beyond this a narrow fossa is seen, which divides it from two small concave smooth surfaces, that are joined

to

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 peronæus 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 minimi 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 epiphysē.

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*) Σκαφοειδής, Os cymbæ.

tarfus. 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 peronæus 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 the 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 tessaræ, 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 cu-

neiforme 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 *mufculus 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 *fœtus* of nine months.

These 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 *fossæ* 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 either side of it, as might be judged by what was said of the particular bones.

Sprains occasion here, as in the wrist, great pain and obstinate tumours, which too often cause carious bones.

M E T A T A R S U S.

METATARSUS (*a*) is composed of five bones, which, in their general characters, agree with the metacarpal bones; but may be distinguished from them by the following marks: 1. They are longer, thicker, and stronger. 2. Their anterior round ends are not so broad, and are less in proportion to their bases. 3. Their bodies are sharper above and flatter on their sides, with their inferior ridge inclined more to the outside. 4. The tubercles at the lower part of the round head are larger.

The first or internal metatarsal bone is easily distinguished from the rest by its thickness. The one next to it is the longest, and with its sharp edge almost perpendicular. The others are shorter and more oblique, as their situation is more external. Which general remarks, with the description I am now to give of each, may teach us to distinguish them from each other.

Os metatarsi pollicis is by far the thickest and strongest, as having much the greatest weight to sustain. Its base is oblong, irregularly concave, and of a semilunar figure, to be adapted to the os cuneiforme maximum. The inferior edge of this base is a little prominent and rough, where the tendon of the peronæus primus muscle is inserted. On its outside an oblique circular depression is made by the second metatarsal bone. Its round head has generally

(*a*) Στηθος, πειδιον, Planta, planum, vestigium, folium, pectus, precordium, pectusculum.

on its fore-part a middle ridge, and two oblong cavities, for the ossa sesamoidea; and on the external side a depression is made by the following bone.

Os metatarsi of the second toe, is the longest of the five, with a triangular base supported by the os cuneiforme medium and the external side produced into a process; the end of which is an oblique smooth plane, joined to the os cuneiforme externum.—Near the internal edge of the base, this bone has two small depressions, made by the os cuneiforme maximum, between which is a rough cavity.—Farther forwards we may observe a smooth protuberance, which is joined to the foregoing bone.—On the outside of the base are two oblong smooth surfaces, for its articulation with the following bone; the superior smooth surface being extended longitudinally, and the inferior perpendicularly; between which there is a rough fossa.

Os metatarsi of the middle toe, is the second in length.—Its base, supported by the os cuneiforme externum, is triangular, but slanting outwards, where it ends in a sharp-pointed little process; and the angle below is not completed.

The internal side of this base is adapted to the preceding bone; and the external side has also two smooth surfaces covered with cartilage, but of a different figure; for the upper one is concave, and being round behind, turns smaller as it advances forwards; and the lower surface is little, smooth, convex, and very near the edge of the base.

Os metatarsi of the fourth toe, is near as long as the former, with a triangular slanting base joined to the os cuboides, and made round at its external angle; having one hollow smooth surface on the outside, where it is pressed upon by the following bone; and two on the internal side, corresponding to the former bone; behind which is a long narrow surface impressed by the os cuneiforme externum.

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, tuberos, and produced into a long-pointed process externally, where part of the *abductor minimi digiti* is fixed; and into its upper part the *peronæus 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.

T O E S.

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,

les.—The little toe, and frequently that next to it, have the second and third bones intimately united into one; which may be owing to their little motion, and the great pressure they are subject to.

The toes are of great use to us in walking; for, when the sole is raised, they bring our body, with its centre of gravity, perpendicular to the advanced foot.

The bones of the METATARSUS and TOES, are in the same condition in children as those of the metacarpus and fingers.

THE only bones now remaining to complete the description of the skeleton, are the small ones which are found at the joints of the fingers and toes, and in some other parts, called

OSSA SESAMOIDEA.

THESE are of very different figures and sizes, though they are generally said to resemble the seed of the sesamum.—They seem to me nothing else than the ligaments of the articulations, or the firm tendons of strong muscles, or both, become bony by the compression which they suffer. Thus the sesamoid bones at the beginning of the gastrocnemii muscles, are evidently composed of the tendinous fibres only. These, at the first joint of the great toe, are as plainly the same continued substance with the ligaments and the tendons of the adductor, flexor, brevis, and abductor.—That which is sometimes double at the second joint of that toe is part of the capsular ligament; and if we enumerate the other sesamoid bones that are at any time found, we may observe all of them formed in this manner. Their number, figure, situation, and magnitude, are so uncertain, that it were in vain to insist on the

the

the differences 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, *cæteris 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, *cæteris 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.

A P P E N D I X.

MARKS of a FEMALE SKELETON.

TO finish the description of the bones, is generally to conclude the osteology: but, that no part of the subject may be left untouched, I think it necessary to subjoin the distinguishing marks of the Male and Female skeletons; and I have chosen to illustrate them principally in the latter; because women having a more delicate constitution, and affording lodging and nourishment to their tender fœtuses till they have sufficient strength and firmness to bear the injuries of the atmosphere, and contact of other more solid substances, their bones are frequently incomplete, and always of a make in some parts of the body different from those of the robust male; which agree to the description already given, unless where the proper specialties of the female were particularly remarked; which could not be done in all places where they occur, without perplexing the order of this treatise: Therefore I choose rather to sum them up here by way of appendix.

The causes of the following specialties of the female bones may be reduced to these three: 1. A weak lax constitution. 2. A sedentary unactive life, increasing that constitution. 3. A proper frame for being mothers.

The bones of women are smaller in proportion to their length than those of men; because the force of their muscles is not so great, nor is such strong external force applied to them to prevent their stretching 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 ofteneft 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 superior cartilages of the ribs sooner ossify, to support the weight of the mammæ.

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

(*b*) Cheselden, Anatomy, book 1. chap. 1.

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 consequence of the *pelvis* of women being wider, the articulations of their thigh-bones must be farther removed from each other; and therefore a larger space is left for the procreation and birth of children (c); which distance of the thighs may be one reason why women in running shuffle more from one side to the other than men, to preserve the centre of gravity of their bodies from falling too far to a side of the joint of the thigh that supports them when the other is raised, which would endanger their tumbling to the ground.

(c) Albin. De ossib. § 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.

T O
ALEXANDER MONRO, M. D.
PROFESSOR OF ANATOMY and MEDICINE in the
University of Edinburgh.

S I R,

HAVING been repeatedly sollicitated, 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, }
1766. }

JOHN INNES.

P R E-

P R E F A C E.

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 Treatise, was born at Callart, an obscure 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, professor of anatomy; who instructed him in the knowledge of the human body, and in the art of dissection. When he was about the age of eighteen years, Dr Monro appointed him dissector 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 dissecting the most minute parts of the human frame. He described the various organs with ease and with perspicuity. This happy talent attracted the notice of the students; and, at their sollicitation, and by the approbation of Dr Monro, he opened an evening course of anatomical demonstrations.

The number of pupils who annually attended these demonstrations afforded the best evidence of his abilities, and of the advantages derived from his labours. During his last course, he was attended by near two hundred students.

For some time before his death, he was troubled with an affection of the lungs, which terminated in a phtisis pulmonalis, and proved fatal to him on the 12th of January 1777.

On the 15th of the same 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 dissecting art : He made a rapid progress in his profession ; and his genius and industry were rewarded with the privilege of giving private lectures for his own emolument. The utility of his lessons were soon perceived. Numbers of students resorted to him

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 is 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."

A D V E R T I S E M E N T.

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.

I. 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 muscle; 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 aëque 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, Winflow.

2. CORRUGATOR SUPERCILII,

Arises fleshy from the internal angular process of the os frontis, above the joining of the os nasi, and nasal process of the superior maxillary bone; from thence it runs outwards, and a little upwards.

Inserted into the inner and inferior fleshy part of the occipito-frontalis muscle, where it joins with the orbicularis palpebrarum, and extends outwards as far as the middle of the superciliary ridge.

Use. To draw the eye-brow of that side towards the other, and make it project over the inner canthus of the eye: When both act, they pull down the skin of the forehead, and make it wrinkle, particularly between the eye-brows.

Musculus Supercilii, Winslow.

Musculus Frontalis verus, seu Corrugator, Douglas.

C H A P. II.

Of the MUSCLES *of the* EAR.

THE muscles of the ear may be divided into three classes, 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 small bones within the tympanum.

The common muscles are,

I. ATTOLLENS AUREM,

Arises 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,

Arise, 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,

I. 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. ANTI-TRAGICUS,

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:

I. LAXATOR TYMPANI,

Arises by a small beginning from the extremity of the

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 petroso, near the cells of the mastoid process, before the inferior part of the passage for the portio dura of the auditory nerve; its tendon passes straight through a small round hole in the same cavern, enters the anterior part of the tympanum, and is

Inserted into the posterior part of the head of the stapes.

Use. To draw the stapes obliquely upwards towards the cavern, by which the posterior part of its base is moved inwards, and the anterior part outwards.

Musculus stapedis, Winslow.

Stapidæus, Douglas.

C H A P. III.

Of the MUSCLES *of the* EYE-LIDS.

THE palpebræ or eye-lids, have one muscle common to both, and the upper eye-lid one proper to itself.

I. ORBICULARIS PALPEBRARUM,

Arises, by a number of fleshy fibres, from the outer edge of the orbital process of the superior maxillary bone, and from a tendon near the inner angle of the eye: these run a little downwards, then outwards, over the upper part of the cheek, below the orbit, covering the under eye lid, and surround the external angle, being loosely connected only to the skin and fat; run over the superciliary ridge of the os frontis, towards the inner canthus, where they intermix with those of the occipito frontalis and corrugator supercillii; then covering the upper eye-lid, they descend to the inner angle opposite to the inferior origin of this muscle, firmly adhering to the internal angular

gular process of the os frontis, and to the short round tendon which serves to fix the palpebræ 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 *tarfi*.

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 alæque nasi.

2. LEVATOR PALPEBRÆ 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.

 C H A P. IV.

MUSCLES of the EYE-BALL.

THE muscles which move the globe of the eye are six, viz.

Four *straight* and two *oblique*.

The four straight muscles very much resemble each other; all

Arising by a narrow beginning, a little tendinous and fleshy, from the bottom of the orbit around the foramen opticum of the sphenoid bone, where the optic nerve enters, so that they may be taken out adhering to this nerve; and all having strong fleshy bellies.

Inserted at the fore-part of the globe of the eye into the anterior part of the tunica sclerotica, and under the tunica adnata, at opposite sides, which indicates both their names and *Use*; so that they scarcely require any further description, but to name them singly.

I. LEVATOR OCULI,

Arises from the upper part of the foramen opticum of the sphenoid bone, below the levator palpebræ superioris; and runs forwards to be

Inserted into the superior and fore-part of the tunica sclerotica, by a broad thin tendon.

Use. To raise up the globe of the eye.

Attollens, Albinus.

Elevator, Douglas.

2. DEPRESSOR OCULI,

Arises from the inferior part of the foramen opticum.

Inserted opposite to the former.

Use. To pull the globe of the eye down.

Deprimens, Albinus.

3. ADDUCTOR OCULI,

Arises, as the former, between the obliquus superior and depressor, being, from its situation, the shortest.

Inserted opposite to the inner angle.

Use. To turn the eye towards the nose.

4. ABDUCTOR OCULI,

Arises from the bony partition between the foramen opticum and lacerum, being the longest from its situation; and is

Inserted into the globe opposite to the outer canthus.

Use. To move the globe outwards.

The oblique muscles are two :

I. OBLIQUUS SUPERIOR, seu TROCHLEARIS,

Arises, like the straight muscles, from the edge of the foramen opticum at the bottom of the orbit, between the levator and adductor oculi; from thence runs straight along the pars plana of the ethmoid bone to the upper part of the orbit, where a cartilaginous trochlea is fixed to the inside of the internal angular process of the os frontis, through which its tendon passes, and runs a little downwards and outwards, inclosed in a loose membranous sheath.

Inserted, by a broad thin tendon, into the tunica sclerotica, about half way between the insertion of the attollens oculi and optic nerve.

Use.

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 eyebrow; 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 MUSCLE 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 alar nasi externally, where part of the levator labii superioris

alæque nasi is connected to it; it spreads into a number of thin separate fibres, which run up along the cartilage in an oblique manner towards the dorsum of the nose, where it joins with its fellow, and is

Inserted slightly into the anterior extremity of the os nasi and nasal process of the superior maxillary bone, where it meets with some of the fibres descending from the occipito-frontalis muscle.

Use. To compress the ala towards the septum nasi, particularly when we want to smell acutely; but, if the fibres of the frontal muscle, which adhere to it, act, the upper part of this thin muscle assists to pull the ala outwards. It also corrugates the skin of the nose, and assists in expressing certain passions.

Rinaus, vel nasalis, Douglas.

CHAP. VI.

MUSCLES of the MOUTH and LIPS.

THE mouth has nine pair of muscles, which are inserted into the lips, and a common one formed by the termination of these, viz. three *above*, three *below*, three *outwards*, and the common muscle surrounds the mouth.

The three above are,

I. LEVATOR ANGULI ORIS,

Arises, thin and fleshy, from the hollow of the superior 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 ALÆQUE 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 obicularis 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 ALÆQUE NASI,

Arises, thin and fleshy, from the os maxillare superius, immediately above the joining of the gums with the two

dentis incisivi, and the dens caninus; from thence it runs up under part of the levator labii superioris aequæ 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 alæ nasi, Albinus.

Incisivus medius, Winslow.

Depressor labii superioris proprius, Douglas.

The three below are,

I. 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 left 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. LEVATOR LABII INFERIORIS,

Arises, from the lower jaw, at the roots of the alveoli of two dentes incisivi and of the caninus; is

Inserted into the under lip and skin of the chin.

Use. To pull the parts into which it is inserted upwards.

Levator menti, Albinus.

Incisivus inferior, Winslow.

Elevator labii inferioris proprius, Douglas.

The three outward are,

I. BUCCINATOR,

Arises, tendinous and fleshy, from the lower jaw, as far back as the last dens molaris and fore-part of the root of the coronoid process; fleshy from the upper jaw, between the last dens molaris and pterygoid process of the sphenoid bone; from the extremity of which it arises tendinous, being continued between both jaws to the constrictor pharyngis superior, with which it joins; from thence proceeding with straight fibres, and adhering close to the membrane that lines the mouth, it is

Inserted into the angle of the mouth within the orbicularis oris.

Use. To draw the angle of the mouth backwards and outwards, and to contract its cavity, by pressing the cheek inwards, by which the food is thrust between the teeth.

Retractor anguli oris, Albinus.

2. ZYGOMATICUS MAJOR,

Arises, fleshy, from the os maxillæ, near the zygomatic suture.

Inserted into the angle of the mouth, appearing to be lost in the depressor anguli oris and orbicularis oris.

Use,

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.

C H A P. VII.

MUSCLES of the LOWER JAW.

THE lower jaw has four pair of muscles for its elevation or lateral motions, viz. two, which are seen on the side of the face, and two concealed by the angle of the jaw.

I. TEMPORALIS,

Arises, fleshy, from a semicircular ridge of the lower and lateral part of the parietal bone, from all the pars squamosa of the temporal bone, from the external angular process of the os frontis, from the temporal process of the sphenoid bone, and from an aponeurosis which covers it; from these different origins the fibres descend like radii towards the jugum, under which they pass; and are

Inserted, by a strong tendon, into the upper part of the coronoid process of the lower jaw; in the duplicature of which tendon this process is inclosed as in a sheath, being continued down all its fore-part to near the last dens molaris.

Use. To pull the lower jaw upwards, and press it against the upper, at the same time drawing it a little backwards.

N. B. This muscle is covered by a tendinous membrane, called its *aponeurosis*, which arises from the bones that give origin to the upper and semicircular part of the muscle; and,

and, descending over it, is inserted into all the jugum, and the adjoining part of the os frontis

The use of this membrane is to give room for the origin of a greater number of fleshy fibres, to fortify the muscle in its action, and to serve as a defence to it.

Crotaphite muscle, Winslow.

2. MASSETER,

Arises, by strong, tendinous, and fleshy fibres, which run in different directions, from the superior maxillary bone, where it joins the os malæ, and from the inferior and anterior part of the zygoma, its whole length, as far back as the tubercle before the socket for the condyle of the lower jaw; the external fibres slanting backwards, and the internal forwards.

Inserted into the angle of the lower jaw, and from that upwards to near the top of its coronoid process.

Use. To pull the lower to the upper jaw, and, by means of its oblique decussation, a little forwards and backwards.

3. PTERYGOIDEUS INTERNUS,

Arises, tendinous and fleshy, from the inner and upper part of the internal plate of the pterygoid process, filling all the space between the two plates; and from the pterygoid process of the os palati between these plates.

Inserted into the angle of the lower jaw internally.

Use. To draw the jaw upwards, and obliquely towards the opposite side.

Pterygoideus major, Winslow,

4. PTERYGOIDEUS EXTERNUS,

Arises from the outer side of the external plate of the pterygoid process of the sphenoid bone, from part of the
tuberosity

tuberosity of the os maxillare adjoining to it, and from the root of the temporal process of the sphenoid bone.

Inserted into a cavity in the neck of the condyloid process of the lower jaw; some of its fibres are inserted into the ligament that connects the moveable cartilage and that process to each other.

Use. To pull the lower jaw forwards, and to the opposite side; and to pull the ligament from the joint, that it may not be pinched during these motions: when both external pterygoid muscles act, the fore-teeth of the under jaw are pushed forwards beyond those of the upper jaw.

Pterygoideus minor, Winslow.

C H A - P. VIII.

*The MUSCLES which appear about the anterior part of the
NECK.*

ON the side of the neck are two muscles or layers.

I. MUSCULUS CUTANEUS, VULGO PLATYSMA MYOIDES,

Arises, by a number of slender separate fleshy fibres, from the cellular substance that covers the upper parts of the deltoid and pectoral muscles; in their ascent they all unite to form a thin muscle, which runs obliquely upwards along the side of the neck, adhering to the skin.

Inserted into the lower jaw, between its angle and the origin of the depressor 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.

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 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 inside 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. LINGUALIS,

Arises from the root of the tongue laterally; runs forwards between the hyo-glossus and genio-glossus, to be

Inserted into the tip of the tongue, along with part of the stylo-glossus.

Use. To contract the substance of the tongue, and bring it backwards.

C H A P. X.

MUSCLES *situated between the Os HYOIDES and TRUNK.*

THESE may be divided into two layers.

The first layer consists of two muscles.

1. STERNO-HYOIDEUS,

Arises, thin and fleshy, from the cartilaginous extremity of the first rib, the upper and inner part of the sternum, and from the clavicle where it joins with the sternum.

Inserted into the base of the os hyoides.

Use. To pull the os hyoides downwards.

2. OMO-HYOIDEUS,

Arises, broad, thin, and fleshy, from the superior costa of the scapula, near the semilunar notch, and from the ligament that runs across it; thence ascending obliquely, it becomes tendinous below the sterno-cleido-mastoid muscle; and, growing fleshy again, is

Inserted into the base of the os hyoides, between its cornu and the insertion of the sterno-hyoideus.

Use.

Use. To pull the os hyoides obliquely downwards.
Coraco-hyoideus, Albinus and Douglas.

The second layer consists of three muscles.

I. 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.

2. 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.

C H A P. 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,

I. 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 femi-lar 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*, Win-flow.

Musculus tubæ 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 *amygdala*, 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 œsophagus*, which leads to the stomach.

C H A P. 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,

I. 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 thuts the opening into the fauces.

Glossostaphylinus, Winflow 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 amygdalæ, 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 UVULÆ,

Arises, fleshy, from the extremity of the suture which joins the palate-bones, runs down the whole length of the

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.

C H A P. XIII.

MUSCLES *situated on the posterior part of the* PHARYNX.

OF these there are three pair.

I. CONSTRICTOR PHARYNGIS INTERIOR,

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 cricothyroideus. 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 œsophagus.

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. CONSTRUCTOR PHARYNGIS MEDIUS,

Arises 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 superior part running obliquely upwards, and, covering a considerable part of the superior constrictor, terminate in a point.

Inserted into the middle of the cuneiform process 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 transversely than those above or below.

Use. To compress that part of the pharynx which it covers, and to draw it and the os hyoides upwards.

Hyo-pharyngeus, Syndesmo-pharyngeus, Douglas.

3. CONSTRUCTOR PHARYNGIS SUPERIOR,

Arises, above, from the cuneiform process of the os occipitis, before the foramen magnum, near the holes where the ninth pair of nerves passes out; lower down, from the pterygoid process of the sphenoid bone; from the upper and under jaw, near the roots of the last dentes molares; and between the jaws, it is continued with the buccinator muscle; and with some fibres from the root of the tongue, and from the palate.

Inserted into a white line in the middle of the pharynx, where it joins with its fellow, and is covered by the constrictor medius.

Use. To compress the upper part of the pharynx, and draw it forwards and upwards.

Cephalo-pharyngeus, Pterygo-pharyngeus, Mylo-pharyngeus, Glosso-pharyngeus, Douglas.

C H A P. XIV.

MUSCLES *situated about the GLOTTIS.*

THEY consist generally of four pair of small muscles, and a single one.

1. CRICO-ARYTÆNOIDEUS 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-ARYTÆNOIDEUS 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-ARYTÆNOIDEUS,

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-arytænoides 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.

Arytanoideus 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.

Arytanoideus major, Douglas.

Besides these, there are a few separate muscular fibres on each side; which, from their general direction, are named,

I. 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.

C H A P. 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 extended

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.

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* 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 fœtus 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 herniæ only happens in the tendon of the external.

From that part, which is named its *anterior superior spinous process*, it is stretched tendinous to the os pubis, and is named *Poupart's* or *Fallopian'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 peritonæum and abdomen; assists the evacuations of fæces and urine, and likewise in the exclusion of the fœtus; 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 vertebræ, by a tendon common to it and to the ferratus 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 *Fallopian'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 herniæ; 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,

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where

* To obtain a proper view of the two layers of the tendon of the internal oblique muscle, 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 vertebræ 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 intermixes with some fibres of the pectoral muscle.

It is generally divided by three tendinous interfections; 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 interfection below the umbilicus: These interfections 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 interfections, 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.

C H A P. 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

C R E M A S T E R.

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,

I. E R E C T O R P E N I S,

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. A C C E L E R A T O R U R I N Æ, seu E J A C U L A T O R S E M I N I S,

Arises, fleshy, from the sphincter ani and membranous part of the urethra; and tendinous from the crus, nearly as far

far

far forwards as the beginning of the corpus cavernosum penis; the inferior fibres run more transversely, and the superior descend in an oblique direction.

Inserted into a line in the middle of the bulb, where it joins with its fellow, by which the bulb is completely inclosed.

Use. To drive the urine or semen forwards; and, by grasping the bulb of the urethra, to push the blood towards its corpus cavernosum and the glans, by which they are distended.

Bulbo-cavernosus, Winslow.

3. TRANSVERSUS PERINEI,

Arises from the tough fatty membrane that covers the tuberosity of the os ischium; from thence it runs transversely inwards, and is

Inserted into the accelerator urinæ, and into that part of the sphincter ani which covers the bulb.

Use. To dilate the bulb, and draw the perineum and verge of the anus a little outwards and backwards.

Transversalis urethra, Winslow.

Transversus perinei, Albinus.

Levator parvus, seu *externus*, Douglas.

There is often a fourth muscle, named

TRANSVERSUS PERINEI ALTER.

Arises behind the former, runs more obliquely forwards, and is

Inserted into that part of the accelerator urinæ which covers the anterior part of the bulb of the urethra.

Use. To assist the former.

Inferior prostate, Winslow.

Transversus perinei alter, Albinus.

CHAPTER 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, acceleratores urinæ, and transversi perinei; behind, by an acute termination, into the extremity of the os coc-

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 urinæ, 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 vesiculæ 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 fæces, 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,

S P H I N C T E R V A G I N Æ.

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 nymphæ, and covers the corpus cavernosum vaginæ.

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,

T R A N S V E R S U S P E R I N E I.

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.

SPINCTER ANI,

Arises, 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.

C H A P. XIX.

MUSCLES *situated within the PELVIS.*

OF these there are two pair.

I. 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 leva-

tor ani; and appears to be divided into a number of fasciculi, which unite and form a roundish tendon, that passes out of the pelvis, between the posterior sacro ischiatic ligament and tuberosity of the os ischium; where it passes over the capsular ligament of the thigh-bone, it is inclosed as in a sheath, by the gemini muscles.

Inserted, by a round tendon, into the large pit at the root of the trochanter major.

Use. To roll the os femoris obliquely outwards.

Marsupialis, seu *Obturator internus*, Douglas.

N. B. The insertion of this muscle should not be prosecuted, until the muscles of the thigh, to which it belongs, are dissected. *Vid.* Chap. xxix.

2. C O C C Y G E U S,

Arises, tendinous and fleshy, from the spinous process of the os ischium, and covers the inside of the posterior sacro-ischiatic ligament; from this narrow beginning, it gradually increases, to form a thin fleshy belly, interspersed with tendinous fibres.

Inserted into the extremity of the os sacrum, and near the whole length of the os coccygis laterally.

Use. To support and move the os coccygis forwards, and to tie it more firmly to the sacrum.

C H A P. XX.

MUSCLES *situated within the Cavity of the ABDOMEN.*

THESE consist of a single muscle, and four pair.

D I A P H R A G M A.

This broad thin muscle, which makes a complete septum 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 vertebræ, 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 œsophagus and eighth pair of nerves.

Inserted,

Inferted, 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 expiration, 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 expiration, the quadrati lumborum, sacro-lumbales, and longissimi dorsi, concur in pulling down the ribs.

••

The four pair are,

I. QUA-

I. QUADRATUS LUMBORUM,

Arises, somewhat broad, tendinous and fleshy, from the posterior part of the spine of the os ilium.

Inserted into the transverse processes of all the vertebræ of the loins, into the last rib near the spine, and by a small tendon into the side of the last vertebra of the back.

Use. To move the loins to one side, pull down the last rib, and, when both act, to bend the loins forwards.

Quadratus, seu Lumbaris externus, Winslow.

2. PSOAS PARVUS,

Arises, fleshy, from the sides of the two upper vertebræ of the loins, and sends off a small long tendon, which ends thin and flat, and is

Inserted into the brim of the pelvis, at the junction of the os ilium and pubis.

Use. To assist the psoas magnus in bending the loins forwards; and, in certain positions, to assist in raising the pelvis.

N. B. This muscle is very often wanting.

3. PSOAS MAGNUS,

Arises, fleshy, from the side of the body, and transverse process of the last vertebra of the back; and, in the same manner, from all those of the loins, by as many distinct slips.

Inserted, tendinous, into the trochanter minor of the os femoris; and fleshy into that bone, a little below the same trochanter.

Use. To bend the thigh forwards; or, when the inferior extremity is fixed, to assist in bending the body.

Psoas, seu Lumbaris internus, Winslow.

4. ILIACUS

4. ILIACUS INTERNUS,

Arises, fleshy, from the transverse process of the last vertebra of the loins, from all the inner lip of the spine of the os ilium, from the edge of that bone between its anterior superior spinous process and the acetabulum, and from most of the hollow part of the ilium. It joins with the psoas magnus, where it begins to become tendinous; and is

Inserted along with it.

Use. To assist the psoas in bending the thigh, and to bring it directly forwards.

N. B. The insertion of the two last muscles should not be prosecuted till the muscles of the thigh are dissected.

C H A P. XXI.

MUSCLES *situated on the Anterior Part of the THORAX.*

THESE may be divided into two layers. The first layer consists of one muscle, named

PECTORALIS MAJOR,

Arises from the cartilaginous extremities of the fifth and sixth ribs, where it always intermixes with the external oblique muscle of the abdomen; from almost the whole length of the sternum, and from near half of the anterior part of the clavicle: the fibres run towards the axilla in a folding manner.

Inserted, by two broad tendons, which cross each other

at

at the upper and inner part of the os humeri, above the infertion of the deltoid muscle, and outer side of the groove for lodging the tendon of the long head of the biceps.

Use. To move the arm forwards, and obliquely upwards, towards the sternum.

Pectoralis, Albinus.

The second layer consists of three muscles:

I. SUBCLAVIUS,

Arises tendinous from the cartilage that joins the first rib to the sternum.

Inserted, after becoming fleshy, into the inferior part of the clavicle, which it occupies from within an inch or so of the sternum, as far outwards as to its connection, by ligament, with the coracoid process of the scapula.

Use. To pull the clavicle downwards and forwards.

2. PECTORALIS MINOR,

Arises, tendinous and fleshy, from the upper edge of the third, fourth, and fifth ribs, near where they join with their cartilages.

Inserted, tendinous, into the coracoid process of the scapula; but soon grows fleshy and broad.

Use. To bring the scapula forwards and downwards, or to raise the ribs upwards.

Serratus anticus, Albinus.

Serratus minor anticus, Douglas.

3. SERRATUS MAGNUS,

Arises from the nine superior ribs, by an equal number of fleshy digitations, resembling the teeth of a saw.

Inserted, fleshy, into the whole base of the scapula 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.

C H A P. 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.

I. INTERCOSTALES EXTERNI,

Arise 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,

Arise 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.

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 vertebræ 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. 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.

C H A P. XXIII.

MUSCLES *situated on the Anterior Part of the NECK*
close to the VERTEBRÆ.

THESE consist of one layer formed by four muscles.

I. LONGUS COLLI,

Arises, tendinous and fleshy, from the bodies of the three vertebræ of the back laterally; and from the transverse process of the third, fourth, fifth, and sixth vertebræ of the neck, near their roots.

Inserted into the fore-part of the bodies of all the vertebræ 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 vertebræ 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, Winslow.

3. RECTUS CAPITIS INTERNUS MINOR,

Arises, fleshy, from the fore-part of the body of the first vertebra of the neck, opposite to the superior oblique process.

Inserted near the root of the condyloid process of the os occipitis, under, and a little farther outwards than the former muscle.

Use. To bend the head forwards.

Rectus anterior brevis, Winslow.

4. RECTUS CAPITIS LATERALIS,

Arises, fleshy, from the anterior part of the point of the transverse process of the first vertebra of the neck.

Inserted into the os occipitis, opposite to the foramen stylo-mastoideum of the temporal bone.

Use. To bend the head a little to one side.

Transversalis anticus primus, Winslow.

C H A P. XXIV.

MUSCLES *situated on the Posterior Part of the TRUNK.*

THESE may be divided into four layers, and a single pair.

The first layer consists of two muscles, which cover almost the whole posterior part of the trunk.

I. TRAPEZIUS *feu* 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 vertebræ of the neck; but rises from the spinous processes of the two inferior, and from the spinous processes of all the vertebræ 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 Nuchæ* 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 vertebræ of the loins, and from the seven inferior ones of the vertebræ 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 scapula, towards the axilla, where they are all collected, twisted, and folded.

Inserted, by a strong thin tendon, into the inner edge of the groove for lodging the tendon of the long head of the biceps.

Use. To pull the arm backwards and downwards, and to roll the os humeri.

N. B. The insertion of this muscle should not be prosecuted till the muscles of the os humeri, to which it belongs, are dissected.

The second layer consists of three pair, two on the back, and one on the neck.

On the back,

I. SERRATUS POSTICUS INFERIOR,

Arises, by a broad thin tendon, in common with that of the latissimus dorsi, from the spinal processes of the two inferior vertebræ of the back, and from the three superior vertebræ of the loins.

Inserted into the lower edges of the four inferior ribs, at a little distance from their cartilages, by as many distinct fleshy lips.

Use. To depress the ribs into which it is inserted.

2. RHOMBOIDEUS.

This muscle is divided into two portions.

1. *Rhomboideus major*, *arises*, tendinous, from the spinous processes of the five superior vertebræ of the back.

Inserted into all the basis of the scapula below its spine.

Use. To draw the scapula obliquely upwards, and directly inwards.

2. *Rhomboideus minor*, *arises*, tendinous, from the spinous

nous

nous processes of the three inferior vertebræ of the neck, and from the ligamentum nuchæ.

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 vertebræ of the back; tendinous and fleshy, from the five inferior of the neck, and adheres firmly to the ligamentum nuchæ. 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 vertebræ 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 vertebræ 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 vertebræ 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,

I. SPINALIS DORSI,

Arises from the spinous processes of the two uppermost vertebræ of the loins, and the three inferior of the back by as many tendons.

Inserted into the spinous processes of the nine uppermost vertebræ of the back, except the first, by as many tendons.

Use. To erect and fix the vertebræ, 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 vertebræ of the loins.

Inserted into all the transverse processes of the vertebræ 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 vertebræ, 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 vertebræ 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,

I. COMPLEXUS,

Arises from the transverse processes of the seven superior vertebræ 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 muscle that is situated next the spinous processes, lies more loose, and has a roundish tendon in the middle of it; for which reason Albinus calls it *Biventer cervicis*.

2. TRACHELO-MASTOIDEUS,

Arises from the transverse processes of the three uppermost vertebræ of the back, and from the five lowermost of the neck, where it is connected to the transversalis cervicis, by as many thin tendons, which unite into a belly, and run up under the splenius.

Inserted into the middle of the posterior side of the mastoid process, by a thin tendon.

Use. To assist the complexus; but it pulls the head more to a side.

Complexus minor, seu Mastoideus lateralis, Winflow.

Trachelo-mastoideus, seu Capitis par tertium Fallopii, Douglas.

3. LEVATOR SCAPULÆ,

Arises, tendinous and fleshy, from the transverse processes of the five superior vertebræ of the neck, by as many distinct slips, which soon unite to form a muscle that runs downwards and outwards.

Inserted, fleshy, into the superior angle of the scapula.

Use. To pull the scapula upwards, and a little forwards.

Angularis, vel Levator proprius, Winflow.

Elevator seu Musculus patientiæ, Douglas.

The fourth layer consists of two pair on the back, two on the posterior part of the neck, four small pair situated immediately below the posterior part of the occiput, and three on the side of the neck.

On the back are,

I. SEMI-SPINALIS DORSI,

Arises, from the transverse processes of the seventh, eighth, ninth, and tenth vertebræ of the back, by as many distinct tendons, which soon grow fleshy, and then become tendinous again; and are

Inserted into the spinous processes of all the vertebræ of the back above the eighth, and into the two lowermost of the neck, by as many tendons.

Use. To extend the spine obliquely backwards.

Semi-spinalis externus, seu *Transverso spinalis dorfi*,
Winflow.

2. MULTIFIDUS SPINÆ,

Arises from the side and spinous processes of the os sacrum, and from the posterior part of the os ilium, where it joins with the sacrum; from all the oblique and transverse processes of the vertebræ of the loins; from all the transverse processes of the vertebræ of the back, and from those of the neck, except the three first, by as many distinct tendons, which soon grow fleshy, run in an oblique direction; and are

Inserted, by distinct tendons, into all the spinous processes of the vertebræ of the loins, of the back, and of the neck, except the first.

Use. When the different portions of this muscle act on one side, they extend the back obliquely, or move it laterally; but if they act together on both sides, they extend the vertebræ backwards.

Transverso-spinalis lumborum, veterib. *Sacer*.

Semi-spinalis internus, five *Transverso-spinalis dorfi*.

Semi-

Semi-spinalis, five *Transverso-spinalis colli*, *Pars interna*,
Winflow.

Transversalis lumborum, vulgo *Sacer*.

Transversalis dorfi.

Transversalis colli. Douglas.

On the posterior part of the neck are,

I. SEMI-SPINALIS COLLI,

Arises, from the transverse processes of the uppermost six vertebræ of the back, by as many distinct tendons, ascending obliquely under the complexus.

Inserted into the spinous processes of all the vertebræ of the neck, except the first and the last.

Use. To extend the neck obliquely backwards.

Semi-spinalis, five *Transverso-spinalis colli*, Winflow.

Spinalis cervicis, Albinus.

Spinalis, Douglas.

2. TRANSVERSALIS COLLI,

Arises from the transverse processes of the five uppermost vertebræ 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 vertebræ, 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,

I. 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 ascent, which is not straight, but obliquely outwards.

Inserted, tendinous and fleshy, into the os occipitis, near the rectus capitis lateralis, and the insertion of the obliquus capitis superior.

Use. To pull the head backwards, and to assist a little in its rotation.

Rectus major, Winflow and Douglas.

2. RECTUS CAPITIS POSTICUS MINOR,

Arises, by a narrow beginning, close to its fellow, from a little protuberance in the middle of the back part of the first vertebra of the neck, its outer edge being covered by the rectus major.

Inserted, somewhat broad, into the sides of a dimple in the os occipitis, near its foramen magnum.

Use. To assist the rectus major in moving the head backwards.

Obliquus minor, Winflow and Douglas.

3. OBLIQUUS CAPITIS SUPERIOR,

Arises from the transverse process of the first vertebra of the neck.

Inserted, tendinous and fleshy, into the os occipitis behind the back-part of the mastoid process of the temporal bone, and under the insertion of the complexus muscle.

Use. To draw the head backwards.

Obliquus major, Winflow.

Obliquus superior, Douglas.

4. OBLIQUUS CAPITIS INFERIOR,

Arises, fleshy, from the spinous process of the second vertebra of the neck, its whole length; and, forming a thick fleshy belly, is

Inserted

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 vertebræ 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 vertebræ 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 vertebræ; which are accordingly named,

1. INTERSPINALES COLLI,

The space between the spinous processes of the vertebræ of the neck, most of which are bifurcated, is filled up with fleshy portions; which

Arise, double, from the spinous process of the inferior vertebræ 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 vertebræ 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 distinct small bundles of flesh, which fill up the spaces between the transverse processes of the vertebrae of the loins, and serve to draw them towards each other.

CH A P. XXV.

MUSCLES of the SUPERIOR EXTREMITIES.

THESE may be divided into the muscles that are situated on the scapula, on the os humeri, on the cubit or fore-arm, and on the hand.

Muscles situated on the scapula.

These are called *muscles* of the *os humeri*; and are three behind, one along its inferior costa, two before, and one beneath it.

Behind are,

I. SUPRASPINATUS,

Arises, fleshy, from all that part of the base of the scapula that is above its spine; also from the spine and superior costa; passes under the acromion, and adheres to the capsular ligament of the os humeri.

Inserted, 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.

Use. To raise the arm upwards; and, at the same time, to pull the capsular ligament from between the bones, that it may not be pinched.

2. INFRASPINATUS,

Arises, fleshy, from all that part of the base of the scapula that is between its spine and inferior angle; from the spine as far as the cervix of the scapula. The fibres ascend and descend obliquely towards a tendon in the middle of the muscle, which runs forwards, and adheres to the capsular ligament.

Inserted, by a thick and short tendon, into the upper and middle part of the large protuberance on the head of the os humeri.

Use. To roll the humerus outwards; to assist in raising, and in supporting it when raised; and to pull the ligament from between the bones.

N. B. These two muscles are covered with a tendinous membrane, from which a number of their fleshy fibres arise. It serves besides to strengthen their actions, and keeps them from swelling too much outwardly when in action.

3. TERES MINOR,

Arises, fleshy, from all the round edge of the inferior costa of the scapula, and runs forwards along the inferior edge of the infraspinatus muscle, and adheres to the ligament.

Inserted, 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 last-named muscle.

Use. To roll the humerus outwards; to draw the humerus backwards; and to prevent the ligament from being pinched between the bones.

Along the inferior costa of the scapula is,

TERES MAJOR,

Arises, fleshy, from the inferior angle of the scapula, and from all that portion of its inferior costa that is rough and thicker than the rest; its fleshy fibres are continued over part of the infraspinatus muscle, to which they firmly adhere.

Inserted, by a broad, short, and thin tendon, into the ridge at the inner side of the groove for lodging the tendon of the long head of the biceps, along with the latissimus dorsi.

Use. To roll the humerus inwards, and to draw it backwards and downwards.

The two before the scapula are,

I. DELTOIDES,

Arises, fleshy, from all the posterior part of the clavicle that the pectoralis major does not possess; tendinous and fleshy, from the acromion, and lower margin of almost the whole spine of the scapula opposite to the insertion of the cucullaris muscle: from these origins it runs in three different directions, i. e. from the clavicle outwards and downwards; from the spine of the scapula outwards, forwards, and downwards; and from the acromion straight downwards; and is composed of a number of fasciculi, which form a strong fleshy muscle that covers the anterior part of the joint of the os humeri.

Inserted, tendinous, into a rough protuberance in the outer side of the os humeri, near its middle, where the fibres of this muscle intermix with some part of the brachialis externus.

Use. To pull the arm directly outwards and upwards, and a little forwards or backwards, according to the different directions of its fibres.

2. CORACO-BRACHIALIS,

Arises, tendinous and fleshy, from the fore-part of the coracoid process of the scapula; adhering, in its descent, to the short head of the biceps.

Inserted, tendinous and fleshy, 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 sends down a thin tendinous expansion to the internal condyle of the os humeri.

Use. To raise the arm upwards and forwards.

N, B. There passes a nerve through this muscle, called *Musculo cutaneus*.

The one beneath the scapula is,

SUBSCAPULARIS,

Arises, fleshy, from all the base of the scapula internally, and from its superior and inferior costæ, being composed of a number of tendinous and fleshy fasciculi, which make prints on the bone; they all join together, fill up the hollow of the scapula, and pass over the joint adhering to the capsular ligament.

Inserted, tendinous, into the upper part of the internal protuberance at the head of the os humeri.

Use. To roll the humerus inwards, and to draw it to the side of the body; and to prevent the capsular ligament from being pinched.

 C H A P. 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,

I. 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 on 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 muscles on the inside of the fore-arm, and joins with another tendinous membrane, which is sent off from the *triceps extensor cubiti*, and covers all the muscles on the outside of the fore-arm, and a number of the fibres, from opposite fibres, decussate each other. It serves to strengthen the muscles, by keeping them from swelling too much outwardly, when in action; and a number of their fleshy fibres take their origin from it.

Biceps brachii, Albinus.

Coraco-radialis, seu *biceps*, Winflow.

Biceps-internus, Douglas.

2. BRACHIALIS INTERNUS,

Arises, fleshy, from the middle of the *os humeri*, at each side of the insertion of the deltoid muscle, covering all the inferior and fore-part of this bone, runs over the joint, and adheres firmly to the ligament.

Inserted, by a strong short tendon, into the coronoid process of the ulna,

Use. To bend the fore-arm, and to prevent the capsular ligament of the joint from being pinched.

Brachialis, Winflow.

Behind are,

I. TRICEPS EXTENSOR CUBITI,

Arises, by three heads; the first called *longus*, some what broad and tendinous, from the inferior costa of the scapula, near its cervix. The second head called *brevis*, arises by an acute, tendinous, and fleshy beginning, from the back-part of the *os humeri*, a little below its head, outwardly. The third, called *brachialis externus*, arises by an acute beginning, from the back part of the *os humeri*. These three heads unite lower than the insertion of the te-

res

res major, and cover the whole posterior part of the humerus, from which they receive addition in their descent.

Inserted into the upper and external part of the process of the ulna, called *olecranon*, and partly into the condyles of the os humeri, adhering firmly to the ligament.

Use. To extend the fore-arm.

Anconeus major, Anconeus externus and Anconeus internus, Winslow.

Biceps externus, and Brachialis externus, Douglas.

3. A N C O N E U S,

Arises, tendinous, from the posterior part of the external condyle of the os humeri; it soon grows fleshy, and is continued from the third head of the triceps.

Inserted, fleshy, and thin, into a ridge on the outer and posterior edge of the ulna, being continued some way below the olecranon, and covered with a tendinous membrane.

Use. To assist in extending the fore-arm.

Anconeus minor, Winslow.

Anconeus, vel Cubitalis Riolani, Douglas.

C H A P. XXVII.

MUSCLES *situated on the CUBIT or FORE-ARM**.

THESE may be divided into three classes; *first*, flexors and extensors of the whole hand; *second*, flexors

* In the following description, the arm is supposed to hang by the side with the palm turned forwards; so that the radius and thumb are upon its outer side, and the ulna and little finger upon its inner side; whereas, when the muscles are described in the less straining posture of pronation, as has been generally done by authors, the utmost confusion is necessarily introduced in the application of the terms *outer* and *inner*, from the decussation of the radius and ulna.

ors and 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 :

I. 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 cutaneous, Winslow.

2. FLEXOR CARPI RADIALIS,

Arises, tendinous and fleshy, 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.

Inserted, by a flat tendon, into the fore and upper part of the metacarpal bone that sustains the fore-finger, after running through a fossa in the os trapezium.

Use. To bend the hand, and to assist in its pronation.

Radialis internus, Albinus and Winslow.

3. FLEXOR CARPI ULNARIS,

Arises, tendinous; from the internal condyle of the os humeri. It has likewise a small fleshy beginning from the outer side of the olecranon; between which and the condyle the ulnar nerve passes to the fore-arm; and a number of its fleshy fibres arise from the tendinous membrane which covers the fore-arm.

Inserted, by a short strong tendon, into the os pisiforme; at a little distance from its insertion, a small ligament is sent off to the metacarpal bone that sustains the little finger.

Use. To assist the former in bending the arm.

Ulnaris internus, Albinus and Winslow.

Extensors are,

1. EXTENSOR CARPI RADIALIS LONGIOR,

Arises, broad, thin, and fleshy, immediately below the supinator radii longus, from the lower part of the external ridge of the os humeri, above its external condyle.

Inserted, by a round tendon, into the posterior and upper part of the metacarpal bone that sustains the fore-finger.

Use. To extend and bring the hand backwards.

Radialis externus longior, Albinus.

Radialis externus primus, Winflow.

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, Winflow.

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 Winflow.

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

the ulna, near the edge of the cavity that receives the head of the radius; fleshy from the tubercle of the radius; and membranous and fleshy from the middle of the fore-part of the radius, where the flexor pollicis longus arises. Its fleshy belly sends off four round tendons before it passes under the ligament of the wrist.

Inserted into the anterior and upper part of the second bone of each finger, being, near the extremity of the first bone, divided for the passage of the perforans.

Use. To bend the second joint or phalanx of the fingers.

Sublimus, Albinus.

Perforatus, Douglas.

2. FLEXOR PROFUNDUS PERFORANS,

Arises, fleshy, from the external side, and upper part of the ulna, for some way downwards, and from a large share of the interosseous ligament. It splits into four tendons, a little before it passes under the ligamentum carpi annulare; and these pass through the flits in the tendons of the flexor sublimis.

Inserted into the fore and upper part of the third or last bone of all the four fingers.

Use. To bend the last joint of the fingers.

Profundus, Albinus.

Perforans, Douglas.

The four small flexors are named

LUMBRICALES.

Arise, thin and fleshy, from the outside of the tendons of the flexor profundus, a little above the lower edge of the ligamentum carpi annulare.

Inserted, by long slender tendons, into the outer sides of

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,

I. 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

Supinator longus, Albinus, Winflow, and Douglas.

2. SUPINATOR RADII BREVIS,

Arises, tendinous, from the external condyle of the os humeri; tendinous and fleshy, from the external and upper part of the ulna, and adheres firmly to the ligament that joins these two bones.

Inserted into the head, neck, and tubercle of the radius, near the insertion of the biceps, and ridge running from that downwards and outwards.

Use. To roll the radius outwards, and so bring the hand supine.

Pronators are,

1. PRONATOR RADII TERES.

Arises, fleshy, from the internal condyle of the os humeri, and tendinous from the coronoid process of the ulna.

Inserted, thin, tendinous, and fleshy, into the middle of the posterior part of the radius.

Use. To roll the radius, together with the hand, inwards.

2. PRONATOR RADII QUADRATUS,

Arises, broad, tendinous, and fleshy, from the lower and inner part of the ulna; the fibres run transversely, to be

Inserted into the lower and anterior part of the radius, opposite to its origin.

Use. To turn the radius, together with the hand, inwards.

C H A P. 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,

I. EXTENSOR OSSIS METACARPI POLLICIS MANUS,

Arises, fleshy, from the middle and posterior part of the ulna, immediately below the insertion of the anconæus 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. EXTENSOR PRIMI INTERNODII,

Arises, fleshy, from the posterior part of the ulna near the former muscle, and from the interosseous ligament.

Inserted, tendinous, into the posterior part of the first bone of the thumb; and part of it may be traced as far as the second bone.

Use. To extend the first bone of the thumb obliquely outwards.

Extensor minor pollicis manus, Albinus.

This and the preceding muscle is called

Extensor pollicis primus, Winflow.

Extensor secundi internodii, Douglas.

3. EXTENSOR SECUNDI INTERNODII,

Arises, by an acute, tendinous, and fleshy beginning, from the middle back-part of the ulna, and from the interosseous ligament; its tendon runs through a small groove at the inner and back part of the lower end of the radius.

Inserted into the last bone of the thumb.

Use. To extend the last 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 fleshy beginning, from the ligamentum carpi annulare, and from the os trapezium.

Inserted, tendinous, into the outer side of the root of the first bone of the thumb.

Use. To draw the thumb from the fingers.

N. B. Albinus names the inner portion of this muscle *Abductor brevis alter*.

Abductor, Thenar Riolani, Douglas.

A B D U C T O R P O L L I C I S M A N U S,

Arises, fleshy, from almost the whole length of the metacarpal bone that sustains the middle finger; from thence its fibres are collected together.

Inserted, tendinous, into the inner part of the root of the first bone.

Use. To pull the thumb towards the fingers.

Abductor ad minimum digitum, Douglas.

Fore-finger :

I N D I C A T O R,

Arises, by an acute fleshy beginning, from the middle of the posterior part of the ulna; its tendon passes under the same ligament with the extensor digitorum communis, with part of which it is

Inserted into the posterior part of the fore-finger.

Extensor secundi internodii indicis proprius, vulgo indicator, Douglas.

A B D U C T O R I N D I C I S M A N U S,

Arises, from the os trapezium, and from the superior part and inner side of the metacarpal bone of the thumb.

Inserted, by a short tendon, into the outer and back part of the first bone of the fore-finger.

Use. To bring the fore-finger towards the thumb.

Semi-interosseus, Winslow.

Little finger :

ABDUCTOR MINIMI DIGITI MANUS,

Arises, fleshy, from the os pisiforme, and from that part of the ligamentum carpi annulare next it.

Inserted, tendinous, into the inner side of the upper end of the first bone of the little finger.

Use. To draw this finger from the rest.

Hypothenar minor, Winslow.

Extensor tertii internodii minimi digiti, Douglas.

ADDUCTOR METACARPI MINIMI DIGITI MANUS,

Arises, fleshy, from the thin edge of the os unciforme, and from that part of the ligament of the wrist next it.

Inserted, tendinous, into the inner side and anterior part of the metacarpal bone of this finger.

Use. To bend and bring the metacarpal bone of this finger towards the rest.

Metacarpus, Winslow.

Flexor primi internodii minimi digiti, Douglas.

FLEXOR PARVUS MINIMI DIGITI,

Arises, fleshy, from the outer side of the os unciforme, and from the ligament of the wrist which joins with that bone.

Inserted, by a roundish tendon, into the inner and anterior part of the upper end of the first bone of this finger.

Use. To bend the little finger, and assist the adductor.

Abductor minimi digiti, *Hypothenar Riolani*, Douglas.

Between the metacarpal bones, there are *four internal* and *three external* muscles named *interossei*.

Interossei

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

X x 2

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 :

I. 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 inside of the tendinous expansion of the extensor digitorum communis, which runs along the posterior part of the ring-finger.

Use. To extend and draw the ring-finger inwards.

Fifth interosseus, Douglas.

N. B. The internal interossei are only conspicuous on the palm of the hand; but the external are apparent on both the palm and back of the hand.

C H A P. XXIX.

MUSCLES of the INFERIOR EXTREMITIES.

THESE may be divided into the muscles *situated* on the outside of the *pelvis*, on the *thigh*, on the *leg*, and on the *foot*.

Muscles on the outside of the *pelvis*, which are called *muscles of the thigh*.

These are composed of *one layer before* and *three layers behind*.

The layer before consists of five muscles :

- | | |
|----------------------|--|
| 1. PSQAS MAGNUS. | } These were described, p. 311. & 312. |
| 2. ILIACUS INTERNUS. | |

3. PECTINALIS,

Arises, broad and fleshy, from the upper and anterior part of the os pubis or pectinis, immediately above the foramen thyroideum.

Inserted into the anterior and upper part of the linea aspera

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 anterior 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, Winflow.

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, Winflow.

3. ADDUCTOR MAGNUS FEMORIS,

Arises, a little lower down than the former, near the symphysis 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 ilium, a little higher up than the joining of the ilium with the os sacrum, from the whole external side of the os sacrum, below the posterior spinous process of the os ilium; from the posterior sacro ischiatic ligament, over which part of the inferior edge of this muscle hangs in a folded manner; from the os coccygis. All the fleshy fibres run obliquely forwards, and a little downwards, to form a thick broad muscle, which is divided into a number of strong fasciculi. The upper part of it covers almost the whole of the trochanter major, between which and the tendon of this muscle there is a large bursa mucosa, and where it is inseparably joined to the broad tendon of the *tensor vagina femoris*.

Inserted, by a strong, thick, and broad tendon into the upper and outer part of the linea aspera, which is continued from the trochanter major, for some way downwards.

Use. To extend the thigh, by pulling it directly backwards, and a little outwards.

Gluteus magnus, Albinus.

Gluteus major, Cowper.

Second Layer.

GLUTEUS MEDIUS,

Arises, fleshy, from the anterior superior spinous process of the os ilium, and from all the outer edge of the spine of the ilium, except its posterior part, where it arises from the dorsum of that bone.

Inserted, by a broad tendon, into the outer and posterior part of the trochanter major.

Use. To draw the thigh-bone outwards, and a little backwards; to roll the thigh-bone outwards, especially when it is bended.

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 vaginæ femoris, and latissimus dorsi.

Third Layer consists of four Muscles.

I. G L U T E U S M I N I M U S,

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. P Y R I F O R M I S,

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. G E M I N I,

Arises, by two distinct origins; the superior from the

spinous process, and the inferior from the tuberosity of the os ischium; also, from the posterior sacro-ischiatic ligament. They are both united by a tendinous and fleshy membrane, and form a purse for the tendon of the obturator internus muscle, which was formerly described.

Inserted, tendinous and fleshy, into the cavity at the inner side of the root of the trochanter major, on each side of the tendon of the obturator internus, to which they firmly adhere.

Use. To roll the thigh outwards, and to preserve the tendon of the obturator internus from being hurt by the hardness of that part of the ischium over which it passes; also, to hinder it from starting out of its place, while the muscle is in action.

Gemelli, Winslow.

4. QUADRATUS FEMORIS,

Arises, tendinous and fleshy, from the outside of the tuberosity of the os ischium; and, running transversely, is

Inserted, fleshy, into a rough ridge, continued from the root of the large trochanter to the root of the small one.

Use. To roll the thigh outwards.

C H A P. XXX.

MUSCLES *situated on the* THIGH.

THESE are called *muscles* of the leg; and consist of *one*, on the *outside*; *two*, on the *inside*; *four*, *before*; and *four*, *behind*.

Previous to the description of the muscles that are situated on the thigh and leg, it is necessary to take notice of a broad tendinous fascia or sheath, which is sent off from the back and from the tendons of the glutei and adjacent muscles.

It is a strong thick membrane on the outside of the thigh and leg; but, towards the inside of both, it gradually turns thinner, and has rather the appearance of cellular substance, than a tendinous membrane. A little below the trochanter major, it is firmly fixed to the linea aspera; and, farther down, to that part of the head of the tibia that is next the fibula; where it sends off the tendinous expansion along the outside of the leg.

It serves to strengthen the action of the muscles, by keeping them firm in their proper places while in action, particularly the tendons that pass over the joints, where this membrane is thickest; and it gives origin to a number of the fleshy fibres of the muscles.

On the outside is,

TENSOR VAGINÆ FEMORIS,

Arises, by a narrow, tendinous, and fleshy beginning; from the external part of the anterior superior spinous process of the os ilium.

Inserted, a little below the trochanter major, into the inner side of the membranous fascia which covers the outside of the thigh.

Use. To stretch the membranous fascia, to assist in the abduction of the thigh, and somewhat in its rotation inwards.

Musculus fasciæ latæ, Winslow.

On the inside are,

I. 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 adductor 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, five *Rectus internus*, Winslow.

Before are,

I. 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,

Inserted, 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 inserted into the tubercle of the tibia.

Use. To extend the leg, and in a powerful manner, by the intervention of the patella, like a pulley.

Rectus, five *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. CRURALIS,

Arises, fleshy, from between the two trochanters of the os femoris, but nearer the minor, and firmly adhering to most of the fore-part of the os femoris, and connected to both vasti muscles.

Inserted; tendinous, into the upper part of the patella, behind the rectus.

Use. To assist in the extension of the leg.

Cruralis, Albinus.

N. B. These four muscles *before*, being inserted into the patella, have the same effect upon the leg, as if they were immediately inserted into it, by means of the strong tendon, or rather ligament, which is sent off from the inferior part of the patella to the tibia.

Behind are,

I. SEMITENDINOSUS,

Arises, tendinous and fleshy, in common with the long head of the biceps, from the posterior part of the tuberosity of the os ischium; and sending down a long roundish tendon, which ends flat, is

Inserted into the inside of the ridge of the tibia, a little below its tubercle.

Use. To bend the leg backwards and a little inwards.

Seminervosus, Winflow and Douglas.

2. SEMIMEMBRANOSUS,

Arises, tendinous from the upper and posterior part of the tuberosity of the os ischium, sends down a broad flat tendon, which ends in a fleshy belly, and, in its descent, runs at first on the fore-part of the biceps, and, lower, between it and the semitendinosus.

Inserted,

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 hamstring*.

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, Winflow and Douglas.

N. B. This muscle forms what is called the *outer hamstring*; 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 capsular

fular ligament from being pinched. After the leg is bent, this muscle serves to roll it inwards.

C H A P. 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 fleshy fibres from the posterior part of that bone for some space below its head. The other origin begins from the posterior 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 fleshy fibres for some way down. The flesh of this muscle, 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 gastrocnemii unite, and form a strong round chord, which is called *tendo Achillis*.

Inserted into the upper and posterior part of the os calcis; by the projection of which the tendo Achillis is at a considerable distance from the tibia.

Use. To extend the foot, by bringing it backwards and downwards.

Gemellus and *Soleus*, Albinus.

Gastrocnemii and *Soleus*, Winflow.

Extensor tarfi suralis, vel *Extensor magnus*, Douglas.

3. PLANTARIS,

Arises, thin and fleshy, 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 descent. It passes along the second origin of the soleus, and under the gemellus, where it sends off a long, slender, thin tendon, which comes from between the great extensors, where they join tendons; then runs down by the inside of the tendo Achillis.

Inserted into the inside of the posterior part of the os calcis, below the tendo Achillis.

Use. To assist the former, and to pull the capsular ligament of the knee from between the bones. It seems likewise to assist in rolling the foot inwards.

Tibialis gracilis, vulgo *Plantaris*, Winflow.

Extensor 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.

I. TIBIALIS ANTIQUS,

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 tarfi 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 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*, Winflow.

Peroneus secundus, seu *Anticus*, Douglas.

Second Class.

Common Extensors.

These consist of two.

I. 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 tarfi 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

Inserted into the second phalanx of the four lesser toes. The tendon of the little toe is often wanting.

Use. To bend the second joint of the toes.

Perforatus, seu Sublimis, Douglas.

2. FLEXOR LONGUS DIGITORUM PEDIS, PROFUNDUS, PERFORANS,

Arises, by an acute tendon, which soon becomes fleshy, from the back part of the tibia, some way below its head, near the entry of the medullary artery; which beginning, is continued down the inner edge of this bone by short fleshy fibres, ending in its tendon; also by tendinous and fleshy fibres, from the outer edge of the tibia; and between this double order of fibres the tibialis posticus muscle lies inclosed. Having passed under two annular ligaments, it then passes through a sinuosity at the inside of the os calcis; and, about the middle of the sole of the foot, divides into four tendons, which pass through the flits of the perforatus; and, just before its division, it receives a considerable tendon from that of the flexor pollicis longus.

Inserted into the extremity of the last joint of the four lesser toes.

Use. To bend the last joint of the toes.

This muscle is assisted by the

FLEXOR DIGITORUM ACCESSORIUS, seu MASSA CARNEA JACOBI SYLVII.

Arises, by a thin fleshy origin, from most part of the sinuosity at the inside of the os calcis, which is continued forwards, for some space on the same bone; also by a thin tendinous beginning, from before the tuberosity of the os calcis externally; and, soon becoming all fleshy, is

Inserted

Inserted into the tendon of the flexor longus, just at its division into four tendons.

Use. To assist the flexor longus.

3. LUMBRICALES PEDIS,

Arise, 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 slender 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.

C H A P. 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 :

I. EXTENSOR PROPRIUS POLLICIS PEDIS,

Arises, by an acute, tendinous, and fleshy beginning, some way below the head and anterior part of the fibula, along which it runs to near its lower extremity, connected

to

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, Winflow.

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, Winflow.

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 *Metatarsæus*, Winflow.

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 metatarsal bone, and root of the first joint of this toe.

Use. To bend this toe

Parathenar minor, Winflow.

Muscles from the metatarsal bones.

These are four external and three internal interossei, and one muscle which is common to all the metatarsal bones.

Interossei Pedis externi, Bicipites.

1. ABDUCTOR INDICIS PEDIS,

Arises, tendinous and fleshy, by two origins, from the root of the inside of the metatarsal bone of the fore toe, from the outside of the root of the metatarsal bone of the great toe, and from the os cuneiforme internum.

Inserted, tendinous, into the inside of the root of the first joint of the fore toe.

Use. To pull the fore toe inwards from the rest of the small toes.

2. ABDUCTOR INDICIS PEDIS,

Arises, tendinous and fleshy, from the roots of the metatarsal bones of the fore and second toe.

Inserted, tendinous into the outside of the root of the first joint of the fore toe.

Use. To pull the fore toe outwards towards the rest.

3. ADDUCTOR MEDII DIGITI PEDIS,

Arises, tendinous and fleshy, from the roots of the metatarsal bones of the second and third toes.

Inserted,

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.

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 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.

O F

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 papillæ erected; and along with this hardness it contracts itself in length. Again, the cellular fibres are animated with this perpetual nifus to shorten, always endeavouring to contract themselves. Hence, when the skin or any other membrane

brane is extended, as soon as the cause of extension is taken off, it returns by a gentle effort to its former shortness. But it even somewhat resists the attempt to perpetual distension; 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 same power also seems to limit the excretion of vapour; for the fibres and plates of the cellular texture being preternaturally relaxed, an immense quantity, either of fat or of watery humour, is deposited in that texture. And this debility seems to be the principal cause of a dropsy. The same cause being always efficacious, and at work in the heart, joints, and every where throughout the body of the embryo, brings into nearer contact the arteries, auricles, and ventricles; produces flexures; and contracts the heart into the form of a cone. The same cause, by an unknown or hidden power, seems to form the shape of most parts of the human body; and while it expels the gluten received into the cells, it brings the terrestrial particles nearer to one another, and gives the proper solidity, curvature, and situation, to the different parts.

It is the nature of this power to act continually by gentle but uninterrupted efforts. It is common for it also to be excited by poisons, in every membrane, fibre, and in the cellular texture; but never by cutting or puncturing with a sharp instrument. These are the known properties of the red muscular fibre. The structure of this fibre, then, it is now necessary for us to consider.

By the name of *muscular* or *moving fibres* in the human body, we call bundles of reddish coloured threads, which perform all the motions visible in the human body. When many of these fibres are collected together, and appear more evidently red, they are called *a muscle*. The extreme simplicity of the texture in these parts has been the
cause

cause of the obscurity in understanding how a small soft portion of flesh, can produce such strong and ample motions as we see in man, and more especially in the crustaceous insects.

In every muscle we meet with long soft threads or *fibres*, somewhat elastic, or extensible, and almost constantly disposed parallel with each other; and these, being surrounded with a good deal of cellular substance, are by that fastened together into little bundles, called *lacertuli*; which are again tied together into larger bundles, by a more loose cellular net-work, that contains some fat; and between these we constantly perceive membranous partitions and stripes of the cellular substance removing them farther from each other, till at last a number of them combined together, either parallel or inclined, are surrounded with a more thin and dense cellular membrane, continuous with that of their partitions; and this being again surrounded by a thicker plate of the cellular substance, parts the whole bundle from the adjacent flesh, and gives it the denomination of a *single or entire muscle*. In every one of these threads there appears a lesser series of filaments, which, by oblique extremities, are cemented to others of the same kind, forming together a large fibre*.

The generality of the muscles, but more especially those which are inserted into the bones, have other fibres fixed to them; but these are condensed into a more slender, hard, and shining substance, of a silver colour, which has the name of *tendon*. When the tendinous fibres expand into a broad flat surface, they form what is called an *aponeurosis*.

* Swammerdam, Lyonet, and Roefel, have elegantly painted the appearance of the muscular fibres in frogs, and other animals, which Leeuwenhoeck, Cowper, and Muys, have shewn in man. But their structure is more particularly described and delineated in a small work by Profchaska, *De Carne musculari*, published 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 fœtus, 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 fœtus, 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 fœtus 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 furrounds 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 Profchaska thinks is nothing else than

impressions made by the vessels and cellular substance and perhaps by the nerves: but Dr *Monro*, in the work above quoted, has described and delineated a similar appearance in the tendons and nerves; and is of opinion, that they are to be considered as folds or joints, serving to accommodate the parts to the different states of flexion and extension. In proof of this, he finds, that those parts which appear thus in their relaxed state, lose it when they are much stretched.

With regard to the nature of the ultimate moving fibres, there have been many disputes. Some anatomists think them solid; others, hollow, formed of a series of vessels or rhomboidal chains communicating with each other: Some, again, have been of opinion, that they are full of a kind of down or woolly substance, &c.

It may be asked, Whether they are hollow? whether they are continued from the arteries? or whether the difference between muscular and tendinous fibres lies in the latter being rendered more dense, and beat closer together by an expulsion of the fluids? That these are not probable, appears from the minuteness of the fibres, which are found less than the red-blood globules, and from the whiteness of a muscle after the blood is washed out of it; to which add the physiological reasons, after mentioned, (p. 385.) And, in general, more strength may be expected from a solid fibre.

The structure of the tendons and aponeuroses agrees in some respects with, but differs in others from that of the muscles. We observe their fibres regularly disposed, and separated by cellular substance and blood-vessels; and without doubt they have lymphatics and nerves: but the tendinous fibres are closer together than those of the muscles, the cellular substance which separates them is finer, their red vessels are fewer in number, and the nerves cannot be traced, without difficulty, into their substance.

It has been doubted whether the fibres of tendons are a continuation of the moving fibres, or of a different nature. Many, both antients 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

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 muscle also becomes shorter, and draws its extremities towards the middle ; hence it draws towards each other those parts with which it was connected : the muscle also swells by its contraction, becoming hard at the same time, and as it were increases its circumference on every side. Haller has never observed it to turn pale. Whether on the whole it is increased in bulk, or acquires more in breadth than it loses in length, is difficult to be known. It draws after it the tendons, which are obsequious to its motions, though of themselves neither moveable nor irritable. The whole muscle is also 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 anything to muscular motion ? and whether the palsy of the lower limbs after a ligature upon the aorta, be not an argument of this opinion ? we answer, No farther than as they conduce to the sound state of the muscle, or to the conservation of the mutual structure and habit of the parts, which they supply with vapour, fat, &c. : for the irritation of an artery does not affect or convulse the muscle to which it belongs ; nor does a ligature on it cause a palsy, unless after a considerable time, when the muscles begin to be destroyed by a gangrene. Moreover, it is impracticable to explain the motion of peculiar muscles from a cause derived with an equal force from the heart to all parts of the body. Lastly, the influence of the will is confined to the nerves, without residing in the arteries or other solid parts of the body.

But the direct manner by which the nerves excite motion in the muscles, is so obscure, that we may almost for ever despair of its discovery. The opinion, that the nervous vesicles swell by a quicker flux of the nervous spirits, is inconsistent

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 muscle so as to excite it into action, seems not to be the soul, but a law derived immediately from God. For animals newly born, or newly transformed, without any attempt, or exercise, know how to execute compound motions, very difficultly to be defined by calculation; whereas the soul knows not how to perform any actions until she has learnt, by making experiments, the methods of performing them. A muscle then is contracted when in a given time it receives more of the nervous fluid, whether that be occasioned by the will, or by some irritating cause arising in the brain, or applied to the nerve.

But though we may suppose the soul to be the cause of the nervous motion, we cannot do the same with regard to that arising from the *vis insita*. The heart and intestines, and also the organs of generation, are governed by a *vis insita*, and by stimuli. These powers do not arise from the will; nor are they lessened, or excited, or suppressed, or changed by it. No custom nor art can make these organs subject to the will, which have their motions from a *vis insita*; nor can they be made to obey the commands of the soul, like attendants on voluntary motion. It is so certain that motion is produced by the body alone, that we cannot even suspect any motion to arise from a spiritual cause, besides that which we see is occasioned by the will; and, even in that motion which is occasioned by the will, a stimulus will occasion the greatest exertions, when the mind is very unwilling.

There seems to be this difference between the muscles obeying the will, and those which are governed by a *vis insita*; namely, that the latter, being more irritable, are very easily excited into motion by a gentle stimulus; as for instance, the heart and intestines; which organs are most manifestly, and greatly, and constantly, irritable. On the other hand, the muscles, which obey the will, are neither
endowed

endowed with so great nor so durable a power of this kind. Hence they either stand in need of the power of the will, or of a stronger stimulus; when they are excited by a stimulus, they are animated to motion against the will. Thus it happens, that in apoplexies the muscles which obey the will languish, and become paralytic, as being destitute of all influx from the brain; while the vital muscles, having no occasion for the operation of the brain, continue to be excited into contraction by their stimuli, independent of the will, as the heart by the blood, and the intestines by the air and aliments.

The strength of the muscles is very considerable in all persons, but more especially phrenetic and robust men; since frequently, with the use of a few muscles only, they will raise a weight equal to, or much greater, than that of the whole human body. In a healthy man, very slender muscles suffice to lift 200 or 300 pounds. The muscles of the back will even sustain 3000. Notwithstanding this, we see, that much the greater part of the force or power exerted by a muscle is always lost without producing any visible effect. For all the muscles are inserted nearer the point or centre of motion, than the weights they are applied to; and therefore their action is weaker, in the same proportion as they move a shorter part of the lever than that to which the weight is applied. Moreover, in most of the bones, especially those of the limbs, the muscles are inserted at very acute angles; whence again the effect which a muscle exerts in action is proportionally less as the sine of the angle intercepted between the bone and the muscle is less than the whole sine. Again, the half of all muscular force is lost, because a muscle, like an extended cord, exerts as much force at its fixed as at its moving extremity. Besides, many of the muscles are seated in the angle of two bones; and when the joint is bent, the muscle

becomes also bent; consequently a quantity of force must be first applied to stretch the muscle, before the muscle can act on the bone in which it is inserted. Many of them pass over several joints, each of which they bend in some degree, whereby a less part of their remaining force goes to bend the joint to which they are particularly destined. The fleshy fibres themselves of the muscles frequently intercept angles with the tendon in which they terminate; whence their force is diminished in proportion to the sine of the angle of their insertion. Finally, the muscles move their opposed weights with the greatest velocity and expedition, so as not only to overcome the equilibrium, but likewise to add a considerable celerity to the weight.

All these losses of power being computed, make it evident, that the force exerted by muscles in their contraction, is exceeding great, and almost beyond any mechanical computation. The effect is scarce one-sixtieth of the whole force exerted by the muscle, and yet only a small number of these muscles, weighing but a few pounds, are able not only to raise some thousands of pounds, but also with a considerable celerity. Nor is this to be reputed any defect of wisdom in the Creator: For all those losses of power were necessary for a just symmetry 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, since, in an engine so small, it can exert a force equal to some thousand pounds for a considerable time, even for many days together; nor does this seem to be otherwise 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 such a velocity, is not in our power to say; it is sufficient that we know the laws of its motion are

such, 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 muscles are rendered more safe, certain, and easy. The large long muscles, by which the greater motions of flexure are performed, being included in tendinous capsules or cases, drawn and tightened by other muscles, are thus secured and strengthened; and thus the muscle, in a state of contraction, remains pressed against the bone all the time that the limb is bent, and consequently avoids a considerable loss 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 slippery channels; and in these sheaths a particular liquor is separated for the lubricating of the tendons. Nature makes a similar provision for those muscles which perforate others in their course. In other parts, the tendons are either carried round certain eminences of the bone, in order that they may be inserted at greater angles into the bone which they move; or else they are inserted into another bone, from whence a different tendon descends under a larger angle into the bone to be moved. In other parts, the muscles which are derived from convenient situations, have their tendons carried round in a contrary direction by nature, so that they pass into the part to be moved as it were round a pulley. Nature has likewise surrounded the muscles on all sides with a considerable quantity of fat, which is spread also between their bundles of fibres, and also between the small fibres themselves: which fat, being pressed out by the turgescence of the muscles and fibres, renders them soft, flexible, slippery, and fit for motion.

Moreover, the power and action of one muscle is determined by the co-operations or oppositions of others, which

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 press it towards the heart. By too much exercise or action, the muscles themselves grow hard and tendinous on all sides; they render the parts upon which they are incumbent, cartilaginous, or else change those which are membranous into a bony nature; they increase the roughness, protuberances, and processes, 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 muscle which the stimulus has ceased to irritate, or for the action of which the mind has no occasion, is relaxed, and grows soft; its wrinkles grow plain; its fibres are rendered longer, receding from the middle towards the fixed extremities; and its swelling falls. Whatever is the cause of additional contraction is then taken away; but the vis insita remains. It may be asked, What becomes of the spirit that is sent from the brain? A part of it perhaps exhales; a part of it may be suspected to adhere to the fibre; and thus it happens that the muscles grow strong with exercise, and their brawny parts become thicker.

“The three noted classes of animal powers, *elasticity*, *irritability*, and *sensibility*, Dr Wrisberg observes, have been and are yet too much confounded, although it is no difficult task to distinguish these affections from one another. The elasticity and cohesion 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 similarity to irritability, sensibility, and what is called vital power. It either alone performs the various actions of the animal and vegetable body, or adds strength and vigour to them: the former is manifest in the motion of the ribs and cartilages; and the latter

latter in the constriction of the uterus, vessels, and membranes. It by no means depends on the vital powers, but may endure long after death; it is not completely destroyed even by putrefaction. During life it is diminished by various causes, and again restored by several remedies. Irritability, which Haller thought existed in the fibres of the muscles alone, and which indeed was known by name, but not in reality to Glisson, is a kind of animal power, unknown to earlier anatomists, and is different from that power which Hippocrates calls *ενορμότης*. It is proved, from the experiments of Lups, Haller, Fontana, Hoffman, and several others, to differ from elasticity in its rise, duration, seat, causes, effects, and phenomena. We shall add a few remarks:

1. It is most powerful in the muscular fibres of the whole body, but not equally dispersed through all; more powerful in the heart, muscles of respiration, and intestines, but becomes gradually weaker among the voluntary muscles; and it exists perhaps, in a small degree, in the vessels and membranes, as appears from the doubts offered by Whyte, De Haen, Van Doeveren, &c. which Haller and the learned Cigna have answered.

2. The phenomena of irritability, and the irritations themselves by which these phenomena are produced, are not always the same: In some parts we constantly perceive a manifest irritability produced by every irritation, as is the case in almost all the muscles. In many other parts you see the greatest inconstancy and very irregular effects, varying differently, at different times, being sometimes increased and sometimes diminished, at one time yielding to; and at another resisting the irritations: all which is evident in the skin, viscera, vessels, and iris.

3. The learned pathologists Eller, Tissot, and Gerhard, have long ago acknowledged the great use of the doctrine

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 *dionæa muscipula*, according to Ellis's observations, or of the *hedyfarum* or the antheræ 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

alcohol upon the tongue a little before. It cannot however be denied, that in inflammatory diseases, affections of the mind, and other causes, it may happen, that hurt parts may feel, which, under any other condition, seem insensible. The *vital power* of certain learned men of later times, as Vanden Bos, Bikker, Gaubius, Albinus, &c. seems rather compounded of all the animal powers comprehended together; which opinion, except in some minutæ, the great Boerhaave and Simpson have more exactly adopted."

As the doctrine delivered above, concerning the existence of a *vis insita* different from the *vis nervea*, has been the cause of considerable debate, and is at present called in question by several anatomists, particularly by Dr Monro, we think it necessary to give a few objections as stated in his Observations on the Nervous System. The chief experiment, says the Doctor, which seems to have led Dr Haller to this opinion, is the well-known one, that the heart and other muscles, after being detached from the brain, continue to act spontaneously, or by stimuli may be roused into action for a considerable length of time; and when it cannot be alledged, says Dr Haller, that the nervous fluid is by the mind or otherwise impelled into the muscle.

That in this instance, we cannot comprehend by what power the nervous fluid or energy can be put in motion, must, perhaps, be granted: But has Dr Haller given a better explanation of the manner in which his supposed *vis insita* becomes active?

If it be as difficult to point out the cause of the action of the *vis insita* as that of the action of the *vis nervea*, the admission of that new power, instead of relieving, would add to our perplexity.

We should then have admitted, that two causes, of a different nature, were capable of producing exactly the same 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 sup-

posed 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.

A
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
M E D I C A L S O C I E T Y.

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.

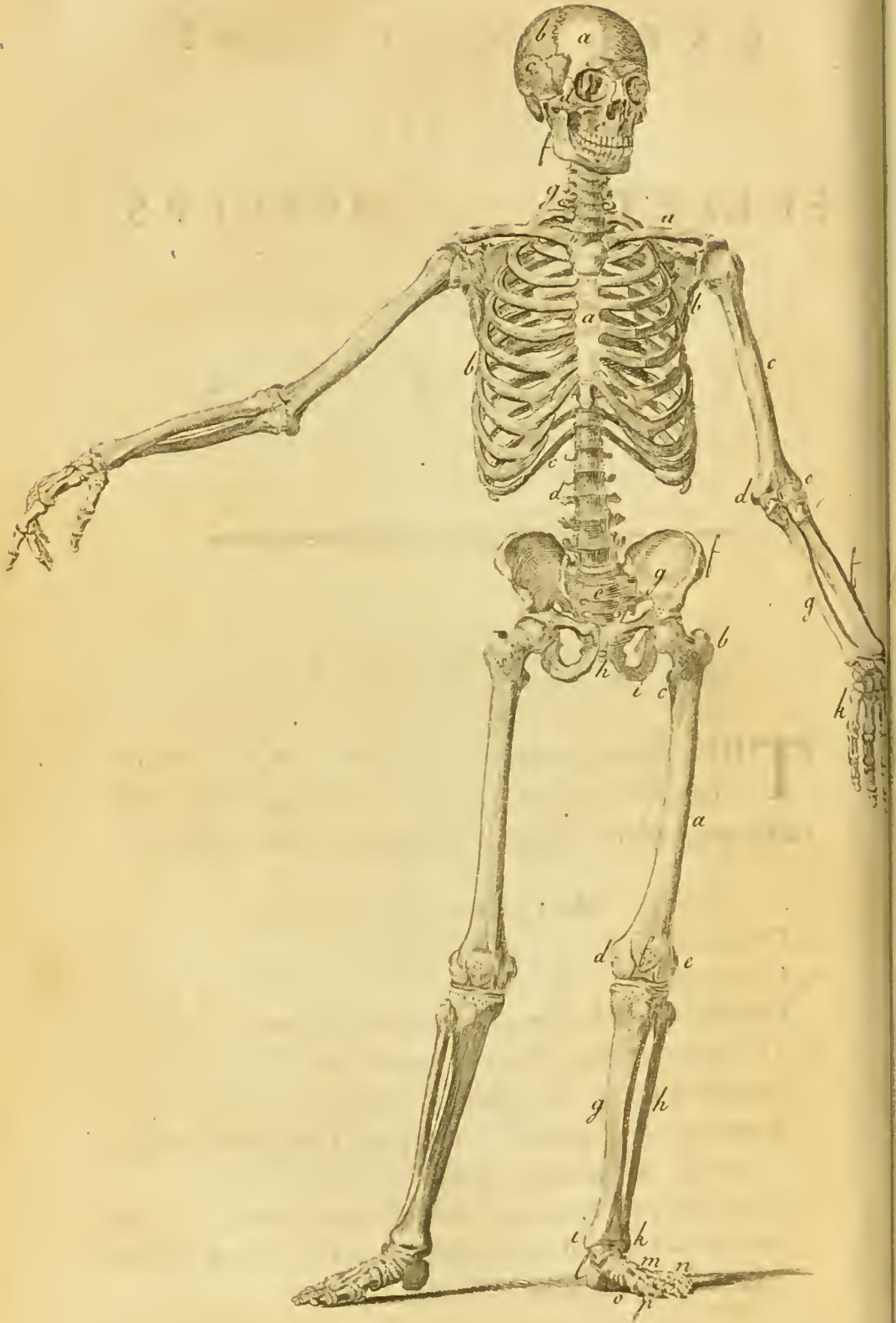
If this little work be of use in facilitating your anatomical studies, it will give the greatest pleasure to,

Gentlemen,

Your very much obliged humble servant, and
Fellow-member,

JOHN INNES.

TAB. I.



Thos. Donaldson delin^t. et sculp.

1307

E X P L A N A T I O N S
O F T H E
S K E L E T O N A N D M U S C L E S,
A S R E P R E S E N T E D I N T H E
T A B L E S.

T A B L E I.

THIS figure represents a front view of the human skeleton, with some of the ligaments and cartilages, which connect the bones to each other.

H E A D *and* N E C K.

a, Os frontis.

b, Os parietale.

Between *a* and *b*, part of the coronal future.

c, The pars squamosa of the temporal bone.

Between *b* and *c*, the squamous future.

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 malæ.

Above *d*, a portion of the transverse future.

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 future, 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 future.

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 malæ, the coronoid process.

g, The seven cervical vertebræ, with their intermediate cartilages.

Opposite to *g*, their transverse processes.

T R U N K.

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.

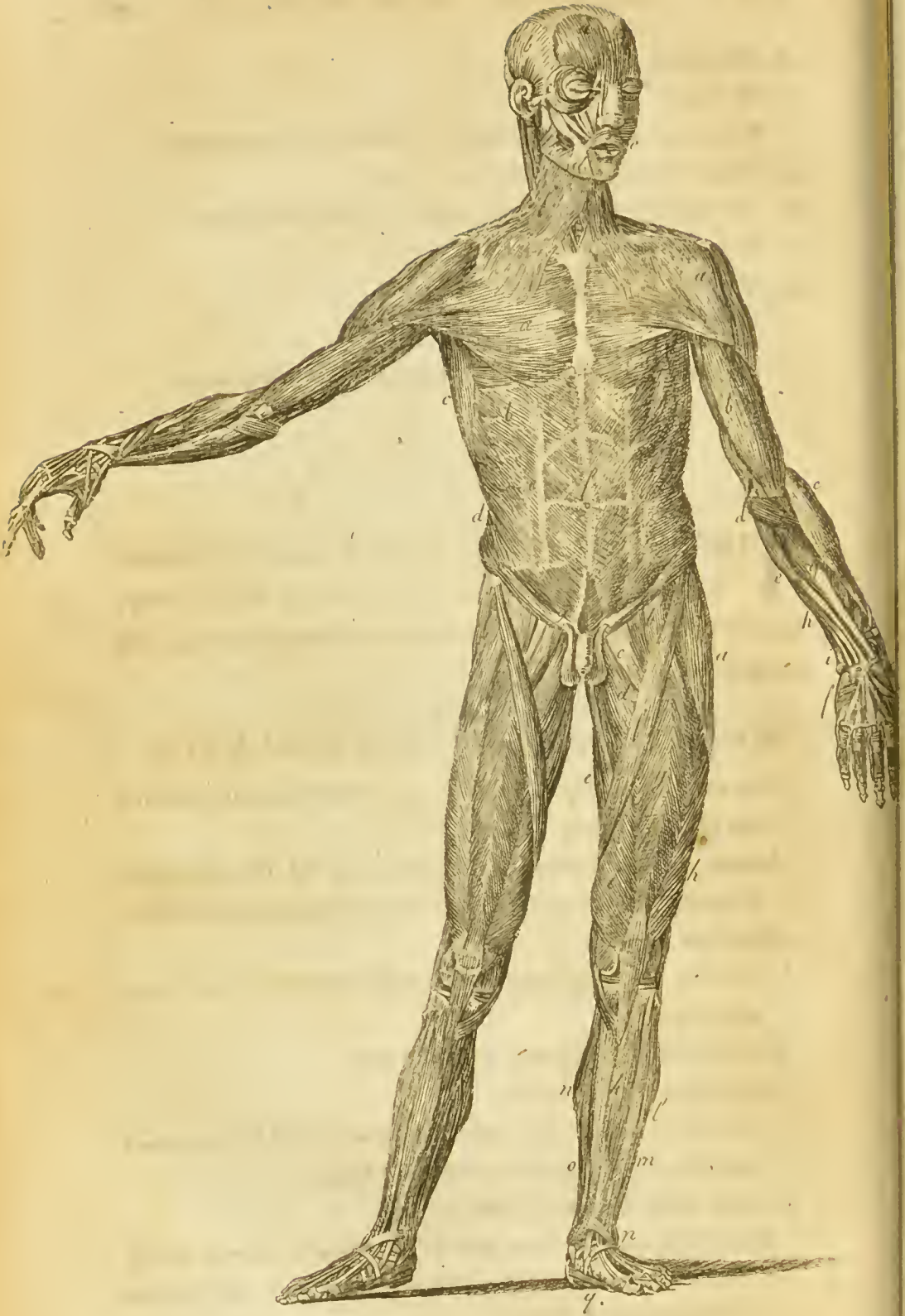
b, The seventh, or last true rib.

c, The

- c*, The twelfth, or last of the five false ribs.
d, The five lumbar vertebræ, 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



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.

T A B L E 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 Fasciæ.

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 aponeurosis 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.

e, Orbicularis palpebrarum.

Its tendon is seen at the inner canthus, fixed to the nasal process of the superior maxillary bone.

Levator labii superioris aëque 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-mastoidæus is seen through the platysma-myoides.

T R U N K.

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 femilunaris.

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 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, 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 glutæus 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 cruris.

Its tendon is seen inserted 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, Peronæus longus.

On the outside of it, a portion of the solæus.

m, Extensor longus digitorum pedis, with the peronæus tertius, and extensor proprius pollicis pedis.

n, Gastrocnemius externus, seu Gemellus.

o, Solæus.

p, Ligamentum tarfi annulare.

q, Abductor pollicis pedis.

T A B L E 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. I. *Corporis humani delineat. et sculp.*

- g*, Depressor labii inferioris.
- b*, Sterno-cleido-mastoidæus, which is
Seen below, arising from the sternum and clavicle, by
two heads.
- i*, Sterno-hyoidæus.
On the outside of it, the
Omo-hyoidæus.
Further out, a portion of the
Hyo-thyroidæus.
- k*, Levator scapulæ.

T R U N K.

- 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.

S U P E R I O R E X T R E M I T Y.

- 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 in-
ternus.
- 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
 Extensor carpi radialis brevior.
- e*, Flexor sublimis perforatus.
- f*, Insertion of the extensor carpi ulnaris.
- g*, Extensors of the thumb.
- b*, Opponens pollicis.
 On the inside of it, a portion of the
 Flexor pollicis brevis.
- i*, Tendon of the flexor longus pollicis manus, after passing
 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 psoas 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 strong tendon is sent to be inserted into
 a tubercle of the tibia.
- g*, Portion of the glutæus medius.
 On the inside of it, part of the glutæus minimus.
- h*, Vastus internus.
- i*, Vastus externus.
- k*, Cruræus.
- l*, Insertion of the biceps flexor cruris into the fibula.
- m*, Tendons of the gracilis and semitendinosus inserted into
 the tibia.
- n*, Solæus.
- o*, Peronæus longus.

p, Extensor



Fig. 3

Fig. 2



Fig. 4

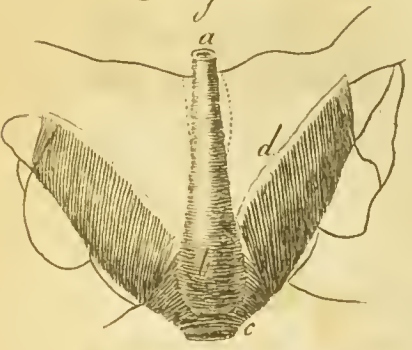
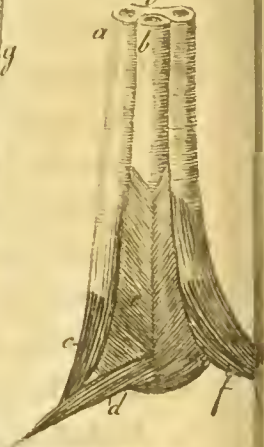


Fig. 5



Fig. 6



- p*, Extensor longus digitorum, with the peronæus tertius on the outside, and extensor pollicis proprius on the inside.
- q*, Solæus.
- r*, Flexor longus digitorum.
- f*, Tendons of the tibialis posticus and flexor longus digitorum pedis.
- z*, Flexor brevis digitorum pedis.

T A B L E 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 pulley, 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.

Represents the anterior Part of the Cartilage of the right Ear, with its proper Muscles.

a, Helicis major.

b, Helicis minor.

c, Tragicus.

d, Antitragicus.

Transversus auris, *vid.* Tab. viii. fig. 3.

Fig. 3.

Represents the third Layer of Muscles, with some of the Ligaments, Cartilages, and naked Bones on the anterior Part of the whole Body.

a, Depressor labii superioris alæque nasi.

b, Orbicularis oris, after most of the muscles, which are fixed to it, and assist to form it, have been taken away.

c, Buccinator.

Above *c*, part of the pterygoidæus externus is seen passing behind the coronoid process of the lower jaw.

d, Levator labii inferioris.

e, Sterno thyroideus.

Immediately above, and seemingly the continuation of it, the

Hyo-thyroideus.

f, Scalenus anticus.

Contiguous to it, on the inside, the Scalenus medius.

Above it, a portion of the Trachelo-mastoidæus.

Between the scalenus anticus, and sterno thyroideus, and hyo-thyroideus, the

Rectus

Rectus capitis anterior major, and
 Longus colli.

T R U N K.

- 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 peritonæum 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 peritonæum.
- 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.

S U P E R I O R E X T R E M I T Y.

- 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 brevis.

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, Gluteus 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, Peronæus

Tab. IV. SKELETON AND MUSCLES. 411

b, Peronæus longus.

i, Peronæus brevis.

Between these two peronæi and tibia, the tibialis posticus is seen.

k, Tendon of the tibialis posticus, covering the tendon of the flexor longus digitorum pedis.

l, Extensor brevis digitorum pedis.

Fig. 4.

Represents the Levatores 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 cavernosum cut off.

b, Bulb of the urethra.

c, The circular fibres which surround the verge of the anus; by some named *sphincter internus*.

d, The anterior edge of the levator ani, cut off from the os pubis, and side of the pelvis.

Fig. 5.

Represents the anterior part of the Sphincter Ani, and Bulb of the Urethra.

a, The urethra, and its corpus cavernosum cut.

b, Bulb of the urethra.

c, Left half of the sphincter ani, running obliquely upwards, to join with the right half.

d, The acute portion, which is inserted into the perinæum.

Fig. 6.

Represents the Corpora Cavernosa of the Penis, Corpus Cavernosum Urethræ, Acceleratores Urinæ, Transversales and Erectores Penis.

- a*, Corpus cavernosum penis cut.
- b*, Urethra, and its corpus cavernosum cut.
- c*, Erector penis covering the crus.
- d*, Transversalis penis.
- e*, Accelerator urinæ.
- f*, Transversalis penis alter, running along the inside of the left erector.

T A B L E V.

REPRESENTS a Back View of the Human Skeleton, with some of the Ligaments and Cartilages which connect the Bones.

H E A D *and* N E C K.

- a*, Os parietale, joined to its fellow by the sagittal future.
- b*, The os occipitis, joined to the parietal bones by the lambdoid future, which is between *a* and *b*.
- c*, Os malæ.
- d*, Maxilla inferior, with a view of the teeth of both jaws from behind.
- e*, The seven cervical vertebræ.

T R U N K.

- a*, The seventh or last true rib.
- b*, The twelfth or last rib.

c, The



- c, The five lumbar vertebræ.
- 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.

T A B L E VI.

REPRESENTS a Back View of the Muscles which are immediately situated below the common Integuments,

H E A D *and* N E C K.

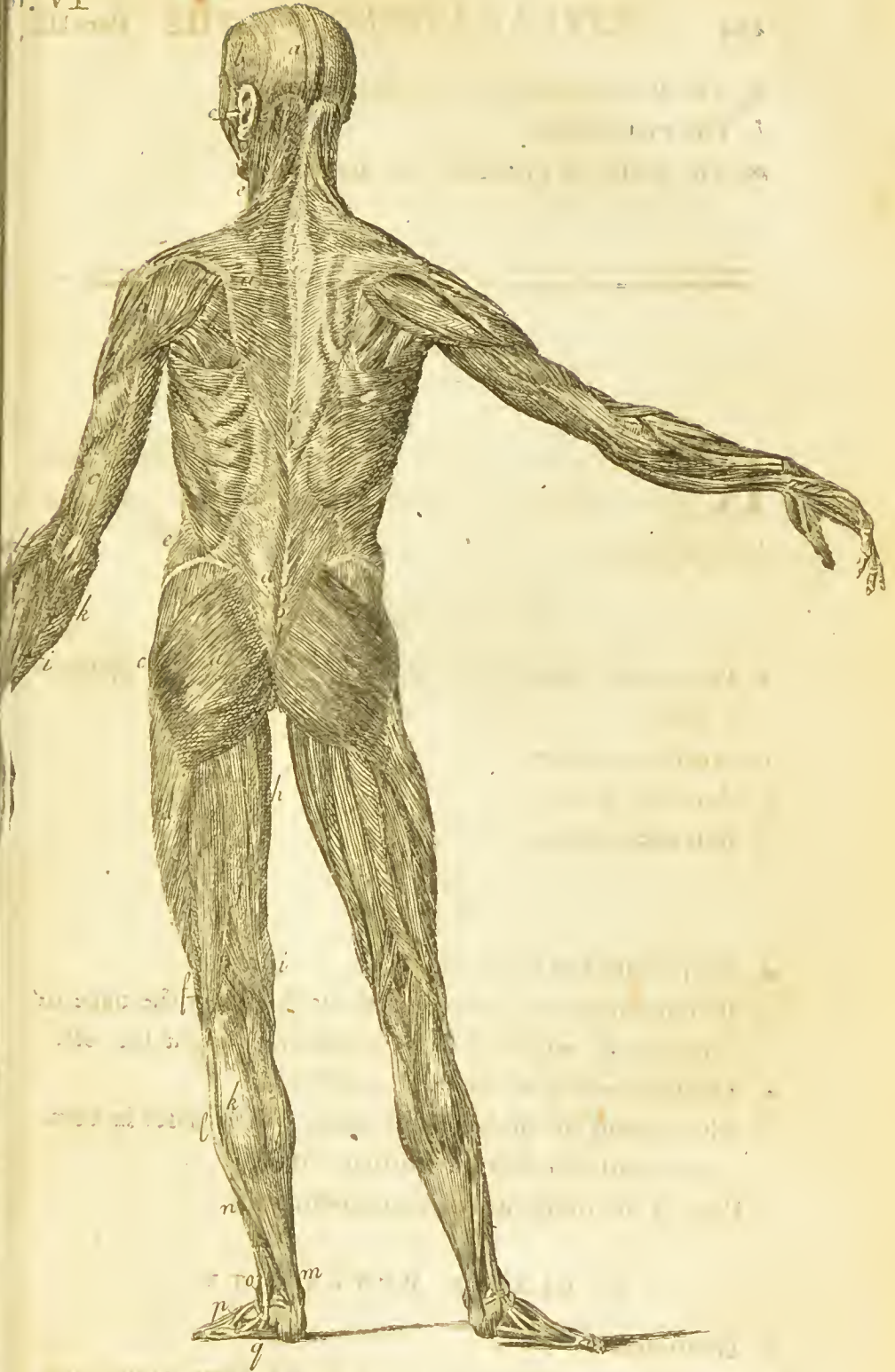
- a*, Part of the occipito-frontalis muscle, with its aponeurosis.
- b*, Attollens aurem.
- c*, Anterior auris.
- d*, Retrahentes auris.

T R U N K.

- a*, Trapezius, seu cucularis.
- b*, Its tendinous edge joining with its fellow in the nape of the neck, which is called *ligamentum nuchæ 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.

S U P E R I O R E X T R E M I T Y.

- a*, Deltoides.
- b*, Infraspinatus, with a portion of the teres minor and major below it.
- c*, Triceps



Tho: Donaldson delin: & sculp:!

The first part of the book is devoted to a general history of the United States from its discovery to the present time. It is divided into three volumes. The first volume contains the history of the discovery and settlement of the continent, and the second and third volumes contain the history of the United States from the first settlement to the present time.

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c, Triceps extensor cubiti.

Its tendon is seen inserted into the head of the ulna, called *olecranon*; and, on the inside of it, the *anconæus*.

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, Glutæus maximus.

b, Part of the glutæus medius.

c, Part of the tensor vaginæ femoris.

d, Vastus externus.

e, The long head of the biceps flexor cruris:

And beneath it,

f, Part of the short head.

g, Semi-

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, Peronæus longus.

o, Peronæus 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 peronæus tertius passing under the ligamentum tarfi annulare; and the flexor brevis digitorum pedis is seen beneath them.

q, Abductor minimi digiti pedis; and above it the tendons of the peronæus longus and brevis, passing under proper ligaments of their own.

T A B L E 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, Mas-



Tho. Lovell delin. et sculp.

CHAPTER I
THE EARLY HISTORY OF THE UNITED STATES

1607

The first permanent English settlement in North America was established in 1607 at Jamestown, Virginia. The colony was founded by a group of men sent by the Virginia Company of London. The settlement was initially plagued by disease and lack of food, but it eventually became a successful colony. In 1620, the Pilgrims arrived in Massachusetts, and in 1630, the Puritans arrived in New England. The colonies grew and developed, and in 1776, they declared their independence from Great Britain.

THE REVOLUTIONARY WAR

The Revolutionary War began in 1775 and ended in 1783. It was a war for independence from Great Britain. The American colonists fought against the British, and in 1783, they won the war and became an independent nation. The war was fought in several key battles, including the Battle of the Clouds, the Battle of the Clouds, and the Battle of the Clouds.

- b*, Maffeter.
- c*, Splenius capitis et colli.
- d*, Portion of the complexus.
- e*, Levator scapulæ, feu musculus patientiæ.

T R U N K.

- a*, Rhomboides major.
- b*, Rhomboides minor:
And immediately above it, the upper edge of the ferratus posticus superior is seen.
- c*, The ferratus posticus superior on the right side.
- d*, Serratus posticus inferior.
- e*, Part of the spinalis dorfi.
- f*, Part of the longissimus dorfi.
- g*, Part of the sacro lumbalis.
- h*, Serratus magnus.
- i*, The broad tendon, by which the latissimus dorfi begins, and from which the tendon of the ferratus 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 coccygæus, and a portion of the levator ani, are seen; and lower down, opposite to *l*, part of the transversalis penis.

S U P E R I O R E X T R E M I T Y.

- 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*, *Anconæus*, which seems to be continued from that part of the *brachialis externus* immediately above it.
- m*, *Extensor carpi radialis longior*; and beneath it, the *brevis*: 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.

I N F E R I O R E X T R E M I T Y .

- a*, *Glutæus 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*, is seen within the
- the

the pelvis, partly covered by the coccygæus and levator ani.

d, Quadratus femoris.

e, Vastus externus.

f, f, Parts of the triceps magnus.

g, Long head of the triceps flexor cruris, and beneath its part of the short head is seen.

h, Semitendinosus, and beneath it parts of the semi-membranosus are seen on each side of it.

i, Gracilis.

k, A small portion of the vastus internus.

l, Poplitæus.

m, The fleshy belly of the plantaris; and its long slender tendon is seen passing over the inside of the solæus.

n, Solæus.

o, The place where the tendon of the gemellus was cut off; but the flesh of the solæus runs farther down.

p, Tendo Achillis, with the plantaris.

q, Peronæus longus, passing at the outer ankle to the sole of the foot; beneath it, the peronæus brevis to the root of the metatarsal bone of the little toe; and, between it and the tendo Achillis, a portion of the flexor longus digitorum pedis.

r, Tendons of the extensor longus digitorum pedis, with the peronæus tertius; and beneath these, the extensor brevis digitorum pedis.

s, Flexor brevis minimi digiti pedis.

T A B L E VIII.

Fig. 1.

REPRESENTS the third Layer of Muscles on the posterior Part of the Body, with some of the Ligaments and naked Bones.

MUSCLES on the HEAD and NECK.

- a*, Part of the buccinator.
- b*, Complexus.
- c*, Trachelo-mastoidæus; on the outside of it, the transversalis colli.
- d*, Scalenus medius.
- e*, Scalenus posticus.

T R U N K.

- a*, Spinalis dorsi; and beneath it, the multifidus spinæ.
- b*, Longissimus dorsi, which sends off a fleshy slip to the trachelo-mastoidæus.
- c*, Sacro-lumbalis, with the cervicalis descendens sent off from it along the side of the neck, and outside of the transversalis colli.
- d*, Semispinalis dorsi.
- e*, Transversalis abdominis.

N. B. The spaces between the spinous processes of the vertebræ have muscular fasciculi between them, particularly those of the neck; and are named *interspinales colli, dorsi, and lumborum*; but those of the back seem to be tendinous and ligamentous.

Fig. 1

Fig. 3

Fig. 4



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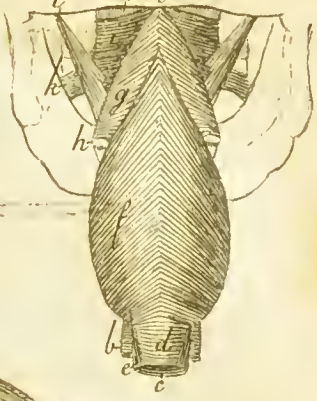
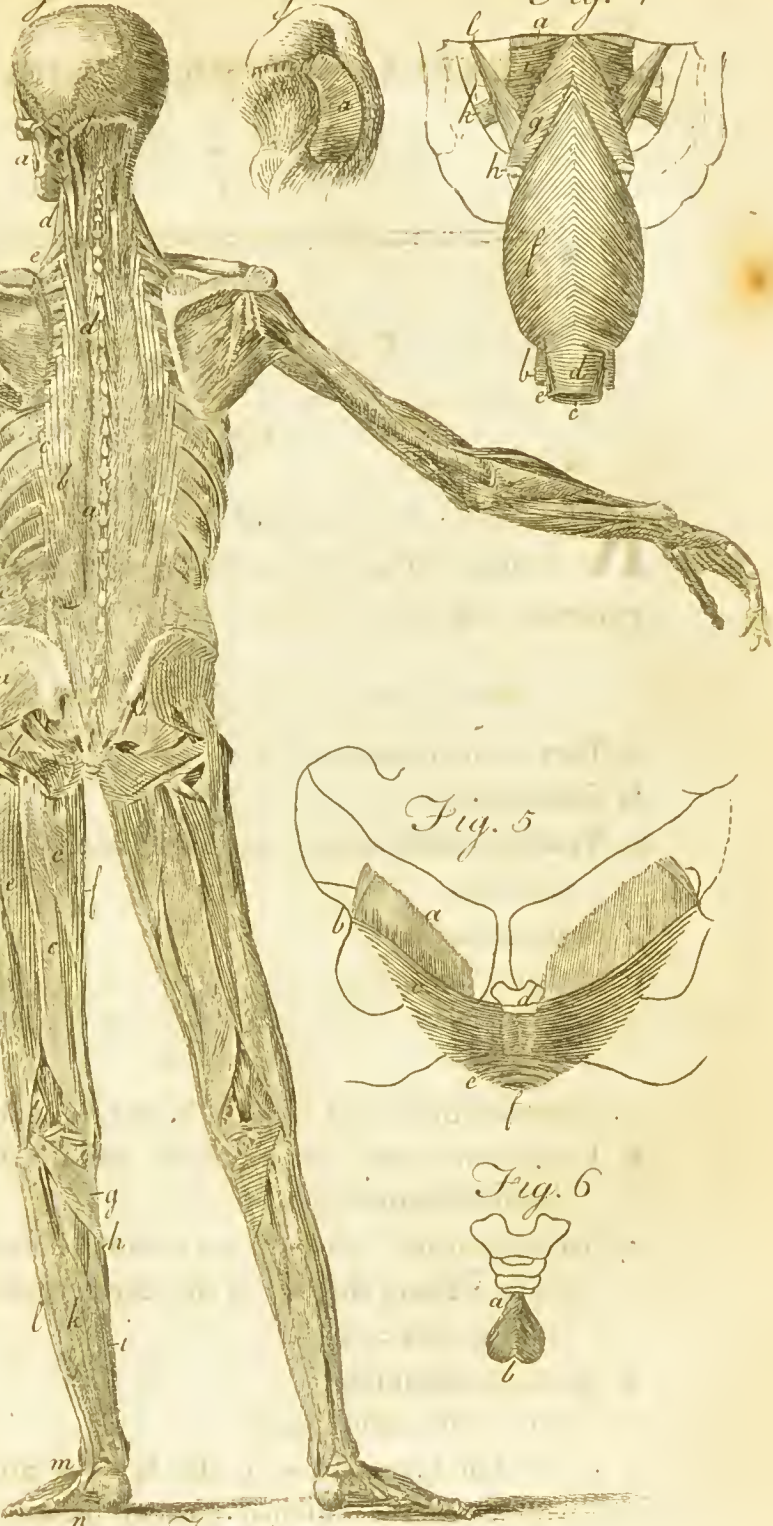


Fig. 6



Fig. 7



CHAPTER I

The first part of the history of the United States is the history of the colonies. The colonies were first settled by Englishmen in 1607, and they remained loyal to the British crown until the outbreak of the American Revolution in 1776. The colonies were at first dependent on the British for their supplies and for their protection. They were also subject to the laws of the British Parliament. The British government, however, was unwilling to grant the colonies the same rights and liberties that were enjoyed by the British people. This led to a growing feeling of discontent among the colonists. They began to demand more rights and more independence. The British government, in turn, refused to grant these demands. This led to a series of conflicts between the colonies and the British, which culminated in the American Revolution.

CHAPTER II

The second part of the history of the United States is the history of the early years of the new nation. The United States was declared independent in 1776, and the new government was established in 1787. The new government was a republic, and it was based on the principles of liberty and justice for all. The new government was faced with many challenges, including the need to establish a strong central government and to protect the rights of the states. The new government was also faced with the need to establish a system of laws and a system of courts. The new government, however, was able to overcome these challenges and to establish a strong and lasting republic.

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, Glutæus 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, Poplitæus.
- h, Tibialis posticus.

i, Flexor

- i*, Flexor longus digitorum pedis.
k, Flexor pollicis longus.
l, Peronæus longus, running down to be inserted into the metatarsal bone of the little toe.
 Beneath it, the peronæus brevis, passing to the sole of the foot.
m, Extensor brevis digitorum pedis.
n, Part of the flexor longus digitorum pedis.

Fig. 2.

Represents the fourth layer of Muscles on the posterior part of the neck.

- a*, Rectus capitis posticus major.
b, Rectus capitis posticus minor.
c, Obliquus capitis superior.
d, Obliquus capitis inferior.
e, Scalenus medius.
f, Part of the multifidus spinæ, covered by the semispinalis colli.

Between the spinous processes of the vertebræ, the interspinales colli are seen double; because these processes are bifurcated.

Between the transverse processes, the posterior row of the intertransversales colli is seen.

Fig. 3.

Represents a portion of the posterior part of the cartilage of the ear, to shew,

- a*, Transversus auris,

Situated on the parts opposite to the antihelix and scapha.

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 œsophagus, cut.
- d*, The inner transverse fibres of the œsophagus, laid bare.
- e*, The outer fibres descending obliquely backwards.
- f*, Constrictor inferior pharyngis.
- g*, Constrictor medius pharyngis.
- h*, The cornu of the os hyoides.
- i*, Constrictor superior pharyngis.
- k*, The part of it which joins with the buccinator.
- l*, Stylo-pharyngæus.

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 thyroidæum.
- b*, Its origin from the spinous process of the os ischium.
- c*, The posterior part seen on its outer side.

d, Its

- d*, Its insertion into the os coccygis, below which the fleshy fibres are continued with its fellow.
- l*, The circular fleshy fibres surrounding the extremity of the rectum, which authors name *sphincter internus ani*.
- m*, The anus.

Fig. 6.

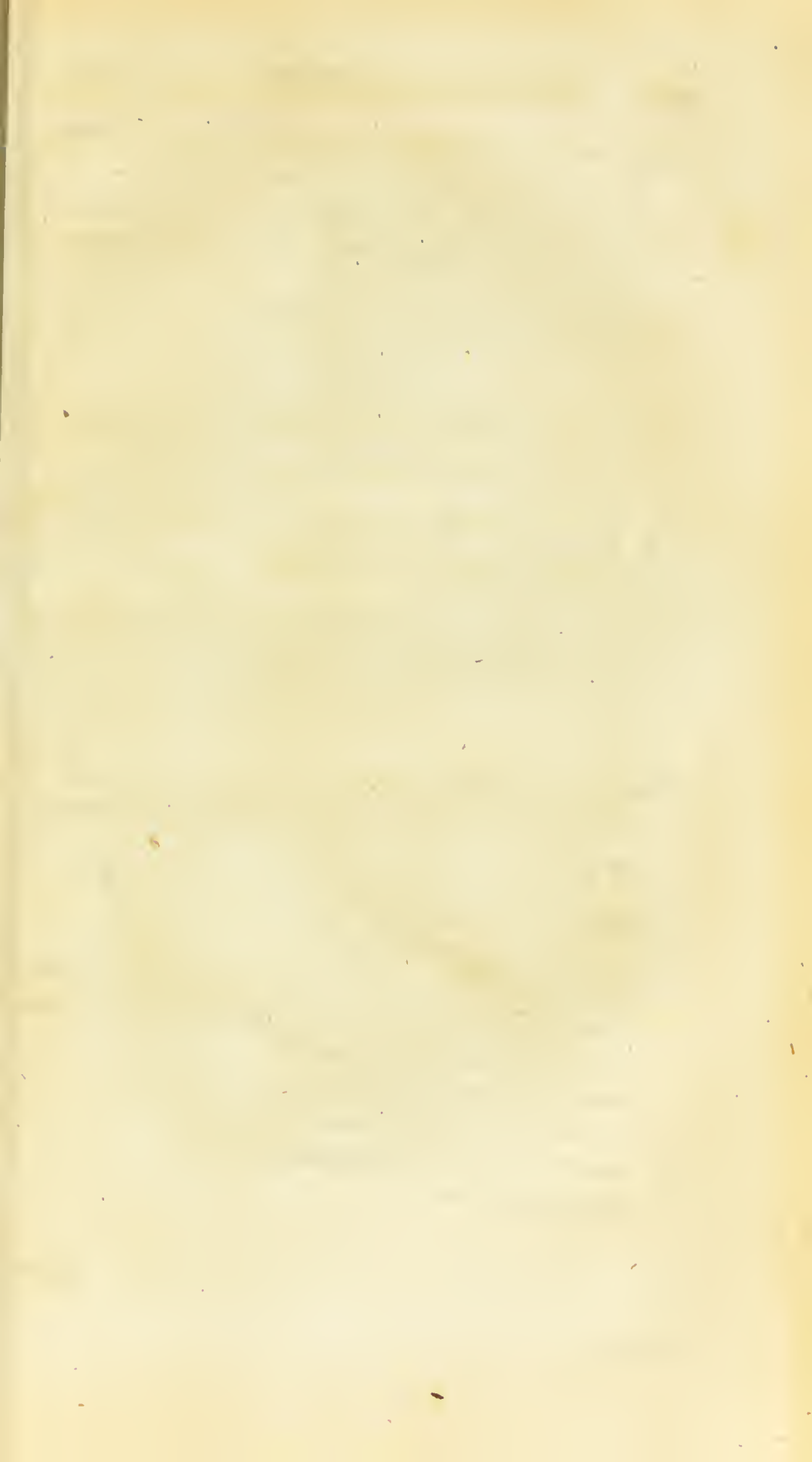
Represents an Outline of the Back of the Os Coccygis, and posterior Part of the Sphincter Ani.

- a*, The insertion of the sphincter ani into the extremity of the os coccygis; to which, from
- b*, The anus,
- The fibres meet from each side, in angles; which are more acute as they point upwards.

Fig. 7.

Represents the first Layer of Muscles on the Sole of the Foot, after the Aponeurosis Plantaris has been taken away.

- a*, Abductor pollicis pedis.
- bb*, Abductor minimi digiti pedis.
- c*, Flexor brevis digitorum pedis, which splits into four tendons, that are perforated by the tendons of the flexor longus digitorum pedis.
- Between these tendons the lumbricales are seen.
- d*, Tendon of the flexor pollicis longus.
- And beneath it, the flexor pollicis brevis.
- e*, Transversalis pedis.



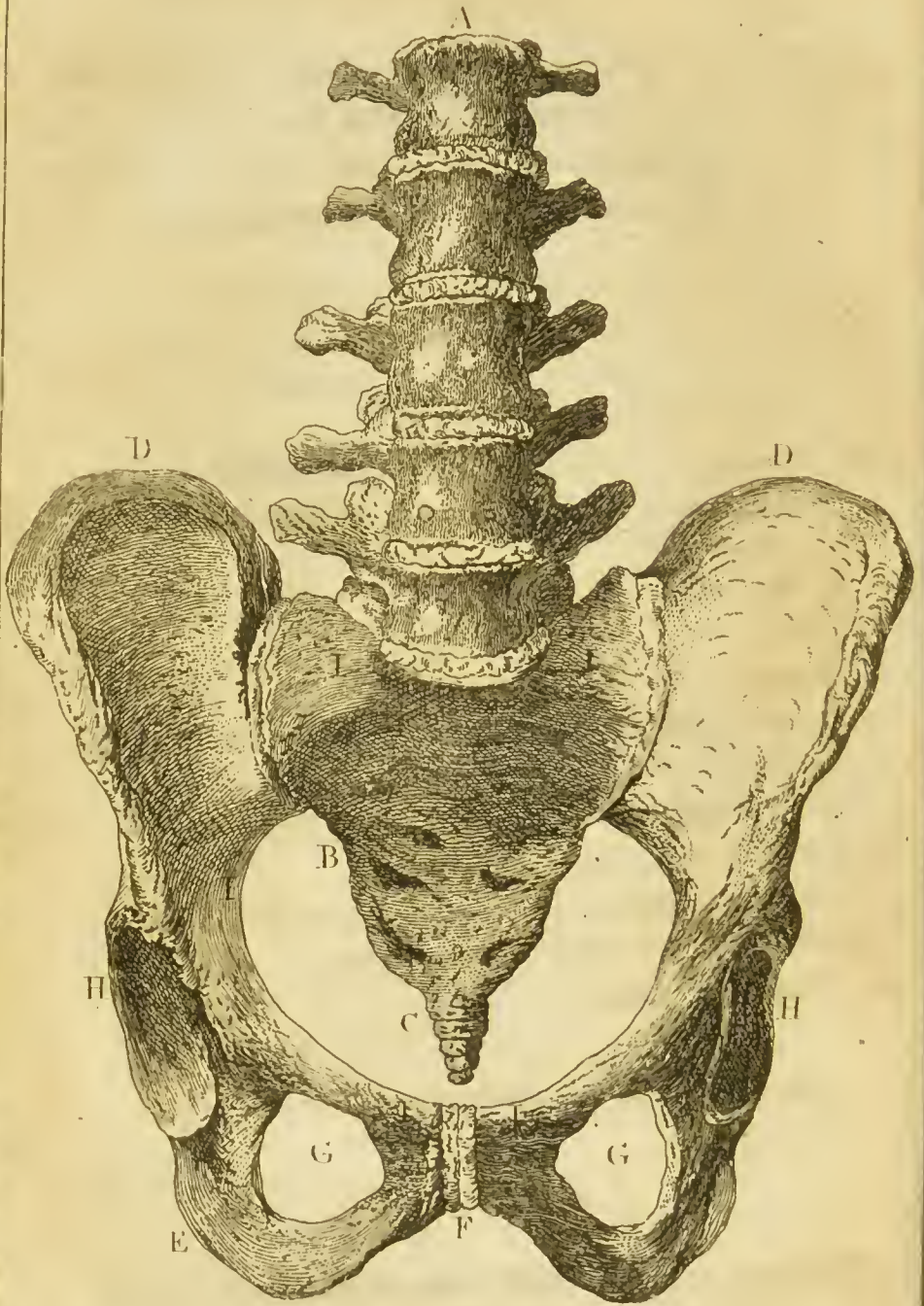


Fig. 8.

Represents the second Layer of Muscles 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 accessorius, seu massa carnea Jacobi Sylvii.
- cccc*, The four lumbricales arising from the tendons of the flexor longus digitorum.
- dd*, Tendon of the flexor pollicis longus; which, in its progress, joins the tendon of the flexor longus digitorum pedis.
- e*, Tendon of the tibialis anticus.
- f*, Tendon of the peronæus longus.
- g*, Tendon of the peronæus brevis.
- h*, Flexor pollicis brevis, with a portion of the abductor pollicis, on the inside of the great toe.
On the outside of *i*, is the adductor pollicis.
- k*, Flexor brevis minimi digiti pedis.
- l*, A ligament which supports the bones of the tarsus.
Before *l*, two of the interossei are seen.
- m*, Transversalis pedis.

T A B L E IX.

REPRESENTS a front view of the Bones of the Pelvis in a Female Skeleton.

- A, The five vertebræ of the loins.
- B, The os sacrum.

C, The os coccygis.

DD, The ossa ilium.

EE, The ossa ischium.

F, The ossa pubis.

GG, The foramina magna.

HH, The acetabula.

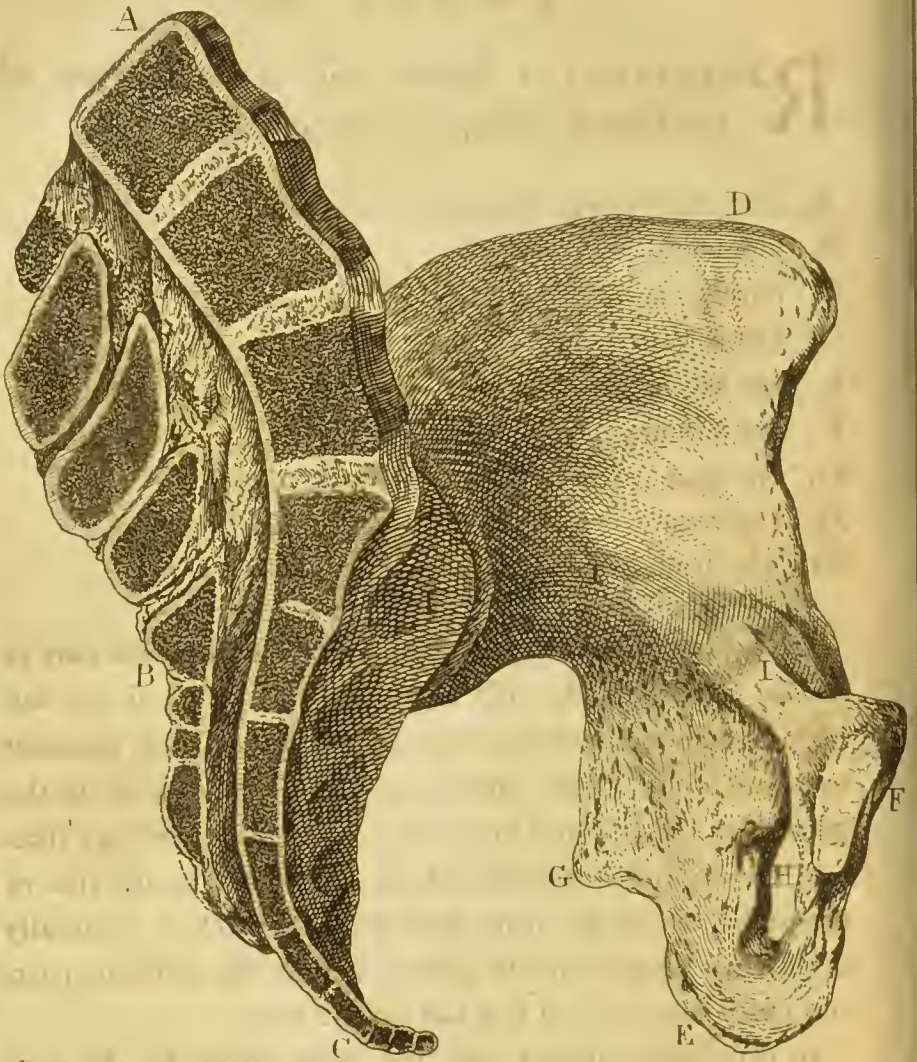
IIII, The brim of the pelvis, or that circumference of its cavity which is described, at the sides by the inferior parts of the ossa ilium, and at the fore and back parts by the superior parts of the ossa pubis and sacrum.

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.

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The first part of the history is devoted to the description of the country and the people. The second part is devoted to the history of the country from the first settlement to the present time. The third part is devoted to the history of the people from the first settlement to the present time. The fourth part is devoted to the history of the country and the people from the first settlement to the present time.





T A B L E X.

REPRESENTS a lateral and internal View of the Pelvis, divided longitudinally.

- A, The three lower vertebræ 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.

SYSTEM OF ANATOMY.

PART IV.

Of the Different CARTILAGES, LIGAMENTS, &c. of the FRESH BONES*.

OF THE HEAD.

THE condyloid processes of the os occipitis, the glenoid cavities or articular fossulae of the ossa temporum, the eminences next these cavities, and the condyloid processes of the lower jaw, are all covered over with very white and smooth cartilages; and there is likewise 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 transparent, and sometimes perforated in the middle. The lower side is uniformly concave, answering to the oblong convexity of the maxillary condyle; but the upper side is partly concave, and partly convex, suited to the fossula and eminence of the temporal bone. It is fixed by its circumference to the inner side of the capsular ligament.

The

* The anatomy of the Fresh Bones in general, has been considered in the first part of this Work.

The remaining cartilages of the bones of the head, viz. the cartilaginous septum, and other cartilages of the nose, the small cartilaginous pulley in each orbit, the cartilages of the outer ear, and those which are joined to the os hyoides, must be referred to the description of the viscera.

The ligaments of the bones of the head are, Those of the articulation of the lower jaw with the temporal bones; those between the occipital bone and vertebræ of the neck; those by which the os hyoides is connected to the styloid process.

LIGAMENTS by which the LOWER JAW is fixed to the
TEMPORAL BONES.

Ligamentum capsulare, composed of firm and strong fibres, fixed by one extremity round the glenoid or articular fossula 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 such a manner as to allow the intermediate cartilage to follow the motions of the condyles, and to change their situation from the glenoid cavities to the tubercles of the zygomatic processes, and to return again, as was mentioned in the description of the bones.

Ligamentum laterale maxillæ inferioris, which arises from the inner surface of the angle of the lower jaw, near the passage where the vessels and nerves go into the bone, is fixed to the root of the styloid process, and to the posterior margin of the articular cavity of the temporal bone. It assists in keeping the jaw in its proper place.

LIGAMENTS between the OCCIPITAL BONE and VERTEBRÆ
of the NECK.

Ligamenta capsularia, arise from the edges of the condyloid

dyloid processes of the os occipitis, and are fixed to the edges of the superior oblique processes of the first vertebra.

Ligamentum latum anterius, arises from the fore-part of the foramen magnum occipitis, and runs down to be fixed to the anterior arch of the first vertebra of the neck.

Ligamentum latum posterius, arises from the posterior margin of the foramen magnum occipitis, and is inserted into the upper part of the posterior arch of the first vertebra.

Ligamentum processus odontoidis seu perpendiculare, arises from the fore-part of the foramen magnum, and runs down to be fixed to the processus dentatus of the second vertebra. This ligament is short, but remarkably strong; it assists in fixing the head to the spine, but is twisted in the rotation.

Ligamenta lateralia, are two short, but very strong ligaments, which run over from each side of the processus dentatus to be fixed to the inner side of the first vertebra, and to the edge of the foramen magnum. See description of the Vertebrae.

Ligamentum cervicale seu nucha, arises from the spinous process of the os occipitis, runs down upon the back-part of the neck, adhering to the spinous processes of the cervical vertebrae, and giving origin to part of the trapezius muscle.

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 surrounding the other bones is called simply *periosteum*.

The internal structure of the bones of the head being for the most part cellular, they contain also distinct portions

tions of marrow included in membranous cells lying in the diploë.

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 VERTEBRÆ.

The cartilages of the vertebræ in general are of two kinds; one proper to each vertebra, the other common to the two vertebræ 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 vertebræ 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 vertebræ.

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 these two vertebræ has

five articular cartilages, besides the interarticular ones already mentioned.

The vertebræ 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 fossulæ in the bodies of these vertebræ, and the fossulæ of their transverse processes, by both of which they are articulated with the ribs.

The cartilages of symphysis lie between the bodies of the vertebræ, 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 vertebræ. Between the vertebræ 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 vertebræ 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 vertebræ 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 vertebræ to which they are joined, we see they are composed of many cartilaginous concentrical lamellæ contained within each other. The most external lamellæ are fibrous, thickest, and firmest, and separated by considerable intervals: the internal approach nearer and nearer together, becoming

becoming gradually thinner, and of a softer consistence, till at last they are almost in the form of a glairy liquor in the centre.

These rings do not form an entire circumference; being turned inwards on the back-part, answering to the fore-part of the passage for the spinal marrow. They lie horizontally between the vertebræ. The interstices of the rings are filled with a mucilaginous substance, less fluid than that of the joints. Each lamina taken separately is very pliable, according to its length; but taken together, they are not so easily bent, partly because of their circular figure, and partly because of their vicinity and multiplicity. They yield, however, in the inflections of the spine; and their external surface, which in the ordinary situation of the spine is even with the surface of the vertebræ, becomes prominent or juts out on that side towards which the inflection is made, the cartilages being then compressed by the vertebræ.

They likewise yield on all sides, without any inflection of the spine, to the weight of the upper part of the body; but this is done by very small and imperceptible degrees, and especially at the under part of the true vertebræ, and when the body is loaded with an additional weight.

They restore themselves afterwards merely by being freed from compression: So that a man is really taller after lying, than after he has walked or carried a burden for a length of time; the most natural and simple reason that can be given for the different height of the same person at different times, first observed in England, and afterwards confirmed by Mr Morand, a member of the Royal Academy of Sciences, being the different state of the intervertebral cartilages. According to Sabatier, &c. the same person is sometimes 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 vertebræ, than those of the back and loins. Without this convexity and hollow-ness in these vertebræ, which are the least of all, the cartilages could not have been made large enough to resist strains and great exertions.

LIGAMENTS of the VERTEBRÆ.

The vertebræ 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 vertebræ colli primæ, 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 than 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 fixed

ed to the bodies of the vertebræ, 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 vertebræ 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 vertebræ. 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 vertebræ, 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 vertebræ. 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 vertebræ, 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 spinous processes of one vertebra, to the corresponding parts of the vertebra next it; and thereby joining the different vertebræ 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 vertebræ. 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 vertebræ.

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 symphysis, 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,
and

and in their extremities; all which were explained in the description of the skeleton. We have only to observe here, that these cartilages are whiter, more polished, broader, and thicker in the natural state than when they are dried. The cartilages of the false ribs are naturally more slender and pliable than those of the true ribs: the middle or inner substance acquires the consistence of bones in old age; and their extremities sometimes ossify, and are immovably fixed to the sternum. The posterior extremities of the ribs are likewise tipped with cartilage where they are joined to the vertebræ.

LIGAMENTS *proper to the* STERNUM.

Membrana sterni propria, is a firm expansion, composed of many tendinous fibres, running in different directions, but chiefly longitudinally, covering both the external and internal surface of the sternum. On the fore-part of the sternum the external fibres begin at the articulations of the cartilages of the ribs, and run across in a radiated manner to their fellows on the opposite side, while the internal fibres have a longitudinal direction.

Ligamentum cartilaginis ensiformis, is composed of tendinous fibres similar to the former, arising from the cartilaginous extremity of the seventh rib and corresponding part of the sternum; and which, after descending obliquely, are fixed to the cartilago ensiformis. The fibres of this are intermixed with those of the *membrana sterni*.

LIGAMENTS *between the* STERNUM *and* RIBS.

Ligamenta capsularia cartilaginum costarum verarum, arise round the cartilages of the seven true ribs, to be fixed to the articular pits in the sides of the sternum. On the upper and under side of each articulation, these ligaments are very short; but on the anterior side many fibres are produced,

produced, which run in a radiated manner on the forepart 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 vertebræ 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 vertebræ of the back; much in the same manner with those between the heads of the ribs and vertebræ.

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 vertebræ 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 vertebræ.

The ligamentous expansions of the vertebræ 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 vertebræ.

The synovial glands of all these articulations are very small ; but are accompanied by many other fatty molecules 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

face 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 crufted 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 clavicula, 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 scapulæ, arises from the internal surface of the coracoid process of the scapula, and ends at the posterior extremity of the clavicle.

Ligamentum conoideum scapulæ, arises from the root of the coracoid process, is inserted into the rough protuberance of the posterior extremity of the scapula.

Ligamentum proprium scapulæ anticum, arises from the external surface of the coracoid process, and is fixed to the posterior margin of the acromion.

Ligamentum proprium scapulæ 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 liga-

ment 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 fossulæ 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

culuation 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 furrounds 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 brachæus 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

ment

ment line. The lateral notch of the basis is also covered by a continuation of the same cartilage.

At this end of the radius, there is likewise a particular additional cartilage, or triangular production, longer than it is broad, very thin, and rather flat than concave on both its smooth sides. It is fixed by its basis, or shortest side, to the lateral sigmoid notch of the basis of the radius, in such a manner, that one side of it is on a level with the large cartilaginous surface of the basis of the bone, and its apex directly opposite to the styloid process. The other side touches the flat extremity of the small head of the ulna, but is not fixed to it. This cartilage may be termed the *interarticular cartilage* of the joint of the wrist. It is tied to the radius by very short ligaments; and, playing on the small head of the ulna, it follows all the motions of the radius. It is therefore a sort of particular production of the lower side of the basis of the radius, and fills, in the natural state, the void space which, in the skeleton, appears between the end of the ulna and the neighbouring bone of the carpus. The inferior extremity, or small head of the ulna, is crufted over by a cartilage round its cylindrical border, in the notch near the styloid process, and for some space on the process itself.

LIGAMENTS of the inferior extremity of the BONES of the FORE-ARM.

Ligamentum capsulare, arises 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 first bones of the carpus.

Ligamentum capsulare seu sacciforme, arises from the edges of the semilunar cavity, at the under end of the radius, and furrounds the head of the ulna.

Ligamenta duo transversa. One of these arises from the
styloid

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 covered 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, arise 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 muscoli

musculi lumbricales, 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 vaginæ and tendons, and are fixed to the ridges on the concave side of the bones of the fingers. They serve as fræna 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 shal-

low depression for the synovial gland, reaching from the notch beyond the middle of the cavity. All the rest of the surface is covered with a very white shining smooth cartilage, which terminates precisely at the edge of the cavity.

The circumference of the acetabulum has, besides, a border of a particular kind; the substance of which is neither wholly cartilaginous, nor wholly ligamentous; but it may be rather placed among the ligaments. The os sacrum has no cartilage excepting that between its upper end and the last vertebra of the loins, and those by which it is connected with the ossa innominata. The intervertebral cartilages of this bone are, for the most part, entirely obliterated in the adult. The cartilages which join the different portions of the os coccygis, are preserved in some subjects to a very great age; in others they soon become entirely ossified.

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 insertions, as was observed of the spine of the os ilium. The cartilaginous substance which, to a certain age, unites the epiphyses to the body of the bone, does not belong to this place, because 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, deserves, however, to be observed; because that epiphysis has been separated by violent falls.

LIGAMENTS *proper to the BONES of the PELVIS.*

Ligamenta ileo-sacra, are strong ligaments arising from the posterior part of the spine of the os ilium, which is opposite to the side of the os sacrum, and descending obliquely,

liquely, are fixed to the first, third, and fourth spurious transverse processes of the os sacrum.

Ligamenta pelvis transversalia superius et inferius, are two ligaments arising from the posterior spinous process of the os ilium; the superior is fixed to the transverse process of the last vertebra of the loins; the inferior is fixed to the first transverse process of the os sacrum.

Ligamenta sacro ischiatica. Between the os ischium and os sacrum, we find two very strong ligaments called *Sacro-sciatic*; one broad and external, the other small and internal. The external arises from the anterior and external edge of the false transverse processes of the os sacrum. From thence diminishing in breadth, it descends obliquely towards the tuberosity of the os ischium, and is inserted immediately below the sinus, which lies between the tuberosity and spine of that bone. This insertion is afterwards continued over the whole internal labium of the inferior portion of the os ischium, 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 ischium, it produces a kind of falx; one edge of which is fixed to the bones, the other lies loose; and by this insertion of the falx, it forms, together with the bones, a kind of deep channel or groove.

The internal sacro-sciatic ligament adheres closely to the inside of the posterior portion of the former. It arises internally from the edge of the inferior part of the fourth false transverse process, and from the whole side of the os sacrum, and from the basis of the upper part of the os coccygis. From this it runs up a little obliquely to the spine of the os ischium; to the sharp point and upper part of which it is fixed.

By these two ligaments two openings are formed; a large one, with the superior sciatic sinus, through which the pyriform muscle, the posterior crural vessels, and the sciatic

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 fræna of different sizes.

Ligamentum inguinale, seu Poupartii, 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 it expands considerably towards both extre-
mities,

mities. 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,

sum, and also to the edge of the rough impression at the bottom of the acetabulum. From this insertion it runs obliquely backwards and a little upwards, between the synovial gland within the acetabulum and the cartilaginous convexity at the head of the os femoris, and ends in the upper part of the small femilunar notch. This insertion is oblique, a little rounded on the upper part, and flat on the lower; and in some subjects there is a sort of depression in the head of the bone for the passage of the ligament.

The periosteum of the bones of the pelvis agrees with that on other flat bones.

The rough unequal depression at the bottom of the acetabulum is filled with a broad synovial gland, bordered with a fatty substance, and covered by a fine membrane, through which a mucilaginous liquor passes to moisten the joint and facilitate its motions. This membrane rises above the gland, and gives a sort of covering to the ligament contained in the joint.

The blood-vessels of this gland pass between the bottom of the acetabulum and the ligament at ~~the~~ inner edge of that cavity.

The blood-vessels pass chiefly through the small holes in both convex and concave surfaces of these bones; and ramifying upon the bony cells, they end in a great number of small capillary tubes, which make the medullary juice appear red.

The cartilage which covers the lower extremity of the femur is exactly fitted to the semi-oval convexity of the inferior surface of each condyle, and to the pulley formed by their union.

The two cartilages which cover the two superior surfaces of the head of the tibia are gently hollow; but the internal is more depressed than the external: the back-part of the

the latter is sensibly depressed, by which a sort of convexity is formed. The cartilage is absent where the crucial ligament of the patella has a thick cartilage on its posterior side, divided by a superficial longitudinal ridge, 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 seems 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 capsular ligament; thin at their inner edge, particularly at the middle; convex superiorly next the condyles of the femur; flatted below next the tibia; and tied together by a small ligament. These cartilages are in shape of a crescent, or Roman C. Their convexity or greatest curvature is very thick; their concavity or smallest curvature very thin; something like the edge of a sickle. They lie on the two upper surfaces of the head of the tibia; their thickest part or convexity corresponding with the edges of the head, and their thin sharp edges to the middle of each surface; their extremities or corners being turned toward each other. Each cartilage covers about two thirds of the surface of the tibia on which it lies, leaving one third bare in the middle. Their under sides are flat, the upper side hollow; and, together with the middle portions of the surfaces 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 these, called *posterior*, is fixed to the internal superficial impression in the notch between the condyles of the femur; and reaching almost straight

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 *anterior*, 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 other 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 side 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, and 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 extension

tenſion of the limb. They are quite looſe in the flexion, and put upon the ſtretch in the extenſion of the limb.

Ligamentum poſticum, has an irregular form. It deſcends from the poſterior, inferior, and external part of the outer condyle of the femur; and having croſſed the poſterior part of the articulation, it terminates in the poſterior, ſuperior, and internal part of the tibia. Some fibres go by the ſide of the former, to end in the upper and back part of the tibia. The three ligaments above deſcribed are firmly glued to the capsular ligament.

The capsular ligament is fixed quite round the inferior extremity of the os femoris, at a ſmall diſtance above the anterior, lateral, and poſterior parts of the cartilage, and above the poſterior 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 ſuch a way that the patella itſelf forms a part of the capsula of the joint. It is ſtrengthened by the tendinous aponeuroſis and tendons of the muſcles which ſurround the joint, and likewiſe by the ligaments already mentioned; internally, it adheres to the ſemilunar cartilages, and ſends off a very fine vagina over the ligaments, &c. within the joint.

Ligamenta cartilaginea, are two ſmall ligaments which join the ſemilunar cartilages to each other, and likewiſe to the os femoris and tibia.

Ligamentum patelle, is a very ſtrong ligament which ariſes 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 maſs in the middle cavity of the bone, and in ſmall diſtinct cluſters in the cells of each extremity. The firſt is penetrated at diſferent diſtances by the bony filaments or ramifications of the reticular texture, and thereby ſuſtained 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

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 moleculæ 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.

LIGAMENTS of the BASES of the METATARSAL BONES.

Ligamentum capsulare, joins the metatarsal bone of the great toe to the os cuneiforme internum.

Ligamenta articularia, 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 plantæ, 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, arise 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 tibiæ. 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 tarfi 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 forepart 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 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 *moleculæ* in the cavernous portions, and in masses in those which have large cavities. Thus the marrow of all the tarsal bones is dispersed in *moleculæ*, 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 *moleculæ* 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 *moleculæ*.

The synovial substances answer in number and figure to the depressions between the cartilaginous edges and ligaments.

A

SYSTEM OF ANATOMY.

PART V.

Containing a DESCRIPTION of the

COMMON INTEGUMENTS.

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

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

The three first of these coverings are truly common or universal, that is, extended over all parts of the body.

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

The moderns divide the integuments into *cuticula*, *rete mucosum*, *cutis vera*, and *corpus adiposum*.

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 laminæ, 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 laminæ 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 papillæ under it; but it may be separated by boiling, or steeping for a long time in cold water. It is not impossible to separate

parate 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 folliculæ 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 increased by this dilatation and tension of the cuticle.

But when the cuticle is separated from the skin, it carries along with it part of these cutaneous fibres; which being compressed by the matter contained in the blister, shut the pores of the separated cuticle like so many valves; and it is probable, that some of these small portions being detached, are the substances which have been taken for valves of the cutaneous tubes.

With respect to its origin, some authors have supposed it to be formed by a moisture exhaled from the whole surface of the body, which gradually hardens when it is exposed to the air; but the fœtus in utero, where no air is admitted, is a proof against this opinion; and it grows readily under plasters applied to any part of the body. Leeuwenhoeck supposed its formation to be owing to the expansion of the extremities of the excretory vessels, which are found every where upon the surface of the true skin. Ruysch attributed its origin to the nervous papillæ of the skin; and Heister thinks it probable that it may be owing both to the papillæ and the excretory vessels. Morgagni, on the other hand, contends, that it is nothing more than the surface of the cutis, hardened and rendered insensible by the liquor amnii in the uterus, or by the pressure of the air. In fact, we know little about its origin; but the regeneration of it is very evident, sudden, and surprising; for, let it be destroyed ever so often, it still grows again.

CORPUS MUCOSUM.

Under the cuticle, we meet with a substance of a greyish colour, which has been thought to represent a net-work; hence it has got the name of *corpus reticulare*, or *mucosum*. It is of a soft, mucilaginous, and viscid nature; and fills up the interstices of the fibres running between the cutis

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

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

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

The papillæ of the palm of the hand, of the sole of the foot, and of the fingers and toes, are higher than on the other parts of the body; but they are likewise smaller, closely united together, and placed as it were 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 papillæ, representing very fine hairs or villi closely united together.

There is another particular kind under the nails; the papillæ being there more pointed, or in a manner conical, and

and turned obliquely toward the ends of the fingers. Those which are found in the hairy scalp, scrotum, &c. are still of other kinds.

In inflammations, we observe a reticular texture of capillary vessels, more or less extended on the surface of the skin; and curious anatomists demonstrate the same thing by fine injections, which may be looked upon as artificial inflammations. Something similar to this has been injected lately by Mr Baynham of London, who thought it *rete mucosum*; and afterwards by Mr Cruikshank, who calls it *cuticula quarta*. (See Mr Cruikshank's letter to Mr Clare). But neither of these methods prove, that, in the natural state, these vessels are blood-vessels; that is, that they contain the red portion of the blood.

It is more probable that this vascular texture is only a continuation or production of the very small capillaries of the arteries and veins; which, in the natural state, transmit only the ferous part of the blood, while the red part continues its course through wider ramifications, which more properly retain the name of *blood-vessels*.

This vascular texture is of various forms and figures in the different parts of the body. It is not the same in the face as it is elsewhere; neither is it alike on all the parts of the face, as may be discovered by the most ordinary microscopes; and from hence we might perhaps be enabled to give a reason why one part of the body turns red more easily than another.

The skin has several considerable openings, some of which have particular names; such as, the fissure of the palpebræ, the nares, the mouth, the external foramen of the ears, the anus, and openings of the parts of generation.

Besides these, it is perforated by an infinite number of small holes, called *pores*, which are of two kinds. Some

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are more or less perceivable by the naked eye; such as the orifices of the milky ducts of the mammæ, the orifices of the excretory canals of the cutaneous glands, and the passage of the hairs.

The other pores are imperceptible to the naked eye, but visible through a microscope; and their existence is likewise proved by the cutaneous transpiration, and by the effects of topical applications; and from these two phenomena, they have been divided into arterial and venal pores.

We ought likewise to observe the adhesions and folds of the skin. It is every where united to the corpus adiposum; but it adheres to it much more closely in some parts than in others, as in the palm of the hand, sole of the foot, elbow, and knee.

Some plicæ or folds in the skin depend on the structure of the membrana adiposa or cellularis, as those in the neck and buttocks: others do not depend on that membrane, such as the rugæ in the forehead, palpebræ, &c. which are formed by cutaneous muscles, and disposed more or less in a contrary direction to these muscles. These folds increase with age.

There is, besides, a particular kind of folds in the skin of the elbow, knee, and condyles of the fingers and toes; which are owing neither to the conformation of the membrana adiposa, nor to any muscle.

Lastly, there is a kind of plicæ, or rather lines, which cross the palm of the hand, sole of the foot, and corresponding sides of the fingers and toes, in different directions. These serve for employment to fortune-tellers; whose pretended art is contrary to religion, and despised by all men of sense.

GLANDS OF THE SKIN.

In different parts of the body, we meet with small glands or follicles of an oval form, and seated chiefly under the skin in the corpus adiposum.

They are composed of convoluted vessels; but in some parts of the body they appear to be formed of small cylindrical tubes, or simple follicles, continued from the ends of the arteries, and discharging, by small excretory ducts, a fat and oily matter, that serves to lubricate and moisten the surface of the skin. When the fluid they secrete has acquired a certain degree of thickness, it approaches to the colour and consistence of suet: and from this appearance they have derived the name of *sebaceous glands*. They are found chiefly on the nose, ears, axillæ, likewise round the nipple, and about the external parts of generation, in both sexes.

Besides the sebaceous glands, anatomical writers mention other small spherical bodies placed every where over the surface of the body, in much greater abundance than those just mentioned, and named *miliary*. They are said to have excretory ducts that open on the surface of the cuticle, and distil the sweat and matter of insensible perspiration; but after all that has been said by different authors about them, it is certain there are no distinct glands that can be traced by the knife.

USES OF THE SKIN.

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

The skin is able to resist external injuries to a certain degree, and such impressions, frictions, strokes, &c. to which the

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the human body is often liable, as would hurt, wound, and disorder the parts of which it is composed, if they were not defended by the skin.

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

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

The epidermis serves to keep the pencils or nervous filaments of the papillæ in an even situation, and without confusion; and it likewise moderates the impressions of external objects. Particular, as well as general feeling, is more or less perfect, in proportion to the thinness of the epidermis; callosities in which weaken, and sometimes destroy both.

Another use of the epidermis is, to regulate the cutaneous evacuations already mentioned; the most considerable of which is insensible transpiration.

MEMBRANA ADIPOSITA, AND FAT.

The last universal integument of the human body, is the membrana adiposa, or corpus adiposum. This is not, however, a single membrane, but a congeries of a great number of membranous laminæ, joined irregularly to each other at different distances, so as to form numerous interstices of different capacities, which communicate with each other.

other. These interstices have been named *cellulae*, and the substance they compose the *cellular substance*.

The thickness of the membrana adiposa is not the same all over the body, and depends on the number of laminæ of which it consists. It adheres very closely to the skin; runs in between the muscles in general, and between their several fibres in particular; and communicates with the membranes which line the inside of the thorax and abdomen.

This structure is demonstrated every day by butchers, in blowing up their meat when newly killed; in doing which, they not only swell the membrana adiposa, but the air insinuates itself likewise in the interstices of the muscles, and penetrates even to the viscera, producing a kind of artificial emphysema.

These cellular interstices are so many little bags or fat-chels, filled with an unctuous or oily juice, more or less liquid, which is called fat; the different consistence of which depends not only on that of the oily substance, but on the size, extent, and subdivision of the cells.

It is generally known, that the illustrious Malpighi took a great deal of pains about this substance; that in birds and frogs, the viscera and vessels of which are transparent, he thought he saw a kind of ductus adiposi; and that, by pressing these ducts, he observed oily drops to run distinctly into the small ramifications of the mesenteric veins; such ducts, however, have not been seen by later anatomists.

The manufacture of soap, the composition of some of the ointments, and the different mixtures of oils with saline and acid liquors, give us some idea, at least, of the formation of the fat in the human body; but the organ which separates it from the mass of blood, which ought to be the

subject of our present inquiry, is not as 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

stuffed with fat, is raised, and an agreeable form given to the parts.

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

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

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

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

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

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

their feet, with spirituous oils, such as that of turpentine, &c.

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

But the difference of all these particular masses of fat consists chiefly 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 papillæ; 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 papillæ, and go along with the epidermis, to which they remain united like a kind of appendix; and yet their substance and structure appears to be very different from that of the epidermis: 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

epidermis where it is thinnest, to the end of the finger where it is thickest.

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

After this femilunar fold, the skin is continued on the whole inner surface of the nail, the papillæ insinuating themselves in the manner already said. The fold of the skin is accompanied by the epidermis, to 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 femilunar 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 papillæ 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 H A I R S.

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 adiposa*. The trunk or beginning of the stem perforates the skin, and the rest of the stem advances beyond the outer surface of the skin, to a certain distance, which is very various in the different parts of the body.

When the different hairs are examined by a microscope, we find the roots more or less oval, the largest extremity being either turned towards, or fixed in, the *corpus adiposum*. The smallest extremity is turned towards the skin, and in some places it is fixed in the skin.

This oval root is covered by a whitish strong membrane, in some measure elastic; and it is connected either to the skin, to the *corpus adiposum*, or to both, by a great number of very fine vessels and nervous filaments.

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

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

Hairs are scattered almost over the whole surface of the body, the palms of the hands and soles of the feet excepted. They differ in length, thickness, and solidity, in the different parts of the body. Those on the head, are called in English by the general name of *hairs*; those which are dis-

posed

posed archwise above the eyes, *supercilia* or the *eye-brows*; those on the edges of the palpebræ, *cilia* or the *eye-lashes*; and those which surround the mouth, and cover the chin, the *beard*. In other parts of the body, they have no particular names; and their different lengths, thickneses, &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

but even that muscle cannot in any tolerable sense be reckoned a common integument.

There is no common membrane of the muscles, which covers the body like an integument; it being no more than particular expansions of the membranes of some muscles, or aponeurotic expansions from other muscles.

The elongations from the lamina of the membrana adiposa or cellularis, may likewise have given rise to this mistake, especially in such places where this membrane is closely united to the proper membrane of the muscles.

FEELING.

The sense of feeling is to be understood in a two-fold manner: Every change of the nerves, produced by the heat, cold, roughness, smoothness, weight, moisture, or dryness of external substances applied to any part of the body, is commonly called feeling. In this sense, feeling is ascribed to almost all parts of the human body; to some more, to others less, as in different places of the body the nerves are more numerous and bare, or covered with more tender membranes; and thus even pain, pleasure, hunger, thirst, anguish, itching, and the other sensations, belong to the sense of feeling.

In a more peculiar sense, feeling is said to be the change arising in the mind from external bodies applied to the skin, more especially at the ends of the fingers. For, by the fingers, we more accurately distinguish the qualities of tangible substances than by other parts of our body.

USE OF THE SKIN, AND THE NATURE OF TOUCH.

The papillæ, regularly disposed in spiral folds at the ends of the fingers, on the inside of the hand, may, by the attention of the mind, become erect or elevated*; and being

* This erection appears from shiverings, frights, and from similar erections in the nipples of the breasts.

ing in this state gently pressed or rubbed against a tangible substance, they receive an impressiion 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 papillæ. 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 uselefs vapours, or oil. The nails serve to guard the organs of feeling, that the papillæ and ends of the fingers may not be bent back by the resistance of tangible objects: at the same time they

increase our power of grasping large objects, and assist in the handling minute objects. In brute animals, they generally serve as weapons of offence, and might be of the same use to man, if they were not cut off.

One most important office of the skin is, to exhale from the body a large quantity of humours, and to resorb vapours from the air. The skin is replete with an infinite number of small arteries, either coiled up into papillæ, or passing directly through it, which afford a passage to the exhaling vapour; and lest this vapour should be collected, as it is in some diseases, between the skin and the cuticle, there are pores in the cuticle corresponding with the exhaling arteries of the skin, through which it freely passes. These exhaling vessels or arteries are easily demonstrated by an injection of water or isinglass into the arteries, which sweat out from all parts of the skin, in an infinite number of small drops; and these substances being transfused under the cuticle, rendered impervious by death, raise it up into a blister.

In a living person, this exhalation is many ways demonstrable. A clean looking glass placed against the warm and naked skin, is quickly obscured by the moist vapour. In subterraneous caverns, where the air is more dense, it is evidently seen to fly off from the whole surface of the body, like a thick cloud.

Whenever the motion of the blood is increased, while at the same time the skin is hot and relaxed, the small cutaneous pores, instead of an invisible vapour, discharge *sweat*, consisting of minute but visible drops, which run together into larger drops by joining with others of the same kind. The hottest parts are most subject to sweat, as the head, breast, and foldings of the skin. The experiment before mentioned, of injecting the arteries, the simplicity 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 the blood, attenuated by perpe-

tual heat and triture, and changed into an acrimonious nature. These afford the scent which is closely followed by dogs, who would not know their masters unless something of a peculiar nature perspired from each person.

The quantity of our perspiring moisture is very large, whether we consider the extent of the organ by which it is separated; 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 discharged in a healthy person by the insensible perspiration alone, independent of the visible sweat, and other excretions. In colder climates, the quantity perspired was found to be $4\frac{2}{3}$ out of 8. But the cutaneous exhalation is even much larger than this; since it not only throws off a quantity of the aliment, but likewise what is added to the blood by inhalation, which entering, often in a very considerable quantity, is thus again expelled. But different dispositions of the air, and of the human body, cause great variations in these proportions. In warm countries, in the summer months, and in young persons using much exercise, more goes off from the body by perspiration, and less by the urine; while in cold climates, during the temperate or winter seasons, in aged or inactive persons, more goes off by the urine than by the insensible discharge. In temperate countries, making a computation throughout the whole year, something more is perspired than what passes off by urine; and joining together all the experiments made in different countries, both excretions are almost alike. The difference of time after feeding also in some measure varies the quantity perspired; but in general it is most copious when the greater part of the digested nourishment is conveyed into the blood, and there attenuated so as to be fit for exhalation. It is naturally diminished in
sleep,

sleep, even in the warmer climates; but it is increased by the heat of bed-cloaths.

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 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 papillæ.

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

ding to later 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, opium, 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 tumescence 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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