SECOND EDITION.

A

MANUAL

OF

ANATOMY,

WITH

THE ELEMENTS

OF

PHYSIOLOGY AND PATHOLOGY;

COMPILED FOR THE USE OF THE STUDENTS OF THE SUBORDINATE BRANCH OF THE MEDICAL SERVICE ATTENDING THE MEDICAL SCHOOL.

BY

W. MORTIMER, M. D.

SURGEON OF THE PRESIDENCY GENERAL HOSPITAL OF MADRAS,

AND

SUPERINTENDENT OF THE MEDICAL SCHOOL.

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PREFACE.

THE elementary treatise contained in the following pages was at first used in manuscript and in a much more abridged form, and was compiled for the use of the pupils of the School instituted by Government, for "the instruction in medicine and surgery of Indo-British "and Native youths" entering the public service in the subordinate branch of the medical department. The preliminary qualifications even of the former class do not, in general, exceed a tolerable knowledge of the English language, and a corresponding acquaintance with the other branches of an ordinary education, while in these respects the Natives are considerably less advanced.—From the desire of information, however, manifested by many of the more intelligent students of both classes, it was soon found, that instruction might be advantageously extended beyond what was at first contemplated as being more immediately necessary to qualify them for their intended duties, and, in accommodating it to their growing wants, the written text was enlarged to an inconvenient size.

The compilation having been thus extended, it is, now printed, with the view of serving as a text book, and of supplying the place of any of the English works on the subject, which are not only too expensive to conveniently accessible to the pupils of the institutio but, from being intended for students who have r ceived a more liberal preparatory education, are n suited to meet the wants of those for whom th manual is solely intended.

Technical terms might have been dispensed with a still greater extent, but it has been considered pr per to retain such of them, for familiar explanation the course of instruction, as may be afterwards requir to enable the pupils to peruse ordinary profession works with advantage.

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INTRODUCTORY ADDRESS TO THE PUPILS.

The word *anatomy*, which is of Greek origin, signifies *dissection*, or *minute separation*, and the proper object of the science of anatomy is to ascertain the structure of organized bodies. The general sense, therefore, in which the term is now received, includes the examination of the minute structure of all organized bodies, whether animal or vegetable; hence, the more modern divisions of *human anatomy*, as applied to the *human body*, *comparative anatomy*, as it regards the dissection of *animals*, and *vegetable anatomy*, as applied to *vegetables*.

The first of these divisions or branches is that which will engage our immediate attention, and, in its investigation, it is the business of the anatomist to examine the *number*, *form*, *size*, *relative position*, and *connections*, of the organs of which the human body is constructed. This having been ascertained by dissection, the vital properties of the several textures, and the functions and uses of the numerous organs which they compose, present themselves as the next objects of enquiry; and the consideration of these, in their healthy state, forms the province of *physiology*. *Anatomy* and *physiology*, then, are so closely connected, that they must be studied together; for, as every organ has its use, the ultimate object of anatomy is to lead to a knowledge of this use, or, in other words, of the functions resulting from the assemblage of parts of which the organ is formed. But there still is another and important branch, which is intimately connected with anatomy, and often, indeed, included under the comprehensive meaning of that term. This is *pathology*, or, as it is called, *morbid anatomy*, which has for its object the science of *diseased structure*, and its investigation necessarily presupposes a knowledge of the parts in their healthy condition. It is thus seen, that *anatomy*, *physiology*, and *pathology*, are so mutually and so intimately connected with each other, as to be more appropriately considered parts of one system, than separate branches of science.

The human body is composed of *solids* and *fluids*, the former so arranged as to give form to it, and being generally contractile, while the latter are in constant motion; and both are so constantly undergoing change by waste and reproduction, that it is difficult to assign any exact proportion to either. It is such an arrangement of parts that constitutes what is called *organization*, and which varies in form and perfection, from the formation of the animal endowed with a scarcely appreciable degree of vitality, up to that of man.

But as *man* is destined to be an intellectual being, and a moral agent, he must have organs and a structure corresponding with these endowments, to render the exercise of them possible. A consideration, therefore, before-hand, of what would be necessary for such a being, as given in illustration of this subject by the celebrated Dr. William Hunter, appears well calculated to convey a general idea of the variety of parts of which the body is composed, of their delicate mechanism, nice adjustment, and complicated operations.

Let it be supposed, that the mind or immaterial part is to be placed in a corporeal fabric, in order to hold a correspondence with other material beings, by the intervention of this body; then, let it be considered before-hand, what will be wanted for its accommodation.

In taking a general survey of these, it will be seen in the very earliest stage of this enquiry, that, in order to meet some of the requisites, human foresight and invention would be altogether insufficient; and it is not, therefore, surprising, that the use of some of the parts of the body are still unknown to us. We can, however, see, that the construction of the whole, and, indeed, of evary part of the machine, bears the most striking characters of excelling wisdom and ingenuity, which the imperfect capacity and senses of man cannot pretend to reach, and which nothing less than the intelligence and power of a Supreme Being could conceive and execute.

We find, that the mind or immaterial part, which is the controlling power of the whole machine, has accommodation assigned to it in the *brain*, and that it is enabled to hold correspondence with the material beings around it, through the intervention of the body. For the purpose of communicating to the brain, the different kinds of impressious made upon the body by external objects, the *five senses*, or organs of *seeing*, *hearing*, *smelling*, *taste*, and *touch*, are given; and, as they are all more or less distant from the brain, there are numerous fine cords called *nerves*, for the purpose of receiving and conveying their information to the seat of intellect, and also, for bearing the necessary influence or will from it, to the several more distant parts of the frame.

To enable the body to avoid danger, when its presence is indicated by the senses, on the one hand, as well as to enable it to seek what may be pleasing or necessary, on the other, it is supplied with *limbs*, which are moved by *muscles* and *tendons* numerously situated in every part where motion is necessaay.

To supply fixed points and give direction to the muscles, to afford the necessary firmness and support to the machine, and to protect the more delicate and important organs from external injury, we find the soft parts of the body constructed upon a frame work of *bone*. This frame, however, is not made of one rigid piece, for such a construction would not admit of motion. It consists, therefore, of a number of bones united together with sufficient firmness by *cartilages* and *ligaments*, and moveable upon each other wherever motion is necessary, by their extremities having smooth and slippery surfaces, or, in other words, forming *joints*, lubricated with an oily fluid to prevent the effects of friction.

To adapt the several parts to each other, and to give form and rotundity to the whole, the interstices are filled up by what is called *cellular substance*, a membrane both soft and ductile, and in the texture of which the fat is lodged.

The mind, therefore, has the power of communicating through the nerves, with every part of the corporeal fabric in which it resides ; and to enable it, further, to hold intercourse with other beings like itself, the faculty of *speech* has been given to man, and organs appropriated to it, enabling the mind to make signs and to vary them without end.

Such a fabric, as has been described, is no doubt wonderfully calculated for the performance of the several animal functions required of it. But it is the nature of all matter to be wasted as it is worked upon, and, being so constituted, were there no provision for the means both of supplying waste, and repairing injuries, it would soon be destroyed. This want is, therefore, supplied by a series of operations carried on within the body itself, the existence of which constitutes the grand distinguishing mark between what is called *organic*, and *inorganic* matter.

In the first place, the *blood*, full of nutritious and healing particles, proceeds through the *arteries* from the left side of the *heart*, and, penetrating into the minutest parts of the animal, affords such supplies as are required either for the nourishment or repair of the several textures of which the body is composed ; and such portion of it, as is not required for these purposes, is collected and returned by the *veins*. The blood, however, brought back by the veins, is of a darker colour than when it left the heart, being not only deprived of some of the essential properties with which it was then endowed, but impregnated with others which are uselses. Having arrived at the heart, the great trunks empty themselves into its right side, which sends the venous blood to the *lungs*, where, meeting with the atmospheric air, it is enabled to part with what is useless, while the remainder returns again to the left side of the heart, fit to commence another course of circulation.

As many, however, of the materials of which the body is composed, become unserviceable from use or disease, the system is furnished with organs called *glands*, for separating and straining whatever is noxious from the mass of blood, that it may be carried out of the body by channels called *organs of excretion*.

We see now, how the body is *nourished ;* but it is evident, that the mass of blood would be speedily exhausted, were there no provision made for fresh supplies.

Such supplies are plentifully produced both in the animal and vegetable kingdoms ; and, in order to effect the necessary changes upon them, before they can be converted into blood, the animal is provided with a set of organs called those of *mastication* and *digestion*. After being reduced to a proper condition by the teeth, the food has to pass through a tube about six times the length of the body ; and, in its course through the various convolutions of this canal, it undergoes a series of changes, by which the finer parts and those fit for nourishment, are separated from the coarser or useless part. The finer parts thus separated, and now called *chyle*, are taken up in a particular part of the tube by a set of vessels, whose mouths open numerously on its lining membrane, and carried into the blood, while the coarser part of the mass is ejected from the system, in the form of excrement.

We now see the animal furnished with what is necessary, not only for its immediate existence, but also, for protracting that existence to an apparently indefinite period. To the duration of life, however, limits have been assigned by the Creator, and the period of decay approaches when the being has performed that series of functions, for which it was destined. When, uninjured by disease or accident, the life of the individual is prolonged to such a limit, the process of *dissolution* commences ; the assimilating organs gradually lose their tone, and the absorbents, the vessels which have been mentioned as carrying off the materials that have become useless, carry off more than is received as nutrition ; the sensibility of the moving fibres becomes blunted ; the cartilages ossify ; the smaller and delicately minute vessels, becoming obstructed, no longer transmit their contents ; the bones become harder under this diminished state of vitality ; and, the parts in general being no longer obedient to their ordinary stimulants, death ensues.

But there is yet another and most important characteristic belonging to man, in common with all other living beings, namely, that though individuals perish, the race is perpetuated ; hence, sex, generation, and offspring.

It may be observed, that the functions, by which the complex machine, of which a general view has been given, is maintained, are of various kinds ; namely, *sensation, volition, motion, digestion, absorption, circulation, respiration, secretion, generation*, &c. a chain of complicated motions, the investigation of which forms the object of *physiology*.

It must now be obvious, from the idea of the constitution of our bodies, which may be formed from the above general description, that the principles of our profession necessarily rest upon a practical acquaintance with anatomical science.

On this subject, Mr. Abernethy says, " how absurd would
" be the conduct of a mechanic, whose business was to rec-
" tify the errors of a complex machine, were he merely to
" provide himself with fit tools for the purpose, without
" possessing the knowledge of the structure of the machine,
" by which means alone he can be able to discover the cause
" of error, or the stoppages of the different parts, and con-
" sequently the knowledge of what is to be done, to render
" it again perfect and useful ; yet equally absurd would be
" the conduct of medical men, should they study botany,
" chemistry, natural philosophy, searching indeed through
" all the paths of nature, and science, and art, for the means
" of cure, and yet neglect *anatomy*, by which alone they can
" distinguish between health and disease, and consequently,

" what is necessary to reconvert the latter into the former,
" and which is the only thing, that can render medicine a
" science."

Anatomy is allowed to be the very basis of *surgery*, for it is dissection alone that can teach where the living body can be cut with safety, and where such injury would be fatal. Sir Astley Cooper, one of the most distinguished surgeons of this, or of any former age, says to his pupils " an imperative necessity exists for your making yoursevles acquainted with anatomical science, without which you cannot conscientiously discharge your duty to society."

" You should know the human machine well, or how can you pretend to repair it ?" He says, " if you have a watch injured, you will get the best watchmaker you can to set it to rights, and can it be supposed that the finest and most perfect organization should be consigned to the hands of unlearned persons ?" But it appears superfluous to quote authority, in proof of what must be so obvious to the most ordinary mind.

It may, however, be said, that many instances occur of disease being successfully treated by those who are unacquainted with the structure of the body ; and we daily hear of the wonderful cures effected by *universal remedies*, It is true, that some persons of more than usual sagacity and observation, although unacquainted with the principles of medicine, have acquired a knowledge of the virtues of certain remedies in particular maladies, as ascertained both by their own experience, and that of others. This is called *empiricism*, and, so far as it goes, appears to stand upon a legitimate foundation. But its general extension would necessarily be dangerous in practice, and, although sometimes successful, there is no doubt of its being more frequently the reverse. It is, therefore, the power of detecting the variety and complication of disorders, by the exercise of that judgment, which is based upon knowledge of structure, that enables the physician to adapt his treatment to the infinite diversity of cases, which occur in practice, and constitutes the difference between him and the empiric. As to universal remedies, it is surprising that any man should have the hardihood to recommend an universal specific, and equally so, how any one, even of the lowest understanding, should give credit to such an assertion.

The period has, however, fortunately passed, for either indolence or ignorance to conceal the necessity of anatomical knowledge. The labours of the eminent men of our profession, who have advanced it to its present position among sciences, are open to us ; and the history of medicine abundantly shows, that all important advancement in the knowledge of disease, is to be more immediately referred to the progress made in the investigation of the structure and functions of the body.

If then, it has now been seen upon what grounds that knowledge rests, which enables us to alleviate or remove suffering, and to preserve the greatest of human blessings, health ; and, that it is only in those parts of the world, in which this knowledge has been cultivated, that the use of remedies for the cure of the disease can be generally employed with success, or even safety ; it will not be difficult to conceive the degraded condition of medicine and surgery, in a country where such knowledge is almost unheard of, and where those professing to cure disease, are often among the most ignorant of its inhabitants.

That this is the present condition of this country does not admit of denial. Altogether unacquainted with the conformation of the human frame and its functions, they who profess to cure disease are necessarily ignorant of the circumstances which render the interposition of art either salutary or necessary. The mischief, therefore, done by the ignorant practitioners of medicine and surgery throughout India, is of fearful extent, and there are but few European medical men who have not, too frequently, seen the grievous effect of it, in the sacrifice of human life, and had occasion to lament the want of that professional knowledge among the people, which alone can prevent their being victims of ignorant temerity.

It is necessary to impress on the minds of those commencing the study of the medical profession, that it requires the most unremitting attention from the very beginning, to enable them to practise it with safety to their patients, or satisfaction to themselves; and common honesty requires, that no one should undertake a serious duty, involving risk to another, and confided to him in the faith of his being able to perform it, without having previously qualified himself for the responsibility. This argument alone ought to be sufficient to induce that assiduous attention, which is indispensably required. Let it, however, be remembered in addition to this, that, while the pupils of this institution, who are in the public service, are qualifying themselves for duties, upon the correct performance of which their future respectability and livelihood depend, the means of doing so, as well as present their maintenance, are afforded by the state, in anticipation of their future usefulness; and it will be seen, that government has every right to demand an adequate return for its bounty, in the proficiency of its servants.

It is to the pupils of this institution, that the people of this part of India must be mainly indebted for the introduction of a rational practice of medicine, and for rescuing them from the hands and present influence of men, professing a knowledge which they do not possess, and deriving their gains at the expense of human suffering. To acquire the power of accomplishing this great end, such a knowledge of the profession is required, as can only be attained by an unremitting application to the study of it, and a deep conviction of the serious nature of the confidence reposed in those to whom the care of human life may be entrusted. This cannot be too forcibly impressed upon every pupil of this school, for, whether he may be in future employed under the Government, or on his own private responsibility, both the present comfort and eventual recovery of his patients are deeply involved in his being possesed, not only of the necessary professional knowledge, but of that kindliness of disposition, which humanity has a right to expect at the hands of a medical practitioner.

MANUAL OF ANATOMY,

&c.

PART I.

THE BONES.

GENERAL OBSERVATIONS.

The bones are of a white, light yellow, or light brown colour, and opaque. In the healthy state, they are hard, compact, inflexible, insensible, and, when dried, do not change their figure.

The bones when united together in their natural order by the ligaments, form what is called a *natural skeleton*, when united by wires, an *artificial skeleton* ; and the division of anatomy which treats of the bones is called *osteology*.

The skeleton is the foundation on which the whole fabric is built. It is the basis to which all other parts are directly, or indirectly, connected ; and to these it gives stability and support.

The bones defend from external injury the brain, heart, lungs, and other organs, on which life more immediately depends, and also many of the larger bloodvessels and nerves. The skeleton determines the size, figure, position, proportion, and motions of the several members of the body, and regulates its attitudes.

The skeleton forms an essential part of the organs of locomotion, being an immoveable fulcrum for the action of the muscles and their tendons without which they could not act ; hence, when the bones are rendered soft by disease, we lose the power of locomotion.

The bones of the spine, and extremities of the body, form solid, though flexible columns, capable of being moved in various directions.

The extremities of the bones give form to the joints, and this connection has been termed their articulation.

In children, the ends of those bones which are not immoveably joined to other bones, have smaller ones annexed, which afterwards become scarcely distinguishable from the bone itself. These are called *epiphyses*, or *appendices*, and most of what are called *processes* in adult bones belonged to that description. The *epiphyses* are united chiefly to such bones as are destined for frequent and violent motion, and are generally formed of a larger diameter than the bone to which they belong: several processes, such as the trochanters of the thigh, spine of the scapula, &c. have *epiphyses*.

By *processes*, are meant *protuberances* rising out from bones, and these have various names given to them, according to their shape and figure: for instance, if a process stands out in a roundish form, it is called a *head*: if the head is flattened, it is called a *condyle*. When a process rises narrow, and then becomes large, the narrow or small part is called the *cervix*, or neck. Long ridges of bones are called *spines*: such processes as terminate in sharp points are called *coronoid*: others take their names from supposed resemblances, as *mastoid*, *coracoid*, *&c*.

Processes serve for the advantageous origin and insertion of muscles.

All the bones, except the bodies of the teeth, are covered by a membrane, named on that account *periosteum*, which will be afterwards noticed.

OF THE PARTICULAR BONES OF THE SKELETON.

The bones of the skeleton in number 248, have been generally divided into three classes, viz. the bones of the *head*, those of the *trunk*, and those of the *extremities*.

The bones proper to the head, have been arranged by anatomists, into those proper to the *cranium*, and those of the *face*.

The Bones of the Cranium.

1 Os Frontis.
2 Ossa Parietalia.
2 ,, Temporum.
1 Os Occipitis.
1 Os Sphenoides (*in the adult joined to the preceding bone.*)
2 Ossa Mallei
2 ,, Incudes
2 ,, Stapides
2 ,, Orbicularia
} *contained in the osso temporum.*
1 Os Ethmoides.

The Bones of the Face.

2 Ossa Maxillaria Superiora.
1 Maxilla inferior.
2 Ossa Malarum.
2 ,, Nasi.
2 ,, Unguis.
2 ,, Palati.
2 ,, Turbinata.
2 ,, Triangularia.
1 Os Vomer.
32 Teeth.

The *tongue* has one bone, viz. Os Hyoides.

The bones of the trunk of the body are subdivided into those of the *Spine*, *Thorax*, and *Pelvis*.

The Bones of the Spine and Thorax.

7 Vertebræ of the Neck.
12 Vertebræ of the Back.
5 Vertebræ of the Loins.
24 Ribs or Costæ.
2 or 3 Bones compose the breast bone or Sternum.

The Bones of the Pelvis.

2 Ossa Pubis
2 ,, Ilia
2 ,, Ischia
} *forming the ossa innominata.*
1 Os Sacrum.
1 ,, Coccygis.

The bones of the extremities are subdivided into those of the *upper*, and those of the *lower extremity.*

The bones of the *upper extremity* are made up of the bones of the *shoulders*, *arms*, *forearms*, and *hands*.

The Bones of the Shoulders.

2 Clavicles, or claviculæ.
2 Scapulæ.

Bones of the Arms.

2 Humeri.

Bones of the Forearms.

2 Ulnæ.
2 Radii.

Those of the *hands* include the bones of the *carpi*, *metacarpi*, and *fingers*.

Bones of the Carpi.

2 Ossa Scaphoides.
2 ,, Lunaria.
2 ,, Cuneiformia.
2 ,, Pisiformia.
2 ,, Trapezia.
2 ,, Trapezoidea.
2 ,, Magna.
2 ,, Unciformia.

Bones of the Metacarpi.

10 Ossa Metacarpi

Bones of the Fingers.

10 Posterior Phalanges.
8 Middle Phalanges.
10 Anterior Phalanges.

The bones of the *inferior extremity* are subdivided into the bones of the *thighs*, *legs*, and *feet*.

Bones of the Thighs.

2 Ossa Femorum.

Bones of the Legs.

2 Tibiæ.
2 Fibulæ.
2 Patellæ.

The bones of the *feet* have been subdivided into the bones of the *Tarsi*, *Metatarsi* and *Toes*.

Bones of the Tarsi.

2 Astragali.
2 Ossa Calcium.
2 ,, Navicularia.
2 ,, Cuboidea.
2 ,, Cuneiformia externa.
2 ,, ,, media.
2 ,, ,, interna.

Bones of the Metatarsi.

10 Ossa Metatarsi.

Bones of the Toes.

10 Posterior Phalanges.
8 Middle Phalanges.
10 Anterior Phalanges.

The number of the *sesamoid bones* found in the thumbs and great toes, varies from 4 to 8.

THE CRANIUM.

The bones of the cranium are composed of two tables, and intermediate cancelli commonly called *diploë*.

The cranium of the adult consists of *seven bones* only, though *eight* have been commonly enumerated, *six* of which are said to be *proper*, and the other *two* are reckoned *common* 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 *os sphenoides*.

These bones are joined to each other by five *sutures*, the names of which are the *coronal*, *lambdoid*, *sagittal*, and two *squamous*.

The sutures said to be common to the cranium and face are five, viz. the *ethmoidal*, *sphenoidal*, *transverse* and two *zygomatic*.

Of the sutures of the cranium, three are termed *true*, from having serrated edges ; and two are called *false* or *squamous* sutures, from the bones which form them, overlapping each other, as the scales of fishes do.

The three true sutures are, the *coronal* suture placed between the frontal and parietal bones, and getting its name from this being the part where the ancients wore their *coronæ* or *garlands* ; the *lambdoid* suture situated where the occipital joins the parietal and temporal bones ; the *sagittal* suture situated between the parietal bones, and extending between the middle of the coronal and lambdoid sutures ; and the two false, called also the *temporal* or *squamous* sutures, placed between the upper edge of the temporal, and under edge of the parietal bones.

In the sutures of the cranium, there are often additional bones, called *ossa triquetra*, from their being of a triangular form, or *ossa Wormiana*, from the name of their supposed discoverer.

The sutures common to the head and face are, the *ethmoid* suture which surrounds the ethmoid bone ; the *sphenoid* suture which surrounds the sphenoid bone ; the *transverse* suture which runs across the orbits and root of the nose, between the frontal, malar, sphenoid, ethmoid, superior maxillary and nasal bones ; and the *zygomatic* sutures which are placed between the temporal and cheek bones.

That part of the cranium, above a line drawn from the frontal eminences to the occipital protuberance, and which is that usually removed for the inspection of the brain, receives the name of *calvaria* or *skull-cap*.

OS FRONTIS.

The *os frontis* is named from its being the only bone of that part of the face we call the forehead.

In it are to be noticed the following processes and holes :—

The *external* and *internal angular processes*, forming the angles of the orbits :

The *superciliary ridges*, on which the eyebrows are placed, extending between the external and internal angular processes on each side :

The *nasal process*, placed between the internal angular processes, and forming part of the nose :

The *orbitar processes*, or *plates*, which, contrary to the rest of the bone, are hollow below, and extend a considerable way back to form the upper parts of the orbits, for lodging the eyes and their appendages :

The *sinuosity* at the upper part of the orbit, behind the outer end of the superciliary ridge, on each side, for lodging the *lachrymal gland* :

The opening between the orbitar processes for receiving the *cribriform plate* of the *ethmoid bone* :

The *foramen supra-orbitarium*, a little to the inner side of the middle of each superciliary ridge, through which a *branch* of the *ocular artery*, and part of the *ophthalmic branch of the fifth pair of nerves*, passes to the soft parts of the forehead. Frequently instead of a hole, a notch only is seen, the vessels and nerves then passing over the superciliary ridge :

The concave inner and forepart of the os frontis, for lodging the *anterior lobes* of the brain :

The *frontal spine*, in the middle of the under part of the bone, formed by the coalescence of the inner table, for the attachment of the *falx* of the dura mater :

The *frontal sinuses* placed behind the inner ends of the superciliary ridges, about an inch in height, and somewhat more than that in breadth, and, in some skulls, forming prominences near the root of the nose.

In a fœtus of nine months, the os frontis is divided through its middle into two pieces which are incomplete at their upper and back part where they assist in the formation of the *bregma*, *fontanelle*, or *opening of the head*.

OSSA PARIETALIA.

The *ossa parietalia* are situated in the upper and lateral parts of the cranium.

The figure of each parietal bone is that of a *trapezium*, or approaching that of a square. The upper edge is longest ; the anterior edge is next in length ; the posterior edge shorter than the two former ; and the inferior, shortest, and in form of a ragged arch.

There is a *transverse arched ridge*, or line, which is frequently of a whiter colour than the rest of the bone, and placed externally a little below its middle height, for the *origin of the temporal muscle*.

There is a small hole called the *foramen parietale*, near the upper and back part of the bone, for the transmission of a *vein* from the integuments of the head to the superior longitudinal sinus, and sometimes, of a *small branch from the temporal or the occipital artery*, to the falx of the dura mater.

There are *furrows* on the internal concave surface of the bone, made by the principal trunk of the bloodvessels of the dura mater called the *middle meningeal artery*. They begin at the under and forepart of the bone, where frequently a real canal is formed for the vessel.

There is a *fossa*, at the under and back part of the bone, for lodging a small part of the *lateral sinus*.

In the fœtus, the sides of the parietal bones are incomplete, and there is no parietal hole. Between the parietal bones, and the middle of the divided os frontis, there is also a large interstice, termed in common language, opening of the head, and by Anatomists, *bregma*, *fons*, or *fontanelle*.

OS OCCIPITIS.

The *os occipitis* is so called from its situation at the occiput or back part of the head.

It is of a *rhomboid* figure, with the angle above, generally a little rounded, its external surface being convex and smooth at the upper part.

There are *two arched ridges*, a larger and a smaller, running across the bone, near the middle of the convex surface.

To the centre of the former, where there is a prominence called the tubercle, the *trapezii muscles* are fixed, the outer parts giving origin to the *occipito-frontalis muscle*.

The *depressions*, between the middle of the large and small arches, are for the connexion of the *complexi muscles*.

The *inferior angle*, contrary to the rest of the bone, is flattened and stretched forwards in form of a wedge, hence called *cuneiform process*, or, from its situation, *basilar process*.

The *condyles* which are two knobs, or, protuberances, are placed at the base of the *cuneiform process*, and at the fore and lateral parts of the *foramen magnum*, for the articulation with the *atlas*, or first vertebra of the neck. They run obliquely forwards and inwards, and are deepest at their inner parts, in consequence of which they are prevented from sliding to either side out of the cavities of the *atlas*.

The internal surface of the bone is hollow for containing the back part of the brain.

On it, is seen the *cruciform spine* formed by two ridges, the one placed perpendicularly in the middle of the bone, the other crossing the first in a horizontal direction.

The *upper limb* of the perpendicular spine is hollow in the middle, or frequently at one side, for the reception of the *superior longitudinal sinus*, and the attachment of the *falx major*.

The *lateral limbs*, placed opposite to the great external arched spine, and hollow in the middle, are for the reception of the *lateral sinuses*, and give attachment to the *tentorium duræ matris*.

The *lower limb* is short, for the attachment of the *falx minor*, and sometimes hollow, for the reception of an *occipital sinus*.

The *fossæ*, at the sides of the upper limb, are for receiving the *posterior lobes of the cerebrum*, and those at the sides of the lower limb, for the *cerebellum*.

The concave surface of the *cuneiform process*, is for receiving the *medulla oblongata* and *basilar artery*.

The *two semilunar notches* at the base of the *cuneiform process*, form, with the temporal bones, a foramen on each side.

The *foramen magnum*, the large hole, situated behind the basilar process, and between the condyles, for the passage of the *medulla oblongata*, *vertebral bloodvessels*, and *accessory nerves*.

The *edges* of the foramen magnum are rough, for the insertion of *ligaments* by which the head is fixed to the vertebræ of the neck.

The *superior*, or *anterior condyloid foramina*, at the sides of the foramen magnum, and immediately over the condyles, are for the passage of the *ninth pair* of *nerves*.

The *posterior condyloid foramina*, at the back part of the root of the condyles, are for the passage of *veins* from the occiput or from the vertebral veins, into the lateral sinuses, near their terminations.

Frequently one of the posterior condyloid foramina is wanting, sometimes both, when the veins pass through the foramen magnum.

This bone is connected to the ossa parietalia, by the lambdoid suture.

OSSA TEMPORUM.

The *ossa temporum*, so named from the hairs first becoming grey on the temples, are situated in the under and lateral parts of the cranium. Each is usually divided into two portions, viz. the *squamous* and *petrous*.

The *pars squamosa*, or *squamous plate*, so called from the manner of its connection with the neighbouring bones, forms a part of the temple, and gives origin to a portion of the *temporal muscle*. The *pars petrosa* or *petrous part*, so called from its hardness, will be described with the inner surface of the bone.

The *mastoid*, or, as called from its resemblance to a nipple, *mamillary process*, is at the lower and back part of the bone; it gives insertion to strong muscles, particularly the *sterno-mastoid*, and contains cells which communicate with each other, and with the cavity of the ear called *tympanum*.

The *zygomatic process* runs from the under and forepart of the squamous plate, to join the *os malæ* or cheek bone, forming an arch under which the *temporal muscle* passes to the lower jaw.

The *styloid process* is placed at the root of the *pars petrosa*, and, going obliquely downwards and forwards, gives origin to muscles which borrow part of their name from it, and belong to the tongue and throat.

The *vaginal process* is of an inconsiderable size, surrounding the root of the *styloid process*, and is deepest at its forepart.

The *rough semicircular ridge*, at the under part of the *external meatus*, for the attachment of the cartilage of the ear, is sometimes also considered as a process, and called *auditory*.

This bone has the following cavities and holes:—

A *groove*, at the inner part of the root of the *mastoid pro-*

cess, giving origin to the *digastric muscle*, and a little anterior to this, *another groove* in which the *occipital artery* runs :

The *glenoid*, or *articular cavity*, behind the root of the *zygoma*, of an oblong or somewhat oval form, of great size, and lined with cartilage, for the articulation of the lower jaw :

The *glenoid fissure*, at the back part of this cavity, and between it and the *pars petrosa*, and also between the *pars petrosa* and *sphenoid bone*, for the attachment of part of the *capsular ligament* of the articulation of the lower jaw :

A *depression* between the *glenoid fissure*, and *styloid process*, for lodging a portion of the *parotid gland :*

The *thimble-like* cavity, or the *jugular fossa*, at the inner side of the root of the *styloid process*, for lodging the top of the *internal jugular vein :*

The *meatus anditorius externus*, a large canal between the *mastoid* and *zygomatic processes*, leading inwards and forwards to the organ of hearing :

The *foramen stylo-mastoideum*, or *aqueduct of Fallopius*, between the *styloid* and *mastoid processes*, for the transmission of the *portio dura* of the *seventh pair of nerves :*

The *foramen caroticum*, or *canalis caroticus*, at the inner and forepart of the *jugular fossa*, and also before and at the inside of the *styloid process*, leading upwards, then forwards, through the point of the *pars petrosa*, for the transmission of the *internal carotid artery* to, and of the great *sympathetic nerve* from the brain.

The *iter a palato ad aurem*, or *Eustachian tube*, between the fissure for the *capsular ligament* of the lower jaw, and the passage of the *internal carotid artery*, extending outwards and backwards in a horizontal direction, till it terminates in the *tympanum :*

The *foramen mastoideum* occasionally found at the back part of the *mastoid process* or in the *lambdoid suture :* When present, it sometimes transmits an artery to the *dura mater*, but more commonly a vein from the integuments of the head to the *lateral sinus*.

The *pars petrosa*, or *petrous portion* as seen in the inside, is of great size, running forwards and inwards, with a sharp angle above and two flat sides, one facing obliquely forward and outwards, and the other as much backwards and inwards. It contains the *internal organ of hearing.*

The anterior and outer surface of the *pars petrosa* is opposed to the middle lobes of the brain, while the posterior and inner is towards the cerebellum.

There is a *ridge*, between the two surfaces of the *pars petrosa*, for the attachment of the *tentorium duræ matris*, and a groove for the *petrosal sinus.*

There is a *fossa* at the root of the posterior surface of the *pars petrosa*, and opposite to the *mastoid process*, for lodging the *lateral sinus*, where it turns downwards to go out of the cranium. In this *fossa*, the passage is observed corresponding with the *foramen mastoideum.*

The *lateral sinuses* being frequently of unequal size, of course this cavity is then larger in one temporal bone than in the other.

The *meatus auditorius internus*, or *foramen auditivum* is seen passing outwards and backwards, in the posterior surface of the *pars petrosa*, for the passage of the *seventh pair of nerves*, and the *principal artery* belonging to the *inner ear.*

The *foramen innominatum* is a hole near the middle of the anterior surface of the *pars petrosa*, and leading backwards, for the passage of the *Vidian nerve*, which is a reflected portion of the *fifth pair of nerves.*

The *orifice* of the *canalis caroticus* appears at the under part of the point of the pars petrosa.

The *foramen lacerum posterius* is the hole formed by the *pars petrosa* of the temporal bone and *cunieform process* of the *occipital* bone, for the passage of the *lateral sinus*, the *eighth pair*, and *accessory nerves.*

OS ETHMOIDES.

It is situated in the forepart of the base of the cranium,

The *cribriform plate*, from which the bone has its name, is placed horizontally and perforated, excepting at its back part, with many holes, for the transmission of the branches of the *first* or *olfactory pair of nerves.*

The *crista galli* arises perpendicularly from the middle of the *cribriform plate*, and is highest at the upper and fore-part.

To the edge of this process, and to the unimperforated part of the *cribriform plate*, the *falx* of the *dura mater* is fixed.

The *nasal lamella* or *plate* extends downwards and forwards, from the base of the *crista galli* ; and the external plates, sometimes called ossa plana, form the inner wall of each orbit.

Near the middle of the inside of each orbit, sometimes being formed in the transverse suture where that suture attaches the orbitar process of the frontal with the ethmoid bone, is situated the *foramen orbitarium internum anterius* which transmits the *nasal twig* of the *first branch of the fifth pair of nerves*, and a *branch* of the *ophthalmic artery*. About an inch behind this, the *foramen orbitarium internum posterius* is placed, which is smaller than the anterior one ; and through it a *small branch* of the *ocular artery*, passes to supply the dura mater.

The *ethmoid cells*, are placed under the cribriform plates and on the inner side of the *ossa plana*, and communicate with each other, and with the cavity of the nose.

The *spongy portions* of the bone, sometimes called *ossa turbinata superiora*, project inwards and downwards into the cavity of the nose, at the side of the *nasal plate*, and serve to enlarge the organ of smell.

OS SPHENOIDES.

The *sphenoid*, or *wedge shaped* bone, is situated in the middle of the cranium. Its figure is irregular, and has been compared to that of a bat with extended wings.

The following are the processes of this bone :

The *temporal plates* or *wings* placed at the sides of the bone, and each hollow at the upper and outer part for lodging a share of the temporal muscles :

The *orbitar plates*, at the forepart of the *temporal wings*, forming a portion of the outside of the orbits :

The *spinous process* at the under and back part of each *temporal plate* :

A *styloid*, or *styliform process* frequently observed at the point of the *spinous*, from both of which, the *circumflexus palati muscle* arises :

Between the *temporal* and *spinous processes*, there is an arch for receiving the forepart of the temporal bone :

The *two pterygoid*, or *aliform processes* placed almost perpendicular to the base of the cranium. The *pterygoid processes* are compared to the wings, though more properly resembling the feet of a bat. Each is composed of two plates ; the *external plate*, is broad and hollow without, where the *external pterygoid muscle* has its origin ; the *internal plate*, is narrower and larger than the external, and with its fellow, forms the back part of the nose :

A *hook-like process* upon the internal plate, over which the *circumflexus palati muscle* moves :

The hollow between the plates facing backwards, gives rise to the *internal pterygoid muscle*, and is called *fossa pterygoidea :*

The *processus azygos*, standing single, and forming a sharp ridge, which projects from under the middle and forepart of the bone :

The *clinoid processes* seen on the inside of the bone, and compared to the supporters of a bed. They are *three* in number, the *two anterior* project from the forepart of the body of the bone, and extend horizontally outwards, each terminating in a point, which obtains the name of *transverse spinous process ;* and the *posterior* is situated transversely some way behind the *anterior processes*, and frequently ends in two knobs, which incline obliquely forwards :

The *processus olivaris*, considered by some as a *fourth clinoid process*, lying between and a little behind the roots of the *anterior clinoid processes :*

Between the *anterior clinoid processes*, a *small pointed process*, frequently juts forwards, to join the *cribriform plate* of the *ethmoid bone*, from which it is sometimes called *ethmoid process*.

The following are the fossæ, and foramina of this bone :—

The *fossæ* of the *temporal* part of this bone, lodging a share of the middle lobes of the brain.

The *fossa pituitaria*, *sella Turcica*, *ephippium*, or *Turk-*

ish saddle, situated between the *processus olivaris*, and *posterior clinoid process*, for lodging the *glandula pituitaria*:

The *foramina optica* situated at the roots of the *anterior clinoid processes*, for transmitting the *second pair*, or *optic nerves*, and *ocular arteries*:

The *foramina lacera orbitalia superiora*, or *superior orbitar fissures*, under the *anterior clinoid processes*, and their *transverse spinous parts*, for the passage of the *third, fourth, first part of the fifth*, and the *sixth pairs of nerves*, with the *ocular veins*.

The foramina lacera orbitalia inferiora, or *spheno-maxillary fissure*, situated between the orbitar processes of the sphenoid and superior maxillary bones, bounded behind by the palate bones, and extended along the back and under part of the orbits:

The *foramina rotunda*, a little behind the *foramina lacera superiora*, for the passage of the *second part* of the *fifth pair of nerves*, which are termed also *superior maxillary*:

The *foramina ovalia*, considerably larger than the *foramina rotunda*, and placed further back, and more externally, for the passage of the *third part* of the *fifth pair* of *nerves*, or inferior maxillary, and commonly for the passage of *the veins*, which accompany the principal arteries of the *dura mater*:

The *foramina spinosa*, a little to the outer and back part of the *foramina ovalia*, and in the points of the spinous processes, for the transmission of the *principal artery* of the *dura mater*:

The *foramina pterygoidea*, termed also, after the discoverer, *foramina Vidiana*, at the roots of the inner plates of the pterygoid processes, for the passage of two reflected branches of the *second* part of the *fifth pair of nerves*.

The *foramina lacera anteriora*, common to the points of the petrous portions of the *temporal bones*, and *sphenoid bone*; in the fresh subject partly filled with cartilage.

The *body* of the bone is occupied by two *large sinuses*, which are wanting in the fœtus.

This bone is connected with all the other bones of the cranium.

BONES OF THE FACE.

These are divided into *upper* and *under jaws*.

The upper jaw, or *maxilla superior*, besides the teeth, is composed of seven pair of bones, and one without a fellow; viz. two *ossa nasi*, two *ossa unguis*, two *ossa malarum*, two *ossa maxillaria superiora*, two *ossa palati*, two *ossa spongiosa inferiora*, two *ossa triangularia*, and the *vomer*.

The lower jaw, or *maxilla inferior*, consists of a single bone, with the teeth.

The bones of the upper jaw are joined together by *sutures* which have no distinct indentations, like those of the cranium, but, like them they are frequently found obliterated in the skulls of old people.

OSSA NASI.

They are so named from their situation at the root of the nose. They are of an irregular oblong square figure, being broadest at their lower end, and narrowest a little higher than their middle. They are joined to the frontal bone above.

OSSA UNGUIS, OR LACHRYMALIA.

These are so called from their resemblance to the nail of a finger, and because the tears pass upon them into the nose.

They are situated at the inner and forepart of the orbit, and have a depression for containing part of the lachrymal sac and duct.

OSSA MALARUM.

These are called *cheek bones*, from their forming the prominence at the outer part of the cheek.

The *superior orbitar process* forms part of the outside of the orbit.

The *inferior orbitar process* forms part of the lower edge of the orbit.

The *arch*, between the *orbitar processes*, forms nearly a third part of the anterior circumference of the orbit.

The *maxillary process* forms the under part of the prominence of the cheek.

The *zygomatic process*, the most conspicuous, with that of the temporal bone forms an arch over the temporal muscle.

The *internal orbitar plate* forms the outer and forepart of the orbit.

OSSA MAXILLARIA SUPERIORA.

They are situated in the forepart of the upper jaw, and sides of the nose, the latter of which are formed by the *nasal*, or *angular process* of each bone.

There is a depression called the *lachrymal fossa*, at the back part of the *nasal process*, which, with that of the *os unguis* already noticed, forms the passage of the *lachrymal duct* into the nose.

The *orbitar plate* of this bone forms a large share of the under side of the orbit.

The *tuberosity*, or *bulge* at the back part, forms the body of the bone, and the posterior boundary of the cavity called *antrum maxillare*, or *Highmorianum*, the *maxillary hollow*, or *hollow of Highmore*, from the name of the supposed discoverer. This cavern or hollow, and the sockets of the teeth, are often divided by the interposition of only a very thin plate of bone, which is liable to be eroded by acrid matter collected in the antrum, or to be broken in drawing a tooth.

The *alveolar arch*, where the *alveoli* or sockets of the teeth are placed, is of a spongy nature.

The *palate plate* of each maxillary bone is thin in its middle, and thick at its edges, smooth towards the nose, but rough and unequal below, for the firm connection of the membrane of the palate.

There is a hole called *foramen palato maxillare*, at the back part of the *palate plate*, and a *foramen incisivum*, in the middle of the forepart at the junction of the bones, giving passage to *branches* of the *second division* of the *fifth pair of nerves*.

There is also, a canal in the *orbitar plate* terminated anteriorly by the *foramen infra-orbitarium*, through which the *infra-orbitar branch* of *the second part* of *the fifth pair of nerves*, with a branch of the *internal maxillary artery*, pass to the face.

OSSA PALATI.

These are described as *two small square bones* in 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, where, by their junction with the sphenoid bone, a common hole is formed on each side, called *foramen spheno-palatinum*, for the passage of a considerable branch of *the second part of the fifth pair of nerves* to the *nose*.

OSSA SPONGIOSA, OR TURBINATA INFERIORA.

They are situated in the under part of the side of the nose, upon a ridge on the inner side of the *nasal process* of each *os maxillare superius*, and afford a larger surface for extending the organ of smell.

OSSA TRIANGULARIA, OR CORNUA SPHENOIDALES.

Each *triangular bone* is situated between the body of the *sphenoid* bone, and root of its internal *pterygoid process*, covering the under part of the *sphenoid sinus*.

VOMER.

It is situated in the under part of the *sphenoid* bone, forming a part of the *septum nasi* where it separates the nostrils from each other. Its superior edge forms a groove, for the *ozygous process* of the sphenoid bone, and its inferior edge is connected to the *spines* of the *superior maxillary*, and *palate* bones.

MAXILLA INFERIOR.

The figure of the *maxilla inferior*, or lower jaw, is compared to that of the letter U, or, it forms half of a long oval with the convex middle part turned forwards.

It is divided into *chin*, *sides*, and *processes*.

The *chin* extends between the holes, termed *mental foramina*, at the forepart of the jaw, and there is a prominence on the inner surface of the chin, for the attachment of the *frænum linguæ*.

There is a *transverse ridge* on the fore part of the chin, with depressions on each side, for the origin of muscles of the under lip.

The *base*, or lowest part, forms the under boundary of the face.

The *angles* of the jaw are at the back part of the *base*, or *horizontal plate*, from which arises the *ascending plate*, dividing itself, on each side, into a *condyloid*, and a *coronoid* process.

The *condyloid*, or *articular process*, with an oblong rounded head covered with cartilage, is placed almost transversely upon a cervix, at the upper and back part of the bone, on each side.

The *coronoid process*, into which the *temporal muscle* is inserted, is situated a little before the *condyloid process*, and, in the natural situation of the jaw, is placed on the inner side of the *zygoma*.

The *alveolar process* and *alveoli* are nearly similar to those of the upper jaw.

The *posterior maxillary foramen* is a hole at the roots of the *condyloid*, and *coronoid processes*, upon the inner side of the jaw, for the passage of the *third*, or *inferior maxillary branch* of *the fifth pair of nerves*, with the corresponding *blood vessels*.

The *anterior maxillary foramina*, or *mental holes*, are situated at the sides of the *chin*, where the remains of the *inferior maxillary nerve*, and *vessels* come out.

The *inferior maxillary canal* runs in the substance of the bone, between the *posterior*, and *anterior foramina*, a little below the roots of the teeth, and has many perforations, for the passage of small branches of *vessels* and *nerves*, which supply the jaw and teeth.

In the fœtus, the lower jaw is composed of two pieces, joined together in the *middle* of the chin, which is termed the *symphysis*.

THE TEETH.

The teeth are in the *alveoli* of the jaws, and their number, *sixteen* in each jaw. They are divided into *four classes*, viz. in each side of each jaw, *two incisores*, *one cuspidatus*, (or *caninus*), *two bicuspidati*, (or *small molares*), and *three large molares*. The molares are also called *grinders*.

The *base*, or *body* of each tooth, appears without the sockets.

The *roots*, or *fangs*, are placed in the sockets, and are of a conical form.

The *cervix*, or *collar*, is that part between the *base*, and *roots* of the teeth.

The *roots* of the teeth are covered by a vascular membrane, reflected from the gums, and serving as a periosteum to the teeth, and a lining to the alveoli.

The *cortex*, or *enamel*, covers the base of each tooth, and becomes gradually thinner towards the cervix.

There is a *foramen* at the point of each *root*, or *fang*, and a passage leading from it into a *common cavity*, at the *base* of the tooth, for lodging the vascular, and nervous substance, called the *pulp* of the tooth.

Of the formation of the Teeth.

The first set of teeth are formed upon pulps, which are contained within the alveolar processes of the jaw.

The pulps of the teeth are involved in capsules, which consist of two membranes, in both of which there is a great number of bloodvessels ; the external membrane adheres to the gum, and the internal to the pulp.

The pulps of the teeth are, at first, of a gelatinous consistence, nearly of the figure of the tooth, and adhere to the inner surface of the gums. The pulp of each tooth is contained in its proper capsule, which is shaped like the base of the tooth but without roots, and is attached, by means of its nerves, and bloodvessels, to the bottom of the alveolar processes, having its upper part attached to the inner side of the gums.

The ossification begins, about the *sixth month after conception*, upon the pulps, in the form of spots, the situation of which corresponds with the points of the teeth.

The number of these ossifications corresponds with the eminences on the pulp, and they gradually increase, and form a thin shell of bone, which covers the surface of the tooth.

At the period of birth, the outer shells of five teeth are formed, on each side of each jaw, or, of twenty teeth in all.

The *bodies* of the teeth are first converted into bone, and the ossification goes on by a successive deposition from without, inwards ; the layer next the enamel being first formed, and the other layers being added within it.

The *roots* are then added to the teeth, and are formed upon the pulp which is elongated, in consequence of the pressure made upon it, by the progress of the ossification of the body of the tooth.

Of the formation of the Enamel.

The *enamel* is secreted by the outer membrane of the pulp, and, when first formed, is so soft that it may be scraped off by the nail.

The *enamel* is at first perfect on the cutting edges, or protuberances of the tooth, and it does not extend beyond the neck of the tooth.

For the composition of the teeth, vide "CHEMICAL ANALYSIS OF THE BONES." Page 46.

Of the period at which the first set, or temporary Teeth, appear.

There is the utmost variety as to the time at which the teeth appear.

In a stout, healthy child, the *incisor teeth*, more generally of the *under* jaw, show themselves between the *sixth*, and *seventh* month, after birth, but, in a puny, sickly child, not before *ten*, or *twelve* months.

There are *some diseases* which seem to have a specific effect, in arresting the growth of the teeth.

The *middle incisors* of the *under* jaw, generally, first cut the gum ; a few weeks afterwards, those of the *upper* show themselves ; and, in the next place, the *lateral incisors* of *both* jaws.

When the child is about *a year and a half old*, the *first smaller grinders* of the *lower* jaw cut the gum, and are followed by the *smaller grinders* of the *upper* jaw.

The *canine teeth* generally appear after the first *small grinders*, or *bicuspidati*, or about the 16*th* or 20*th month*, and the *posterior bicuspidati* appear between the 25*th*, and 30*th month*, thus forming 20 teeth, called *milk teeth.*

Of the shedding of the first, and of the appearance of the second set.

About the *sixth year*, all the second set, excepting the *two posterior grinders* in each jaw, called *wisdom teeth*, are ossified, so that, at this period there are no less than *forty-eight* teeth in the jaws : the first set, consisting of *twenty*, has appeared, and the second set, consisting of *twenty eight*, lies within the jaws.

The first set of teeth begins to fall out, in consequence of their roots being absorbed, when the child is about *six*, or *seven* years old.

The shedding of the first set is generally not completed in less than six years, and, in some instances, some of the first set of teeth remain in the jaws, during the greater part of life.

Of the formation of the second set of Teeth.

The second set, like the first, is formed upon pulps, and these pulps are parts, or elongations of the pulps of the first set, which are sent out as soon as the rudiments of the first set have made some progress.

The teeth, in persons far advanced in life, are worn down by manducation; the enamel is worn off the bases of the teeth, yet the bony part of the teeth continues to live ; and, after the points are worn down, the enamel at the sides acts like the enamel in the teeth of a graminivorous animal, and keeps the tooth sharp.

OS HYOIDES, or LINGUALE.

The situation of this bone is at the root of the *tongue*, and top of the *larnyx*.

Its shape is compared to that of the greek letter *v*, from which the bone has derived its name.

The bone has been divided into a *body*, two *cornua*, and two *appendices*.

The *body* is placed in the middle and forepart, and is the largest of the five pieces, with impressions on the forepart, for the attachment of numerous muscles.

The *cornua* extend backwards from each end of the body, and also give attachment to muscles of the tongue and larnyx.

The *appendices* are placed above, at the point of union of the cornua with the body, and give attachment to a small ligament.

The *os hyoides* is not immediately connected to any other bone.

THE TRUNK.

The trunk is composed of the *spine*, *thorax*, and *pelvis*.

The *spine*, reaching from the condyles of the *occipital* *bone* to the lower end of the *os coccygis*, has several curves when viewed in a lateral direction, but appears straight when viewed anteriorly or posteriorly.

The spine is commonly divided into *true*, and *false vertebræ*.

TRUE VERTEBRÆ.

The *true vertebræ* are the 24 upper bones of the spine, on which the several motions of the trunk of the body are performed.

Each of the true vertebræ is composed of a *body*, *arch*, *foramen*, and *processes*.

The *body* is of a spongy nature, with its *upper*, and *under surfaces*, placed horizontally.

The bodies of the vertebræ are, in general, smaller and more solid above ; as they descend, they become larger, and more spongy.

The *intervertebral substances*, of a cartilaginous nature, are placed between the bodies of the vertebræ, for fixing them together, and allowing the spine to be moved in all directions.

There is an *arch*, sent out from the back part of the body of each *vertebra*, forming with the body *a large hole*, called the *foramen vertebrale* ; and the different holes being placed over each other, a *canal* is formed, for lodging the *spinal marrow*.

There is also a *notch*, at the upper and under edges of each side of the *arch*, forming, in the contiguous vertebræ, the passages of the *spinal nerves*.

The *processes* of each *vertebra*, are seven in number, viz. two *superior oblique*, two *inferior oblique*, two *transverse*, and one *spinous*.

The *two superior oblique*, or *articulating processes*, are covered with cartilage, and placed upon the upper part of the sides of the *arch*.

The *two inferior oblique*, or *articulating processes*, are also covered with cartilage, and placed upon the under part of the sides of the *arch*.

The *two superior oblique processes* of one *vertebra*, are articulated with the two *inferior oblique*, of the *vertebra* immediately above it.

The *two transverse processes* project from the sides of the arch, and between the *oblique processes.*

The *spinous process* which is sent out from the back part of the *arch*, being sharp, and pointed, gives name to the whole chain of bones.

The *vertebræ* are divided into seven *cervical*, twelve *dorsal* and five *lumbar*.

The Cervical Vertebræ, or *vertebræ of the neck*, have their bodies *smaller*, more flattened before and behind, and more hollowed above and below, than those of the other vertebræ.

Their *articulting processes* are *more oblique*, than those of the others.

Their *transverse processes* are *perforated*, for the passage of the *vertebral bloodvessels*, and *hollowed* above, for the transmission of the *spinal nerves.*

The *spinous processes* are placed *horizontally*, are *shorter* than those of the other vertebræ, and *bifurcated*, or *forked*, for the attachment of muscles.

The *first* vertebra is called the *atlas*, from its supporting the globe of the head, and has only a small *arch* instead of a *body*.

The back part of the *arch* is hollow, and covered by a smooth cartilage, where it turns upon the *processus dentatus* of the *second* vertebra.

There is a long *arch* upon the back part of the *atlas*, instead of a *spinous process*, marked by muscles and ligaments.

Its *superior oblique processes* are oval, slanting, and hollow, for receiving the *condyles of the occipital bone*.

The *atlas* is connected to the occipital bone, where the head has its *flexion* and *extension*, but little other motion.

The *second vertebra* is called *dentata*, from the *tooth-like process* on the upper part of its body.

The *body* of this vertebra is larger than the rest, and of a conical figure.

The forepart of the *processus dentatus* is convex, and covered with cartilage where it turns upon the *atlas*.

The *superior oblique processes* are placed horizontally, and a little elevated in the middle, to be received into the hollow *inferior oblique processes* of the *atlas*, where the head has its principal *rotatory* motion.

The *spinous process* is thick and strong, to give origin to the muscles which assist in the *extension* and *rotation* of the head, and turned down, to allow these motions to be readily performed.

The *seventh cervical vertebra* approaches to the form of the *dorsal vertebræ*. The *spinous*, and *transverse processes* have no bifurcation, and the latter are not perforated except in some rare cases.

The DORSAL VERTEBRÆ, or *vertebræ of the back*, are horizontal above and below, having their bodies *larger*, *sharper* before, *flatter* at the sides, and *more hollow* behind, than those of the cervical vertebræ. There are *pits* lined with cartilage, at the sides of the *upper*, and *under edges*, of their bodies, near the *transverse processes*, for the articulation of the *heads of the ribs*.

The *spinal canal* is here more circular, but, corresponding with the size of the spinal marrow, is smaller than in any other vertebræ.

The *oblique processes* have nearly a *perpendicular* direction, the upper ones slanting forwards, and the under ones backwards.

The *transverse processes* are long, turned *obliquely* backwards, and enlarged at their outer extremities, where they are faced with cartilage, to be articulated with the *tubercles* of the *ribs*.

The *spinous processes* are long, thick at the roots, but slender near the extremities, and pointing *obiquely downwards* over each other, by which, the spinal marrow in this part is well protected.

The *first dorsal vertebra*, besides having a hollow in its lower edge, for assisting in the formation of the cavity for receiving the head of the *second* rib, has the *whole* of the pit for the *head of the first rib*, formed in it.

The *eleventh* often has the *whole* cavity, for the head of the *eleventh* rib, in its body, and wants the smooth surface on each *transverse process*.

The *twelfth* receives the *whole head of the last rib*, and has no cartilaginous surface on either *transverse process*.

The LUMBAR VERTEBRÆ, or those of the *loins*, have their bodies *larger*, and *broader* than those of the other two classes, and the *spinal canal* is larger than in the back.

The *oblique processes* are remarkably *deep*, and placed *upright*, the superior oblique processes of one vertebra facing *inwards*, and receiving the inferior oblique processes of the vertebra above it, which are turned *outwards*.

The *transverse processes* are long, slender, and almost *straight*, to give origin to large muscles, and to admit of free motion.

The *spinous processes* are *short*, large and strong, and placed *horizontally*, with narrow edges above and below, and broad flat sides, giving origin to muscles of great strength.

FALSE VERTEBRÆ.

The *false vertebræ* are composed of the *os sacrum*, and *os coccygis*.

OS SACRUM.

The form of the bone is triangular, with its *base* towards the lumbar vertebræ, and its *point* downwards.

The anterior surface is concave, for enlarging the cavity of the pelvis.

The surface behind is convex, and irregular, where strong muscles arise which assist in extending the spine and thigh.

There are *four transverse prominent lines* seen anteriorly, indicating the situation of the cartilages which originally divided the bone into *five* pieces.

The *spinal canal* is here of a triangular form, of great size above, but becomes gradually smaller in its descent, and corresponds to the size of the under end of the spinal marrow, termed *cauda equina*, from the resemblance to a horse's tail.

The two *oblique processes*, belonging to this bone, face *backwards* and *inwards*, to correspond with the two *inferior processes* of the *last lambar vertebra*.

There is a *large oblong process*, on each side of the bone, formed by the concretion of all the original *transverse processes*.

There are *four pair of large holes*, on the *anterior* surface of the bone, at the end of the lines already described; and grooves running out from the holes for the passage of the *sacral nerves*.

There are also *four pair of holes*, on the *posterior* surface, not much smaller than those seen anteriorly, for *nerves* to pass out to the muscles on the back part of the pelvis, and minute *arteries* to enter to the *cauda equina*.

OS COCCYGIS.

The *os coccygis*, or rump-bone, forms an appendage to the under end of the os sacrum, and is sometimes considered as being formed of *two*, or *three* pieces.

THORAX.

The thorax is formed of the *sternum* before, of the *costæ*, or *ribs*, on each side, and of the *dorsal vertebræ* behind.

The general figure of the thorax approaches that of a cone.

COSTÆ or RIBS.

Their number is, commonly, *twelve on each side*, though sometimes *thirteen*, and at other times only *eleven*; the number of the *dorsal vertebræ* always corresponding with that of the ribs.

Their figure is convex externally, by which their strength is increased, and concave and smooth internally, with their flat sides turned towards the lungs which they protect.

The *head* of each rib is formed into a ridge, and two hollow surfaces, to be articulated with the bodies of *two vertebæ*, and their intermediate cartilage.

In each, there is a *tubercle*, at a little distance from its *head*, with a flat cartilaginous surface, and irregular edge, to be articulated with the *transverse process* of the *undermost* of the *two vertebræ* to which the head of the rib is joined.

The *cervix*, or *neck* of the rib, is between its *head*, and *tubercle*, and of a roundish form. The remaining portion of the rib is called its *body*, and the sudden curve which it forms in turning towards the sternum, is called the *angle*.

The ribs become broader and flatter, at the lateral part of the thorax, and the flat surface is opposed to the lungs.

The upper edge of the rib is *round*, and the under edge is *sharp*, and grooved internally, to receive the intercostal artery, veins, and nerve. The groove commences at the tubercle, and, becoming gradually less distinct, is lost about the middle of the bone.

There is an *oval pit*, in the anterior extremity of each rib, for receiving the *cartilage* which runs from it to the *sternum*.

The *cartilages* of the ribs are placed between them, and the *sternum*.

The ribs are connected *behind* to the vertebræ by a double articulation, and *before* to the *sternum* by the cartilages, or by the cartilages to each other, in such a manner as to allow motion upwards and downwards.

The *first rib* is the most crooked ; from this downwards, the ribs become gradually straighter.

The length of the ribs increases from the *first* to the *seventh*, and then decreases to the *twelfth* rib.

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

The *true ribs* are the *seven uppermost*, having their cartilages joined to the sternum, and opposed to the heart and lungs.

The *false* ribs are the *five inferior*, not reaching the sternum.

The posterior extremity of the *first rib* is articulated only with the *first vertebra of the back*.

The *fossa*, for the intercostal vessels, is wanting at the edge of this rib.

The *eleventh rib* has no *tubercle* for articulation, being only loosely joined to the transverse process of the vertebræ.

The *twelfth rib* is much shorter, and straighter than the rest. Its head is only joined to the *twelfth vertebra* of the back, and it has *no tubercle*, nor articulation with the *transverse process*, neither, has it any *fossa* at its under edge, the vessels running some way below it.

The anterior extremities of the *eleventh*. and *twelfth ribs*, are not joined to each other, nor to any other rib ; and, from lying loose among the muscles, they are sometimes named *floating ribs*.

STERNUM.

The *sternum* is situated in the *forepart* of the *thorax*, and, until middle age, is composed of *three pieces* joined together by cartilage.

The *sternum* is thick and broad above, and thin and narrow below.

The upper and back part is hollowed, to make way for the *trachea* ; and there is a cavity at each corner, lined with cartilage, for receiving the end of the *clavicles*, or *collar bones*.

There are *pits* upon each edge of the sternum, to receive the cartilaginous ends of the *seven true ribs*.

The lower piece of the *sternum* is cartilaginous in the young subject, and pointed like a sword, hence called *ensiform cartilage*.

PELVIS.

It is so named, from the resemblance which the cavity, formed by the bones which compose this division of the trunk, has to a basin.

It consists, in the adult, of four pieces, viz. the *os sacrum*, and *os coccygis*, *behind* and *below*, and the *ossa innominata*, on *either side*. The only division remaining to be described, is the *os innominatum*.

OS INNOMINATUM.

The *os innominatum* is situated in the forepart, and side of the pelvis, and in the under and lateral part of the abdomen.

The bone is divided, in children, into the *os ilium*, the *os ischium*, and the *os pubis*.

In the adult, the three bones are ossified together, but retain their original names.

OS ILIUM.

The *os ilium* forms the upper part of the os innominatum, and spreads out to assist in supporting the contents of the abdomen.

The *dorsum*, or outer *convex surface* of the bone, is raised in some parts, and depressed in others, where the *glutei muscles*, or extensors of the thigh, have their origin.

The *spine*, or upper *semicircular edge* of the bone, is for the attachment of the *oblique* and *transverse abdominal muscles*, and, in the fresh subject, is covered with cartilage.

The *anterior superior spinous process*, or anterior extremity of the spine, is for the attachment of the *sartorius muscle*, and *Poupart's ligament*.

The *anterior inferior spinous process*, a little below the former, is for the attachment of the *rectus femoris muscle*.

The two *posterior spinous processes*, at the back part of the spine, are less considerable than the two anterior; they partly give origin to muscles, but are chiefly for the attachment of the ligaments which belong to the junction between this bone, and the *os sacrum*.

There is a notch of the os ilium, under the *posterior inferior spinous process*, for the passage of the *pyriform muscle*, the *sciatic nerve*, and *bloodvessels*. This notch which is bounded below by the ischium, is called the *iliac*, or *ischiatic notch*.

The *venter*, or internal *concave surface* of the bone, called also the *iliac fossa*, is for the attachment of one of the *flexors* of the thigh termed *iliacus internus*, and the support of a portion of the *intestinum ilium* and *colon*.

The under, fore, and outer part, of the bone forms the upper and back part of the *acetabulum*, or cavity for the articulation of the thigh bone.

OS ISCHIUM.

The *os ischium* is situated in the lowest part of the pelvis.

Its figure is irregular, its size, next to that of the *os ilium*.

The upper thick part of the bone forms the under part of the *acetabulum*.

The *spinous process*, sent back from the upper part of the bone, is for the attachment of muscles, and of the *superior sacro-sciatic ligament* which completes the *notch* of the *os ilium* into a *foramen*, called the *iliac foramen*.

The *tuberosity*, or *tuber-ischii*, at the lower part of the bone, is covered with cartilage that may be separated by macerating the bone. To its upper part, the *inferior sacro-sciatic ligament* is attached, and, it also gives origin to the principal *flexor mucles* of the leg.

Between the *spinous process*, and *tuberosity*, there is a *sulcus* or *groove*, for the passage of the *obturator internus muscle*.

The tuberosity of the bone contracts and goes upwards and inwards, to form the *crus*, or *ramus*, which is united to that of the os pubis, and gives attachment to the great *adductor* muscle of the thigh, on the outer side, and to parts of the *penis*, within.

OS PUBIS.

The *os pubis* is situated at the upper, and forepart of the *pelvis*.

Its size is the least of the three portions of the *os innominatum*.

The thickest and strongest part of the bone, forms the upper and foreside of the acetabulum.

The upper and inner part of the bone, increases in size, and forms the rough *crest*, or *angle*, to which the inner end of *Poupart's ligament*, and the *rectus abdominis muscle*, are attached.

A *ridge*, or *spine*, extends from the outer and forepart of the crest, along the upper and inner edge of the bone, to form, with a similar ridge of the *os illium*, the *linea-ileo-pectinea*, *brim*, or *upper opening*, of the *pelvis*.

Another ridge extends downwards and outwards, towards the breach in the forepart of the *acetabulum*, and, below it a *notch* is formed into a *hole*, by the addition of the *obturator ligament*, for the passage of the *obturator vessels*, and *nerves*.

The inner end of the bone is rough, and unequal, but covered with a ligamentous cartilage, in fresh bones, which joins the two *ossa pubis* so firmly together, as to prevent them from moving upon each other. This junction is called *symhysis pubis*, or *anterior symphysis* of the pelvis.

The inner part of the bone becomes narrower, and ends in the *crus* which goes downwards to join that of the *os ischium*, and, with it, forms one side of the *arch* of the *pubis*.

The *foramen thyroideum* is formed by the *os pubis*, and *os ischium*, and, in the subject, is filled by a membranous ligament, (excepting at the notch above mentioned) which gives origin to a large share of the *obturator muscles*.

The *acetabulum*, or *cavity* (compared to a vinegar measure used by the ancients,) placed further out than the *foramen thyroideum*, is formed by the three pieces which compose the *os innominatum*, in such a manner, that the *os ilium* constitutes nearly *two fifths*, the *os ischium* more than *two-fifths*, and the *os pubis one-fifth* of that cavity.

The cavity of the *acetabulum* is very deep, especially behind, and made still deeper in the subject, by its brim being tipped with a cartilaginous ligament.

Round the outer edge of the brim, the bone is rough, where the *capsular ligament* of the joint is fixed.

There is a breach, in the inner and forepart of the *acetabulum*, which has a strong ligament stretched across it, leaving a hole behind, for containing part of the substance called *gland of the joint*.

The cavity of the *acetabulum* is lined with cartilage, excepting at its under, inner and forepart, where there is a rough *depression*, for containing the greater part of the substance mentioned above, and for the attachment of the *round ligament of the joint*.

The *ossa innominata* are joined behind to the *os sacrum*, by a thin cartilage, and by strong ligaments, so as to have no motion; the joint obtaining the name of *posterior*, or *sacro-iliac symphysis*.

The pelvis forms the *basis of the trunk*, and *sockets* for the *thigh bones* to move in. It contains the *bladder* of *urine*; and the *rectum*, in the male, and, together with these, the *uterus*, in the female. It gives origin to the muscles which *extend* the *trunk*, and insertion to those which *bend the body*. It sends off the principal part of the muscles which move the *thigh*, and gives passage and protection to *bloodvessels*, and to some of the *largest nerves* of the body.

SUPERIOR EXTREMITY.

The superior extremity is composed of the bones of the *shoulder*, *arm*, *forearm*, and *hand*.

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

CLAVICLE.

The *clavicle* is situated between the upper part of the sternum, and top of the scapula.

The *scapular*, or external extremity, is oval and flat, and tipped with cartilage, to be articulated with the *acromion* of the scapula.

The *sternal*, or internal extremity, is triangular, and larger than the body, with one of the angles elongated backwards.

The body of the bone towards the *sternum* is bent forwards, and that part next the *shoulder* is turned back; the whole resembles an *Italic f*.

Near the back part of the scapular extremity, there is a *tubercle*, for the attachment of a strong ligament which connects this bone to the *coracoid* process of the scapula.

The *clavicle* supports the *shoulder* at a proper distance from the *thorax*, and thereby renders the motions of the arm more extensive. It gives origin to several muscles, and defence to large vessels and nerves.

SCAPULA.

The *scapula* is situated upon the upper and back part of the *thorax*, at some distance from the ribs; the intervening space being filled up by a cushion of flesh.

The shape of the *scapula* is triangular, with one of the angles placed downwards.

The *venter*, or *inner surface*, is concave, corresponding with the convexity of the ribs, snd marked with ridges and depressions by the *subscapularis muscle*.

The *dorsum*, or *outer surface* of the *scapula*, is rendered convex in some parts, and concave in others, by the action of the muscles which cover it.

The *body* of the *scapula* is remarkably thin, and in an old person transparent.

The *edges* of the bone are thick and strong, and termed *costæ*.

The *superior*, or *cervical costa*, is the shortest of the three, and placed nearly opposite to the second rib.

Near the forepart of the *superior costa*, there is a *semilunar notch*, for the passage of the superior scapular vessels, and nerves.

The *inferior*, or *anterior costa*, extends obliquely downwards and backwards, between the *third* and *eighth ribs*, and is impressed where it gives origin to the *teres minor muscle.*

The *posterior costa*, or *base* of the bone, is placed obliquely with respect to the spine, the upper end being considerably nearer to it than the under.

The *cervix*, or *neck* of the bone, descends from the *semilunar notch*, and supports the *head* of the bone, which is considered as one of its processes.

The *glenoid cavity* is placed on the forepart of the *head* of the bone, and lined with cartilage, for the articulation of the *os humeri* ; the narrower part connecting it with the body of the bone, being called the *cervix*, or *neck*.

The *spine* runs across the bone, dividing it into a *small upper*, and *large under* surface, and giving origin to part of the *spinati muscles*.

The *fossa supra-spinata*, or space above the spine, is for the origin of the *supra-spinatus muscle*.

The *fossa infra-spinata*, or space below the spine, is for the origin of the *infra-spinatus* muscle.

The *spine* becomes broad and flat, acd terminates in a point at its anterior extremity, where it is termed *acromion*, or *top of the shoulder*.

The *acromion* is situated over the joint of the humerus, and, together with the ligaments, contributes to its protection.

The *coracoid process* arises from the neck of the bone, making a curvature forwards, so as to leave a hollow at its root, for the passage of the *subscapularis muscle*.

OS HUMERI.

The *os humeri* is situated at the side of the *thorax*, and under the *scapula*.

The *ball*, or *head* of the *os humeri*, is covered with cartilage, and placed at the upper, inner, and back part of the body of the bone, to correspond with the *glenoid cavity* of the *scapula*.

The *cervix*, or *neck*, surrounds the edge of the *ball*, and forms a superficial *fossa*, where the *capsular ligament* is fixed.

There is a *fossa*, or long *groove*, lined with cartilage, in the upper and forepart of the bone, for lodging the tendon of the *long head of the biceps muscle*.

The *small tubercle*, placed at the *upper*. and *inner side* of the abovementioned groove, is for the attachment of the *subscapularis muscle*.

The *large tubercle*, opposite to the former, and on the *outer side* of the groove, is for the attachment of the *muscles*, which cover the *dorsum* of the scapula.

There is a *ridge* extending down from *each tubercle*, along the sides of the *bicipital groove* ; to the *external*, the *pectoralis major muscle* is fixed, and to the *internal*, the *latissimus dorsi*, and *teres major muscles* are attached.

The outer side of the bone, near its middle, is somewhat rough, for the insertion of the *deltoid muscle*.

The body of the bone becomes flatter towards its lower extremity, forming a sharp edge or ridge on each side, terminating in the condyles.

The *external condyle* is placed at the under and outer part of the bone, for the origin of the *extensor* and *supinator muscles* of the hand, and fingers.

The *internal condyle*, at the under and inner part of the bone, is more prominent than the former, for the origin of the strong *flexor* and *pronator muscles* of the hand, and fingers.

There is an *articulating surface*, at the under end of the bone, between the *condyles*, covered with cartilage, for the articulation with the bones of the *forearm*.

The *inner part* of the articulating surface consists of a large *internal*, and small *external eminence*, with a middle *cavity*, or *trochlea*, upon which the *ulna* moves.

The *outer part* of the *articular surface*, upon which the head of the *radius* moves, is of a round form, and considered by some authors as the smooth part of the outer condyle.

There is a *small cavity* at the under and forepart of the bone, above the *trochlea*, for receiving the *coronoid process* of the *ulna*, in the flexion of the forearm.

There is a *large cavity* at the under and back part of the bone, also above the *trochlea*, the under part of it, for receiving the *olecranon of the ulna*, in the extension of the forearm, and the upper part, for containing the fat of the joint.

The **Forearm** consists of two bones, the *ulna* and *radius.*

ULNA.

The *ulna* is situated at the *inner* part of the forearm, the arm being supposed to hang by the side of the body, with the *palm of the hand* turned *forwards.*

The *olecranon,* or *processus anconeus,* is placed at the upper end of the bone, and forms the posterior prominent part of the elbow.

The *coronoid,* or *sharp process,* at the upper and forepart of the bone, but considerably lower than the *olecranon,* forms a part of the hinge of the joint of the elbow.

The *great sigmoid,* or *semilunar cavity,* is between the *olecranon,* and *coronoid process,* lined with cartilage, and divided into *two slanting surfaces,* by a *middle ridge,* the cavity being adapted to the *trochlea* of the *os humeri.*

There is a *small sigmoid,* or *semilunar cavity,* lined with cartilage, at the outer side of the *coronoid process,* where the round head of the *radius* plays.

The *body* of the *ulna* is of a triangular form, becoming gradually smaller in its descent.

The *under end* of the bone forms a *small round head,* which is covered with cartilage on that side where the *radius* moves upon it.

The *styloid process,* at the inner side of the *small round head,* has a strong ligament between it, and the bones of the wrist.

The *ulna* is articulated, at its *superior extremity,* with the lower end of the *os humeri ;* it allows an extensive degree of *flexion,* and as much *extension* as to approach a straight line with the upper arm, but little or no *rotation.*

RADIUS.

The *radius* is situated at the *outer* part of the forearm.

The upper end of the *radius* is covered with cartilage, and formed into a *circular head,* which is hollowed above, for receiving the outer part of the articular surface of the *os humeri.*

The *inner side* of the *head* is smooth, and also, covered with cartilage, where it plays in the *small semilunar cavity* at the outer side of the *ulna.*

The *cervix* of the *radius* is smaller than the *head*, and, in the recent subject, surrounded by a circular ligament which keeps the bone in its place, and allows it to roll upon the *ulna*.

The *tubercle* of the *radius* is at the under and inner part of the *cervix*, for the insertion of the *biceps flexor cubiti*.

The *body* of the bone is larger than that of the *ulna*.

The *lower end* of the *radius* becomes gradually larger, and flat on its forepart; and upon the back part, there are two or three *grooves* formed by the tendons of the *extensor muscles* of the thumb, and fingers.

There is a *semilunar cavity*, at the inner side of the under end of the *radius*, lined with cartilage, for receiving the corresponding extremity of the *ulna*.

The lower end of the bone is formed into the *scaphoid cavity*, and lined with cartilage, for receiving the two first bones of the *carpus*.

The under and outer part of the *radius* forms a *process*, somewhat similar to the *styloid* process of the *ulna*. From this process a ligament is sent to the wrist.

The head of the *radius* is articulated with the outer part of the articular surface of the *os humeri*. The head of the *radius* is also received into the small semilunar cavity of the *ulna*; while, the under end of the *ulna* is received into the small semilunar cavity of the *radius*.

The turning of the *radius* with the hand, is termed *supination*, and *pronation*; when the palm is turned upwards, it is in a state of *supination*, and in *pronation*, when in a contrary direction.

Between the bones, and attached to their inner sharp angles, is the *interosseous ligament*.

The HAND is composed of the bones of the *carpus*, *metacarpus*, and *fingers*.

The *posterior* surface of the hand is *convex*, which gives it a greater degree of strength.

The *anterior* surface of the hand is *concave*, for grasping, and holding substances.

CARPUS.

The *carpus* is composed of *eight* bones, disposed in *two rows*.

In the *first row* of carpal bones are, the *scaphoides, lunare, cuneiforme*, and *pisiforme*.

In the second row, are the *trapezium, trapezoides, magnum*, and *unciforme*.

The *os scaphoides* is placed at the outer and upper part of the *carpus*, having a part of the *annular ligament* attached to its outer end.

The *os lunare* is situated upon the inner, or ulnar side of the former bone.

The *os cuneiforme* is situated on the inner side of the *os lunare*.

The *os pisiforme* is placed upon the anterior and inner surface of the *os cuneiforme*, forming a *prominence* which is readily felt in the *wrist*, and which gives attachment to strong tendons, and ligaments, particularly to part of the *ligamentum carpi annulare*.

The *os trapezium*, named from the four unequal edges of its posterior surface, is situated at the root of the metacarpal bone of the thumb; the upper part of it forms a smooth pit, to be articulated with the *os trapezium*.

The *os trapezoides* is so named from its being somewhat like the former bone, though considerably smaller, and is situated at the *inner side* of the *os trapezium*.

The *os magnum*, or *capitatum*, or largest bone of the *carpus*, is placed at the *inner side* of the former bone.

The *os unciforme* is placed in the under and inner part of the wrist, the inferior surface of it being opposed to the metacarpal bones of the *ring*, and *little* fingers.

METACARPUS.

This consists of *four bones* for supporting the *fingers*, and *one*, for the *thumb*.

The *metacarpal bones* of the *fingers* differ a little in length with each other, that of the *forefinger* being usually the *longest*, and that of the *little-finger*, the *shortest*.

They have long round bodies, and their extremities are larger than the bodies, leaving spaces between them, for the *interossei muscles*.

The *upper ends*, or *bases* are flat and articulated with the bones of the *carpus*, and with each other.

The *lower ends*, or *heads*, are more rounded, and flattened at the sides, by their motions upon each other.

The *metacarpal bone* of the *thumb* has a general resemblance to those of the fingers, but is placed obliquely with respect to them.

FINGERS.

The fingers are composed each of *three bones*, and the three rows taken transversely are termed *phalanges*.

The different *phalanges* taper a little as they descend, and their bases are larger than their inferior extremities.

The bases of the *first phalanges* are formed into sockets, to receive the rounded heads of the *metacarpal bones* ; and the under ends of the *third phalanges* are rough, where the nervous and vascular substance of the points of the fingers is situated.

The thumb consists of only *two bones*, having a resemblance to the phalanges of the fingers, but they are thicker and stronger.

INFERIOR EXTREMITY.

The inferior extremity is composed of the *thigh*, *leg*, and *foot*.

THE THIGH consists of a single bone, viz. the *Os Femoris*.

OS FEMORIS.

The *os femoris* is the longest bone of the body, and the thickest and strongest of the cylindrical bones.

The bone is situated at the under and outer part of the pelvis, the under end being considerably nearer, than the upper one, to its fellow.

The *ball*, or *head* of the thigh-bone, is smooth, covered with cartilage, and, forming almost two thirds of a sphere, is received into the deep socket formed by the *acetabulum* of the *os innominatum*.

There is a rough *pit* at the inner part of the ball, for the attachment of the *ligamentum rotundum*, which is fixed by its other end to the bottom of the *acetabulum*.

The *cervix*, or *neck*, is much longer than that of any other bone, and there are numerous holes upon it, for the insertion of the fibres of the *capsular ligament*.

The *trochanter major* is placed at the outer part of the *neck*, and upper end of the *body* of the bone, for the insertion of the *extensor*, *abductor*, and *rotator muscles* of the thigh.

The *trochanter minor* is at the under and inner part of the *cervix*, for the insertion of the *flexor muscles* of the thigh.

The *body* of the thigh bone is bent forwards, and a little outwards.

There is, on the back part of the bone, a ragged ridge called the *linea aspera*, extending from the *trochanters*, but chiefly from the larger one, to the lower part of the bone, and giving attachment to numerous *muscles* which pass from the pelvis to the thigh, or from the thigh to the leg.

There is a cartilaginous *trochlea*, at the under and fore-part of the bone, placed obliquely, with its outer surface larger and higher than its inner one, to be adapted to the *patella* which moves upon it.

The *external* and *internal condyles*, are continued back from the trochlea, and also covered with cartilage, for the motion of the *tibia*.

The *internal condyle* is larger and deeper than the *external*, to compensate for the obliquity of the thigh, and to give less obliquity to the leg.

There is a *notch*, between the back part of the *condyles*, for lodging the *popliteal vessels* and *nerves*.

There is also, a *semilunar rough notch*, deeper and lower than the former one, for the attachment of the *crucial*, or *internal ligaments* of the *knee-joint*.

The Leg is composed of two bones, the *tibia*, and *fibula*, to which may be added, the *patella*.

TIBIA.

The *tibia* is situated at the *inner* part of the leg.

The *upper end* of the *tibia* forms a large *head*, divided on its upper surface into two *superficial cavities*, for receiving the *condyles* of the *os femoris*.

There is a *rough protuberance*, projecting between the *articulating cavities*, received in the space between the *condyles*, and pitted on its fore and back parts, for the insertion of the *anterior* and *posterior crucial ligaments*.

The articulating surfaces, at the upper end of the *tibia*, are rendered deeper in the fresh subject, by the addition of two *semilunar cartilages* placed upon their edges.

There is a *tubercle*, at the upper and forepart of the bone, for the insertion of the *ligament* of the *patella*.

The body of the bone is of a triangular form, with the sharpest angle placed anteriorly.

The *anterior angle* is called *spine*, or *shin* ; the *internal* gives attachment to the *fascia* of the leg, and the *external* gives attachment to the *interosseous ligament*.

The under end of the tibia is smaller than the upper one, and its *inferior surface* is *hollow*, and covered with cartilage, for the articulation of the *astragalus*.

The *malleolus internus*, or *inner ankle*, is produced from the inner and forepart of the under end, and is also covered with cartilage where the *astragalus* plays.

There is a *semicircular cavity*, at the under and outer side of the *tibia*, for receiving the under end of the *fibula*.

FIBULA.

The *fibula* is placed at the *outer side* of the tibia, and is by much the smaller of the two bones ; being the most slender bone, in proportion to its length, of any in the body.

The upper end of the *fibula* is formed into a *large head*, with a superficial *smooth cavity* towards its inner side, to be articulated with the *tibia*, where it is tied by ligaments of such strength as to allow very little motion.

The body of the bone is somewhat of a triangular shape, and has a *ridge*, on the *inner side*, opposed to the outer angle of the tibia, for attachment of the *interosseous ligament*.

The *under end* of the *fibula* is *broad* and *flat*, to be received by the *semilunar cavity* of the *tibia*, and forms the *mallelolus externus*, or *outer ankle*, which is lower, and further back, than the *inner ankle*.

There is a process called the *coronoid*, sent down from the *malleolus externus*, from which, *ligaments* go to the bones at the outer side of the foot.

PATELLA OR ROTULA.

The *patella* is placed at the *forepart* of the joint of the knee, and in some respects bears the same relation to the *ibia*, as the *olecranon* does to the *ulna*.

The *shape* of the *patella* is somewhat *triangular*, and *flat*, having the apex directed downwards.

The *anterior surface* of the bone is *convex*, and perforated by numerous holes for the insertion of tendons, and ligaments, which cover it.

The *posterior surface* is *smooth*, covered with cartilage, and divided by a longitudinal prominent ridge into two unequal and slightly concave spaces, of which the *external* is the *larger*.

The Foot is composed of the *tarsus*, *metatarsus* and *toes*.

TARSUS.

The *tarsus* is composed of *seven* bones, viz. the *astragalus*, *os calcis*, *naviculare cuboides*, *cuneiforme externum*, *cuneiforme medium*, *and cuneiforme internum*.

The *astragalus* is placed immediately *under* the bones of the leg.

The *os calcis* is the largest of the tarsal bones, and situated *under* the *astragalus*, and in the back part of the foot, where it projects behind to form the *heel*.

The *os naviculare* is situated at the *forepart* of the *astragalus*, and *inner part* of the foot.

The *os cuboides* is placed at the *fore* and *outer part* of the *tarsus*.

The three *ossa cuneiformia* are situated at the *forepart* of the *tarsus*, and inner side of the *cuboides*, and are applied to each other like the stones of an arch.

METATARSUS.

The *metatarsus* is composed of five bones, which answer to the general characters given to the *metacarpal bones*, but may be distinguished from them by being *longer*, *thicker*, and *stronger*.

TOES.

The bones of the *toes* are the same in number, with those of the *fingers*, viz. *two* to the *great toe*, and *three* to each of the *smaller toes*, and the different bones here, as in the fingers, are disposed in *rows* or *phalanges*.

OSSA SESAMOIDEA.

The size, situation, and number of these bones, vary in different persons ; when present, they are generally placed in pairs at the *roots* of the *thumbs*, and *great toes*, and serve for the attachment of small *muscles* belonging to these parts.

DISTINCTION BETWEEN THE MALE AND FEMALE SKELETONS.

The *female skeleton* is smaller in all its dimensions, as well as more slender in regard to the individual bones, than that of the *male*. It is not so much impressed by the muscles, and the cavities are not so deep ; hence, its greater *smoothness*.

The more remarkable differences however, in the *female* skeleton, may be traced in the trunk of the body, which may be compared to a *pyramid*, of which the *pelvis* forms the *base* ; while, in the *male* the proportions are reversed, and the *shoulders*, being the broader, may be considered as the *base*.

The *female chest* is shorter and deeper than the *male*, more convex in front, and more distant from the pelvis, the *loins* being *longer*. The shoulders are, at the same time, carried more backward, and stand out less from the trunk.

The *breadth* and *capacity* of the *pelvis*, may be considered as the principal characteristic of the female form, it being larger in all its dimensions, than that of the male.

The *ossa innominata* are further expanded laterally ; the os sacrum is more turned back ; the acetabula are removed to a greater distance ; and of course, the thigh bones are placed more obliquely ; the knees in a well formed female, being turned a little inwards. In the female, the outlet of the pelvis is much more capacious than in the male, and besides this characteristic of the female pelvis, all its lateral dimensions, or measurements of breadth, preponderate, the long diameter of the upper opening being between the ilia, and thus, corresponding with the long axis of the child's head in passing through the pelvis during parturition.

PHYSIOLOGY OF THE BONES.

The formation of bone, or ossification.—When ossification is about to take place, there is an increased determination of the blood to the part, the bloodvessels of which become larger, and admit red globules of blood. In a short time, a number of white spots may be observed attached to the extremities of the arteries, being the earthy matter deposited by them. In the process of time, these bony specks appear to coalesce, and become of a firmer consistence, after which, the layers of bone are added internally, the jelly, or cartilage, which formerly existed, disappearing or being absorbed as the earthy matter is deposited.

There is still a difference of opinion among Physiologists, as to the source of bone ; some believing it to be derived from the vessels of the periosteum, and others, from the arteries common to the substance of the bones.

In the fœtus, the bones are much more numerous than in the adult, many pieces that are distinct in the former, being united by ossification in the latter. The ossification of irregular shaped bones begins by a sort of nucleus, or point. In long bones, there are generally several of these centres of ossification in the form of rings.

The intimate structure of bones.—Bones are composed of a great many plates, each of which is made up of fibres united by smaller fibrils, which, being irregularly disposed, and interwoven with the other larger fibres, make a reticular work.

Bones are more or less cavernous internally. In some, (as in the middle thin part of the *scapula*, or *os ilium*,) the solid sides are brought so near, that little cavity can be seen ; and in others, (as the middle of the *os humeri*, *os femoris*,

&c,) the cavities are so large, that such bones are generally considered to be hollow, or *fistular*.

The spongy, cavernous, internal part of bones is generally called their *cancelli*, or *lattice work*.

PERIOSTEUM.

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

The great sensibility of the periosteum, in the deep-seated species of *paronychia*, in *exostosis*, &c. 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, one cannot well 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.

The uses of the periosteum are :—

1*st*. 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*d*. To support the vessels, in their passage to the bones.

3*d*. To strengthen the conjunction of bones with their epiphyses, ligaments, and cartilages, which are easily separated in young creatures, when this membrane is taken away.

4*th*. To afford convenient origin, and insertion, to the muscles, which are fixed to this membrane.

5*th*. To assist in forming bone.

MARROW.

The *marrow* may be considered as an appendage to the general *corpus adiposum*. It is deposited by the arteries, in the cavities of the bones, at the same time that the rest of the body is supplied with fat.

THE BLOODVESSELS OF BONES.

The arteries which supply the bones are called their *nutritious arteries*, and may be demonstrated as they enter their foramina, more especially, in the long bones. Each has its corresponding *vein*.

That a great number of arteries do enter into the composition of the bones, is obvious from what has been said to be the effect of madder, which, when given along with the food of an animal, gradually communicates its tinge to every part of the bone.

LYMPHATIC VESSELS OF BONES.

From what has been said of the vessels of bones, it is evident, 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, therefore, exceeds the waste during the growth of the bones ; while the renewal, and waste, keep pretty nearly equal, in adult, and middle age ; and the waste exceeds the supply from the fluids, in old age—This is demonstrable, from their increase of weight as a person approaches to maturity, and its continuing nearly the same, till old age begins, when they become lighter. In consequence of this, the bones of old people are thinner and firmer in their sides, and have larger cavities, than those of younger persons.

THE NERVES OF THE BONES.

Though it be impossible to demonstrate nerves, within the bones, (the teeth excepted,) yet, it cannot be doubted that bones are extremely sensible.

The granulated flesh, which sprouts from the bones after amputation, or after an exfoliation, is extremely sensible.

This sensibility however, appears to be manifest only in the diseased condition of bone.

CHEMICAL ANALYSIS OF BONES.

The component parts of bone, are *earth*, *jelly*, *cartilage* and *oil*. These constituent principles may be separated in different ways, viz, by burning the bones, by acids, and by boiling. By the aid of fire, the animal matter is driven off, and, by the aid of acids, the earthy matter is dissolved, and may be precipitated.

The *earthy* matter contained in human bones, consists of phosphate of lime, of carbonate of lime, and of a very small proportion of sulphate of lime.

The *oil*, and *jelly*, may be readily obtained by boiling the bones ; the former swims on the surface, and the water dissolves the jelly.

When bones have been boiled for some time, and deprived of their *jelly*, and of their *earthy* matter, by immersion in an acid, a *cartilage* remains, which is similar in its properties to coagulated albumen.

The matter which forms the body and roots of the teeth, appears to be the same as that of bone generally, and the enamel which covers the crown owes its excessive hardness to a less proportion of animal matter.

INJURIES AND ORGANIC DISEASES OF BONES.

The bones, being much exposed to external injury are frequently *bruised*, *cut*, *displaced*, or *broken*. They are also, subject to several organic diseases ; for example, they *inflame swell*, *suppurate*, and become *gangrenous*. Their organic diseases however, are less rapid in their progress, than those of the softer parts ; thus, a wound of the softer parts, if properly treated, heals in a few days, but a broken bone does not re-unite for several weeks ; the process being, however, quicker in young, than in an old subject.

Inflammation of bone.—Bones are frequently inflamed, and when reduced to that state, like the softer parts acquire a degree of unnatural redness, and are liable to the various changes consequent upon that process.

Swelling of bone, or *exostosis.*—This is a partial disease, which sometimes appears at a very early period of life, without any evident cause, and becomes gradually larger. At other times, it appears to arise from external violence, *scrophula*, *syphilis*, or *cancer*.

Exostoses differ, as to size, situation, consistence, and sensibility.

There exists, in some constitutions, a very strong disposition to the formation of *exostoses*.

The *scrophulous exostoses,* which sometimes attain a large size, are most frequent in bones of the spine, of the tarsus, carpus, and in the bones forming the hip, and knee-joints ; while, .he *venereal exostoses* appear most frequently in the middle and most compact part of the tibia, humerus, ulna, or in the os frontis, and ossa parietalia.

Exostoses generally grow *outwardly*, but sometimes, although much more rarely, *inwardly*, so as to press upon the brain, the viscera of the thorax, or abdomen.

The structure of *exostoses* differs from that of the original bone ; some, when divided, consisting of substance of a gristly appearance alone, or with fungous granulations, and a quantity of ill-conditioned pus ; while others consist of solid bone as dense as ivory, being generally smaller than the other kind, and externally very hard to the touch.

There are some *exostoses* which speedily degenerate into *caries*, or *ulceration*, more particularly the cancerous and venereal, while the hard frequently remain for years without increasing or diminishing.

Abscess, and caries of bones.—Abscess is sometimes found between the periosteum and bone, at other times, within its cancellated structure, but rarely between the laminæ forming the shell. It is analogous to suppuration in the soft parts.

Caries, or *ulceration* of bone, bears a strong resemblance to ulceration of the softer parts, and occurs more especially in the spongy bones, as the vertebræ, bones of the tarsus, and extremities of the long bones.

The ill-conditioned fetid matter, the concomitant of *caries*, generally makes its way outwards, at small fistulous openings, and these are generally filled with fungous flesh which readily bleeds on being touched.

When carious bones are probed, they communicate a gritty sensation, and are sometimes so soft, that the probe sticks in them.

Gangrene of bone or *necrosis.*—In this disease, the bone is altogether deprived of vitality, and becomes of an opaque white colour, brown, or black. The *gangrene* is frequently confined to the outer table of the bone, which is cast off by the process called *exfoliation*; but in other cases, it extends through the greater part of the bone, and is then cast off; the place of the dead bone being, in many cases, supplied by a new growth of bone around the dead part. The dead part of the bone which has been called the *sequestrum* is, for a time, included in the newly formed bone. It at length however, protrudes, and the dead portion of the bone gradually becoming looser, in consequence of being partly absorbed, it falls out, through an opening in the new shell, either in the shape of an entire cylinder, or in the form of a number of sharp spicula. In young subjects, the old bone is sometimes entirely absorbed, and no part discharged externally.

The new bone, is at first ill-shaped, and irregular on its surface, and, as it is formed upon the old bone, it is necessarily larger.

Necrosis is most frequent in the middle of such bones as are but slightly covered, as the lower jaw, tibia, humerus, or clavicles.

The disease is sometimes the effect of fractures.

DISEASES ARISING FROM A DEFECT IN THE USUAL PROPORTIONS OF EARTHY MATTER IN THE BONES.

The bones sometimes attain an unusual size, in consequence of an excess of bony matter, which is deposited not only upon the outer, but upon the inner surface, of the original bone.

When bones do not contain a due proportion of bony matter, instead of protecting the softer organs, they are sometimes protruded inwards, and press upon the contained parts, thereby deranging their functions.

Fragility of bones.—This condition, in which the bones are too brittle, is the effect of an excess of earthy matter. They are reduced to this state by old age, and by different diseases, as *scurvy*, *syphilis*, *cancer*, &c. but especially by the former, the bones becoming so brittle in the last stages of *scurvy*, that they break from the slightest violence, and do not consolidate afterwards.

Rachitis, or *rickets*, *mollities ossium*, or *softening of the bones*, and *osteo-sarcoma*, or *fleshyness of the bones*, although described as different diseases, appear to arise from the same cause; namely, a deficiency of bony matter.

The only difference, between the first and the other two, is, that in *rickets*, which is a disease of infancy or child-hood, the earthy matter is not deposited originally, while, in the latter affections which occur in more advanced life, it is absorbed after having been deposited. The degree of softening which takes place in *osteo-sarcoma* is much greater than in either of the other diseases.

In the rickety skeleton, the bones are crooked, and in many cases flattened, and broader than in the sound state.

The skull is generally preternaturally large, the thorax is sharper before, and more depressed at its sides, the cartilages of the ribs, instead of being convex outwardly, become often concave, and, in many cases, there are hard osseous tumours at the junctions of the cartilages with the bony parts. The scapulæ are much higher than usual, and the spine is crooked. The thigh bones are bent forward, the neck of the thigh-bone, instead of being oblique with respect to the shaft of the bone, forms a right angle with it, and the bones are enlarged. The bones of the legs are bent in a similar manner with those of the thighs.

ANCHYLOSIS, OR STIFF-JOINT.

This is the sequel of various accidents, and diseases of joints; it may be either *perfect*, or *imperfect*, and takes place in two ways.

The most simple form of the disease is not attended by any loss of substance, and appears to be produced by inflammation attacking the cartilages, and succeeded by the accretion of the bones. This variety of the disease is a consequence of *caries;* the articular cartilages being destroyed, the diseased surfaces of the bones are in contact, and freely grow together. In the other kind of *anchylosis*, the bones are united by a shell of bone, which supplies the place of the capsular ligament of the joint.

OBSERVATIONS ON FRACTURE.

The bones of the old are, for the reasons mentioned above, more easily fractured than those of the young, and are longer in uniting. This remark is equally applicable to the bones of persons afflicted with *cancer*, *gout*, *scurvy*, or *scrophula*.

Some bones, as the long bones of the extremities, from their situation and office, are more exposed to fracture than others.

There are none of the flat bones so much exposed to fracture, as those of the *cranium*. Both tables are usually fractured by violence to the skull, and the injury is often accompanied with depression. In early life, however, the skull may be depressed without being fractured.

Fractures of the skull often extend further on the *inner*, than on the *outer* table of the bone, and sometimes follow the depressions made by the bloodvessels.

The clavicles and radii are much exposed, from their office, to fracture ; the former keeps the shoulder and breast-bone at a proper distance, and is more or less affected by every movement of the shoulder, while the other supports the hand. The clavicle is not only broken by violence, but by the shock communicated by falls on the shoulder, or on the hand.

The smaller irregular shaped bones of the wrist, and those of the ankles, and feet, may be crushed by a great weight, but can scarcely be said to be broken.

Fractures are *simple*, or *complicated* ; in the former, the injury is limited to the bone and periosteum ; in the latter, which are also called *compound*, the muscles and skin are injured.

OBSERVATIONS ON LUXATIONS.

By this term is understood, the displacement or dislocation of the bones forming a joint, from their natural situation.

Luxations are most frequent, where a joint admits of free motion in different directions. Thus, the motion of the shoulder joint is more free than that of any other, and therefore, it is more frequently dislocated.

The structure of the joints points out the direction in which the *luxation* commonly happens. Thus, the humerus may be dislocated *upwards*, *downwards*, *inwards*, or *outwards*, or the ball of the humerus may pass over any part of the glenoid cavity.

The hip-joint is most commonly dislocated *downwards*, and *inwards*, from the deficiency of bone at the inner edge of the acetabulum.

Luxations are *complete, incomplete,* or *complicated* with contusion or fracture.

In the *complete* dislocation, the bone is completely displaced, its articulating surfaces not being in contact, and the capsular ligament is generally lacerated.

There are some joints that can only be completely luxated, as the hip-joint ; the smooth head of the thigh bone being covered with cartilage and lubricated by synovia, either slips from the edge of the acetabulum into its natural, or into a new situation.

In *incomplete* luxation, the head of a bone is merely partially displaced, and rests upon some part of the articulating surface of the contiguous bone ; such dislocations are most frequent at the elbow, knee and foot.

Sometimes dislocation is *complicated* with *fracture*, either *simple*, or *compound*. In such cases permanent stiffness, more or less complete, is a common consequence. The rent in the capsular ligament, through which the head of the bone passed, is filled up, and the lacerated ligament adheres to the neighbouring parts : sometimes also, when luxations have not been reduced, new joints are formed, the cellular substance surrounding the new position of the bone becoming condensed into a kind of capsular ligament.

Sub-luxation vide DISEASES OF LIGAMENTS. PART II.

PART II.

THE LIGAMENTS, CARTILAGES, SYNOVIAL MEMBRANE, BURSÆ MUCOSÆ, AND ARTICULATIONS.

THE LIGAMENTS.

As the *ligaments* are chiefly concerned in the mechanism of *joints*, and in immediate connection with *cartilages*, the *synovial apparatus*, and often with what are called *bursæ mucosæ*, these parts will be described in relation to each other, so that, a knowledge of the structure of all of them may be attained without their being separated by description. The division of anatomy which embraces a description of the ligaments is called *syndesmology*.

The *ligaments* are *compact*, *strong*, and *flexible* membranes, and possess but a small share of elasticity.

The *ligaments* are externally rough, but internally smooth, and lubricated by *synovia*.

There are different kinds of *ligaments*, which, on account of their shape, or situation, have been arranged into classes.

The *first class*, or *capsular ligaments*, are connected to the necks of the bones, or to that part where the bodies of the bones are joined with their epiphyses, and, from forming capsules including the joints, have been called *capsular ligaments*.

A *second class*, called *lateral ligaments*, moderate, and in same measure, regulate the movements of the joints.

A *third class* includes those uniting the bones, which do not move upon each other; as the *os sacrum*, and *os innominatum*.

A *fourth class* includesthose ligaments which supply the place of *tendons*; such are the ligaments between the *spinous processes* of the *vertebræ*.

A *fifth class* comprehends such ligaments as supply the place of *bones;* as the ligaments which fill up the *foramina obturatoria*, and those between the bones of the *forearm*, and *leg*.

A *sixth class* includes those ligaments which are situated *within the joints*, for the sake of additional security, moderating, and regulating their movements; as the round ligament of the *hip joint* and the crucial ligament of the *knee joint*.

CARTILAGES.

Cartilage is a white, elastic, glistening substance, usually attached to articulating surfaces of bones, and in common language known by the name of *gristle*.

Cartilages are less solid than bones, from the smaller quantity of earthy matter which they contain; but more so, than ligaments.

The particular and more important cartilages will be described with the parts, with which their functions are more immediately connected.

The *uses* of cartilages are, to allow, by their smoothness, bones that are designed for much motion, to slide easily over each other without attrition; while, by their elasticity, they accommodate themselves to the several positions of the joint. They sometimes also serve as ligaments, to fasten together bones that are immoveably joined; as between the *os sacrum*, and *ossa ilia*, the *ossa pubis*, &c. or to connect bones that have manifest motion; as the *vertebræ*.

THE SYNOVIAL MEMBRANE, AND BURSÆ MUCOSÆ.

Synovia.—This is the name given to an *unctuous fluid*, like the white of an egg, which exudes from adipose follicles and a very delicate membrane, in the joint which contains it. The obvious use of this fluid is to lubricate the cartilaginous surfaces of the articulations of bones, and thereby to facilitate their motions.

Bursæ Mucosæ.—These are *mucous bags* situated in the joints, and near to the principal tendons, in order that the liquid which they secrete may moisten, lubricate, and contribute to their easy motion. They are only to be found in the extremities of the body, are tolerably regular in their distribution, and situations, and in all amount to about 140; thirty-three in each superior, and thirty-seven in each inferior extremity. They are placed where there is likely to be the greatest attrition, many being on the inner sides of tendons, between these and the bones, while others cover not only the inner, but the outer sides of tendons, or, are interposed between them and external parts, as well as between those, and bones. Some of them are also, found where a bone plays against a ligament, or one bone upon another.

Where two or more tendons are contiguous, and afterwards separate from each other, we generally find a bursa divided into branches.

An example of a bursa, *between bones*, is found in that between the clavicle, and coracoid process of the scapula :

Between *ligament* and *bone*, as in that between the acromion and ligaments of the humerus :

Between *tendon* and *ligament*, as between the tendon of the psoas, iliacus internus, and ligament of the hip-joint :

Between *two tendons*, as between the extensores carpi longior, and brevior :

Between a *tendon*, and *its sheath*, as within the sheaths of the tendons of the fingers and toes :

Between *tendon* and *cartilage*, as between the tendon of the superior oblique muscle of the eye, and its cartilaginous pulley : and

Between *tendon* and *bone*, as between the biceps flexor cubiti, and radius.

OF THE ARTICULATIONS OF THE HEAD, SPINE, AND THORAX.

ARTICULATION OF THE LOWER JAW.

The articulation has *two lateral ligaments*, a capsule of *synovial membrane*, and an *inter-articular cartilage*.

1. *External lateral ligament.*—Consists of strong perpen-

dicular fibres, which arise from the posterior extremity of the zygoma, descend upon the synovial capsule, and are inserted into the outer side of the neck of the lower jaw.

2. *Internal lateral ligament.*—Consists of a thin tendinous layer which arises from the styloid process of the temporal bone, passes obliquely downwards, outwards, and forwards, and is attached to the lower jaw, below the posterior maxillary foramen.

3. *Synovial membrane.*—Forms a double sac, one of which is above, and the other below the inter-articular cartilage. It is continued above, to the edge of the glenoid cavity, and below, to the circumference of the condyloid process of the lower jaw, being so united, in the interval, to the inter-articular cartilage, that the two cavities have no communication with each other. It is so loose as to admit of considerable and easy movement of the lower jaw.

4. *Inter-articular cartilage.*—Is of an oval figure, and is placed horizontally. It is hollowed out both above and below, and is thicker at the circumference than in the centre, and thicker behind than before, so as to adopt its upper surface to the articular eminence, and glenoid cavity of the temporal bone.

Ligament of the jaw, and os hyoides.

Besides these ligaments, there is a process of condensed cellular membrane intermixed with some ligamentous fibres, (*ligamentum stylo-mylo-hyoideum*) which passes from the extremity of the styloid process, to the posterior edge of the angle of the lower jaw, and thence, sends a rounded elongation to the appendix of the os hyoides.

ARTICULATION OF THE HEAD WITH THE FIRST AND SECOND VERTEBRÆ, AND OF THESE VERTEBRÆ WITH EACH OTHER.

In order to display the connexion of these parts, the head with the first and second vertebræ should be separated from the rest of the spine. The occipital bone should then be cut so as to lay open the foramen magnum behind, and the vertebral canal should be opened by cutting away the back part of the arches of the first and second vertebræ.

The ligaments which connect the occiput to these vertebræ, are

I. *Between the occiput, and atlas.*

1. *Anterior ligament.*—Is a continuation of the anterior ligament of the spine. It is a broad ligamentous expansion which is continued from the anterior arch of the atlas, to the anterior edge of the foramen magnum.

2. *Posterior ligament.*—Is a similar broad but thinner ligamentous expansion, which is extended between the posterior arch of the atlas and the posterior edge of the foramen magnum.

3. *Capsular ligament.*—The Capsular ligaments are attached to the articular processes of both bones; and their formation is assisted by the *synovial membrane,* which is in contact with those portions of bones.

II. *Between the occiput, and the vertebra dentata.*

1. *Perpendicular ligament.*—Extends from the point of the dentiform process of the second vertebra, to the edge of the foramen magnum. It consists of straight fibres, which are frequently not very strong nor distinct.

2. *Lateral ligaments.*—Arise from the sides of the processus dentatus; they pass obliquely upwards and outwards, and are fixed to the inner edge of the foramen magnum. They are short, but strong, and have a rounded form.

III. *Between the atlas, and vertebra dentata.*

1. *Transverse ligament.*—Is composed of transverse fibres, which arise from one side of the atlas, pass across behind the processus dentatus, and are fixed to the opposite side of the atlas. Between it and the dentiform process, is a synovial capsule.

The edges of this ligament extend upwards and downwards, and form two processes called its *appendices,* which are fixed to the foramen magnum and processus dentatus.

The articulating surfaces are connected by loose synovial membranes, which are strengthened on the exterior by ligamentous fibres, which extend between the bones.

ARTICULATIONS OF THE VERTEBRÆ IN GENERAL.

1. *Anterior common ligament.*—Is a strong ligamentous band, composed of longitudinal fibres, which extend from the forepart of the foramen magnum along the forepart of the bodies of the vertabræ, and anterior surface of the sa-

crum, as far as the os coccygis. It is thicker upon the fore-part of the vertebræ than at the sides, and is more considerable in the middle of the vertebræ than towards the inter-vertebral substance. It is thinnest on the uppermost lumbar, and lowermost cervical vertebræ, in order to allow a greater degree of motion of those parts. Besides the perpendicular, there are oblique decussating fibres which run between the bodies of the vertebræ upon the inter-vertebral substance, and are sometimes distinguished by the name of *crucial intervertebral ligaments.*

2. *Posterior common ligament.*—Extends along the posterior surfaces of the bodies of the vertebræ within the vertebral canal, from the foramen magnum to the lower part of the lumbar vertebræ. Its breadth diminishes irregularly from above to below. In its descent, it becomes broader over each of the inter-vertebral substances, diminishes between them upon the bodies of the vertebræ, and adheres firmly to their upper and under edges. It prevents the spine from being bent too much forwards.

3. *Inter-spinous ligaments.*—Consist of thin membranous processes, extended between the bodies of the spinous processes, and of small rounded ligaments extended between the extremities of those processes.

4. *Inter-transverse ligaments.*—Are small ligaments extended between the transverse processes of the undermost dorsal vertebræ.

5. *Cervical ligament.*—Arises from the external perpendicular spine of the occipital bone, descends on the back part of the neck, and adheres to the spinous processes of the cervical vertebræ. It is also called *ligamentum nuchæ.*

6. *Intervertebral substances.*—Are the principal means of connexion between the bodies of the vertebræ. They are highly elastic, and of a ligamento-cartilaginous structure, and are composed of concentric layers, the edges of which are firmly fixed to the bodies of the vertebræ. The lamellæ, which decussate, are united to each other by fibres passing between them. Between the layers a soft gelatinous and incompressible substance, is interposed ; it is in small quantity at the circumference, but increases towards the centre where it is almost fluid, and has so little compressibility as to serve as a pivot for the motions of the spine.

The strength of this structure is such, that, under injury to the spine, it is found that the bone will break sooner than this substance will give way. The intervertebral substances are thicker in the centre than at the circumference, and their thickness increases from above downwards.

7. *Elastic ligaments.*—The arches of the vertebræ are connected by means of a very elastic and yellowish ligamento-cartilaginous structure. This substance fills up the spaces between the arches, completes the back part of the vertebral canal, and affords a very strong mode of union, which, at the same time, admits of a considerable degree of motion.

8. *Capsules of the articular processes.*—The surfaces of the articular processes are covered with cartilage, and are provided with capsules of synovial membrane, which are strengthened on the exterior by ligamentous fibres.

ARTICULATIONS OF THE RIBS.

I. *Of the ribs with the vertebræ.*

1. *Of the heads.*—The articulating surfaces are received into the cavities formed for them, in the two adjoining vertebræ, and are connected by means of a synovial membrane, and by bands of ligamentous fibres, which extend on the anterior and posterior part of the joint.

2. *Capsules of the tubercles.*—Consist of synovial membrane, which connects the articulating surfaces of the tubercles, with those of the transverse processes of the vertebræ. They are more loose than those of the heads.

3. *External transverse ligaments.*—Are strong ligamentous bands which arise from the extremity of each transverse process, pass transversely outwards, and are attached to each tubercle.

4. *Internal ligaments of the necks of the ribs.*—Arise from the lower part of each transverse process, and descending obliquely become fixed to the neck of each rib, below that with which the process is connected.

5. *External ligaments of the necks of the ribs.*—Arise from the transverse processes externally, descend obliquely in an opposite direction to that of the former ligaments, and are attached to the upper and outer part of the necks of the ribs.

II. *Of the ribs with the sternum.*

The greater number of the ribs are connected with the sternum, either mediately, or immediately, by means of their cartilages. The cartilage of the first rib is inseparably united with the uppermost bone. The cartilages of the six lower true ribs, are adapted by articular surfaces, and are connected by means of capsules of synovial membrane. These are strengthened on the exterior by ligamentous bands, which arise from the extremities of the cartilages, are continued before and behind the articulation, and spread upon the sternum. There are also shining ligamentous bands, which extend upon the cartilages and connect them together.

LIGAMENTS OF THE STERNUM.

Membranes of the sternum.—Are firm aponeurotic expansions, composed of fibres which run in different directions, but chiefly in a longitudinal one, and cover the anterior and posterior surfaces of the bone.

THE JOINTS OF THE UPPER EXTREMITY.

The joints of the upper extremity are.—1. Those of the bones of the *shoulder*, including that of the *sternal* extremity of the *clavicle* with the the trunk, and that of the *scapular* extremity, with the scapula.—2. *The shoulder joint.*—3. *The elbow joint.*—4. *The joints of the radius and ulna.*—5. *The wrist joint.*—6. *The joints of the hand.*

ARTICULATIONS OF THE BONES OF THE SHOULDER.

I. *Of the sternal extremity of the clavicle.*

The sternal extremity of the clavicle is received into a depression of the uppermost bone of the sternum, with which it is connected; but it is attached also by ligament to the clavicle of the opposite side, and to the first rib. The parts which form the articulation are situated superficially, so that its situation, form, and motion, are in a great degree manifest before the integuments have been removed.

1. *Interclavicular ligament.*—Is formed of transverse fibres, and extends from the one clavicle to the opposite. It is attached to the upper bone of the sternum, above which it rises in the form of a thin edge. It connects, therefore, the two clavicles with each other, and with the sternum, and prevents the former from being carried too far backwards.

2. *Rhomboid ligament*.—Is so named from its figure. It is attached above, to the rough surface at the under and fore-part of the *clavicle*, and is fixed below, to the cartilage of the *first rib*. It fixes the clavicle, and moderates its motions.

3. *The sterno-clavicular articulation* is surrounded by ligamentous fibres, which are distinct, more especially, on the anterior and posterior parts, and are attached to the bones about the articulating surfaces. Those before are the strongest; those behind, from their direction, have been called the *radiated* ligament.

4. *Inter-articular cartilage.*—It is found between the articulating surfaces, and divides the joint into two cavities. It is thin in the centre and thick at the circumference, being hollowed out in both surfaces.

5. *Synovial membranes*.—There are *two capsules* formed by synovial membrane, which correspond to the divisions of this joint by the inter-articular cartilage.

II. *Ligaments of the scapular extremity of the clavicle.*

The connexion of the clavicle to the acromion of the scapula is by means of a *scapular ligament*, and several *accessory ligaments*. This articulation, like the former, is situated so superficially, as to admit readily of examination beneath its common coverings.

1. *Capsular ligament*.—Is attached to the bones near the articular surfaces. It is short, and strengthened by strong transverse fibres on the exterior, more especially, at the upper part.

Within this capsule is sometimes found a small *inter-articular cartilage*.

There are, besides, two ligaments which pass from the *clavicle* to the *coracoid process*; they are intimately connected with each other, and are only distinguished by the different direction of their fibres, viz.

2. *The coracoid ligament*, which passes from the root of the *coracoid process*, and is fixed to a projection, called the *tubercle*, on the posterior edge of the clavicle: and,

3. *The trapezoid ligament*, which is situated exterior to the former. It extends from about the middle of the convexity of the carocoid process, passes more transverse-

ly, and is attached farther out, to the under surface of the scapular extremity of the clavicle.

III. *Proper ligaments of the scapula.*

1. *Anterior, or triangular ligament.*—Is broad, flattened, and of a triangular figure. Its broad extremity is attached to the convexity of the *coracoid process*; it becomes gradually narrower, and is fixed to the posterior edge of the *acromion*. It is sometimes formed by two separate bundles, united by a membranous substance. From its edge, a layer of dense cellular membrane extends under the deltoid muscle, and projects over the shoulder-joint. It thus assists in preventing a displacement of the *os humeri* upwards.

2. *Posterior ligament.*—Is stretched across the semilunar notch, from the *superior costa* to the root of the *coracoid process* of the scapula, and forms that depression into a passage, for the superior dorsal vessels, and nerve of the scapula.

Besides these, there is a band from the root of the *acromion* to the edge of the *glenoid cavity*, and another, which extends from the root of the *coracoid process*, and is also fixed to the lip of the bone which bounds that *cavity*.

THE SHOULDER JOINT.

The shoulder-joint is surrounded by thick and strong muscles, which, more especially, contribute to give figure to this joint externally; of these the deltoid, which is the principal, covers the articulation, and gives, in a muscular person, a well marked rotundity to the shoulder. From this circumstance, deformity in consequence of accident is not so easily detected, and the parts which form the articulation cannot be readily handled, so as to determine the nature and degree of any injury which may have occurred. The parts about the articulation, which may be felt when surrounded by the soft parts, are the *acromion*, and less distinctly, the *coracoid process* of the scapula, and the *head* of the os humeri.

1. *Capsular ligament.*—Is in the form of a loose bag, which is attached above, to the circumference of the *glenoid cavity*, and below, to the *neck* of the os humeri, and incloses the *head* of that bone. It is made up of fibres, closely interwoven with each other. It is strongest above, and thinnest on the inner side. It is strengthened above, by the tendon

of the *supra-spinatus*, and behind, by the tendons of the *infra-spinatus*, and *teres minor muscles*. At the under and forepart, at its edge, is a small aperture for the passage of the tendon of the *long head* of the biceps, and the capsular ligament sends off a process to inclose the tendon in its descent.

2. *Synovial membrane*.—It lines the capsular ligament, and is continued upon the articular surfaces of the scapula, and os humeri. A *process* is extended into the groove for the tendon of the *biceps*, and is then reflected upwards, round the tendon.

3. *Glenoid ligament*.—Is a projecting ring of ligamento-cartilaginous substance, which is attached to the circumference of the *glenoid cavity*, and thereby renders it deeper.

The tendon of the *long head* of the biceps answers somewhat the purpose of a ligament, in restraining the motions of the head of the os humeri ; like the round ligament in the hip joint.

THE ELBOW JOINT.

The bones which enter into the composition of this joint, are the *os humeri*, the *radius*, and the *ulna* ; and the parts of these bones connected with the joint are :—Of the *os humeri*, the *two condyles*, the double *articular surface*, and the *anterior*, and *posterior depressions* : of the *ulna*, the *olecranon*, the *coronoid process*, and the *sigmoid cavity* : of the *radius*, the *head*. These articular surfaces are covered with cartilage.

The external form of the joint is determined, in a great measure, by the muscles which surround it ; as the flexors of the forearm anteriorly ; the flexors of the hand and fingers and the pronator, below and before the inner condyle; the extensors of the hand and fingers and the supinator, about the outer condyle. These muscles conceal much of the articulation, and, thereby, often render the detection of the kind of injury, which may have occurred at this joint, difficult. The parts which may be felt are .—the olecranon, which is subcutaneous, and the inner condyle ; and less distinctly, the outer condyle, between the extensors of the hand and fingers. The coronoid process is distinguished, with difficulty, in the depression at the upper part of the forearm, between the flexors and extensors.

1. *Internal lateral ligament.*—Is fixed above, to the fore-part of the inner condyle of the os humeri, then descends, spreading upon the inner side of the synovial capsule, and is attached below, to the inner side of the *coronoid* process of the ulna.

2. *External lateral ligament.*—Resembles the former, and is stretched between the forepart of the outer condyle of the os humeri above, and the coronary ligament surrounding the *neck* of the radius below.

3. *Anterior and posterior ligaments.*—Are broader, but thinner than the lateral ligaments, and consist of fibres which are spread irregularly upon the fore and back parts of the capsule.

4. *Synovial membrane.*—It extends from the articular surfaces of the os humeri ; before, from above the anterior depression, and behind, from above the posterior depression, to the articular surfaces of the radius and ulna. The portion attached to the radius descends as far as the neck, so that the head is loosely surrounded by the *synovial capsule.* On the ulna, it is extended to the greater and less sigmoid cavities. The *synovial capsule* is looser before, and behind, than at the sides. In the posterior depression of the os humeri, and at other parts of the joint, a quantity of fatty matter is found.

ARTICULATIONS OF THE RADIUS, AND ULNA.

The *head* of the *radius* is received into the smaller *semilunar cavity* of the *ulna* above ; and the extremity of the *ulna* is received in a depression of the *radius* below. The surfaces in contact are covered by cartilage, so as to admit of motion ; and ligaments are found at these parts for the purpose of moderating such motion. There is besides, a broad ligamentous expansion filling up the space between the two bones.

1. *Coronary, or annular ligament.*—Is extremely firm and strong, and is composed of transverse circular fibres. It arises from the forepart of the *small semilunar depression* of the *ulna*, and, after surrounding the *neck* of the *radius*, is fixed to the opposite extremity of that cavity. It is intermixed with fibres of the anterior and posterior, and of the external lateral ligaments above, but is terminated by an edge below.

2. *Oblique ligament.*—Is attached above to the *tubercle,* or a rough spot below the coronoid process of the ulna. It extends obliquely downwards to the radius, and is fixed to the lower part of the *tubercle* of that bone.

3. *Interosseous ligament.*—Connects the *radius* and *ulna,* through the greater part of their length, and is extended between the sharp ridges of these bones. It is broadest in the middle, and is composed of fibres, which run obliquely downwards and inwards. At different parts, there are openings for the passage of vessels ; the most remarkable of which are above and below.

4. *Sacciform capsule.*—The under extremity of the ulna, is attached to the radius, by a *synovial capsule,* which surrounds the articular surfaces of both bones, and is strengthened on the exterior by ligamentous fibres.

THE WRIST JOINT, OR ARTICULATION OF THE BONES OF THE FOREARM, WITH THOSE OF THE CARPUS.

The bones, which are here articulated with each other, are the *radius,* and *ulna,* with the three first bones of the upper row of the carpus, the *scaphoides, lunare,* and *cuneiforme.* They are connected by means of a *capsule,* and *accessory ligaments ;* but the extremity of the *ulna* does not form a part of the joint, owing to the intervention of an *inter-articular* cartilage. The parts of this joint, being surrounded only by tendons, are superficial, and therefore, readily admit of examination : the parts, which are the most prominent, are the *styloid processes* of the *radius,* and *ulna.*

1. *Anterior and posterior ligaments.*—Are formed of strong fasciculi of oblique and perpendicular fibres. They are attached above, to the margin of the articular surface of the *radius, styloid process* of the *ulna,* and inter-articular cartilage, and are fixed below, to the *three first bones* of the *carpus.*

2. *Inner lateral ligament.*—Is attached above to the *styloid process* of the ulna, is connected with the posterior ligament, and is fixed below to the posterior surface of the *cuneiform,* and to the *pisiform* bones.

3. *Outer lateral ligament.*—Is attached above to the *styloid process* of the radius, and is fixed below to the *scaphoid* bone.

4. *Interarticular cartilage.*—It is placed between the extremity of the *ulna*, and the *cuneiform* bone. It is firmly connected with the cartilage covering the end of the radius, and is loosely attached to the *styloid process* of the ulna. It is hollowed above and below. The *synovial membrane* in the wrist joint, is attached to its under surface, and the sacciform capsule, to its upper surface, so that the extremity of the ulna and superior surface of the cartilage are excluded from the wrist-joint, but communicate with the articulation between the under extremities of the radius, and ulna. The proper joint of the wrist is, therefore, formed by the articular surface of the *radius*, and the inferior surface of the interarticular cartilage above, and the articular surfaces of the *scaphoid*, the *lunar*, and the *cuneiform* bones, below.

5. *Synovial membrane.*—Is connected with the articular surfaces and lines the ligaments which surround the joint.

ARTICULATIONS OF THE HAND.

I. *Articulations between the carpal bones.*

The bones of the first, and second rows of the carpus, are connected by ligaments, which resemble those of the wrist-joint.

1. *An anterior, and posterior ligament.*—Are attached to the *three first* bones of the *uppermost* row, and are fixed below to the *four* bones of the *second* row. They consist of bundles of fibres, which take different directions.

2. *Lateral ligaments.*—Situated on the inner and outer side. The outer is extended between the *scaphoides*, and *trapezium* ; the inner, between the *cuneiform*, and *unciform* bones.

3. *Articulation of the os pisiforme.*—Is by means of a separate *synovial membrane* ; and it is further connected by short *ligamentous fibres* to the *os unciforme*.

4. *Accessory ligaments.*—Besides the ligaments above described, there are various *ligamentous slips* extending in different directions, both on the palmar, and dorsal side, which assist in connecting these bones.

5. *Synovial membrane.*—It extends from the *three first* bones of the *upper* row, to the *four* of the *lower* row, sends off processes between them, and is continued to the articulations of the metacarpal bones.

II. *Articulations between the carpal, and metacarpal bones.*

The ligaments consist of slips, which run in various directions between these bones, and are strongest on the dorsal side. They are so short as only to allow of a slight yielding motion.

The ligamentous fibres of the first metacarpal bone are longer and stronger, extending from the *trapezium* upon it; and to this joint, there is a peculiar *synovial membrane.*

III. *Articulations between the metacarpal bones.*

The four metacarpal bones, which support the fingers, have smooth articular surfaces at their posterior extremities, where they are in contact with each other, and processes of the common synovial membrane of the carpus are generally extended to them. The ligaments of these bones are :—

1. *Anterior.*—Or *interosseous,* situated at the anterior extremities, or at the heads. They consist of transverse fibres, which are much stronger than the former, but are longer ; and allow, therefore, of more motion. They are placed in the palmar side of the hand, and connect the heads of the four metacarpal bones of the fingers to each other.

2. *Posterior.*—Situated at the posterior extremity, consisting of transverse fibres.

IV. *Articulations of the metacarpal bones and fingers, of the bones of the phalanges, and of the bones of the thumb.*

The capsules, and ligaments of these joints do not differ from each other. They consist of *capsules,* formed by synovial membrane, which inclose the articular surfaces, and *lateral ligaments,* situated at the sides of the joints, which adhere to and strengthen them.

THE JOINTS OF THE LOWER EXTREMITY.

The joints of the lower extremity are—1. *Those of the pelvis*—2. *The hip joint.*—3. *The knee-joint.*—4. Those of *the tibia* and *fibula.*—5. *The ankle-joint.*—6. *The joints of the foot.*

ARTICULATIONS OF THE PELVIS.

The articulations of the bones of the pelvis are formed, in part, by ligamento-cartilaginous substances, and in part, by ligaments; but distinct synovial capsules are not found.

I. *Symphysis pubis.*

The ossa pubis, where they form the symphysis, are each covered by a layer of cartilage united by a *fibro-cartilaginous substance.* The union is seldom complete, and is found to vary considerably in degree, being generally separate to a greater or less extent, with a corresponding difference in the quantity of the fibro-cartilaginous substance.

The uniting medium of the symphysis is covered by a strong *layer of ligament*, which is composed of transverse fibres. These are strongest at the lower part, and are attached to the bones of the pubes. This layer is sometimes described as a capsular ligament, and assists materially in strengthening the junction.

II. *Sacro-iliac symphysis.*

The anterior and smaller portion, of the articulating surface of each bone, is covered by a smooth cartilage. These cartilages touch each other, but are seldom completely united, and are lubricated by a slippery fluid, of a thicker consistence than synovia.

On the other hand, the posterior and larger portions are not covered by cartilage, but are firmly united by an exceedingly tough, and strong *fibro-cartilaginous structure*, which has been sometimes described as a peculiar ligament, under the name of the *sacro-iliac.*

The articulation is further strengthened by one posterior, and two anterior ligaments.

1. *Posterior.*—Consisting of perpendicular and oblique fibres forming a strong broad ligament, which passes from the posterior extremity of the spine of the ilium, to the *transverse-like* processes of the *third* and *fourth* pieces of the *sacrum*, or false vertebræ. Besides these, there are irregular *bands*, which cross in different directions, and assist in strengthening the articulation.

2. *Anterior superior.*—Is formed of oblique fibres, which pass from the posterior part of the spine of the ilium, and is fixed to the transverse processes of the *fourth* and *fifth lumbar vertebræ.* It is then triangular.

3. *Anterior inferior.*—Passes from the same part, and is attached to the transverse process of the fifth lumbar vertebra.

III. *Articulation of the os coccygis with the sacrum.*

There is a *fibro-cartilaginous substance*, interposed between the articulating surfaces of these bones, which forms a band of union between them. The articulation is strengthened by *longitudinal ligaments*, which descend from the os sacrum, spread over the os coccygis, and connect its different portions together. The ligaments at the back part, which pass between the bones are the most considerable.

IV. *Proper ligaments of the pelvis, or those which are not appropriated to the strengthening of the articulations.*

1. *Posterior sacro-ischiatic ligament.*—Situated at the under and back part of the pelvis. It arises from the transverse processes of the os sacrum, from the under and lateral part of that bone, and from the upper part of the os coccygis. It passes downwards and forwards, becomes considerably narrower and thicker, and is fixed to the *tuberosity* of the ischium.

2. *Anterior sacro-ischiatic ligament.*—Is the smaller of the two. It arises from the same parts anterior to the former, passes forwards across it, and is fixed to the *spinous process* of the ischium. This ligament divides the sacro-ischiatic notch.

3. *Obturator ligament*—Is a thin ligamentous expansion composed of irregular fibres, which adhere to the margin of the foramen thyroideum, and fill the whole of that opening, except at the upper and outer part, where a passage is left for the obturator vessels and nerve. This opening is remarkable from its admitting, occasionally, of the descent of a hernia.

THE HIP-JOINT.

The hip-joint is surrounded by thick and strong muscles, which contribute principally to give figure to this joint externally. From this circumstance, some difficulties arise in the examination of this joint under accident or disease; it furnishes, however, a stronger reason for acquiring an intimate acquaintance with the form and proportions of the part, in its natural and healthy state. The joint is composed of the *os innominatum*, and *os femoris*, and the parts connected with it are :—of the *os innominatum*, the *acetabulum* ; and of the *os femoris*, the *head*, *neck*, *trochanter major*, and *trochanter minor*. The only part which can be felt before the coverings have been removed is the trochanter major : but the joint itself is the least covered anteriorly.

1. *Capsular ligament.*—Is the largest and most complete of any in the body. It is attached above, to the outside of the brim of the acetabulum, it surrounds the head and neck of the os femoris, round the latter of which it is firmly connected. The external part is extended farther down than the internal, which is fixed to the neck by several separate bands or fræna. It is strongest at the upper, outer, and forepart, is composed of several layers of strong longitudinal fibres, and is strengthened by the surrounding muscles.

2. *Fibro-cartilaginous ligament of the acetabulum.*—Is seen on cutting open the capsular ligament. It is composed of a ligamento-cartilaginous substance, which surrounds and is attached to the brim of the acetabulum. It is stretched across the breach in that cavity, so as to complete its edge, and increases the depth of the whole cavity. The breach is filled up by strong ligamentous bands.

3. *Round ligament.*—Arises by a broad flat attachment from the under and inner part of the cavity of the acetabulum. It passes upwards, becomes rounder, and is fixed by a broad attachment to the pit on the inner surface of the head of the os femoris. It is composed of longitudinal fibres, which are continued with the cartilaginous lip of the acetabulum.

4. *Synovial membrane.*—Is continued from the acetabulum over the cartilaginous brim, lines the capsular ligament, and descends to the outer part of the neck, reaching farther down before than behind. It is then reflected back, and covers the neck to the cartilage of the head. The ligamentum teres is included, also, in a process of synovial membrane.

The greater part of the acetabulum is covered by cartilage except at its under and middle part, which is the deepest, and contains a considerable quantity of fat.

THE KNEE-JOINT.

This joint is situated superficially. Its figure is principally produced by the form of the bones which enter into its composition. It readily, therefore, admits of examination; and alterations in its form from accident, or disease, are detected without difficulty. It is composed of the *os femoris*, the *tibia*, and the *patella*; and the parts of these connected with the joint are:—of the *os femoris*, its *condyles, their articular surfaces*, and the *depression* between them: of the *tibia*, its *head*, the *two articular surfaces*, and the *tubercle*: of the *patella*, its *articular surfaces*.

The knee-joint is more complicated in its structure than any other joint of the body, in consequence of the number and disposition of its ligaments, which are situated both internally and externally, and are calculated to afford great strength to the articulation; and, besides these, by interarticular cartilages, which increase and deepen the surfaces of articulation.

I. *Ligaments situated externally.*

1. *Inner lateral ligament.*—Is the strongest of these. It arises from the fore and inner part of the inner condyle of the os femoris, and is attached below, to the upper part of the inner surface of the tibia. It is composed of perpendicular fibres, and is broader above than below.

2. *Long external lateral ligament.*—Is a narrow, rounded, but strong ligament, and is situated before the short. It arises from the outer part of the outer condyle, and is fixed below, to the fore and outer part of the head of the fibula.

3. *Short external lateral ligament.*—Is less considerable than the former, and is situated behind it. It arises from the posterior part of the outer condyle, passes obliquely downwards, and is attached below to the head of the fibula.

4. *Posterior ligament.*—Is formed of irregular bands, which arise from the upper and back part of the outer condyle of the os femoris, descend obliquely, and are fixed below to the inner and back part of the head of the tibia.

5. *Ligament of the patella.*—Is placed anteriorly, and is of great strength and size. It arises from the depression behind the apex of that bone, and is fixed below to the tubercle at the upper and forepart of the tibia. By means of this

ligament, the muscles inserted into the patella exert their action also on the tibia, in the extension of the leg.

II. *Capsule of synovial membrane.*

It arises from the whole circumference of the under end of the os femoris ; anteriorly, a little above the margin of the articulating cartilage, and posteriorly, immediately above it. From this it descends, and is fixed round the head of the tibia, and into the margin of the articulating surface of patella, so that this bone projects somewhat into the cavity, and forms a part of the boundary of the joint. It is lost upon the articular cartilage of these parts. At the upper and forepart, it lines, also, the under part of the extensors of the leg, and is connected to the other surrounding parts by a loose cellular texture.

The synovial membrane forms a fold, on each side of the patella, in which are some ligamentous fibres called the *alar* ligament. Another fold is extended from the patella to the depression in the os femoris, and called the *mucous* ligament.

Depositions of adipose substance are found at different parts of the joint—for instance, about the circumference of the patella, in the above mentioned fold, and between the projections of the thigh bone.

III. *Ligaments situated internally.*

These are the *crucial* ligaments, which most essentially contribute to strengthen the junction of the os femoris with the tibia. They arise from the depression between the condyles, and are so called from crossing each other. They are covered by the synovial membrane, but, in fact, are situated externally to it.

1. *Anterior crucial ligament.*—Arises from the inner side of the outer condyle of the os femoris ; it passes downwards, inwards, and forwards, crossing the posterior ligament, and is fixed below, to a depression on the forepart of the head of the tibia, between the articulating surfaces.

2. *Posterior crucial ligament.*—Is stronger and broader than the former ; it arises from the outer side of the inner condyle of the os femoris, passes downwards, outwards, and backwards, and is fixed to a depression on the back part of the head of the tibia : a bony protuberance separating it from the insertion of the former.

IV. *Inter-articular cartilages.*

The semilunar cartilages.—They are so named from their figure, and are broader behind than before ; their outer convex edge is thick, while the inner concave edge is thin and sharp ; they are hollowed out above, so as to render the sockets for the condyles of the os femoris deeper ; are more or less flat below ; and they cover about two thirds of the tibia. The inner edge is unattached, the outer is fixed to the circumference of the head of the tibia, by means of the capsule of the joint ; their extremities are attached by strong fibrous bands to the protuberance between the articulating surfaces on the head of the tibia.

The anterior extremities of these cartilages are connected by a strong transverse band, called the *transverse ligaments.*

THE TIBIA AND FIBULA.

I. *Superior articulation.*

The head of the fibula is connected to the tibia by means of a short *capsule* of synovial membrane, which is strengthened on the exterior by *ligamentous bands*, extended obliquely between the bones. The articular surfaces of the bones are covered by a smooth cartilage.

II. *In the middle.*

The tibia and fibula are connected by the *interosseous ligament.* It is a thin expansion, one edge of which is fixed to the outer and posterior angle of the tibia, the other to the corresponding ridge of the fibula. It occupies the spaces between the two bones, and is composed of oblique fibres. It has an opening above, for the passage of the anterior tibial vessels, and is perforated, besides, in various parts for the passage of vessels and nerves.

III. *Inferior articulation.*

It is formed by the adaptation of the articular surfaces of the tibia and fibula, between which a duplicature of synovial membrane is extended from the ankle joint, and by a strong ligament before and behind.

1. *Anterior.*—It arises from the outer and forepart of the extremity of the tibia, and is attached to the outer malleolus of the fibula.

2. *Posterior.*—Is stretched between the corresponding points of the tibia and fibula, in the posterior part.

THE ANKLE-JOINT.

The bones which enter into the composition of this joint are the *tibia*, the *fibula*, and the *astragalus*. The parts of these bones, connected with the articulation, are the *malleolus externus*, the *malleolus internus*, the *articular surfaces* of the *tibia* and *fibula*, and the *pulley-like articular surface*, and the *lateral articular surfaces* of the *astragalus*; all of which are covered by smooth cartilage. The parts which may be distinguished before the integuments have been removed, are the malleoli; but, in consequence of being surrounded only by ligaments and tendons, the joint is so superficial, that alterations in its form or motions are readily detected.

I. *Ligaments which connect the bones of the leg with those of the tarsus, namely, with the os calcis, the astragalus, and the os naviculare.*

1. *Deltoid ligament of the tibia.* It arises from the malleolus internus, spreads as it descends, and is attached below to the astragalus, the os calcis, and the os naviculare.

2. *Anterior ligament of the fibula.* It arises from the anterior part of the outer malleolus, and passing obliquely forwards and inwards, becomes fixed to the fore and outer part of the astragalus.

3. *Middle, or perpendicular ligament of the fibula.* It arises from the extremity of the outer malleolus, and after descending nearly perpendicularly, is fixed below to the outer side of the os calcis.

4. *Posterior ligament of the fibula.* It arises from the inner and back part of the outer malleolus, passes nearly transversely inwards, and is attached to the back part of the astragalus.

Besides these ligaments, the joint is further strengthened by *ligamentous fibres*, which extend upon the capsule, from the tibia to the astragalus.

II. *Synovial membrane.*

Arises from the margin of the articular surfaces of the tibia and fibula, and is attached to the circumference of the articular surfaces of the astragalus.

THE FOOT.

Of the tarsal bones.

The bones of the tarsus are firmly united by strong ligaments situated between the bones on the dorsal, and plantar, as well as on the inner, and outer sides of the foot ; and they are distinguished by names, designative of their situation, and the bones which they connect. The applied surfaces of these bones are covered by cartilage, and included in synovial capsules ; that which connects the first with the second row being the most remarkable of these articulations.

1. *Of the astragalus and os calcis.*

Between the inferior surface of the astragalus and the upper part of the os calcis, there is a distinct synovial capsule : in addition to which, there are strong ligaments uniting these bones. They are as follows :—

1. *Interosseous ligament.*—This consists of strong fibres, passing between the corresponding grooves, which divide the opposite articular surfaces, of these bones.
2. *Posterior ligament.*—It passes from the back part of the astragalus, to the inner and back part of the os calcis.
3. *Anterior ligament.*—Passes from the inner part of the astragalus, to the inner and fore part of the os calcis.

II. *Of the first and second rows of the tarsal bones.*

There is a common *synovial membrane*, which incloses the opposed articular surfaces of the *astragalus*, the *os naviculare*, and the *os calcis*, and there is a distinct *synovial membrane* which includes the articular surfaces of the *os calcis*, and the *os cuboides*. These bones are connected by the following ligaments.

Ligament between the astragalus, and os naviculare.

Superior or dorsal ligament.—It passes from the upper part of the astragalus to the upper part of the os naviculare.

Ligaments between the os calcis, and os naviculare.

1. *External ligament.*—It passes from the forepart of the os calcis, to the outside of the os naviculare.

2. *Inferior or plantar ligament.*—This very strong ligament passes from the under and forepart of the os calcis, to the under part of the os naviculare.

Ligaments between the os calcis and os cuboides.

1. *Superior or dorsal.*—It consists usually of several bands, which pass between the upper edges of the bones.

2. *External.*—Is extended on the outside between these bones.

3. *Inferior plantar.*—Is the strongest of the tarsal ligaments. It passes at the under surface of the bones.

Ligaments between the os naviculare, and os cuboides.

1. *Interosseous ligaments.*—A band of short transverse fibres which passes in the space between the bones.

2. *Superior or dorsal ligament.*—Passes from the outer edge of the os naviculare, to the upper surface of the os cuboides.

3. *Inferior or plantar ligament.*—From the under part of the os naviculare, to the inner edge of the os cuboides.

III. *Of the second row of tarsal bones.*

Ligaments between the os naviculare, and the three ossa cuneiformia.

These bones are connected by *ligamentous bands,* both above and below, passing irregularly from the os naviculare to each of the bones. They are severally distinguished, as the *plantar,* and *dorsal ligaments.* Besides these, there is a *synovial capsule,* between the *os naviculare* and the *ossa cuneiformia,* and penetrating the interspaces of the three latter bones.

Ligaments between the os cuboides, and the os cuneiforme internum.

These likewise consist of *plantar,* and *dorsal* ligaments, and there is a distinct *synovial membrane.*

Ligaments between the ossa cuneiformia.

Consist of irregular bands, called the *interosseous,* the *plàntar,* and the *dorsal* ligaments. Their synovial membrane is noticed above, as occupying the interspaces of these bones.

IV. *Of the tarsal and metatarsal bones.*

Between the inner cuneiform bone, and the base of the first metatarsal bone, a distinct *synovial membrane* is commonly found. Another, and separate *synovial membrane* includes the articular surfaces of the second metatarsal bone, and the ossa cuneiformia.—A third *synovial membrane* is found between the articular surfaces of the third cuneiform, and third metatarsal bone; and the articular surfaces of the fourth and fifth metatarsal bones are inclosed in a common capsule, which contains, likewise, the anterior surface of the os cuboides.

The *ligaments* which unite the metatarsal bones to those of the tarsus, consists of irregular bands, both on the upper and under surface, called *dorsal*, and *plantar*.

The ligaments connecting the metatarsal bone to each other, the articulations between the metatarsal bones, and those of the first phalanx, and the articulations between the bones of the toes, so nearly resemble the corresponding articulations in the hand, that it is not considered necessary to particularize their structure.

THE DISEASES OF LIGAMENTS, CARTILAGES, &c.

Ligaments.—Ligaments are serous membranes, and subject to all the diseases of membranes of a similar structure.

They are also frequently torn, more especially, those of the extremities, in cases of dislocation of the bones. *Subluxation*, or sprain, is an injury occurring to the ligaments, or tendons surrounding a joint, which are either forcibly stretched, or lacerated—It is usually caused by the sudden extension of a joint in a direction, which the muscles are unprepared for, in the same manner as when dislocation is produced, only, that the violence is not sufficient to produce displacement of the bones.

Ligaments are frequently *inflamed*, and become exquisitely sensible, are much *thickened*, and sometimes *suppurate*.

They are likewise, often rendered rigid by *gout*, and *rheumatism*.

The ligaments are often reduced to a thickened and spongy state by *scrophula*. They are also sometimes *ossified*.

Cartilages.—Cartilages are rendered thinner by pressure, hence, by long continued pressure on one side, the body is thrown off its balance, and the foundation of a permanent curvature of the spine may be laid.

The cartilages are often converted into *bone*, or ossified, especially in old people.

Unnatural and *loose pieces* of cartilage, are also, sometimes, found within the knee-joint.

By scrophula, the cartilages become softer, and are absorbed.

Synovial membrane.—The parts secreting the synovia are frequently much injured by external violence.

In cases of sprains, bruises, rheumatism, and gout, an *unnatural quantity* of synovia is secreted within the knee-joint. On the other hand, the liquor is sometimes secreted in *too small a quantity*, and is said to give rise to the crackling noise which is often observed in the joints of old people.

Anchylosis also, has been said to originate in a defect of the synovia which is secreted in smaller quantity than usual, in consequence of the limb not being moved ; a condition that is succeeded by inflammation, and accretion of the articular cartilages.

Bursæ Mucosæ.—The organic derangements of the bursæ which are serious membranes, resemble those of ligaments, and similar textures in other parts of the body.

PART III.

THE MUSCLES.

This division of the anatomy is called *myology* ; and the name of *muscular system* is given to the whole of the muscles taken collectively.

There is infinite variety in the form, disposition, &c. of the muscles.

A *muscle* is composed of a number of fasciculi, or bundles of fibres, which are again divisible into others still smaller. When a filament is so small, as to be no longer divisible, by any of our means of division, it is called *muscular fibre*. This fibre is longer, or shorter, according to the muscles to which it belongs. It always preserves a straight line, and does not divide, nor become confounded with other fibres of the same kind. It is covered by a fine cellular tissue, easily torn in the dead body, but possessed of an astonishing resistance in the living.

Every muscular fibre is fixed by its two extremities to fibrous prolongations, tendons, or aponeuroses, which are the conductors of its power when it contracts.

By the *origin* of a muscle, is meant that end of it at which fibres commence, and towards which their contraction is made ; while, the *insertion* of a muscle means the other extremity of it, or its attachment to that part, which, by its contraction, is drawn nearer to its *origin* The intermediate portion, which is usually fleshy, and thicker than the ends, and which swells or enlarges during the contraction of the muscle, is called its *belly*.

Tendons are white shining cords, usually, at one or both extremities of a muscle, (there are numerous exceptions to this) appearing as a condensation of the body of the muscle, into a tissue resembling ligament. They are of great strength, and capable of great extensibility.

The term *aponeurosis*, is used to express an expansion of tendinous substance, which grows thinner and thinner, until it is at last lost in the cellular membrane. These expansions, also called *fasciæ*, are often of great size, and serve to bind muscles together, so as to keep them in their places when acting, and also, to increase their strength by compressing them.

MUSCLES OF THE EXTERIOR OF THE CRANIUM, AND FACE.

ORBICULARIS PALPEBRÆ.—*Origin.*—From the internal angular process of the frontal bone, and from a tendon at the inner angle of the eye, by a number of fleshy fibres, which pass round the orbit.

Insertion.—By a short round tendon, into the nasal process, of the superior maxillary bone.

Use.—To shut the eye, by bringing down the upper lid, and pulling up the lower.

CORRUGATOR SUPERCILII.—*Origin.*—From the internal angular process of the os frontis.

Insertion.—Into the inferior fleshy part of the occipito-frontalis muscle.

Use.—To smooth the skin of the forehead, by pulling it down, after the action of the occipito-frontalis.

OCCIPITO FRONTALIS.—*Origin.*—On each side of the head, fleshy and tendinous from the transverse ridge of the occipital bone, as far forwards as the mastoid process.

Insertion.—Into the orbicularis palpebrarum, skin of the eye-brows, and the internal angular process of the os frontis, and os nasi.

Use.—To pull the skin of the head backwards, raise the eye-brows, and corrugate the skin of the forehead.

LEVATOR PALPEBRÆ SUPERIORIS.—*Origin.*—By a small tendon, from the upper part of the foramen opticum of the sphenoid bone.

Insertion.—Into the upper eye lid, by a broad thin tendon.

Use.—To open the eye, by drawing the superior lid upwards.

ORBICULARIS ORIS.—*Origin.*—Consists of two planes of semicircular fibres, which decussate at the angles of the mouth. These fibres are formed chiefly by the muscles which are inserted into the lips; they surround the mouth.

Use.—To shut the mouth, by contracting and drawing both lips together.

Compressor naris.—*Origin.*—From the outer part of the ala nasi and neighbouring part of the os maxillare superius.

Insertion.—Into the lower part of the os nasi, and nasal process of the superior maxillary bone ; some of the fibres run obliquely to join its fellow, on the dorsum nasi.

Use.—To compress the ala towards the septum nasi, and to corrugate the skin of the nose.

Levator labii superioris, alæque nasi.—*Origin.*—By two distinct origins ; the first from the nasal process of the superior maxillary bone ; and the second, from the external orbitar process of the superior maxillary bone.

Insertion.—The first is inserted into the outer part of the ala nasi, and the second into the upper lip and orbicularis oris.

Use.—To raise the upper lip towards the orbit, and a little outwards and to raise the ala of the nose.

Depressor labii superioris alæque nasi.—*Origin.*—From the os maxillare superius, where it forms the alveoli of the dentes incisivi, and dens caninus.

Insertion.—Into the upper lip and root of the ala nasi.

Use.—To draw the upper lip and ala nasi downwards, and backwards.

Levator anguli oris.—*Origin.*—From a depression of the superior maxillary bone, betwixt the root of the socket of the first dens molaris, and the foramen infra-orbitarium.

Insertion.—Into the angle of the mouth.

Use.—To draw the corner of the mouth upwards.

Zygomaticus major.—*Origin.*—From the os malæ, near the zygomatic suture.

Insertion.—Into the angle of the mouth, appearing to be lost in the depressor anguli oris, and orbicularis oris.

Use.—To draw the corner of the mouth and under lip upwards, and outwards.

Zygomaticus minor.—*Origin.*—From the upper prominent part of the os malæ.

Insertion.—Into the upper lip, near the corner of the mouth.

Use.—To draw the corner of the mouth and upper lip obliquely upwards and outwards.

Buccinator.—*Origin.*—From the lower jaw at the root of the coronoid process, from the upper jaw at the pterygoid process of the sphenoid bone, and from the alveolar processes of both jaws.

Insertion.—Into the angle of the mouth.

Use.—To draw the angle of the mouth backwards and outwards, and to contract its cavity, by pressing the cheek inwards.

Levator labii inferioris.—*Origin.*—From the lower jaw, at the root of the alveolus of the lateral incisor.

Insertion.—Into the under lip and skin of the chin.

Use.—To raise the under lip, and skin of the chin.

Depressor labii inferioris.—*Origin.*—From the side of the lower jaw, a little above its lower edge.

Insertion.—Into the edge of the under lip.

Use.—To pull the under lip downwards.

Depressor Anguli Oris.—*Origin.*—From the lower edge of the inferior maxillary bone, at the side of the chin.

Insertion.—Into the edge of the mouth.

Use.—To pull down the corner of the mouth.

The ten muscles, last described, act in moderating the action of the orbicularis oris.

MUSCLES SITUATED WITHIN THE ORBIT.

Vide muscles of the eye. *Part VIII.*

MUSCLES OF THE EXTERNAL EAR.

These are *eight* in number, and generally, very indistinct and confused.

Attolens aurem.—*Origin.*—From the tendon of the occipito-frontalis, where it covers the aponeurasis of the temporal muscle.

Insertion.—Into the upper part of the ear, opposite the anti-helix.

Use.—To draw the ear upwards.

Anterior auris.—*Origin.*—From near the posterior part of the zygoma.

Insertion.—Into the back of the helix, opposite the concha.

Use.—To draw forwards the cartelages of the ear.

Posterior or retrahens auris.—*Origin.*—By two or three distinct fleshy slips from the back part of the mastoid process, above the insertion of the sterno mastoid muscle.

Insertion.—Into the back part of the ear opposite the concha.

Use.—To draw the ear back and stretch the concha.

HELICIS MAJOR.—*Origin.*—From the upper and acute part of the helix, anteriorly.

Insertion.—Into its cartilage, a little above the tragus.

Use.—To depress the part from which it arises.

HELICIS MINOR.—*Origin.*—From the inferior and anterior part of the helix.

Insertion.—Into the crus of the helix, near the fissure in the cartilage opposite to the concha.

Use.—To contract the fissure.

TRAGICUS.—*Origin.*—From the middle and outer part of the concha, at the root of the tragus, along which it runs.

Insertion.—Into the point of the tragus.

Use.—To pull the joint of the tragus a little forwards.

ANTITRAGICUS.—*Origin.*—From the internal part of the cartilage that supports the antitragus.

Insertion.—Into the tip of the antitragus, as far as the inferior part of the antihelix.

Use.—To turn the tip of the antitragus, a little outwards, and depress the extremity of the antihelix towards it.

TRANSVERSUS AURIS.—*Origin.*—From the prominent part of the concha, on the dorsum of the ear.

Insertion.—Opposite to the outside of the antihelix.

Use.—It draws the parts to which it is connected towards each other, and stretches the scapha and concha.

MUSCLES SUPERFICIALLY SITUATED ON THE ANTERIOR PART OF THE NECK.

PLATYSMA MYOIDES.—*Origin.*—From the cellular substance covering the upper part of the deltoid, and pectoral muscles.

Insertion.—Into the skin and muscles covering the lower jaw and cheek.

Use.—To draw the skin of the cheek downwards, and when the mouth is shut, to draw the skin under the lower jaw, upwards.

Sterno-cleido mastoideus.—*Origin.*—By two distinct origins from the top of the sternum, and from the upper and anterior part of the clavicle, where it is joined to the former bone.

Insertion.—Into the outside of mastoid process, and into the transverse ridge behind that process.

Use.—When one acts singly, it turns the head to one side. When both act together, they bend the head forwards.

MUSCLES DEEPLY SEATED ON THE ANTERIOR PART OF THE NECK.

Longus colli.—*Origin.*—From the sides of the bodies of the three superior dorsal vertebræ, and from the anterior surface of the transverse processes of the four or five lower cervical vertebræ.

Insertion.—Into the forepart of the bodies of all the vertebræ of the neck.

Use.—To bend the neck forwards, and to one side.

Rectus capitis anticus major.—*Origin*—From the anterior points of the transverse processes of the third, fourth, fifth, and sixth cervical vertebræ.

Insertion.—Into the cuneiform process of the os occipitis, little before the condyloid process.

Use.—To bend the head forwards.

Rectus capitis anticus minor.—*Origin.*—From the forepart of the body of the first vertebra of the neck, near its transverse process.

Insertion.—Near the root of the condyloid process of the occipital bone, under the last described muscle.

Use.—To bend the head forwards.

MUSCLES WHICH FIX THE OS HYOIDES.

Sterno-hyoideus.—*Origin.*—From the upper and inner part of the sternum, clavicle, and first rib.

Insertion.—Into the base of the os hyoides.

Use.—To pull the os hyoides downwards.

STERNO THYROIDEUS.—*Origin.*—From the inside of the sternum, and of the extremity of the first rib.

Insertion.—Into the inferior edge of the oblique ridge in the ala, or side of the thyroid cartilage.

Use.—To draw the thyroid cartilage, and consequently the larynx, downwards.

THYRO-HYOIDEUS.—*Origin.*—From the upper surface of the oblique ridge in the ala of the thyroid cartilage.

Insertion.—Into part of the base, and almost all the cornu of the os hyoides.

Use.—To pull the os hyoides downwards, or the thyroid cartillage upwards.

OMO-HYOIDEUS.—*Origin.*—From the root of the coracoid process, and semilunar notch of the scapula; ascends across the neck, and forms a middle tendon, where it passes below the sterno-cleido-mastoideus.

Insertion.—Into the base of the os hyoides, between its cornu and the insertion of the sterno-hyoideus.

Use.—To pull the os hyoides obliquely downwards.

STYLO-HYOIDEUS.—*Origin.*—From the middle and inferior part of the styloid process of the temporal bone; its fleshy belly is perforated by the *digastricus.*

Insertion.—Into the os hyoides, at the junction of its base and cornu.

Use.—To pull the os hyoides to one side, and a little upwards.

MUSCLES WHICH DEPRESS THE LOWER JAW.

DIGASTRICUS.—*Origin.*—From the fossa at the root of the mastoid process of the temporal bone; it passes through the fleshy belly of the stylo-hyoideus, and is fixed to the os hyoides.

Insertion.—Into a rough sinuosity, on the anterior inferior edge of that part of the lower jaw, called the chin.

Use.—To open the mouth, by pulling the lower jaw downwards, and backwards; and, when the jaws are shut, to raise the larynx, and consequently the pharynx, upwards; as in deglutition.

Mylo-hyoideus.—*Oirgin.*—From all the inside of the lower jaw, between the last dens molaris, and the middle of the chin.

Insertion.—Into the lower edge of the base of the os hyoides.

Use.—To pull the os hyoides forwards, upwards, and to either side, and to assist in depressing the lower jaw.

Genio-hyoideus.—*Origin.*—From a projection on the inside of that part of the lower jaw, which is called the chin.

Insertion.—Into the base of the os hyoides.

Use.—To draw the os hyoides forwards and upwards to the chin.

Genio-hyo glossus—*Origin*—From a rough protuberance on the inside of the lawer jaw, higher up than the origin of the genio-hyoideus ; its fibres run in a very radiated manner.

Insertion.—Into the posterior part of the base of the os hyoides, near its cornu, and the tip, middle, and root of the tongue.

Use.—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 the os hyoides forwards, and to thrust the tongue out of the mouth. When the os hyoides is fixed, it assists in depressing the lower jaw.

MUSCLES OF MASTICATION.

Temporalis.—*Origin.*—From a semicircular ridge in the lower and lateral part of the parietal bone ; from all the squamous portion 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 the muscle.

Insertion.—Into the upper part of the coronoid process of the lower jaw.

Use.—To pull the lower jaw upwards, and press it against the upper.

Masseter.—*Origin.*—By two portions which decussate one another. The anterior, from the superior maxillary bone, where it joins the os malæ, and from the lower edge of the os malæ and zygomatic process ; and the posterior, from the inferior surface of the os malæ, and of the whole of the zygomatic process.

Insertion.—The anterior portion, into the outer surface of the side of the lower jaw ; and the posterior, into the outer surface of the coronoid process of the lower jaw.

Use.—To pull the lower to the upper jaw, and to move it forwards and backwards.

PTERYGOIDEUS INTERNUS.—*Origin.*—From the inner and upper part of the internal plate, and fossa between the pterygoid plates of the sphenoid bone, and from the pterygoid process of the os palati.

Insertion.—Into the inside of the angle of the lower jaw.

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

PTERYGOIDEUS EXTERNUS.—*Origin.*—From the outer side of the external plate of the pterygoid process of the sphenoid bone ; from part of the tuberosity of the os maxillare ; and from the root of the temporal process of the sphenoid bone.

Insertion.—Into a depression in the neck of the condylord process of the lower jaw, and into the anterior and inner part of the ligament of the articulation of that bone.

Use.—When this pair of muscles act together, they bring the jaw horizontally forwards. When they act singly, the jaw is moved forwards, and to the opposite side.

MUSCLES OF THE TONGUE.

LINGUALIS.—*Origin.*—From the root of the tongue laterally ; and runs forward between the hyo-glossus and genio-hyo-glossus.

Insertion.—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.

HYO-GLOSSUS.—*Origin.*—From half of the base, and part of the cornu of the os hyoides.

Insertion.—Into the side of the tongue.

Use.—To move the tongue inwards and downwards.

Stylo-glossus.—*Origin.*—From the styloid process, and from a ligament that connects that process to the angle of the lower jaw.

Insertion.—Into the root of the tongue; runs along its side, and is lost near its tip.

Use.—To move the tongue laterally and backwards.

MUSCLES OF THE FAUCES AND SOFT PALATE.

Constrictor isthmi faucium.—*Origin.*—From the side of the tongue, near its root; thence, it runs upwards within the anterior arch, before the amygdala, or tonsil.

Insertion.—Into the middle of the velum palati, as far as the root of the uvula.

Use.—To draw the velum towards the root of the tongue, and to contract the opening into the fauces.

Palato-pharyngeus.—*Origin.*—From the root of the uvula, in the middle of the velum pendulum palati, and from the tendinous expansion of the circumflexus palati; the fibres pass along the posterior arch, and run backwards.

Insertion.—Into the edge of the upper and back part of the thyroid cartilage, and into the back part of the pharynx.

Use.—To draw the uvula and velum downwards, and backwards, and pull the thyroid cartilage and pharynx upwards.

Azygos uvulæ.—*Origin.*—From the extremity of the suture which unites the ossa palati; runs down the whole length of the velum, adhering to the tendons of the circumflexi palati muscles.

Insertion.—Into the tip of the uvula.

Use.—To raise the uvula upwards and forwards, and to shorten it.

Circumflexus palati.—*Origin.*—From the spinous process of the sphenoid bone, behind the foramen ovale, and from the Eustachian tube, near its osseous part: it forms a round tendon, which passes over the hook of the internal plate of the pterygoid process of the sphenoid bone.

Insertion.—Into the velum pendulum palati, and semilunar edge of the os palati.

Use.—To stretch the velum, to draw it downwards, and to one side.

Levator palati mollis.—*Origin.*—From the extremity of the petrous portion of the temporal bone, and from the Eustachian tube.

Insertion.—Into the whole length of the velum pendulum palati, as far as the root of the uvula, uniting with its fellow.

Use.—To draw the velum upwards and backwards, so as to shut the passage from the fauces, into the nose.

MUSCLES OF THE LARYNX.

Vide Larynx and its appendages. *Part* VIII.

MUSCLES OF THE PHARYNX.

Constrictor pharyngis inferior.—*Origin.*—From the outside of the ala of the thyroid cartilage, and from the side of the cricoid cartilage, near the crico-thyroideus.

Insertion.—Into the white line on the back part of the pharynx, where it is united to its fellow.

Use.—To compress that part of the pharnyx which it covers, and to raise it with the larynx, a little upwards.

Constrictor pharyngis medius.—*Origin.*—From the superior edge of the cornu of the os hyoides, and from the ligament which connects it to the thyroid cartilage.

Insertion.—Into the cuneiform process of the os occipitis and into a white line in the middle of the posterior surface of the pharynx.

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

Constrictor pharyngis superior.—*Origin.*—From the cuneiform process of the os ocipitis, from the pterygoid process of the sphenoid bone, from the upper and under jaw, and from the back part of the buccinator muscle.

Insertion.—Into a white line in the middle of the posterior surface of the pharynx.

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

Stylo-pharyngeus.—*Origin.*—From the root and inner part of the styloid process.

Insertion.—Into the side of the pharynx, and back part of the thyroid cartilage.

Use.—To dilate and raise the pharynx, and draw the thyroid cartilage upwards.

MUSCLES OF THE UPPER EXTREMITY.

MUSCLES WHICH ATTACH THE SCAPULA TO THE TRUNK.

Trapezius.—*Origin.*—From the lower part of the protuberance in the middle of the os occipitis behind; from the superior transverse ridge of that bone; from the five superior cervical spinous processes, by the *ligamentum nuchæ;* and tendinous, from the two inferior cervical spinous processes, and from the spinous processes of all the vertebræ of the back.

Insertion.—Into the posterior third part of the clavicle, into the acromion and into the upper edge of all the spine of the scapula.

Use.—To move the scapula in different directions. Also, to draw back the head, and contribute to its rotatory motions.

Rhomboideus major.—*Origin.*—From the spinous processes of the four or five superior dorsal vertebræ.

Insertion.—Into all the base of the scapula below its spine, as far as its inferior angle.

Use.—To draw the scapula obliquely upwards, and directly backwards.

Rhomboideus minor.—*Origin.*—From the spinous processes of three inferior vertebræ of the neck, and from the *ligamentum nuchæ.*

Insertion.—Into the base of the scapula, opposite to the triangular plane surface at the root of the spine.

Use.—To draw the scapula obliquely upwards, and directly backwards.

Levator scapulæ.—*Origin.*—From the transverse processes of the five superior vertebræ of the neck, by five tendinous and fleshy slips, which unite and form a considerable muscle.

Insertion.—Into the base of the scapula, above the root of the spine, and under the superior angle.

Use.—To draw the scapula upwards, and a little forwards.

Omo-hyoideus.—*Origin.*—From the root of the coracoid process, and semilunar notch of the scapula; ascends across the neck, and forms a middle tendon, where it passes below the sterno-cleido mastoideus.

Insertion.—Into the base of the os hyoides, between its cornu, and the insertion of the sterno-hyoideus.

Use.—To pull the os hyoides obliquely downwards.

Pectoralis minor.—*Origin.*—From the upper edges of the third, fourth, and fifth ribs, near their cartilages.

Insertion.—Into the anterior part of the coracoid process of the scapula.

Use.—To draw the scapula forwards and downwards, and, when that bone is fixed, to elevate the ribs.

Subclavius.—*Origin.*—From the cartilage of the first rib.

Insertion.—Into the inferior surface of the clavicle, and into the coracoid process of the scapula.

Use.—To draw the clavicle downwards and forwards, and perhaps to elevate the first rib.

Serratus magnus.—*Origin.*—By nine fleshy digitations, from the nine superior ribs.

Insertion.—Into the whole of the base of the spacula.

Use.—To move the scapula forwards, and when the scapula is forcibly raised, to draw the ribs upwards.

MUSCLES OF THE SHOULDER-JOINT.

Pectoralis major.—*Origin.*—From the anterior surface of the sternum, its whole length; from the cartileges of the fifth, sixth, and sometimes the seventh ribs; and from two anterior thirds of the clavicle.

Insertion.—Into the ridge of the os humeri, on the outside of the groove for the long tendon of the biceps flexor cubiti.

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

Latissimus dorsi.—*Origin.*—From all the spinous processes of the os sacrum, and of the lumbar vertebræ ; from the spinous processes of the seven inferior dorsal vertabræ ; from the posterior part of the spine of the os ilium ; and from the extremities of the four inferior false ribs.

Insertion.—Into the inner edge of the groove in the os humeri, which receives the long tendon of the biceps flexor cubiti.

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

Deltoides.—*Origin.*—From the posterior third of the clavicle ; from the whole edge of the acromion ; and from the lower margin of the whole spine of the scapula.

Insertion.—Into a triangular rough surface, on the outer side of the os humeri, near its middle.

Use.—To draw the arm directly upwards, and to move it a little forwards, or backwards, according to the different directions of its fibres.

Supra-spinatus.—*Origin.*—From all that part of the base of the scapula that is above its spine ; from the superior costa as far forwards as the semilunar notch ; from the spine itself ; and from the concave surface betwixt it and the superior costa.

Insertion.—Into the anterior and superior part of the great tuberosity, near the head of the os humeri.

Use.—To raise the arm.

Infra-spinatus.—*Origin.*—From the lower part of the spine of the scapula, as far back as the triangular flat surface ; from the base of the bone below the spine, to near the inferior angle ; from the posterior ridge of the inferior costa ; and from all the dorsum of the bone, below the spine.

Insertion.—Into the middle part of the great tuberosity of the so humeri.

Use.—To roll the humerus outwards ; to assist in raising the arm, and in moving it outwards when raised.

Teres minor.—*Origin.*—From the narrow depression between the two ridges in the inferior costa of the scapula, extending from the neck of the bone, to within an inch or two of the inferior angle.

Insertion.—Into the lower and back part of the great tuberosity of the os humeri.

Use.—To draw the humerus downwards and backwards, and to roll it outwards.

SUBSCAPULARIS.—*Origin.*—From all the base of the scapula internally; from the superior and inferior costæ; and from the whole internal surface of the bone. Its fibres converge, slide over the neck of the scapula, pass under the root of the coracoid process, and adhere to the inner part of the capsular ligament.

Insertion.—Into the smaller tuberosity, near the head of the os humeri.

Use.—To roll the os humeri inwards, and to draw it to the side of the body.

TERES MAJOR.—*Origin.*—From an oblong, rough, flattened surface, at the inferior angle of the scapula.

Insertion—Into the ridge of the os humeri, at the inner side of the groove for lodging the tendon of the long head of the biceps flexor cubiti.

Use.—To roll the humerus inwards, and to draw it backwards and downwards.

CORACO-BRACHIALIS.—*Origin.*—From the middle part of the apex of the coracoid process of the scapula.

Insertion.—About the middle of the internal part of the os humeri, into a rough ridge.

Use.—To move the arm upwards and forwards.

MUSCLES OF THE ELBOW-JOINT.

BICEPS FLEXOR CUBITI.—*Origin.*—By two heads. The first and outer-most, called the *long head*, by a strong tendon, from a smooth surface in the upper edge of the glenoid cavity of the scapula. The second and inner-most, called the *short head*, from the lower part of the coracoid process of the scapula.

Insertion.—Into the posterior and internal rough part of the tubercle of the radius.

Use.—To turn the hand supine, to bend the forearm on the arm, and the arm on the shoulder.

Brachialis internus.—*Origin.*—From the middle of the os humeri by two fleshy slips, and from all the forepart of the bone below, nearly as far as the condyles.

Insertion.—Into the rough surface immediately below the coronoid process of the ulna.

Use.—To bend the forearm.

Triceps extensor cubiti.—*Orgin.*—By three heads. The first, or *long head*, from the inferior costa of the scapula, near its cervix. The second, or *short head*, by an acute, tendinous, and fleshy beginning, from a ridge which runs from the back part of the great tuberosity, towards the outer condyle. The third head, called *brachialis externus*, from the inside of the os humeri, above its middle, and from a ridge, extending to the inner condyle ; also, from the surface behind this ridge, and from the internal intermuscular ligament.

Insertion.—Into the rough back part of the process of the unla, called olecranon, and partly into the condyles of the os humeri, adhering firmly to the capsular ligament.

Use.—To extend the forearm. The long head will also ssist in drawing the arm backwards.

Anconeus.—*Origin.*—From the posterior and lower part of the external condyle of the os humeri.

Insertion.—Into the concave surface on the outside of the olecranon, and into the posterior edge of the ulna.

Use.—To assist in extending the forearm.

MUSCLES BETWEEN THE RADIUS AND ULNA ANTERIORLY.

Superficial layer.

Pronator radii teres.—*Origin.*—From the anterior surface of the inner condyle of the os humeri, and from the coronoid process of the ulna. Italso arises from the fascia of the fore arm.

Insertion.—Into a rough surface on the back part of the radius, about its middle.

Use.—To roll the radius together with the hand, inwards.

Flexor carpi radialis.—*Origin.*—From the lower and forepart of the internal condyle of the os humeri, and from the upper end of the ulna.

Insertion.—By a tendon, which passes *beneath the annular ligament*, into the forepart of the base of the metacarpal bone, sustaining the fore-finger, after running through a fossa, in the os trapezium.

Use.—To bend the hand, and to assist in its pronation.

Palmaris longus.—*Origin.*—From the forepart of the inner condyle of the os humeri, and from the intermuscular ligaments.

Insertion.—Into the ligamentum annulare, and into a tendinous membrane that covers the palm of the hand.

Use.—To bend the hand, and to stretch the palmar aponeurosis.

Flexor digitorum sublimis *vel* perforatus.—*Origin.*—From the under part of the internal condyle of the os humeri; from the lower part of the coronoid process of the ulna, and from the tubercle of the radius; from the middle of the forepart of that bone, and from the middle third of its outer edge.

Insertion.—By four tendons, which pass together *beneath the annular ligament*, into the anterior and upper part of the second phalanx, each tendon being, near the extremity of the first, divided for the passage of a tendon of the flexor profundus.

Use.—To bend the second joint or phalanx of the fingers.

Flexor carpi ulnaris.—*Origin.*—From the inferior part of the internal condyle of the os humeri; from the inner side of the olecranon; from the posterior ridge of the ulna; and from the intermuscular ligaments and fascia of the forearm.

Insertion.—Into the os pisiforme; and sometimes sends its fibres over a small ligament, which goes to the base of the metacarpal bone of the little finger.

Use.—To bend the hand.

Deep layer.

Flexor digitorum profundus *vel* perforans.—*Origin.*—From the smooth concavity, on the inside of the ulna;

from the smooth flat surface of the ulna ; from the under part of the coronoid process ; from the forepart of the ulna below the process, betwixt the internal angle, and that angle which gives attachment to the interosseous ligament ; and also from the inner half of the interosseous ligament.

Insertion.—By four tendons, which pass together *beneath the annular ligament*, into the fore and upper part of the third or last phalanx of all the fingers ; each tendon having previously perforated that of the flexor sublimis, at their respective insertions.

Use.—To bend the last joint of all the fingers.

Flexor tertii internodii, *vel* longus pollicis manus.—*Origin.*—From the upper and forepart of the radius, below the tubercle ; from the outer edge and anterior surface of that bone, to within two inches of its extremity ; from the outer part of the interosseous ligament ; and from the internal condyle of the os humeri.

Insertion.—By a tendon, which passes *beneath the annular ligament*, into the base of the extreme phalanx of the thumb.

Use.—To bend the last joint of the thumb.

Pronator quadratus.—*Origin.*—From the inner edge of the ulna, extending from the lower extremity of the bone, two inches up its edge.

Insertion.—Into the lower and anterior part of the radius.

Use.—To turn the radius together with the hand, inwards.

MUSCLES BETWEEN THE RADIUS AND ULNA POSTERIORLY.

Superficial layer.

Supinator radii longus.—*Origin.*—From the external ridge of the os humeri, which leads to the outer condyle.

Insertion.—Into a rough surface on the outer side of the inferior extremity of the radius.

Use.—To roll the radius outwards, and turn the palm of the hand upwards ; also to bend the forearm on the humerus.

EXTENSOR CARPI RADIALIS LONGIOR.—*Origin.*—From the external ridge of the os humeri, beginning immediately below the origin of the supinator longus, and continuing to arise as far as the upper part of the outer condyle.

Insertion.—Into the posterior and upper part of the metacarpal bone of the forefinger.

Use.—To extend the wrist, and move the hand backwards, and to assist in bending the forearm.

EXTENSOR CARPI RADIALIS BREVIOR.—*Origin.*—From the under and back part of the external condyle of the os humeri, and from the external literal ligament of the elbow joint.

Insertion.—Into the upper and back part of the metacarpal bone, that supports the middle finger.

Use.—To extend the hand.

EXTENSOR DIGITORUM COMMUNIS.—*Origin.*—From the under part of the external condyle of the os humeri ; from the intermuscular ligaments, which connect it to the extensor carpi radialis brevior before, and the extensor carpi ulnaris behind ; and from the inner surface of the fascia.

Insertion.—Into the posterior part of all the bones of the fingers, by a tendinous expansion.

Use.—To extend all the joints of the fingers.

EXTENSOR CARPI ULNARIS.—*Origin.*—From the under part of the external condyle ; from the intermuscular ligaments and inside of the fascia ; and from the back part of the ulna.

Insertion.—Into the posterior and upper part of the metacarpal bone of the little finger.

Use.—To extend the wrist, and bring the hand backwards, but chiefly to bend the hand laterally towards the ulna.

ANCONEUS.—*Origin.*—From the posterior and lower parts of the external condyle of the os humeri.

Insertion.—Into the concave surface on the outside of the olecranon, and into the posterior edge of the ulna.

Use.—To assist in extending the forearm.

Deep layer.

Supinator radii brevis.—*Origin.*—From the lower part of the external condyle of the os humeri, and from the ridge running down from the coronoid process, along the outer surface of the ulna.

Insertion.—Into the upper and outer edge of the tubercle of the radius, and into an oblique ridge, extending from the tubercle downwards and outwards, to the insertion of the pronator teres.

Use.—To roll the radius outwards, and bring the hand supine.

Extensor primi internodii pollicis, *vel* extensor ossis metacarpi.—*Origin.*—From the middle and posterior part of the ulna; from the interosseous ligament; and from the posterior surface of the radius, below the insertion of the supinator radii brevis.

Insertion.—Into the os trapezium, and into the upper and back part of the metacarpal bone of the thumb.

Use.—To extend the metacarpal bone of the thumb outwardly.

Extensor secundi internodii pollicis.—*Origin.*—From the back part of the ulna, below its middle, and from the interosseous ligament and radius.

Insertion.—Into the posterior part of the first bone of the thumb.

Use.—To extend the first phalanx of the thumb obliquely outwards.

Extensor tertii internodii policis.—*Origin.*—From the posterior surface of the ulna, above its middle, and from the interosseous ligament.

Insertion.—Into the posterior and upper part of the second, or extreme phalanx of the thumb.

Use.—To extend the last joint of the thumb, obliquely backwards.

Extensor indicis, *vel* indicator.—*Origin.*—From the middle of the back part of the ulna, and from the interosseous ligament.

Insertion.—Into the posterior part of the forefinger, with the tendon of the common extensor.

Use.—To assist in extending the forefinger.

MUSCLES OF THE PALM OF THE HAND.

Palmaris breves.—*Origin.*—From the annular ligament of the wrist, and from the inner edge of the fascia palmaris.

Insertion.—Into the skin and fat, which covers the short muscles of the little finger, and inner edge of the hand.

Use.—To assist in contracting the palm of the hand.

Lumbricales.—*Origin.*—From the outer side of the tendons of the flexor profundus perforans, soon after those tendons have passed the ligamentum carpi annulare.

Insertion.—Into the tendinous expansion, which covers the back part of the phalanges, about the middle of the first joint.

Use.—To increase the flexion of the fingers, while the long flexors are in full action.

Abductor pollicis.—*Origin.*—From the anterior surface of the annular ligament of the wrist, and from the os naviculare, and os trapezium.

Insertion.—Into the outer side of the root of the first phalanx of the thumb, and into the tendinous membrane, which covers the back part of the phalanges.

Use.—To draw the thumb, from the fingers.

Flexor primi internodii, *vel* opponens pollicis.—*Origin.*—From the annular ligament of the wrist, and from the os naviculare, and os trapezium.

Insertion.—Into the anterior and lower part of the metacarpal bone of the thumb.

Use.—To bring the first bone of the thumb inwards.

Flexor secundi internodii, *vel* brevis pollicis.—*Origin.*—By two distinct heads. The *outer head*, from the inside of the annular ligament; from the anterior surface of the os trapezium and os trapezoides; and from the root of the metacarpal bone, of the forefinger. The *inner head*, from the upper part of the os magnum, and os unciforme; and from the root of the metacarpal bone of the middle finger.

Insertion.—The *outer head*, into the outer sesamoid bone, which is connected by a ligament, to the root of the first phalanx of the thumb. The *inner head*, into the inner sesamoid bone, which is connected by a ligament, to the root of the first phalanx of the thumb.

Use.—To bring the second bone of the thumb towards the palm.

Adductor pollicis.—*Origin.*—From almost the whole length of the metacarpal bone, sustaining the middle finger.

Insertion.—Into the inner part of the root of the first phalanx of the thumb.

Use.—To pull the thumb towards the fingers.

Abductor indicis.—*Origin.*—From the os trapezium, and from the inner side of the metacarpal bone of the thumb.

Insertion.—Into the outer side of the root of the first phalanx of the forefinger.

Use.—To move the forefinger towards the thumb, or the thumb towards the forefinger.

Abductor minimi digiti.—*Origin.*—From the os pisiforme, and adjacent part of the annular ligament of the wrist.

Insertion.—Into the inner side of the first phalanx, and into the tendinous expansion, which covers the back part of the little finger.

Use.—To draw the little finger from the rest.

Flexor brevis minimi digiti—*Origin.*—From the outer side of the os unciforme, and from the annular ligament of the wrist, where it is affixed to that bone.

Insertion.—Into the base of the first phalanx of the little finger.

Use.—To bend the little finger, and bring it towards the other fingers.

Adductor minimi digiti.—*Origin.*—From the os unciforme, and adjacent part of the annular ligament of the wrist.

Insertion.—Into the forepart of the metacarpal bone of the little finger, nearly its whole length.

Use.—To bend and bring the metacarpal bone of the little finger, towards the rest.

Interossei interni.—Are seen in the palm of the hand, and are four in number. They *arise*, tendinous and fleshly, from the base and sides of the metacarpal bones, and are *inserted* into the side of the first phalanx of the fingers, and into the tendinous expansion, which covers the posterior surface of all the phalanges.

Use.—To assist in the extension and lateral movements of the fingers, INTEROSSEI EXTERNI.—Are three in number. They are larger than the internal, and are situated betwixt the metacarpal bones on the back of the hand.—Each of these muscles *arises* by a double head from two metacarpal bones, and is *inserted* into the side of one of the fingers, and into the tendinous expansion, which covers the posterior part of the phalanges.

Use.—Same as the interni.

MUSCLES CONCERNED IN PERFORMING THE MOTIONS OF THE JOINTS OF THE UPPER EXTREMITY.

MUSCLES OF THE SHOULDER-JOINT.

The shoulder-joint is formed by the attachment of the humerus to the scapula, and is a joint possessing the most extensive motion of any in the body.

The humerus moves upon the scapula in *every direction*, but its principal movements are *forwards* and *upwards*, *downwards* and *backwards*, *outwards*, *inwards*, and *rotatory*; and a combination of all these motions.

The motion forwards and upwards, or *extension* of the humerus, is performed by the fibres of the *deltoid*, which arise from the acromion and clavicle, also, by the *supra-spinatus*, *infra-spinatus*, *coraco-brachialis*, and *pectoralis major*, (by the portion of it coming from the clavicle,) assisted by the *biceps*, a muscle of the elbow joint. It is the *deltoid*, *supra-spinatus*, *coraco-brachialis*, and the clavicular portion of the *pectoralis major*, that first raise the humerus, while, the *infra-spinatus*, *subscapularis*, and *biceps*, unite to fix it, in a raised position. All these *extensors* of the shoulder-joint must necessarily be put upon the stretch, in the dislocations of the head of the humerus into the axilla.

The *flexion* of the humerus, or motion backwards and downwards, is performed by the posterior fibres of the *deltoid*, *teres major*, *teres minor*, *latissimus dorsi*, and by the *long head of the triceps*.

The motion outwards, or *abduction* of the arm, is performed by the *deltoid*, *supra-spinatus*, and *infra-spinatus*, assisted, when carried from the side, by the *subscapularis*.

The motion inwards, or *adduction*, is performed by the *pectoralis major*, and *latissimus dorsi;* this motion being rendered more perfect by the motion of the *trapezius, rhomboideus*, and *pectoralis minor*.

Rotation outwards is performed by the *supra-spinatus, infra-spinatus, teres minor*, posterior fibres of the *deltoid*, and *coraco-brachialis*.

Rotation inwards is performed by the action of the *sub-scapularis. teres major*, and clavicular portion of the *deltoid*.

MUSCLES OF THE ELBOW-JOINT.

The articulation of the elbow, having its motions in two directions only, requires a less numerous arrangement of muscles.

The motions of the elbow-joint are *flexion*, and *extension*.

In the *flexion* of the forearm, both the radius and ulna move upon the humerus ; and this motion is chiefly performed by the *biceps flexor cubiti*, and *brachialis intermus*.

The *extension* of the forearm is performed by the *triceps extensor cubiti*, and *anconeus*.

Three of these muscles are inserted into the ulna, the principal strength of the joint being maintained between this bone, and the humerus, which are placed in a continued line with each other.

The *biceps flexor*, being attached to the radius and not to the ulna, appears to be for the purpose of drawing the head of the radius firmly upon the external condyle of the humerus, when powerful supination is required.

There are several of the muscles belonging to the forearm called into action, to maintain the elbow in a state of *flexion*, and these actions are variously modified by the position of the limb.

What are termed *rotation* and *supination* of the hand, are positions produced by the rotatory motions of the radius upon the ulna, the hand being articulated with the radius, and moving upon that bone. These rotations are produced by the following muscles : pronators—*pronator radii teres*, and *pronator quadratus*, assisted by the *palmaris longus*, and *flexor carpi ulnaris* ; the two last acting most powerfully when the wrist is extended : supinators—*supinator radii longus, supinator radii brevis*, the *extensors* proper to the thumb, and the *biceps*.

The only rotatory motion, of which the ulna is capable, is in common with, but not upon the humerus.

MUSCLES OF THE WRIST-JOINT.

The wrist-joint is capable of being either *flexed*, or *extended*, and allows the motion of the hand either towards the radius or ulna.

The *flexors*, are the *flexor carpi radialis, flexor carpi ulnaris, palmaris longus, flexor sublimis*, and *flexor profundus digitorum*, and the *flexor tertii internodii pollicis*. The first three are the principal flexors.

The *extensors*, are the *extensores carpi radialis longior*, and *brevior, extensor carpi ulnaris, extensor tertii internodii, extensor indicis*, and the *common extensors* of the fingers. The first three may be considered as the chief muscles acting in the extension of the wrist-joint.

The inflexion of the hand towards the radius, is produced by the action of the *extensor primi internodii*, or *extensor ossis metacarpi, extensor secundi internodii, extensores carpi radialis longior*, and *brevior*, and *flexor carpi radialis*.

The inflexion of the hand towards the ulna, is produced by the *extensor carpi ulnaris, extensor digitorum communis* especially, that part which goes to the little finger, the *flexor carpi ulnaris*, and the *common flexors* of the fingers.

MUSCLES OF THE JOINTS OF THE THUMB AND FINGERS.

The motions of the thumb are produced by eight muscles, a *flexor*, and *extensor*, proper to each phalanx, and an *abductar*, and *adductor*, common to the three.

The first phalanx of each finger differs from that of the thumb, in being connected with a metacarpal bone, instead of a carpal bone, and having no other motion upon it, than the phalanges enjoy upon each other.

Flexion of the first phalanx of all the fingers is produced by the *lumbricales*, of the second, by the *flexor sublimis perforatus*, and of the third, by the *flexor profundus perforans*.

The first phalanx of the *forefinger*, however, has a considerable motion towards the thumb by the *abductor indicis*.

The first phalanx of the little finger has, also, a motion from three muscles proper to it, independent of the muscles common to the other fingers.

MUSCLES OF THE BACK.

Under the common integuments, there is found a layer of fascia giving more or less of a general covering to the subjacent muscles, and extending from the occiput to the pelvis. This expansion derives different names, from the parts to which it is attached.

The extensive mass of muscles, which is found on the back, has, for the sake of description, been divided into *seven layers*.

First layer.

The first layer consists of the *trapezius*, and *latissimus dorsi*, the former already described as attaching the *scapula*, and the latter, the *os humeri* to the *trunk*.

Second layer.

This is composed of the *rhomboidei* and *levator scapulæ*, also described as attaching the *scapula* to the *trunk*.

Third layer.

Serratus posticus superior.—*Origin*—From the spinous processes of the three inferior cervical vertebræ, and of the two superior dorsal.

Insertion.—Into the second, third, fourth, and sometimes the fifth ribs, a little beyond their angle.

Use.—To elevate the ribs and dilate the thorax.

Serratus posticus inferior.—*Origin*—From the spinous processes of the two or three inferior dorsal vertebræ, and from the three superior lumbar spines, by the fascia lumborum.

Insertion.—Into the lower edges of the four inferior ribs, at a little distance from their cartilages.

Use.—To pull the ribs downwards and backwards.

Fourth layer.

SACRO-LUMBALIS.—*Origin.*—In common with the following muscle, from the spinous processes and posterior surface of the os sacrum ; from the posterior part of the spine of the os illium, extending nearly as far forwards as the highest part of that bone, when the body is erect ; from the spinous processes, and from the roots of the transverse processes of all the lumbar vertebræ.

Insertion.—Into all the ribs near their angles, by long and thin tendons.

Use.—To pull the ribs downwards, to assist in erecting the trunk of the body, and in turning it to one side.

LONGISSIMUS DORSI.—*Origin.*—In common with the former muscle, from the spinous processes and posterior surface of the os sacrum ; from the posterior part of the spine of the os ilium, extending nearly as far forwards as the highest part of that bone, when the body is erect : from the spinous processes, and from the roots of the transverse processes of all the lumber vertebræ.

Insertion.—Into all the ribs, except the two inferior, betwixt their tubercles and angles, by slips which are tendinous and fleshy ; and into the transverse processes of all the dorsal vertebræ, by small double tendons.

Use.—To extend the vertebrœ, and keep the body erect.

SPINALIS DORSI.—*Origin.*—From the spinous processes of the two superior lumbar vertebrœ, and of the three inferior dorsal.

Insertion.—Into the spinous processes of the nine upper vertebræ of the back, except the first, by as many distinct tendons.

Use.—To extend the vertebræ, and to assist in raising the spine.

The Splenius, is divided into two portions.

1. SPLENIUS CAPITIS.—*Origin.*—From the spinous processes of the two superior dorsal, and five inferior cervical vertebræ.

Insertion.—Into the posterior part of the mastoid process, and into a small part of the os occipitis.

2. SPLENIUS COLLI.—*Origin.*—From the spinous processes of the third, fourth, fifth, and sometimes the sixth dorsal vertebræ.

Insertion.—Into the transverse processes of the four or five superior cervical vertebæ, by distinct tendons, which lie behind similar tendons of the levator scapulæ.

Use.—To bring the head and upper vertebrœ of the neck obliquely backwards. When both muscles act, they pull the head directly backwards.

Fifth layer.

CERVICALIS ASCENDENS —*Origin.*—From the upper edge of the four or five superior ribs, by as many distinct tendons, which lie on the inside of the tendinous insertions of the sacro-lumbalis.

Insertion.—Into the fourth, fifth, and sixth cervical vertebræ.

Use.—To turn the neck obliquely backwards.

TRANSVERSALIS COLLI.—*Origin* —From the transverse processes of the five superior dorsal vertebræ, by five tendinous and fleshy slips.

Insertion.—Into the transverse processes of the five or six inferior cervical vertebræ.

Use.—To turn the neck obliquely backwards, and a little to one side.

TRACHELO-MASTOIDEUS.—*Origin.*—From the transverse processes of the three uppermost vertebræ of the back, and of the five inferior of the neck.

Insertion.—Into the posterior surface of the mastoid process.

Use —To keep the head and neck erect, and to draw the head backwards, and to one side.

COMPLEXUS —*Origin.*—From the transverse processes of the seven superior dorsal, and of the four or five inferior cervical vertebræ.

Insertion —Into the hollow betwixt the two transverse ridges of the os occipitis, extending from the middle protuberance of that bone, nearly as far as the mastoid process.

Use.—To draw the head backwards, and to one side.

Sixth layer.

Rectus capitis posticus major.—*Origin.*—From the side of the spinous process of the dentata, or second cervical vertebra.

Insertion.—Into the inferior transverse ridge of the os occipitis, and into part of the concavity about that ridge.

Use.—To extend and pull the head backwards, and to assist in its rotation.

Rectus capitis posticus minor.—*Origin.*—From an eminence in the middle of the back part of the atlas, or first cervical vertebra.

Insertion.—Into the inferior transverse ridge of the os occipitis, and into the surface betwixt that ridge, and the foramen magnum.

Use.—To draw the head backwards.

Obliquus capitis superior.—*Origin.*—From the upper and posterior part of the transverse process of the first cervical vertebra.

Insertion.—Into the inferior transverse ridge of the os occipitis, behind the mastoid process, and into a small part of the surface above and below that ridge.

Use.—To draw the head backwards, and to assist in rolling it.

Obliquus capitis inferior.—*Origin.*—From the side of the spinous process of the dentata, or second cervical vertebra.

Insertion.—Into the under and back part of the transverse process of the atlas.

Use.—To rotate the head, by turning the first vertebra upon the second.

Semi-spinalis colli.—*Origin.*—From the transverse processes of the six superior dorsal vertebræ.

Insertion.—Into the spinous processes of all the vertebræ of the neck, except the first and last.

Use.—To extend the neck obliquely backwards.

Semi spinalis dorsi.—*Origin.*—From the transverse processes of the seventh, eighth, and ninth vertebræ of the back.

Insertion.—Into the spinous process of the five superior dorsal, and of the two lower cervical vertebræ.

Use.—To extend the spine obliquely backwards.

Seventh layer.

Multifidus spinæ.—*Origin.*—From the spinous processes and back part of the os sacrum, and from the posterior adjoining part of the os ilium, from the oblique and transverse processes of all the lumber vertebræ; from the tranverse processes of all the dorsal vertebræ: and from those of the cervical vertebræ, excepting the three first.

Insertion.—Into the spinous processes of all the vertebræ of the loins and back, and into those of the six inferior vertebræ of the neck.

Use.—To extend the back obliquely, or move it to one side. When both muscles act, they extend the vertebræ backwards.

Interspinales colli, dorsi, et lumborum.—These are small bundles of fibres, which fill up the spaces between the spinous processes of the vertebræ. Each of these little muscles arises from the surface of one spinous process, and is inserted in the next spinous process. In the neck, they are large and appear double, as the spinous processes of the carvical vertebræ are bifurcated. In the back and loins, they are indistinct, and rather small tendons than muscles.

Use.—To draw the spinous processes nearer to each other.

Inter-transversales colli, dorsi, et lumborum.—Are small muscles, which fill up in a similar manner the spaces between the transverse processes of the vertebræ. In the neck they are bifurcated and distinct, in the back they are small and slender, and in the loins they are strong and fleshy.

Use.—To draw the transverse processes towards each other.

Muscle deeply-seated on the anterior surface of the Lumbar Vertebræ.

Psoas parvus.—*Origin.*—From the sides of the last dorsal, and first lumbar vertebræ.

Insertion.—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; in some positions, it will bend the pelvis on the loins.

Muscles situated deeply on the lateral aspects of the Spine.

Rectus capitis lateralis.—*Origin.*—From the anterior and upper part of the transverse process of the atlas.

Insertion.—Into a rough ridge of the os occipitis, which extends from the condyloid process, to the mastoid process.

Use.—To pull the head a litte to one side.

Scalenus anticus.—*Origin.*—From the transverse processes of the fourth, fifth, and sixth vertebræ of the neck.

Insertion.—Into the upper edge of the first rib, near its cartilage.

Scalenus medius—*Origin.*—From the transverse processes of all the vertebræ of the neck.

Insertion.—Into the upper and outer part of the first rib: from its root to within the distance of half an inch from the scalenus anticus.

Scalenus posticus.—*Origin.*—From the transverse processes of the fifth and sixth vertebræ of the neck.

Insertion.—Into the upper edge of the second rib, near the spine.

Use.—*The three last muscles* bend the neck to one side; and when the muscles of both sides act, they bend it forwards, or when the neck is fixed, they elevate the ribs, and dilate the chest.

Muscles attached to the Thorax and directly employed in respiration.

Intercostales externi.—*Origin.*—From the transverse processes of all the dorsal vertebræ, and from the acute edge of each superior rib; their fibres pass obliquely downwards and forwards.

Insertion.—Into the upper obtuse edge of each inferior rib, from the spine to near the cartilage of the rib.

Intercostales interni.—*Origin.*—From the inferior acute edge of each superior rib, beginning at the sternum, and extending as far as the angle of the rib, having their fibres directed backwards.

Insertion.—Into the superior obtuse edge of each inferior rib, from the sternum to the angle of the rib. The oblique direction of the fibres of these muscles serves to approximate the ribs more completely than if they had passed perpendicularly.

Use.—The intercostal muscles elevate the ribs, so as to enlarge the cavity of the thorax.

The small fleshy bundles of the external intercostal muscles, which arise from the transverse processes, are inserted, partly into the rib connected with the vertebra, and partly into the next rib below. These have been described as the *levatores costarum breviores* ; *et longiores* ; but are, in fact, merely the commencement of the external intercostals.

From the seventh to the eleventh rib, also, at about their centre, slips of the internal intercostal muscles, instead of being inserted into the rib immediately below, pass over it, to be inserted into the second rib below. These have received the name of *depressores costarum.*

The intercostal muscles decussate, forming a double layer in the centre of the ribs ; and a single layer only from the sternum to the junction of the cartilages with the ribs before, and from the angle of the ribs to the transverse processes behind.

Triangularis sterni.—*Origin.*—From the edge of the whole cartilago ensiformis, and from the edge of the lower half of the middle bone of the sternum.

Insertion.—Into the cartilages of the third, fourth, fifth, and sixth ribs.

Use.—To depress the cartilages and the bony extremities off the ribs, and, consequently, to assist in lessening the cavity of the thorax.

Diaphragma.—Vide Viscera of the Abdomen, Part VI.

Quadratus rumborum.—*Origin.*—From rather more than the posterior third part of the spine of the os ilium.

Insertion.—Into the transverse processes of all the vertebræ of the loins ; into the posterior half of the last rib ; and into the side of the last vertebræ of the back.

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

MUSCLES OF THE ABDOMEN.

These muscles are ten in number, five on each side.

Obliquus descendens *vel* externus.—*Origin.*—By eight triangular fleshy slips, from the lower edges of the eight inferior ribs, at a little distance from their cartilages ; the four superior slips lie between similar digitations of the serratus major anticus, and the four inferior are in contact with the attachments which the latissimus dorsi has to the ribs.

The muscular fibres pass obliquely downwards and forwards, and, about the middle of the side of the belly terminate abruptly in a thin broad tendon, which is continued in the same direction over all the forepart of the belly.

Insertion.—Tendinous and fleshy, into two anterior thirds of the outer edge of the spine of the os ilium ; tendinous, into the whole length of Poupart's ligament, into the os pubis, into the ensiform cartilage, and the whole length of the linea alba.

Use.—To draw down the ribs in expiration ; to bend the trunk forwards when both muscles act or to bend it obliquely to one side when one of them acts singly ; to raise the pelvis obliquely when the ribs are fixed ; to compress the abdominal viscera, and to thrust the diaphragm upwards ; and to assist in the expulsion of the urine and fæces, and of the fœtus.

In the course of the dissection of this muscle, the following points must be attended to.

Linea alba.—A *white line* running along the middle of the abdomen, from the cartilago ensiformis to the os pubis ; formed by the tendinous fibres of the two oblique, and the transverse muscles, interlaced with those of the same muscles on the opposite side ; it is broader above the umbilicus than below it.

Linea semilunaris.—A *semilunar* or *creasent-shaped white line*, having its convexity outwards, and running from the os pubis obliquely upwards over the side of the abdomen, at the distance of about four inches from the line a alba ; formed by the tendons of the two oblique and transverse muscles uniting at the edge of the rectus, before they separate to form the sheath for that muscle.

Lineæ transversæ.—Three or four white lines, *crossing* from the linea semilunaris, to the linea alba : formed by the tendinous intersections of the recti, shining through the strong sheath which covers them.

UMBILICUS, OR NAVEL.—This, which before the integuments were removed was a depression, appears as a prominence ; it consists of condensed cellular membrane. In the fœtus, it was a foramen which gave passage to the two umbilical arteries, the umbilical vein, and the urachus.

ANNULUS ABDOMINALIS, OR ABDOMINAL RING.—There is an oblique silt, just above the angle of the pubes, formed by the tendon of the external oblique, splitting into two parts, or pillars, as it is about to be inserted into the os pubis ; and forming an opening called the *external ring*, which allows the spermatic cord in the male, and the ligamentum teres of the uterus in the female, to pass through it. This opening is of a triangular form, having the pubes for its base, and the part where the tendons split for its point. There are however, some transverse fibres which run from one pillar to the other, near the apex of the opening. On making an incision through the tendon of the external oblique, beginning an inch above the external ring, and carrying it on towards the ilium, and then separating the edges of the cut tendon, the cord in the male, or the round ligament in the female will present itself to view, taking a course obliquely upwards, and outwards, to a point mid-way between the superior spinous process of the ilium, and pubes, where it is lost by passing into the abdomen by what is called the *internal ring*. This inner ring is bounded above, by the free edges of the internal oblique, and transversalis muscles, as they are passing from the outer third of Poupart's ligament to be inserted into the pubes, and below, by Poupart's ligament. The space between the rings measures from two to three inches, and is called the *inguinal canal*.

Ligamentum Inguinale, vel Poupartii, vel Fallopii, a strong ligament stretching from the anterior superior spinous process of the os ilium, to be fixed to the spine of the os pubis.

In taking off the skin from the groin, there is not a strong regular fascia, as on the outer part of the thigh, but a confused and irregular aponeurosis coming off from the abdomen, and going down upon the thigh, strengthened by the intermixture of condensed cellular substance, and very loose above the great vessels.

Immediately under the skin, and above this aponeurosis. there is a congeries of lymphatic glands, and, sometimes, the lymphatic vessels themselves can be seen running like lines of a reddish colour, and resembling loose muscular fibres, Also, immediately under the skin, the vena saphena is seen running from below upwards, superficial to the fascia, and then gradually sinking through it to join the femoral vein, about an inch below Poupart's ligament.

On removing this irregular fascia, we come down upon the great vessels, which lie deeply imbedded in cellular substance, and are closely invested and supported by a firm sheath, or fascia, consisting chiefly of cellular substance very much condensed. This should all be cautiously removed with the scissors, along with some lymphatic glands, which lie amongst the fat.

Observe, that the great *inguinal artery* lies cushioned on the fibres of the psoas, and iliacus internus muscles ; that the *inguinal vein* lies in close contact with the artery on its inside, that is, nearer the pubes ; that the *anterior crural nerve* is on the outside of the artery, but is not in contact with it, till it has fairly emerged from under Poupart's ligament ; previously to this, it is separated from it by some projecting muscular fasciculi : observe Poupart's ligament forming an arch over the great vessels ; the artery passing under the middle of the ligament, and, before it has fairly emerged into the thigh, sending off two considerable branches.

A circumflexa ilii is sent off from the outside of the artery, passes upwards and outwards, runs along the inside of Poupart's ligament, till it arrives at the anterior superior spinous process of the os ilium, thence, it is continued along the inside of the spine of the ilium, lying close upon the bone, between the transversalis abdominis, and the upper edge of the iliacus internus, to both of which it gives twigs, and ends in inosculating with the ilio-lumbar artery That distribution, however, cannot be seen in this stage of the dissection.

A. epigastrica comes off from the inside of the artery crosses the great inguinal vein, passes obliquely upwards and inwards under Poupart's ligament, to which it is but loosely connected, and runs behind the upper extremity of the abdominal ring and the spermatic cord, to reach the rectus abdominis. At first, it is situated between the posterior surface of that muscle and the peritoneum, but higher up, between the muscular fibres and the sheath. It terminates in ramifications, which supply the rectus, and which inosculate with the ramifications of the mammaria interna, sent down within the thorax on each side of the sternum.

OBLIQUUS ASCENDENS *vel* INTERNUS.—*Origin.*—By short tendinous fibres, which soon become fleshy, from the whole length of the spine of the os ilium, and from the fascia lumborum ; also, fleshy from the upper part of Poupart's ligament at the part next to the os ilium.

The fibres run in a radiated direction ; those which originate from the back part of the os ilium, run obliquely upwards ; those from the forepart of the ilium pass more transversely across the belly ; and, from Poupart's ligament the fibres descend. The fleshy belly is continued rather more forward than that of the external oblique, before it terminates in a flat tendon.

Insertion.—Into the cartilages of the six or seven lower ribs,—fleshy into the three inferior, and, by a tendinous expansion, which is extremely thin, resembling cellular membrane, into the four superior, and also into the ensiform cartilage. The sheet of tendon, in which the fleshy belly ends, is continued, single and undivided, into the linea semilunaris, where, adhering pretty firmly to the tendons of the obliquus externus and transversalis, it divides into two layers. The anterior 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, adhering to the anterior surface of the transversalis, passes into the linea alba behind the rectus, 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, for its principal part passes along with the tendon of the external oblique before the rectus, and is inserted into the lower part of the linea alba. At its undermost part, it is inserted, fleshy, into the os pubis.

Use.—To assist the obliquus externus ; but it bends the trunk in the reverse direction, so that the muscle on each side co-operates with the obliquus externus of the opposite side.

About the middle of Poupart's ligament, a delicate fasciculus of fibres called the *cremaster* is sent off from this muscle over the spermatic cord, where it passes under its edge in its way to the ring.

THE CREMASTER is continued down on the cord, till it is insensibly lost on the tuinca vaginalis testis ; it will be seen in the dissection of the scrotum. Its use is to suspend, draw up, and compress the testicle.

TRANSVERSALIS ABDOMINIS.—*Origin.*—Tendinous, from the fascia lumborum, and back part of the spine of the os ilium ; fleshy, from all the remaining part of the spine of the ilium, and from the inner surface of Poupart's ligament ; and fleshy, from the inner or back part of the cartilages of the seven lower ribs, where some of its fibres are in contact with those of the diaphragm.

The fleshy fibres proceed transversely, and end in a flat sheet of tendon, which, after being connected to the other tendons at the linea semilunaris, passes with the posterior layer of the internal oblique behind the rectus, and is *inserted* into the ensiform cartilage, and into the whole length of the linea alba, excepting its lowermost part ; for, at the middle distance between the umbilicus and os pubis, a transverse slit, or fissure, is formed in this tendon, through which the rectus abdominis passes ; and the remainder of the tendon passes before the rectus, to be inserted into the lower part of the linea alba.

Use.—To support and compress the viscera of the abdomen.

The sheath of the rectus is now to be attended to ; it is formed by the tendons of the three other muscles, viz. the two oblique, and the transversalis. These, when they reach the edge of the rectus, are firmly united, giving the appearance named *linea semilunaris* ; they then split and inclose the rectus in their duplicature ; the whole tendon of the external oblique, with the anterior layer of the internal oblique, passes before the rectus ; and the whole posterior layer of the internal oblique, together with the whole tendon of the transversalis muscle, passes behind the rectus, excepting at the lower part, where, for two or three inches above the pubes, the posterior part of the sheath is deficient, and the rectus lies naked on the peritoneum.

Rectus abdominis.—*Origin.*—By a flat tendon, from the forepart of the os pubis; as it ascends, its fleshy belly becomes broader and thinner, and is intersected by the lineæ *transversæ.*

Insertion.—By a thin fleshy expansion, into the ensiform cartilage, and into the cartilages of the three inferior true ribs.

Use.—To compress the forepart of the abdomen, to bend the trunk forwards, or to raise the pelvis.

On each side of the linea alba, and inclosed in the lower part of the sheath of the rectus, is sometimes found a small muscle named

Pyramidalis.—*Origin.*—Tendinous and fleshy, of the breadth of an inch, from the os pubis, anterior to the origin of the rectus.

Insertion.—By an acute termination, near half-way between the os pubis and umbilicus, into the linea alba and inner edge of the rectus muscle.

Use.—To assist the lower part of the rectus.

MUSCLES OF THE PERINÆUM.

Sphincter ani.—*Origin.*—This muscle consists of two semicircular fibres, which run round the extremity of the rectum, passing nearly as far out as the tuber ischii; the fibres on each side decussate where they meet.

Insertion.—Into the extremity of the os coccygis behind, and before into a tendinous point common to this muscle, and to the acceleratores urinæ and transversi perinæi.

Use.—To close the anus, or extremity of the rectum, and to pull down the bulb of the urethra.

Accelerator urinæ *vel* ejaculatur seminis.—*Origin.*—From the descending ramus of the pubis, and from the ascending ramus of the ischium, nearly as far down as the tuberosity.

Insertion.—Into a white tendinous line in the middle of the bulb of the urethra, joining there with the muscle of the opposite side.

Use.—To drive the urine and semen forwards, by compressing the lower part of the urethra, and to propel the blood towards the corpus spongiosum, and the glans penis.

Erector penis.—*Origin.*—From the tuberosity of the os ischium; its fleshy fibres proceed upwards over the crus of the penis, adhering to the outer and inner edges of the ascending ramus of the os ischium, and of the descending ramus of the os pubis.

Insertion.—It ends in a flat tendon, which is lost in the strong tendinous membrane that covers the corpus cavernosum.

Use.—To compress the crus penis, which propels the blood into the forepart of the corpus cavernosum, and, thus, to produce erection.

Transversus perinæi.—*Origin.*—From the tough fatty membrane that covers the tuber ischii, immediately behind the attachment of the erector penis.

Insertion.—Into the central point of union where the sphincter ani touches the accelerator urinæ, and where a kind of tendinous projection is formed, common to the five muscles.

Use.—To dilate the bulb of the urethra; to prevent the anus from being too much protruded; and to retract it when protruded.

Levator ani.—*Origin*—From the inside of the os pubis at the upper edge of the foramen thyroideum; from the inside of the os ischium; and from the tendinous membrane covering the obturator internus, and coccygeus muscles.

Insertion.—Into the two last bones of the os coccygis, and into the extremity of the rectum; passing within the fibres of the sphincter ani, but on the outside of the longitudinal muscular fibres of the gut itself.

Use.—To draw the rectum upwards after the evacuation of the fæces; to assist in shutting it; and to compress the vesiculæ seminales and other viscera of the pelvis.

Coccygeus.—*Origin.*—From the spinous process of the os ischium; it covers the inside of the posterior sacro-ischiatic ligament.

Insertion.—Into the extremity of the os sacrum, and into the lateral surface of the os coccygis.

Use.—To support and move the os coccygis forwards, and connect it more firmly with the sacrum.

In the female, there are also the following.

Erector clitoridis.—*Origin.*—From the tuber-ischii; from the inside of the ramus of the os ischium; and from the ramus of the os pubis.

Insertion.—It passes over the crus of the clitoris, and, becoming tendinous, is lost upon it.

Use.—To draw the clitoris downwards, and forwards, and, by compressing it, to propel the blood.

Constrictor vaginæ.—*Origin.*—Anteriorly from the crura of the clitoris on each side; it surrounds the orifice of the vagina.

Insertion.—Into the ligamentous point of the perinæum, where the fibres of each side meet, and are connected with those of the transversi perinæi, and with the sphincter ani.

Use.—To contract the mouth of the vagina.

MUSCLES OF THE LOWER EXTREMITY.

MUSCLES OF THE HIP JOINT.

Psoas magnus.—*Origin.*—From the side of the body, and transverse processes of the last vertebra of the back; and in the same manner from all those of the loins, by as many distinct slips.

Insertion.—Into the trochanter minor of the os femoris; and, fleshy, into that bone, immediately below the trochanter.

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

Iliacus internus.—*Origin.*—From the transverse process of the last vertebra of the loins, from all the inner margin of the spine of the os ilium; from the edge of that bone, between its anterior superior spinous process and the acetabulum; and from all its hollow part between the spine and the linea ileo-pectinea.

Insertion.—With the psoas magnus.

Use.—To assist in bending the thigh, and in bringing it directly forwards.

PECTINEUS.—*Origin.*—From that ridge of the os pubis which forms the brim of the pelvis, and from the concave surface below the ridge.

Insertion.—Into the linea aspera, immediately below the lesser trochanter.

Use.—To bend the thigh forwards; to move it inwards; and to perform rotation, by turning the toes outwards.

GLUTÆUS MAXIMUS.—*Origin.*—From the posterior third of the spine of the os ilium; from the whole lateral surface of the sacrum, below the posterior spinous process of the os ilium; and from the back part of the posterior or inferior sacro-sciatic ligament.

Insertion.—Into a rough surface at the upper and outer part of the linea aspera, immediately below the trochanter major.

Use.—To extend the thigh, by pulling it directly backwards, and a little outwards; to rotate it outwards, and to prevent the coccyx from being carried too far backwards.

GLUTÆUS MEDIUS.—*Origin.*— From all the outer edge of the spine of the os ilium, as far as the posterior tuberosity, from the upper part of the dorsum of the bone; also, from the rough surface which extends from the anterior superior, to the anterior inferior spinous process; and from the inside of a fascia, which covers its anterior part.

Insertion.—Into the upper and outer part of the great trochanter.

Use.—To draw the thigh-bone outwards, and a little backwards, and to roll it.

GLUTÆUS MINIMUS.—*Origin.*—From the semicircular ridge of the ilium, and from the dorsum of the bone below the ridge, to within half an inch of the acetabulum.

Insertion.—Into the anterior and superior part of the great trochanter.

Use.—To assist the other glutæi muscles in drawing the thigh outwards and backwards and in rolling it.

PYRIFORMIS.—*Origin.*—Within the pelvis, from the second, third, and fourth false vertebræ, or divisions of the sacrum.

Insertion.—Into the uppermost part of the cavity, at the root of the trochanter major.

Use.—To move the thigh a little upwards, and roll it outwards.

GEMINI.—1. *Geminus superior.*—*Origin.*—From the back part of the spinous process of the ischium.

Insertion.—Into the cavity at the root of the trochanter major, immediately below the insertion of the pyriformis, and above the insertion of the obturator internus.

Use.—To roll the thigh outwards, and to bind down the tendon of the obturator internus.

2. *Geminus inferior.*—*Origin.*—From the upper part of the tuberosity of the os ischium, and the anterior surface of the posterior sacro-sciatic ligament.

Insertion.—Into the cavity at the root of the trochanter major, immediately below the insertion of the pyriformis, and above the insertion of the obturator externus.

Use.—To roll the thigh outwards, and to bind down the tendon of the obturator internus.

OBTURATOR INTERNUS.—*Origin.*—From more than one half of the internal circumference of the foramen thyroideum, and from the inner surface of the ligament which fills up that hole.

From these origins the fleshy fibres converge towards the spinous process of the ischium; at which point, they form a tendon which passes out of the pelvis, lodged in a slight groove covered with cartilage, placed between the spinous process and tuberosity of the ischium, and consequently, between the sacro-sciatic ligaments.

Insertion.—Into the pit at the inner side of the trochanter major, and between the gemini.

Use.—To roll the os femoris obliquely outwards.

QUADRATUS FEMORIS.—*Origin.*—From an oblique ridge, which descends from the inferior edge of the acetabulum, along the body of the ischium, between its tuberosity and the foramen thyroideum.

Insertion.—Into a rough ridge on the back part of the femur, extending from the root of the greater trochanter, to the root of the smaller.

Use.—To roll the thigh outwards.

Triceps adductor femoris.—Consits of three distinct muscles, which, passing from the pelvis to the thigh, lie in different layers upon one another.

1. *Adductor longus.—Origin.*—From the upper and inner part of the os pubis, near its symphysis.

Insertion.—Into the middle part of the linea aspera, occupying rather more than one third of its length.

2. *Adductor brevis.—Origin.*—From the os pubis, between the lower part of the symphysis pubis, and the foramen thyroideum.

Insertion.—Into the upper third of the linea aspera.

3. *Adductor magnus.—Origin.*—From the lower part of the body, and from the descending ramus of the os pubis, and from the ascending ramus of the ischium, as far as the tuberosity of that bone.

Insertion.—Into the whole length of the linea aspera; into the oblique ridge above the internal condyle of the os femoris; and, by a roundish long tendon, into the upper part of the condyle.

Use.—To bend the thigh on the pelvis; to move it inwards, and in some degree, to roll it outwards. The action of the fibres, will vary according to their different degrees of obliquity. When the thigh is bent, some will assist in extending it on the pelvis.

Obturator externus.—*Origin.*—From almost the whole circumference of the foramen thyroideum, and from the external surface of the obturator ligament.

Insertion.—Into the lowermost part of the cavity, at the root of the trochanter major immediately below the insertion of the inferior head of the gemini.

Use.—To roll the thigh bone obliquely outwards.

Tensor vaginæ femoris.—*Origin.*—From the external part of the anterior superior spinous process of the os ilium.

Insertion.—Into the inner side of the great fascia, where it covers the outside of the thigh, a little below the trochanter major.

Use.—To stretch the great fascia of the thigh; to assist in the abduction of the thigh, and in its rotation inwards.

MUSCLES OF THE KNEE-JOINT.

RECTUS FEMORIS.—*Origin.*—From the inferior anterior spinous process of the os ilium; from the dorsum of that bone, a little above the acetabulum; and from the capsular ligament of the hip joint.

Insertion.—Into the upper extremity of the patella.

Use.—To extend the leg on the thigh, and to bend the thigh on the pelvis.

CRURÆUS.—*Origin.*—From between the two trochanters of the os femoris; from all the forepart of the bone; and from the outside, as far back as the linea aspera.

Insertion.—Into the posterior surface of the tendon of the rectus, and upper edge of the patella.

Use.—To extend the leg.

VASTUS EXTERNUS.—*Origin.*—From the anterior surface of the root of the trochanter major; from the outer edge of the linea aspera; and from the oblique line, running to the external condyle.

Insertion.—Into the external surface of the tendon of the rectus cruris, and into the side of the patella.

Use.—To extend the leg.

VASTUS INTERNUS.—*Origin.*—From the forepart of root of the trochanter minor; from all the inner edge of the linea aspera; and from the oblique line, running to the inner condyle.

Insertion.—Into the lateral surface of the tendon of the rectus cruris, and into the side of the patella.

Use.—To extend the leg.

SARTORIUS.—*Origin.*—From the anterior superior spinous process of the os ilium; it soon becomes fleshy, extends obliquely across the thigh, and passes behind the inner condyle.

Insertion —Into the inner side of the tibia, immediately below its anterior tubercle.

Use.—To bend the leg obliquely inwards on the thigh, and to bend the thigh forwards.

GRACILIS.— *Origin* —From the lower half of that part of the os pubis, which forms the symphysis, and from the inner edge of the descending ramus.

Insertion —Into the inside of the tibia.

Use.—To bring the thigh inwards and forwards, and to assist in bending the leg.

SEMITENDINOSUS.—*Origin* —In common with the long head of the biceps, from the tuberosity of the ischium ; it has also some fleshy fibres arising from that projection more outwardly ; and from the inside of the tendon of the biceps.

Insertion.—Into the anterior angle of the tibia, some little way below its tubercle.

Use.—To bend the leg backwards, and a little inwards. This muscle forms part of the inner *hamstring*.

SEMIMEMBRANOSUS.—*Origin*·—From the upper and outer part of the tuberosity of the ischium ; the tendon soon becoming broader, sends off obliquely a fleshy belly ; this muscle is continued fleshy, much lower down than that last described.

Insertion.—Into the inner and back part of the head of the tibia.

Use.—To bend the leg backwards. It, also, forms a part of the inner *hamstring*.

BICEPS FLEXOR CRURIS - *Origin.*—By two distinct heads : the first, called the *long head*, arises in common with the semitendinosus, by a short tendon, from the outer part of the tuberosity of the ischium, and descending, forms a thick fleshy belly,—the second, termed the *short head*, arises from the linea aspera, and from the oblique ridge, running to the outer condyle, where it is connected with fibres of the vastus externus.

Insertion.—Into a rough surface on the outside of the head of the fibula.

Use —To bend the leg. This muscle forms the outer *hamstring*.

Popliteus.—*Origin.*—Within the capsular ligament of the knee, by a round tendon, from a deep pit or hollow on the outer side of the exteranl condyle.

Insertion.—Into an oblique ridge on the posterior surface of the tibia, a little below its head, and into the triangular space above that ridge.

Use.—To bend the leg, and when bent, to roll it, so as to turn the toes inwards.

MUSCLES POSTERIOR TO THE TIBIA AND FIBULA.

Superficial layer.

Gastrocnemius.—*Origin*.—By two distinct heads; the first, or *internal head*, from the upper and back part of the internal condyle of the os femoris, and from the oblique ridge above that condyle: the second, or *external head*, from the external condyle.

Insertion.—The two bellies, of which the internal is by much the largest, descending, unite a little below the knee-joint in a middle tendinous line, and below the middle of the tibia, send off a broad flat tendon, called *tendo Achillis* which unites a little above the ankle with the tendon of the soleus, to be inserted into the upper and posterior part of the os calcis.

Soleus, sometimes called *gastrocnemius internus*.—*Origin*.—By two origins or heads: the first, or *external head* from the posterior surface of the head of the fibula, and from the external angle of that bone, for two-thirds of its length, immediately behind the peroneus longus: the second, or *internal head*, from an oblique ridge on the posterior surface of the tibia, just below the *popliteus*, and from the inner angle of that bone, during the middle third of its length.

Insertion.—Inserted together with the tendon of the gastrocnemius into the os calcis.

Use.—To extend the foot; and the gastrocnemius, from its origin in the thigh, also bends the leg on the thigh.

Plantaris.—*Origin*.—From the upper part of the external condyle, and from the oblique ridge above that condyle, forms a pyramidal belly about three inches in length which adheres to the capsule of the knee-joint, runs over the popliteus, and terminates in a long thin tendon.

Insertion.—Into the superior part of the os calcis, on the inside of the insertion of the *tendo Achillis,* and somewhat before it.

Use.—To extend the foot, and roll it inwards, and to assist in bending the leg.

Deep Layer.

TIBIALIS POSTICUS.—*Origin.*—From the posterior surface of both the tibia and fibula, immediately below the upper articulations of these bones with each other; from the whole of the interosseous ligament; and from the flat surface of the fibula, behind its internal angle, for more than two-thirds of its length. It forms a tendon which passes behind the malleolus internus, through a groove in the tibia.

Insertion.—Into the upper and inner part of the os naviculare; being further continued through a groove in that bone, to the internal and external cuneiform bones. It, also, sends filaments to the os cuboides, and the base of the metatarsal bones of the second and middle toes.

Use.—To extend the foot, and turn it inwards.

FLEXOR LONGUS COMMUNIS DIGITORUM PEDIS, *vel* PERFORANS.—*Origin.*—From the posterior flattened surface of the tibia, below the attachment of the soleus; and continues to arise from the bone, to within two or three inches of the ankle, where its fibres terminate in a tendon, which passes behind the malleolus internus, in the same groove with the tibialis posticus.

Insertion.—Into the extremity of the last joint of the four smaller toes, by four tendons, which perforate those of the flexor brevis.

Use.—To bend the last joint of the toes, and to assist in extending the foot.

FLEXOR LONGUS POLLICIS PEDIS.—*Origin.*—From the posterior flat surface of the fibula; continuing its origin from some distance below the head of the bone to within an inch of the ankle, where it forms a tendon which passes behind the inner malleolus, posterior to the tendon of the flexor communis digitorum.

Insertion.—Into the last joint of the great toe.

Use.—To bend the last joint of the great toe, and, being connected by a cross slip to the flexor digitorum communis, to assist in bending the other toes.

MUSCLES ANTERIOR TO THE TIBIA AND FIBULA.

Tibialis anticus.—*Origin.*—From the exterior surface of the tibia, from its anterior angle or spine, and from nearly half of the interosseous ligament; from these surfaces it continues to arise down two-thirds of the length of the bone; also, from the inner surface of the fascia of the leg, and from the intermuscular ligaments. Its fibres terminate in a strong tendon, which passes from the outer to the anterior surface of the tibia, and runs *under the annular ligament.*

Insertion.—Into the upper and inner part of the os cuneiforme internum, and the base of the metatarsal bone supporting the great toe.

Use.—To draw the foot upwards and inwards.

Extensor longus digitorum pedis.—*Origin.*—From the outer part of the head of the tibia; from the head of the fibula; from part of the smooth surface between the anterior and internal angles, from a small part of the interosseous ligament: and from the fascia and intermuscular ligaments. The fibres terminate in a tendon which splits into three, before it passes *beneath the annular ligament*; the inner tendon afterwards splitting into two.

Insertion.—Into the root of the first phalanx of each of the four small toes, and expanded over the upper side of the toes, as far as the root of the last phalanx.

Use.—To extend all the joints of the four small toes.

Peroneus tertius.—*Origin.*—From the anterior angle of the fibula, and from part of the smooth surface between the anterior and internal angles; extending from below the middle of the bone downwards, to near its inferior extremity. It passes, with the last named muscle, *under the annular ligament.*

Insertion.—Into the base of the metatarsal bone, that supports the little toe.

Use.—To assist in bending the foot.

Extensor proprius pollicis pedis.—*Origin*.—From part of the smooth surface between the anterior and internal angles of the fibula, and from the neighbouring part of the interosseous ligament; extending from some distance below the head of the bone, to near its inferior extremity; a few fibres also arise from the lower part of the tibia. The fibres terminate in a tendon which passes *under the annular ligament.*

Insertion.—Into the base of the first and second phalanges of the great toe.

Use.—To extend the great toe.

MUSCLES SITUATED ON THE OUTER SIDE OF THE LEG.

Peroneus longus.—*Origin.*—From the forepart and outside of the head of the fibula, and from the adjacent part of the tibia; from the external angle of the fibula, and from the smooth surface between the anterior and external angles, as far down as one third of the length of the bone from its lower extremity; and also, from the fascia of the leg, and intermuscular ligaments. From these origins, it terminates in a tendon which passes behind the outer ankle, through a groove in the lower extremity of the fibula, and crosses the foot above the muscles of the sole.

Insertion.—Into the outside of the base of the metatarsal bone, that sustains the great toe, and into the os cuneiforme internum.

Use.—To move the foot outwards, and to assist in extending it.

Peroneus brevis.—*Origin.*—From the outer edge of the anterior angle of the fibula, and from part of the smooth surface behind that angle; from the fascia of the leg, and from the intermuscular ligament. At the lower part of the leg it forms a tendon, which passes behind the malleolus externus, with the peroneus longus.

Insertion.—Into the external part of the base of the metatarsal bone that sustains the little toe.

Use.—To bend the foot outwards, and extend it a little.

MUSCLES OF THE FOOT.

First layer.

Flexor brevis digitorum pedis, *vel* perforatus.—*Origin.*—From the anterior and inferior part of the protuberance of the os calcis, and from the inner surface of the fascia plantaris.

Insertion.—Into the second phalanx of the four smaller toes, by four tendons, which split to permit the passage of the tendons of the flexor longus.

Use.—To bend the second joint of the toes.

Abductor pollicis pedis.—*Origin.*—From the lower and inner part of os calcis; from a ligament which extends from the os calcis to the os naviculare and cuneiforme internum; and from the fascia plantaris.

Insertion.—Into the internal sesamoid bone, and base of the first phalanx of the great toe.

Use.—To move the great toe from the rest, or towards its fellow.

Abductor minimi digiti pedis.—*Origin.*—From the outer side of the os calcis, and from a strong ligament which passes from the os calcis to the metatarsal bone of the little toe, also, from the fascia plantaris.

Insertion.—Into the base of the metatarsal bone of the little toe, and into the outside of the base of the first phalanx.

Use.—To move the little toe from the other toes.

Second layer.

Flexor digitorum accessorius.—*Origin.*—From the sinuosity at the inside of the os calcis, and tendinous, from that bone more outwardly.

Insertion.—Into the outside of the tendon of the flexor digitorum longus, just at its division.

Use.—To assist the flexor longus.

Lumbricales pedis—*Origin.*—From the tendons of the flexor longus digitorum, immediately after their division.

Insertion.—Into the inside of the first phalanx of the four smaller toes, and into the tendinous expansion, that is sent from the extensors to cover the upper part of the toes.

Use.—To promote the flexion of the toes, and to draw them inwards.

The tendons of the flexor longus digitorum, and flexor longus pollicis, will be found forming a part of the second layer.

Third layer.

FLEXOR BREVIS POLLICIS PEDIS.—*Origin.*—From the under and forepart of the os calcis, where it joins with the os cuboides; also from the os cuneiforme externum.

Insertion.—Into the external and internal sesamoid bones: and continued on to the base of the first phalanx of the great toe.

Use.—To bend the first joint of the great toe.

ADDUCTOR POLLICIS PEDIS.—*Origin.*—From a strong ligament which extends from the os calcis to the os cuboides; and from the roots of the second, third, and fourth metatarsal bones.

Insertion.—Into the external sesamoid bone, and root of the metatarsal bone of the great toe.

Use.—To bring this toe nearer the rest.

TRANSVERSUS PEDIS.—*Origin.*—From the anterior extremity of the metatarsal bone supporting the little toe.

Insertion.—Into the anterior extremity of the metatarsal bone of the great toe, and into the internal sesamoid bone: adhering to the adductor pollicis.

Use.—To contract the foot, by bringing the toes near to each other.

FLEXOR BREVIS MINIMI DIGITI PEDIS.—*Origin.*—From the os cuboides, and from the root of the metatarsal bone of the little toe.

Insertion.—Into the base of the first phalanx of the little toe, and into the anterior extremity of the metatarsal bone.

Use.—To bend this toe.

The tendon of the *tibialis posticus* is seen dividing into numerous tendinous slips, to be inserted into the bones of the tarsus.

The muscles of the third layer, lie under those of the second layer, but are only partially concealed :—The *flexor brevis pollicis* lies under the tendon of the *flexor longus pollicis* ; the *adductor pollicis* lies on the outer side of the *flexor brevis*, and is in part concealed by the tendons of the *flexor digitorum longus*—The *flexor brevis minimi digiti* is a small fleshy mass, lying on the metatarsal bone of the little toe, and not concealed by any muscle of the second layer.—The *transversus pedis* runs across, under the tendons of the *flexor digitorum longus*, and *lumbricales* and is seen projecting betwixt those tendons.

Having removed the muscles last described, the fourth and last layer is seen.

The tendon of the *peroneous longus* is seen passing along a groove in the os cuboides, and crossing the tarsal bones, to be inserted into the base of the metatarsal bone of the great toe, and into the internal cuneiform bone.

Fourth layer.

Interossei interni, *vel* inferiores.—*Origin.*—Are three in number, situated in the sole of the foot, arising from between the metatarsal bones of the four smaller toes.

Insertion.—Into the inside of the base of the first phalanx of each of the three smaller toes.

Use.—To move the three smaller toes inwards towards the great toe.

MUSCLES SITUATED ON THE DORSUM OF THE FOOT.

Irterossei externi, *vel* superiores.—*Origin*—Are four in number, larger than the internal interossei, and situated on the back of the foot ; they are *bicipites*, or arise by two slips between the metatarsal bones of the toes.

Use.—To separate the toes, and assist in their abduction.

Extensor brevis digitorum pedis.—*Origin.*—From the anterior and upper part of the os calcis, from the os cuboides and from the astragalus ; forms a fleshy belly, divisible into four portions ; these send off four slendor tendons.

Insertion.—The first tendon, into the first phalanx of the great toe, and the other three, into all the small toes except the little one, uniting with the tendons of the extensor digitorum longus, and being attached to the upper convex surface of all the phalanges.

Use.—To extend the toes.

MUSCLES CONCERNED IN PERFORMING THE MOTIONS OF THE LOWER EXTREMITY.

MUSCLES OF THE HIP-JOINT.

The motions of this joint have been classed into those of *flexion*, as when the thigh is directed forwards upon the pelvis ; *extension*, when carried backwards ; *abduction*, when the thighs are separated ; *adduction*, when approximated ; *rotation* when the knee is turned outwards or inwards ; and *circumduction*, which is the quick succession of all these motions.

Flexion of the hip-joint is performed principally by the *psoas magnus*, *iliacus*, and *pectineus*, which, being the first muscles of the lower extremity put in action in progression, are termed the *progressors* ; but *flexion* is further assisted by other muscles of the hip-joint, namely, the *adductor femoris*, *obturator externus*, with perhaps a few fibres from the *glutæi*, &c.

Extension of the hip-joint is effected chiefly by the *glutæi*, *obturator internus*, *gemini*, *quadratus femoris*, and *adductor magnus* ; also, assisted by the *semitendinosus* and *semimembranosus*.

Abduction of the hip-joint is produced by the three *glutæi*, *tensor vaginæ femoris*, *pyriformis*, *gemini*, and *obturator internus* of the hip, and *sartorius* of the knee-joint ; the three first being the principal agents.

Adduction of the hip-joint is performed by the *triceps adductor femoris*, the *quadratus femoris*, *obturator externus*, *pectineus*, *psoas magnus*, and *iliacus* of the hip ; *semitendinosus*, *semimembranosus*, *long head* of the *biceps*, and *gracilis*, of the knee-joint.

Rotation outwards, by the *pyriformis*, *gamini*, *obturatores*, and *quadratus femoris* ; assisted by the *iliacus*, *psoas* *magnus, glutæus magnus, medius*, and *triceps adductor femoris.*

Rotation inwards, by the *tensor vaginæ femoris*, anterior fibres of the *glutæus medius* and *minimus* ; assisted by the *sartorius, gracilis*, and *semitendinosus* of the knee-joint.

All these muscles successively in action, produce *circumduction* of the hip joint, assisted by motions of the trunk.

MUSCLES OF THE KNEE-JOINT.

The motions of the knee are *flexion* and *extension*, for which different sets of muscles are provided ; but independently of flexion and extension, the exertion of these muscles is constantly called forth in conjunction with those of the hip, to maintain the erect position of the body, by fixing the knee-joint, and confining the condyles of the femur in a steady position on the head of the tibia ; for this purpose, muscles surround the joint in every direction.

The muscles of the knee-joint are *flexors* and *extensors*. The *flexors* are the *gracilis, sartorius, semimembranosus, semitendinosus, biceps*, and *popliteus* assisted by the *gastrocnemius*, and *plantaris*, muscles of the ankle-joint.

The *extensors* are the *rectus femoris, cruræus*, and two *vasti* ; assisted by the *tensor vaginæ femoris*, and *glutæus maximus* ; the two latter muscles being thus capable of producing flexion or extension, when the limb is placed in certain positions by the other muscles.

MUSCLES OF THE ANKLE-JOINT.

The ankle joint is capable of *flexion* and *extension*, and a slight *inflexion* outwards and inwards. These latter motions only occur in just reference to the ankle-joint, when the foot is extended, in which position, the smaller portion of the articular surface of the astragalus is admitted between the malleoli, and admits of this motion. When the bones of the leg rest on the astragalus at a right angle, or during flexion of the foot, then the larger part of the astragalus is fixed between the malleoli, and the rotatory motion communicated to the foot, depends upon the motions of the knee and hip ; and wholly to the latter when the knee is extended.

The *flexors* of the ankle-joint are the *tibialis anticus*, and *peroneus tertius*, as proper to the joint ; assisted however, by the *extensor longus digitorum*, and *extensor pollicis.*

The *extensors* are the *gastrocnemii, soleus, plantaris, tibialis posticus, peroneus longus*, and *brevis*, assisted by the *flexor longus digitorum*, and *flexor longus pollicis*.

Inflexion inwards is performed by the *tibialis posticus, extensor pollicis, flexor longus pollicis*, and *flexor longus digitorum*.

Inflexion outwards, by the *peroneus longus, brevis*, and *tertius*, assisted by the *extensor longus digitorum*.

The motions of the bones of the tarsus are extremely limited.

The motions of the toes are much more limited than those of the fingers. This may, in a great measure, depend on their comparative disuse, and the manner of covering the feet. They have, however, like the fingers, their common and proper muscles.

PHYSIOLOGY OF THE MUSCLES.

The muscles have been divided into *voluntary, involuntary*, and *mixed*.

VOLUNTARY MUSCLES.

The *voluntary* muscles are those which belong to the animal functions, are attached to the bones, and constitute the active power which puts these levers in motion. These muscles are firm and solid, and contribute a very considerable portion of the bulk of the human body; they are of a florid red colour, composed of fasciculi which run parallel to each other, and are usually attached at each extremity to tendons, or some other parts of fibrous texture, through the medium of which, they become connected with the bones. There are but few exceptions, among the voluntary muscles, to their being found in pairs: the diaphragm and sphincters may be considered exceptions, if not to be classed among mixed muscles. The size of the voluntary muscles varies considerably; some being of very large size, while others are of the smallest dimensions. They vary also in figure; some being *long*, as in the extremities; others *broad*, as those that cover cavities; while those attached to the irregular bones, are *short* muscles.

The motions which take place in the human body and are produced by the action of the voluntary muscles, are flexion, extension, lateral inclination, rotation towards opposite directions, abduction, adduction, elevation, and depression : and from the performance of these motions, have many of the muscles been named.

The *long* muscles, attached to the extremities, are more or less cylindrical, and have a remarkable length of tendon attached to them, even sometimes longer than the muscle itself, while they, also, frequently divide into several tendons for their insertion.

The *broad* muscles are generally thin, and, as has been mentioned, usually assist in forming the parietes of great cavities, contributing also, at times, to the functions of the viscera enclosed by them.

The *short* muscles are generally thick in proportion to their length and breadth ; they are usually of a square form, and are the strongest of all muscles, as they contain in proportion to their size the most fibres. They are therefore, found in situations where great power and quickness, rather than extent of motion, are required—for instance, in the articulation of the lower jaw, in the hand, foot, &c.

INVOLUNTARY MUSCLES.

These are sometimes also called the *internal* muscles. They bear separately no particular names, but are denominated according to the organ of which they form a part.

To this class; belong the muscles of the *heart*, of the *alimentary canal*, of the *uterus*, of the *urinary organs*, and, probably also, the fibrous structure of the *iris*.

The muscles of this class are deeply seated, and may be easily distinguished from the voluntary muscles. They are much less bulky, and form hollow cylinders, the internal surface of which is lined by mucous membrane. Their fibres are of a greyish colour, with the exception of those of the heart, which are of a deep red ; and, unlike the voluntary muscles, they are not furnished with tendinous attachments.

MIXED MUSCLES.

The *mixed* class of muscles are those, which, both in structure and function, are intermediate to the voluntary and involuntary.

They are called *mixed*, in consequence of the voluntary power we possess over them, to modify their action; although, at the same time, we cannot by any effect of the will entirely stop the performance of their function for any length of time. The *diaphragm*, and all the muscles of *respiration* are included in this class, as we are enabled to use them quickly or slowly at will; but we cannot by the same effort cease to respire for any length of time, although, habit renders some persons capable of suspending this action for a considerable period, as may be observed in divers. The *sphincter* muscles are included, as they are not constantly under the control of the will.

These muscles are of greater irritability than the voluntary, but of less than the involuntary.

PROPERTIES OF MUSCLES.

The *physical properties* of the muscular fibre depend upon its form, structure, and general external characters; and may be said to be flexibility, extensibility, adhesiveness and elasticity. By maceration, a muscle undergoes several changes, which vary with the kind of fluid to which it is exposed; thus, alcohol and diluted acids cause it to soften and swell; a solution of corrosive sublimate, or alum makes its fibres separate by the shrinking of the cellular membrane surrounding them, and increases the consistency of the fibre itself, by inducing its contraction; a solution of common salt renders it harder, and increases the redness of its colour. By boiling, the fibres of a muscle are entirely separable, and become colourless.

The *vital properties* are those by which the functions of the muscular system are produced. During life the muscles possess and exercise a power called *contractility*; and the capacity for the exercise of this power is termed *irritability*. By the former, is meant that power by which a muscle, from the application of a stimulus, is capable of shortening itself, or contracting, and it is in consequence of this, that all their actions are performed; while the latter means the susceptibility to receive the necessary impressions from stimuli. The stimulants may be *vital, mechanical, or chemical*. Those of the first kind act through the medium of the brain, and consist of the influence of the will, and passions; the second are impressions from without, from the slightest touch to the greatest degree of violence, whether applied to the brain or nerve itself; and the third are alcohol, acids, electricity, &c. which more especially affect the involuntary muscles.

It is very remarkable, that not only particular muscles, but particular fibres of the same organ, should be differently affected by different stimuli; thus, certain substances produce the natural action of the stomach and bowels, while others will produce vomiting and purging, and yet, no difference can be perceived in the organization or chemical properties of the fibres themselves.

The nourishment of the muscles decreases very sensibly in old age. They then diminish in size, become pale, lax, and unsteady, particularly in the extremities. Muscular contraction also suffers nearly the same changes as the nutrition of muscles, ecoming gradually diminished in power as old age advances.

The whole of the sensible phenomena of *muscular contraction* go on in the muscles; but, it is certain that no action can take place without the immediate influeuce of the *brain* and *nerves*; for, if the nerves of a muscle be cut, it loses all power.

The intensity of muscular action, or the degree in which the fibres draw themselves together, is regulated by the action of the brain, and generally depends on the will, according to certain limits which are different in different individuals. The muscular power may be carried to a wonderful degree by the action of the brain alone, as is seen in the instances of enraged maniacs, and of persons in convulsions.

The will governs the duration of contraction; it cannot be continued beyond a certain time, however it may vary in different individuals. A feeling of weariness takes place, and goes on increasing until the muscle refuses to act.

Voluntary, or natural muscular contraction, must not be confounded with that, which is the effect of diseaae, such as convulsions, spasms, tetanus,&c.

Relaxation is the opposite state to *contraction*, but is seldom altogether complete in the voluntary muscles, which are usually in a kind of middle state, ready to assume a greater degree of either, without requiring any particular exertion. As an example, it may be observed, that in *hemiplegia* the muscles of the affected side are much more relaxed, than the sound when in their natural condition. The heart and intercostal muscles are, perhaps, more completely relaxed than the voluntary muscles.

VESSELS AND NERVES OF MUSCLES.

Bloodvessels are found in great abundance in all the muscles, the bellies of which derive their red colour from the blood. The *arteries* are large and in most instances capable of being demonstrated, their larger trunks generally entering near the centre of a muscle, and dividing into minute branches to supply the parts at both extremities, &c. The larger trunks of arteries, as they pass through the muscular system to distant parts, are deeply situated, and so placed as to be protected from injury.

The *veins*, which return that portion of blood from the muscular system which is not required for its use, are distributed into two sets, the one being situated in the interior of muscles accompanying the arteries, while the other is observed running on the surface of the muscles. The object of this appears to be, that, during the action of a muscle, the flow of blood through the veins towards the heart, should not be interrupted ; and, hence, the phenomenon of the superficial veins becoming distended with blood, when the muscles of the arm are put into a state of contraction.

The *nerves* of the muscular system are both numerous and large, more especially, those which supply the external muscles.

OF THE ORGANIC DISEASES OF MUSCLES.

The muscles are frequently inflamed, and are said to be in some modification of this condition in rheumatism ; this kind of affection not terminating in suppuration, but in debility, rigidity, and the effusion of a gelatinous matter into the sheaths of the tendons, and their bursæ mucosæ.

This inflammation is very apt to change its place, and to become chronic. Pus is also, sometimes, effused between the fasciculi of muscles.

Muscles are sometimes lacerated, partially, or wholly, in consequence of violent exertion, while at other times they may be partially displaced.

They also, frequently lose their sensibility to the action of stimuli, the contraction of the voluntary muscles being no longer under the influence of the will, and deprived of the power of contraction. This state is called *paralysis*.

They are, at other times, rigidly, and involuntarily contracted, forming what is called *spasm*.

Some poisons, but especially lead, occasion a remarkable shrinking of the muscles, followed by *palsy*.

Muscles are also subject to gangrene, and they have been sometimes found partially ossified.

PART IV.

THE BRAIN.

The name of *brain* has been given to that soft mass contained in the cranium, from which the *nerves* pass to the organs of the senses, and over the whole body, receiving impressions, or sensation, and acting as agents of the will. While it is the receptacle of all *sensation*, it is also believed to be the instrument of *thought*.

The substance of the brain is delicate and soft, and possesses a degree of elastic resistance ; but the nerves appear firmer and harder, because, though their peculiar substance has equal delicacy with the brain, the membranes in which they are enveloped give them firmness and strength, to enable them to pass through the moving parts of the body, without sustaining injury or interruption to their proper functions. The brain is protected by the skull, and its *coats*, *meninges*, or *membranes*. The latter are three in number, viz. the *dura mater*, the *tunica arachnoides*, and the *pia mater*.

THE DURA MATER.

The *dura mater* is the most external of the coverings, being the strong membrane which is found covering the brain on the removal of the calvaria,'or skull-cap, to which it strongly adheres, and has sometimes been called the *internal periosteum*. It is divisible into two or more laminæ, or layers, and upon its outer surface may be observed, along the course of the sagittal suture, a number of small fleshy papillary bodies, like millet seeds, called *glandulæ Pacchioni*. The brain is intersected by *septa*, or *processes*, formed by a reflection of the inner lamina of the dura mater.

Their use appears to be, to support the brain against any sudden motion, or the mutual gravitation of its parts. The largest of these partitions, is the *falx major*.

The triangular channels, left between the layers in forming the several septa, are called *sinuses*. They serve for conveying blood, and will be afterwards described.

Falx Major.—It extends from the front, to the back part of the skull, in a line with the sagittal suture, being attached before, to the crista galli of the ethmoid bone, and behind, to the superior perpendicular limb of the cruciform spine of the occipital bone ; passing deep into the brain in its course, and thus dividing it into two halves, or *hemispheres*. It is narrower before than behind, becoming gradually broader, or descending deeper between the hemispheres, as it passes backwards, and necessarily preserving the shape of the cranium, hence, it has been called *falx*, meaning a scythe, or bill-hook.

Tentorium.—It is so called from its stretching over the *cerebellum*, like a tent or roof, and is another process of the dura mater running horizontally in a line with the transverse ridge of the cruciform spine of the occipital bone, and supporting the posterior lobes of the cerebrum.

It is continued round the cavity of the cranium, from the occipital bone to the sharp edges of the petrous portions of the temporal bone, thus, dividing the cavity of the cranium into two compartments, the upper for the *cerebrum*, and the under for the *cerebellum*. There is, however, a circular opening at the anterior part of the tentorium, where the *cerebrum* and *cerebellum* are united.

The duplicatures of the dura mater, which stretch between the edges of the petrous portions of the temporal bone, and posterior clinoid processes, and again, forward to the anterior clinoid, on each side, are called *sphenoidal folds*, and leave a space for the *pituitary gland*. By the irregular splitting of the layers of the dura mater, there is a sinus formed which is situated at the sides of the sells Turcica and is called the *cavernous sinus*.

Falx Cerebelli.—This is a small process which descends from the tentorium, along the lower limb of the perpendicular spine of the occipital bone, to the margin of the foramen magnum, and divides the cerebellum into two *lobes*.

THE TUNICA ARACHNOIDES.

This coat has received its name from its extreme thinness, and resemblance to a *spider's web*. It is situated between the dura mater and pia mater, and covers the surface to the brain uniformly, without sinking into any of the interstices of the convolutions.

It is so thin that it cannot be separated by dissection, for any considerable space, from the pia mater, although, it may be partially raised for a little by the blow pipe, when it appears to be cellular. It has by some been considered as merely an outer layer of the pia mater.

THE PIA MATER.

This, also called *tunica vasculosa*, or *vascular coat*, is the membrane which immediately invests and connects itself with the substance of the brain. It is called the vascular coat, from its conveying the vessels not only to the cavities of the brain, but to every part of its substance ; all vessels in the body, however minute, being always conveyed in membranes.

The *pia mater* passes into the substance of the brain, divides, and subdivides ; every capillary vessel, and every particle of brain, is invested or supported by its subdivisions ; it is thus, to the brain, what the cellular membrane is to other viscera and parts of the body.

OF THE SUBSTANCE OF THE BRAIN.

The surface of the brain appears like a number of convex serpentine ridges, called *convolutions*, and between which are clefts or fissures. When cut into, its substance is found to be *externally*, of an *ash colour*, while the *inner portion* varies in colour in different parts, between *white* and *reddish*. The former has been called *cortical*, from its situation, or resemblance to the bark of a tree, or *cineritious*, from its ash colour ; while, the inner, or white substance, is called *medullary*, or *marrow* part.

The brain has been divided by Anatomists into three parts, viz. the *cerebrum*, *cerebellum*, and *medulla oblongata*.

THE CEREBRUM.

The *cerebrum* forms the greater or superior division of the brain, occupying the upper part of the cavity of the cranium, and resting on the tentorium.

It is divided by the falx major into *two halves*, or *hemispheres*, each of which is again divided *into three lobes*, called *anterior*, *middle*, and *posterior;* to be afterwards described.

On separating the hemispheres with the fingers, we see a broad portion of white, or medullary substance, called *corpus callosum*, extending between the internal flattened side of one hemisphere, and that of the other. Its upper surface is slightly convex, and upon it are two medullary lines slightly raised, parallel to each other, and running longitudinally. Between them, is a superficial furrow, or rut, called the *raphè* ; and there are observed other minute lines, running across as if passing from one hemisphere, to the other, called *lineæ transversæ*.

When the two hemispheres are removed by an incision, down to the level of the corpus callosum, the medullary substance appears of an oval form, and is called the *centrum ovale*.

Immediately beneath the corpus callosum, is the *septum lucidum*, a thin, transparent medullary membrane, resting at its lower edge on the *fornix*, (to be described) and completely separating the two cavities called *lateral ventricles*. The septum lucidum is narrow before, becomes gradually broader, and is composed of two plates of medullary substance, between which a minute quantity of fluid has been found, and hence, this space has sometimes been called the *fifth ventricle*.

THE LATERAL VENTRICLES.

The *lateral ventricles*, which have been alluded to as being separated from each other by the septum lucidum, are situated partly under the corpus callosum, but chiefly under the medullary centre. On cutting, therefore, on each side of the corpus callosum, we get into *two oblong cavities* placed *horizontally*, of very irregular shape, and stretching into *three prolongations*, or *cornua* (*horns*) whence, they have been called *tricornes*.

The *anterior cornua*, pass forwards and outwards, to the *anterior lobes* of the cerebrum, in a horizontal direction; the *middle, inferior*, or *descending cornua*, take a direction outwards, then downwards and forwards, terminating near the base of the brain in the *middle lobes;* while, the *posterior cornua* appear as elongations of the ventricle continued from the origin of the others, and proceeding backwards into the *posterior lobes;* they terminate in a pointed form, converging towards each other, and are called *digital cavities*.

Parts seen in the Lateral Ventricles.

The FORNIX, already alluded to as the part on which the septum lucidum rests, is a *medullary body, flat,* and of a *triangular* shape, separating the *two lateral,* and *third ventricles*; its lateral margins being in the former, while its lower surface is towards the latter. The fornix has *four crura*, or *pillars, two anterior* and *two posterior*.

The *anterior* are close together, and are continued down between the *corpora striata*, and behind the *anterior commissure* of the brain.

The *posterior crura* are the larger, and, coalescing with the *corpus callosum*, are continued into the inferior or descending horns of the lateral ventricles, forming in each a long convex elevation called *hippocampus major*.

At the inner edge of each *hippocampus*, is a thin tape-like body, with a fimbriated or puckered edge, called *tænia hippocampi*, or *corpus fimbriatum*. The inferior extremity of the *hippocampus* is called *pes hippocampi*, or, *cornu Ammonis* from making a curve inwards, like a ram's horn.

The *smaller hippocampus*, or *hippocampus minor*, is a relief, or convexity, in the floor of the posterior horn of the ventricles, which may be also traced backwards from the crura of the fornix.

On raising the fornix, its under surface is found to be in contact with what is called the *velum interpositum*, and it is marked by lines, which, being compared to the strings of a lyre, have originated the name of *lyra*, or *psalterium*.

The VELUM, so called from its resemblance to a veil or curtain, lies in the centre of the brain, and is a continuation of the pia mater passing in between the posterior lobes of the cerebrum, and the cerebellum, enveloping the *corpora quadrigemina* (parts to be described) and then passing under the fornix. Its margins lie on the *thalami nervorum opticorum*, and appear to be terminated laterally by the *choroid plexus*, which consists of the connected folds, or plicæ of the internal membrane of the ventricles loaded with vessels. The veins of this plexus meet below the fornix, and, about the middle of the velum, form a trunk called *vena Galeni*.

The CHOROID PLEXUS, rises on each side from the bottom of the inferior horn of the ventricle, and lies large and fleshy-like about its origin. It goes to the superior level of the ventricle, and then passes inwards and forwards, diminishing in thickness, until it coalesces with the plexus of the opposite side under the fornix, in the communication between the ventricles, which is called the *foramen of Munro*. This hole is situated under the anterior part of the fornix, and behind its anterior crura.

The CORPORA STRIATA are smooth, cineritious convexities, in the forepart of the lateral ventricles. Each is somewhat of the shape of a pear, and approaches its fellow, towards the forepart with a regular convexity, but, becoming narrower, and at the same time separating as they pass backwards, their posterior extremities appear as if pushed outwards by the thalami nervorum opticorum.

These bodies are called *striata*, from the intermixture of medullary and cineritious matter, which gives the appearance of *striæ*, or *streaks*, when they are cut. The corpora striata are connected by what is called the *anterior commissure*, a transverse medullary cord, immediately before the anterior crura of the fornix.

The THALAMI NERVORUM OPTICORUM are, in a great measure, concealed by the posterior angles of the fornix, and the choroid plexus. It is therefore, necessary, for the purpose of exposing them, to remove the fornix and velum. They may be observed to be somewhat of a *whiter colour* than the corpora striata, their *surface* being *medullary*, while they are *internally, cineritious*. They have their convex surfaces towards each other, and unite under the fornix, by what is called the *commissura mollis* (from its softness) in contradistinction to the *commissura magna*, a name sometimes given to the corpus callosum, the *commissura anterior*, joining the corpora striata, and the *commissura posterior*, yet to be described.

Between the bodies of the corpora striata, and optic thalami, there is a very narrow tract of medullary matter called *tænia semicircularis*. It appears to give covering to a vein passing to join the vena Galeni.

THE THIRD VENTRICLE.

The *third ventricle* does not in any way resemble those described, being merely a *vertical fissure*, or *sulcus*, bounded on either side by the *thalami*, above, by the *velum* and *fornix*, below, by the *infundibulum*, *corpora albicantia*, and *crura cerebri*, in front, by the *anterior commissure* and *crura* of the *fornix*, and behind, by the *pineal gland*, and *posterior commissure*, parts to be described.

The third ventricle opens forwards and upwards, into the *lateral ventricles*, and downwards, and forwards, into the *infundibulum*. The former communication which is called *foramen commune anterius*, takes place where the choroid plexus of one side unites with that of the other, in the *foramen of Munro*.

There is another communication between the lateral and third ventricles, but it is covered by the velum, and situated between the *commissura mollis*, and *posterior commissure*. It is called, in contradistinction to the anterior, *foramen commune posterius*.

There is also, a fourth opening called the *iter a tertio ad quartum ventriculum*, or *passage from the third to the fourth ventricle*. It leads downwards and backwards, *under* the *corpora quadrigemina* and *posterior commissure*.

Parts between the Hemispheres posteriorly.

THE CORPORA QUADRIGEMINA.—These, also called *nates* and *testes*, are four rounded projections, separated by a cruciform furrow. The *upper*, *anterior*, and *larger*, are called *nates*, and the *lower* and *posterior*, *testes*. They are situated behind the third ventricle, between the posterior extremities of the thalami, and above the passage to the fourth ventricle.

Pineal gland.—This is a *small oval body*, situated *above* and *upon* the *tubercular quadrigemina*, and of a cineritious colour. It is behind the thalami nervorum opticorum, with which it appears to be connected by *two narrow medullary bands*, which are continued upon the inner surface of the thalami, till they are lost near the anterior pillars of the fornix. They are called the *pedunculi* of the pineal gland. The gland sometimes contains a few grains of sand, and is enveloped in the pia mater in common with the above bodies.

The posterior commissure.—This commissure, with which the pineal gland appears connected, is seen like a *cord*, or like the anterior commissure, towards the *back part* of the *third ventricle*, *before* the *tubercula quadrigemina*, and *above* the *iter ad quartum ventriculum*.

INFERIOR SURFACE OF THE CEREBRUM.

Each hemisphere is now distinctly seen to be divided into *three lobes*.

The *anterior lobes* rest upon the orbitar plates of the frontal bone; the *middle*, which are separated from the former by a fissure called *fossa Silvii*, occupy the depressions bounded by the transverse spines of the sphenoid, and the petrous portions of the temporal hones; while, the *posterior lobes* rest upon the tentorium, and are lodged in the depressions above the transverse ridge of the cruciform spine of the occipital bone.

The crura cerebri.—They are two bodies composed of white fibrous medullary matter, diverging and enlarging as they extend forwards. They are formed from the whole *central medullary matter* of the cerebrum, which, passing downwards and backwards, forms the *crura*. They appear *anteriorly*, below the junction of the optic nerves, and, having contracted their diameters and united *posteriorly*, are covered by the *pons Varolii*. *Internally*, they have a layer of darker substance called *locus niger*.

The infundibulum.—It is seen on the under surface of the cerebrum, and is a *funnel-shaped cineritious body*, placed in an oblique direction, above the *corpora albicantia*; its apex, which is anterior to them, rests upon the *pituitary gland*.

THE PITUITARY GLAND, is of an *oval shape*, externally of *a reddish brown color*, and situated in the sella Turcica, in a duplicature of the dura mater.

THE CORPORA ALBICANTIA, or *mamillary eminences*, are small white bodies, situated close together, between the crura cerebri. They are said to be formed by the extremities of the anterior pillars of the fornix.

THE CEREBELLUM.

The *cerebellum*, is less than one third of the volume of the cerebrum, is situated under the posterior lobes of the latter, from which it is separated by the tentorium, and in the lower fossæ of the occipital bone.

It is divided into two *parts*, or *lobes*, by the falx minor. It is like the cerebrum, composed of two substances, *cineritious* and *medullary*, but, instead of being convoluted, its surface is formed into *grooves* or *furrows*, which are much narrower than those of the cerebrum, and have a concentric arrangement, their convexities facing outwards. The appearance of the two substances of the cerebellum, when cut into, from the resemblance to branches, has been called *arbor vitæ*.

The superior surface of the cerebellum, presents in its middle, a longitudinal eminence transversely furrowed, and called *processus vermiformis superior ;* and, on separating the hemispheres, there will be seen between them, another longitudinal eminence of a cineritious colour, larger behind than before, furrowed transversely, and named *processus vermiformis inferior*.

The *superior vermiform process* is continued anteriorly into the *valvula cerebri*, or *velum Vieusenii*, which is a thin lamina of medullary substance lying over the under part of the passage to the fourth ventricle, and the upper part of the ventricle itself. At the sides of the velum are two *medullary columns*, extending between the testes and cerebellum, and called *processus ad testes*.

THE FOURTH VENTRICLE.

By making a longitudinal incision through the cerebellum, from above downwards, the *fourth ventricle* is exposed. It is an almost *perpendicular sulcus* of a triangular figure. The under part is continued into a kind of fissure, called the *calamus scriptorius*, which extends some way down the medulla oblongata.

Crura cerebelli.—These are two round *medullary bodies*, which extend between the *pons Varolii* on each side, and the sides of the *cerebellum*.

Pons varolii, or tuber annulare.—This is a considerable arched eminence, oblong from side to side, situated at the under surface of the brain, appearing to be formed by the union of the *crura cerebri*, and *crura cerebelli*, and to be made up of transverse fibres of a white colour, with sineritious substance within.

THE MEDULLA OBLONGATA.

The *medulla oblangata* is the prolongation of the substance of the *crura cerebri*, and *cerebelli*, and the *pons Varolii*. It is the undermost part of the brain, about an inch in length, and extends from the middle of the cuneiform process, to the atlas, where it terminates, or is continued into the *medulla spinalis*, or spinal cord. The anterior surface is divided into a *right* and a *left* half, by a *longitudinal furrow*, which is continued to the spinal marrow. There are observed upon its surface, four eminences called *corpora pyramidalia* and *corpora olivaria*.

Corpora Pyramidalia.—They are situated in the *middle*, and are in contact with each other. They reach through the whole length of the medulla oblongata, are broader and more prominent above, becoming gradually narrower, as they descend, and are composed entirely of mednllary matter.

Corpora Olivaria.—These are situated at the *outer sides* of the pyramidalia, form an oval prominence on each side and are externally medullary ; but contain a layer of cineritious substance, with a medullary nucleus.

The posterior surface of the medulla oblongata, is marked by the fissure described as the calamus scriptorius. The more minute subdivisions of this column and of the spinal cord, with the peculiar properties said to belong to each, will be found described under the head of "Physiology of the nerves." Part X.

NERVES OF THE BRAIN.

These nerves have been variously enumerated, from some of them being, at times, considered either as parts of others, or separately. They may be properly enumerated however, as consisting of *eleven pairs*, as follows :—

1st.	*Olfactory.*	
2d.	*Optic.*	
3d.	*Common Oculo-muscular*, or *motor oculi.*	
4th.	*Inner Oculo-muscular*, or *trochlearis.*	
5th.	*Trigeminal, from being divided into three parts.*	
6th.	*Outer Oculo-muscular*, or *abducens.*	
7th.	*Facial*, or *portio dura.*	*referred to, in Osteology; as the 7th pair.*
8th.	*Auditory*, or *portio mollis.*	
9th.	*Glosso-pharyngeal.*	*do. do. the 8th pair.*
10th.	*Pneumo-gastric*, or *par vagum.*	
11th.	*Lingual.*	*do. do. the 9th pair.*

1st. *Olfactory.*—This nerve is situated in a groove on the anterior lobes. It arises, by three roots of medullary matter, from the inner and back part of the anterior lobe, where it joins the middle one, and, having reached the *cribriform plate*, becomes bulbous, and passes through it, by numerous filaments, to the *nose.*

2d. *Optic.*—This nerve arises from the back and outer part of the thalamus, and corpora quadrigemina. It is continued forwards and inwards, over the inferior surface of the crus cerebri, becoming thicker and rounder, and meeting the other optic nerve, with which it joins immediately under the third ventricle. This course is called the *tractus opticus.* The nerve passes through the *foramen opticum.*

3d. *Common Oculo-muscular.*—This nerve comes off close to the anterior edge of the pons Varolii, from the inner surface of the crus cerebri. It is continued through the outer wall of the cavernous sinus and passes through the *foramen lacerum orbitale superius.*

4th. *Inner Oculo-muscular, (trochlearis.)*—This is the smallest of the cerebral nerves, and arises behind the testes, from the processus ad testes. It is continued along the under surface of the brain, communicating by one thread, with the first branch of the fifth pair, and passes through the *foramen lacerum orbitale superius.*

5th. *Trigeminal.*—It appears between the pons Varolii and crus cerebelli, from which it may be traced backwards to the depression between the latter and the corpus olivare, taking its origin from both. It gradually enlarges, and spreads in passing to the edge of the petrous portion of the temporal bone, along which it is continued in a sheath of the dura mater, which separates it from the cavernous sinus. Upon the anterior part of its surface, it is enlarged, and forms the *semilunar ganglion,* which passes off in *three* principal branches, viz. I. The *ophthalmic,* or superior branch, the smallest, is continued along the outer side of the cavernous sinus to the orbit, through the *foramen lacerum orbitale superius.* II. The *superior maxillary,* the middle in size and situation, passes forwards to the *foramen rotundum.* III. The *inferior maxillary* the largest, from the lower and back part, passes downwards and outwards to the *foramen ovale.*

6th. *External Oculo-muscular, (abducens).*—It arises from the upper end of the corpus pyramidale, and posterior edge of the pons Varolii; sometimes, from the corpus pyramidale or olivare. It passes outwards and forwards, and opposite to the posterior clinoid process, goes through the dura mater into the cavernous sinus, from the blood of which, it is separated by the internal membrane. It lies on the outer side of the carotid artery, with which it is connected, and sends some filaments to the *sympathetic nerve.* It is continued through the *foramen lacerum orbitale superius.*

7th. *Facial, (portio dura of the 7th pair.)*—This is smaller, than the following nerve, the auditory, or *portio mollis* of the 7th pair, as it has been called from its comparative softness, and comes out from the fossa, formed between the pons Varolii, corpus olivare, and crus cerebelli. The nerve passes forwards and outwards to the *auditory foramen,* is continued in its canal with the *portio mollis,* which it quits to pass through the *foramen stylo-mastoideum.*

8th. *Auditory, (portio-mollis.)*—It arises from the calamus scriptorius, and from the lateral surface of the crus cerebelli, just above the former nerve. Its inner surface is hollowed for the reception of the portio dura. This nerve passes to the inner ear, as already mentioned.

9th. *Glosso-pharyngeal.*—It arises by five or six threads between the nervus vagus, and facial nerve, close to the former, from the under surface of the crus cerebelli, from the depression between it, the corpus olivare, and the posterior edge of the pons Varolii, from which it receives a filament or two. It takes its course outward, and at first forward, and is connected by a strong filament, with the pneumo-gastric nerve. It passes into a separate sheath of the dura mater, and is continued through the forepart of the *foramen lacerum posterius*, in the base of the skull.

10th. *Pneumo-gastric (par vagum, nervus vagus.)*—It arises from the under and lateral part of the crus cerebelli, and from the groove between it and the corpus olivare, by numerous filaments. They converge into a flat trunk, which takes its course in a short sheath of the dura mater, through the forepart of the *foramen lacerum posterius*, sometimes, separated by a long process of bone from the internal jugular vein, and by the dura mater, from the nervus glosso-pharyngeus, and accessory nerve.

11th. *Lingual*—This nerve arises by from four to eight filaments, from the anterior surface of the medulla oblongata, and from the groove between the corpus olivare, and corpus pyramidale. It forms two or three fasciculi, which pass separately through the dura mater, into the *anterior condyloid foramen*, and are united as they leave it in a single trunk.

CIRCULATION OF THE BRAIN.

Although a description of the bloodvessels of the brain may be properly considered to belong to another division of Anatomy, the introduction of it in this place will complete the description of the parts *within the skull.*

Arteries.

The *dura mater* is chiefly supplied from the *spinous artery*, on each side, which enters the skull by the *foramen spinosum* of the sphenoid bone, and divides into numerous branches.

The *cerebrum, cerebellum.* and *medulla oblongata,* are supplied with blood by the *carotid,* and *vertebral arteries.* The former enter the skull by the *canalis caroticus* on each side, and having ascended to the sella Turcica, each divides into several branches.

The first branch, or *anterior cerebral artery,* having passed forwards, unites with its fellow on the opposite side, by means of a cross branch, called the *anterior communicating branch.* It afterwards proceeds in the fissure between the anterior lobes of the cerebrum, to be distributed backwards upon the corpus callosum. This branch gets the name of *arteria corporis callosi.*

The second, or *middle cerebral artery,* passes outwards in the *fossa Silvii,* sends twigs into the descending cornu of the ventricle, and is distributed to the middle lobes of the brain.

A *posterior communicating branch* is given off from the carotid, to unite with the posterior cerebral artery, which is derived from the *basilar,* and thus, is formed that communication which is called the *circle of Willis.*

The *basilar artery* is formed by the union of the *two vertebral arteries,* (to be described) near, or upon the posterior edge of the pons Varolii. It passes along the middle of the under surface of the pons, and divides near its anterior edge into four principal branches, viz. the *two superior arteries* of the *cerebellum,* and the *two posterior arteries* of the *cerebrum.*

The former pass outwards near the anterior ridge of the pons Varolii, and then over it, and backwards to the *cerebellum,* to which their branches are distributed.

The cerebral branches are rather larger, and form the anastomoses with the communicating branch of the internal carotid already described.

Sinuses.

The principal vessels which return the blood carried to the brain by the arteries just described, are formed by the dura mater, and called *sinuses.* They serve the purpose of *veins,* but differ from them in structure and figure ; their shape is *triangular ;* they have *no valves* ; and they do *not* accompany arteries.

I. *Superior Longitudinal sinus.*—It begins at the crista galli, passes directly backwards, is placed at the upper part of the falx major, and situated under the sagittal suture. It is narrow at its commencement, but becomes more capacious in its course backwards, and terminates in the *lateral sinuses*, most commonly, in the *right*.

On laying open the sinus, the openings of the veins are seen, the greater number of them taking their course and entering the sinus from behind to before ; near the entrances of the veins, are numerous tendinous fibres, called, *chordæ Willisii.* The small bodies also, formerly described as *glandulæ Pacchioni*, are found in this sinus.

II. *Lateral sinuses.*—These are two in number. They begin at the termination of the longitudinal sinus, pass outwards on each side, in the grooves of the transverse ridge of the occipital bone, and are continued in the sulci, or grooves, already mentioned, to the base of the cranium, where they terminate in the *internal jugular veins*, at the *foramina lacera posteriora.*

There is a variety in the origin of these sinuses, the left sometimes coming off from the straight sinus.

III. *Inferior Longitudinal sinus* —This is the inferior sinus of the falx major, running along its inferior edge, as the corresponding larger sinus does, along the upper margin. It is small towards the forepart of the falx, but increases in size, as it passes backwards, by the accession of veins from both hemispheres, and terminates near the edge of the tentorium, in the *fourth sinus.*

IV. *Fourth, Straight sinus*, or *Torcular Herophili*, so called from a notion formerly entertained of the blood being squeezed in it, as in a torcular, or wine press, is formed by the sinus last mentioned, and the *vena magna Galeni*, but chiefly by the latter. It terminates more commonly in the left lateral sinus, than at the communication of the three sinuses.

The above are the principal sinuses, both as to size and function. The others have been named, and enumerated as follows :—

Circular sinus, which is placed about the pituitary gland, and terminates in the cavernous sinus :

Cavernous sinuses situated at the sides of the sella Turcica, receive branches from the adjacent parts, surround the carotid arteries, appear cellular, and communicate with the petrosal sinuses :

Superior Petrosal sinuses situated on the ridges of the petrous portions of the temporal bones, and terminating in the lateral sinuses :

Inferior Petrosal sinuses situated at the roots of the petrous portions, receiving blood from the cavernous sinuses, but communicating with the jugular veins, instead of the lateral sinuses :

Occipital sinuses situated near the foramen magnum, and communicating with the inferior petrosal and lateral sinuses.

The Vena Galeni, noticed above, is the great central vein of the brain. It is mentioned as terminating in the fourth sinus, towards which it may be seen collecting its branches from the internal part of the brain, receiving the blood from the membrane lining the ventricles, plexus choroides, &c.

PHYSIOLOGY OF THE BRAIN.

The brain is the organ of thought, and intelligence. Being, however, of a very delicate texture, and its functions being deranged by the least disturbance of any of its parts, nature has been extremely careful to defend it against external injury. Among the protecting parts may be noticed the hair, skin, muscles, pericranium, and the peculiar shape and formation of the bones of the skull ; while, the brain is supported and defended internally, by the dura mater, and other membranes. There are similar precautions taken to preserve the spinal marrow, which may be considered as a continuation of the brain.

In man, of all animals, the brain is proportionally of the greatest volume ; but in this respect, there is a great difference in different individuals. The volume of the brain has been said to be in direct proportion to the capacity of mind. It must, however, be remembered, that, in judging from external appearance, there are many causes of an increased size of the head, besides the size of the brain.

The uses of the brain, in the animal economy, are very numerous and important. Besides being the organ of intelligence, it furnishes the principle of our action on exterior bodies ; it exerts a greater or less influence on all the functions of life ; and it establishes an active relation between the different organs, or it is the principal agent of what has been called *sympathy*.

DISEASES TO WHICH THE CONTENTS OF THE CRANIUM ARE LIABLE.

Processes of bone sometimes project from the inner table of the skull, and grow into the membranes and substance of the brain, or the membranes may be themselves partially ossified, producing *headache*, (*cephalalgia*) *epilepsy*, *paralysis*, &c. Similar effects may be produced by tumours, or pressure of any kind upon the brain.

Inflammation may take place in the dura mater, or in the arachnoid coat, and pia mater (*meningitis*) or in the substance of the brain itself (*phrenitis*). The parts affected are liable to all the terminations of inflammation in common with other structures. There may therefore, be found within the skull, *adhesions*, *effusion*, *suppuration*, *ulceration*, *gangrene*, or *thickening* of any of the membranes.

Hydrocephalus. (*Water in the head.*) This has been called *internus*, when the fluid is found in the cavities of the brain ; and *externus*, when between the membranes.

Ramolissement, or *softening* of the substance of the brain, and the various conditions of the organ producing apoplexy.

The effects of external injuries, producing *concussion*, *compression*, &c.

Apoplexy. The remarkable condition called *coma*, which characterizes apoplectic affections, appears to be connected with various and different conditions of the brain. It may exist either with, or without effusion, or, indeed, without any perceptible deviation from the healthy structure, although the latter may be considered as rather a rare condition. On the other hand, both effusion and organic destruction of the brain, have been found without apoplectic symptoms. This subject is still involved in obscurity.

Almost all affections of the mind are more or less dependant upon, or connected with a morbid condition of the brain.

PART V.

THE VISCERA OF THE THORAX.

The *thorax* is of a conical shape, and extends from the *neck* to the *diaphragm*, which is a strong muscular septum, or partition, separating it and the abdomen and perforated for the passage of the œsophagus, vessels, &c. It will be described in its proper place.

The walls, or *parietes*, of the thoracic cavity are formed, in *front*, by the *sternum* and *ribs* assisted by the *clavicle; laterally*, by the *ribs*; and *posteriorly*, by the *ribs* and *dorsal vertebræ*; their interstices being chiefly occupied by the *intercostal muscles*.

In addition to the common integuments, the ribs are covered externally by muscles, to be afterwards described; and anterior to what is called the greater pectoral muscle, or *pectoralis major*, are found the breasts, called in the female *mammæ*, and in the male *mamillæ*.

They adhere, by means of cellular membrane, to the muscular fibres beneath, and vary in size, at different periods of life. At birth, they are of equal size in both sexes, the great change in those of the female taking place about the period of puberty. They are composed of *glandular follicles, lactiferous ducts*, (or milk tubes,) *fat, bloodvessels, nerves*, and *lymphatic vessels*.

From the interior and glandular part of the mamma, small *lactiferous tubes* arise, which, in their course. are united into twelve or sixteen larger tubes opening near the *apex* of the conical shaped projection of the mamma called the *papilla*, or *nipple*.

The *nipple* is surrounded by a dark coloured line called *areola*, upon the surface of which, there are the orifices of glands, which secrete a mucous fluid to prevent excoriation.

By the breasts, the milk is secreted, which is intended for the nourishment of the child, for some time after birth.

CONTENTS OF THE THORAX.

The contents of the thorax may be exposed by dividing the cartilages connecting the ribs to the sternum on each side, and then by raising the latter, having cut the connexion between it and the diaphragm, and separated its articulation with the clavicles. The chest is lined by a thin but strong membrane called the *pleura*.

PLEURA.

The *pleura* is a reflected membrane, and, in examining the extent of it, it must be traced over the parts which it covers. The description may be begun at the lateral parts of the sternum: the pleura passes thence, outwards upon the walls of the chest, which it covers throughout in connexion with the ribs and intercostal muscles, as far as the spine; inferiorly, it covers the surface of the diaphragm; and superiorly, it proceeds upwards to a little above the first rib, and corresponds with the shape of the cavity of the chest. It passes forwards from the vertebral column, approaches the pleura of the opposite side, leaving a space before the spine, and is continued on to a small portion of the pericardium. Leaving this, it passes over the posterior part of the pulmonary vessels, or to the surface of the lung, extending over its summit, and its base, exactly adapting itself to the irregularities of its surface, and giving a distinct covering to each lobe. The pleura then passes from the lung over the anterior part of the pulmonary vessels, is continued upon the pericardium which it covers, approaches the opposite pleura, and terminates at the posterior part of the sternum, where the tracing commenced.

That portion of pleura lining the ribs is called *pleura costalis*, and that reflected over the lungs, *pleura pulmonalis*. The membrane may be said to consist of two sacs, situated laterally with respect to each other. In the centre of the chest the two sacs approach each other, the heart and its appendages preventing their absolute union. The space before this part is called the *anterior mediastinum*, and the space behind, the *posterior mediastinum*.

The *anterior mediastinum* contains *absorbent vessels*, and the *remains* of the *thymus gland*. It is formed by the pleuræ approximating behind the sternum, from the cartilages of the first ribs and pericardium, and is inclined towards the left margin of the sternum in its course downwards to about the 6th rib, where it terminates. The direction however, of the mediastinum varies a little in different subjects.

Posterior mediastinum.—This is formed by two portions of the pleuræ, which pass between the posterior part of the *pericardium* and *dorsal vertebræ*. It contains the *aorta*, or main trunk of the arterial system, which is situated rather to the *left* side upon the vertebræ ; the *œsophagus*, or tube for conveying food to the stomach, which is situated before the aorta, and rather to the *right* ; the *vena azygos*, which takes its course close to the spine, on its anterior part ; the *thoracic duct*, (the principal trunk of the absorbent vessels) about the size of a crow-quill, and situated to the right of the aorta, between that vessel and the vena azygos ; the *trachea*, and its divisions, or *bronchi*, before they enter the root of the lungs ; the *nervus vagus*, running upon the œsophagus ; and some *lymphatic glands*.

THE LUNGS.

The lungs are two spongy bodies, of a *reddish grey* or *blueish* colour, occupying the lateral parts of the thorax, and moulded into the shape of the cavities which they fill. Their figure is therefore, necessarily irregular, but they are usually described as being conical-shaped. Externally, they are convex towards the ribs, while they are flattened internally, and concave towards the diaphragm. That part of the lung which is turned towards the spine, is called the *root*, and is the part by which the great vessels enter.

The Right lung is the larger, and is divided into *three lobes*, two large, and an intermediate one, which is less.

The Left lung, has only *two lobes*, and there is a square notch in it, opposite to the *apex* of the heart.

Structure of the lung.—Each lung is composed, 1st, of the branches of the *trachea*, or tube for the transmission of air, called *bronchi* ; 2d, of the ramifications of an artery, called the *pulmonary artery*, which carries the blood from the heart to the lungs, and, of those of a vein, called the *pulmonary vein*, by which the blood is again collected and returned to the heart ; 3d, of a reticular, or net-work tissue, divisible by maceration into numerous minute cells, entirely devoid of fat, and called *air-cells*; and 4th, of the branches of the *bronchial arteries* and *veins*, the vessels supplying nourishment to the organs, with their corresponding *nerves* and *lymphatics*.

TRACHEA.—It begins below the *cricoid cartilage*, (which will be described in its place) extends through the middle of the neck to the upper and posterior part of the chest, and terminates opposite to the *second* or *third dorsal vertebra*, by dividing into the right and left branches, or *bronchi*. The *bronchi*, (or *bronchia*,) separate from each other, and pass to each lung, which they penetrate about the middle of its inner side. The left branch, or bronchus, is somewhat smaller than the right, but longer, from the situation of the heart. Within the substance of the lungs they divide into branches, which at last become extremely minute, and are lost in the air-cells.

The *trachea* is formed of cartilages of a *horse-shoe* form, continued about two-thirds round the windpipe, which is convex and strong before, but flattened behind, where it is in contact with the œsophagus.

In the ramifications of the bronchi, the cartilages are annular, but are at last lost in its more minute sub-divisions. They are connected together by an elastic ligamentous subtance, and the tube is lined with a mucous membrane.

PERICARDIUM.—This is the bag, or sac of the heart. It is strong, white, compact, and smooth; and lubricated upon the inside by a fluid called *liquor pericardii*. It is situated in the middle of the chest between the two pleuræ, which it separates. It is like the pleura, a reflected membrane, and passes over the roots of the great vessels, and of the heart itself, to all of which it gives a close covering.

THE HEART.

It is situated obliquely in the middle of the breast; its posterior surface is flat, and lies upon the diaphragm; its apex is turned forwards and towards the left side, so that, in the living body, it is felt striking between the fifth and sixth ribs of the left side, about the point where their cartilages are united to the bony parts. For the sake of description, the heart has been divided into a *base*, *body*, and *apex*, with an *anterior* and *posterior* surface, and a *right* and *left mar-*

gin. The *right* margin is thin, and generally contains fat. The *left* margin is more obtuse, or thick and rounded. The *base* is placed *posteriorly* and *superiorly* towards the vertebral column, from which it is separated by the contents of the posterior mediastinum, the great vessels being also connected to this part of the heart. The *apex* is placed *anteriorly*, *inferiorly*, and to the *left*, corresponding to a depression in the lung, and the space between the ribs already mentioned.

The heart is double, or is formed of *two sides*, and each side is divided into *two cavities*, one of which is distinguished by the name of *auricle*, the other by that of *ventricle*. There are thus, *four cavities*, viz. *two auricles*, and *two ventricles*. The *sides* of the heart have been called *right* and *left*, the former being rather anterior, and the latter posterior. The *auricles* are the *receiving* cavities, and the *ventricles*, those which *propel* the blood.

Right auricle—This auricle is turned forwards, and might properly be called the anterior. Its figure is irregular, being broad posteriorly and to the right, and narrow anteriorly. The shape of the auricles has been considered like that of a *dog's ear*, hence their name. On laying open the auricle there are seen internally, a number of fleshy fibrès, or pillars, arranged somewhat similarly to the teeth of a comb, and hence called *musculi pectinati*, and behind, and at the upper part, is seen the opening of the *superior vena cava*, marked by a rounded and projecting edge of fibres. The opening has the same direction, as that which forms the communication between the auricle and the ventricle. At the lower part of the auricle, is the opening of the *inferior cava*, which is directed obliquely inwards and upwards.

At the point common to the two *venæ cavæ*, *Lower* has described a tubercle, called *tuberculum Loweri*. It is found in beasts, but its existence in the human subject is indistinct or doubtful. At the circumference of the *vena cava inferior*, there is a projecting fold of the inner membrane, called the *valve of Eustachius*, and below this, is the opening of the *coronary vein*.

At the lower part of the auricle, is the opening which forms the communication between it and the *right ventricle*. To the inner side, it has a *septum*, common to it and the *left auricle*, and in this septum, there is a depression called the *fossa ovalis*, which was the *foramen ovale*, in the fœtus.

Right Ventricle.—It is of a larger size than the auricle, and of a pyramidal figure. Its upper part answers to the opening of the communication with the *auricle*, to the right, and that of the *pulmonary artery*, to the left. Its inferior extremity is situated at the apex of the heart, but a little higher than the left ventricle.

On opening the *right ventricle*, there are found attached to its sides, numerous bundles of fleshy fibres of various sizes, called *columnæ carneæ*, and so disposed, as to form an irregular net-work. Among them are several bundles larger than the rest, which ascend perpendicularly, and terminate in rounded extremities. From these arise the *chordæ tendineæ* or tendinous cords, which diverge, and are attached to a membranous fold coming from the margin of the auricular opening. This membranous fold is divided into *three points*, or projections, which are attached by means of the *tendinous chords* to the *fleshy columns*. This forms the *tricuspid valve* which opens into the *ventricle*, but is prevented from being driven into the auricle, when the former is filled with blood, by the mechanism which has just been described.

There are *two openings* from the right ventricle, viz. that of the *auricle*, just mentioned, superiorly, and to the right; and that of the *pulmonary artery*, superiorly, and to the left. The auricular opening is the larger, and occupies nearly the whole of the upper part, or base of the ventricle.

The opening of the pulmonary artery is placed obliquely to the left, and has three *valves* called, *sigmoid*, or *semilunar*, to prevent the reflux of blood.

These valves consist of three sacs, concave towards the artery, each attached by part of its edge to the side of the vessel, while the other edge is loose, projecting, somewhat thicker than the rest of the valve, and has, on its inner side, a small body called *corpusculum sesamoideum*.

From the right ventricle, the *pulmonary artery* ascends on the left side of the aorta, and divides into *right* and *left branches*, the right passing under the arch of the aorta, and proceeding behind the vena cava superior, to the right lung, while the left passes in front of the descending aorta to the left lung. The *ductus arteriosus*, (to be more particularly noticed, in the circulation of the fœtus) passes from the trunk of the pulmonary artery, to the arch of the aorta, and is found converted into *ligament* in the adult.

The *left side* of the heart is composed, like, the right, of an *auricle* and a *ventricle*.

Left auricle.—It is at the left side of the heart, and terminates somewhat anteriorly, in a projecting appendix, which is all that can be seen of this auricle, in the natural position of the heart. The inner side of the left auricle is formed by the common septum already mentioned, as containing the fossa ovalis, and is sometimes described as having the appearance of the remains of a kind of semilunar valve. To the right of the auricle, the *pulmonary veins* of that side enter, one from above, and another from below; while, on the left, are seen the openings of the *two pulmonary veins* of that side. The former are the larger and pass behind the superior cava, while the latter are shorter and pass before the descending aorta. Below and anteriorly, the auricle is terminated by a large opening by which it communicates with the left ventricle.

Left ventricle.—It is of a conical shape, and, from being much thicker in its walls than the right ventricle, it does not become flattened when empty. It is larger than the right ventricle and its apex projects more. Its internal surface, like that of the corresponding cavity on the other side of the heart, presents a net-work of bundles of muscular fibres, but they do not appear so numerous, and are more regularly disposed than in the other.

There is, also, a valve in this ventricle, of a construction similar in principle to that already noticed as the *tricuspid valve*. But, as the left auricular opening is smaller than that of the right, a valve divided into two parts instead of three, and called the *mitla*, from its resemblance to a bishop's cap of ceremony, or *mitre*, is sufficient for the opening into the left ventricle. The membranous fold then, is divided into two parts, having the *columnæ carneæ* and *chordæ tendineæ*, accommodated to the difference between the valves, which, with regard to mechanism, are otherwise exactly similar. The *aorta*, or great trunk of the arterial system, opens from the left ventricle.

It arises from the back part, and right side of the ventricle, its root being covered by the pulmonary artery. It then ascends between that artery and the vena cava superior. It has three *semilunar valves*, resembling those of the pulmonary artery, but somewhat thicker and stronger. Opposite to them are three depressions, which have been described as the *sinuses of Valsalva*. In the two anterior, a little above the valves, are seen the openings of the two *coronary arteries*.

Structure of the heart.—The proper structure of the heart is muscular, its external surface being covered by a coat reflected from the pericardium, and it has a peculiar lining membrane. The muscular fibres composing it cross each other in all directions. The thickness of the walls of the heart varies; it is thinner in the auricles, than in the ventricles, and it is much thinner in the right side, than in the left.

Coronary vessels.—These are vessels for the nourishment of the heart itself. They consist of *two arteries*, and *a vein*. The two *arteries* are the first given off by the aorta, as already mentioned, and are distinguished by the names of *right* and *left coronary arteries*. The *right*, or *anterior*, takes its course transversely, between the right auricle and ventricle, is continued to the flattened surface of the heart, and then in the direction of the septum, to the apex. The *left* passes downwards, covered by the appendix of the left auricle, to the convex surface of the heart, one branch running in a groove between the ventricles, as far as the apex, and another between the left auricle and ventricle to the flattened surface.

The *coronary veins* accompany the arteries, the greater number of them forming a considerable trunk, which passes between the left auricle and ventricle, and terminates, as already described at the under part of the right auricle.

PHYSIOLOGY OF THE HEART AND LUNGS.

Heart.—The blood which flows from the left side of the heart is distributed by the *arteries* to every part of the body, and again returns to the heart by means of the *veins*, which have been described as terminating in the right side of that organ, the *superior vena cava* bringing that portion, which has been circulated in the part of the body above the heart, while the *inferior vena cava* brings that from the lower part of the body.

When the *right auricle* is filled, it contracts and discharges its contents into the *right ventricle*, which, when it is completely filled, shuts the tricuspid valve, the blood being at the same time propelled through the *pulmonary, artery* to the lungs.

From the lungs, the blood is returned by the *pulmonary veins* to the *left auricle*, which, becoming thus distended, contracts and throws its blood into the *left ventricle*. The *left ventricle*, on receiving the blood from the *auricle*, shuts its valve, in the manner described in reference to the corresponding cavity on the other side of the heart, and propels its contents through the *aorta* to the different parts of the body.

It is obvious from what has been said, that the structure of the heart has an immediate reference to the lungs ; and that it is a double organ. There may be, therefore, said to be two hearts, one proper to the lungs, and another proper to the rest of the body, or, there is a circulation through the lungs, and a general circulation throughout the other parts of the body.

The contractions of the heart, by which this is accomplished, are independent of the will, as well as, in a great degree, of the brain and nerves ; for the action of the heart continues after the head has been removed, and, of course, the nerves which lead to it have been divided.

The heart continues in an alternate state of contraction and dilatation from birth until death. The contraction has been called *systole*, and the dilatation, *diastole*. When the heart contracts, the arteries are at that time dilated, and it is in this state, that their pulsatory motion may be perceived.

The different effects of pressure upon an artery and vein afford incontrovertible evidence of the circulation of the blood. For instance, a ligature put round the humeral artery, prevents the flow of blood to the fingers, and, causes a swelling in the course of the artery, between the ligature and the heart ; while, a ligature round the arm sufficiently firm to compress the veins without stopping the flow of blood through the arteries, which are deeper seated, produces swelling of the veins, between the fingers and the ligature. The circulation of the blood is also visible by the aid of a microscope. The important uses of the circulation are the distribution of nourishment, and reparation of injuries of whatever texture, throughout the whole frame.

Lungs.—They have been mentioned as spongy bodies. The substance or *parenchyma* is divided and subdivided into cavities called *lobes*, and *lobules*, the forms and dimensions of which cannot be determined, from their extreme minuteness. On examination with a powerful microscope, a *lobule* appears to be made up of a spongy tissue, the minute cells of which communicate with each other, and are surrounded by a layer of thin cellular tissue, which defines the lobule, and separates it from the adjoining lobules.

Into each of these lobules enter one of the divisions of the *bronchi*, and of the *pulmonary artery*; this last is distributed to the substance of the lobule, and is there transformed into the *radicles* of the *pulmonary veins*. It is thus seen, by what an admirable artifice nature has contrived to produce such an immense surface of contact between the blood and the air, one of the indispensable conditions to our existence, within such an inconsiderable space as that occupied by the lungs.

It is in this contact, that the air removes from the blood some of the elements which compose it, and that the blood acquires some of those of the air. The change which thus takes place constitutes *respiration*, or the transformation of *venous* into *arterial* blood.

The blood, in this process, is brought in contact with the air by a surface, in extent, said to be equivalent to the surface of the body.

The passage of air through the windpipe into the lungs, is called *inspiration*, and the expulsion, of air, from them, *expiration*.

Respiration has a remarkable connexion with the action of the heart. When the pulse is frequent, the breathing is hurried; and when the pulse is slow and gentle, the breathing is scarcely to be observed. Respiration is also modified by affections of the mind.

The mechanical construction of the thorax amply furnishes it with the means of carrying on this alternate contraction and expansion, from all the parts bounding it being more or less moveable. During *inspiration*, the thorax is dilated and sensibly elevated. This is effected through the mobility of the ribs and sternum, and the depression of the diaphragm. On *expiration*, the motion is reversed, and is produced by the elasticity of the cartilages, and of the ligaments of the ribs, which resume their former state, by the relaxation of the muscles which had raised the thorax, and by the contraction of a number of others, whose action is to lower and contract the chest, when elevated.

From a series of experiments, the general sum of a man's natural inspirations, is said to be about twenty-six, or twenty-seven, in a minute, but it varies from fourteen or fifteen upwards.

Changes which the Air undergoes in the lungs.

The *air*, in its passage from the lungs, has a temperature nearly the same as that of the body, but there escapes with it from the chest, a great quantity of vapour called *pulmonary transpiration*, and its chemical composition is different from that of the inspired air, for, although the proportion of *azote* or *nitrogen*, is much the same, that of *oxygen* and *carbonic* acid is quite different. The *oxygen* in the atmosphere is 0.20, while that in expired air is 0.16, to 0.17; the latter containing about 0.3, to 0.4, of *carbonic acid*, the loss of the former being, in general, about equalled by the addition of the latter.

When the venous blood traverses the small vessels in the pulmonary lobules, it assumes a bright scarlet colour; its odour becomes stronger, and its temperature rises about a degree. A portion of its serum, or watery part, also disappears in the form of vapour, and mixes with the air. Its tendency to coagulate augments considerably, and its specific gravity diminishes. The venous blood having acquired these characters, becomes arterial.

The colour of the blood depends upon its contact with oxygen, for, if there be any other gas in the lungs, or the air be not suitably renewed, the change of colour does not take place. But how the oxygen produces the red colour of arterial blood, is a point upon which chemists have not yet agreed.

Respiration seems to be the principal, or, at least, the most evident source of animal heat. There is, therefore, a partial difference observable between the heat of the extremities, and parts nearer the source of heat. The former are colder than the trunk, being sometimes 89°, or 91°, of Farenheit, or less, when the heat of the thorax is about 104° of Farenheit.

CIRCULATION IN THE FŒTUS.

The *navel-string* or *umbilical cord*, or communication between the mother and the child is composed of *two arteries*, and *a vein* with a quantity of jelly enclosed in *membranes*.

The *umbilical vein*, (a vessel arising from the *placenta*, where it collects its blood from the mother,) enters the abdomen of the child at the *umbilicus*, and, having ascended in a fold of peritoneum behind the recti muscles, reaches the inferior surface of the liver. After giving branches to both lobes of the liver, it terminates in the *left-vena portæ*, from which a branch called the *ductus venosus* passes to the *inferior cava*.

From the *umbilical vein* proceeding direct to the liver, the *ductus venosus* has been described as coming off from the *left vena portæ*, but it may with propriety be considered as coming direct from the *umbilical vein*.

Although the *vena portæ* will be described more particularly hereafter, it may be mentioned here, that the trunk of this vessel is formed by the veins returning blood from the viscera of the abdomen, and that it divides into right and left branches, in a cleft of the liver, called the *porta* or *gate*. It is thus seen, therefore, that the left branch is supplied, as just noticed, *in the fœtus*, while the right receives its blood from the abdominal veins.

The course of the *ductus venosus* is short and a little curved; it joins the larger of the *hepatic veins*, whose office is to return the blood from the liver, and goes directly to the *vena cava inferior* where it joins the *right auricle*; this vessel and the umbilical vein are *ligamentous* in the adult.

The blood then, having set out from the *placenta*, is thus carried by the *umbilical vein* as far as the *liver*, to which one part of it passes, while the other goes to the *vena cava*, where it mixes with that brought from the liver by the *hepatic veins*, and by these two sources reaches the heart.

Having arrived at the heart, it passes into the *right auricle* where it meets the blood of the superior cava, and then partly *into the left*, through the *foramen ovale*, which is an oval opening in the partition, described in the adult as separating the right and left auricles. From the *right auricle*, a portion of the blood passes into the *right ventricle*, which propels it into the *pulmonary artery*. This portion however, does not all go to the lungs as in the adult, the greater part of it being carried to the *aorta* by a canal or anastomosing branch called the *ductus arteriosus*. The portion of blood carried to the lungs is returned by the four *pulmonary veins* to the left auricle, where it mixes with that received direct from the right auricle, and passes into the left ventricle, whence, it is sent through the aorta, and, again meeting the blood that comes through the *ductus arteriosus* goes to the different parts of the body.

The blood is eventually returned to the mother by the *umbilical arteries*, which, in the fœtus, may be considered as continuations of the *hypogastric arteries*, and are directed over the sides of the bladder, and attached to the *urachus;* they are comparatively of great size, and become obliterated after birth, the current of blood being directed into the branches of the aorta, which supply the lower extremities, the small size of which in the fœtus being said to depend on the limited supply of blood sent to them.

The *urachus*, is, in quadrupeds, a sac, or canal, leading to another sac hanging from the navel, and carrying to it urine from the bladder. In the human fœtus which generally secretes no more than the absorbents remove, it is a mere vestige, and appears as a *ligament* of the bladder.

DISEASES TO WHICH THE CONTENTS OF THE THORAX ARE LIABLE.

Diseases of the Lining Membrane and Lungs.

The lining membranes of the cavity of the chest, as well as the parts within it, are, in common with all other textures of the body, liable to *inflammation*, and all its terminations.

The following are the principal affections :—

Pleuritis, or Pleurisy.—This is an inflammation of the lining membrane of the chest. It sometimes affects the pleura-costalis, sometimes, the pleura-pulmonalis, and sometimes both. In the latter case, the two layers of membrane become connected together by the coagulable lymph thrown out, and are said to adhere.

Hydro-thorax, or Water in the Chest.—The cavity of the pleura sometimes contains an effusion of serous fluid, which, by pressing upon the lung, prevents its action.

Emphysema of the Lungs.—This disease consists in a rupture of the partition, by which one pulmonary lobule or air-cell, is separated from another ; hence, the air becomes extravasated.

Pneumonia or *Inflammation of the substance of the Lung.* In this disease, the substance of the lung may, from being spongy, become *solid, heavy, granular*, or what is called *hepatized*. It is also, subject to all the other terminations of inflammation.

Phthisis Pulmonalis, or Consumption.—A disease usually found in scrophulous subjects, and commencing with the formation of small *tubercles* of a greyish colour, which increase in size and numbers, unite, form masses, and *ulcelate*.

Bronchitis.—Inflammation of the mucous lining of the Bronchi.

Hæmoptysis, or Spitting of blood.—This takes place, either from the rupture of some small vessel in the lungs, or, it is said to be effused from the surface of the mucous membrane lining the air-tubes, without erosion, or lesion of its structure.

Pneumo-thorax, or Air in the Chest.—This seldom occurs without some perceptible lesion, communicating with the bronchi.

Diseases of the Heart and its membranes.

Aortitis, or Inflammation of the Aorta in the vicinity of the Heart.—This is noticed here, as it frequently extends to the cavities of the heart. It often terminates in the deposition of calcareous matter, or *ossification*.

Aneurism of the Aorta, or *dilatation of the coats of the artery*. In some cases, this does not extend to all the coats of the vessel ; the inner and middle coats being torn, and the cellular one alone forming the wall ; at other times, the coats of the artery are both dilated and torn, the blood being effused beneath the cellular membrane. There are generally found some *ulcerated* or *ossified* spots.

Affections of the valves of the Heart.—The valves of the heart are subject to *induration*, or to *osseous* or *cartilaginous concretions*. These alterations of structure may take place in any of the valves, either of the heart or arteries.

Pericarditis, or *Inflammation of the Pericardium.*

Hydrops Pericardii, or *Dropsy of the Pericardium.*—In this disease, the heart may be unaffected. There may or may not, be traces of previous inflammation in the *pericardium*.

Hypertrophy, Thickening, or *Enlargement of the Heart.*—This may take place in any of the cavities, those, the walls of which are effected, being diminished in proportion to the increased thickness.

Carditis, or *Inflammation of the Heart.*—This is rather a rare disease, and the inflammation is usually confined to a part of the substance of the heart.

Ramolissement, or *Softening of the Heart.*—The symptoms of this disease are very obscure. The consistence of the heart is found to be diminished, being sometimes so soft and friable, as to be easily penetrated by the finger.

Induration of the Heart.—In this case, the reverse of the above takes place. The induration is variable in degree, as well as in its extent, but sometimes approaches to that of cartilage.

Malconformation of the Heart.—Deviations from the natural structure of the heart of very different descriptions sometimes occur. Of these, the most common is that in which the *foramen ovale* continues open.

The above are the principal morbid changes of structure which take place in the viscera of the thorax, and, although the names adopted are those which are more frequently used, yet, they are frequently designated by others derived more from the appearance of the symptoms, than the intrinsic nature of the disease.

PART VI.

THE VISCERA OF THE ABDOMEN.

The *abdomen* is one of the largest of the cavities of the body, is more capable than any other of augmenting its dimensions, and contains a great number of organs destined for important functions.

The form of the abdominal cavity is *ovoid*, and, on account of its considerable dimensions, it has been, for the sake of precision, divided into regions, each of which has a peculiar name.

To comprehend this division, which is altogether arbitrary, the abdomen is supposed to be marked by lines as follows: 1st, across the *xiphoid* or *ensiform cartilage*, from the *last true rib* on one side, to that of the other: 2d, from the lower margin of the *last false rib* on one side, to that of the other: 3d, from the *anterior superior spinous process of the os ilium* on one side, to that of the other: thus, dividing the abdomen into the *epigastrium*, or *epigastric region*, being that space between the first and second lines; the *umbilical*, the space between the second line and that below, and being about the breadth of four fingers both above and below the *navel*; and the *hypogastric*, the space between the third line and *pubes*.

Each of these regions is again divided into three parts, viz. the *epigastrium* is divided into the *epigastric region*, properly so called, or *scrobiculus cordis*, having on its sides the *right* and *left hypochondriac* regions; the *umbilical*, into a middle, or *umbilical region*, and two lateral ones called *iliac regions*, or *flanks*; and the *hypogastric*, into a middle space, bearing the same name, or that of *pubic*, with sides called *inguinal regions*, or *groins*.

On the back, the space occupied by the dorsal vertebræ is *equally* divided into *superior*, and *inferior dorsal regions*, while, that occupied by the lumbar is called the *loins*, or *regio lumborum*.

Above, the abdomen is separated from the thorax, by the *diaphragm*, while its lower boundary is formed by the *pelvis*.

DIAPHRAGM.

Although the *diaphragm* is a muscle, and properly belongs to another division of the subject, it is necessarily so often referred to, in speaking of the contents of the *thorax* and *abdomen*, that a description of it is here introduced.

It is a thin, broad muscle, in the shape of a vault over the contents of the belly, and forms a partition between the thorax and abdomen. In describing it, it is usually divided into a *superior*, or *greater*, and an *infeior*, or *smaller* muscle.

Superior or *greater muscle.*—It *arises* by fleshy slips from the cartilago ensiformis, and from the cartilages of the seventh, and all the inferior ribs. From these attachments, the fibres radiate from the circumference towards the centre, where they are *inserted* into a middle, or *cordiform* tendon. This tendon is formed by tendinous fibres running in different directions, and interwoven with each other. On the right side of the tendon, is a rounded triangular opening, for the passage of the *vena cava inferior*, from the abdomen to the chest.

Inferior or *smaller muscle* —It *arises* from the three uppermost lumbar vertebræ, by four heads, of which the fleshy bellies form the *crura* of the diaphragm. These unite, are continued upwards, and spread in their ascent. The inner and longer crura leave between them a long oval opening through which the *aorta* passes from the thorax to the abdomen, and the *thoracic duct* from the latter to the former. Above this opening, the fasciculi of the *crura* of each side decussate in part, and again separate to form an oval aperture, which is situated rather to the left, and through which the *œsophagus* and *nervus vagus* are continued from the thorax to the abdomen. They afterwards run upwards and forwards, to be *inserted* into the *cordiform* tendon.

CONTENTS OF THE ABDOMEN.

The abdomen contains, besides the *peritoneum* and its productions, the *stomach*, the *small* and *large intestines*, the *liver*, the *spleen*, and the *pancreas*, their *bloodvessels*, *appendages* &c with part of the *urinary organs*, viz. the *kidneys*, *renal capsules*, and *ureters*. It also contains part of the *bladder*, when it is distended.

PERITONEUM.

It lines the abdomen, and gives a general covering to most of its contents, as well as to those of the pelvis, while, it forms *ligaments* for retaining the bowels in their places.

The *peritoneum*, like the *pleura*, and *pericardium*, is a membrane of the *reflected* kind. After lining the parietes, or walls of the belly, it is reflected from them, giving covering to the different viscera, and their vessels. It is without any opening, so that, if it could be raised from the parts which it envelopes, it would form a large bag, with the viscera, strictly speaking, on the outer side of it. When it is distended with fluid, the fluid is contained between the peritoneum lining the abdominal muscles, and that part of it, which invests or forms the outer covering of the intestines.

Of the various productions of the peritoneum, the most remarkable are the *mesentery*, the *meso-colon*, and the *omenta*.

THE MESENTERY.—It is composed of two layers of peritoneum, which pass off from the posterior part of the abdomen, in an oblique line from about the second lumbar vertebra, to the right iliac fossa. This attachment is straight, and narrow, while that towards the intestines is convex, broad, and as extensive as the bowels, to which it is connected. It commences with the last turn of the *duodenum*, and terminates at the *rectum*.

The two layers are connected by loose cellular membrane, and between them, are situated the glands and bloodvessels of the intestines. That part of this membrane, which follows the course of the colon, is called *meso-colon*, and that attached to the rectum, *meso rectum*.

OMENTA.—Of these there are two, a greater, and smaller, or the *omentum majus*, and the *omentum minus*.

Greater Omentum.—This, called also *epiploon*, is a floating membrane of great delicacy, often loaded with fat, and extends from the *greater curvature of the stomach* anteriorly, to the *transverse arch of the colon* posteriorly. From the former attachment, it extends downwards over the small intestines which it covers, and, sometimes, descends as low as the pelvis, before it turns upon itself to ascend to the transverse arch of the colon, which it encloses, thus, appearing to form a bag.

Smaller Omentum.—This is described as a membrane extending between the *smaller curvature of the stomach*, and *concave surface of the liver*, being fixed, also, to the extremity of the *œsophagus*, to the *diaphragm*, the *pylorus*, and the commencement of the *doudenum*.

It is placed before the *lobolus Spigelii* of the liver, which may be seen through it. It is composed of two layers, and, between them at the right extremity, are situated the *hepatic vessels*, and *biliary ducts*. This part is called the *capsule of Glisson*, and contains the *hepatic artery* on the *left*, the *vena portæ* on the *right*, with the *biliary ducts*, consisting of the *ductus hepaticus*, *ductus*, *cysticus*, and the *ductus communis choledochus* before it, and *nerves* and *lumphaties*. surrounding the vessels. The ducts mentioned will be described with the liver and gall-bladder. Behind this capsule, is an aperture communicating with the common bag of the omenta, and called the *foramen of Winslow*.

The *greater omentum* may be considered as derived from, or, as being a continuation of that now described. The layers of the *smaller omentum*, which separate at the smaller curvature of the stomach, the one passing *before* that viscus, and the other *behind*, again meet at the greater curvature, and, becoming applied to each other, from the membrane described as the *larger omentum*. There are some other processes of the omenta mentioned, but they are unimportant.

STOMACH.

It is situated at the upper and left part of the abdomen, or in the *left hypochondriac*, and *epigastric regions*. It is a muscular bag, capacious, and rounded at one extremity, and gradually decreasing to the opposite. For the sake of description, it is divided into *two surfaces*, an *an-*

terior, and a *posterior* ; *two curvatures*, a *greater*, and a *smaller* ; and *two extremities*, a *right*, and a *left*, called also, *small* and *large*, or *pyloric* and *cardiac*. The *greater curvature* is convex, forms the *inferior edge*, and reaches from one extremity to the other. The *smaller curvature* is concave, situated at the *upper part*, and comprehended between the orifices. The orifices of the stomach are the *cardiac* or *œsophageal*, which is the *superior*, and the *pyloric*, which is the *inferior*.

The stomach has *three coats*, a *peritoneal*, or outward covering, in common with all the other contents of the abdomen, a *muscular*, or middle, and a *mucous*, or *villous* coat, forming the lining.

The *peritoneal coat* is formed by the two layers of the peritoneum, which, on the formation of the little omentum, separate and cover the stomach, and, uniting again at the greater curvature form the large omentum, as already described.

The *muscular coat* is the most considerable, and is composed of two layers of muscular fibres, a *longitudinal*, and a *transverse*. The former take the course of the long diameter of the stomach, as if continued from the œsophagus, while the others pass round the stomach, or rather consist of segments of circles taking that direction. They are few at the cardiac orifice, but numerous and well marked, about the middle of the stomach.

The *villous*, or *mucous coat* appears as a continuation of the lining membrane of the œsophagus, but differs from it, in the minute projections, or *villi* resembling the pile of velvet, which project from its inner surface, and give it its name. It is of a reddish yellow colour, and frequently found disposed in folds from the contraction of the muscular fibres. These appear in a radiated form at the *cardiac* orifice. At the lower, or *pyloric orifice*, there is a doubling of the mucous lining, enclosing a bundle of muscular fibres, with some condensed cellular substance, and corresponding to an external depression. This is called the *pylorus*, and has the form of a broad flat ring, fixed by its circumference to the parietes of the stomach. It is the valve, which shuts the stomach during digestion.

The *œsophagus* mentioned above, and the course of which through the posterior mediastinum, has been already described, is of a cylindrical form, and united to the surrounding parts by loose cellular tissue. It is composed of a *muscular* and a *mucous* coat. The former is thick and dense, having its longitudinal fibres external, and its circular, which are more numerous, situated internally. The mucous coat is white, thin, and smooth, and formed into longitudinal folds. It has been noticed however, as differing from the mucus lining of the stomach, with which it has been said to be continuous. It has numerous follicles for the secretion of mucous, is paler than the lining of the stomach, and has been described as having a very firmly fringed border, hanging free at the cardiac orifice.

INTESTINES.

These have been divided into *small* and *large*.

SMALL INTESTINES.

The *small intestines* are divided into *duodenum*, *jejunum*, and *ileum*.

DUODENUM.—This is the intestine into which the food passes from the stomach; it is the *largest* of the three small intestines, and, from its capability of dilatation it has been called a secondary stomach.

It derives its name from being about twelve fingerbreadths in length, and extends from the *pylorus* to the transverse *meso-colon*, forming a curve, of which the convexity is to the right, and the concavity to the left. Taking a course from the pylorus horizontally backwards, and to the right, as far as the neck of the gall-bladder, it turns and passes downwards as low as the right kidney, surrounding the head of the pancreas, and, about the second lumbar vertebra, it crosses the spine behind the root of the mesentry by which it is fixed.

When the intestine becomes transverse, the *ductus communis choledochus*, and *ductus pancreaticus*, terminate obliquely on the internal surface, by a common orifice.

JEJUNUM and ILEUM.—The part of the canal of the small intestines, formed by the *jejunum*, and *ileum*, commences at the termination of the *duodenum*. The direction, taken from the commencement of this portion of the bowels, is obliquely from above to below, and from the left to the right side.

Although distinguished into *jejunum*, and *ileum*, there does not appear to be any natural foundation for such a division, and their extent is determined by measurement; the former portion being considered as forming *two-fifths*, and the latter, *three-fifths* of the length. The part called *jejunum* is generally found more empty, and its convolutions are in the *umbilical region*, while the portion called *ileum* is of rather less diameter, and lies chiefly in the *hypogastric*, and *iliac regions*.

STRUCTURE OF THE SMALL INTESTINES.

Their structure is similar to that of the stomach. They are cylindrical, and present a smooth and even surface externally. The *external*, or *peritoneal* coat, is a continuation of the *peritoneum*; the *muscular coat* is composed of two sets of fibres, disposed as in the stomach; and the *villous* coat presents the same appearance of *villi*, as the internal membrane of the stomach of which it is a continuation.

The *peritoneal coat* is derived from the two layers of the peritoneum forming the mesentery. This coat of the duodenum is only partial, as the peritoneum does not give an entire covering to the small intestine until it has pssed through the *root of the mesentery* or, in other words, from the part at which the jejunum begins.

The *villous coat* forms, within the canal, numerous duplicatures fixed transversely to the circumference of the intestine, and called *valvulæ conniventes*. They vary in breadth and length, but none of them form entire circles, and they are broader in the middle, than at the ends. They begin about an inch below the pylorus, and, although they are found in all the divisions of the smaller intestine, they are most numerous and most conspicuous in the jejunum, while they nearly disappear in the ileum. The mucous coat is fixed to the muscular by a cellular membrane, which was at one time enumerated as a coat.

LARGE INTESTINES.

These are divided into *cæcum*, *colon*, and *rectum*.

CÆCUM.—This gut is so called on account of its forming a *pouch, sac,* or *blind extremity.* It is the first of the large intestines, being that in which the *ilium* terminates, and it lies in the hollow of the right *os ilium,* attached to the *iliacus internus* muscle. The gut appears like a part of the colon of two or three inches in length, closed at the end, and cut off by the *ileum* terminating abruptly in the side of the former. It is therefore, frequently called *caput coli,* or *caput cæcum coli.*

There is an *appendage* attached to the *cæcum,* about two, three, or four inches long, of about the size of a large quill, and terminating in a shut or blind extremity. From its resemblance to an earth-worm, it has been called the *appendix vermiformis.*

VALVE of the COLON.—This is sometimes also called *valve* of the *ileum,* or *ileo-cæcal,* or *ileo-colie valve.*

At the place where the ileum terminates in the side of the large bowel, there is a *valve,* to prevent the return of the contents of the large intestines. In the recent subject, it appears like a rounded projection into the cavity of the large intestine, with a fissure in the middle, forming two lips, united at their extremities, and continued by folds on each side until they are insensibly lost on the sides of the intestine. In the dried intestine, the valve appears as *two semilunar flaps,* adhering by their convex edges to the termination of the ileum, while their concave edges project unattached into the canal. It is formed by a projection of the internal membrane of the gut, doubled upon itself.

COLON.—This gut is a continuation from the part just described. From the caput coli, it passes upwards on the right side of the small intestines, and before the *right kidney,* until it gets under the margin of the *liver,* and in contact with the *gall-bladder.* It then crosses the belly to the left side, in an arched direction, before, or immediately under the *stomach,* after which it descends in the left side, as low as the *iliac fossa,* where it makes a curve, which, from its resemblance to the shape of the letter *s,* has been called the *sigmoid flexure,* and terminates in the *rectum.*

From the changes which thus take place in the course of this gut, it has been divided into four portions, 1, *ascending colon* ; 2, *transverse arch of the colon* ; 3, *descending colon* ; 4, *sigmoid flexure of the colon.*

The ascending colon is that part of the gut, which is situated in the *right lumbar region*, above the *cæcum*, and below the *gall-bladder*. It is covered, anteriorly, by the peritoneum, and is connected, posteriorly, with the *quadratus lumborum* muscle and *right kidney*, by a quantity of cellular membrane.

The arch of the colon is said to commence at the part where the gut begins to proceed across the *epigastric* region. It is usually situated below the *stomach*, although, it is sometimes found passing across the abdomen opposite to the *navel*, or even lower. It is the longest and largest portion of the colon, and is united behind with the *transverse meso-colon*, a fold of the peritoneum formed of two layers, which pass transversely, and connect the colon with the posterior wall of the abdomen.

The descending colon is that portion which passes downwards from the arch, before the *left* kidney, and below the *spleen*, having the same relative situation, size, and connections as the right.

The sigmoid flexure of the colon is situated in the *left iliac fossa*, being bound down by a double layer of peritoneum, sometimes called the *iliac meso-colon*.

Rectum.—This intestine is straight, as its name implies, and is about six inches in length. Descending in the *pelvic* cavity, it is supported behind by the *sacrum*, and *os coccygis*, and bounded in front by the *urinary bladder*, with which it is in immediate contact at its lower part. It terminates at the *anus*, covered with the *levator* and *sphincter ani* muscles.

STRUCTURE OF THE LARGE INTESTINES.

Their surface is not even, like that of the small bowels, but of a puckered appearance, and has attached to it numerous small processes, formed of elongations of the peritoneal covering, generally loaded with fat, and called the *appendices pinguedinosæ*, or *epiploicæ*.

The large intestines are composed of the same number of coats, as the small intestines. The *peritoneal* covering is seldom complete at the cœcum, where that gut is connected with the *psoas*, and *iliacus internus* muscles. This coat is also, often defective at the posterior part of the *rectum*, and in its lower third is *altogether wanting*.

This covering is, however, liable to vary, from the varying size of the parts near it, thus, it will be less covered from the distention of the *uterus* or *bladder*. From the point of contact between the bladder and rectum, the peritoneum is reflected over the *fundus* of the former.

The *muscular coat* is thicker and stronger than that of the small bowels, and its longitudinal fibres differ in their disposition, being collected into three distinct bands intermixed with tendinous fibres, and called *the bands of the colon*. These bands, two of which are anterior, and one posterior, begin at the vermiform process of the *cæcum*, and are continued the whole length of the colon. In the *rectum*, the longitudinal muscular fibres are spread over the intestine, and are lost towards its extremity, while, towards this part the circular one become particularly strong, and form what has been called the *internal sphincter muscle.*

The *villous* appearance of the *internal membrane* is less distinct than in the small bowels. It is thicker, and, in the rectum, is disposed in folds chiefly transverse and apparently caused by the contraction of the muscular fibres.

LIVER.

The liver, the largest gland of the body, is of a dark red colour, inclining to yellow, and is situated in the upper part of the abdomen, in contact with the *diaphragm*, under the margin of the *ribs* of the *right side*, or, in the *right hypochondrium*, and extending across into the *epigastrium.*

The average weight of the liver, in adults, is about three pounds, and its figure is irregular. Its superior surface is *convex*, fitting the concavity of the diaphragm, while the inferior surface is of less extent than the upper, irregularly *concave*, and rendered unequal by several eminences.

The liver is kept in its place by the following *ligaments*, which, with the exception of that called the *round*, are productions of the peritoneum.

The suspensory ligament.—This consists of two layers of peritoneum, passing from before to behind, and continued from the diaphragm to the convex surface of the liver, so as to divide its surface into two unequal parts, or right, and left portions. At its *anterior* edge, between its layers, are contained the remains of the *umbilical vein*, which thus passes to the liver on the exterior of the peritoneum, and is called the *round ligament*.

The coronary ligament is formed by the separating of the two layers of the *suspensory ligament* behind, and where it is attached to the diaphragm. There is, consequently, a triangular space left, which is filled with cellular substance.

Right and left lateral ligaments.—These may be considered a continuation of the same layers, continued on each side, along the posterior margin of the liver, and connecting it with the diaphragm.

The two parts, into which the liver is divided by the suspensory ligament, are called the *right*, and *left lobes*, the former being the larger.

The *inferior surface* of the liver is rendered unequal by the following cavities and projections.

1. To the left a slightly concave surface, corresponding to the *stomach*.

2. The *fossa umbilicalis*, or *great fissure*, which divides the under surface of the liver into the right and left lobes, and passes from the anterior to the posterior edge. It is often crossed anteriorly by a process of the liver, called *pons hepatis (bridge of the liver)* so as to render it a canal. It lodges anteriorly, the *umbilical vein*, and contains posteriorly, the *ductus venosus* referred to in describing the circulation in the fœtus, but which in the adult are both *ligamentous*.

3. The *porta* or *sulcus transversus*, which is not so long as the last, passes from left to right, in the direction of the long diameter of the liver, of which it occupies the *middle third*. It is situated, at nearly an equal distance from the anterior and posterior edges of the viscus, and at right angles with the last fissure. It contains the trunk of the *vena portæ*; the principal *branches* of the *hepatic artery*; the *biliary ducts*, where they form the *ductus hepaticus*; and the *nerves* and *absorbents* of the liver, united together by cellular substance.

4. There are two eminences of the porta, called the *lobulus quadratus*, and the *lobulus Spigelii*. The former is so called from its square shape, and bounds the porta anteriorly, separating the anterior half of the longitudinal or great

fissure, from the depression in which the gall-bladder rests. The *lobulus Spigelii* is more considerable than the last, and is seen through the little omentum. It varies in figure, but is generally of a triangular form. It bounds the porta *posteriorly*, and is situated between the two great lobes, but appears rather to belong to the right, to which it is connected by a process extending from it, and called *processus*, or *lobulus caudatus*. On the left side of it, there is a passage for the *ductus venosus*, and on the right, a fissure or depression for the *inferior vena cava*.

5. There is a superficial oval depression, in which part of the *gall-bladder* lodges, situated on the right side of the *lobulus quadratus*.

6. There are two smaller depressions to be observed on the right lobe, the anterior answering to the point of the *colon*, where it commences its transverse course, to form its arch ; and the posterior, to the superior extremity of the *right kidney*, and *capsula renalis*.

The circumference of the liver is irregular in figure, and of unequal thickness. The anterior edge or margin is thin, and has two notches ; one deep and narrow, the commencement of the longitudinal fissure lodging the remains of the umbilical vein ; the other for receiving the fundus of the gall-bladder, but not always found. The *posterior* edge is shorter and thicker, especially to the right. It is attached to the diaphragm by the ligaments described, and has in its middle, an irregular depression, which terminates the *great fissure*, and a *fossa*, which assists in forming a canal, for the *inferior cava*, and at the bottom of which, the *hepatic veins* terminate.

STRUCTURE OF THE LIVER.

This is of a peculiar character, and appears to consist of a reticular mass of brownish yellow substance, chiefly made up of numerous vessels. These vessels are the *vena portæ*, forming a venous system, the peculiar structure, distribution, and function of which will be described ; the ramifications of the *hepatic artery*, and *hepatic veins* ; those of its *excretory ducts* ; with the numerous branches of *nerves*, and *absorbent vessels*, distributed to it.

VENA PORTÆ.—This consists of two orders of vessels, which communicate by a common trunk, one set for collecting, the other for distributing blood. The one is formed of the veins, which return the blood from the *spleen*, *pancreas*, *stomach*, and *intestines*, and is called the *vena portæ abdominalis*; while, the other called the *vena portæ hepatica* consists of the ramifications of the trunk formed by the former veins in the substance of the liver where they are distributed like arteries.

The trunk of the *vena portæ abdominalis* is formed more immediately by the *splenic*, and *superior*, and *inferior mesenteric veins*. It passes upwards and to the right, from the vertebral column to the porta, and is about five inches in length. It is at first placed behind the right extremity of the pancreas, and duodenum, and afterwards within the *capsule of Glisson*. At the porta, the trunk bifurcates, the branches forming a canal lying *horizontally* in the porta, each branch making nearly a *right angle* with the trunk. Of these branches, the right is the shorter but larger, and passes to the right lobe, the other, a left branch, being continued as far as the great fissure, where it unites with the ligamentous remains of the umbilical vein, and is distributed to the left lobe.

The ultimate divisions of the *vena portæ*, anastomose with the radicles of the *biliary ducts*, and *hepatic veins*. The branches of the *vena portæ* are accompanied by those of the hepatic arteries, veins, biliary ducts, and lymphatics, and they are all connected by dense cellular substance. The *vena portæ*, like the rest of the abdominal veins, differs from the general venous structure, in having its coats thicker, and in the absence of valves.

Hepatic artery.—This is a branch of the *cœliac artery*, to be described in its proper place, and subdivides into two principal branches, which pass into either lobe at the *porta*, and are continued with the ramifications of the *vena portæ*.

Hepatic veins.—These, which may be considered as the veins of the substance of the liver, take their origin in all parts of it, from the capillary extremities of the *hepatic artery*, and *vena portæ*. They unite into larger and less numerous branches, and terminate by three or four principal trunks in the *vena cava* behind the liver.

Biliary ducts.—They arise by minute extremities, from all parts of the substance of the liver, their ramifications accompanying the nerves and vessels. Their minute origins, being distinguished by the yellow fluid which exudes from them on making a section of the liver, have been called *pori biliarii*. They gradually unite into larger branches and form trunks, which are all united at the porta in the *ductus hepaticus*, which is found in the *capsule of Glisson*.

Although the ramifications of the vessels above described, together with the nerves and absorbents, constitute the principal part of the mass of the liver, there appears to be a structure constituting the *peculiar* substance of the liver.

When the liver is cut, it presents a smooth surface composed of small points of a reddish brown, and pale yellow intermixed, the orifices of the vessels becoming also apparent; the *ducts* being distinguished by the thickness of their coats and their yellow colour, the *arteries*, by less thickness and more elasticity, and the branches of the *venæ hepaticæ*, and *venæ portæ*, by the thinness of their coats.

If the substance of the liver, however, be torn, it appears rough and granulated, or made up of a number of small irregular rounded grains or bodies of a reddish brown colour and soft consistence. These bodies are called *acini*, and, if injected minutely and dried, may be seen to give origin to, or to send off very minute vessels, which radiate from them in all directions, and are called *penicilli*.

GALL-BLADDER.

It is a membranous bag of a *pyriform* shape, situated under the right lobe of the liver, in a superficial cavity already noticed. Superiorly, it is connected to the liver, and below, it presents a surface more considerable than the former, and covered by peritoneum, being contiguous to the *pyloric orifice* of the *stomach*, to the *duodenum*, and the right extremity of the *arch of the colon*.

The *gall-bladder* is divided into a *body*, *fundus*, and *cervix*. In the erect position, its *fundus*, or *base*, is situated *anteriorly*, *inferiorly* and to the *right*, and its *cervix*, *posteriorly*, *superiorly*, and to the *left*. The *cervix* is bent, so as to form a convexity above, and a concavity below, and terminates in the *ductus cysticus*. This is about the same length as the *hepatic duct*, with which it unites below, to form the *ductus communis choledochus*.

The *gall-bladder* is found to be composed of two coats, viz. an external or *peritoneal*, and an internal or *mucous*. The external, which is partial, belongs only to the under surface or base, passing off from the circumference of the cavity, in which the gall-bladder is placed, and covering rather more than half. Under it, there is some dense cellular membrane forming filaments, which by some have been described as *muscular fibres*. The internal or *mucous coat* is thicker, and has a *villous* appearance. It is disposed in numerous *rugæ* or folds, which have a reticular distribution, and has numerous follicles for the discharge of a protecting and lubricating mucus.

Ductus communis choledochus.—By the union of the *cystic* and *hepatic* ducts, at an acute angle, this duct is formed, appearing as a continuation of the latter. It passes before the *vena portæ* in the *capsule of Glisson*, joins the posterior part of the right extremity of the *pancreas*, passes behind the second portion of the *duodenum*, where it sometimes joins the *duct* of the *pancreas*, but more frequently passes with it, through the *muscular coat* of the bowel, after which, the ducts accompany each other obliquely between the *muscular* and *villous coats*, and terminate by a *common orifice* as already noticed.

Structure of the Ducts.—The ducts of the *liver* and *gall bladder*, and the *common bile duct*, are composed of two coats; an *external*, which partakes of the nature of the cellular texture, is dense, and has the appearance of longitudinal fibres; and an *internal*, or *mucous coat*, having a villous appearance, like that of the gall-bladder, and forming numerous folds about the beginning of the *ductus cysticus*, which give the passage a tortuous direction.

SPLEEN.

The *spleen* is a viscus of an irregular oval figure, and of a purple or livid colour, often mixed with patches of bright red, or black. It is situated in the *left hypochondrium*, above the *left kidney*, under the *false ribs*, and is connected with the left extremity of the *pancreas*, and also the *stomach*, by cellular membrane and peritoneum, from which it derives a covering. The size of the spleen differs considerably in different individuals. It has several *notches* in its edges, and it is not uncommon to find several bodies of the same structure, as the spleen, attached to it.

It has been divided into *two surfaces*, an *external*, and an *internal*, and a *circumference*. The *external surface* is convex, and contiguous to the *diaphragm*, to which it is consequently sometimes found united by preternatural adhesions. This surface corresponds to the four last ribs of the left side. The *internal surface* is divided lengthwise into two parts, by a depression which has been called the *fissure of the spleen*, containing some fat, and being the part where the *vessels* and *nerves* enter. The *circumference* of the *spleen* is irregular, being commonly thicker above than below, and the edge is usually interrupted by the notches referred to, which are indefinite in extent and number.

Substance of the Spleen.—The substance of the spleen is spongy and friable, yielding readily to the pressure of the finger. It consists chiefly of a *congeries of bloodvessels*, in addition to *lymphatics, nerves*, and *cellular membrane*. It is invested by a continuation of the peritoneum, which covers it entirely except at the fissure, where it passes off with the fold which fixes the spleen to the diaphragm. Between these folds are the *splenic vessels*, which will be described in their places.

The intimate structure of the spleen has not been clearly explained. If a healthy spleen be cut, the surfaces present a spongy appearance, intermixed with small *granular bodies*, varying in size, and of a greyish colour. After maceration, the *splenic artery* is found to terminate in these bodies which on minute injection appear to consist of a congeries of vessels, the rest of the bulk of the viscus being made up of connecting cellular substance.

PANCREAS.

The *pancreas* is a gland of a yellowish colour, and the largest of those called *conglomerated*, or composed of a number of smaller glands united. It is long, and narrow, flattened both anteriorly and posteriorly, and has been compared to a dog's tongue. It lies directly across the spine ; is divided into *two extremities*, a *right* and a *left* ; *two surfaces*, an *anterior* and a *posterior* ; and *two edges*, a *superior* and an *inferior*.

The *right extremity*, called also the *head* of the *pancreas*, is larger, than the left, and adheres to the second curve of the *duodenum*. From this extremity, there generally extends along the duodenum, a process called the *smaller pancreas.* The left *extremity* is connected with the *spleen.*

The *pancreas* resembles the salivary glands in structure, being of a firm consistence, and composed of lobes, which are again made up of smaller lobes, or lobules, and connected together by dense cellular membrane.

The *excretory duct* of the *pancreas* is white, membranous, and about the size of a crow-quill. It passes through the middle of the gland, receiving in its passage collateral branches, and, on reaching the *duodenum,* terminates along with the *ductus communis choledochus,* as already described.

URINARY ORGANS.

Some of these only being situated in the abdominal cavity, they will be described, with their physiology, &c., in connexion with the viscera of the *pelvis,* in which the other urinary organs are situated.

PHYSIOLOGY OF THE CONTENTS OF THE ABDOMEN.

The stomach has been described as being intermediate to the œsophagus and duodenum ; and, being intended for the accumulation of food, its dimensions, situation, and relations to the neighbouring parts, must necessarily suffer considerable variations.

As the food arrives at the stomach, the first few mouthfuls are readily admitted, the organ being so little compressed by the surrounding viscera that it readily yields, but, after a time, and when the food has begun to accumulate, its distention becomes less easy, from its increased bulk beginning to press upon the neighbouring viscera. The food is more immediately lodged towards the left extremity, and middle part, the pyloric half giving way with more difficulty.

When the stomach is distended, instead of being of the same flattened appearance as when empty, and occupying the epigastrium, and *part* of the hypochondrium, it becomes of a round form, and its great *blind sac* is thrust into the hypochondrium, which it almost entirely fills ; the greater curvature descends towards the umbilicus, particularly on the left side, while the *pylorus* alone, fixed by a fold of the *peritoneum*, preserves its relation to the contiguous parts. On account of the vertebral column behind, the posterior part of the stomach cannot extend itself in that direction ; the viscus is, therefore, wholly curved forward, its greater curvature being turned in this direction when distended.

The dilatation of the stomach produces very important changes in the abdomen. The total volume of the cavity augments, its contents are compressed, and, often, the necessity of passing urine or fæces is felt. The diaphragm is at the same time pressed towards the thorax, thence, the motions of respiration, and the phenomena depending upon it, such as speech, singing, &c. are incommoded.

The accumulation of food in the stomach is accompanied by various sensations. At first, it is an agreeable feeling, and, as hunger becomes by degrees appeased, the general weakness, that accompanied it, is followed by a feeling of renewed energy. If the introduction of food be continued, a sensation of fulness and satiety is experienced, indicating that the stomach is sufficiently replenished. If, however, contrary to this indication, the use of more food be persisted in, disgust and nausea are produced, and vomiting soon follows.

The presence of aliments in the stomach causes excitement, as is manifested by the redness of the mucous membrane, from the quantity of fluid it secretes, and the volume of the vessels directed there. The progress of food along the œsophagus is slow and uninterrupted, and appears to depend almost entirely on muscular action.

Changes of aliment in the Stomach.—It is usually more than an hour before food suffers any apparent change in the stomach, beyond what results from its admixture with the fluid with which it may meet, and which is constantly renewed by the mucous coat. The food having reached the stomach becomes converted into *chyme*, which the best authors have considered as a homogeneous substance, pultaceous, greyish, of a sweetish taste, insipid, acidulous, and preserving none of the properties of food. These are its common qualities, from whatever kind of food it may have been produced.

The chyme is said to be principally formed in the pyloric portion of the stomach, and the transformation of alimentary matters into chyme takes place from the surface to the centre, the substances, undergoing the change, appearing to be acted upon by something capable of dissolving them. For instance, the white of a hard-boiled egg becomes in a little time, as if plunged in vinegar, or a solution of potass. It is, however, remarkable, that, if the alimentary substance be enveloped in a covering, scarcely, if at all digestible, the solution will take place within, while the shell or outer layer remains untouched.

There is, sometimes, a small quantity of gas found in the stomach during the formation of chyme, but at other times none.

When a quantity of chyme, seldom exceeding in volume two or three ounces of water, has collected at the pyloric extremity of the stomach, it passes through the pylorus to the duodenum. The pylorus opens readily to such parts of the food as have attained the qualities of chyme, but those that have not are detained for a longer period, and afterwards passed with difficulty.

All alimentary matters are not transformed into chyme, with the same facility. In general, *fatty matters*, *tendons*, *cartilages*, *concrete albumen*, *mucilaginous* and *sweet vegetables*, resist more the action of the stomach, than *cheesy*, *fibrinous*, and *glutinous* substances. *Bones*, the *rinds* of *fruits*, their *stones* and *seeds*, are of very difficult digestion. The extraordinary instances on record, of the hardest subtances having been dissolved in the stomach, are exceptions to the rule.

There have been various hypotheses regarding the changes, which take place in the formation of chyme from the various articles of food conveyed into the stomach, but the real nature of the chemical changes is still unknown.

The following considerations however, may lead to an approximation to the knowledge of what takes place in the stomach. The food suffers a pressure more or less strong either from the sides of the abdomen, or from those of the stomach ; the whole is moved by respiration ; it is exposed to a temperature of 100° to 104° of Farenheit, and also to the action of the saliva, and of the mucus proceeding from the mouth and œsophagus, as well as the fluid secreted from the stomach, called *gastric juice*, of the specific nature of which we have but little satisfactory information, notwithstanding the labour that has been bestowed in attempting to discover it. All that we yet know is, that it contains certain saline substances, in small quantity, more especially the *muriate of soda*, in common with other animal fluids ; but that it does not essentially differ in its chemical properties from saliva, or from the secretions of mucous membranes generally.

Changes of chyme in the small intestine.—This intestine, as already noticed, has been divided into *duodenum, jejunum* and *ileum*. Its mucous coat secretes abundance of viscid mucous fluid, of a saltish taste, and capable of turning *litmus paper* red.

At the part of the *duodenum*, where the *pancreatic* and *biliary ducts* terminate, the chyme begins to change its apparent properties ; its colour becomes yellowish, its taste bitter, and the pungency of odour, which it formerly possessed, diminishes. The alteration, however, which chyme undergoes in the small intestines, is unknown ; but, it is easily seen to be in connexion with the action of the bile, of the pancreatic juice, and of the fluid secreted by the intestine itself. What is the exact nature of the reciprocal actions or affinities, that take place in the chemical process, and why the chyle is precipitated on the surface of the *valvulæ conniventes*, while the rest of the mass remains in the intestine to be expelled, is completely unknown.

It is however, ascertained that, after the chyme receives the biliary and pancreatic secretions, it appears to separate into the whitish tenacious liquid termed *chyle*, and a *yellowish pulp*. The former is the nourishing part of the food carried back into the system, and called the *recrementitious* portion, while the other, or *excrementitious* part, after undergoing some further change as it passes along, is thrown out of the body. The viscera concerned in the preparation of chyle are called *chylopoietic*. Both chyle and chyme pass slowly along the small intestines. The viscid chyle, however, being separated in its passage is detained in the furrows, between the *valvulæ conniventes*, to be absorbed by the vessels called *lacteals*, which will be described under their proper division of the subject. It is sufficient, here, to notice, that their contents are eventually conveyed through the *mesenteric glands*, to the *thoracic duct*, which enters the *left subclavian vein*.

The process of forming *chyle*, or *chylification*, being completed in the small intestines, the contraction of the inferior portion of the ileum propels the matter it contains into the cæcum, where the mass, now called *fæces*, acquires a fetid odour. After having remained a certain time in the cæcum, the mass passes into the colon in which it continues its progression very slowly, under the influence of the contraction of the muscular fibres of the intestines and pressure of the abdominal muscles, until it arrives at the rectum, for expulsion from the body.

Expulsion of the fæces.—The principal agents in the expulsion of the fæces are the *diaphragm* and *abdominal muscles*, the *colon* and *rectum* co-operating slightly in the operation. As long as the matter is not in any great quantity in the large intestine, and, particularly, so long as there is no great accumulation in the rectum, its presence is not rendered sensible to the feelings ; but, when the quantity is considerable, and the rectum becomes distended, there is a sensation of fulness and uneasiness in the abdomen, producing the desire of expulsion.

Secretion of bile.—It has been seen in describing the anatomy of the liver, that it received blood from two sources, and has the peculiarity of being traversed by a quantity of *venous blood*, received from the veins of the stomach and bowels, besides the *arterial blood*, which it receives in common with every other part. When fine injection is thrown into the *hepatic artery*, it passes from the capillary extremities of that vessel into the *vena portæ*, while fluids injected into the *hepatic artery*, or *vena portæ*, pass readily into the *venæ cavæ hepaticæ*, and into the *hepatic ducts*.

Few fluids are of such a compound nature, and so different from the blood as the *bile*. It is viscous, ropy, and sometimes muddy, while its colour varies from light green, to yellowish brown. That in the gall-bladder is called *cystic bile*, and is of a much darker colour, than that direct from the liver, which is called *hepatic bile*.

The bile contains *water*, *albumen*, *picromel* (a matter called by some chemists resinous,) a *yellow colouring principle*, *soda*, and *some salts*, viz. *muriate phosphate*, and *sulphate of soda*, *phosphate of lime*, and *oxide of iron*.

The *gall bladder* appears intended as a *reservoir*, in which the bile may be retained, when not needed in the small intestines. It becomes thicker by retention, and is believed to undergo other changes not so easily observed.

Much difference of opinion exists as to the source whence the bile is secreted. It has been found to be secreted, when the *vena portæ* terminated in the cava, instead of in the liver, and also when the *hepatic artery* has been tied.

The use of the Spleen.—This may be considered as wholly unknown. The viscus forms one of a class of parts, that have the texture of glands, and have great vascularity, but no excretory ducts, such as the *thyroid gland*, the *thymus gland*, and the *renal capsules*.

It is well known, that the spleen may be removed, without any serious effect being produced on the system, and it is sometimes altogether wanting.

Secretion of pancreatic juice.—It has been already seen, that the pancreas has an excretory canal, which terminates in the *duodenum*. It also, appears to be of the same structure as the *parotid* and *submaxillary* glands, and the fluid it secretes, is very similar to the *saliva*, or that secreted by the glands alluded to. It answers some important purpose, in the process of *chylification*, but its precise effect is not known.

MORBID CHANGES TO WHICH THE CONTENTS OF THE ABDOMEN ARE LIABLE.

STOMACH AND INTESTINAL CANAL.

These are, in common with every other tissue, subject to *inflammation*, and its various terminations. It has been seen, that these organs consist of three structures, viz, the *peritoneal*, the *muscular*, and the *mucous coats*. The changes produced by inflammation are, therefore, necessarily modified by the peculiarity of the structure affected.

Peritonitis, and *Enteritis*, are the terms used to designate inflammation of the bowels, the former term being used to indicate an inflammatory affection of the *outer covering* of the tube, while the latter more especially applies to its structure generally, or more especially to its *muscular* and *mucous coats*.

Peritonitis may be either *acute* or *chronic*, and may terminate by effusion of serious fluid, sometimes clear and limpid, at other times opaque and milky, while, it sometimes contains flocculent matter, and is at others like pus.

In its structure, the *peritoneal coat* is sometimes found much thickened, of a colour varying from dark purple to bright red, highly injected, and adhering to the contiguous parts.

When the *muscular coat* has been affected by inflammation, the bowel is usually found in a state of distention, the effect of it appearing to destroy the action of muscular fibre. Sometimes from this effect, the intestine is ruptured, while at other times, it is found in a state of *gangrene*, a result of inflammation peculiar to muscular fibre.

The consequences of inflammation, on the lining or *mucous membrane*, exist in various forms and degrees, but we are far from being acquainted with the causes by which these varieties are regulated. The first effect of inflammation, in a low degree, on this structure, appears to be a simple increase of its proper secretion, more or less changed in its qualities from the healthy condition. In a more advanced stage of inflammation, the mucous intestinal lining, to a greater or less extent, becomes softened, or of an ash-colored pulpy degeneration, and parts or patches so affected fall out, leaving spaces which often pass into *ulceration*. Sometimes large portions of the membrane are found in this state, or in that of uniform dark softening, resembling *gangrene*. The mucous lining also, is occasionally covered to a greater or less extent, with irregular patches of a bright red colour, and sensibly elevated above the level of the surrounding parts, and sometimes, its surface is covered with *ulcers* to a greater or less extent.

The mucous lining of the large bowels appears to be more especially the seat of these changes, and the structure under consideration, is that implicated in *dysentery*.

Intus-susceptio.—A portion of intestine sometimes passes within another, carrying along with it its mesentery. The intestine generally passes into that immediately beneath it, but sometimes the reverse is the case. This affection is much more frequent during the infancy, than at any other period of life. It is also more frequent in the small than in the large intestines.

Hernia or *Rupture.*—This term is usually applied to the protrusion of some part of the bowels, without the cavity of the abdomen. The different kinds of *herniæ* have been named from their situations, or, from the contents of the hernial sac, hence, the terms *umbilical hernia, inguinal hernia, femoral hernia,* and *scrotal hernia,* &c. and the term *enterocele,* when the tumour contains only *intestine;* and *entero-epiplocele,* when both *intestine* and *omentum,* &c. &c.

Vermes or *Worms*—There are several kinds of worms found in the intestinal canal. Those peculiar to the human body are, the *tænia* or *tape* worm, so named from its resemblance to a piece of tape, the *ascaris lumbricoides* or *lumbricus,* resembling an *earth-worm,* the *ascaris vermicularis,* (or *ascarides* as they are usually called) the smallest description of worm, being seldom more than half an inch in length, and the *trichuris hominis,* the most uncommon kind, about an inch in length.

Alvine concretions, or *Intestinal calculi.*—These substances are sometimes found in the human intestines. They vary much in size, some being no larger than a pea, while others attain a size sometimes equal to that of an orange, and generally consist of a number of lobes, or a congeries of smaller concretions. Some are porous and spongy, others are lamellated, and they have been found to be composed of the following substances: 1. *albumen*; 2. a *brown peculiar substance;* 3. *common salt;* 4. *phosphate of lime* and *magnesia;* 5 *sulphate of soda*; and 6. *sulphate of lime.*

Hæmorrhoids or *Piles*—These are tubercles or excrescences about the verge of the *anus,* deriving their origin in their simplest state, from a turgid or *varicose* state of the hæmorrhoidal veins, which are covered by the inner membrane of the rectum. In severe cases, the mucous follicles of the gut, and the neighbouring tissues become involved, and the disease often assumes a very serious character.

Prolapsus ani, or *Falling down of the Fundament.* This is a common, but very troublesome disease. When the action of the *sphincter ani* muscle is feeble, it collapses but imperfectly, and the part of the rectum, that descends to the verge of the anus upon the expulsion of fæces, instead of being retracted, continues exposed or ascends but partially. It sometimes, also, depends on the reverse condition of the parts, or *spasm*, in which case when the descent of the gut has taken place, from violent straining, &c. its return is prevented by spasmodic contraction of the sphincter.

Tabes mesenterica, or *Wasting of the body from disease of the mesenteric glands.* In this disease, which is generally one of infancy, the mesenteric glands through which the lacteals pass become obstructed, and the system, being thus deprived of nourishment, wastes.

LIVER.

Hepatitis, or *Inflammation of the Liver.*—This is the principal, and most important derangement to which this viscus is liable. By means of inflammation, the liver becomes enlarged and united to the neighbouring parts, while, by its pressure, it may interrupt the functions of the stomach, or, by impeding the free flow of blood through itself, and consequently through the other contents of the abdomen, it may produce dropsy of the belly. It terminates either in *abscess*, which may be discharged into the cavity of the peritoneum, the colon, the sacs of the pleura, or lungs; in *gangrene*, which is more uncommon; or in permanent *induration* and *obstruction*, with change of structure, varying from the slightest degree to *schirrosity*. The reverse condition also takes place, and the liver is found of a *cream colour*, and of remarkable *softness*, and *friability*, throughout its substance.

Collections of Hydatids also, are often found in the liver. By the term *hydatid*, is to be understood a round or oval shaped semi-opaque bag said to possess a contractile power, without any external opening, containing a watery fluid, and often a number of smaller bags within it. They vary in size from that of a millet seed, to that of an ordinary sized bladder.

Biliary calculi, or *Gall-stones.*—These have been found in every part of the biliary ducts and gall-bladder, and are very various in size, colour, consistence, and chemical composition. They appear to be of three kinds: 1, *cholesteric*, so called from being composed of a substance found only in them, and called *cholesterine*, of a pearly white colour; 2, the *mellitic*, from their having the appearance of granulated honey; and 3, the *inspissated bile calculi*, from being entirely composed of inspissated bile.

SPLEEN.

Splenitis, or *Inflammation of the Spleen.*—The *investing membrane* of this viscus may be inflamed, and the disease may terminate in either of the modes peculiar to inflammation of serous membranes. It is often therefore, found adhering to the stomach, diaphragm, or neighbouring parts.

The *substance* of the spleen however, may be *inflamed*, may terminate in *abscess*, and be destroyed, so that nothing remains but the peritoneal covering which forms the cyst or boundaries of the abscess. Sometimes the spleen becomes very much *enlarged*, and acquires an uniform *hardness*.

Rupture of the Spleen.—From the texture of the spleen, it appears more liable to this accident from external causes, than any other of the viscera. It has sometimes occurred from over-exertion, or from blows.

PANCREAS.

Inflammation of the Pancreas.—The pancreas is subject to inflammation, and all its consequences.

Gangrene of the Pancreas.—This affection has been mentioned, when it is said the viscus becomes of a deep violet colour, preternaturally soft, and contains a black fetid liquor.

Scirrhus of the Pancreas.—This condition of the gland, has also been found.

Calculi in the Pancreas.—Although these are occasionally found, they are by no means so frequent, as either biliary or urinary calculi. *Pancreatic calculi* appear to be similar to calculi found in the ducts of salivary glands.

PART VII.

VISCERA OF THE PELVIS, AND ORGANS OF URINE AND GENERATION.

Although from some of those organs being partly in the *abdomen*, and partly in the *pelvis*, there is no very accurate division between the contents of these cavities, it has still been preserved by most Anatomists.

The *pelvis*, in the *male*, contains the *rectum*, the *urinary bladder*, the *prostate gland*, the *vesiculæ seminales*, and part of the *urethra* The organs peculiar to the *female* will be described under the head of "PARTS OF GENERATION IN "THE FEMALE."

A description of the *rectum* has been already given, while that of the *kidneys*, an d*ureters*, has been reserved for this place.

KIDNEYS.

They are of a pale red colour, and are situated deep in the lumbar region, and behind the peritoneum, which covers them anteriorly. They are placed one on each side of the spine, extending downwards almost to the crista of the ilium from a point nearly opposite the eleventh rib, and connected with the *diaphragm*, the *psoas* and *quadratus lumborum* muscles. The *right* kidney, lying behind the colon, is somewhat lower than the *left*, being placed immediately below the large lobe of the liver, which occupies more space than the spleen fills on the opposite side. The left kidney is placed below and behind the spleen, and also posterior to the left portions of the stomach, pancreas, and colon.

The figure of the kidney, is that of an oval, with a *sulcus*, *concavity*, or *sinus* for its vessels, towards the spine. The substance of the kidney which is covered by a cellular tunic, peculiar to itself, under that of the peritoneum, is firm in consistence, and formed of two different kinds of structure: viz. the *cortical* or *outer*, and the *medullary* or *tubular*. The *cortical* is disposed in a layer, of about a quarter of an inch in thickness, around the exterior part of the gland, and sends partitions into its interior, which divide the portions of the *medullary* substance, and diminish in thickness, as they extend towards the *pelvis* of the kidney. The cortical part of the kidney is less firm, and more easily torn than the medullary: it is of a yellowish, or brownish red colour, and principally composed of vessels. It is in this part of the kidney, that the minute ramifications of the *renal*, or *emulgent artery*, are found terminating, on the one hand, in the extremity of veins, and, on the other, furnishing the secretion of urine from their minute extremities. The *cortical* has, therefore, been, called the *secerning* part of the kidney. The *tubular* or *medullary* substance is dense in its consistence, and distinguished by its reddish white colour. It is formed of several *conical bodies* of different sizes, with their bases placed outwards, and their points towards the *pelvis* of the kidney. These bodies are surrounded except at the point, by *cortical* substance; they have a striated appearance, being composed of the ducts called *tubuli uriniferi*, which convey the urine, after its secretion in the cortical part, and pass from their bases to the points. These points project, and are called *papillæ* or *processus mamillares* from their being of the shape of *nipples*. They vary somewhat in figure, and in number, being from eight to eighteen; sometimes *one cone* has *two* processes, or *two cones* unite to form *one* larger process.

The points at which the uriniferous tubes begin, are very small seed like bodies called *acini*.

The *papillæ* are surrounded by membranous tubes, called *infundibula*, within which their points project. They vary in number, are of different lenghts, and commonly join into two or three large trunks which terminate in a membranous cavity or sac, of some size, called the *pelvis*. It is of a conical form, situated in the sinus of the kidney, already mentioned, appearing partly within, and partly without its body, and at a little distance from the sinus, it contracts and forms the *ureter*.

URETERS.

These are *membranous tubes* one of which descends, on each side, from the pelvis of the kidney, upon the psoas muscle behind and in contact with the peritoneum, into the pelvic cavity, where it is inserted into the lower part of the *bladder*.

CAPSULÆ RENALES.

These are two small bodies, one on each kidney, at its upper and inner part, and surrounding it like the comb of a cock. They are usually of a dark yellow colour, and, besides their connection to the kidney, are attached to the diaphragm, the right to the liver, and the left to the spleen. They have a small cavity within, sometimes containing a yellowish brown fluid.

URINARY BLADDER.

The bladder when moderately dilated, is of an *ovoid* figure, the inferior and posterior part being the most capacious. It is anatomically divided into the *fundus*, placed upwards and a little forwards; the *base*, below and posteriorly; the *body* between the parts mentioned; and the *cervix*, at the under and forepart.

It is connected to the adjacent parts by cellular membrane and peritoneum, but more especially to the *ossa pubis*, by means of a *ligamentous expansion*, that passes from their arch to each side of the neck of the bladder and prostate gland. It is attached also, to the parietes of the abdomen, by means of the remains of the *umbilical arteries*, which in the *fœtus* passed up by the sides of the bladder to the umbilicus; and by the *urachus*, which is continued to the same part, from the fundus of the bladder. These several attachments have been called, the *ligaments* of the bladder.

The bladder has three proper *coats*, which are connected by interposed cellular substance. The *external coat* called the *peritoneal*, gives, as has been mentioned in the description of the peritoneum, only a partial covering to the upper and posterior parts, from which it is reflected upon the recti muscles, being, during the full distention of the organ, lifted up for a space of nearly *two inches* above the pubes. The *second coat*, called *muscular*, is composed of distinct fleshy fibres, which are much stronger and more numerous, about the neck of the bladder, and behind the prostate gland, where they form a muscle, and are called the *sphincter vesicæ* The *third*, or *inner coat* is formed of *mucous membrane*, being united to the former by cellular membrane, which some Anatomists have described, as a *nervous coat*. This *mucous membrane* is thin, presents a smooth surface, and, in a healthy condition has a whitish appearance. It forms folds when the bladder is empty, and has its internal surface lubricated by mucus.

At the under part of the bladder, there are three openings, of which, *one* is placed anteriorly, and *two* posteriorly. The anterior opening is the beginning of the *urethra*, and formed by the neck of the bladder; and the two posterior, which are not found, without difficulty, are the openings of the *ureters*. The *ureters*, near their termination, run obliquely forwards for about an inch, between the muscular and mucous coats of the bladder, each terminating upon the inner coat by a contracted opening, about half an inch distant from its fellow, and, at the same distance behind the opening of the urethra.

URACHUS.

The *urachus*, in quadrupeds, is a sac, or a canal leading to a sac, called *allantois*, hanging to their navel, and has a communication with the bladder. In the human fœtus, which generally secretes no more urine than is removed by the absorbents, it is in general a mere vestige; although, monsters are occasionally born, in whom its functions are necessary and perfect.

PROSTATE GLAND.

This gland is of a rounded figure, about the size, although not of the shape, of a large nutmeg, and embraces the neck of the bladder, and beginning of the urethra, so that the larger portion of it is situated inferiorly. It has been compared in its figure, to that of a heart, as painted on playing cards. The *base*, or broad part, is placed posteriorly, and the *apex* or narrow part, is placed inferiorly and anteriorly, towards the *bulb of the urethra*, (to be described.) The lower convex surface of the gland is divided, by a middle line, into *two lobes*, which project laterally, on either side of the *urethra*. There is sometimes, what is called a *third lobe*, seen in cases of enlargement, between the entrance of the *vasa deferentia* and the *bladder*.

The gland is surrounded by dense cellular substance. It has within it numerous small straight ducts, running obliquely forwards, and terminating by different orifices, at the sides of the *caput gallinaginis* (to be afterwards noticed.)

VESICULÆ SEMINALES.

These are *membranous pyriform cavities*, attached to the bladder near its neck, and situated between its lower and posterior part and the hollow of the rectum. Their length is about an inch and a half, and their anterior parts, which are narrow, are connected with the *prostate gland*. They recede from each other, as they extend upwards and backwards; thus, their broad extremities, being at some distance form each other, there is a portion of the bladder of a triangular form between them.

The surface of the *vesiculæ* is irregular and formed of tortuous eminences and depressions from their being composed of the convolutions of a lengthened tube, coiled up and united by dense cellular substance.

From each *vesieula* there is a *duct*, which joins on the same side with the *vas deferens*, the duct coming from the testicle. At this junction, a common canal is formed which converges towards its fellow of the opposite side, passes through the prostate gland, and terminates in the *veru montanum*, or *caput gallinaginis*, an eminence situated in the urethra, immediately before the neck of the bladder, and called by the latter name, from its resemblance to the head of a cock in miniature.

URETHRA.

By this name is known all that length of the *canal*, from the neck of the bladder, to the extremity of the penis. It commences at the former part, passes downwards and forwards, in a curved direction, first, through the *prostate gland* behind, and then under the *symphysis pubis*; afterwards, into the *corpus spongiosum* of the penis, in the groove formed by the two *corpora cavernosa*; and terminates, by a longitudinal orifice, called *meatus urinarius* at the under and forepart of the glans penis, from which the fold forming the *frænum præputii* is continued.

The urethra is about $8\frac{1}{2}$ to 9 inches long, from the orifice of the urethra to the neck of the bladder, and is described as being divided into *three portions*.

1st, that part which passes along the penis, and is included in the *corpus spongiosum*, being about 7 inches in length; 2d or *membranous part*, which extends from the termination of the former to the prostate gland, being about $1\frac{1}{2}$ inches; and 3d, what is called the *prostatic portion*. or that part which is imbedded in the prostate gland, and occupies the space of about $\frac{1}{2}$ an inch in length.

The *urethra* is also described as having several *dilatations* and *contractions*. It has a dilatation at its *origin* from the bladder, it becomes smaller in its passage through the *prostate gland*, and attains its utmost contraction immediately anterior to that gland, or in its *membranous part*. It then dilates again anteriorly to the part mentioned, forming, what is called the *bulb of the urethra*, after which it contracts again along the penis to the glans.

The urethra consists principally of a mucous membrane, which is continuous with the membrane which lines the bladder.

COWPER'S GLANDS.

These are two small bodies of the size of peas, of a more or less rounded figure, situated at the *back part* of the *corpus spongiosum*, by the *sides* of the *membranous part* of the urethra. They are of a firm consistence, of a reddish colour, and have each an excretory *duct*, of about half an inch in length, which terminates within the urethra. They secrete a fluid, the peculiar properties and functions of which are not understood.

PARTS OF GENERATION EXTERIOR TO THE PELVIS IN THE MALE.

PENIS.

The *penis* is divided into three portions, viz. the part by which it is attached to the pubes called its *root*; the extremity by which it terminates, called the *glans*, and the intervening portion called the *body*.

It is also composed of three portions, two of which form the upper part and sides of the body, and are called *corpora cavernosa*, or *cavernous bodies*, from their being composed of cells; and one which is situated below, and called *corpus spongiosum*, or *spongy body*, from its being of a spongy texture.

Corpora Cavernosa.—These appear, when distended, like two equal but irregular cylinders, closely applied and joined together. At the posterior part, and under the symphysis pubis, they separate, and terminate on each side by a conical extremity of about an inch in length. These extremities are called *crura*, and are attached to the *rami* of the *ischia*, and *pubes*. They terminate anteriorly in a rounded extremity, to which the glans is attached, and are connected to the pubes by a triangular shaped condensation of cellular substance, called the *suspensory ligament*. They are separated lengthwise by a fibrous partition, attached by its upper and under edges to the sheath, or elastic covering, by which they are surrounded.

Corpus Spongiosum.—This is also called *corpus spongiosum urethræ*, from its surrounding the urethra, and is situated *under* and *between* the *corpora cavernosa*. *Posterior* to the *junction* of the *corpora cavernosa*, it dilates into a conical projection, called *the bulb*, which is placed between the crura, and extends from the root of the penis, to near the anus. The *corpus spongiosum*, having extended along *beneath the corpora cavernosa*, expands at the extremity of the urethra, into a body called the *glans penis*, surrounded by a prominent margin called the *corona glandis*.

The *penis* is covered by the common integument, which at the glans is formed into a fold called the *præputium, or prepuce*. The prepuce is fixed to the under part of the glans by a small slip of skin, called its *frænum*, running from the lower part of the *corona glandis* to the lower edge of the opening of the urethra. The muscles of the penis have been described under the proper head.

SCROTUM.

The *scrotum* contains the testicles, and is formed by a continuation of the common integuments; and, its cellular membrane being particularly lax and free from fat, has been considered by some as a *muscle* and called *dartos*.

Upon the surface of the scrotum, directly in the middle, there is a line passing from the lower part of the penis along the perinæum. This is called the *raphè*, and opposite to it is a septum, or partition between the testicles, formed by the loose reticular membrane, which lines the scrotum.

TESTES, OR TESTICLES.

The *testes* have each two distinct coats, the *tunica vaginalis*, and *tunica albuginea*. The former covers the testicle loosely, and without adhering to its general substance, while the other is in close union with it, and is the immediate coat of the testicle. Both coats are derived from the peritoneum, the *tunica albuginea* forming the covering of the testis while situated in the abdomen, behind that membrane, and the *tunica vaginalis*, that which it afterwards receives in its descent through the abdominal ring, already noticed.

The *substance* of the *testes* is made up of the *excretory ducts*, together with the *lymphatics*, *bloodvessels*, and *nerves*.

On removing their coats, the *testes* appear of a yellowish colour, being made up of minute ducts called *tubuli seminiferi*, which begin at the extremities of the secreting arteries. These *ducts*, or *tubes*, which are extremely numerous and minute, are coiled up and separated from each other by septa of cellular membrane. These *seminiferous tubes* run in meshes, fifteen or twenty in number, and where they come out from the testicle, they run along the back of it, and communicate by inosculations with each other, so as to form a net-work, sometimes called the *rete testis*. Where the membranous septa meet on the back of the testicle, there is a white line called the *corpus Highmorianum*.

From the *rete testis*, the *vasa efferentia* arise. These are very delicate vessels, which run out from the head of the testicle; they are at first single, but afterwards become convoluted and formed into cones, called *coni vasculosi*. The *vasa efferentia*, after forming the cones, unite and form larger tubes, and these again uniting form one duct, called the *vas deferens*; this vessel being extremely convoluted, forms, together with the vascular cones, a body, which being as it were placed upon the testicle, has been called *epididymis*.

SPERMATIC CORD.

This consists of the vessels and nerves belonging to the testicle. It has *three coverings*; the *external* is derived from the *aponeurosis* of the *external oblique* muscle, continued around it within the scrotum; the *second* is that of the *cremaster* muscle, consisting of pale fibres which derive their origin from the lower edge of internal oblique and transverse muscles of the abdomen, and pass with the cord through the abdominal ring, as far as the testicle, where the fibres spread upon the *tunica vaginalis*; the *third* is the *tunica vaginalis*, a continuation of the covering of the testicle.

Vessels of the Cord.—The vessels of the cord are the *spermatic artery*, *spermatic veins* and *nerves*, and the *vas deferens*; the former arises from the aorta within the abdomen; the veins are larger than the artery, and form a plexus, which accompanies it, and on the right side terminate in the *vena cava inferior*, opposite to the lower end of the kidney, by a single trunk, and on the left side, in the *left emulgent vein*; the spermatic nerves come from the intercostal and lumbar nerves. The origin and termination of the vas deferens, have been already described.

PARTS OF GENERATION IN THE FEMALE, EXTERIOR TO THE CAVITY OF THE PELVIS.

Mons veneris.—This is a rounded prominence covered with hairs at the age puberty, situated at the lower part of the belly, and lying over the forepart of the *ossa pubis*. It consists of common integuments, with an additional proportion of cellular and adipose substance.

Labia pudendi.—These proceed downwards and forwards, in the direction of the symphysis pubis, and terminate in the *perinæum anterius*. Their structure is similar to that of the *mons veneris*; they are thicker above than below, and are red and vascular, on their inner side. The places where they are joined to each other, above and below, are called *commissures*.

The longitudinal cavity, or *fissure*, situated between the labia, and extending from the mons veneris to the perinæum anterius, contains several parts, which are seen on separating the labia.

Clitoris.—This is a red projecting body, situated below the arch of the pubes, and partly covered by its *prepuce*, which is a fold of skin, continued from the inner surface of the labia, so as to cover the superior and lateral parts of the clitoris. The *clitoris* resembles the penis in the male, and consists of two *cavernous bodies*.

Perinæum anterius.—This is the portion of the soft parts, which extends from the inferior commissure to the anus.

Perinæum Posterius.—This is the part included in the space between the anus, and point of the os coccygis.

Nymphæ.—These are two prominent doublings of the integuments, extending from the *glans*, of the *clitoris*, to the sides of the *vagina*. A little lower is seen the *orifice of the urethra*. It is situated below the clitoris and arch of the pubes, between the nymphæ, and above the orifice of the vagina, its situation being marked by a small rising prominence like a pea, in the centre of which their is a small opening.

On separating the lower part of the labia pudendi, the *vestibulum*, or space leading to the vagina, is seen. It is bounded behind, by the *carunculæ myrtiformes*, or by the *hymen*, and before, by the *perinæum anterius*. The *hymen*, or *circulus membranosus*, is a flat pulpy kind of membrane formed by a doubling of the inner surface of the vestibulum, and lower part of the vagina. It has an aperture in its upper part, but it is completely ruptured in married women. It is after its rupture, that those irregular projections, called *carunculæ myrtiformes*, are seen marking the orifice of the vagina.

Behind these is the *vagina*, or canal leading to the *uterus*, the mouth of which may be felt projecting into it. The *vagina* lies between the rectum, and inferior surface of the urethra and bladder, and is connected to them by cellular substance.

PARTS WITHIN THE CAVITY OF THE PELVIS.

Uterus or Womb.—It is situated between the *bladder* and *rectum*, to both of which it is connected by reflections of the peritoneum. It is of an oblong shape, broader above than below, somewhat flattened, inwardly hollow, of a whitish colour, and firm consistence. The broad upper part is called *fundus*, the lower and narrower part the *neck*, or *cervix*, and the intervening part the *body*.

The *uterus* has four ligaments, the *ligamentum teres*, or *round ligament*, extending from the side of the fundus uteri on each side, and passing through the *abdominal ring* to the groin; and the *ligamentum latum*, or *broad ligament*, which is a fold of the peritoneum, reflected from the body of the uterus, and connecting it to the sides of the pelvis.

FALLOPIAN TUBES.—These are two, each going out from the fundus of the uterus, and situated in the upper part of the doubling of the *broad ligament*. These tubes are slender and hollow, and are curved downwards and backwards at their outer ends, where they terminate in fringed extremities, called the *fimbriæ*.

OVARIA.—They are two small oval bodies, white and flat, situated by the sides of the uterus, and enclosed in the posterior fold of the *broad ligament* behind the outer ends of the *Fallopian tubes*, with the fimbriated extremities of which they are connected.

The BLADDER is situated before the uterus.

The URETHRA is short in females, and, near the bladder, is surrounded by a spongy fleshy substance. It runs for some space between the bladder and vagina, before it enters the former.

PHYSIOLOGY OF THE ORGANS OF URINE AND GENERATION.

Secretion of urine.—The kidneys or organs which *secrete* this liquid, are, as have been seen, situated in the abdomen. The artery which is directed to each, is large, short, and proceeds direct from the aorta; it has easy communications with the *veins* and *tubular part*, as may be seen by the coarsest injections, thrown into the artery, passing into the veins, and pelvis of the kidney, after having filled the cortical substance.

If the pelvis be opened in a living animal, the urine is seen to pass out slowly, by the points of the cones; while, a slight compression upon the cones, makes the urine pass out in considerable quantity, but instead of being limpid, it is muddy and thick. It appears to be filtered by the hollow fibres of the tubular substance.

The liquid secreted by the kindneys is much more abundant than that from any other gland, and instead of serving for an internal purpose, it appears to be one of the means used for separating from the blood, substances that would interfere witht its salutary qualities. It is therefore, carried to the bladder to be expelled, its undue suppression by the kidney, or retention in the bladder, being attended with the most serious consequences.

The urine being secreted, passes slowly along the ureter to the bladder, which it gradually distends sometimes to a considerable degree. In proportion as the urine distends this organ, it flattens the ureters, and shuts them so much the more firmly, as it becomes more abundant. Though the quantity of urine is very copious, and, although it contains several principles that are not found in the blood, the result of some chemical action in the kidneys, its secretion is nevertheless very rapid. It has been observed, that *rhubarb* could be detected in the urine, in seventeen minutes after it had been swallowed. This has given origin to the supposition, that there is a direct communication between the stomach and bladder, but none has ever yet been detected.

In a state of health, the colour of the urine is yellowish; its taste is salt, and a little bitter, and its odour is peculiar to itself. It is composed of *water*, *mucus*, which probably proceeds from the mucous membrane of the urinary ducts, of *uric acid*, *lactic acid*, *muriates of soda* and *ammonia*, *phosphates of soda*, *ammonia*, *lime*, and *magnesia*, of *sulphate of potass*, of *lactate of ammonia* and *silex*.

The physical properties of urine are subject to great variations. If rhubarb or madder has been used, it becomes of a deep yellow or blood red colour, or, if the vapour of terpentine has been inspired, it takes a violet odour. Its chemical composition is not less variable.

Certain salts carried into the stomach, even in small quantity, are found in a short time in the urine.

Excretion of urine.—As soon as there is a certain quantity of urine in the bladder, there is a desire felt to expel it. By a voluntary effort, the *levator ani*, *abdominal muscles*, and *diaphragm* contract, and, in a few seconds the *bladder* acts and the urine flows, the passage of the urine through the urethra being accelerated by muscles for that purpose.

Organs of Generation in the Male.—The genital organs in man constitute an apparatus of glandular secretion, of which the *testicle* is the gland, the *vesiculæ seminales* the receptacle, and the *vas deferens* and *urethra* the excretory canal.

The fluid secreted by the testicle, is called *semen*. The course of this secretion is very tortuous, as is seen from a reference to the anatomy of the testes. When it has however, reached the extremity of the *vas deferens*, it enters the *vesiculæ seminales*, from which it reaches the *urethra*, where it meets with secretions from the *prostate*, and *Cowper's glands*.

In order that the emission of the semen may take place in the healthy state, the spongy tissue of the penis must be distended in all directions, become rigid, warm, or, in other words, be in a state of *erection*. Different explanations of this state have been proposed, but that which attributes *erection* to compression of the veins is the most probable. Whatever be its nature, it is produced by several very different causes, such as mechanical excitation, venereal desire, fulness of the vesiculæ seminales, the use of certain foods, and medicines, &c.

Organs of generation in the female.—The *ovaria*, the *Fallopian tubes*, the *uteres*, or *matrix*, and the *vagina*, are the essential female organs of generation.

Notwithstanding the numerous labours of anatomists and physiologists, we are far from being well informed, with regard to the changes which take place in the ovarium, after fecundation. There is however, no doubt, but *something* is detached from the ovarium, and passes into the uterus through the Fallopian tube, to form the *embryo* of the future being. We know but little of what takes place in the *embryo*, whose organs appear, at least to us, as rudely delineated. There is however, a kind of circulation recognized. The heart sends blood into the large vessels, and into the rudimentary placenta.

The developement of all the principal organs happens successively, until about the middle of the fourth month, the period at which the state of *embryo* is considered to cease, and that of *fœtus* to begin, the latter being continued till the end of pregnancy.

The peculiarities of circulation, as far as the fœtus itself is concerned, have been described, and those in connexion with the mother will now be mentioned.

Placenta.—This is the most singular, and one of the most important organs, in the circulation of the fœtus. It is very small at first, but soon acquires a very considerable size. It adheres by its exterior surface, to the inside of the uterus, and is irregularly furrowed, or is divided into several lobes. Its fœtal surface is covered by the *chorion*, and *amnion*, except where the umbilical cord enters it, the former being the exterior, and the latter the interior of the two membranes which form the bag, containing the liquid, in which the fœtus floats.

Its *parenchyma*, or substance, is composed of the numerous sanguiferous vessels, divided and subdivided, by which the communication between the mother and fœtus is kept up. There have been various opinions, regarding the precise manner in which this is maintained, some, believing that the uterine arteries, (or those of the mother) anastomosed directly with the radicles of the umbilical vein, while the last division of the umbilical arteries of the fœtus, opened into the veins of the uterus ; and others have been of opinion, that the blood is deposited by the uterine vessels at the surface, or in the tissue of the placenta, and absorbed by the radicles of the umbilical vein.

The umbilical cord, the anatomy of which has been described, extends from near the centre of the placenta, to the umbilicus of the child ; its length being, in general, about *two feet* at birth. The peculiarities also, of the fœtal circulation having being detailed, the following may be noticed as the principal effects produced on the different parts of the system of the child, by the change in the circulation after birth.

When the umbilical cord is tied and divided, and the child thus separated from the mother, great changes take place in the *respiratory*, and *alimentary* organs, which have now to perform the functions devolved upon the placenta, before the division of the cord. The liver, particularly its left lobe, decreases in size almost immediately. This decrease of bulk enables the diaphragm, formerly pushed upwards, to descend, and thus make room for the play of the lungs, which it is, at the same time, now better able to assist in their yet feeble powers of respiration. This collapse of the liver also permits the expansion of the stomach and bowels, now distended with food and air. When the umbilical arteries are obliterated by the ligature, the hypogastric arteries are at the same time obstructed, and thus, the greater part of the blood of the descending oarta is diverted from its foreign course, to be applied to the nourishment of the pelvis and inferior extremities, which were hitherto but very small, in proportion, and but partially supplied with blood.

Among the functions of the uterus, *menstruation* remains to be mentioned. This is a periodical flow of sanguineous matter from the surface of the uterus, and derives its name from its monthly return. This discharge shows itself at different periods, in different climates, being several years earlier in tropical, than in temperate, while, it finally disappears earlier in the former than in the latter. It is usually suspended during pregnancy and lactation.

STRUCTURAL DERANGEMENTS OF THE ORGANS OF URINE AND GENERATION IN THE MALE.

KIDNEY.—The secretion of urine is sometimes wholly, or partially interrupted, constituting the disease called *ischuria renalis*, or *suppression of urine*. The kidneys are sometimes *inflamed*, and *suppuration* is not an uncommon consequence.

Urinary concretions have also worked their way through the substance of the kidney.

Sometimes, when *calculi* have lodged for some time within the ureters, the kidney acquires extraordinary bulk, the papillæ become obliterated, and it is converted into a number of cysts filled with urine or purulent matter.

Dropsy of the kidney occasionally occurs, and the water may be collected either within the *substance* of the kidney, or within its *capsule*.

URETERS.—These are sometimes much distended, from the lodgement of *calculi* in them, and the consequent obstruction of the flow of urine into the bladder. They are often highly *inflamed*, from a similar cause, and at times become much *thickened*.

BLADDER.—The muscular fibres of the bladder become sometimes *paralyzed*, or *spasmodically* affected.

The bladder is also subject to *inflammation*, which is sometimes limited to its neck, and sometimes to its inner coat only, which being a mucous membrane, is subject to all the organic derangements of membranes of that description.

Polypi and *tumours* of various kinds, as well as *gravel* and *urinary calculi*, are also found in the bladder. There are three of the substances entering into the composition of urine, which principally form the *calculi* found in the bladder, viz. *uric* or *lithic acid*, *phosphate of line*, and *phosphate* of *ammonia and magnesia*. There are four kinds of *calculi*, differing from each other in appearance and composition, under which all others may be arranged, namely, the *lithic calculus*, the *mulberry*, the *phosphate of lime*, and the *ammoniaco-magnesian phosphate*. Sometimes, the bladder becomes enormously *distended*, and at other times, it is found much *contracted*.

Fistulous openings, between the bladder and rectum, or through neighbouring parts, also take place.

Urethra.—*Inflammation* of the lining membrane of the urethra is very common, and is frequently followed by *contraction*, or *stricture* of the passage, more especially in the membranous part of it, or two or three inches from the glans.

There are different kinds of stricture, 1. The sides of the urethra approximate each other, for the space of half an inch, or more, the corpus spongiosum being obliterated for this space, and the contractile power of the urethra lost.

2. There is a kind of stricture occasioned by a morbid growth, or ridge, from the sides of the canal, by which its diameter is diminished in a greater or less degree.

3. In those cases where the urine flows through a fistulous opening in the bladder, the urethra generally becomes much contracted.

The urethra, behind a strictured part, becomes much enlarged from the pressure of the urine, which frequently produces *inflammation*, *abscess*, *&c.* often terminating in a fistulous opening through the perinæum.

Scrotum and Testes.—The former is subject to all the diseases of the skin.

The testicle is subject to a great number of organic derangements.

It is sometimes *inflamed*, and much *swollen*, the affection being either confined to the glandular part, or to the epididymis, or involving both, and occasionally terminating in *abscess*. Sometimes the *veins* of the epididymis become *varicose*, and this condition extends to those of the cord.

The testicle, also, acquires a preternatural bulk from *scirrhus*, and sometimes contains *cysts filled with serum*, and in the progress of the former disease, the spermatic cord is often reduced to a similar state.

A *wasting* of the testicle is one of the most common diseases, and often attacks both testes at the same time.

The coats of the testicle, being serous membranes, are subject to all the derangements of membranes of that description, and *dropsy of the testicle*, or *hydrocele*, a collection of fluid between its coast, is one of the most common.

PREPUCE and PENIS.—Sometimes the prepuce is so tight' that it cannot be drawn back. This is called *phymosis*.

When the prepuce has been drawn back, and cannot be brought forward, the disease is called *paraphymosis*.

The glans penis, or the prepuce near it, is the seat of *venereal sores*, and *verrucæ* (warts,) which are of a red colour, of an irregular form, have a spongy fungous appearance, and are often the remains of chancres.

Cancer of the penis sometimes occurs, especially in advanced life.

Gangrene may be also considered as one of the organic derangements of the penis being frequently the effect of veneral sores improperly treated.

PROSTATE GLAND.—This gland is a frequent seat of disease, especially in the aged.

It often attains a large size from *scirrhus*, from *abscesses* within it, from *scrophula*, and from *calculi*.

When thus enlarged, a part of the diseased gland projects into the urethra, altering the direction of that canal, while at other times, there is a projection from each side of the prostate into the bladder, or enlargement, which, by displacing any of the neighbouring parts may, disturb their functions.

STRUCTURAL DERANGEMENTS OF THE ORGANS OF GENERATION IN THE FEMALE.

LABIA.—They are occasionally of *unnatural bulk*, and *œdematous*, and very frequently *inflamed*, in consequence of which they adhere to each other, leaving no passage into the vagina.

They are also subject to attacks of *erysipelas*, which spreads rapidly to ulcers of different descriptions, to *venereal excrescences*, and sometimes they become *scirrhous*.

VAGINA and CLITORIS.—The former has been found much *contracted*, the effect of original *mal-conformation*.

A *passage* may be formed by *ulceration*, between the vagina and urethra, or between the vagina and rectum.

Sometimes the bowels have been *prolapsed*, between the vagina and rectum, forming *perinœal hernia*.

The *clitoris* is subject to the morbid changes of structure resulting from all the varieties of inflammation.

UTERUS.—The uterus is occasionally found either larger or smaller than natural, and has been found *double*.

This viscus is subject to *inflammation*, more especially after child-birth, and is also the seat of *ulceration*.

The disease, however, to which it is most subject, is *scirrhus*. When attacked with this affection, it at times acquires a very large size, and presses upon the rectum and bladder.

Tubercles sometimes grow from the uterus, but more frequently *polypi*, which, when they acquire great bulk, as they occasionally do, produce *prolapsus* of the uterus.

This viscus is also subject to *fungus hæmatodes*, a kind of tumour, having a resemblance to the substance of the brain, and containing cysts filled with bloody serum.

Hydatids are sometimes found in the uterus.

The uterus has sometimes been *ruptured* at the time of delivery. It is occasionally displaced, forming *prolapsus*, and sometimes protrudes beyond the external parts, so as to form what is called *procidentia uteri*.

OVARIUM.—*Dropsy* is the most frequent derangement of the ovarium. The fluid may be contained in one, or in a number of cysts, and the dropsical ovarium, sometimes acquires such a large size as to reach the diaphragm.

The ovaria are also, in common with the uterus, subject to *scirrhus*.

FALLOPIAN TUBES.—These have been sometimes obstructed, in consequence of previous inflammation, and when obstruction has taken place at both ends, they have been found filled with serum.

PART VIII.

THE ORGANS OF THE SENSES.

These are the *organs* through whose functions a knowledge of the impressions made upon the body, by external objects, is communicated to the *understanding*.

The number of them is five, viz. *seeing*, *hearing*, *smell*, *taste*, and *touch*; and they receive the appellation of *external senses*, as distinguished from *memory*, *imagination*, &c. which, not necessarily depending upon external impressions, are named *internal senses* by physiologists.

SECTION I.

THE ORGAN OF VISION.

The apparatus of vision is composed of the *eye*, and the *optic nerve*, and is situated within the orbit, which is formed by bones that have been already described.

The description of the eye is usually divided into that of the *globe*, and its *appendages*. The latter however, will be first described.

THE APPENDAGES OF THE EYE.

The Eye-brows, or Supercilia, are slight eminences of the common integuments, somewhat arched in figure, placed on the superciliary ridges, and covered with short hairs.

The Eye-lids, or Palpebræ, consist of an upper and under, the former being the larger, and are composed of the common integument remarkably thin, and a portion of the orbicularis palpebrarum muscle. They are joined, and form angles at their extremities, distinguished by the names of *outer* and *inner canthi*. In each of them, there is found a thin fibrous layer, approaching to cartilage, called the *tarsus*, the upper tarsus being broader than the lower, and both being broader in the middle than at the extremities.

The tarsus of the upper eyelid is supported in its situation by a *ligamentous production*, which is formed from the pericranium, and is attached to its orbital edge, while, that of the lower is supported by a similar production, from the periosteum of the superior maxillary and malar bones, and attached to its orbital margin. The two tarsi, also, have a ligament, called *ligamentum palpebrale*, common to them, of a round shape, extending from their inner extremities, to the nasal process of the superior maxillary bone.

At the edges of the eye-lids, are placed several rows of stiff hairs, called the *cilia*, or *eye-lashes*, those of the upper eye-lid being bent upwards, and those of the other in an opposite direction. Immediately within the eye-lashes, are a row of sebaceous follicles, called the *ciliary glands*, *glandulæ tarsi*, or *Meibomii*. When examined with a magnifying glass, they appear like a congeries of very minute roundish shaped glands, each of which pours out an unctuous fluid into its excretory duct, called *punctum ciliare*.

The Lachrymal Gland.—This is a conglomerate gland of a yellow colour. It is about the size of a small almond, and situated in the hollow of the orbitar process of the os frontis, at the anterior and outer part of the orbit. It has several small excretory ducts, which terminate on the *conjunctiva*.

Caruncula Lachrymalis.—This is a small gland, situated at the inner angle of the eye, between the eye-lids. It is of a conical shape, and of a red colour, and, when examined through a microscope, it is found to be a congeries of glandular bodies, like the cilary glands.

Puncta Lachrymalia.—These are two minute orifices, one in the *upper*, and another in the *under eye-lid*, situated on the inner extremity of the tarsus, near the caruncula lachrymalis. They are the orifices of two canals, which run in the direction of the edges of the eye-lids towards the nose, and terminate in the *lachrymal sac*.

Lachrymal Sac, and Duct.—The *lachrymal sac* is the cavity into which the tears are received. It is situated in the lachrymal fossa, formed by the nasal process of the superior maxillary bone and os unguis, and is separated only by a thin partition from the nose. It is of an oval form, with a blind extremity above, and continued into the lachrymal *duct*, or *ductus ad nasum*, which leads to the nose, and is nearly an inch long. Its direction is obliquely downwards, and it is lined by mucous membrane.

THE GLOBE OF THE EYE.

The globe is nearly spherical, except where broken by the prominence of the *cornea*. It appears to rest on a cushion of fat and cellular membrane, which fills up the orbit, and thus causes the projection of the eye. It is composed of *tunics*, or *coats*, and *humours*, together with *vessels* and *nerves*.

COATS OF THE EYE.

The *coats* are the *tunica conjunctiva*, or *adnata*, the *sclerotica*, the *choroides*, and the *retina*. The three last are considered as the *proper coats* of the eye, while the first, and also, the *cornea* and *iris* are described as *accessory*.

Tunica Conjunctiva.—This is the thin, semi-pellucid mucous membrane, which lines, and as its name implies, connects the eyelids to the globe of the eye, the anterior part of which it also covers. It may be said to commence at the margin of the upper eyelid, and to line it internally, after which, it is reflected on the globe, covers its anterior surface, and passes to line the under eyelid, covering the ciliary glands, and terminating upon its edge.

In quitting the globe of the eye at the inner canthus, to cover the *caruncula lachrymalis*, it forms a fold, called the *valvula*, or *plica semilunaris*. That part of the membrane which invests the eyelids is called *tunica conjunctiva palpebrarum*, while that which belongs to the eye is called *tunica conjunctiva oculi*, and is subdivided into *conjunctiva scleroticæ*, and *conjunctiva corneæ*.

Some anatomists consider, that this coat terminates around the margin of the cornea ; but, the easy separation of it by putrefaction, from the whole anterior surface of the eye, and other proofs, show the inaccuracy of the opinion. The conjunctiva of the cornea, is thinner than that of the sclerotic coat.

TUNICA SCLEROTICA.—This is the strongest coat of the ball of the eye. It is *dense* and *thick*, not divisible into layers, but composed of a number of fibres interlaced together, and crossing each other in all directions. It is the thickest posteriorly, strengthened anteriorly by the tendons of the muscles of the eye, and pierced for the transmission of vessels and nerves.

Posteriorly also, it has an opening, through which the *optic nerve* passes. This opening is not in the direction of the axis, but on its inner side. On the forepart of the eye, the sclerotic leaves a space for the *cornea*.

CORNEA.—This anterior transparent tunic occupies about a *fifth* of the globe, is circular, and projects from the surface of the sclerotic, with the oblique edge of which, its circumference is intimately connected. It is *hard, dense*, and *transparent*, but thinner than the sclerotic, and may be separated into a number of layers.

TUNICA CHOROIDES.—This coat is immediately below the sclerotic; it begins at the entrance of the optic nerve into the eye, and after lining the internal surface of the former, terminates at the *ciliary ligament*, to be afterwards described.

The internal surface of the choroid coat is lined by a deep brown or black colouring matter, called *pigmentum nigrum*. which is in greater abundance on the anterior, than on the back part. and is secreted by the inner surface, which from its fleecy appearance, has been called *tapetum*, or *carpet*. When this coat is macerated, and the black substance removed, it becomes semi-transparent, and appears to be made up of a congeries of bloodvessels, connected by cellular substance; hence, the name sometimes given to this coat of *tunica vasculosa oculi*, or *vascular coat of the eye*.

The *choroid coat* has been described by some anatomists, as consisting of two laminæ, the *outer*, or *proper choroid*, being that next to the sclerotic, while, the *internal layer* is that alreedy noticed as the tapetum, and sometimes called *tunica Ruyschiana*.

On tracing the inner surface of the choroid coat, from the optic nerve onwards, towards the *chrystalline lens*, we observe, at some distance, before arriving at the *iris*, numerous *loose folds*, disposed like *rays*, converging towards the *lens*, and constituting what has been called the *corpus ciliare*, or *ciliary body*, or *zone*. These folds are closely applied to the vitreous *humour*, and the *canal of Petit*; and their small points, which are continued from the *corpus ciliare*, inwards and slightly backwards over the edge of the lens, and float in the posterior chamber, are called the *processus ciliares* or *ciliary processes*.

Ciliary Ligament.—By this name is understood; the circle of union of the *sclerotic* and *choroid coats*, and the *iris*. This is observed to take place, not exactly at the edge of the transparent cornea, but at about the twelfth part of an inch, or *a line* behind the part where the cornea is joined to the sclerotic. It appears to consist of a quantity of condensed cellular substance, at the junction of the anterior margin of the ciliary folds, with the iris and sclerotic coat.

Iris.—This is the membrane seen through the cornea, and on which the apparent colour of the eye depends. The greater circumference of it, is attached to the *ciliary ligament*, and it forms a septum in the anterior part of the eye, dividing it into *two chambers*. It is perforated in the centre, forming the *pupil*, or that part through which the rays of light are transmitted to the interior of the globe.

Upon its posterior surface, is a dark coloured pigment called *uvea*, upon which its colour is said to depend, as it becomes perfectly colourless, and appears to be composed of *circular* and *radiated* fibres, on the removal the *uvea*, by washing.

Retina.—This is the delicate medullary expanse of the *optic nerve*, which lines the choroid coat, being situated between it and the vitreous humour.

At the back part of the ball of the eye, and a little removed from the axis towards the nose the fasciculi of the *optic nerve* pass through the *sclerotic* and *choroid coats*. The nerve contracts at its passage through them, and afterwards expands to form the *retina*.

The retina appears to terminate on arriving at the *corpus ciliare*, but a thin layer is continued under the *ciliary processes*. The texture of the retina, resembles medullary substance; it is tender, pulpy, and semi-transparent. About one sixth of an inch outwards from the entrance of the optic nerve, directly in the axis of the eye, a central dark mark with a yellow border, has been discovered, and is known as the *yellow spot of Soëmmering*, from the name of the discoverer.

THE HUMOURS OF THE EYE.

These are three in number, the *aqueous*, the *chrystalline*, and the *vitreous*.

AQUEOUS HUMOUR.—It is situated between the *cornea* and *chrystalline lens*. This space is divided into *two chambers*, the *anterior*, and by much, the larger, being between the *cornea* and *iris*; and the *posterior*, between the *iris* and *chrystalline lens*.

The *aqueous humour* is perfectly pellucid, and possesses powerful solvent qualities; it does not amount to more than four or five drops, and circulates freely from one chamber to the other, through the *pupil*.

CHRYSTALLINE HUMOUR OR LENS.—This is a transparent body, with two convex surfaces, the anterior of which is less convex than the posterior, being formed of segments of spheres of unequal size.

It is situated opposite to the pupil, behind the posterior chamber of the aqueous humour, and its posterior part is received into a depression, on the forepart of the vitreous humour. The external part of the lens is soft and gelatinous, but it becomes denser and firmer towards the centre, which is of the consistence of softened wax, and found to be composed of concentric lamellæ.

The lens is surrounded by a perfectly transparent membrane or film, called its *capsule*. It is very firm, tough, and elastic, especially on its anterior portion, and its posterior portion adheres firmly to the membrane surrounding the vitreous humour, to be described. The minute quantity of fluid found between the capsule and the lens, has been called the *liquor Morgagni*.

VITREOUS HUMOUR.—This is the largest in quantity of the humours, filling the posterior part of the globe, and occupying more than *three-fourths* of the eye. It consists of clear fluid, thicker than the aqueous humour, contained in transparent cellular structure, and enveloped by an equally transparent covering, called *membrana vitrea* or *hyaloidea;* so that it may be removed in a mass from the globe of the eye, provided the membrane be preserved entire, as the humour exudes only on its being broken.

On the *anterior aspect* of the vitreous humour, there is the concavity, which has been mentioned as receiving the posterior surface of the *chrystalline lens*, and to this part, the *tunica chrystalloidea* is said to be attached. Some authors, however, describe the *tunic* of the vitreous humour, or *hyaloid membrane*, as dividing into two laminæ at the edge of the *lens*, one giving an *anterior* and another a *posterior* covering and forming, by their separation, a canal round the lens, called the *canal of Petit*, while others describe this canal as being formed between the proper covering of the lens, and the hyaloid membrane.

VESSELS AND NERVES OF THE EYE.

ARTERIES.—The eye, with its appendages, is almost exclusively supplied with blood by the *ophthalmic artery*, a branch of the *internal carotid*, which enters the orbit with the optic nerve, at the foramen opticum, runs tortuously around the former, and afterwards towards the inner wall of the orbit, where it emerges between the cartilaginous pulley of the superior oblique muscle, and the ligamentum palpebrale, and inosculates with the facial and infra-orbitar arteries. In this course, the ophthalmic artery gives off the following branches:

1 *The lachrymal*, one of the first and largest, proceeding along the abductor muscle to the *lachrymal gland*:

2 *The central artery of the retina*, a small branch, which pierces the *optic nerve*, running in its centre, to the interior surface of the retina, where it divides into a number of minute twigs:

3. *The supra-orbital*, or *frontal branch*, comes from the ophthalmic artery within the orbit, and at once ascends with the frontal nerve to the *superciliary foramen*, and distributes itself to the forehead.

4. The *ciliary arteries*, are small, numerous, and irregular in number, varying from six to twelve. They encircle the optic nerve in a spiral manner, separating from, and inosculating with, each other; while, one or two of them, on each side, run onwards between the *sclerotic* and *choroid coats*, to the *ciliary zone*, which they supply. They afterwards pierce the *ciliary ligament*, subdivide and form a *plexus*, from which the *iris* is supplied with blood. These long branches, which run between the coats mentioned, and parallel to the axis of the eye, are called the *long ciliary arteries*.

5. *The ethmoidal branch* enters the nares at the *foramen orbitarium internum posterius*, to be distributed to the mucous membrane of the *ethmoid cells*.

6. *The nasal branch* is the continuation of the ophthalmic to the nose, along which it descends, to inosculate with the facial artery.

These are the chief and more important branches. There are others enumerated, but their origin and distribution are irregular.

VEINS.—The blood which is circulated by the ophthalmic artery and its branches, is returned to the cranium, by the *ophthalmic vein*, the branches of which nearly correspond with those of the artery.

The *frontal vein* returns the blood of the *frontal*, *nasal*, and *supra-orbital branches*, to the *ophthalmic vein*, which is found at the inner angle of the eye, along with the ophthalmic artery, and which, running backwards, passes through the foramen lacerum, to join the *cavernous sinus*. In this course it receives the *ethmoidal*, *lachrymal*, and *ciliary veins*, and the *vena centralis retinæ*.

NERVES.—The nerves, which supply the eye and its appendages, are the 2d, or *optic*, the 3d pair, or *motores oculorum*, the 4th, or *pathetici*, the 1st part of the 5th pair, or *trigemini*, and the 6th, or *abducentes*. These generally adhere to the covering of the dura mater, within the orbit, so that it is tedious and difficult to separate them.

The optic nerve having entered the orbit, as already described, advances, surrounded by the *recti muscles*, and enveloped in a strong sheath of the dura mater and pia mater, to enter the eyeball, a little towards its nasal side, in order to form the *retina*, already described.

The third pair, or *motores oculorum*, having passed through the foramina lacera superiora, divide on either side into two principal branches, a *superior* and an *inferior*, the former dividing into twigs, for supplying the muscles of the *upper* part of the eye, and eye-lid, while, the latter sends its filaments to the adductor, and muscles of the *inferior* parts of the eye, giving a twig, which, with a branch from the first part of the 5th pair, forms the *lenticular ganglion*. This is a small reddish ganglion, resting on the *temporal side* of the *optic nerve*, and from which the *ciliary nerves* proceed.

The fourth pair, or *pathetici*, run from their origin to the *cavernous sinus*, which they enter inclosed in a fold of the dura mater, and, having passed through the foramen lacerum on each side, are chiefly distributed to the *superior oblique muscle*.

The first part of the 5th pair, having passed through the hole common to it and the others, usually gives off three twigs, within the orbit, the *nasal*, *frontal*, and *lachrymal*.

The *nasal* branch enters the *foramen orbitale internum anterius*, and having run along the cribriform plate of the ethmoid bone, descends along the cartilagnious septum of the nose.

The *frontal* branch, the largest of the three, after uniting some of its twigs with those of the other nerves within the orbit, and giving filaments to the cartilaginous pulley of the oblique muscle, &c. proceeds out of the orbit at the *superciliary foramen*, to be distributed to the muscles of the forehead.

The *lachrymal* branch is chiefly for the lachrymal *gland*.

The *sixth pair* takes the same course into the orbit with the other nerves, and is supplied to the *abductor muscle* only, from which it derives the name of *abducens*. While passing through the cavernous sinus, filaments are given off for the formation of *the sympathetic nerve*.

MUSCLES OF THE EYE.

These are noticed in this place, as they, strictly speaking, form part of the appendages of the eye. The muscles within the orbit are, *one* belonging to the *upper eyelid*, and *six* belonging to the *globe of the eye*, *two* of which are called *oblique*, and the other *four*, *straight* or *recti* muscles.

The *Levator palpebræ superioris*, the muscle of the upper eyelid, the *Levator oculi*, and *Depressor oculi*, two of the straight muscles of the eye, *arise* from the *margin* of the *foramen opticum*; the two former at its upper, and the latter at its lower edge. The *first* is *inserted* into the whole edge of the upper eyelid, which it raises, the *second*, into the superior part of the sclerotic coat, and the *third*, opposite to its antagonist. The two last muscles, as their names imply, elevate and depress the globe of the eye.

The *Adductor* and *Abductor oculi*, the other two straight muscles, *arise* on *either side* of the *foramen opticum*, between the two last mentioned muscles, and are *inserted* in the same way. They are antagonist, and roll the eye inwards and outwards.

The *Obliquus superior arises* between the *Levator* and *Adductor* muscles, passes tendinous through a cartilaginous ring, or *pulley*, (hence sometimes called *Trochlearis*) fixed behind the internal angular process of the os frontis, and is *inserted*, somewhat posteriorly, in the upper part of the globe, beneath the *Levator* muscle. Its action is to direct the eye downwards and outwards.

The *Obliquus inferior arises* from the orbitar process of the superior maxillary bone, near the os unguis, passes beneath the globe to the outer and upper part and is *inserted* opposite to the former muscle. It directs the eye upwards and completes the extensive motions of the globe.

The tendons of these muscles are seen through the external coat of the eye, so as to give a brilliant appearance to that part, which, in common language, is called the *white of the eye*.

PHYSIOLOGY OF THE EYE.

Vision is the function which enables us to perceive the *size*, *figure*, *colour*, *distance*, &c. of bodies; and the organs which compose the apparatus are acted upon by a particular *excitant*, or *stimulus*, denominated *light*.

The apparatus of vision is composed of three distinct parts; the first includes the *humours*, and *cornea*, by which the light is modified by having its rays *refracted*; the second is the *retina*, which receives the impression; and the third is the *optic nerve*, which conveys it to the brain.

As the space through which the rays of light have to pass to the bottom of the eye, where their impression must be made, is very limited, it is evident, that they must be very much concentrated, so as to form a very lively, although small image of the object on the *retina*.

As a *lens*, (a double convex glass) therefore, is necessary to concentrate the rays of the light proceeding from an object, so, in the same manner, an essential part of the eye is the lens, which concentrates, or brings the rays of light to a *focus*. In order, however, that the lens may be enabled to form an accurate focus, the *vitreous humour* is interposed between it and the retina, with its diameter in the axis of the eye, suited to the focal distance of the lens, and having the effect of so assisting the convergence of the rays of light, as that the image of an object is accurately formed on the surface of the proper organ of vision, at the bottom of the eye.

In order to increase the sphere of vision, it is necessary that the anterior part of the eye should project. This is provided for, by the introduction, as if it were, of a large segment of a small circle, distended by the aqueous humour, and forming that part which has been described as the *cornea*.

For the purpose of regulating the quantity of light, in either protecting the organ from the effects of too great brilliancy, or in collecting a sufficient number of rays in a converse condition, there is a curtain with a central opening supplied. This has been described as the *iris*, and the opening is the *pupil* of the eye.

The apparatus of vision being of an extremely delicate texture, and consequently capable of being deranged by the slightest accident, nature has provided means for its protection.

These are the *eyebrows*, the *eyelids*, and the *secreting* and *excreting* apparatus of tears.

The *eyebrows*, by their projection, protect the eye against external violence, while the hairs, by the oblique direction in which they are placed, and the oily matter with which they are covered, prevent the perspiration of the forehead from flowing towards, and irritating the surface of the eye. They also, protect the eyes from too much light, especially when coming from above, as may be observed by knitting the bows.

The *eyelids* cover the eye during sleep, and, with the eyelashes, preserve it from the contact of extraneous particles that might injure it, while at the same time, they moderate the force of too brilliant a light, and by their partial opening or shutting, regulate the proportion of this fluid, so as to fit it for vision, without offending the organ.

The liquid secreted by the *Meibomian glands*, serves to facilitate the continual friction of the eyelids upon the globe of the eye.

The protection of the eye, however, does not depend entirely upon the parts mentioned, there being another part of its mechanism, for the *secretion of tears*.

This is composed of the *lachrymal gland*, the *excretory ducts*, the *caruncula lachrymalis*, the *lachrymal canals*, and the *nasal duct*.

STRUCTURAL DERANGEMENTS OF THE EYE-BALL AND ITS APPENDAGES.

The globe of the eye has been seen to be made up of parts of different structures. It is therefore, subject to a great variety of morbid changes.

It may be almost said, that each structure of the eye is subject to some peculiar derangement, while, the eyelids and lachrymal passages are liable to all the diseases of mucous membranes.

Diseases also, primarily limited to one part of the eye, are frequently communicated to adjacent parts.

Diseases of the Cornea.—The *cornea*, being covered by the tunica conjunctiva, is subject to inflammation, which sometimes appears as a spot or speck, and of which there are different descriptions.

The word *pterygium* has been employed to indicate a red coloured membrane, of a triangular shape, which generally grows from the internal angle of the eye, over the margin of the cornea, and sometimes looks like a small fleshy tumour.

In consequence of inflammation, there is sometimes a dense lymph effused, between the layers of the cornea, forming different degrees of opacity, known by the names of *albugo, leucoma*, or *nebula*.

Sometimes the cornea assumes a conical shape, becomes opaque, of a pearly colour, and projects beyond the eyelids. This is called *staphyloma*.

Pustules appear on the cornea, and, on breaking, frequently form small *ulcers*, a condition usually attended with inflammation.

The cornea is also subject to *fleshy excrescences*, which occasionally become *fungous* ; and sometimes, in old age, its transparent edge becomes of a whitish colour, and opaque, an appearance called *arcus senilis*.

Inflammation of the Eyeball.—The globe of the eye is very subject to attacks of inflammation, or *ophthalmia*, the disease being often limited to the internal parts, or chiefly to the retina.

When the *inflammation* is external, vessels filled with red blood are seen ramifying over the whole of its suface, and blood is sometimes effused between the *conjunctiva*, and *sclerotica*.

The kind of inflammation attended with a copious discharge of yellowish, or greenish matter, is called *purulent ophthalmia*.

Disease of the Aqueous humour.—In consequence of inflammation, or external violence, a yellowish glutinous fluid is occasionally effused into the aqueous humour of the eye, or the humour itself may become of this character, forming the disease called *hypopium*.

Disease of the Chrystalline lens.—The lens becomes opaque, and the disease is called *chrystalline*, or *lenticular cataract*.

When the capsule *only* becomes opaque, the disease is called *membranous*, or *capsular cataract*.

Contaracts are of various colours, and differ in consistence from complete *fluidity*, to *hardness*.

When a child is born with this affection, the disease is called *congenital cataract.*

Dropsy of the Eye —Sometimes the humours of the eye are secreted in an unnatural quantity, by which the eye-ball attains an unusual size, projecting forward, and preventing the eyelids from shutting. This is called dropsy of the eye, and is attended with more or less inflammation, consequent upon the irritation kept up by dust, from which the eyelids can no longer protect it.

Disease of the Iris.—The iris is frequently *inflamed,* losing its healthy colour, becoming thickened, and adherent to the lens, so that the pupil is all times entirely closed ; or, it has lymph effused upon its surface, so as to obstruct the free passage of light to the bottom of the eye.

Amaurosis —This arises from *palsy,* or loss of sensibility of the *optic nerve,* and is frequently unattended with any evident change of the structure of the eye.

Cancer of the Eyeball.—By this organic disease, the globe of the eye is much enlarged ; it assumes an irregular figure, and the organization of the part is so much changed, as to resemble a mass of *indurated flesh.* When the disease has made some progress, fungous excrescences shoot out from the anterior surface of the eye, and degenerate into *malignant ulcers.*

Fungous hœmatodes of the Eyeball.—In this disease, which is of an equally malignant nature as the former, the globe is filled by a soft substance resembling brain. The sclerotic coat becomes of a leaden colour, the cornea ulcerates, and fungous bleeding excrescenes, of a dark purple colour, protrude from the cornea.

STRUCTURAL DERANGEMENTS OF THE APPENDAGES OF THE EYE.

Diseases of the eyelids.—The eyelids are a frequent seat of *inflammation,* which often extends to the cheeks. Different kinds of *tumours* form upon the eyelids. Of these, the little tumour known by the name of the *hordeolum,* or *stye,* is most frequent.

The eyelids are sometimes turned *outwards,* or *inwards* upon the eyeball. The former is most frequent in the under eyelid, which is turned outward upon the cheek, the disease being called *ectropium*, or *eversion*. When the eyelashes are turned inwards upon the eye, the disease is called *entropium*, or *inversion*.

Disease of the Caruncula lachrymalis.—The caruncula lachrymalis becomes, in some cases, much enlarged, and exhibits a fungous appearance. It sometimes suppurates, and at other times, it remains in an indolent state for years. The disease is called *encanthis*.

Fistula lachrymalis.—This disease is situated in the *lachrymal sac* and *duct*. When there is any obstruction to the flow of tears into the nose, the lachrymal sac becomes distended, and forms a sensible tumour at the internal angle of the eye.

On pressing this tumour, a viscid yellow fluid is discharged through the *puncta lachrymalia*.

The lachrymal sac sometimes ulcerates, and its contents are discharged externally. This is also frequently attended with caries of the os unguis.

SECTION II.

THE ORGAN OF HEARING.

The organ of hearing is divided into the *external, middle*, and *internal ear.*

THE EXTERNAL EAR.

This comprehends the external appendage, or *auricle*, and the *meatus externus.*

AURICLE.—This has an irregular figure, and is distinguished into the *pinna*, and *lobus.*

The *pinna* is the whole superior part, and its surface has been divided into *depressions*, and *eminences*, which have received particular names. The latter are, 1 the *helix*, a nearly semicircular eminence, which divides the concha, beginning at the lobe, and terminating nearly opposite its origin ; 2 the *anti-helix*, which surrounds the concha, beginning by two eminences which coalesce ; 3 the *tragus*, a small eminence connected to the under part of the helix, and lying over the meatus ; and 4 the *anti tragus*, opposite to, and less than the former, and below the inferior extremity of the anti-helix.

The depressions or cavities are, 1 the *fossa innominata*, between the helix and anti-helix ; 2 the *scapha*, or *fossa navicularis*, between the divergent extremities of the anti-helix, and 3 the *concha*, or larger cavity, divided into two parts by the helix, the upper and smaller being continued behind the helix, with the fossa innominata, and the lower and larger leading to the meatus.

The back of the *pinna* is irregularly convex, and connected to the temporal bone by the common integuments, and by its muscles. It is formed of a cartilage, which is attached to the auditory process.

MEATUS EXTERNUS.—This has been already referred to in the description of the temporal bone. It extends from the edge of the concha to the membrane of the tympanum, and is about an inch in length, the canal being lined with common integuments, upon which the mouths of sebaceous glands open, and also the mouths of the ducts of the *glandulæ ceruminosæ*, which secrete the wax.

THE MIDDLE EAR.

It comprehends the *tympanum*, the *little bones* contained in this cavity, the *mastoid cells*, and the *Eustachian tube*, &c.

MEMBRANA TYMPANI.—This membrane, sometimes called the *drum of the ear*, is composed of thin layers, separates the tympanum from the meatus, and is tense, and slightly concave towards the latter.

TYMPANUM.—This is a cavity of an irregular form, situated within the petrous portion of the temporal bone, at the extremity of the meatus, and above the glenoid cavity. To its inner side, is placed the labyrinth, from which it is separated by an osseous septum, in which there are several eminences and two remarkable openings, called the *fenestra ovalis*, and *fenstra rotunda*. Below the tympanum is the *glenoid fissure*, through which the *chorda tympani* passes.

At the upper part of the tympanum, is an open short canal directed obliquely downwards and backwurds, leading to the cells of the mastoid process called *mastoid cells*.

Anteriorly the tympanum communicates with the *Eustachian tube*, or *iter a palato ad aurem*.

BONES OF THE TYMPANUM.—The tympanum contains *four* small bones, which extend across from the membrane of the tympanum to the labyrinth ; these are, the *malleus*, *incus*, *stapes*, and *orbiculare*, the three former named from their supposed resemblance to a *hammer*, an *anvil*, and a *stirrup*, and the last, from its spherical shape. They are articulated with each other by means of capsular ligaments, proportioned to their size, and they have also small muscels belonging to them, *two* to the *malleus*, and *one* to the *stapes*.

MASTOID CELLS.—These have just been mentioned, as being contained in the mastoid process. They vary very much in different crania, being in some large and few in number, while in others they are small, and numerous

They are lined with a mucous membrane, common to the cavity of the tympanum and Eustachian tube.

Eustachian tube.—It extends from the cavity of the tympanum, to the posterior aperture of the nares. In this course, it is attached to the under surface of the petrous portion of the temporal bone, the part appearing in the dry skull, more like an accidental fissure than a regular passage. The tube begins small in the tympanum, but gradually swells in diameter, and is lined throughout, with a mucous membrane.

THE INTERNAL EAR, OR LABYRINTH.

It is composed of the *vestibule*, the *coehlea*, and the *three semicircular canals*.

The Vestibule has, to its *outer* side, the tympanum, to its *inner*, the meatus internus ; *anteriorly*, the cochlea ; and *posteriorly*, the semicircular canals. Its shape is irregularly spherical, and its size about that of a *millet seed*. It is common to the openings of the neighbouring parts.

Cochlea.—It is so named from its resembling the shell of a snail, and lies more forward than the vestibule ; it has the *base* of its canal towards the meatus internus, and its *apex* outwards. It has a central pillar called *modiolus*, round which the canal has a spiral course, and is divided into two parts by a thin plate, placed edge ways. These side parts are called the *gyri* of the cochlea.

Semicircular canals.—They are three in number, corresponding below and behind to the mastoid cells, and named from their posiitions, *vertical, oblique*, and *horizontal*, each enlarging as it enters the vestibule.

The whole of the cavities of the internal ear are hollowed out of the hardest part of the petrous portion of the temporal bone. They are lined with an extremely fine membrane, and are full of a very thin and limpid fluid, called *liquor of the labyrinth*, or, *liquor Cotunnii*, which can flow out of two narrow apertures called the aqueducts, of the cochlea and vestibule.

There are several other minute parts described in the anatomy of the internal ear, but a knowledge of the above is sufficient for all practical purposes.

VESSELS AND NERVES OF THE ORGAN OF HEARING.

Vessels.—The temporal bone is pierced in different directions by minute vessels, for the transmission of blood to and from the internal ear; the branches of arteries are chiefly derived from the *internal carotid*, in its passage through the carotid canal; and corresponding veins empty their blood into the *lateral sinus*.

Nerves.—These are the *7th pair of cerebral nerves*, and a twig from the reflected branch of the *2d division* of the *5th pair*. The former enters the *foramen auditivum internum*, and the *portio molis*, the part which supplies the internal ear, passes immediately to the *cochlea*, *vestibule*, &c. upon which it is expended, in the same way as the retina is produced from the 2d pair of nerves, while, the *portio dura* enters a small canal in the osseous septum, between the tympanum and labyrinth, and emerges at the *foramen stylo-mastoideum*, to form the *facial* nerve.

The branch of the 5th pair, joins the portio dura, through the foramen innominatum at the upper part of the canal, and before the emergence of the latter, a twig is given off, which enters the cavity of the tympanum (hence called *chorda tympani*) passes across to the glenoid fissure, and from thence proceeds to join the lingual branch of the 5th pair.

MUSCLES OF THE INTERNAL EAR.

These are very small, and situated within the temporal bone itself.

Laxator Tympani.—*Origin*.—By a small beginning, from the spinous process of the sphenoid bone, and side of the Eustachian tube. It runs backwards, and a little upwards, along with the nerve called chorda tympani, in a fissure of the glenoid, or articular cavity of the os temporis.

Insertion.—Into the *long process* of the *malleus*.

Use.—To draw the malleus obliquely forwards towards its origin, and consequently the membrana tympani, by which that membrane is made less concave, or is relaxed.

Tensor Tympani.—*Origin*.—By a small fleshy 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, and runs along the bony half-canal of the tympanum, where it is invested by a membranous vagina.

Insertion.—Into the *neck of the malleus*, above the small process, advancing likewise as far as the handle.

Use.—To pull the malleus, and membrana tympani, towards the part petrosa, by which that membrane is made more concave and tense.

Stapedius.—This is a short and thick muscle. It *arises* from, and lies concealed within, the small bony pyramid at the bottom of the tympanum; the cavity it fills, is near the bony canal of the portio dura of the auditory nerve. It terminates in a small tendon, which goes out of the cavity, through the small hole in the opex of the pyramid, and runs forwards.

Insertion.—Into the *neck* of the *stapes*, on the sides of the longest and most crooked leg of that bone.

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

PHYSIOLOGY OF THE EAR.

The *auricle* collects the sounds, or sonorous radiations, and directs them towards the external meatus; sound being transmitted by the air, attended with sensible virbration, and, like water, being capable of being reflected. Sound is deadened by passing from one medium to another, and is lost altogether, when there is none present, fit for its transmission.

The essential part of the organ of hearing, as has been seen, consists of a series of cavities.

The *Meatus auditorius* having received the sound transmits it, partly by the air it contains, and partly by its parietes, until it arrives at the tympanum, the hairs, and cerumen, or wax, with which it is provided at its entrance, being to prevent the introduction of dust, insects, &c.

Membrane of the tympanum.—This membrane, which separates the canal just mentioned from the tympanum, being tense, thin, and elastic, readily vibrates under the influence of the sonorous undulations, transmitted to it by the meatus.

From the manner in which the muscles of the malleus are inserted into that small bone, as well as from the insertion of the malleus itself into the membrane, it has been inferred, that the membrane has its degrees of tension regulated, becoming relaxed, for weaker or more agreeable sounds, and stretched, for those that are more intense. Hence, it is liable to be ruptured by the violent vibration or percussion caused by the firing of cannon.

Tympanum.—The uses of the tympanum are to transmit sounds from the external, to the internal ear. This appears to be done through the chain of small bones, which are so united together, that the malleus touches the membrane of the tympanum, and the stapes, the fenestra ovalis.

Eustachian tube.—This tube is for the purpose of renewing the air in the tympanum; and its destruction has the effect of producing deafness.

Mastoid cells.—The uses of these are not so well known. Is is supposed that they help to augment the intensity of the sound, that arises in the cavity.

Internal Ear.—We know but little of the functions of the internal ear. It would, however, appear that the sonorous vibrations are propagated in different modes, but principally, by the membrane of the fenestra ovalis, by that of the fenestra rotunda, and by the internal partition of the tympanum.

The internal gyri of the cochlea receive the vibrations principally by the fenestra ovalis, the vestibule, by the chain of bones, and the semicircular canals, by the sides of the tympanum, and perhaps by the mastoid cells, which frequently extend beyond the canals.

OF HEARING.

The sonorous vibrations transmitted in the manner mentioned, and impressed upon, or received by, the *acoustic nerve*, or nerve of hearing, are communicated by it to the brain, which perceives them with more or less facility, and exactness, in diffesent individuals. Those persons are said to have a false ear, who do not distinguish sounds accurately.

The ear can perceive a great number of sounds at once;

thus, agreeable sounds of various degrees of intensity, combined and succeeding each other in a particular manner, are a source of pleasant sensstions; and it is in such combinations, for the production of this effect, that music is employed.

OF THE STRUCTURAL DERANGEMENTS OF THE EAR.

The *external ear* is, from its situation, much exposed to external injury. When divided however, it readily unites.

It is sometimes much *swelled*, in consequence of *erysipelas* and various *cutaneous affections*, more especially during infancy; while, insects and other extraneous bodies sometimes enter and stick in it.

The accumulation and *hardening of the wax* also, occasionally produce *dullness of hearing*, from being interposed between the radiations of sound, and the tympanum.

Sometimes also, the *membrane of the tympanum* becomes *inflamed*, and is occasionally *ruptured* by the intensity of sound.

Dulness of hearing may be caused by *obstruction* of the *Eustachian tube*, not an unusual consequence of venereal, or other ulcers of the throat.

Deafness is also said to be caused by *palsy* of the *portio mollis*, without any visible lesion of the nerve.

SECTION III.

THE ORGAN OF SMELL.

The nose consists of an *external* and prominent part, and an *internal* part formed of two cavities.

EXTERNAL PART OF THE NOSE.

The external part is divided into the *radix, root*, or *upper part*, the *dorsum*, or *middle prominence*, the *apex*, or *point*, the *alæ*, or *lateral moveable parts*, and the *columna*, or under part of the partition next to the upper lip, which separates the two openings called nostrils, leading to the internal cavities.

It is composed superiorly of *bone*, inferiorly of *cartilage*, and is lined by *mucous membrane*.

The *cartilages* are *one* large single one, which assists in forming the *septum* of the nose, and *four* smaller ones, situated at the sides. The cartilage of the *septum* is in the middle, and of a somewhat triangular figure; its base or superior edge being joined to the anterior edge of the nasal lamella of the *ethmoid bone*, while its anterior edge forms a part of the *dorsum* of the nose, and its inferior edge is attached to the *vomer*. It is thick above, but becomes gradually thinner as it descends.

The *lateral* cartilages extend on either side from the former, are placed obliquely at the sides of the nose, and connected to the edges of the *nasal bones*, and to the cartilages of the *alæ*. They are triangular, and externally somewhat convex.

The *cartilages* of the *alæ* are two in number. Their shape is irregular, but forms the greater part of an oval, being composed of two branches united in front.

INTERNAL PART OF THE NOSE.

This comprehends the *nares*, or *internal cavities*. They are divided by the *septum*, and their greater extant is from before to behind, where they, also, form two considerable openings towards the pharynx.

The nose is divided into two chambers, by a partition which consists of the *nasal processes* of the *ethmoid* and *sqhenoid* bones, of the *vomer*, and of the *cartilage* of the septum of the nose. The floor of each chamber, or nostril, is formed by the superior maxillary and palate bones, as already described. At the upper part of the nose, is the narrow cribriform plate of the ethmoid bone, below which the *turbinated bones* hang into the nose and leave three passages called the *superior, middle* and *inferior meatus.* The inside of the nose is rendered irregular by the projection of the turbinated bones, and is lined with a thick soft spongy membrane, called the *mucous, pituitary,* or *Schneiderian membrane,* which extends to all the cavities connected with the nose, and upon which a number of mucous follicles open.

CAVITIES CONNECTED WITH THE NOSE.—The *ethmoid cells,* or *sinuses,* have two openings into the nose, the *anterior,* having a common canal of communication with the *frontal sinuses,* terminates in the *middle meatus* or passage, while the *posterior* opens into the *superior meatus.*

The *frontal sinuses* have been described.

The *sphenoidal sinuses* are within the body of the sphenoid bone. Sometimes there is but one. They open sometimes direct, and at other times through the posterior cells of the ethmoid bone, into the *superior meatus.*

The *antrum Highmorianum* is situated in the superior maxillery bone. It is separated from the orbit above, by a thin plate in which is the sub-orbitary canal ; below, by a thin partition from the alveoli of the molar and bicuspides teeth, and is strengthened on the outer side by the malar projection. Its base corresponds to the nasal cavities, with which it communicates at the *middle meatus,* the opening being concealed by the superior turbinated bone.

The orifice of the *lachrymal duct* may be seen, beneath the inferior turbinated bone, where it terminates in the *inferior meatus* of the nose.

BLOODVESSELS AND NERVES OF THE NOSE.

Bloodvessels, Externally, the nose is supplied by branches from the *ophthalmic,* and *facial arteries,* as alredy described ;

internally, a branch, from the *internal maxillary* enters at the *foramen spheno-palatinum*, and is dispersed upon the lining membrane of the nose; a small branch is also supplied by the *ophthalmic*, through the *foramen orbitarium internum posterius*.

The *veins* empty their blood into the *internal*, and *external jugulars*, respectively.

Nerves.—The external parts are supplied by twigs from the terminations of the *2d divison of the 5th*, and *portio dura of the 7th pair of nerves*, where they are distributed upon the muscles of the face.

The internal parts are principally supplied by the *1st pair*, and the *2d division of the 5th pair*. The former called *olfactory nerves*, having descended through the *cribriform plate* of the ethmoid bone, are dispersed upon the lining membrane of the nares, septum, &c. The latter supplies a *spheno-palatine branch*, which enters with the artery on each side, and is dispersed chiefly upon the back part and sides of the cavities of the nose, whence the name of *lateral nasal nerve* has been applied to it.

There is also a *nasal* twig, from the *1st division of the 5th*, which has already been described.

PHYSIOLOGY OF THE NOSE.

The odour, or smell of bodies, is constituted by infinitely minute particles leaving them, and being carried away from them by the air, sometimes to a great distance. All bodies do not, with equal readiness, part with their particles in this manner, hence, their different characters, in regard to volatility or intensity of smell; while, bodies whose atoms are fixed have no smell, and are therefore called *inodorous*.

The nose is *the organ*, and smelling *the sense*, destined to receive and appreciate odours, which are distinguished into agreeable and disagreeable, as well as into weak and strong. The sense of smell therefore, is calculated both to give warning of the vicinity of unwholesome objects, and to minister to the appetites by selection.

It has been seen that the organ of smell is separated into two chambers, by a partition, which is seldom exactly in the middle of the plane of the head, and that its extensive surface of bone and cartilage, is covered by the *Schneiderian membrane.* This membrane is chiefly supplied by the *2d division of the 5th pair*, which distributes filaments over the whole of it, while the distribution of the *olfactory nerve* appears to be limited to the superior parts.

It is usually supposed that, from the first nerve being entirely expended upon the nose, it is that employed in the sense of smelling. It has however, been ascertained by experiment, that the general sensibility of the pituitary membrane ceases on the division of the *fifth pair* of nerves, from which it would appear, that the *olfactory nerve* is in the same case with the *optic* and *acoustic* nerves ; it cannot act, if the fifth pair be not entirely untouched.

The *fifth nerve* seems to invest the pituitary membrane with the sense of *touch*, while the *olfactory* belongs to the sense of smell, properly so called ; at all events, their mutual functions appear to be so intimately connected, as to render any derangement of then incompatible with a healthy condition of the sense in question.

The *nasal twig* of the *ophthalmic* division of the *fifth* pair appears to be the medium of keeping up such a connexion of the nerves of the eye, and nose, as to account for the obvious *sympathy* existing between these parts.

STRUCTURAL DERANGEMENTS OF THE NOSE.

The nostrils of infants are sometimes closed by a membrane stretched across them.

The nose, from its situation, is much exposed to injury. Its cartilages are therefore often torn off or its bones broken. It is, also, frequently destroyed by *syphilis* or *cancer*.

The mucous membrane which lines the nose, is subject to the same organic derangements as other mucous membranes. The nose is, also, the seat of a *herpetic* eruption of a virulent kind called *noli me tangere.*

Polypi frequently are attached to the mucous lining of the nose.

It is liable also, to all the other terminations of *inflammaton* of the several structures of which it is composed.

SECTION IV.

THE ORGAN OF TASTE.

The *tongue* is the principal organ of taste. It is however assisted in receiving its impressions, by all the parts entering into the construction of the *mouth*.

THE MOUTH.

The *mouth* is formed *anteriorly*, by the lips, *behind*, by the velum palati and opening to the pharynx, *above*, by the vault of the palate, *below*, by the tongue and membrane of the mouth, and *on the sides*, by the cheeks.

THE LIPS AND CHEEKS.—The former are called the *upper* and *under*. Externally, the superior has a longitudinal depression from the septum of the nose called *filtrum*. Internally, the lips and gums are covered by the lining membrane of the mouth, which, about the middle of each lip, forms a fold called the *frœnum labii*, connecting them to the corresponding maxillary bones, and they are united at their outer angles by what are called the *commissures*. The lips and cheeks are formed of muscles, common integuments, membranes, their vessels, nerves, and glands. The glands are situated below the mucous lining membrane, and pour out a viscid fluid to lubricate the parts.

The *gums* are formed of an interestitial substance, thick in consistence, and vascular, and invest the *alveolar* processes on each side.

THE TONGUE occupies the space of the arch of the *inferior maxilla*, between the teeth. It is divided into a *body*, *base*, and *apex*, with an *upper* and *under* surface. The upper surface is divided into halves, by a longitudinal middle line, or *raphé*. The inferior surface is smooth anteriorly, being covered with a continuation of the lining membrane of the mouth : and its posterior part is connected to the parts below, by a triangular fold of the mucous membrane, which is called the sublingual ligament, or *frœnum linguœ*.

The posterior part of the tongue, or *base*, is connected to the *os hyoides*, and through its medium to the adjacent bones and muscles, also to the *epiglottis*, and *anterior pillars* of the *fauces*. The tongue is chiefly composed of muscular fibres, united together by a very fine and close cellular texture.

The tongue is covered with a membrane, which is continuous with that of the mouth. It is plentifully supplied with nerves, and covered with small projecting bodies called *papillæ*, dispersed over the surface. They have been divided into three kinds, and named according to their shape, viz., *capitatæ*, *lenticulares*, and *conicæ*. The *capitatæ* are the largest, and are chiefly about the base : the *lenticulares* are smaller, and scattered over the whole surface : and the *conieæ* are the smallest and most numerous, occupying the upper surface, but most abundant towards the apex. The papillæ are formed principally by the filaments of the *lingual* branch of the 5th pair of nerves, which terminate by minute branches, surrounded by a net work of vessels.

The following glands belong to the mouth, viz. the *parotid*, the *submaxillary*, and *sublingual*, and are of the conglomerated kind.

Parotid gland.—It reaches, in its superficial extent from the zygomatic arch downwards, to below the angle of the jaw, covering a portion of the masseter muscle, and occupying the space between the ascending plate of the jawbone, and mastoid process. It is continued to the root of the meatus externus, and is situated deep between the parts mentioned. Its *duct*, (from the name of the discoverer, called *Stenonian*) arises from its anterior margin, and its course may be marked, generally, by a line drawn from the junction of the lobe of the ear with the pinna, to the base of the nose, passing below the malar eminence. The duct, having described the course noticed, perforates the *buccinator muscle*, opposite to the *second molar tooth* of the *upper jaw*.

Submaxillary gland.—It is smaller then the former, and situated behind the inferior maxiliary bone, between the bellies of the *digastricus*, and is continued on the outer side, as far as the angle of the bone. Its excretory *duct* passes inwards and forwards, and terminates at the side of the frænum linguæ by a small and somewhat prominent orifice.

SUBLINGUAL GLAND.—This is the smallest of the salivary glands. As its name implies, it is under the tongue, and lies horizontally upon its inferior surface. It is parallel to its fellow, and separated by the genio glossi muscles. Its structure is like that of the other salivary glands, but its *excretory apparatus* consists of a number of small *ducts*, which open by the sides of the frænum linguæ.

VESSELS AND NERVES OF THE TONGUE, AND MOUTH.

Bloodvessels.—The *arteries* which supply the tongue and mouth, are the *lingual* and *facial* branches of the *external carotid*. The *lingual artery* (which is the second branch of the external carotid,) runs beneath the hyo-glossus muscle, above the os hyoides, proceeding onwards to the base and tip of the tongue. In this course, it supplies the muscles near which it passes. It gives a sublingual branch, which proceeds to the symphysis of the chin, and running by the side of the frænum linguæ is sometimes called *arteria ranina*.

The *facial artery* arises above the last, but occasionally varies in size and origin. It passes upwards and forwards under the jaw, behind the digastricus and stylo-hyoideus, and is deeply imbedded in the submaxillary gland. It is next continued upwards over the side of the jaw, and is situated superficially at the under and forepart of the masseter. It then passes towards the corner of the mouth, where it divides into two branches, one to each lip, called the *coronary arteries*, and after making several turns, proceeds by the side of the nose, to the inner angle of the eye, where it anastomoses with the *nasal branch* of the *internal carotid*. In this course, the artery gives several branches, a palatine, which supplies the tongue and velum palati, tonsils and Eustachian tube, branches to the adjacent muscles, and numerous branches to the submaxillary gland, lining membrane of the mouth, and pharynx.

The blood is returned by the *facial* and *lingual veins*, which accompany their corresponding *arteries*, and terminate in the *external* and *internal jugular veins*.

Nerves.—The *nerves* which supply the tongue are the *glosso pharyngeal*, the *gustatory* branches of the *inferior maxillary*, and the *lingual nerves*.

The glosso pharyngeal often passes through the foramen lacerum in the base of the skull with the pneumo-gastric, of which it is sometimes considered a part, and is connected by a filament with it, and by another with the facial nerve. It however, chiefly divides into branches to the parts about the fauces and tonsils, to the muscular structure of the tongue and *papillæ* at its *root*, and the constrictor muscles of the pharynx.

The gustatory nerve comes off from the *3d part of the 5th pair*, on its emerging from the foramen ovale. It passes between the pterygoid muscles and ascending plate of the lower jaw, and is joined by the chorda tympani. From about the angle of the jaw, the nerve passes forwards, with the duct of the submaxillary gland, and is divided into branches, which, passing principally to the *apex* and *sides* of the tongue, terminate in the *papillæ*.

The lingual nerve.—After coming through the anterior condyloid foramen, it takes its course downwards, appears *between* the internal carotid artery and internal jugular vein, and then crosses both carotids, at the origin of the occipital artery. It continues its course near the os hyoides passing behind the digastricus and stylo-hyoideus muscles. It is in contact with its corresponding artery, until it has reached the side of the tongue, after which it is continued forwards, dividing into two branches, distributed to the muscles under the tongue, and to the fleshy part of the tongue itself, and connected by a twig or two to the *gustatory branch* of the 5th pair.

PHYSIOLOGY OF TASTE.

Tastes, or *savours*, are the impressions made by certain bodies upon this organ, and those bodies which produce them are called *sapid*.

Tastes are very numerous, and variable, and are sufficiently understood in their general characters by the terms *bitter*, *acid*, or *sour*, *sweet*, *&c.*

For the full exercise of taste, the mucous membrane which covers the organs of it must be perfectly uninjured; it must be covered with mucuous fluid, and saliva must flow into the mouth. When the mouth becomes dry, taste cannot be excited.

Different parts of the mouth appear to possess different degrees of sensibility for sapid bodies; for they act sometimes on the gums, on the tongue, or on the teeth; and at others, they have an exclusive action on the palate, or on the pharynx. Bitter bodies, for instance, leave an impression on the pharynx ; acids, upon the lips and teeth ; and peppermint leaves an impression, which exists both in the mouth and pharynx.

The obscurity, in which the functions of the lingual nerve was at one time involved, has been completely solved. If the *gustatory branch* of the 5th pair be divided, the tongue of the animal continues to *move*, but it has lost the property of being *sensible to savours*. The palate however, together with the gums, and interior parts of the cheeks, still preserve their aptitude to exercise taste.

But, if the *trunk of the 5th pair* be cut within the cranium, then the power of recognizing flavours is completely *lost*, the whole of the parts concerned in the constitution of this function, being *deprived of sensibility* to the action of the most acrid, or caustic substance.

On the division of *9th pair*, or *lingual nerves*, the power of *moving* the tongue is entirely lost.

The immediate office performed by the *glosso-pharyngeal nerve*, with reference to the sense of taste, is still involved in obscurity.

Although the parts described are considered to be those more immediately concerned in the formation of the organ of taste, there are others of great importance, so intimately connected with them, that this appears the proper place to describe them.

PARTS CONNECTED WITH THE MOUTH AND THROAT.

Os hyoides.—This has been already described.

The *mouth* is bounded posteriorly by the *velum pendulum palati*, a kind of curtain which depends from the edge of the ossa palati, and from the pterygoid processes of the sphenoid bone, and forms a partition between the mouth and the pharynx. Its inferior part forms an unattached edge, in the middle of which the *uvula*, or *pap* of the throat takes its origin. It is of a conical shape, and hangs over the root of the tongue.

The edges of the *velum* are continued to the tongue and pharynx, by two membranous and muscular folds on each side, which singly are called the *pillars*, and each pair the *arches* of the *fauces*. At the sides of the *uvula*, they are close together, but separate as they descend, so that the *anterior* terminate at the base of the tongue, while the *posterior* are lost on the sides of the pharynx. The *triangular space* left on either side by the separation, lodges the *tonsil*.

The *tonsils* are glandular bodies of a reddish colour, situated in the space between the pillars of the fauces, and called *amygdalæ*, or *almonds*, from their oblong shape. They are made up of several lobes connected together. They have numerous small openings, communicating with small cavities, disposed like cells.

THE PHARYNX.

This is a large muscular bag, in the form of an irregular funnel, with the *œsophagus* descending from it, and forming its under end. It is bounded *above*, by the cuneiform process of the os occipitis; *anteriorly*, by the pterygoid processes, the jaws, and the larynx, with all of which it is connected; and *posteriorly*, it lies upon the cervical vertebræ and upon the muscles which cover them. It corresponds *laterally* to the internal carotid arteries and internal jugular veins.

There are *seven openings* into it, by which it communicates with the neighbouring cavities. At its upper part, are the openings of the *nares*; below these, is the velum palati, and below it, the *isthmus of the fauces*, the opening of communication between the mouth and pharynx. Lower down, is the base of the tongue, and then the *epiglottis*, a moveable cartilage, belonging to the *larynx*, and covering the opening into it. At the upper and lateral parts, are the openings of the *Eustachian tubes*, turning forwards and inwards, and seeming almost to enter into the nares, and at the inferior part, is the opening into the *œsophagus*. The *pharynx* is surrounded by a loose cellular membrane, which unites it to the neighbouring parts, and is lined by a membrane, which is continuous with that of the mouth, larynx, and œsophagus. Its muscular part is formed of four muscles on each side, viz *pharyngeus*, or *constrictor pharyngis superior*, *medius*, and *inferior*, and *stylo-pharyngeus*.

THE LARYNX AND APPENDAGES.

The *larynx* consists of several moveable cartilages connected by ligaments, together with its muscles and membranes. It is situated superficially, at the *upper part* of the *trachea*, and *below* the *os hyoides*, with both of which it is connected.

The cartilages are *five* in number, viz. the *thyroid, cricoid*, the *two arytenoid*, and the *epiglottis*.

Thyroid cartilage.—The thyroid, or *shield-like* cartilage, which is the largest of the five, is placed at the upper and forepart of the larynx. It is larger above than below, and its breadth exceeds its length. It consists of two lateral, quadrangular portions, united in the middle at an angle more or less acute, which is formed into a notch above, and may be felt beneath the integuments. It is more prominent in men than in women, and is called *pomum Adami*, or *Adam's apple*. The lateral portions, or *alæ*, have a plane, or but slightly concave surface, and are covered principally by the *thyro-hyoidei muscles*. These surfaces are terminated by four edges, the *superior*, and more considerable of which, conjointly with the notch, gives attachment to the broad ligament, by which it is fixed to the under part of the os hyoides. The *inferior* edge is shorter, and concave in the middle, while, the *posterior* edges have an oblique direction, are concave above, convex below, and are terminated at the corners by processes called *cornua*. The two *superior* cornua are more or less lengthened, have an oblique direction backwards, and are connected with the extremities of the cornua of the os hyoides by round ligaments. The other two cornua, called *inferior*, are shorter, and fixed by a smooth articulating surface to the cricoid cartilage.

Cricoid cartilage.—The cricoid, or annular cartilage, forms the inferior, and posterior part of the larynx, and may be felt at the fore part of the throat. It is narrow before, where it lies under the thyroid, and thick and broad posteriorly. The superior circumference is anteriorly hollowed out, to which part is attached, the membranous ligament connecting it with the thyroid cartilage. It has *four* small *articulating surfaces*, *two* of which are situated above and behind, for the *arytenoid cartilages*, and the *two others*, at the under and lateral parts, for the connexion of the *inferior cornua* of the *thyroid cartilage*.

ARYTENOID CARTILAGES.—These are *two* in number much smaller than the others, and are placed upon the *upper*, *posterior*, and *lateral* parts of the cricoid cartilage, at a small distance from each other. Their form is *pyramidal*. Their base has an oval concave articular surface, covered by synovial membrane, which corresponds to an analagous surface on the cricoid cartilage, and anteriorly forms a triangular projection, which gives attachment to the ligament connecting them with the thyroid cartilage.

EPIGLOTTIS.—This is situated at the upper part of the larynx, between it and the tongue, and covers the opening of the larynx. It appears of an oval shape, but is broad above close to the tongue, narrowing below, and, when divested of its membrane, appears to terminate in a point. The upper surface next to the tongue is convex, with its point reflected forwards, and is covered by the mucous membrane of the mouth, the membrane forming two loose folds at the sides, and a fold in the middle, called the *frænum epiglottidis*. It is concave towards the glottis, covered by the laryngeal membrane, and fixed to the notch of the thyroid cartilage, by a *broad short ligament*, and by *two lateral ligaments*, and by the membrane to the whole length of the arytenoid cartilages, forming what is properly called the *mouth of the larynx*.

LIGAMENTS OF THE GLOTTIS.—Besides those already mentioned, there passes horizontally forwards from the projection of the base of each arytenoid cartilage, a ligamentous cord, called the *ligamentum thyro-arytenoideum*, to be fixed by its other extremity, to the inside of the anterior angle of the thyroid cartilage. Under these two ligaments, are two others, larger and more distinct than the former; they are considered as the *proper ligaments* of the glottis, and also, called *ligamenta thyro arytenoidea*, but are better known as the *chordæ vocales*. They arise from the base of the arytenoid cartilages, run in the same direction as the former, and like them are fixed to the thyroid cartilage.

The opening formed by these two pairs of ligaments, but more particularly between the inferior, is called the *glottis*, or *rima glottidis*. It is of a triangular figure, the ligaments being in contact before, but at a distance from each other at their posterior extremities. Between the superior and inferior ligaments, on each side, there is a small cavity, capable of admitting the point of the little finger, and called *the ventricles of the larynx*.

The larynx is uniformly lined with a very sensible mucous membrane, which is continuous with that of the pharynx above, and the trachea below.

VESSELS AND NERVES OF THE LARYNX.

The larynx is supplied with blood, in common with the parts in its vicinity, by branches from the *external carotid artery*, which will be more particularly noticed in the description of that vessel. The nerves of the larynx, viz. the *superior* and *inferior laryngeal*, will be described in connection with the *8th pair of cerebral nerves* of which they are branches.

MUSCLES OF THE LARYNX.

As the functions of the larynx are so immediately dependent upon its muscles, a description of which could not have been understood without a previous acquaintance with the organ itself, it has been on that account deferred.

The larynx has a number of muscles for its different motions. Those *common* to it and other parts, are the *sterno-hyoidei*, *thyro-hyoidei*, and *pharyngeus inferior*, together with those attached to the os hyoides, the movements of which are communicated to the larynx. The others proper to it are :

1. *Crico-arytenoideus posticus*, *arising* from the posterior part of the cricoid, and *inserted* into the back part of the base of the arytenoid cartilage :
2. *Crico-arytenoideus lateralis*, *arising* from the side of the cricoid, and *inserted* into the side of the base of the arytenoid cartilage :
3. *Thyro-arytenoideus*, arising from the middle of the internal surface of the thyroid, and *inserted* into the arytenoid cartilage above the former :
4. *Arytenoideus obliquus*, *arising* from the base of one arytenoid cartilage, and *inserted* into the tip of the other, crossing its fellow :
5. *Arytenoideus transversus*, a single muscle, *arising* from nearly the whole length of the side of one arytenoid

cartilage, and passing transversely, is *inserted* in the same *manner*, into the side of the other:

6. *Crico thyroideus*. This muscle *arises* from the side and forepart of the cricoid cartilage, and is *inserted* by two portions into the lower part of the thyroid cartilage. Its action is obvious.

There are other *fibres*, sometimes considered muscles, and called *thyro-epiglottideus* and *aryteno-epiglottideus*.

It has not been considered necessary to define the particular use of each of these muscles; their general tendency is, by approximating the points to which they are fixed, to alter the position of the arytenoid cartilages, so as to open or close the *glottis*, and to slacken or render tense the *thyro-arytenoid ligaments*.

The *thyroid gland*, is situated at the lower and lateral parts of the larynx, and anterior part of the trachea. It is large in the fœtus, but afterwards decreases in size. It is formed of *two lobes*, joined together by a narrow slip, sometimes wanting, which crosses the trachea, a few lines below the cricoid cartilage The lobes begin at the sides of the cricoid cartilage, and descend a certain way upon the trachea and œsophagus. They are covered anteriorly by the *sterno-hyoidei*, *sterno thyroidei*, and *omo-hyoidei* muscles. The gland is of a reddish colour, and of firm consistence.

The *trachea* and *æsophagus* have been already described.

OF DEGLUTITION.

By this term, is understood the passage of a substance, either solid, liquid, or gaseous, from the mouth to the stomach.

This action is produced by the contraction of a great number of muscles, and requires the consent, or concurrence of a great number of important parts.

All the muscles of the *tongue*, of the *velum*, of the *palate*, of the *pharynx*, of the *larynx*, and the muscular coat of the *æsophagus*, are employed in the performance of *deglutition*.

The following is the progress of deglutition As soon as a certain quantity of food has been sufficiently chewed and *insalivated*, or mixed with the saliva of the mouth, the mass is placed by the motions of mastication, and the action of the tongue upon the upper surface of the latter. The tongue is then, during the suspension of mastication, raised and applied to the roof of the mouth in succession from the point to the base.

The portion of food therefore, upon its superior surface, is directed towards the *pharynx*. In its course, it meets the *velum* of the palate, applied to the base of the tongue, and raises it, until it becomes horizontal, so as to make a continuation of the palate.

If the tongue continued to press the food, it would carry it towards the *nasal cavities*; but this is prevented in the manner above mentioned by the velum, which not only protects them, but also the *Eustachian tubes*.

The instant that the mass of food touches the pharynx, a very complicated action takes place. First of all, the *pharynx* contracts, and embraces the body, the *velum palati* being now drawn down, by its pillars acting in such a way as to contract the opening into the mouth, and prevent the return of the food into it. At the same instant also, the *base of the tongue*, the *os hyoides*, and the *larynx*, are raised and carried forward, to render the passage of the mass over the opening of the larynx, more rapid, while the *epiglottis* descends, so as to cover the entrance into the *larynx*. The instant that the *larynx* however, is raised, and behind the os hyoides, the *glottis* shuts with the greatest closeness, so that deglutition can be perfectly performed, even without the epiglottis.

The alimentary mass having fairly passed into the *œsophagus*, proceeds more slowly, being lubricated, as it passes along, by the mucus secreted by the lining membrane of the passage. The presence of the mass excites the circular fibres of the muscular coat of the tube, first the superior, and then those below, as it proceeds; it is at last conveyed into the stomach.

OF VOICE.

By voice, we understand the sound which is produced in the larynx, at the instant that the air traverses this organ, either going into, or coming out of the trachea.

Although there are other parts concerned in the modification of voice, yet the passage of air through the *larynx*, being absolutely necessary to its production, it is the proper organ of voice. It varies in size, according to age, and sex. Both man, and animals, are deprived of voice, by making an incision below the larynx, or even, the inferior ligaments of the glottis; and the voice may be reproduced by closing it. It is therefore, evident, that the part above the incision, is that in which the organ of voice exists.

The voice then is formed in the glottis by the vibrations of the *vocal chords*, or lips of the *glottis* in the following manner: the air being pressed from the lungs, proceeds along the pipe of the trachea, until it arrives at the larynx, where the tube suddenly contracts, and forces the air to pass through a narrow slit, the two sides of which, vibrate like the reeds of a wind-instrument, and thus, produce the sonorous undulations in the transmitted current of air. The use of the *epiglottis* appears to be, to afford the power of increasing the vocal sound, without allowing it to rise.

STRUCTURAL DERANGEMENTS OF THE ORGANS OF TASTE, DEGLUTITION, AND VOICE.

Diseases of the Lips and Cheeks.—There are several organic derangements, which prevent the lips, cheeks, and tongue, from performing their usual actions, namely, the retaining of the food between the teeth during manducation, and the imparting of its flavour to the gustatory nerves.

The *inner membrane* of the lips is sometimes so much *relaxed*, as to protrude between the lips; and children are sometimes born with the lips partially *adhering* to each other, or with a *fissure*, or *fissures* in the lip. The latter affection is called *hare lip*. The fissure is most frequently in the upper lip, and sometimes extends to the *bony palate*.

The lips, cheeks, and gums, are often *inflamed*, covered with *opthæ*, *eroded*, or *ulcerated*, by an unnatural projection of the fore-teeth, or from *syphilis*, *cancer*, or *scurvy*, the latter affection producing *sponginess* and *bleeding* of the gums.

Diseases of the Tongue.—Sometimes this organ is found to be double, from *congenital malformation*, and sometimes of a *preternatural size*. At others, the *frænum* is *too short*, so that the child cannot suck.

It sometimes adheres to the cheek, from previous inflammation, and its cuticle, which often becomes thicker than natural in fevers, after a time, comes off in thick flakes.

The other organic diseases of the tongue are, *swelling*, *ulceration*, *apthæ* and *cancer*.

DISEASES OF THE OS HYOIDES.—The cornu of this bone has been occasionally *dislocated*.

Sometimes also, *bony tumours*, or *exostoses*, grow from it; and acquire such a size, as to impede deglutition.

DISEASES OF THE PALATE.—The *bones* of the palate have been frequently *eroded*, and *destroyed* by *syphilis*, and other diseases.

The *soft palate* has been found *fissured*, and when that happens, the food, instead of passing into the pharynx, partly enters the nose.

The *soft palate* is frequently *inflamed*, in *cynanche tonsillaris*, and also *ulcerated*, and it is very frequently affected with *ulceration*, in *syphilis*.

Polypi sometimes grow from it, and hang into the pharynx.

The *uvula* is often swelled and *relaxed*, so that it becomes longer than usual, and irritates the fauces very much.

DISEASES OF THE SALIVARY GLANDS.—These are by no means uncommon, more especially those of the *parotid*, and often occur as consequences of fever.

The *parotid gland* is often *swelled*, forming the disease called *cynanche parotidæa*, or *mumps*.

The *sublingual gland* is also often *swelled*, forming a painful tumour, called *ranula*, under the tongue, which is sometimes pressed upwards to the roof of the mouth.

Inflammation of these *glands* sometimes terminates in *suppuration*.

When the *ducts* of the salivary glands are destroyed by wounds or ulceration, the saliva is constantly discharged by the opening, and forms what is called, a *salivary fistula*.

The ducts also, have been found much distended by *salivary concretions*, and sometimes acquire a very considerable size.

The glands are also subject to *schirrus*.

DISEASES OF THE LARYNX, &c.—The *cartilages* of the larynx, especially the thyroid, and those of the trachea, *ulcerate* and sometimes are found *ossified*. In such cases the mobility of the different parts of the larynx being lessened or destroyed, the voice becomes much feebler: the voice is also affected by *thickening of the ligaments of the glottis*.

Bronchocele, or Goitre.—By this term is commonly understood an *enlargement* of the *thyroid gland*, which is usually indolent and circumscribed, does not readily advance to suppuration, and is not attended, with pain or discoloration of the skin.

SECTION V.

THE ORGAN OF TOUCH.

The immediate organ of this sense, may be said to be the *skin*, or covering of the whole superficies of the body. This covering has been divided by anatomists into the *epidermis*, or cuticle, the *rete mucosum*, or mucous layer, and the *cutis vera*, or true skin.

The first pellicle which presents itself is named the *epidermis*. It covers the whole surface of the body, and even enters into the mucous passages, as in the eye, the nose, the mouth, the ear, the urethra, &c., but is so modified in its appearance in these parts, as not to be readily detected except at their commencements.

The *epidermis* is a thin, semi-transparent, insensible, membranous expansion, arranged in *laminæ*. In delicate parts, as the face, or glans penis, it consists of only one layer, while in the palms of the hands, soles of the feet, or places much exposed to friction or pressure, it becomes remarkably thick, hard, and opaque. On both outer and inner surfaces of the epidermis, there are a number of minute wrinkles, the impressions of the irregularities of the *cutis*, to which it adheres, and on its interior, there are a number of delicate processes, which are the *sheaths* of the *hairs*. Besides the hairs being transmitted through this membrane, there are small apertures, or pores, for the exudation of the *perspiratory exhalants*, the excretory ducts of the *glands* of the skin, and for the commencement of *lymphatics*.

When the epidermis is separated by maceration or putrefaction, we arrive at the *rete mucosum*, situated between it and the cutis vera. This membrane is difficult of demonstration. It is the *seat of colour*, that of the natives of tropical climates depending upon the *black* colour of this texture seen through the cuticle.

The *cutis vera* is situated beneath the epidermis, and rete mucosum; like the former, it extends all over the surface of the body, and into the mucous passages, and constitutes the chief portion of the skin. It is of a white colour; and of a fibrous structure, and, like the epidermis, is thickest in the palms of the hands, and soles of the feet.

There are numerous, small, reddish projections, to be discovered upon the true skin, when it is laid bare by a blister. They are sensible, essentially vascular, and have been called the *papillæ* of the skin. The epidermis is pierced by little holes opposite their tops, through which the sweat issues.

The skin contains a great number of *sebaceous follicles*, more especially observable in parts that are exposed, as in the nose, ears, mammæ, &c.

Immediately under the cutis, we find the cellular substance, *membrana cellularis*, or *corpus cellulosum*, supporting in its cells the adipose substance, *fat*, or *corpus adiposum*, and serous fluid. The cellular substance forms an envelope to the muscles, and pervades the whole body; it is adundant in some regions, as in the abdomen, about the mammæ, and nates, &c., while there is very little about the eyelids, penis, or scrotum, scarcely any within the spinal canal, and little or none within the cavity of the cranium.

Hairs.—These are *appendages* of the organ of touch, and arise by bulbs, situated in the *corpus cellulosum*, from which an oily secretion is produced for their nourishment; they serve in general for the ornament, warmth, or protection of the different parts, on or near which they are applied.

Nails.—These, another *appendage* of the skin, are situated on the dorsal surface of the extremities of the fingers and toes. They are oblong, and of an irregular oval form. They appear to be of the same substance as the cuticle only of a denser structure.

They are divided into three portions, the root, the body, and the free extremity. They are of a horny nature, possess little or no sensibility, and may be cut without communicating pain.

When separated by disease, a new nail is readily formed.

BLOODVESSELS AND NERVES OF THE SKIN.

The skin is largely supplied with very delicate *blood-*

vessels, which are found, together with the *nerves*, on the external surface of the cutis vera: of the latter, those which minister chiefly to the sense of touch are as follows, viz. the *fifth pair of cerebral nerves* to the face, temples and fauces; the *posterior roots* of the *spinal nerves*, to the trunk, neck, occiput and limbs and the *nervi vagi*, and *glosso pharyngeal nerves*, to the pharynx and œsophagus.

PHYSIOLOGY OF THE SKIN.

The skin forms an envelope for the whole body, it is the seat of the *sense of touch*, and an organ of *absorption* and *secretion*.

The skin is principally formed by the cutis vera, and the external covering or epidermis is considered as a solid matter secreted by the skin, void of feeling and possessing none of the properties of life. It wears and is renewed, and, by being thickest in those parts which are most exposed to pressure, it, to a certain extent, modifies their sense of touch.

The surface is much more actually sensible in some parts than others; while the hands, and the tips of the fingers especially, are endowed with the sense of touch in the highest degree.

The skin is considered as an organ of *absorption*, from the rapidity with which various external applications are taken into the general system.

Its office as a *secreting* organ is obvious. There are a number of vessels which open by minute pores upon its surface, through which the matter of insensible perspiration passes, as may be perceived by confining the arm in a clear glass vessel.

STRUCTURAL DERANGEMENTS OF THE SKIN AND ITS APPENDAGES.

Diseases of the skin, or *cutaneous diseases*, form a very numerous class, which has been divided into various *orders*, *genera*, &c. Those however, of more common occurrence, and more easily distinguished, will be noticed here. They are *scabies, psora*, or itch—*herpes*, or tetter—*tinea capitis* or scald head;—*impetigo*, or ring-worm; *pernio*, or chilblain (a disease of a temperate climate) ;—*lepra*, or leprosy, —*elephantiasis*, or elephant leg—*clavus*, or corn,—*variola*, or small-pox,—*varicella*, or chicken-pox,—and *vaccina*, or cow-pox.

Blotches, or discoloration of different kinds, also, are frequently met with as the accompaniments of *syphilis* and other constitutional diseases.

The skin also, is subject to *erysipelas* or *St. Anthony's fire*, and numerous *tumours* and *excrescences* of various kinds ; and the cutis vera seems to be the seat of all the affections above noticed.

Water, and pus, are sometimes collected in the cellular membrane, and sometimes air, forming *œdema*, *abscess*, or *emphysema*.

The most frequent derangement however, of the cellular substance, is *phlegmone*, a *swelling*, or *tumour* of a red colour, with a defined base, usually rising to a point, and frequently terminating in abscess.

Carbuncle—This is usually in the shape of a broad flat tumour, of a dark purple colour. Its surface usually becomes dark and livid, and there are a number of small apertures, through which the contents of the tumour are discharged.

Tumours.—Various kinds of tumours, are lodged in the cellular substance, and the *guinea-worm*, or *dracunculus*, may be mentioned as a disease to which this structure is liable.

PART IX.

THE BLOODVESSELS.

The bloodvessels are divided into *arteries*, and *veins*, and this division of the subject has been called *angiology* or a name derived from the Greek language, and signifying the doctrine of the vessels.

SECTION I.

THE ARTERIES.

The primitive trunks of the arteries, or those which arise from the *heart*, are the *pulmonary artery*, and the *aorta*. The course and distribution of the former have been already given, with the description of the heart and circulation.

AORTA.

This vessel forms the *origin*, or *common trunk*, of all the ramifications of the *arterial system*. It arises from the upper part of the *left ventricle*, from which it is distinguished, at its commencement, by difference of structure. It first *ascends*, then bends *backwards* and over to the *left* side, opposite to the *third* or *fourth dorsal vertebra* ; after which, it *descends* within the posterior mediastinum, inclined to the *left side* of the *dorsal vertebræ* ; it passes between the crura of the diaphragm, and, continuing its course along the vertebræ, terminates, by division into two parts, at the *fourth* or *fifth vertebra of the loins*. The different portions of the aorta, thus described as taking different directions, are distinguished by corresponding names : viz. 1. the *ascending aorta* ; 2. the *curvature*, or *arch of the aorta* ; and 3. the *descending aorta* ; the latter being subdivided into the *thoracic* and *abdominal* portions.

Ascending aorta.—It is enclosed, during the greater part of its course, by the pericardium. To its *left*, is situated the pulmonary artery, which covers it anteriorly, at its origin ; to *its right*, the vena cava superior ; *behind it*, the right branch of the pulmonary artery ; while, *before it*, is the anterior mediastinum, separating it and the heart from the sternum.

Arch of the aorta.—This is situated immediately before the under end of the trachea, the curve of the vessel being continued over the left branches, and descending immediately behind it, and the left pulmonary artery.

Thoracic aorta.—The aorta, while descending in the thorax, is situated in the posterior mediastinum. It has to the *left*, the left pleura ; to the *right*, the œsophagus, vena azygos, and thoracic duct ; *anteriorly* first the left bronchus, and then the pericardium ; and *behind*, the dorsal vertebræ.

Abdominal aorta.—The vessel where passing on the bodies of the lumbar vertebræ, is situated more nearly on the median plane, than while in the thorax. To the *right* of the abdominal aorta, is placed the inferior vena cava. The aorta rests *behind*, on the vertebræ, and is covered *anteriorly*, and to the *left*, by the peritoneum. Opposite to the fourth or fifth lumbar vertebra, or sometimes higher, it divides or bifurcates into two parts, called the *common iliac arteries*.

The arteries taking their origin from the aorta may be distinguished into those arising from,—1. the *ascending aorta*,—2 the *arch of the aorta*,—3 the *thoracic aorta*, —4 the *abdominal aorta*, and—5. the *termination*, or *division of the aorta*.

BRANCHES FROM THE ASCENDING AORTA.

These are the *cardiac*, or *coronary arteries*, which have been described with the structure of the heart.

BRANCHES FROM THE ARCH OF THE AORTA.

These supply the *head* and *neck*, the *upper extremities*, and partly *the chest*. They are three in number: viz. the *arteria innominata*, or *unnamed artery* (from which the *right common carotid*, and *right subclavian arteries* arise) *the left carotid*, and the *left subclavian artery*. The *arteria innominata* arises foremost and most to the right, the *left carotid*, in the middle and somewhat farther back, close to the unnamed trunk, and the *left subclavian*, at a short distance from it, the most posteriorly and to the left.

These arteries, however, do not always arise in this regular manner from the *arch of the aorta*. They vary occasionally, both in situation, and number; the excess in the latter being the more common variety, as, where the *right carotid* and *right subclavian* arise separately; or, when in addition to the usual vessels, the *vertebral*, the *inferior thyroideal*, or more rarely, the *internal mammary* arise from the *arch*. Occasionally, the number is less, as when two, or all three arteries arise from a common trunk. The deviation from the usual situation is, when the arteries, at their commencement, are unusually close together, or separated from each other, or, when the *right subclavian* passes between the *carotids*, or between the *left carotid*, and the *left subclavian*.

ARTERIA INNOMINATA, OR UNNAMED ARTERY.

It takes its course obliquely upwards, and to the right; and generally divides, after a passage of about an inch, but occasionally somewhat more, into the *right common carotid*, and *right subclavian* arteries. It is covered anteriorly by the sternum and sterno-thyroidei muscles, and is crossed by the left subclavian vein. Posterior to it, is the trachea. The *right carotid* and *subclavian* vessels are shorter than the *left*, by the length of the *un-named trunk*.

COMMON CAROTID ARTERY.

The *common carotid* ascends in the neck, by the side of the *air tube*, diverging in its course from the opposite artery of the same name. It reaches as high, usually, as the upper part of the larynx, where it terminates by dividing into the *external*, and *internal carotids*. Its situation *above* is superficial. *Anteriorly*, and *below*, it is covered more or less by the sterno-cleido-mastoideus, the sterno-hyoideus, sterno-thyroideus, and omo-hyoideus muscles; *anteriorly* and *above*, it is separated from the skin, aponeurosis and platysma myoides, by the projection of the parts about the larynx, and the sterno-mastoid muscle, to the edge of which it corresponds at this part, where it rises about an inch above the omo-hyoideus. *Posteriorly*, it has the vertebral column, the rectus capitis anticus major, and longus colli muscles, and the inferior thyroideal artery, a branch of the subclavian. To *the inner side*, it corresponds to the larynx and trachea, the thyroid gland, which is sometimes continued partly over it, and to the œsophagus which is placed somewhat nearer to the left, than the right trunk. To *the outer side*, the internal jugular vein, and the nervus vagus, situated between it and the carotid, take their course; the *nerve*, the *vein*, and the *artery*, are inclosed within a sheath of condensed cellular membrane. The sympathetic nerve is also situated on the *outer side* of the artery, but exterior to the sheath.

Sometimes one of the carotids crosses the lower part of the trachea. The *right*, when the un-named trunk arises much to the left; the *left* when it arises from the un-named trunk. The division of the common carotid into *external*, and *internal*, sometimes takes place higher than usual, and occasionally, after the first branches of the external have been given off. A case has been observed in which the external carotid was a short stump, from which all the branches of the external came off at one point. The bifurcation, sometimes, takes place lower than the part above described as the usual place. The place of division, with respect to the larynx, is the same in all ages, but is situated at a greater distance from the angle of the jaw in infancy, before the teeth have been cut, than at an after period, especially when the back part of the jaw is completely developed. In consequence of this, the branches of the external carotid are more exposed in the earlier periods of life.

The *external* and *internal carotid arteries* pass, at first, nearly perpendicularly upwards and parallel to each other. The *external* is situated nearer the larynx, and more anteriorly; the *internal* taking its course upon the muscles on the bodies of the vertebræ. Their sise in the adult is nearly the same; but in infancy, owing to the larger proportional size of the brain, the internal is the more considerable vessel of the two.

EXTERNAL CAROTID ARTERY.

The *external carotid* is continued as high as the neck of the lower jaw, where it terminates, by dividing into the *temporal*, and *internal maxillary arteries.* It passes up first behind the posterior belly of the digastricus, and stylo-hyoideus muscles, to near the angle of the jaw; then continues its course between the sterno-mastoideus, mastoid process, and the ear, and the ascending plate of the lower jaw, covered by the parotid gland, to the place of its division.

The branches from the *external carotid* may be divided into the *anterior, internal, posterior,* and those by which it *terminates.*

The *anterior branches* are 1. the *superior thyroideal,*—2. the *lingual,* and 3. the *facial* arteries.

Superior thyroideal.—Usually takes its origin from the root of the external carotid; but occasionally from the common carotid. Sometimes it arises from a trunk common to it and the lingual branch. It varies in size. It winds *downwards, inwards,* and *forwards,* covered by the omo-hyoid and sterno-hyoid muscles, to the upper part of the thyroid gland. It sends off the following branches.

1. *Branches* to the sterno-mastoideus, and omo-hyoideus muscles, and to the superficial parts.

2. *Laryngeal branch.*—This passes forwards and inwards, and after distributing branches to the muscles below the os hyoides, is continued usually between the os hyoides and thyroid cartilage, to be distributed to the muscles and lining membrane of the larynx.

3. *Thyroid branch*—Is the continuation of the trunk. It generally divides into two branches, of which one is continued along the upper part of the thyroid gland, and anastomoses with a corresponding branch from the opposite superior thyroideal; the second passes along the outer and posterior part of the gland, and anastomoses with branches of the *inferior thyroideal.* Both send considerable branches to the substance of the gland.

Lingual.—Is somewhat larger than the superior thyroideal. It arises commonly just above the thyroideal, and sometimes from the same trunk as the facial. It takes its course *upwards* and *forwards* over the cornu of the os hyoides, becomes covered by the hyo-glossus muscle, and is continued forwards under the tongue. It gives off the following branches in its course.

1. *Branches* which are distributed to the adjacent muscles and pharynx.

2. *Hyoideal branch.*—Distributed to the muscles above the os hyoides.

3. *Dorsal branches.*—Distributed to the dorsum of the tongue, and to the parts about the passage of the fauces and pharynx.

4. *Sublingual branch.*—Supplying the sublingual gland and adjacent muscles.

5. *Ranine branch.*—Is the continuation of the trunk. It passes forwards at the under and lateral part of the tongue, close to the frænum, and terminates near its point, furnishing in its course numerous branches.

Facial.—This is generally the largest of the three anterior branches, and arises a little above the last. It varies, however, in size and origin. It passes *upwards* and *forwards*, under the jaw, behind the digastricus and stylo-hyoideus, and is then deeply imbedded in the submaxillary gland. It is next continued upwards over the side of the jaw, and is situated superficially at the under and forepart of the masseter. It then passes towards the corner of the mouth; and, after making several turns, it proceeds by the side of the nose towards the inner angle of the eye. The following are its branches.

1. *Inferior palatine branch.*—Distributed to the pharynx, velum palati, the tonsil, and parts adjacent.

2. *Glandular branches.*—Distributed to the submaxillary gland.

3. *Submental branch.*—It is given off near the edge of the jaw, along which it is continued between the attachment of the mylo-hyoideus, and digastricus muscles. It furnishes branches to both muscles, and is then continued upwards over the jaw to supply the muscles and skin of the

lower lip, and anastomose with branches of the coronary and dental arteries.

4. *Small branches.*—Distributed to the masseter, and to the muscles and skin of the cheek and lips.

5. *Inferior coronary artery of the lip.*—It passes along the under lip, covered by the membrane of the mouth; and, after furnishing branches to the adjacent parts, anastomoses with the opposite branch of the same name. This branch frequently varies both in origin and size. It sometimes arises higher, and is a branch of the superior coronary. Sometimes it is very small, and is wanting altogether on one side, in which case the opposite one is proportionably larger.

6. *Superior coronary artery of the lip.*—Is larger than the former. It passes along the edge of the upper lip, furnishes branches to the adjacent parts, and inosculates with the opposite artery. The course of the coronary vessels in extremely tortuous. From the superior coronary there are branches sent upwards to the point and partition of the nose.

7. *Branches.*—Distributed to the nose, cheek, parts about the inner corner of the eye, and middle of the forehead: and by these branches the facial artery terminates.

The *internal branch* of the *carotid* is the *ascending pharyngeal* artery.

ASCENDING PHARYNGEAL.—It is the smallest branch of the *carotid*, and arises from the beginning of the *external carotids*, sometimes at the part where the common carotid divides, occasionally, from the root of the *internal*, and not unfrequently from the *occipital*. It ascends in the same direction as the external carotid, between that vessel and the pharynx. It then divides into branches distributed to the constrictores pharyngis, sending off likewise a branch which passes through the lacerated opening of the base of the skull, and is dispersed upon the dura mater.

The *posterior branches* of the external carotid are the *occipital* and the *posterior aural* arteries.

OCCIPITAL.—This is a vessel of some size, and nearly as large as the anterior vessels. It arises from the back part of the external carotid nearly opposite to the *lingual* or *facial*. It is rarely a branch of the internal carotid. It takes its course over the internal jugular vein, and then between the transverse process of the first vertebra and the mastoid process of the temporal bone. It is continued under the sterno-mastoid muscle, the trachelo-mastoideus, splenius, and complexus. It then becomes superficial, runs upwards upon the occipital bone, and divides into several branches. It gives off the following branches in its course.

1. *Branches* to the digastricus, sterno-mastoideus, and glands of the neck, and sometimes a branch through the foramen lacerum to the dura mater.

2. *Descending branch,* of considerable size, which passes down between the complexus and trachelo-mastoideus, and is distributed to the muscles at the back of the neck. It anastomoses with the vertebral.

3. *Branch* which passes through the foramen mastoideum to the dura mater. This branch is not always found.

4. *Branches*, by which the occipital artery terminates, are distributed to the occipito-frontalis, and integuments, anastomosing with branches of the temporo-occipital, and of the opposite occipital, so as to form a network of vessels.

Posterior aural.—Is smaller, and arises higher than the former. It is often a branch of the *occipital*. It passes upwards behind the external carotid towards the mastoid process, is continued upon the back of the concha, and terminates upon the side of the head. It supplies the following.

1. *Branches* to the parotid gland, the posterior belly of the digastricus, the stylo-hyoideus, and sterno-mastoideus.

2. *Stylo-mastoid branch*, which passes through the stylo-mastoid foramen, and is distributed to the meatus externus, membrana tympani, and part of the labyrinth of the ear.

3. *Branches.*—Distributed to the ear and side of the head.

The *branches* by which the external carotid *terminates* are the *temporal*, and *internal maxillary*.

TEMPORAL.—This is the smaller, and more superficial. It is continued upwards, in the same direction as the external carotid, before the ear, through the upper part of the parotid gland, and over the root of the zygoma. It passes to a short distance upwards, immediately under the skin, along the margin of the hair, and divides into two considerable branches, an *anterior* and a *posterior*. It sometimes divides, close to the zygoma. Its branches are as follows:

1. *Branches* to the parotid gland.

2. *Branches* which are distributed to the masseter muscle.

3. *Transverse branch of the face*.—It arises near the division of the external carotid and is sometimes, though rarely, a branch of that vessel. It takes its course transversely over the masseter muscle, and accompanies the duct of the parotid gland. It distributes branches to the parotid gland and cheek, and communicates with the facial, and infra-orbitar arteries.

4. *Deep temporal branch*.—It comes off near the zygoma, penetrates the aponeurosis of the temporal muscle, and ramifies within it, forming communications with the deep temporal branches of the internal maxillary.

5. *Anterior auricular branches*.—These come off near the former, and are distributed upon the external ear and meatus.

6. *Anterior, or tempora-frontal branch*.—It passes obliquely forwards, and divides into numerous branches; some of which are continued along the upper part of the forehead, distributed to the skin, occipito-frontalis, and orbicularis palpebrarum, and anastomose with branches of the supra-orbitar and facial. The rest pass upwards towards the vertex, and anastomose with the opposite artery, and the temporo-occipital.

7. *Posterior, or temporo-occipital branch*.—It passes obliquely upwards and backwards on the parietal bone, and distributes numerous branches to the side and upper part of the head, forming numerous anastomoses with the anterior branch of the opposite temporal, and with the occipital artery.

Many small vessels from the arteries on the head penetrate the substance of the bones.

INTERNAL MAXILLARY.—It is larger than the temporal, and passes off from the external carotid, where the latter is covered by the parotid gland. It takes its course, first inwards and forwards behind the neck of the lower jaw, then inwards between the pterygoid muscles; it ascends forming several turns, penetrates the pterygoideus externus, passes behind the tuberosity of the superior maxilla, in a horizontal direction, and terminates behind the orbit by dividing. It gives off the following;

1. *Branches* of small size to the ear.

2. *Spheno-spinal*, or *middle artery of the dura mater.*—It passes directly upwards, distributing branches to the adjacent muscles, to the pharynx, and other parts near it. It is then continued through the *foramen spinosum* of the sphenoid bone, giving off some twigs to the bones, and tympanum of the ear; and, having entered the cranium, gives branches to the lower part of the dura mater. It next divides into two branches; the *anterior*, which is the more considerable, passes upwards and forwards to the anterior and inferior angle of the parietal bone, where it is lodged in the groove or canal at that part, and then divides into numerous branches which spread on the surface of the dura mater; the *posterior* ascends on the parietal bone, and squamous portion of the temporal bone, and divides also into branches. The ramifications of these vessels are lodged in grooves in the bones.

3. *Inferior maxillary branch.*—It passes downwards, between the pterygoidei, to the *posterior maxillary foramen*. After having passed through this opening, it is continued through the *canal* of the *inferior maxilla*, distributing branches to the teeth and substance of the bones; it then passes out through the *mental foramen*, and terminates in branches which anastomose with branches of the facial, and supply, in part, the chin and under lip.

4. *Temporal branches.*—Are distributed to the temporal muscle.

5. *Masseterine.*—Is a *branch* distributed to the masseter.

6. *Buccal.*—Is a *branch* distributed to the buccinator, and to the soft parts of the cheek.

7. *Pterygoideal branches.*—Are distributed to the pterygoid muscles.

8. *Alveolar branch.*—It arises behind the antrum, and takes its course around the superior maxilla, distributing branches to the teeth of the upper jaw, the substance of the bone, gums, and surrounding soft parts.

9. *Infra-orbitar branch.*—Arises behind the orbit, passes through the *infra orbitar canal*, and distributes branches in its course to the orbit, antrum, substance of the jaw, and the fore teeth. It comes out at the *infra orbitar foramen*, and terminates by branches to the cheek, some of which communicate with branches of the facial artery.

10. *Descending palatine branch.*—It gives off, usually, a branch to the upper part of the pharynx, called *superior pharyngeal.* It then descends in the *palatine canal*, and passing out through the *posterior palatine foramen*, advances between the bone and membrane of the roof of the mouth, distributing branches to both. Anteriorly, it communicates with the opposite artery, and sends a branch upwards through the *anterior palatine foramen* to the nose, to anastomose with branches of the lateral nasal.

11. *Lateral nasal branch.*—It takes it course through the *spheno-palatine foramen*, and divides, at the upper and back part of the nose into many branches which supply the greater part of the inside of that organ.

INTERNAL CAROTID ARTERY.

It ascends deeply seated, and most commonly slightly curving in its course, upon the rectus capitis anticus major, to the base of the cranium. It then turns forwards and upwards, and enters the *carotid canal*; it next adapts itself, by several turns, to the tortuous course of that canal, nearly filling it, but surrounded by a quantity of dense cellular membrane. On entering the cranium, it passes upwards and forwards by the side of the sella turcica, and is contained in the same fold of the dura mater as the *cavernous sinus.* Under the anterior clinoid process, it bends upwards and then backwards, and divides into branches. Thus, this vessel is very tortuous in its course, and changes its direction at least five or six times.

Exterior to the cavity of the cranium it seldom gives off any branches. Occasionally, however, it furnishes a branch to the pharynx, or to the fauces, and more rarely, it gives off the occipital.

At the side of the sella turcica, it commonly distributes small branches to the *dura mater*, *ear*, *cavernous sinus*, *pituitary gland*, and *adjacent nerves*.

Where it passes up under the anterior clinoid process, it detaches the OPHTHALMIC ARTERY, for a description of which, vide EYE, PART VIII. SEC. I.

ARTERIES OF THE BRAIN.

Vide CIRCULATION OF THE BRAIN ;—PART IV.

SUBCLAVIAN ARTERY.

The difference of the origin of the subclavian artery, on the right and left sides has been already remarked ; the *left* arising immediately from the *arch of the aorta*, and the *right*, from the *unnamed trunk*. The varieties, occasionally met with in their origin, have been also noticed. They both pass upwards through the upper opening of the chest, bend outwards over the first rib, are continued between the scaleni muscles, outwards and downwards ; and, having descended below the clavicle, change their name to that of the *axillary arteries*.

In consequence of the difference of origin of these arteries on the right and left sides, they differ before they pass over the first ribs, in—1 *Situation ;* the *right* being more superficial, the *left* deeply hid, (arising farther back from the arch of the *aorta*).—2 *Length* ; the *right* being shorter by the length of the *arteria innominata*.—3. *Direction* ; the *right* passing obliquely upwards and outwards to the space between the scaleni ; whilst the *left* ; passes first vertically upwards, then suddenly bends outwards between the scaleni.—4. *Relative position ;* the *right* being placed more anteriorly, near to the apex of the right lung on the outer side, and separated, behind, from the vertebral column and longus colli, to which it corresponds ; the *left* being covered from its origin by the corresponding lung, and closely applied to the longus colli.

The course of the *subclavian arteries*, after their arrival at the space between the scaleni, becomes the same. *Anteriorly*, they have the *scalenus anticus* which is interposed between them and their correspondent *veins*, and then the subclavian vein and the clavicle, which latter they pass at an acute angle.

On the inner side, they have the first rib, to which they are closely applied, thus affording the means of ready compression; and upon the first rib, and before they have passed it, they have the pleura immediately adjacent to them, at the part where the pleura reaches above the upper opening of the chest, and terminates in a blind extremity. *Behind*, and *to the outer side*, are situated the nerves which form the axillary plexus.

The branches of the subclavian are divided into *superior*, and *inferior*. The former are generally six in number, viz. the *vertebral*, the *inferior thyroideal*, the *ascending cervical*, the *supra-scapular*, the *superficial cervical*, and the *deep cervical*; and the latter, or *inferior* branches, are the *internal mammary*, and *superior intercostal* These branches are usually given off before the artery passes between the scaleni muscles, but differ considerably in size, and also, in the manner of their origin, two of them often coming off from a common trunk.

Vertebral artery.—This is commonly the first, and largest branch. It arises sometimes, from the arch of the aorta; this variety rarely takes place, except on the left side, and then, seldom elsewhere but between the left carotid, and subclavian arteries. It then passes upwards, and through the opening in the transverse process of the *sixth* cervical vertebra, rarely through that of the *seventh*, but oftener through that of the *fifth, fourth, or third*. It is sometimes larger on one side than on the other. It is then continued through the openings of the transverse process of the vertebræ above, nearly in a straight direction, as far as the *second* vertebra, but then becomes tortuous in its course: it forms one bend between the first and second vertebræ, and, after passing through the transverse process of the *atlas*, it changes its direction, becomes horizontal, and bends round the root of the articular process in the groove for receiving it: then it passes under the occipital bone to the *foramen magnum*, upwards through the latter, and through the dura mater, and is continued at first on the side of, and then below, the medulla oblongata, upwards and inwards upon the *cuneiform process* of the *os occipitis*. The two arteries thus approaching each other, after the course of about an inch within the cranium, unite at an acute angle near the posterior edge of the *pons Varolii*, or upon it, forming the *basilar artery*. This passes along the middle of the under surface of the pons, and divides near its anterior edge into four principal arteries, viz. the *two superior arteries of the cerebellum*, and the *two posterior arteries of the cerebrum*.

The *vertebral* gives off before entering the cranium:

1. *Branches* to the deep muscles of the neck, some that pass through the vertebral foramina, and are distributed to the membranes of the spinal marrow, and others (and these the larger) at the upper part of the neck distributed to the trachelo-mastoideus, transversalis colli, and to the recti and obliqui capitis.

After entering the cranium it gives off:

2. *Posterior artery of the spinal marrow*, a branch of small size, that passes to the posterior surface of the spinal marrow and descends on each side along the groove of the medulla to its inferior extremity. It is extremely tortuous in its course, and during the whole of its descent is joined and augmented by branches of the vertebral, cervical, and intercostal arteries, which pass through the vertebral foramina.

3. *Inferior artery of the cerebellum*, which arises from the outer side of the vertebral, and is frequently double on one or both sides. Sometimes, one or both arise from the basilary. It passes backwards and outwards between the cerebellum and medulla oblongata, distributes branches to the choroid plexus of the fourth ventricle, ascends between the lobes of the cerebellum, and furnishes branches which ramify on its pia-matral covering.

4. *Anterior artery of the spinal marrow.*—It comes off near the junction of the vertebral arteries, descends and unites with its fellow, forming a branch which takes its course along the anterior groove of the spinal marrow. It divides, subdivides, and anastomoses frequently during its course, forming communications with branches of the vertebral and other arteries.

Basilary artery.—Vide circulation of the brain: part iv.

The other *superior* branches given off from the *subclavian artery* are as follows:

Inferior thyroideal artery.—It arises farther out than the vertebral, and is a branch of considerable, but varying, size ; and the branches into which it divides are not constant. Sometimes, the ascending, the *supra-scapular*, the *superficial*, and the *deep cervical* branches, are given off from this artery, or arise from a common trunk. Occasionally it sends off the *internal mammary*. It passes upwards, and bends inwards behind the common carotid, seldom before it, to the *thyroid gland ;* then divides into a number of branches, which penetrate the under part of the gland, and anastomose with branches of the opposite inferior thyroideal, and of the superior thyroideal on the same side. It distributes branches to the longus colli, some that pass through the *vertebral foramina*, and others that pass to the *air-tube* and *œsophagus*. The continuation of the trunk to the thyroid gland is distinguished by the name of the *thyroideal branch*. Sometimes, there is a separate branch to the thyroid gland, from the *common carotid*, from the *unnamed trunk*, or from the *aorta*, the last of which passes over the forepart of the trachea, and would, therefore, be in danger in the operation of tracheotomy

Supra-scapular artery.—It takes its course transversely outwards, *behind*, and a little *above* the *clavicle*, generally *before*, but sometimes *behind* the scalenus anticus, distributing branches to the muscles of the inferior *hyoideal* region, and to the neighbouring muscles. It is continued to the *superior costa* of the scapula, passes through the *notch* upon the dorsum of the bone, then takes its course between the spine and glenoid cavity to the *fossa infra-spinata*, and anastomoses by one or more branches with the dorsal branch of the infra scapular. It furnishes branches to the spinati muscles, to the adjacent muscles of the shoulder, and to the shoulder-joint.

Ascending cervical artery.—It ascends along the transverse processes of the cervical vertebræ between the longus colli and scalenus anticus. It distributes branches to the muscles, which are attached to the cervical vertebræ, and to those of the back of the neck : at the upper part of the neck it bends backwards, furnishing branches to the muscles under the occiput, and anastomoses with branches of the vertebral and occiptal arteries.

Superficial servical artery.—It is commonly larger than the former, passes nearly transversely outwards, bends backwards, and commonly divides into two branches near the *superior costa* of the *scapula*, one of which passes upwards and the other downwards. It supplies branches to muscles situated at the back part of the neck, shoulder, and chest; and communicates with branches of the occipital and vertebral.

DEEP CERVICAL ARTERY.—Arises generally farther out than the last, and after the sub clavian has passed between the scaleni muscles; it then bends upwards and outwards, is in part concealed in its course by the nerves which form the *axillary plexus*, and divides into branches principally distributed to the *deep seated muscles* at the back of the neck, often furnishing a branch which passes in the direction of the base of the scapula. It sends, likewise, small branches through the *vertebral foramina*, and others which communicate with branches of the vertebral and occipital arteries.

The *inferior* branches are :—

INTERNAL MAMMARY ARTERY.—It comes off from the subclavian artery, nearly opposite to the inferior thyroideal branch, then descends nearly straight, within the chest, behind the cartilages of the ribs, near the edge of the sternum and between the intercostales interni and sterno costalis; nearly opposite to the sixth or seventh rib, it divides into two branches, called *epigastric*, from their inosculating with the artery of that name. It furnishes in its course various branches :

1. *Thymic*, which are distributed to the thymus gland.

2. *Pericardiac*, which are distributed to the pericardium.

3. *Mediastinal*, which are distributed to the mediastinum.

4. *A branch* accompanying the phrenic nerve which is distributed principally to the diaphragm.

5. *Intercostal*, which pass outwards in the spaces between the true ribs, to which commonly they correspond in number, and after distributing branches to the intercostal muscles, anastomose with the aortic intercostals. Others pass between the ribs to the exterior of the chest, distributed to the soft parts, and to the muscles of the abdomen.

6. *Phrenic branch*, which divides into branches to the diaphragm and abdominal muscles.

7. *Epigastric branches*, which assist in the supply of the parietes of the abdomen and anastomose with branches of the epigastric branch of the external iliac artery.

SUPERIOR INTERCOSTAL ARTERY.—It arises more outwards, and from the back part of the subclavian; and is a branch of small, but variable size. It passes down over the neck of the first rib, sends branches to the deep muscles of the neck, some of which pass to the spinal marrow through the holes for the nerves, and then divides into two or three branches, which are distributed to the two or three uppermost intercostal spaces.

AXILLARY ARTERY.

The *axillary artery*, which is the continuation of the *subclavian*, passes outwards and downwards, to the lower edge of the tendon of the latissimus dorsi, and there changes its name to that of the *brachial* or *humeral artery*.

The artery gets the name of *axillary* where it lies in the armpit, or *axilla*. It is seen coming from under the clavicle, and from under the arch formed by the pectoralis minor, passing over the middle of the *first* rib, and between the anterior and middle scaleni muscles. It lies in the hollow of the axilla which, is filled with fat and glands, protected by the deep borders of the pectoral muscle before, and of the latissimus dorsi behind, enclosed within the meshes of the *axilliary plexus of nerves*, and surrounded by the *veins* of the arm, which twine round it.

The branches usually given off by the axillary artery, are the *external thoracic*, the *infra-scapular*, and the *circumflex*, of the upper arm. These branches present numerous varieties in number, size, and origin; chiefly in consequence of two or more arising from a common trunk. Occasionally, the *supra scapular* takes its origin high up from the *axillary*.

The EXTERNAL THORACIC, or MAMMARY ARTERIES, are commonly three or four in number, viz.

SUPERIOR THORACIC ARTERY.—It arises commonly nearly opposite the second rib, and takes its course downwards and forwards upon the exterior of the chest. Sometimes, there are two instead of one. It is distributed to the intercostales interni, pectoralis minor, subscapularis, serratus magnus, to the axillary glands, and skin.

Humeral thoracic artery.—It arises near the beginning of the axillary artery. Sometimes, there are two branches instead of one. It divides almost immediately into branches distributed to the *pectorales*, to the *deltoid*, to the *muscles* about the shoulder, and to the *shoulder joint*. One branch most commonly takes its course along the edge of the deltoid, between it and the pectoralis major.

Long Thoracic artery.—It frequently arises from the infra-scapular. It passes forwards upon the chest, and supplies branches to the serratus magnus, pectoralis major, to the integuments, and, in the female, to the mamma.

Alar, or axillary thoracic artery.—This is sometimes a separate branch, detached near to the humeral thoracic, and assisting in the supply of the axillary glands, pectoralis, serratus, and subscapularis muscles. The external thoracic branches anastomose with branches of the intercostal arteries.

Infra-scapular, or external scapular artery.—This is, in general, the largest branch from the axillary artery. It arises, commonly, concealed by the axillary plexus, opposite to the lower edge of the subscapularis muscle, along which it takes its course, but soon divides into an *internal*, and a *dorsal* branch.

1. *The internal scapular branch*, contitnues in the course of the trunk, along the under edge of the subscapularis, then passes upon the side of the chest directed downwards and backwards, supplying branches to the subscapularis, teres major, latissimus dorsi, serratus major, and to the axillary glands.

2. *The inferior dorsal branch of the scapula*, gives off branches to the subscapularis, and to the teres major and minor; then passes round the neck of the scapula between the subscapularis, and teres mojor, to the dorsum of the bone, upon which, it gives off many branches to the infra-spinatus. The artery is then continued to the root of the acromion, where it anastomoses with the superior dorsal branch of the scapula, and thus a passage for the blood is preserved, under the obstruction of the trunk of the subclavian and axillary arteries, between the origin of the superior dorsal, and infra-scapular branches.

There are *two circumflex arteries* of the arm—an *anterior*, and a *posterior*.

The ANTERIOR CIRCUMFLEX ARTERY is smaller than the posterior. It arises just above the edge of the tendon of the latissimus dorsi, and then passes outwards round the os humeri, between it and the common origin of the coraco-brachialis, and biceps, just below the head of the bone. It sends branches upwards to the *shoulder-joint* and parts adjacent, some of which anastomose with the dorsal branches of the scapula; it is then continued under the deltoid muscle, supplying it with branches, by which it terminates, and which anastomose with branches of the posterior circumflex artery.

POSTERIOR CIRCUMFLEX ARTERY.—This is the larger of the two. It arises frequently from the infra scapular, or from a trunk in common with the profunda humeri, and occasionally in common with the anterior circumflex artery. It passes backwards between the subscapularis, and teres major, then round the os humeri, below its head, between the bone and the long head of the triceps, and is continued to the inner surface of the deltoid muscle. In its course, it distributes branches to the long head of the *triceps*, to the *shoulder joint teres minor*, &c. and terminates by dividing into branches to the deltoid, some of which anastomose with branches of the anterior circumflex, infra-scapular, and dorsal scapular branches.

BRACHIAL ARTERY.

The *brachial artery* passes from the axilla to below the bend of the elbow, where it terminates by dividing into the *radial*, and *ulnar arteries*. During the greater part of its course, it is situated to the inner side of the arm. As it descends it is placed more superficially, and anteriorly; at the bend of the elbow, it is opposite to the middle of the articulation.

Anteriorly, it has first the edge of the coraco-brachialis, which more or less covers it. In the greater part of the rest of its course, it corresponds to, and is near the inner edge of the biceps muscle. At the bend of the elbow, it is covered by the aponeurosis of the biceps muscle, and is crossed by the *basilic median vein*. *Posteriorly*, it has the triceps, from which it is separated by fat and cellular membrane; it passes over the os humeri, and inferiorly, is continued down upon the brachialis internus. *To the inner side,* it is immediately adjacent to the *brachial vein,* and *median nerve,* which latter is placed rather anteriorly; it is separated from the skin by fat and cellular membrane. *To the outer side,* it has the coraco-brachialis, which separates it from the os humeri: as it descends it corresponds to the biceps, and, near its termination, to the tendon of that muscle.

It generally gives off two deep branches, and two others chiefly distributed to the neighbouring muscles.

1. Deep humeral artery.—Arises commonly near the edge of the tendon of the latissimus dorsi; passes then outwards and downwards, accompanied by the *spiral nerve,* between the heads of the triceps, and behind the os humeri. It supplies numerous branches to the heads of the *triceps* in its course, and commonly furnishes the *nutritious artery* of the os humeri, which, where this is not the case, arises from the brachial itself. Its divisions anastomose with branches of the *scapular* and *circumflex arteries.* It gives off the following branch.

a. The *communicating radial,* which passes from behind the os humeri, and is continued, on its outer side, as far as the outer condyle, furnishing branches to the *biceps* and *brachialis internus,* and anastomosing with the *recurrent radial branch* of the *radial artery.*

2. Inferior deep humeral artery.—Comes off lower than the former. It is sometimes a branch of the profunda superior, and is then called the *communicating ulnar.* It descends upon the triceps, on the inner side of the arm, distributing branches to it, and anastomoses below with the *recurrent ulnar branch* of the *ulnar artery,* and *recurrent interosseal branch.*

3. Muscular branches.—These are variable in size and numbers, are given off in the course of the brachial artery, and are distributed to the *biceps, coraco-brachialis,* and *brachialis internus.*

4. Anastomotic branch.—It arises about two inches above the elbow, passes inwards over the brachialis internus, furnishing branches both to it, and to parts about the *elbow joint;* it inosculates, behind the inner condyle, with the *re-*

current ulnar, and thus communicates with the other anastomosing branches.

The place, at which the *brachial artery* divides into *radial* and *ulnar arteries*, has been already described as just below the bend of the elbow, upon the tendon of the brachialis internus. Sometimes, though rarely, the division takes place lower down. But it frequently takes place higher up, at any point between the usual place of division, and the axilla In this latter case, the *radial* takes its course superficially ; and the *ulnar* sometimes passes in the situation of the brachial artery, but sometimes superficially, being continued over the heads of the flexor muscles, between the fascia and skin. Sometimes the common *interosseous artery* is given off in the upper arm. Another variety is, that sometimes one or more considerable additional branches are given off from the upper part of the *brachial*, and after descending superficially, terminate in the lower part of the *brachial*, or more commonly in one of the arteries of the fore-arm, especially the *radial*. These varieties are found on one or both sides, more commonly on both ; they are important with respect to surgical practice, as, in the greater number of instances above cited, they would be more exposed to injury, but would at the same time allow a more ready passage for the blood when its course through the principal trunk had been obstructed, while they would also be the source of difficulty in the operation.

RADIAL ARTERY.

The *radial artery* is commonly smaller than the *ulnar*, but is continued more in the direction of the *brachial*, and is situated more superficially. It passes down in the course of the radius as far as the wrist. During its passage through the fore-arm, it corresponds *posteriorly* to the radius, but is separated from it above by fat, cellular membrane and the supinator radii brevis, and lower by the pronator teres ; it is then situated on the flexor pollicis longus, and below, upon the pronator quadratus, and on the radius itself. On the *inner side*, is placed the pronator teres, flexor sublimis, and flexor carpi radialis. On the *outer side*, it has the supinator radii longus, and is accompanied in part of its course by the superficial branch of the *spiral nerve*. *Anteriorly*, it is covered by the skin and aponeurosis of the forearm, from which, however, it is separated *above*, by fat and cellular membrane, and *below*, by the projection of the flexor carpi radialis, and supinator longus at the sides; but where these muscles become tendinous the artery is immediately beneath the integuments, so that its pulsations can be readily felt. *At the wrist*, it bends backwards, commonly between the trapezium, and the tendons of the extensor ossis metacarpi, and extensor primi internodii pollicis, or sometimes higher, to the space between the metacarpal bones of the thumb and fore-finger. It is continued through the abductor indicis into the palm of the hand where it terminates by forming the *deep seated palmar arch*.

It gives off the following branches :—

1. RECURRENT RADIAL ARTERY.—It comes off usually near the beginning of the *radial*, and is a branch of considerable size. It passes up on the inside of the supinator radii longus, then between it and the extensor carpi radialis longior, and near the olecranon inosculates with the *communicating radial branch* of the deep humeral. It furnishes branches, in its course, to the *supinatores, extensores radiales brachialis internus*, and to the *elbow-joint*.

2. MUSCULAR BRANCHES.—The *radial*, in its course, gives off numerous branches, mostly of small size, to the *pronator teres, flexor carpi radialis, flexor sublimis, flexor longus pollicis, pronator quadratus*, and to the *wrist joint*.

3. SUPERFICIAL PALMAR ARTERY.—This is a branch of variable size, which comes off near the wrist and passes down superficially, close to the tendon of the palmaris longus, to the palm of the hand. When small, or sometimes even when of considerable size, it is entirely expended on the muscles which form the ball of the thumb. When of large size, it commonly joins with the *ulnar* in forming the *superficial palmar arch*; in which case, sometimes, besides the branches to the muscles of the thumb, it sends a branch along its outer side, occasionally a branch along its inner side, and furnishes the radial brunch of the forefinger. In some cases, the superficial branch arises high up and takes the course of the *radial artery*, but more superficially, so that its pulsation might be mistaken for that of the radial artery.

4. Small branches.—Distributed to the ligaments, and other parts about the wrist.

5. Dorsal branches.—Variable in size, and number, to the back part of the *carpus, metacarpus,* to the *interossei muscles*, and to the back part of the *thumb* and *forefinger.*

In the *palm of the hand,* the *radial artery* passes inwards, is called the *deep palmar branch*, forming the *deep seated palmar arch*, and joins with the deep branch of the *ulnar artery.* It furnishes also, the

6. Large artery of the thumb.—This is usually given off on the metacarpal bone of the forefinger, takes its course on the inner side of the metacarpal bone of the thumb, and either divides into two branches, one of which passes along the outer and the other along the inner side of the thumb to its extremity, or furnishes only one of these branches, the other being supplied either from the superficial or deep palmar arch.

7. Radial branch of the forefinger.—Passes along the outer side of the forefinger to its extremity.

ULNAR ARTERY.

The *ulnar artery* is usually a more considerable artery than the radial, and is deeper seated in its course. As it descends, it bends inwards and takes its course in the direction of the ulna, is then continued into the palm of the hand, and terminates by forming the *superficial palmar arch.*

Anteriorly, it is at first covered by the pronator teres, palmaris longus, flexor carpi radialis, and flexor sublimis, but lower is more superficial, being separated only from the aponeurosis and skin by the projection of the flexor sublimis and flexor carpi ulnaris at the sides. *Posteriorly*, it is placed on the flexor profondus. *On the inner side*, it has the flexor carpi ulnaris, and is accompanied by the ulnar nerve. *On the outer side*, it has the flexor sublimis. *At the wrist* it has behind it the ligamentum carpi annulare, a small slip of which usually passes before it: and, on the inner side, the os pisiforme. In the *palm of the hand* it has behind it the tendons of the flexors of the fingers, and is only covered by the aponeurosis and skin.

Its branches are the following:

1. Recurrent ulnar artery.—This is a branch of con-

siderable size. It is commonly the first, but a smaller muscular branch is sometimes given off before it. It passes upwards between the sublimis and profundus, and through the flexor carpi ulnaris, furnishing branches to these muscles, as far as the hollow between the inner condyle, and olecranon; and inosculates with the *lesser deep*, and with the *anastomosing branch* of the *brachial artery*. It is sometimes, in the case of a high division, a branch of the interosseal artery.

2 Interosseal artery.—This is also a branch of considerable size. It is sometimes a branch of the *humeral artery*, and, in a high division, is usually given off by the *radial*. It furnishes one or two branches to the adjacent muscles, and then divides into two nearly equal branches, that occasionally come off separately, forming the *anterior*, and *posterior interosseal branches*.

a. *Posterior interosseal.*—Passes backwards above the interosseous ligament. It then gives off the *recurrent interosseal artery*, which passes upward between the radius and ulna, and inosculates upon the back part of the elbow with the other *anastomosing branches* of the *humeral, radial*, and *ulnar arteries*, forming with these a plexus of vessels at this part. After detaching this branch, the posterior interosseal is continued downwards between the extensors of the thumb and that of the fingers, furnishing branches in its course to these muscles, and reaches as low as the wrist.

b. *Anterior interosseal*.—Is the larger of the two; it takes its course downward upon the anterior surface of the interosseous ligament, and furnishes branches to the *flexor muscles*, some which perforate the interosseous ligament, and supply the *extensors*; it also gives off commonly the *nutritious arteries* of the *radius* and *ulna*. Near the edge of the pronator quadratus it passes through the interosseous ligament, and divides into branches which, upon the back of the carpus and hand, anastomose with branches of the *posterior interosseous* and dorsal branches of the *radial* and *ulnar arteries*, forming with these a plexus, from which branches pass to the back part of the hand and fingers.

3. Muscular.—The *ulnar*, like the *radial artery*, furnishes numerous branches in its course along the forearm to the adjacent muscles, the *flexor carpi ulnaris*, and *flexors of the fingers*.

DORSAL ARTERY.—It comes off near the extremity of the *ulnar*, passes backwards under the tendon of the flexor carpi ulnaris, and, after furnishing branches to the adjacent parts, joins with the branches which form the plexus at the back of the wrist.

DEEP ULNAR ARTERY.—It passes deep into the palm round the flexor of the little finger, is continued outwards, and inosculates with the *radial*, forming the *deep palmar arch*, situated near the bases of the metacarpal bones. It furnishes *interosseal branches*, to the interossei muscles, which anastomose, at the roots of the fingers, with the digital branches of the *superficial arch*, and other branches which pass between the metacarpal bones to the back of the hand.

The *ulnar artery* then passes outwards, over the tendons of the flexor muscles, and forms the *superficial palmar arch*. This is placed with its convex side downwards, and anastomoses frequently with the superficial palmar branch of the *radial*, on the outer side of the hand, or with the large artery of the thumb. It furnishes branches to the fingers, called

DIGITAL ARTERIES which consist of the following :

1. *A branch*, which passes along the inner side of the *little finger*.

2. *Three considerable branches*, which arise in succession, and pass to the interstices between the fingers, where each divides into two branches, one of which passes along the outer or radial side of one finger, and the other passes along the inner or ulnar side of the finger next to it ; so that the *first* supplies the *little* and *ring fingers*, the *second*, the *ring* and *middle fingers*, and the *third*, the *middle* and *forefingers*. There are several varieties in their size, and origin, but not usually in the mode of distribution above indicated. After giving off, in their course, small branches to the fingers, they divide and form an intricate plexus at the tip of each finger.

The superficial arch sometimes supplies the branches to the thumb and forefinger usually given off from the radial artery.

BRANCHES FROM THE THORACIC PORTION OF THE DESCENDING AORTA.

Numerous branches are given off from the *aorta*, in its passage through the chest, but they are so inconsiderable, that the *aorta* is not sensibly diminished in size. These vessels are subject to frequent varieties. They are :—

BRONCHIAL ARTERIES.—These vary considerably in number, and size. The *right upper*, is commonly a branch of the uppermost aortic intercostal ; but sometimes arises immediately from the *aorta*. The *left*, arises about an inch below the arch of the *aorta* ; it is the larger of the two, and usually sends a branch to the *right bronchus*. There are sometimes *one* or *two inferior*. Occasionally, there is only one bronchial artery. The *bronchial arteries* give off branches to the *œsophagus*, the *mediastinum*, and *pericardium* ; and accompany the *bronchi* into the lungs.

ŒSOPHAGEAL ARTERIES.—These are small branches variable in size and number, distributed to the *œsophagus*, and adjacent parts.

MEDIASTINAL ARTERIES.—These are small branches distributed to the *œsophagus*, to the *mediastinum*, and to the *aorta* itself.

INTERCOSTAL ARTERIES.—They supply chiefly the intercostal spaces, but do not correspond to these in number, in consequence of the uppermost space, or spaces, being supplied by the *intercostal branch* of the *subclavian artery* ; and, in consequence of two sometimes, especially the uppermost, arising by a common trunk, they commonly consist of *eight pairs*. They arise from the back part of the *aorta*, at a more or less acute angle, the angle becoming more obtuse inferiorly. They pass upwards, round the bodies of the vertebræ to the corresponding *intercostal spaces* ; the right arteries, from the position of the *aorta*, having the longer course. Near the *head of each rib*, they send a branch backwards, which divides into branches to the *muscles* lying near the spine, to the *spinal marrow*, through the holes for the nerves, and to the *muscles* on the exterior of the chest. They are then continued forwards, in the grooves, at the under edges of the ribs, between the two layers of intercostal muscles, to which they furnish branches ; supplying also, the *muscles* on the *exterior of the chest*, *abdominal muscles*, *the pleura*, and the *diaphragm*, and form communications with the *intercostal branches* of the *internal mammary*, and with branches of the *epigastric*, and *external thoracic arteries*. The last is, excepting the first, the largest ; it passes behind the crura of the diaphragm, and divides upon the *quadratus lumborum* into branches to this muscle, and to the *abdominal parietes* : these branches descend as far as the spine of the ilium, and have several communications with the *lumbar* and *circumflex arteries*.

BRANCHES FROM THE ABDOMINAL PORTION OF THE AORTA.

The branches given off from the *aorta*, during its passage through the abdomen, are much more considerable than those which arise from it in the chest. They may be divided into those which arise *singly*, and those which arise in *pairs*.

Of those which arise *singly*, there are *three* considerable arteries, usually called the three *azygous branches* of the *abdominal aorta*, and known as the *cœliac*, the *superior mesenteric*, and the *inferior mesenteric*. They are distributed entirely to the *chylopoietic viscera*.

CŒLIAC.

The *cœliac* artery arises from the *aorta*, as soon as it has passed into the abdomen, between the crura of the diaphragm, and is placed near the upper edge of the pancreas. It forms a short trunk which soon divides into three branches —the *coronary artery of the stomach*, the *hepatic*, and the *splenic*.

Coronary artery of the stomach.—This is usually the smallest of the three. It frequently arises in common with one or both cœliac arteries. It takes its course, upwards and to the left, to the *cardiac* extremity of the stomach, giving off several branches to the *œsophagus*, *cardia*, and to the *adjacent parts* of the stomach. It is then continued, along the smaller *curvature* of the stomach towards the *pylorus*, furnishing considerable branches in its course, which descend upon the *anterior* and *posterior surfaces* of the stomach, for the supply of its coats, and sending small branches to the *omentum minus*. The *coronary*, frequently gives origin to the *left hepatic* branch.

Hepatic artery.—It is larger than the former. It sometimes arises from the *aorta*, or, in more rare instances, from the *superior mesenteric* ; sometimes, it arises by two branches, one of which only is from the coronary, or superior mesenteric. It takes its course to the right, then, upwards and forwards, passes through *Glisson's capsule* to the *porta* of the liver, a little below which, it divides into a *right* and *left hepatic branch*. Before its division it gives off the following:

1. *Right inferior gastric artery.*—It passes downwards and to the left between the *duodenum*, the *pylorus*, and the *pancreas*, to the *greater curvature* of the stomach, along which it is continued between the layers of the omentum to the left, and anastomoses with the left inferior gastric branch of the splenic. It furnishes the following branches:—

a. Duodenal.—Consisting of one or two branches distributed to the duodenum and pylorus.

b. Pancreatic.—Distributed to the right extremity of the pancreas.

c. Epiploic.—Long, but slender branches, which descend between the layers of the omentum.

d. Gastric.—Branches, which ascend upon the surfaces of the stomach and are distributed to its coats.

2. *Pyloric artery.*—Sometimes given off before the inferior gastric branch, or from that vessel. It descends upon the *pylorus*, furnishes branches to it and to the adjacent parts, and anastomoses with the coronary, upon the less curvature of the stomach.

The hepatic artery then divides into two branches.

1. *Right hepatic artery.*—It is larger than the left, supplies the *right lobe* of the liver, and furnishes the

a. Cystic branch.—It passes upon the gall-bladder, frequently dividing into two branches, and is distributed to its coats.

2. *Left hepatic artery.*—Supplies the *left lobe* of the liver.

Splenic artery—It is commonly the largest of the branches from the *cœliac*, and takes its course to the left behind the stomach, and along the upper edge of the pancreas, as far as the fissure of the spleen, opposite to which it divides into several large branches, which are distributed to the substance of the spleen. It furnishes in its course, the following:—

1. *Pancreatic branches.*—Several in number,

which descend inclined to the left upon the pancreas, and send branches into its substance.

2. *Short gastric arteries* :—Five or six in number, given off where the artery divides, which are distributed upon the left extremity of the stomach, and form numerous communications with the coronary and right gastric branches.

3. *Left inferior gastric artery.*—It arises from the same part as the last, but is of larger size. It takes its course along the greater curvature of the stomach, furnishing branches to the coats of the stomach and to the omentum, and anastomoses with the right inferior gastric branch.

SUPERIOR MESENTERIC ARTERY.

It is generally larger than the *cæliac.* It arises from the *aorta*, immediately below the *cæliac*, and sometimes by a trunk in common with it. It is first concealed by the pancreas, behind which it descends, then passes over the duodenum, and takes its course between the layers of the mesentery, downwards and to the left, forming a bend, of which the concavity is upwards and to the right, and the convexity downwards and to the left, and, gradually diminishing in size, terminates in the right lumbar region. Its first branches are small, distributed to the *pancreas* and *duodenum*, and communicate with branches of the *hepatic*. The principal branches are for the supply of the *small* and *large intestines.*

Branches to the small intestines.—They arise from the convexity of the bend, and are ten, or eleven, in number ; those which are towards the middle, being the longer. But in size, they all decrease from above to below. They take their course between the layers of the mesentery, furnishing small branches both to these and to its glands. They then ramify, and the branches, by uniting, form arches, the convexity of which is towards the intestines. From these again, branches proceed, which unite and form similar smaller arches, and these again detach numerous yet smaller branches, which likewise freely communicate with each other ; so that the distribution of these vessels has the appearance of a net work. From the arches nearest the intestines, numerous small branches pass in a straight direction to the anterior and posterior surfaces of the intestines, and are distributed to their coats, in which they freely anastomose with each other.

From the *concavity of the bend*, arise the arteries which supply the *large intestines*. They are two or three in number, are called the *colic arteries*, and are distinguished as follows :—

1. *Ilio-colic branch.*—It arises the lowest, and passes downwards, and to the right. It detaches a branch which forms, in part, a communication with that portion of the superior mesenteric that supplies the ilium, and is, in part, distributed to the appendix cœci. It then divides into two branches, one of which descending, supplies the *cœcum* and adjacent parts of the *ilium* ; the other ascending in the course of the *ascending colon*, distributes branches to its coats.

2. *Right colic branch.*—This is the smallest of the three branches and frequently arises by a trunk in common with the middle colic, and sometimes in common with the ilio colic. It soon divides into two branches, one of which ascends to join with a similar branch of the middle colic, and the other, the larger, descends to join with the ascending branch of the ilio-colic. Both distribute branches to the *colon*.

3. *Middle colic branch.*—It arises a few inches from the origin of the trunk of the superior mesenteric, passes towards the middle of the arch of the colon, and divides into two branches, one of which passes to the right, and joins with the ascending branch of the right colic, and the other larger one is continued to the left, and joins with a similar branch of the ascending branch of the inferior mesentric. Both give off branches to the upper part of the ascending and right portion of the arch of the colon.

INFERIOR MESENTERIC ARTERY.

It arises commonly about an inch above the bifurcation of the aorta. It takes its course obliquely downwards and to the left, and divides into branches to the left portion of the *colon* and to the *rectum*.

1. *Left superior colic artery.*—Ascends in the course of the descending colon, and divides into two branches, one of which joins with the left branch of the middle colic, and the other with the ascending branch of the

left inferior colic. Both send branches to the arch of the colon, and its descending portion.

2. *Left inferior colic artery.*—It divides like the former into two branches, one of which joins with the descending branch of the left superior colic, and the other with a branch of the internal hæmorrhoidal. They supply the descending colon and its sigmoid flexure. There is some times a third left colic.

3. *Internal hæmorrhoidal artery.*—This is the continuation of the trunk. It sends off a branch to the left to join (as has been already indicated) with a branch of the left inferior colic, and then descends upon the back part of the rectum, dividing into numerous branches, distributed to its coats, which freely communicate, and anastomose with the other branches distributed to this gut.

The *branches*, which arise *in pairs* from the *aorta*, are the *diaphragmatic*, *renal*, *spermatic*, and *lumbar*.

DIAPHRAGMATIC ARTERIES.

They arise separately, or by a common trunk, from the *aorta*, as soon as it enters the abdomen, often, and, according to some, most frequently from the cœliac. They pass upwards, and outwards, over the crura of the diaphragm, furnishing branches to the crura, and glandulæ renales; and then spread into branches upon the under surface of the *greater muscle*, the middle of which they principally supply, anastomosing with the other branches distributed to the diaphragm.

RENAL ARTERIES.

These are also called *emulgent arteries*, and are branches of large size. They arise from the side of the *aorta*, usually nearly opposite to each other, just below the origin of the *superior mesenteric*. They pass outwards and a little downwards, over the bodies of the first and second lumbar vertebræ to the *sinus of the kidney*, opposite to which they divide into *three* or *four branches*, which again subdivide, pass into the substance of the *kidney*, and ramify in the *cortical part*. They vary frequently in size, and in number, from one, to four, on one or both sides, according to the size and situation of the kidney. The *right*, from the situation of the aorta, is the *longer* of the two, and passes commonly *behind* the *vena cava inferior*. They furnish branches to the *ureter*, and frequently a larger branch to the *renal gland*, which, besides supplying the renal gland or capsule, furnishes branches to the crus of the diaphragm and lumbar glands.

SPERMATIC ARTERIES.

They are of small size, but occasionally, have a double origin. They arise from the fore part of the *aorta*, and a little below the *renal arteries*, but often lower, and generally not opposite to each other. Occasionally, one arises from the renal, and very rarely from any other artery. They take their course outwards and downwards on the psoæ muscles, *behind* the peritoneum and *before* the ureters; the *right* passing *before* the *vena cava inferior*. In the *female*, they are shorter than in the male, pass between the layers of the broad ligaments, and are distributed to the *ovaria*, to the *Fallopian tubes*, and the upper part of the *uterus*, upon which they anastomose with the other uterine arteries. In the male they are continued to the *inguinal canal*, where they assist in forming the *spermatic cord*, and in it, pass and are distributed to the *testicle*. They furnish branches in their course to the ureters and adjacent parts.

LUMBAR ARTERIES.

Those from the *aorta* are commonly *four* in number on each side, the *fifth* being usually supplied from the *iliac*, or from the middle *sacral artery*. Sometimes, there are only three, in consequence of the lowermost arising by a common trunk. They come off more from the back part of the *aorta*; then, take their course backward, round the bodies of the lumbar vertebræ, as far as the roots of the transverse processes under the psoœ muscles, to which, as well as to the quadrati, they furnish branches. At the roots of the transverse processes each sends a branch backwards, distributed to the *muscles* lying near the spine, and to the *spinal marrow*, by twigs passing through the *foramina* for the nerves. They are then continued forwards, to supply the *abdominal muscles*, and form communications with branches of the *epigastic artery*.

BRANCHES FROM THE TERMINATION OF THE AORTA.

The *aorta* commonly terminates upon the fourth, or between the fourth, and fifth lumbar vertebræ, by dividing into *two* large, constant, and corresponding branches called the *common iliac arteries ;* and a third small *azygous* and not constant branch, called the *middle sacral.* These branches supply the lower part of the *trunk* and the *lower extremities.*

MIDDLE SACRAL ARTERY.

This is a small branch, which arises from the back part of the aorta at its *bifurcation* ; but is sometimes a branch of the common iliac. It desends, over the body of the last lumbar vertebra, thence, along the middle of the *sacrum,* and *os coccygis,* and is lost upon the adjacent parts and back part of the rectum. In its course, it gives off commonly a branch on each side to form the *fifth lumbar arteries* ; it next detaches, on each false vertebra, commonly a pair of branches, which pass outwards, are distributed to the sacrum, sending branches through the sacral foramina, to the spinal canal, and form communications with the lateral sacral arteries.

COMMON ILIAC ARTERY.

The *common iliac arteries* come off at an acute angle, and are continued outwards and downwards, over the last lumbar vertebra. The *right,* passes commonly, before the *left common iliac vein,* the *left,* before and to the *outer side* of the same vein. About opposite to the *sacro-iliac symphysis,* they each terminate by dividing into the *internal,* and *external iliac arteries.* The *right* is commonly a little *longer* than the *left.* In their course, they furnish only small branches to the adjacent parts.

INTERNAL ILIAC ARTERY.

The *internal iliac artery* passes downwards, into the cavity of the pelvis, and soon divides into several branches of various sizes. These vary considerably in their mode of origin, sometimes coming off immediately from the trunk, and sometimes, by trunks common to two or more. They supply the contents, and parietes of the pelvis, and muscles attached to it, and are as follows :—

ILIO-LUMBAR ARTERY.—Commonly the first branch. It passes transversely outwards under the psoas muscle, and near the sacro-iliac symphysis, and usually divides into two branches ; one of which takes its course upwards, and anastomoses with the last lumbar, or takes its plase, and furnishes branches which pass through the last vertebral foramen; the other, is distributed to the *psoas*, *iliacus*, and to the *ilium*, and communicates with branches of the *lumbar* and *circumflex arteries*.

Lateral sacral artery.—This generally consists of *two* or *three branches*, sometimes furnished by the ilio-lumbar, or gluteal arteries, or sometimes formed by a single artery, which then divides into these branches. The lateral sacral arteries furnish *anterior* branches, which pass across the sacrum, distributing branches to it, and inosculate with branches of the middle sacral; and *posterior* branches, which enter the *anterior sacral foramina*, distribute branches, to the *cauda equina*, and send branches through the *posterior foramina*, to be distributed to the under part of the *muscles of the back*.

Obturator artery.—This vessel varies considerably with respect to its origin; most commonly, it arises directly from the trunk of the *internal iliac*, or in common with the *ilio-lumbar*, but frequently from the *external iliac* by a trunk of variable length, in common with the *epigastric* branch of the *external iliac*; occasionally from the *external iliac* itself, and still more rarely, from the *femoral*. When it arises with the *epigastric*, it passes downwards over the body of the *os pubis* If it be a branch of the *internal iliac*, it takes its course forwards, immediately under the *brim of the pelvis*, to the *obturator foramen*. It is continued through the upper part of the ligamentous expansion, which fills up that opening, to the upper and inner part of the thigh. In its passage through the pelvis, it furnishes branches to the *levator ani*, and *obturator internus muscle*, and to the pelvic glands. It divides near the obturator foramen, usually into two branches one of which distributes twigs to the *hip-joint*, and adjacent muscles, and the other furnishes branches to the *obturator externus*, and muscles at the inner and upper part of the thigh, and anastomoses with the internal *circumflex artery*.

Gluteal artery.—It sometimes arises by a trunk in common with the ischiatic. It sends off, in some instance, the *lateral scaral*, the *obturator*, and other branches, usually given off from the *internal iliac*. It passes downwards, and outwards, through the upper part of the *notch of the ilium*, furnishing branches to the *iliacus*, and *pyriformis muscles*, then bends round the edge of the bone, is directed upwards, and divides into two principal branches, the *superficial*, and the *deep*. The *superficial* passes forwards between the *gluteus maximus*, and *medius*, furnishing branches to both, to the *pyriformis*, and to the back part of the *sacrum*, which anastomose with branches of the *lateral sacral*. The *deep* passes under the *gluteus medius*, is distributed to the two *lesser glutei*, and to parts about the *hip-joint*, and communicates with branches of the *ischiatic*, and *sacral arteries*. Some extend as far as the forepart of the thigh, and anastomose with branches of the *femoral*.

ISCHIATIC ARTERY.—Frequently arises by a trunk, in common with the *internal pudic* artery, or with the *gluteal*. It descends, inclined forwards, from the gluteal artery, passes out of the pelvis, below the *pyriformis* muscle, and is continued in the hollow between the tuberosity of the *ischium*, and *trochanter major*. Whilst within the pelvis, it detaches branches to the *pyriformis*, *obturator internus*, and *levator ani* muscles. Exterior to the pelvis, it sends numerous branches to the *gluteus maximus*, to parts about the *os coccygis*, to parts situated about the back part of the *hip-joint*, and at the upper and back part of the thigh; and these branches communicate with the *circumflex arteries*.

PUDIC ARTERY.—It descends within the pelvis, immediately before the *ischiatic artery*, and passes out of the pelvis, with it, before the *pyriformis muscle*. It then, takes its course forwards between the *sacro-sciatic ligaments*, and *re-enters* the pelvis. It is continued along the *ischium*, in the hollow above the tuberosity of that bone, and ascends on the *inner side* of the *ramus* of the *ischium*, and on that of the *os pubis*, in its course upwards, advancing and becoming more superficial, to the under part of the *symphysis pubis*, where it terminates by dividing into branches, distributed to the *organs of generation*. This is the usual course, but in some instances in the male, it pasees forwards at the under and lateral part of the bladder to the ischium. It furnishes the following branches:

1. *Branches* within the pelvis, to the *bladder*, to the *vesiculæ. seminales*, and *prostate gland*, and, in the female, to the *vagina*.

2. *Branches* to the muscles and parts adjacent to the sacro-sciatic ligaments, and hip-joint.

3. *External hæmorrhoidal artery.*—Consisting of one, sometimes of two branches, distributed to the extremity of the rectum, and to the parts about the anus.

4. *Perinæal artery* —Passes under the transversus perinæi, and is continued forwards between the bulb, and crus of the penis ; it distributes branches to the skin and muscles of the perinæum, and to the scrotum ; and, in the female, to the labia.

5. *Artery of the bulb.*—Passes obliquely across the forepart of the perinæum, along the transversus perinæi muscle ; after furnishing several inconsiderable branches to the adjacent parts, it passes into the bulb, and is distributed within the corpus spongisum.

The trunk of the *pudic* is then continued as the proper artery of the penis in the male, and as the artery of the clitoris in the female ; and, under the symphysis pubis, it, in both sexes, divides into a *superficial* and a *deep* branch.

1. *Superficial artery* —Passes through the suspensory ligament, and takes its course along the dorsum of the penis in a tortuous direction, as far as the glans. It gives off branches to the skin and ligamentous covering of the penis, and passes into the substance behind the glans.

2. *Deep artery.*—Passes into the crus penis, and is continued forward through the corpus cavernosum, dividing in its course into numerous branches, which freely communicate with those of the opposite side.

UMBILICAL ARTERY.—This, in the fœtus, is the continuation of the *internal iliac*, and is an artery of large size. But after birth, it contracts, and remains pervious only as far as the bladder. It passes forwards, at the side and upper part of the bladder, towards the parietes of the abdomen, and, at its beginning, sends off one or two branches to the bladder.

VESICAL ARTERIES.—These consist of one, or more branches, from the *internal iliac, internal pudic*, and *umbilical arteries*, which descend to the under and back part of the bladder, and are distributed to the *bladder*, to the *prostate gland*, and *vesiculæ seminales*, in the male, and to the *vagina*, in the female.

MIDDLE HÆMORRHOIDAL ARTERY.—This is sometims a branch from one of the divisions of the *internal iliac*, and sometimes is wanting altogether. It supplies branches to the fore part of the *rectum*, and forms communications with the hæmorrhoidal branches.

Vaginal artery.—Is not a constant branch, but is frequently supplied from one of the other pelvic arteries. It is distributed to the *vagina* and *bladder*.

Uterine artery.—It takes its course to the upper part of the *vagina*, and detaches one or two branches to the *vagina* and *bladder*, then ascends at the side of the *uterus*, between the layers of the *broad ligament*. It is tortuous in its course. It divides into branches to the *uterus*, some of which pass to its appendages; and it anastomoses with branches of the spermatic artery.

EXTERNAL ILIAC ARTERY.

The *external iliac artery* passes forwards from the internal iliac, takes its course outwards and downwards along the psoæ muscles, accompanied by the corresponding vein, which is situated behind, and to its inner side, and covered by the peritoneum. It passes behind Poupart's ligament, and changes its name to that of *the femoral artery*. After furnishing some unimportant branches, to the *psoas* and *iliacus* muscles, it gives off, near Poupart's ligament, the *epigastric*, and *circumflex arteries*.

Epigastric artery.—It arises, commonly, from the inner side of the *external iliac*, immediately above Poupart's ligament, but sometimes higher. It comes off, not unfrequently, as has been already described, by a trunk in common with the *obturator artery*; occasionally, from the *femoral*, and, in some rare cases, from the *common iliac*, or *deep artery* of the thigh. It first passes a little downwards, then bends upwards, and is directed obliquely inwards, and upwards, towards the back part of the *rectus muscle, crossing the spermatic cord*, or *round ligament*, and is situated to the inner side of the internal abdominal ring. In an *oblique inguinal hernia*, it is situated to the *inner side* of the mouth of the sac, and would, therefore, be endangered by directing an incision, or liberating the stricture, inwards: in a *direct inguinal hernia*, it is placed on the *outer side* of the mouth of the sac, and might, therefore, be divided by carrying an incision outward. In a *femoral hernia*, it is situated *above* and to the *outer side*, so as not to be easily endangered, except where it arises from the femoral artery, in which case it might be wounded by carrying an incision outwards.

Having reached the back part of the rectus muscle, about midway between the *umbilicus* and *pubes*, it then ascends nearly perpendicularly upwards, between the muscle and posterior layer of its sheath ; it divides commonly into two branches, near the umbilicus, detaching branches to the forepart of the abdominal muscles, and terminates above the navel by forming anastomoses with the epigastric branch of the *internal mammary*, and the lower *intercostal arteries*. Near the internal ring it sends off :—

1. *A branch*, which, after detaching a twig to form a communication with the obturator, passes to the spermatic cord, or round ligament, and is distributed upon it.

Circumflex artery of the ilium.—It arises, commonly, nearly opposite to the epigastric, but sometimes a little higher or lower than that artery, from the outer side of the *external iliac*. It bends upwards and outwards, to the spine of the ilium, in the course of which it runs from before to behind, between the transverse, and internal oblique muscles. It furnishes branches, in its course to the *iliacus sartorius*, and broad *abdominal muscles*, and forms communications with the *epigastric*, and *ilio-lumbar arteries*. It sometimes detaches a considerable branch, which takes its course inwards and upwards, and is distributed on the forepart of the abdominal parietes.

FEMORAL ARTERY.

The *femoral artery* passes from behind Poupart's ligament, where it commences, and takes its course downwards on the *anterior*, then, on the *inner* side of the thigh ; and, at the *upper part* of the *lowest third* of the thigh, it passes through the tendon of the adductor magnus, and receives the name of *popliteal artery*.

The portion of this artery, which is opposite Poupart's ligament, is sometimes distinguished by the name of the *inguinal artery*. It passes there, into the sheath formed by the fascia transversalis, and fascia iliaca ; it is situated nearly opposite to the junction of the ilium with the os pubis, upon the inner edge of the psoas muscle, with the accompanying vein on the *inner side*, and the anterior crural nerve on the *outer side*, at a little distance from it, and *exterior* to the sheath in which the *artery* is contained.

As it descends it is first situated superficially. *Anteriorly*, it is first covered by the integuments, aponeurosis, inguinal glands, some fat, and the fascia lata, in the triangular space formed by the crural arch above; by the sartorius on the *outer side*, and the adductor longus, and gracilis muscles, on the *inner side*. As it descends, the sartorius, which is gradually inclined towards it, passes obliquely *over it*, and continues upon it, as far as the tendon of the adductor magnus, so as to cover it during its course through the middle third of the thigh. *Posteriorly*, it is opposite to the head of the os femoris, and passes down upon the under end of the psoas, and iliacus muscles, and then upon the adductor brevis, and adductor magnus muscles, more or less fat and cellular membrane being interposed; but it is close upon the last named muscle below. On the *outer side*, after quitting the psoas, it is applied to the vastus internus muscle, which separates it below from the os femoris. One branch only, of the *anterior crural nerve* accompanies it, namely the *saphenus*, situated at the *outer* and *forepart*, and more or less involved in its sheath. On the *inner side*, it is accompanied by the *femoral vein*, which, as it descends, is inclined *behind* the artery, and is applied to the adductor, towards which it passes in its descent.

In the *uppermost third* of the thigh, it is loosely connected to the surrounding parts. In the *middle third*, it is surrounded by muscles, and more closely connected, and is more or less adjacent to the os femoris, so that it may be readily compressed. At the *groin*, likewise, from its vicinity to the bone, and from its superficial situation, it admits easily of compression, so that, pressure applied about *midway* between the *anterior* and *superior spinous process* of the *ilium*, and the *spinous process* of the *os pubis* will, by obstructing the artery, command any hœmorrhage from the vessels below.

The branches of the femoral are:

External epigastric.—This artery is given off close to Poupart's ligament, and ascends on the forepart of the external oblique, under the skin, and is distributed to the superficial parts.

External pudic artery.—One or two branches which pass inwards under the skin, and are distributed to the skin of the parts of generation, and adjacent parts. There are, besides, usually several small branches to the skin, muscles, and absorbent glands.

Deep artery of the thigh.—This is a branch of large size, which comes off from the inner and back part of the *femoral artery*, usually from *one to two inches* below Poupart's ligament, but occasionally lower, or sometimes higher, and close to it, and in some rare cases above it. It is concealed, at its origin, by the *trunk* of the femoral artery. It takes its course downwards, and backwards, inclined from the femoral artery, passes between the adductor, and vastus internus muscles, and terminates at the back part of the thigh. It gives off the following branches :

1. *Internal circumflex artery.*—It arises commonly higher than the external, and sometimes from the femoral before the deep artery is given off. It takes its course backwards, between the extremity of the psoas, and the pectineus muscles, and bends round the neck of the os femoris. It furnishes branches to the pectinalis, psoas, iliacus, and triceps. It next sends off an ascending branch, which distributes branches to the obturator, and upper part of the triceps muscles, a branch of communication with the *obturator artery*, and a branch which enters the *acetabulum* and supplies the *joint*. The continuation of the internal circumflex, distributes branches to the muscles in the *ischiatic region*, and to the *upper* and *back part* of the thigh, and forms anastomoses with branches of the *gluteal*, *ischiatic*, and *external circumflex arteries* : these anastomosing branches are found much enlarged when the external iliac artery has been tied.

2. *External circumflex artery.*—This branch arises commonly from the outer side of the *deed artery*, nearly opposite the former, but often lower, and more rarely from the *femoral*. It takes its course outwards under the rectus, and over the forepart of the os femoris, and divides into two principal branches : one is continued in the direction of the trunk bends round the trochanter major, furnishes branches to the gluteus medius principally, and adjacent parts, and forms communications with the *internal circumflex*, *gluteal*, and *ischiatic arteries*, which are enlarged after the opera-

tion of tying the *external iliac artery*: the other branch is more considerable; it descends on the posterior surface of the rectus, and divides into branches to the *rectus*, *cruræus*, and *vastus externus muscles*, one of them commonly descending on the *vastus* to the *knee*.

The *profunda*, after detaching the circumflex arteries, passes *through* the *adductor magnus*, and divides into the *rami perforantes*: sometimes, it passes down before that muscle, and gives these branchas off successively, in which case they pass through that muscle to the back of the thigh. There are usually two, but sometimes more, and occasionally as many as five *perforating branches*, distributed chiefly to the muscles at the inner and back part of the thigh.

3. *First perforant artery.*—Passes through the triceps a little below the trochanter minor, and commonly divides into two branches. One of the branches ascends behind the trochanter major, forms communications with the *external circumflex*, and distributes branches to the *gluteus maximus*, which communicate with branches of the gluteal. The other brach bends outwards round the thigh bone, and supplies branches to the *vastus externus* and *biceps muscles*, and to the *bone*.

4. *Second perforant artery.*—Is larger than the former. It passes backwards, and is divided into branches to the *flexors* of the leg principally, and to the *adductor* and *vasti muscles*. The perforating branches are subject to considerable varieties. Their branches freely communicate with each other; the upper, also with branches of the *gluteal*, and *circumflex*, and the lower, with branches of the *popliteal*, and *femoral*; so that these branches are found considerably enlarged when the trunk of the femoral artery has been obstructed.

Muscular branches.—The *femoral artery*, in the rest of its course, after having given off the deep artery, furnishes various, but inconsiderable branches, to the muscles and skin at the inner and forepart of the thigh.

Anastomotic branch.—Is sent off just before the artery passes through the tendon of the triceps; it takes its course downwards and forwards upon the vastus internus muscle, upon which it divides into branches, some of which anastomose with the arteries at the upper and outer part of the knee.

POPLITEAL ARTERY.

The *popliteal artery* takes its course obliquely downwards and outwards, and, reaching as low as the edge of the popliteus muscle, terminates by dividing into the *anterior*, and *posterior tibial arteries*. In the greater part of its course, it is deep-seated, owing to the projection of the muscles at the sides which bound the ham. *Posteriorly*, it is covered in the greater part of its course, by the *popliteal vein*, and *tibial nerve*, the latter being the most superficially situated, and corresponding to the edge of the semimembranosus : fat and cellular membrane are interposed between it, and the integuments, but it is connected, at the upper part of the leg, with the gastrocnemii, and plantaris muscles. *Anteriorly*, it is only separated from the os femoris, and, lower down, from the capsule of the knee-joint, by fat and cellular membrane, and below, it is applied to the popliteus muscle. On the *outer side*, it is first contiguous to the biceps, and is then placed close to the outer head of the gastrocnemius externus. On the *inner side*, it has the semimembranosus, and, lower down, the inner head of the gastrocnemius externus muscle. In the whole of its course, it is embedded in fat, and in a loose cellular structure. *Above*, it is surrounded by muscles, though only loosely connected with them ; but *below*, it is firmly embraced by thick and strong muscles. Although it is placed so near to the thigh-bone, it would be with difficulty compressed on account of the projection of the muscles at the sides ; and such compression must act first on the tibial nerve. Its branches are as follows :

1. Small branches to the flexors of the leg.

2. Superior outer articular artery.—It bends outwards and forwards, round the os femoris, above its outer condyle, between it and the biceps flexor cruris, to the vastus externus. It furnishes branches to the *biceps*, to the *interior* of the *knee joint*, and to the *vastus externus* ; and, its branches anastomose with those of the opposite *upper articular*, those of the *lower articular*, on the same side, and with the descending branch of the *femoral artery*.

3. Superior inner articular artery.—It sometimes arises by a trunk, in common with the former, and generally higher ; but in some instances from the femoral artery,

in which case it descends along the edge of the vastus internus. It bends inwards, forwards, round the os *femoris*, above the inner condyle, between it and the semimembranosus and semitendinosus muscles, and the tendon of the adductor magnus, and ramifies to the adjacent muscles, and to the *knee-joint* by branches, which form communications with the *superior*, and *inferior inner articular arteries*, and with the anastomosing branch of the *femoral artery*.

4. Middle articular artery.—Is frequently a branch of one of the superior articular. It passes downwards between the condyles, and is continued to the *knee joint*, to which it is principally distributed, anastomosing with branches of the other *articular arteries*.

5. Inferior outer articular artery,—Comes off nearly opposite to the joint, passes downwards and outwards, and then forwards between the external lateral ligament, and the capsule of the joint. It furnishes branches to the *gastrocnemius* and *knee joint*, and ramifies at the under and forepart of the knee, forming communications with the *upper outer*, and *inferior inner articular arteries*.

6. Inferior inner articular artery.—Comes off near the former, and descends inwards, and then forwards, immediately under the head of the tibia, covered by the inner head of the gastrocnemius. It furnishes branches to the *joint*, and *popliteus muscle*, and is spread into branches at the under and forepart of the knee, which anastomose with the opposite *lower articular*, and with the *upper articular* on the same side.

7. Branches to the gastrocnemius muscle.—These are sometimes called *sural* branches, or those of the leg, and arise from the back part of the artery above the inferior articular. They are commonly two in number, whence they have been sometimes called *gemellæ*, and are distributed to the heads of the *gastrocnemius externus*, and *plantaris muscles*.

There are usually, several other but small and unimportant branches from the popliteal artery.

ANTERIOR TIBIAL ARTERY.

The *anterior tibial artery* sometimes comes off higher than the part before described. It passes forward, through the upper part of the interosseous ligament, and then descends on the *anterior surface* of the ligament, first, between the *tibialis anticus*, and *extensor longus digitorum muscles*, and lower, between the former muscle, and the *extensor proprius pollicis*, accompanied by a branch of the *peroneal nerve*, situated on its forepart, and by the accompanying *veins*. During this part of its course, it is deep-seated, separated from the skin by the projection of the muscles at the sides, and by the aponeurosis of the leg. At the lower part of the leg, it takes its course upon the forepart of the tibia, is crossed by the extensor proprius pollicis, and becomes more superficial. It is continued then, behind the *annular ligament* to the *upper* and *inner part* of the foot, along which it proceeds, as the artery of the foot, on the *outer side* of the tendon of the extensor pollicis, to the space between the metatarsal bones of the *first* and *second* toes, and there divides into a *dorsal branch* of the great toe, and the deep *anastomotic branch*. The artery of the foot is sometimes continued from the posterior tibial or peroneal artery. Its branches are :

1. Anterior recurrent artery Arises after the artery has passed through the interosseous ligament. It takes its course upwards, upon the anterior surface of the head of the tibia, distributes branches to the *tibialis anticus*, and fore-part of the *knee joint*, and forms communications with the *inferior articular arteries*.

2 Muscular.—Numerous but small branches which pass off laterally to supply the muscles and skin at the forepart of the leg.

3. Malleolar arteries.—Two small branches given off near the under end of the tibia, but variable as to size and origin, and distributed to the parts about the inner and outer ankle.

4. Tarsal artery.—Arises from the outer side of the artery near the *ankle-joint*, and is sometimes of considerable size. It passes obliquely outwards, furnishes branches to the *tarsus*, to the outer side of *ankle joint*, and to the muscles and skin on the upper and outer part of foot, and others, which pass along the outer side of the foot to the little toe ; it forms communications with branches of the *fibular, malleolar*, and *plantar arteries*.

5. Metatarsal artery.—Arises from the outer side of the artery, but varies somewhat as to origin. It is directed obliquely outwards, under the extensor brevis digitorum, and forms several communications on the outer side of the foot, with the tarsal and other branches of the foot. In its course it sends off,

1. *Interosseal branches.*—Generally four in number, which pass forwards in all the interspaces of the metatarsal bones, except the first, giving off branches to the interossei muscles, and then continued each, by two branches, upon the lesser toes.

6. Branches which are distributed to the upper and inner part of the foot.

7. Dorsal artery of the great toe.—One of the two branches into which the artery divides in the space between the metatarsal bones of the first and second toes. It passes forwards to the great toe, and sends a branch to the second.

8. Deep anastomotic branch.—The other division of the artery, passes between the first and second metatarsal bones to the sole of the foot, and joins with the plantar arch.

After the origin of the *anterior tibial*, the *posterior tibial* descends, covered by the gastrocnemii, for about an inch, and divides into one branch, which retains the name of the common trunk, and into the *peroneal artery*.

PERONEAL ARTERY.

The *peroneal artery*, compared with the *posterior tibial*, is commonly the less of the two, but varies in size. It sometimes arises higher, and not unfrequently lower; and in some instances is wanting altogether. It takes its course down the leg along the inner side of the fibula, between the superficial and deep layer of muscles, situated at first upon the tibialis posticus, then at the edge of the flexor longus pollicis below, becomes covered by the last named muscle, and terminates by dividing into an anterior and posterior branch. It sends off the following:

1. Muscular branches.—Distributed to the *gastrocnemii, tibialis posticus*, and *flexor longus pollicis* muscles.

2. Branch to the Fibula.—This forms a medullary artery.

3. Anterior artery.—Varies in size, passes *through* the lower part of the *interosseous ligament*, and is continued before the *outer malleolus* upon the foot, dividing into branches distributed to the adjacent muscles, and anastomosing with branches of the anterior tibial artery. It is sometimes, a branch of the posterior tibial, and sometimes is altogether wanting: occasionally, it is a branch of large size, and forms the artery of the foot, in which case the anterior tibial is unusually small, and terminates by joining with it.

4. Posterior artery.—Descends behind the *outer malleolus*, distributing branches to the adjacent parts, and terminates on the outer side of the foot, forming anastamoses with the malleolar and tarsal branches of the anterior tibial artery. In some rare instances, this branch is of large size, and instead of passing behind the outer ankle, bends inwards to the hollow of the os calcis, and divides into the inner and outer plantar arteries.

POSTERIOR TIBIAL ARTERY.

The *posterior tibial artery* is larger than the former. It bends inwards after its origin, and descends through the leg behind the tibia, and between the superficial and deep layer of muscles; after passing behind the *inner malleolus*, it terminates at the hollow of the os calcis by dividing into the *inner*, and *outer plantar arteries*. In its course, it is deep-seated above, and passes over the tibialis posticus and flexor longus digitorum muscles, covered by the soleus. At the lower part of the leg, it is more superficial, situated between the *edge* of the *tendo Achillis*, and *malleolus internus*; it has, at that part, the tendons of the *tibialis posticus*, and *flexor longus digitorum* muscles on the *inner side*, and the *tendon* of the *flexor longus pollicis*, on the *outer side*, and is covered by a strong aponeurosis. The *tibial nerve* is situated at its *outer back* part, and the accompanying *veins* at *the sides*. It gives off:—

1. Branches to the muscles, and principally to the deep-seated. They are given off during the course of the artery through the leg, but are not considerable either in number or size.

2. Nutritious artery of the Tibia.—A branch of considerable size given off from the upper part of the artery.

It descends, and after giving twigs to the periosteum, enters the foramen at the back part of the tibia.

3. Branches, two or three in number, distributed to parts about the inner ankle, heel, and to the muscles of the great toe, which form several communications with branches of the anterior tibial artery.

PLANTAR ARTERIES.

Inner plantar artery.—This is the smaller of the two and passes forwards on the inner side of the sole of the foot. It takes its course, first *under* the tendon of the *flexor longus digitorum*, then *upon* the *adductor pollicis*, and between it and the aponeurosis plantaris.

It supplies *branches* to the muscles of the great toe in the inner plantar region, to the tarsal joints, and branches of communication with branches of the anterior tibial.

The trunk, then, generally bends inwards, and between the first and second toes, joins with the plantar digital branch of the great toe.

Outer plantar artery.—Is larger and more deep-seated than the former. It takes its course obliquely outwards, between the flexor brevis, and flexor accessorius digitorum, to the outer side of the foot. Near the base of the metatarsal bone of the last toe it bends inwards, and is continued as far as the metatarsal bone of the great toe, where it anastomoses with the deep branch of the *anterior tibial*, forming the *plantar arch*.

It furnishes *branches* to the muscles of the middle and outer plantar regions and forms anastomoses on the other side of the foot with branches of the anterior tibial and peroneal arteries.

From the plantar arch, the following branches come off ;

1. A *branch* to the least toe, which passes along its outer side, as far as its extremity, distributing inconsiderable branches in its course.

2. *Plantar digital branches.*—Generally three in number, which come off from the forepart of the arch, pass forwards to the interstices of the toes, (namely, to those of the second and third, third and fourth, and fourth and fifth), and divide each into two branches, one of which passes along the outer side of one toe, and the other along the inner side of the adjacent toe. They are continued as far as

their extremities, where they anastomose, furnishing small branches in their course, partly distributed to the toes, and partly communicating with the dorsal branches.

3. *Plantar digital branches* of the great toe, and inner side of the toe next to it, which present very frequent varieties. Most commonly they come off by a branch detached from the deep branch of the anterior tibial, where it joins with the plantar arch, which then sends one branch along the inner side of the great toe, and one to the interstice between the great toe and toe next to it, and divides into a branch to each. Sometimes, they are supplied by the inner plantar, and sometimes, entirely by the plantar arch.

4. *Perforant branches.*—Small branches from the fore and upper part of the arch to the interossei, transverse muscle, and metatarsus, which send branches between the metatarsal bones to anastomose with branches of the anterior tibial on the dorsum of the foot.

TABLE OF THE ARTERIES.

FROM THE ARCH OF THE AORTA.

The Un-named trunk, dividing into:

Right common carotid, and
Right subclavian.

The Left common carotid, and
Left subclavian.

The Common carotid divides into—External carotid, and Internal carotid.

External carotid.—Its branches are:

1. *Superior Thyroideal*, giving off—
   - *a*, Muscular branches.
   - *b*. Laryngeal, and
   - *c*. Thyroid.
2. *Lingual*, giving off—
   - *a*. Muscular branches.
   - *b*. Hyoideal.
   - *c*. Dorsal of the tongue.
   - *d*. Sublingual, and
   - *e*. Ranine.

3. *Facial*, giving off—
   - *a.* Inferior palatine.
   - *b.* Glandular.
   - *c.* Submental.
   - *d.* Branches to the lips, cheeks, &c.
   - *e.* Inferior coronary.
   - *f.* Superior coronary.
   - *g.* Branches to the nose, corner of the forehead, &c.
4. *Ascending Pharyngeal.*
5. *Occipital*, giving off—
   - *a.* Branches to muscles and glands about the angle of the jaw.
   - *b.* Descending branch.
   - *c.* Branch to dura mater.
   - *d.* Branches to the exterior of the cranium.
6. *Posterior aural*, giving off—
   - *a.* Branches to parotid gland, and muscles.
   - *b.* Stylo-mastoid.
   - *c.* Branches to the ear, and side of head.
7. *Temporal*, giving off—
   - *a.* Branches to the parotid gland.
   - *b.* Branches to the masseter muscle.
   - *c.* Transverse of the face.
   - *d.* Deep temporal.
   - *e.* Anterior auricular.
   - *f.* Temporo-frontal.
   - *g.* Temporo-occipital.
8. *Interal maxillary*, giving off—
   - *a.* Spheno-spinal.
   - *b.* Inferior maxillary.
   - *c.* Temporal.
   - *d.* Masseterine.
   - *e.* Buccal.
   - *f.* Pterygoideal.
   - *g.* Alveolar.
   - *h.* Infra-orbitar.
   - *i.* Descending palatine.
   - *k.* Lateral nasal.

INTERNAL CAROTID. Its branches are :

1. *Ophthalmic*, giving off :
   - *a.* Lachrymal.
   - *b.* Central of the retina.
   - *c.* Ciliary.

d. Muscular.
e. Ethmoidal.
f. Supra-orbitar.
g. Internal angular.

2. *Communicating* (with the basilar.)
3. *Anterior of cerebrum*, giving off—
   a. Transverse.
   b. Artery of corpus callosum.
4. *Middle of the cerebrum.*

SUBCLAVIAN ARTERY. Its branches are :—

1. *Vertebral*, giving off—
   a. Branches to muscles and the spinal marrow.
   b. Posterior artery of the spinal marrow.
   c. Inferior artery of the cerebellum.
   d. Anterior artery of the spinal marrow.

The vertebral arteries unite to form the

1. *Basilar artery*, which gives off :
   a. Branches to pons Varolii, &c.
   b. Internal auditory.
   c. Superior artery of the cerebellum.
   d. Posterior artery of the cerebrum.

The other branches of the subclavian artery are :—

2. *Inferior thyroideal.*
3. *Supra scapular.*
4. *Ascending cervical.*
5. *Superficial cervical.*
6. *Deep cervical.*
7. *Internal mammary*, giving off—
   a. Thymic.
   b. Pericardiac.
   c. Mediastinal.
   d. Branch accompanying phrenic nerve.
   e. Intercostal.
   f. Phrenic.
   g. Epigastric.
8. *Superior intercostal.*

It is then continued into

THE AXILLARY ARTERY; which gives off—

1. *Superior thoracic.*
2. *Humeral thoracic.*
3. *Long thoracic.*

4. *Alar thoracic.*
5. *Infra-scapular*, giving off—
   a. Internal scapular.
   b. Inferior dorsal of the scapula.
6. *Anterior circumflex.*
7. *Posterior circumflex.*

It then becomes

THE BRACHIAL ARTERY; the branches of which are;

1. *Deep humeral*, giving off—
   a. Communicating radial.
   b. Branches to triceps.
2. *Inferior deep humeral.*
3. *Muscular branches.*
4. *Anastomotic branch.*

It then divides into *radial* and *ulnar.*

RADIAL ARTERY; its branches are:

1. *Recurrent radial.*
2. *Muscular branches.*
3. *Superficial palmar.*
4. *Branches to the wrist.*
5. *Dorsal.*
6. *Large artery of the thumb.*
7. *Radial of the forefinger.*
8. *Deep palmar*, which forms the *deep palmar arch.*

ULNAR ARTERY; its branches are;

1. *Recurrent ulnar.*
2. *Interosseal*, giving off—
   a. Posterior interosseal.
   b. Anterior interrosseal.
3. *Muscular branches.*
4. *Dorsal.*
5. *Deep ulnar.*

It then forms the *superficial palmar arch*, which gives off the

6. *Digital branches*, consisting of:
   a. Branch to the inner side of the little finger.
   b. Branch to interstice of ring and little finger.
   c. Branch to interstice of ring and middle finger.
   d. Branch to interstice of middle and fore-finger.

II. BRANCHES FROM THE THORACIC PORTION OF THE AORTA DESCENDENS;

1. *Bronchial.*
2. *Æsophageal*
3. *Mediastinal.*
4. *Intercostal*, eight or nine pair.

III. BRANCHES FROM THE ABDOMINAL PORTION OF THE AORTA DESCENDENS:

CŒLIAC; dividing into:

1. *Coronary of the stomach.*
2. *Hepatic*; the branches of which are:
   a. *Right inferior gastric*, giving off—
      α. Duodenal.
      β. Pancreatic.
      γ. Epiploic.
      δ. Gastric.
   b. *Pyloric.*
   c. *Right hepatic*, giving off—
      a. Cystic.
   d. *Left hepatic artery.*
3. *Splenic*; the branches of which are;
   a. *Pancreatic.*
   b. *Short gastric.*
   c. *Left inferior gastric.*
   d. *Splenic.*

SUPERIOR MESENTERIC: the branches of which are:

1. *Branches* from its convexity, *to small intestines.*
2. *Ilio colic.*
3. *Right colic.*
4. *Middle colic.*

INFERIOR MESENTERIC; the branches of which are:

1. *Left superior colic.*
2. *Left inferior colic.*
3. *Internal hæmorrhoidal.*
4. *Diaphragmatic.*
5. *Renal*
6. *Spermatic.*
7. *Lumbar* (four pairs.)

IV. BRANCHES FROM THE TERMINATION OF THE AORTA:

1. *Middle sacral.*
2. *Common iliac*, dividing into—
   - a. External iliac.
   - b. Internal iliac.

INTERNAL ILIAC; the branches are:

1. *Ilio lumbar.*
2. *Lateral sacral.*
3. *Obturator.*
4. *Gluteal*, dividing into—
   - a. Superficial branch.
   - b. Deep branch.
5. *Ischiatic.*
6. *Pudic*, giving off—
   - a. Branches to parts about the neck of the bladder.
   - b. Branches to parts about the outlet of the pelvis.
   - c. External hœmorrhoidal.
   - d. Perinæal.
   - e. Artery of the bulb.
   - f. Superficial of the penis.
   - g. Deep of the penis.
7. *Umbilical.*
8. *Vesical.*
9. *Middle haœmorrhoidal.*
10. *Vaginal.*
11. *Uterine.*

EXTERNAL ILIAC ARTERY; its branches are:

1. *Epigastric* giving off—
   - a. Branch to spermatic cord or round ligament.
2. *Circumflex of the ilium.*

It is then continued into

THE FEMORAL ARRERY, which gives off:

1. *External epigastric.*
2. *External pudic.*
3. *Deep artery of the thigh*; giving off—
   - a. Internal circumflex.
   - b. External circumflex.
   - c. Perforating $\left\{\begin{array}{l}\text{First perforant.}\\ \text{Second perforant.}\end{array}\right.$
4. *Muscular branches.*
5. *Anastomotic branch.*

It is continued into

THE POPLITEAL ARTERY, which gives off:

1. *Branches to flexor muscles of the leg.*
2. *Superior outer articular.*
3. *Superior inner articular.*
4. *Middle articular*
5. *Inferior outer articular.*
6. *Inferior inner articular.*
7. *Surales.*
8. *Small branches.*

ANTERIOR TIBIAL ARTERY; its branches are:

1. *Anterior recurrent.*
2. *Muscular.*
3. *Malleolar.*
4. *Tarsal.*
5. *Metatarsal*, giving off—
   a. Interosseal.
6. *Dorsal of the great toe.*
7. *Deep anastomotic.*

PERONEAL ARTERY; its branches are:

1. *Muscular.*
2. *Medullary of the fibula.*
3. *Anterior.*
4. *Posterior.*

POSTERIOR TIBIAL ARTERY; its branches are:

1. *Muscular.*
2. *Nutritious, of the tibia.*
3. *Branches to the ankle, heel, &c.*

INNER PLANTAR ARTERY; its branches are:

1. *To the Muscles of the great toe and tarsal joint.*

OUTER PLANTAR ARTERY; its branches are;

1. *Muscular.*

It forms the *plantar arch*, which gives off—

1. *Branch to the little toe.*
2. *Digital branches*, consisting of—
   a. Branch to the interstice of the 4th and 5th toe.
   b. Branch to the interstice of the 3d and 4th toe.
   c. Branch to the interstice of the 2d and 3d toe.
3. *Plantar digital branches*, of the great, and 2d toes.
4. *Perforating.*

SECTION II.

THE VEINS.

The veins are elastic flexible tubes, continued directly from the extremities of the arteries, returning the blood from the different parts of the body to the heart, and having no pulsation.

There are *seven primitive veins*, which pour their contents into the heart, viz. the *vena cava superior*, or *descendens*, the *vena cava inferior*, or *ascendens*, the *coronary vein*, and the *four pulmonary veins*. The coronary and pulmonary veins, and the vessels which return the blood from the brain, have been already noticed with the viscera to which they belong. The two *cavæ* remain to be described.

SUPERIOR CAVA.

The *superior cava* is formed by the union of the two great *subclavian veins*, with the addition of the *vena azygos*; it is situated in the upper part of the thorax, upon the right side of, and a little more anteriorly than, the ascending aorta, and is about two thirds of an inch in diameter.

It begins behind the cartilage of the first rib, somewhat higher than the arch of the aorta, and has, at first, a small inclination towards the right side.

After descending about an inch, it perforates the *pericardium*, and, having run nearly twice this space, enters the *right auricle*, opposite to the termination of the *inferior cava*.

The *superior cava* receives the blood from the head, neck, arms and containing parts of the thorax, and, like the inferior cava, carries it to the heart.

INFERIOR CAVA.

The *inferior cava* is formed by the union of the two *iliac veins*, upon the last vertebra of the loins, a little below the termination of the descending aorta, and is of great size, being about an inch in diameter.

It is situated upon the forepart of the spine, and at the right side of the aorta, which it accompanies a considerable way through the abdomen.

Near the upper part of the abdomen, it recedes from the aorta, and passes behind the large lobe of the liver.

It perforates the diaphragm in its tendinous part, and, having entered the pericardium, it goes immediately into the *right auricle* of the heart.

The *inferior cava* receives the blood from the lower extremities, the pelvis, and the abdomen, and carries it to the heart.

VEINS OF THE OUTER PART OF THE HEAD AND NECK,

The smaller veins, which return the blood from the arteries of the outer part of the head, and of part of the neck, have a similar course with their corresponding arteries; they unite into the following trunks, viz. the *frontal*, *facial*, and *temporal* veins.

The *frontal vein*, which is formed by several branches belonging to the muscles and integuments on the upper and forepart of the cranium, and which is often single, returns the blood then from both sides of the fore-head.

The *facial vein*, which is formed by the *frontal vein*, and by an intricate plexus of branches upon the face, winds obliquely downwards and outwards, at a distance from the artery; but, in crossing the jaw, it goes close by the outside of that vessel, and terminates in the *external jugular vein*.

The *temporal vein* is formed by superficial and deep branches, from the sides and upper part of the head, and, running down upon the temple, at some distance from the artery, it descends at the forepart of the ear, and, along with the artery, which it here covers, sinks into the substance of the *parotia gland*. In its descent, before the meatus auditorius externus, it receives branches from the ear, parotid gland, and cheek, corresponding with those sent to these parts from the carotid or temporal artery.

At the under part of the angle of the lower jaw, the facial and temporal veins commonly unite, and form the *external jugular vein*.

EXTERNAL JUGULAR VEIN.

The trunk of the *external jugular vein* descends in the neck between the platysma myoides and sterno-mastoideus, receives in its course branches from the adjacent parts, and terminates in the *subclavian vein*.

In the formation and termination of this vein, there is great variety in different subjects.

It frequently happens that most of the ramifications, which more commonly run from the face and throat into this vein, go to the *internal jugular*.

Besides the vein commonly called *external jugular*, a small subcutaneous vein, termed *anterior external jugular*, descends in the fore-part of the neck, receiving branches from the adjacent parts, and terminating in the *subclavian vein*.

VEINS OF THE EYE AND ITS APPENDAGES.

The blood sent to the contents of the orbit is returned partly to the *facial vein*, at the inner corner of the eye, but chiefly to the proper *ocular vein*, which terminates in the *cavernous sinus*.

VEINS OF THE BRAIN.

These have been already noticed under the head of "CIRCULATION OF THE BRAIN."

INTERNAL JUGULAR VEIN.

The *lateral sinuses*, having received the blood sent to the brain from the carotid and vertebral arteries, pass out of the cranium, and form the *internal jugular veins*, each of which, at its origin, is bulged back in form of a *varix*, which is termed *diverticulum*, (or curve,) and this is lodged in the jugular fossa at the root of the pars petrosa of the temporal bone.

The internal jugular vein descends behind the sterno-mastoideus, upon the fore and outer part of the common carotid artery, with which it is included in a sheath of cellular substance, and is frequently a good deal dilated towards its under extremity, especially in persons advanced in life.

In its course in the neck, it receives *branches* from the pharynx, and muscles adjacent to it; also, the *internal maxillary veins*, with their branches, termed *meningeal*; one or more *branches* from the occiput; and the *lingual vein*, which sometimes terminates in the external jugular. One branch of this, termed *ranina*, is seen under the tongue, and is that vein which is opened in venesection here.

It also receives the *superior laryngeal*, and, now and then, the *inferior laryngeal*, which more frequently goes into the *subclavian*, or to the top of the *cava*.

The internal jugular also receives branches from the muscles of the neck, and at length terminates in the *subclavian vein*.

VEINS OF THE SUPERIOR EXTREMITY.

The veins of the superior extremity are divided into a *superficial*, and a *deep* set, the former lying immediately under the integuments, and chiefly above the fascia, the latter accompanying the arteries, and taking their names from them.

The subcutaneous veins have many large anastomoses with each other, particularly on the forearm, where they unite, separate, and re-unite several times, thus, forming a plexus by which it is surrounded. They form also considerable anastomoses with the deep-seated veins.

SUPERFICIAL VEINS.

The *superficial veins* from the back of the hand (one of which, belonging to the little finger, was termed by the ancients *salvatella*,) go chiefly to the *superficial radial* and *ulnar* veins, and to the vein termed the *long median*.

The *superficial radial veins* run principally to a vein termed *cephalic*, and the *superficial ulnar veins* to one named *basilic*, at the joint of the elbow.

The superficial veins, on the anterior part of the forearm, form a plexus which communicates laterally with the *radial* and *ulnar* veins, and particularly with the trunk of the *long median*.

From this plexus an *internal median* trunk is commonly formed, which terminates in the *basilic*.

LONG MEDIAN VEIN.

The *long median* arises, by numerous branches, from the back of the hand and root of the thumb, and communicates with the *vena salvatella*.

The long median vein crosses over the radius in a slanting direction, and, a little below the bending of the elbow, is divided into two short veins, the *median cephalic*, and *median basilic*, which, running obliquely upwards, terminate a little above the elbow, the former in the *cephalic*, and the latter, crossing over the humeral artery, in the *basilic* vein.

Though this description corresponds with the general distribution of the veins of the forearm, yet, so great is the variety among them, that they are scarcely found to agree exactly in any two subjects.

Frequently the *cephalic* is almost entirely formed by the *median cephalic*, or the *basilic* by the *median basilic*.

There is however, constantly a communication of the veins on the radial and ulnar sides of the anterior part of the forearm, and also a communication between the superficial and deep trunks, at the bending of the elbow.

BASILIC VEIN.

The *basilic*, in its ascent, forms the principle *humeral vein*, which passes along the side of the os humeri, a little to the inner part of the humeral artery; and receiving branches from the corresponding side of the arm, and communicating with the deep veins, it runs into the arm-pit, and forms the *axillary vein*.

CEPHALIC VEIN.

The *cephalic* ascends at the outer side of the biceps, receives branches from the adjacent parts of the arm, communicates in several places with the *basilic*, and, passing in the groove between the pectoralis major, and the deltoides, terminates in the *axillary vein*.

DEEP VEINS.

The *deep veins* run close to their respective arteries, one lying commonly on each side of the artery, and receiving the blood from the adjacent parts. They terminate directly or indirectly, in the *axillary vein*.

In various places, they anastomose with each other by short branches, which cross over the arteries.

Near the joint of the elbow, the deep *radial*, *ulnar*, and *interosseous veins*, form a plexus over the bifurcation of the *humeral artery*.

From this plexus, a short but large branch passes outwards, and forms a communication with one of the subcutaneous set; and, in general, the communication is with one of the *median veins*.

AXILLARY VEIN.

The *axillary vein*, formed by the trunks of the *superficial* and *deep humeral veins*, but more especially by the *basilic*, receives the *veins* corresponding with the *circumflex arteries*, and also the *internal*, and the *inferior dorsal veins* of the scapula.

A little higher, it is joined by the external *thoracic veins*, and, about this place, changes its name to that of *subclavian vein*.

SUBCLAVIAN VEIN.

The *subclavian vein* passes between the subclavian muscle and first rib, at the *inner side* of the trunk of the artery, and afterwards goes over the forepart of the scalenus anticus, being *more superficial* than the artery at the under end of the neck.

After crossing the first rib, it receives the *vein* corresponding with the *superior dorsal artery* of the scapula, the *veins* which belong to the *cervical arteries*, and also, *small veins* from the skin and muscles on the back part of the neck.

While situated in the neck, it likewise receives the *external*, and then the *internal jugular veins*; and, by the addition of these forms a trunk, which may be called *great subclavian*, or *jugular subclavian vein*.

Near the termination of the internal jugular, the *subclavian* receives *a vein* of considerable size, which corresponds with the trunk of the vertebral artery.

The *vertebral vein* communicates within the cranium, by small branches, with the *inferior petrosal sinuses*, or with the *occiptal sinuses*; but is chiefly formed by branches arising from the spinal marrow and its membranes, and from the bones, and deep-seated muscles of the neck.

Behind the top of the sternum, the great subclavian vein frequently receives the *inferior laryngeal*, *anterior external jugular*, and the *internal mammary vein*, which at other times go into the *superior cava*.

Besides these, the left great subclavian receives also the *left vena azygos* (to be noticed,) after which it goes across the root of the great arteries sent up from the arch of the aorta, in consequence of which it is considerably longer than the right subclavian. It descends a little in its course, and, opposite to the cartilage of the right first rib, it joins its fellow of the other side, to form the *vena cava superior*.

VEINS WITHIN THE THORAX.

The *pulmonary* and *coronary veins* have been already noticed with the *contents* of the thorax.

The blood sent to the thorax by the internal mammary, bronchial, œsophageal, and intercostal arteries, is returned by the following veins, viz. the *internal mammary* and *intercostal veins*.

The *internal mammary veins* accompany their corresponding arteries, and terminate, the *left* in the *left subclavian*, and the *right* in the *right subclavian*, or in the top of the *vena cava*.

The *intercostal veins* are the same in number with their arteries, and accompany them along the edges of the ribs. They terminate, partly in the *left vena azygos*, but chiefly in the *vena azygos*.

VENA AZYGOS.

Several of the *lower left intercostal veins* unite into a trunk, termed *vena axygos*, which crosses over the spine, about the middle of the thorax, behind, but in some rare instances before the trunk of the aorta, to the right side.

The *proper vena azygos*, or vein without a fellow, thus originally formed by the lower left intercostals, ascends on the forepart of the spine over the intercostal arteries, on the right side of the aorta.

Upon the spine, it receives the *right intercostal* and the *right bronchial veins* ; and turning forwards over the root of the great pulmonary vessels of that side, it terminates in the *superior cava*, directly before this vein perforates the pericardium.

The *upper left intercostal veins*, or such as are not received by the veins azygos, terminate in a trunk on the left side, improperly called *left vena azygos*.

The *left vena azygos*, called also the *vena semi-azygos*, besides the *superior intercostal* branches, receives the *left bronchial veins*, and *branches* from the œsophagus, and other parts near it, and terminates in the corresponding *subclavian vein*.

The *vena cava superior*, formed by the union of the *subclavian veins*, with the addition of the *vena azygos*, passes down the right side of the ascending aorta, perforates the pericardium, and terminates in the upper part of the *right auricle*; receiving, therefore, the blood from the head and neck, from the superior extremities, from the parietes of the thorax, and from the bronchial arteries.

VEINS OF THE DIAPHRAGM.

The *veins of the diaphragm*, like the corresponding arteries, run upon the under part of the diaphragm, and terminate in the *inferior cava* behind the liver; the right being commonly a little lower than the left.

VEINS OF THE CONTENTS OF THE ABDOMEN.

The veins which return the blood from the abdominal viscera, accompany their respective arteries; the *hepatic veins* excepted. They have, like their arteries, large and frequent communications with each other, but are much superior in size, and, as well as the other veins of the viscera situated in the great cavities, are *destitute of valves*.

The following are the principal trunks, viz. *the inferior mesenteric*, *splenic*, and *superior mesenteric*.

INFERIOR MESENTERIC VEIN.

The *inferior mesenteric*, or *internal hæmorrhoidal*, runs upon the left side of the spine, and receives—

The *proper internal hæmorrhoidal vein*, which returns the blood from the rectum:

The *left colic veins*, which come from the left portion or side of the colon :—and

The *vein of the duodenum*, which returns the blood from the left portion of the duodenum.

The *inferior mesenteric vein* commonly terminates in the *splenic vein*, though frequently in the *superior mesenteric*.

SPLENIC VEIN.

The *splenic vein* is situated at the under side of its artery, immediately behind the pancreas and receives—

The *rami splenici*, or *splenic branches*, which return the blood from the spleen :

The *rami pancreatici*, or *pancreatic branches*, which pass from the under side of the pancreas :

The *venæ breves*, or *short veins*, which come from the left or great end of the stomach :

The *vena gastica sinistra*, or *left vein of the stomach*, which comes from part of the great arch of the stomach, and corresponding portion of the omentum :—and,

The *superior gastric*, which comes from the small curvature of the stomach, and omentum minus, and goes into the *splenic*, near its termination, or into the beginning of the *vena portæ*.

The splenic and inferior mesenteric veins, after receiving their respective branches, form a short trunk which joins the *superior mesenteric*.

SUPERIOR MESENTERIC VEIN.

The *superior*, or *great mesenteric vein*, is situated at the under side of the artery, and receives—

The *rami mesenterici*, or *mesenteric branches*, which are very large and numerous, returning the blood from the jejunum and ilium, and go to the left side of the general trunk :

The *ilio colic branch*, which comes from the end of the ilium, and beginning of the colon :

The *colica dextra*, or *right colic*, which belongs to the right portion of the colon, and terminates in the right or concave side of the mesenteric trunk :

The *colica media*, or *middle colic*, which comes from the right portion of the great arch of the colon, after forming, with the descending branch of the inferior mesenteric, a large arch similar to that of the corresponding artery. It terminates also, in the right side of the trunk:

The *gastro—epiploica dextra*, or *right vein* of the *stomach* and *epiploon*, which belongs to the right portions of the stomach and omentum, and frequently unites with the veins from the side of the colon, forming a short common trunk, which has the term of gastro-colic applied to it:—and

The *pyloric*, and *duodenal*, which sometimes terminate in the superior mesenteric, at other times in the right gastric.

The great mesenteric vein, formed by the branches mentioned above, passes over the beginning of the corresponding artery, and joins the *splenic vein*.

The trunk formed by these veins runs under the head of the pancreas, and here obtains the name of *vena portæ*, or *vena portarum*.

VENA PORTÆ.

This vein has been already described with the *liver*.

VEINS OF THE ORGANS OF URINE AND GENERATION.

RENAL VEIN.

The *renal*, or *emulgent vein*, terminates in the *inferior cava*, and is more superficial, and less variable than its corresponding artery. It is the largest vein received by the cava from its origin to the part where it reaches the liver.

The *left* renal vein is longer than the *right*, in consequence of the aorta lying between the left kidney and the cava. It is situated on the forepart of the aorta, and goes first behind, but afterwards anterior to the corresponding artery. Sometimes, though rarely, it passes between the aorta and spine.

The *right* vein is short, covers the artery, and passes directly into the cava.

VEINS OF THE RENAL CAPSULES.

The veins of the capsules commonly unite into a large trunk, which, in the left side, terminates in the renal vein, while in the right it frequently goes into the cava.

SPERMATIC VEIN.

The *spermatic vein* is much larger than its corresponding artery, and is furnished with *valves* within, but more particularly without, the abdomen.

It composes a plexus which accompanies the artery ; and about the place where it recedes from it, which is nearly opposite to the under end of the kidney, it forms a *single trunk*, which in the *right* side goes into the *cava*, a little below the termination of the emulgent vein, and in the *left*, into the corresponding *renal vein*.

The spermatic veins have the same termination in a female as in a male, but are considerably larger.

The blood is returned from the branches of the *hypogastric artery*, dispersed upon the organs of urine and generation, by the following veins, viz.

The *vena vesicalis*, which returns the blood from the bladder :

The *vena uternia hypogastrica*, which comes from the uterus :

The *vena magna ipsius penis*, which runs along the middle of the dorsum, and is often double, to near the root of the penis, after which it passes between this, and the arch of the pubes, forming a complicated plexus which surrounds the neck of the bladder and prostate gland, and sends out branches which terminate in others at the sides of the bladder. Like other veins subject to pressure, the veins of the penis is provided with *valves* :

The *vena pudica*, which communicates anteriorly with the branches of the great vein at the root of the penis, and afterwards passes back with the corresponding artery :

The *vena tegmentorum penis*, which is formed by small subcutaneous branches, and ends in the top of the *femoral vein*.

The veins above mentioned, the last excepted, terminate in the *hypogastric*, to be described along with other veins belonging to the pelvis.

VEINS OF THE COVERING OF THE ABDOMEN, AND OF THE PELVIS AND LOWER EXTREMITY.

The veins of the *inferior extremity*, like those of the *superior*, consist of a *subcutaneous*, and a *deep* set, and, like them also, are furnished with numerous valves.

SUBCUTANEOUS VEINS.—The *subcutaneous veins* are situated between the common integuments, and general aponeurosis, and, in many parts, are entirely concealed by the fat. They anastomose frequently with each other, by large branches, and have several communications also, with the *deep seated veins*.

They form two principal trunks, called *great saphena*, and *small saphena*.

GREAT SAPHENA VEIN.

The *great saphena* begins upon the upper side of the foot, runs over the forepart of the inner ankle, and ascends in the leg at the inner edge of the tibia.

From the leg, it passes up by the inside of the knee, and afterwards from the inner to the upper and forepart of the thigh.

It is at first composed of veins derived from the upper and inner part of the dorsum of the foot, which have frequent anastomoses with each other, and are of considerable size.

In its ascent, it is joined by branches from the superficial parts of the leg, and, some way below the knee, is frequently split into a *plexus*.

It receives branches from the superficial parts of the thigh, and small twigs from the inguinal glands.

It perforates the broad fascia at the edge of the falciform ligament, and terminates in the top of the *femoral vein*, nearly opposite to, or a little higher than, the origin of the deep artery.

SMALL SAPHENA VEIN.

The *small saphena* arises upon the outer side of the foot, and afterwards passes behind the external ankle.

From this, it ascends in the back part of the leg, upon the surface of the gastrocnemius, and goes into the ham.

It is formed originally by the veins of the upper and outer part of the foot, and is joined to the *great saphena*, over the metatarsal bones, by one or more arches, which receive a plexus of branches into their lower or convex part.

It is joined by the *superficial veins* of the outer and back part of the leg, which have frequent anastomoses with each other, and with the branches of the *great saphena*.

It terminates in the *popliteal vein*, and, a little above the knee, communicates constantly by a small branch with the *great saphena*.

DEEP VEINS.

The *deep veins* of the leg, like those of the forearm run close at each side of their arteries, and are double their number, but differ a little from the deep radial or ulnar veins, in being proportionably larger.

The *tibial* and *fibular veins* anastomose in some places with each other, and also communicate with the *subcutaneous veins*.

At the upper part of the leg, they are united together to form the *popliteal vein*, and the union is nearly at the same place where the corresponding arteries came off.

The *popliteal vein* adheres closely to the upper or posterior surface of the artery, being more superficial than the latter, which it in a great measure conceals, and is commonly single, excepting a small vein which sometimes accompanies it, end communicates with it.

The *popliteal vein* receives the *sural*, and *articular veins*, and the *small saphena* ; after which it forms the *femoral vein*.

FEMORAL VEIN.

The *femoral vein* receives the veins which correpond with the *perforating branches* of the *femoral artery*, and passes *in* through the triceps, where the artery comes *out*.

In the middle of the thigh, it lies deeper than the artery, afterwards turning gradually to its inner side ; and, at the upper part of the thigh, it is joined by the *deep vein*.

The *deep vein* receives the veins corresponding with the branches of the artery of that name, and is sometimes of a large size, being then in a great measure the continuation of the *popliteal vein* ; a small vein only, in such cases, accompanying the trunk of the femoral artery.

Besides the *deep vein*, the *femoral vein* takes in small veins from the external parts of generation, from the inguinal glands, and from the other superficial parts of the groin ; and in particular, it receives a branch of considerable size, which descends from the integuments of the fore side of the abdomen, and is often very conspicuous in cases of ascites.

ILIAC VEINS.

The trunk of the *femoral*, having received the different veins of the inferior extremity, passes into the abdomen, below Poupart's ligament, still situated at the *inner side* of the artery, the two vessels being here upon the same plane, after which it forms the external iliac.

The *external iliac* receives into its beginning the *epigastric*, and the *circumflex vein* of the os ilium, and sometimes the *obturator vein*.

It is situated at first at the inner side of the external iliac artery, and afterwards crosses behind it on the right, and behind the internal iliac artery on the left side of the pelvis, to join the trunk of the *hypogastric vein*.

The *hypogastric*, or *internal iliac vein*, is situated at the outer side of the concomitant artery, and receives the different veins, which correspond with the branches of that artery, and which are furnished with *valves* where they are situated among the fleshy parts of the pelvis.

The *external* and *internal iliacs* unite, and form the *common iliac*, a little below the division of the corresponding arteries.

The *common iliacs* ascend by the right side of their respective arteries, and, a little below the bifurcation of the aorta, or upon the forepart of the fifth lumbar verterbra ; and behind the right common iliac artery, they unite to form *inferior cava*, situated, as formerly mentioned, at the right side of the aorta.

INFERIOR VENA CAVA.

The *inferior vena cava*, which is much larger than the *superior cava*, and greatly exceeds in size the descending aorta, receives, at its beginning, the *sacral vein*, and higher, the *lumbar veins*, which last, in the left side, pass behind the trunk of the aorta.

It likewise receives the *renal veins*, and the *spermatic vein* of the right side.

At length, it takes in the *veins of the liver* and *diaphragm*, and, perforating the tendinous part of the diaphragm, at the root of the liver, it terminates in the under part of the *right auricle* of the heart; thus, receiving the blood from the *inferior extremities*, from the *viscera* and *parietes of the abdomen*, or, from all the parts situated under the diaphragm.

PHYSIOLOGY OF THE BLOODVESSELS AND CIRCULATION.

A general view of the circulation has already been given, and it has been seen how the blood, returned by the *veins* to the heart, and subsequently transmitted through the lungs, is again rendered fit for circulation through the *arteries*. It has also been seen, that the origins of these vessels are the reverse of each other, the *arteries* commencing from a common trunk, and subdividing into minute branches, while the *veins* commence by minute ramifications, and, by uniting into larger and larger branches, form at last, the two great trunks by which they empty their contents into the right auricle of the heart.

Course and nature of arterial blood.—The end of this function is to transport the blood from the lungs, after it has been purified, or become *arterial*, to all the parts of the body.

Arterial blood is of a scarlet colour, its odour is stronger than *venous*, its taste more distinct, and its temperature higher by upwards of 2°. It is also more coagulable, and is, of all other fluids, the most essential to the support of the functions.

The analyses of the blood have been multiplied by chemists, and, as the processes of investigation become more perfect, more of the principles, or elements of which the various organs are composed, are discovered. For instance, *urea* has been discovered in the blood of animals, from which the kidneys have been extracted; it has been ascertained, that *fibrin* is the same matter, with that of muscular fibre; that *albumen* is the substance from which a great number of membranes and tissues are formed; and that the *earthy phosphates* form a great proportion of the bones, &c. &c. &c.

By the aid of powerful microscopes, the blood has been found to consist of extremely minute globules swimming in *serum*, and rolling upon each other, while they flow through the arteries and veins.

The blood, returned by the veins to the heart, and sent by it to the lungs, may be said to commence its *arterial* circulation, the apparatus for which, consists of the *pulmonary veins*, the *left auricle* and *ventricle* of the *heart*, and the *arteries*.

The former, as has already been noticed, although called *veins*, carry *arterial blood*, but are said to have the power of absorbing, in common with other veins. In proof of this, the fact has been stated, that one inspiration of air, charged with odorous particles, is sufficient for its effects to become manifest in the animal economy; while, the deleterious gasses of medicinal substances floating in air, contagious miasmata, &c. produce effects in this manner with great rapidity.

Coats of Arteries.—The arteries are highly elastic cylindrical tubes of great strength. Their structure is separable into three tunics, viz.; an inner, or *serous*, a middle, or *muscular*, and an outer, or *cellular*.

Both veins and arteries are supplied with blood for their nourishment by vessels called *vasa vasorum*.

The arterial blood is propelled through the aorta by the contraction of the left ventricle. Various accounts have been given of the force with which this contraction takes place, some physiologists assigning to it a force equal to that required to raise 50 lbs. The blood, thus sent forth from the left side of the heart, is continued in its course, not only under the impetus at first received, but under the influence of the contraction of the arteries. As it flows in jerks from the ventricle, this manifests itself in the arteries, by simple dilatation, in those that are straight; and, by a dilatation, and tendency to straighten, in those that are tortuous. The *pulse* is thus formed, principally by the former effect.

The number of pulsations in the heart is, in general, greater in proportion as the person is younger. At birth, it is from 130, to 140 in a minute ; at adult age, from 75, to 80, and at confirmed old age, from 60, to 65.

The quantity of blood contained is the system has been estimated at from 24, to 30 lbs ; but this cannot be accurately ascertained, from the numerous causes according to which it is constantly varying.

The arterial blood having performed its office, and passed into the extreme ramifications of its vessels, is received by the *radicles* of the veins. Those *radicles* are said to be continuous with the arteries, and lympathic vessels, but, their extremities, the disposition of which is unknown, appear also to open at the different surfaces of the membranes of the cellular tissue, and even the parenchyma of organs.

There is considerable variety in the manner of the disposition of the veins, in the organs to which they belong. In proportion as the veins remove from the organs and approach the heart, their number diminishes, and they increase in size, frequently anastomosing with each other during their course. The course of the blood through the veins is readily proved by the application of a ligature, when, the part on the farther side from the heart, immediately swells.

COURSE AND NATURE OF VENOUS BLOOD.—The venous blood having been returned to the heart, has still another course to perform, before it becomes again fit for use. The venous system may, therefore, be said to consist of *veins*, of the *right auricle* and *ventricle* of the *heart*, and of the *pulmonary artery*. The moment the blood is exposed by the latter to the action of the air in the lungs, its condition as *venous blood* is changed to that of *arterial*, and thus, the venous circulation may be considered as terminated.

The venous blood, which is of a dark red colour, on being drawn from a vessel and left to itself, in a short time forms a soft mass, which separates spontaneously into two parts ; the one, liquid, yellowish, transparent, and called *serum* ; the other, soft, almost solid, of a deep brown colour, entirely opaque, and called *cruor*, *crassamentum*, or *clot*. The latter occupies the bottom of the vessel, the serum being on the top. The upper surface of the crassamentum is sometimes found of a straw, or sizy colour, and very tough, to a greater or less depth; this is called *buff*, or, from its common cause, *inflammatory crust* of the blood.

If the venous blood be placed in contact with the atmosphere, or with oxygen gas, it takes a vermilion red; with azote, a deeper brown red.

The serum is a transparent fluid, slightly yellow, which it owes to a colouring matter, and is distinctly alkaline. It runs into a solid mass at 158° of Farenheit, and forms, in coagulating, numerous small cells. Serum is said by Brande, to be pure albumen united to soda, which holds its liquid. It has been, however, found to contain water, albumen, lactate of soda, muriates of soda and potass, also phosphate of soda, and animal matter.

The clot of the blood is chiefly formed of fibrin, and colouring matter. The fibrin, separated from the colouring matter, is whiteish, insipid, and inodorous, heavier than water, elastic when humid, and becoming brittle by being dried. It is composed of carbon, oxygen, hydrogen, and azote.

The colouring matter is soluble in water, and in the serum of the blood. Dried and calcined, in contact with air, it melts, swells up, burns with a flame, and yields charcoal, which can only be reduced to ashes with extreme difficulty. The coal gives oxide of iron, a trace of phosphate of lime, and phosphate of magnesia, pure lime, and charcoal.

The respective relations, in quantity, of the serum to the coagulum, cannot well be ascertained with accuracy, as they are constantly varying according to an infinity of circumstances.

Coats of the Veins.—The sides of the veins are said to be formed of three membranes. The outer one is *cellular*, dense, and difficult to break; the next is said to be *muscular*, and to consist of fibres running parallel to each other, along the course of the vessel, but its existence has been disputed; while the third, or inner tunic, is extremely thin, and very smooth upon the surface, which is in contact with the blood.

Valves of the Veins.—Many veins present in their cavities folds called valves. These are generally double, and have two edges, and two free surfaces; the one edge adheres to the surface of the vein, and the other is at liberty; the first being farther from the heart than the other. The valves are sometimes, though seldom, found single.

The number of valves is not every where the same. They are generally more numerous where the blood flows contrary to the force of its own weight, and where the veins are very extensible, and have only slight support from surrounding parts. They are altogether wanting in the sinuses and veins of the brain, in the veins of the spinal marrow, and of the deep-seated viscera; viz. in those of the lungs, of the system of the vena portœ, of the kidneys, bladder, and uterus, &c.

There is no obscurity in the action of the valves of veins; they are real valves, which prevent the return of blood towards the venous radicles.

Absorption of the veins.—Every sort of gas, or liquid, placed in contact with the different parts of the body, except the skin, is said to pass directly into the small veins, and to go to the lungs with the venous blood. For instance, the introduction of any odoriferous substance into the tissue of any organ will give the breath a very strong odour of it.

When the skin is deprived of the epidermis, and the minute bloodvessels, which cover the external surface of the chorion, are laid bare, absorption takes place; hence, the application, in this manner, of several remedies whose effects are remarkable upon the animal economy.

But these, and numerous other arguments, have been brought forward in discussing this point which still remains in doubt; the opponents of venous absorption ascribing the productionsof the effects mentioned to lymphatic vessels, &c.

STRUCTURAL DERANGEMENTS OF THE VASCULAR SYSTEM.

The heart, arteries, and veins, are, from their structure, situation, and functions, much exposed to organic derangements. Disease of the heart have been already noticed, *Vide*, "DISEASES TO WHICH THE CONTENTS OF THE THORAX ARE LIABLE." Part V.

The most frequent derangement is *ossification*, a morbid process generally affecting the arteries, by which their coats become bony, and usually taking place between the two internal coats, or on the inner surface of the vessel.

Such ossifications appear in their incipient state as sma points or specks of bone, and are more frequently foun about the *semilunar valves* of the *aorta*, or on the *valv* of the *heart*, the *mitral* being, perhaps, that most liable t the affection. This disease is frequently attended with dilatation of the artery, or with an enlargement of the ca pacity of the left ventricle.

The coats of the vessels are also subject to *inflammatio* especially those of the veins, and it occasionally occurs a consequence of bleeding. The veins are also subject, pa ticularly those of the lower extremity, to become *varicos* a condition in which they are enlarged, and irregularly di tended, having a tortuous knotty appearance. It is said t be the effect of a loss of power of the valves.

ANEURISM.

By this term, is understood, a diseased *enlargement* of portion of an *artery*.

When any part of an artery has the appearance of bein dilated, the swelling is commonly called a *true aneurisn* In such cases, the artery either seems only enlarged at small part of its track, and the tumour has a determina border, or, the vessel seems dilated for a considerabl length, the swelling being oblong, and losing itself so gra dually in the surrounding parts that its margin cannot b ascertained. The former is called the *circumscribed tru aneurism*, and the latter the *diffused true aneurism*.

When blood escapes through a *wound* or *rupture* of a artery into the adjoining cellular substance, the swelling i denominated *spurious*, or *false aneurism*.

The dilatation of a cluster of small arteries sometime takes place, and has been called *aneurism by anastomosi* When a communication has been established between a *vei* and an *artery*, as may occur from the one being situated close to the other, the disease has been called *varicose aneurism*.

Internal Aneurisms.—Aneurisms of the *arch*, as well as at the *division* of the *aorta* into its two great branches in the belly, and other large vessels, are frequent in the mid- dle and decline of life. Those of the first kind have been more particularly noticed before. *Vide, as above.*

PART X.

THE NERVES.

The nerves are divided into three classes: 1—the *cerebral nerves*, or those which arise from the brain; 2—the *spinal nerves*, or those which arise from the spinal cord: and 3—the *sympathetic nerves*. This division of anatomy has been called *neurology*.

They consist collectively, including the sympathetic, of *forty three pairs*. Different anatomists have adopted different modes of enumerating and classing them. These differences have chiefly arisen from considering as portions of nerves, some which have been found to be altogether distinct.

The *cerebral nerves* have been already mentioned, in the description of the brain, as consisting of eleven pairs.

The *spinal nerves* are described as consisting of thirty-one pairs, viz.

One Accessory,
One Sub-occipital,
Seven Cervical,
Twelve Dorsal,
Five Lumbar,
Five Sacral.

The *sympathetic* forms *one pair*, and completes the number of *forty-three pairs*.

CEREBRAL NERVES.

The *origins* of these nerves, and their *course within the skull*, have been already described *Vide*, "Brain." Part IV.

I. Olfactory.—This nerve, after forming an oval bulb upon the cribriform plate of the ethmoid bone, sends numerous filaments through its perforations, one set of which passes to the septum of the nose, and another to the ossa turbinata.

II. OPTIC.—This is the largest of the cerebral nerves, *Vide*, "VESSELS AND NERVES OF THE EYE." Part VIII. Section I.

III. COMMON OCULO-MUSCULAR.—*Vide, as above.*

IV.—INNER OCULO-MUSCULAR, or PATHETICI.—*Vide, as above.*

V. TRIGEMINAL.—From the ganglion, or plexus, formed by this nerve, already mentioned as the *semi-lunar*, but sometimes called *Gasserian*, upon the surface of the petrous portion of the temporal bone, three branches are sent off, viz. 1—*the ophthalmic*; 2—the *superior maxillary*: and 3—the *inferior maxillary*.

1. *First branch of the fifth pair*.—The branches of this division of the nerve have been already described, with the others belonging to the eye. It therefore, only remains to be noticed, that it is by this branch from the *fifth*, and another from the *third* pair, that the *opthalmic*, or *lenticular* ganglion is formed. It is of an oblong shape and situated at the outside of the optic nerve: it sends off about *twelve* or *fourteen* filaments, called *ciliary nerves*, which run along the opposite sides of the optic nerve, penetrate the sclerotic coat, pass upon the choroid, to which they give some twigs, and are chiefly distributed to the *iris*.

2. *Second branch of the fifth pair.*—After passing through the foramen rotundum, it is lodged in a space between the bones behind the orbit, where it divides into the following branches:

a. Malar, which passes into the orbit furnishing small twigs, and after passing through a foramen in the malar bone, is distributed to the adjacent parts.

b. Spheno-palatine branches.—These sometimes come off immediately from the trunk; at other times, the trunk divides, reunites, and forms a ganglion called the *spheno palatine ganglion*, from which these branches, with the *palatine* and *Vidian* nerves, are given off. Thr *spheno-palatine* nerve soon divides into three or four considerable branches, which pass through the *spheno-palatine foramen* into the nose, and are distributed to the membrane of the posterior *ethmoid cells*, *sphenoidal sinus*, *Eustachian tube*, outer and back part, and *septum* of the nose.

c. *Pterygoid.*—This is also called the *Vidian* nerve, and directs its course backwards through the *pterygoid hole*, and, in it, divides into a *superficial* and a *deep* branch. The *former* goes into the skull through the membranous substance filling up the *foramen lacerum*, between the sphenoid and temporal bones, and joins the facial nerve. The *deep*, after issuing from the pterygoid canal, passes backwards into the *carotid canal*, and there joins with the branches, which form the communication between the sympathetic, and the fifth and sixth nerves.

d. *Palatine.*—This branch descends in the fossa between the pterygoid process of the sphenoid bone, and the palatine bone, and usually divides into three branches, distributed to the *palate*, *fauces*, *gums*, and adjacent parts.

e. *Alveolar.*—It passes down upon the posterior part of the tuberosity of the superior maxilla, and divides into branches distributed to the cheek and buccinator muscle, and other twigs which pass to the lining membrane of the *antrum*, and to the *molar teeth* of the upper jaw.

f. *Infra-orbitar.*—This appears like the continuation of the nerve itself. It is directed forwards, and takes its course through the *infra-orbitar canal*. Within the canal, it gives off branches to the membrane of the nose, cuspidati, and bicuspidati of the upper jaw, and on leaving it, terminates in branches to the skin and muscles of the *cheek*, *under eye-lid*, *nose*, and *upper lip*.

3. *Third branch of the fifth pair.*—This is the largest of the three branches of the *semi-lunar* ganglion. When it has left the cranium through the foramen ovale, it is covered by the external pterygoid muscle. It then divides into principal branches distributed to the muscles of the lower jaw, the tongue, and lower jaw.

a. *Deep temporal.*—Commonly two in number to the temporal muscle.

b. *Masseterine.*—To the masseter muscle.

c. *Buccal.*—To the buccinator muscle, and to the membrane and glands of the cheek.

d. *Pterygoid.*—To the internal pterygoid muscle.

e. Temporal.—To the ear and side of the head. After having given off the above branches, the trunk divides into the *dental* and *gustatory* branches.

f. Dental, or *alveolar.*—It passes downwards near the pterygoidei muscles, and then between them and the condyle of the lower jaw, to reach the posterior maxillary foramen. It enters the *alveolar canal*, and passes along it, giving branches to the teeth of the lower jaw; it afterwards leaves the jaw by the *mental foramen*, and divides into branches distributed to the skin and muscles of the chin, &c.

g. Lingual, or *gustatory.*—It goes downwards and forwards, behind the pterygoideus externus, where it receives a communicating branch of the facial. It is continued towards the ascending plate of the lower jaw, and, near the angle of the jaw, and above the sub-maxillary gland, it sends branches to the latter, sometimes forming a ganglion for that purpose, called the maxillary ganglion. The nerve gives off branches to the sublingual gland, to the membrane of the mouth, and divides into twigs going to the apex and sides of the tongue, &c.

VI. Outer Oculo-muscular.—It detaches some filaments connected with the *sympathetic*, and having passed through the *foramen lacerum orbitale superius*, goes to the abductor oculi. It sometimes gives a twig to the *lenticular gangsion.*

VII. Facial.—(*Portio dura of the 7th pair.*)—It takes its course, and is continued with the auditory nerve into the *meatus*, at the bottom of which it separates from it, passes through the canal of *Fallopius*, and quits this canal, at the *foramen stylo-mastoideum.* In the canal it receives the recurrent branch of the *Vidian*, and is thus connected with the 2d division of the fifth.

VIII. Auditory.—(*Portio mollis of the 7th pair.*)—Having entered the *meatus anditorius internus*, it divides into two branches, for the supply of the labyrinth of the ear, one being dirtributed to the membrane of the cochlea, and the other to that of the vestibule and semi-circular canals.

It detaches small twigs to the tympanum and sends off the following:

1. *Chorda tympani*, which, directed upwards, enters the tympanum behind, and after passing through it, joins the lingual branch of the inferior maxillary nerve on the inside of the ascending plate of the lower jaw.

The *facial nerve*, after issuing from the *foramen stylo-mastoideum*, passes a little downwards and a little forwards, being situated deep behind the parotid gland. It gives off the following :

2. *Branches* to the auricle and parts about the ear, sending twigs to the back of the ear and head, to the muscles attached to the styloid process, &c.

The *facial nerve* then enters the parotid gland, crosses the external carotid artery, and divides into four or five branches, forming by their junctions a kind of plexus, called the *parotid plexus*, or *pes anserinus*, from which branches are sent off to the side of the face and neck.

The following are the branches of the plexus :

3. *Temporal.*—Two or three in number, which supply small branches to the parotid gland, temple, and forehead, and form communications with the lachrymal and frontal branches of the first part of the fifth pair.

4. *Superior facial.*—Commonly two small branches, which pass more forward than the former, and are distributed to the orbicularis palpebrarum, and about the outer angle of the eye.

5. *Middle facial*, or *buccal.*—Two or three in number, passing forwards over the masseter muscle, and accompanying the parotid duct, to give branches to the cheek, side of the nose and lips. They communicate with the infra-orbitar nerve.

6. *Inferior facial.*—Passes over the lower part of the masseter, to the skin and muscles of the lower lip.

7. *Descending* —Commonly two in number, one passing along the edge of the lower jaw to the adjacent parts, and the other dividing into two or three branches, which descend upon the side of the neck, and are distributed to the skin and platysma myoides, &c.

IX. Glosso-Pharyngeal.—It passes forward and outward with the *pnuemo-gastric* nerve, of which, until late, it was considered a part, and is continued with it through the *foramen lacerum*, in the base of the skull. At this place, it has an enlargement, or ganglion, from which filaments are given off, forming connections with the recurrent branch of the *Vidian* nerve, the *sympathetic*. *pneumo-gastric*, and *accessory nerves*. It then passes down *before the internal jugular vein*, quits the pneumo-gastric nerve, and is continued downwards and forwards, *between the carotid arteries*, and along the stylo-pharyngeus, to the under and back part of the tongue. It gives off various communicating twigs after leaving the skull, but is eventually expended about the passage of the *fauces*, upon the muscular structure of the *tongue*, and the skin and papillæ about its root.

X. Pneumo-gastric.—It passes out of the cranium, with the former nerve, and is continued through the neck and chest into the abdomen, terminating by distributing branches to the stomach, upper part of the alimentary canal, and respiratory organs. It is at first situated *before the jugular vein*, and is closely connected with the former nerve, the *lingual* and *sympathetic*. It descends, separated from the *glosso-pharyngeal* by the internal jugular vein, and passes through the neck *rather before the carotid artery*, between it, and the *internal jugular vein*, and included in the *same sheath* with these vessels. It passes into the chest, on the *right* side, *between* the *subclavian vein* and *artery*, and on the *left* side, *before* the *arch* of the *aorta*. It takes its course through the posterior mediastinum, by the side of the œsophagus, and continues with it through the diaphragm to the stomach.

It gives off the following branches :

1. *Small branches*, communicating with the glosso-pharyngeal nerve, and superior cervical ganglion.

2. *Pharyngeal*.—Formed, in part, by a branch or two of the accessory nerve. It passes down on the inner side of the carotid artery, and forms on the pharynx a plexus (*plexus-pharyngeus*) which receives branches from several other nerves. It is distributed to the *constrictors* of the *pharynx*.

3. *Laryngeal*, or *superior Laryngeal*.—It arises at a part where the nerve enlarges itself, near where the pharyngeal is given off. It passes downwards, receiving some filaments from the pharyngeal plexus, and divides into an *external* and *internal* branch.

a. The *external* is distributed to the constrictors of the pharynx, and to the muscles of the larynx, and, by some twigs, to the thyroid gland and membrane of the larynx.

b. The *internal* takes its course between the os hyoides and thyroid cartilage, to the interior of the larynx, and divides into branches to the muscles of the arytenoid cartilages, the mucous glands and membrane of the larynx.

4. *Filaments* which accompany the pharyngeal and glosso-pharyngeal, upon the carotid artery.

5. *Cardiac branches.*—These are two or three in number and of small size, arising about the middle of the neck, and descending along the outer and forepart of the carotid. They join with the superficial cardiac branches, and spread upon the arch of the aorta.

6. *Recurrent*, or *inferior laryngeal.*—It arises as soon as the nerve enters the chest; the left being given off lower than the right. It first descends directly backwards, then passes up behind the subclavian artery of the right side, and behind the arch of the aorta on the left, and ascends between the œsophagus and trachea as high as the larynx, where it divides into branches distributed to the inferior constrictor of the pharynx, the muscles of the arytenoid cartilages, and lining of the larynx. In its recurrent course, it gives numerous branches.

a. Filaments which join with the cardiac branches of the pneumo-gastric, and those of the sympathetic passing to the *cardiac plexus*.

b. Tracheal.—Distributed to the lining of the trachea, œsophagus, &c.

7. *Pulmonary.*—Five or six branches given off at the root of the lung, which pass partly before and partly behind the trachea; its branches forming the *pulmonary plexus.*

8. *Œsophageal.*—After having given off the pulmonary branches, the pneumo-gastric nerve divides in the right side into five or six, and in the left into two or three fasciculi. These separate but are connected with several communicating branches, and form the *œsophageal plexus.*

The branches again unite and form a cord on each side, descending upon the œsophagus.

2. *Coronary.*—The two branches, above described, descend with the œsophagus through the aperture of the diaphragm, and terminate on the stomach. The right is distributed on the right side and posterior surface, and forms a plexus about the cardia, which sends branches to the left side, to join with the opposite branches, and with filaments of the sympathetic distributed to the stomach, to form the *solar plexus*. The left is distributed to the anterior surface, and pylorus, forming communications with the right, and with the branches of the sympathetic. The distribution of these branches by which the *pneumo gastric* terminates, is called the *coronary*, or *stomachic plexus*.

XI. Lingual.—It comes out through the anterior condyloid foramen. It takes its course downwards, is joined by a twig from the *sub-occipital*, or, from the *superior cervical ganglion*, and, appearing before the internal carotid artery and internal jugular vein, is directed forwards in a bend, and crosses over both carotids at the origin of the occipital artery. The lingual nerve is in contact with the corresponding artery, until it reaches the side of the tongue, when it is continued forwards upon the hyo-glossus muscle, and divides into branches to the muscles under the tongue, and to the fleshy part of the tongue itself, and, joining with one or two branches of the gustatory branch of the fifth pair, it gives off:

1. *Descending branch*, (descendens noni,) coming off near the root of the occipital artery, descending along the external carotid artery, and lower down on the inner side of the internal jugular vein, being frequently included in the same sheath. It sends filaments to the neighbouring parts.

2. *Muscular branches.*—Distributed to the muscles between the maxilla and os hyoides.

SPINAL NERVES.

These have been mentioned as *thirty one pairs*, including the *accessory*, and *sub-occipital* nerves. They arise by a double root, an anterior, and a posterior, from the corresponding surfaces of the medulla; the posterior roots are the larger, arise near the middle, and are composed of fewer, though not so distinctly fibrous, filaments as the anterior. The two sets of roots are separated by the *ligamentum denticulatum*, but unite at the part where the nerves pass through the dura mater.

Ligamentum denticulatum, or *serrated membrane.*—This is a narrow thin membrane, placed between the pia mater and tunica arachnoides of the cord. It is considered by some as a process of the former. Its inner border is straight and connected with the pia mater; its outer one presents a series of angular projections or teeth about twenty in number, which are firmly attached to the dura mater. They are small, dense, strong cords, which pass between the nerves. The membrane begins at the top of the cord, and reaches to the extremity of the dorsal portion.

CERVICAL NERVES.

The *accessory* and *sub-occipital* are described among these.

ACCESSORY.—It arises from the back part of the lateral surface of the spinal marrow, by numerous filaments, which come off close to the posterior roots of all the cervical nerves; although sometimes it has fewer roots. It passes up, near the posterior roots of the upper cervical nerves, and enters the cranium through the *foramen magnum*; then takes its course with the *pneumo-gastric*, and passes with it through the *lacerated* opening of the skull; but, sometimes, through a separate opening of the dura mater. It then detaches a branch, which forms a junction by separate filaments, with the pharyngeal and pneumo-gastric nerves. The nerve descends behind the internal jugular vein, then between this vessel and the sterno-mastoid muscle: passes through the sterno-mastoid, detaching branches, which unite with branches of the second and third cervical nerves, and with twigs of the fourth and fifth, and terminates on the inner surface of the trapezius.

SUB-OCCIPITAL.—It is of very small size, and arises from the beginning of the spinal cord on its forepart, commonly by a single root, and sometimes by two, like the other spinal nerves. It passes out between the occipital bone, and the transverse process of the atlas, where it becomes slightly enlarged, and at the posterior edge of which it divides into two branches. The *anterior*, smaller, passes forwards between the transverse process of the first vertebra, and the mastoid process, divides into filaments, joining with the first cervical, the lingual, and the sympathetic nerve, and furnishes twigs to the adjacent parts. The *posterior*, larger, passes backwards, and divides into branches to the recti and obliqui capitis.

The other *cervical nerves* consist of *seven pairs*. The three upper cervical are smaller than the lower. The anterior branches of the upper form junctions with each other, soon after passing from the vertebral foramina, and from these other branches arise, which, again uniting and dividing, form an intricate plexus, which has been called the *cervical plexus* : from this plexus nerves of communication pass to the *sub-occipital nerve*, and to the superior and middle cervical ganglion of the *sympathetic*, and some anatomists describe all the cervical branches as originating from it.

I. Cervical.—It passes out between the atlas and dentata, and divides into two branches, an anterior and a posterior.

1. The *anterior*, or smaller, passes forwards, sends a branch upwards, which joins with the sub-occipital, from which filaments are detached to join with the superior cervical ganglion, with the lingual, and the pneumo-gastric nerve : and sends a branch downwards to join with the second cervical.

2. The *posterior*, larger, or occipital branch, is directed backwards, and, after furnishing branches to the extensors of the head and neck, ascends upon the occiput, and divides into branches to the skin and occipito-frontalis, some of its filaments forming junctions with branches of the fifth pair, and the facial nerve.

II. Cervical.—This is larger than the former, passes out between the second and third vertebræ, and divides into an anterior and posterior branch. Its twigs supply the muscles on the anterior and posterior parts of the neck, and communicate with the accessory, facial, occipital nerves, &c.

III. Cervical.—Is smaller than the former. It passes out between the third and fourth vertebræ, and divides into an anterior, and posterior branch.

1. The *anterior*, larger, detaches a branch to join with the fourth, and another with the second cervical, a branch which joins with the great *sympathetic*, or superior cervical ganglion, and a branch which joins with the descending branch of the lingual. It furnishes branches to the longus colli, and levator scapulæ, and divides then into three or four branches, which descend and are distributed to the skin about the clavicle and adjacent parts.

2. The *posterior* is the smaller.—It passes deep-seated between the muscles, and is distributed to the extensors of the head and neck.

Diaphragmatic, or Phrenic Nerve.—It arises by different filaments from the lower cervical nerves; the most considerable filament is from the anterior branch of the *fourth*, but it receives a smaller from the *third*, and commonly from the *second*, and often a filament or two from the *axillary plexus*. It takes its course downwards between the rectus capitis and scalenus anticus, and enters the chest *behind* the first rib, *between* the subclavian artery and vein. It is then directed forwards, passes before the root of the lung, and descends between the pericardium and pleura. As it approaches the diaphragm, it divides into several branches which are distributed to the convex part of that muscle. Some of the branches pass through the diaphragm with the inferior cava, distribute filaments to the under surface of the diaphragm, and form connexions with filaments of the *solar plexus*. The left lies farther back, is longer than the right, and furnishes some twigs to the œsophagus.

The four inferior cervical and the first dorsal nerve are of large size, especially the sixth cervical. These form, by their junctions, the *axillary plexus*, from which the nerves originate supplying the upper extremity. They pass out under the corresponding vertebræ, and after issuing from the vertebral foramina, send small branches to the muscles of the back; they take their course outward and downward, between the scalenus anticus, and medius, accompanying the subclavian vessels, being situated above and behind, and to the outer side of the artery. They pass with these vessels under the clavicle, and retain the same relative position with respect to the axillary vessels, as far as the part opposite to the coracoid process of the scapula; but they here pass before the artery so as to conceal it. During this course the nerves divide, join and separate again, so as to form the *axillary*, or *brachial plexus*.

NERVES FROM THE AXILLARY PLEXUS.

These are :—1. *Thoracic*—2. *Scapular*—3. *Articular*—4. *Inner cutaneous*—5. *Inner smaller cutaneous*—6. *Outer cutaneous*——7. *Radial*—8. *Median*—9. *Ulnar*.

I. Thoracic.—They consist of branches derived from the *fourth*, *fifth*, and *sixth* cervical. They descend upon the parietes of the chest, and are distributed to the *sub-clavius*, the *pectorales*, and skin of the chest and shoulder; one branch commonly descending upon the *serratus magnus*, and being distributed to it.

II. Scapular.—It arises frequently from the *fourth* and *fifth* cervical. It passes downwards and backwards, is continued through the notch of the scapula to the fossa supra-spinata, and furnishes twigs to the *supra-spinatus*; it then directs its course along the root of the acromion, and divides into branches for the supply of the *infra-spinatus*, and *teres minor*.

III. Articular.—Arises from the trunk formed by the junction of the *fourth* and *fifth* cervical. It detaches twigs to the *subscapularis*, and to the *teres-major*, and *minor*, and takes its course, between the two last named muscles and the long head of the triceps, round the os humeri just below the head, to the inner surface of the *deltoid*, to which it is distributed. One branch passes through the muscle, and divides into twigs to the skin.

IV. Inner Cutaneous.—Generally formed by several fibrillæ of the *first dorsal*, and sometimes in part from the *seventh cervical*. It takes its course down the inner side of the arm, immediately under the skin, in the course of the basilic vein, and near the radial nerve, and after detaching one or two inconsiderable twigs as it approaches the elbow, divides into two branches :—the smalle ris directed backward, and runs down on the inner and back part of the forearm, dividing and distributing twigs to the skin as far as the little finger :—the other and larger descends on the inner and forepart of the forearm, dividing into several twigs which pass partly over and partly behind the subcutaneous veins, and supply the skin as far as the wrist and the palm of the hand.

V. Inner small Cutaneous.—Is connected principally with the ulnar nerve, and is much smaller than the former. It soon divides into two branches, which distribute twigs to the *biceps*, and to the skin of the back part of the arm, and of the elbow.

VI. Outer Cutaneous.—Formed by the *fourth, fifth*, and *sixth* cervical, and sometimes by a branch of the median. It passes downward and outward, *perforates* commonly the *coraco-brachialis*, or takes its course on the inside of the muscle, and furnishes some twigs to it. It descends then between the biceps and brachialis internus, giving off some branches to both, as far as the bend of the elbow, where it is situated on the outer side of the tendon of the biceps, between it and the cephalic vein. It continues its course on the outer side of the forearm under the skin, to which it distributes numerous twigs, as far as the root of the thumb and back of the hand.

VII. Radial.—Is of large size, and is formed by fasciculi from all the nerves of the axillary plexus. It takes a spiral direction, having its course behind the os humeri and between the two heads of the triceps ; it then makes its appearance on the outer side of the arm, descends between the brachialis internus, and extensores carpi radiales, and divides into a *superficial* and a *deep* branch. Before the division, it distributes—

1. *Branches* to muscles—a branch to the latissimus dorsi,—branches to the heads of the triceps.

2. *Cutaneous branch*, given off behind the body of the os humeri, which descends on the outer and back of the arm, and is distributed to the skin of the forearm.

3. *Branches* to the supinator longus and extensors.

4. *Superficial.*—Descends on the inner side of the supinator longus, giving off some twigs to the radial extensors, and then accompanies for some way the radial artery ; but, towards the lower part of the forearm, it passes backward under the tendon of the supinator longus, and divides into two branches, a dorsal and a palmar.

a. Palmar.—Passes to the thumb, furnishing twigs to the skin of the wrist, and to the muscles and skin of the thumb. It forms junctions with twigs of the external cutaneous nerve.

b. Dorsal.—Divides into twigs distributed to the skin of the back of the hand, to the muscles between the index and thumb, and its principal branches are disposed on each side of the fore and middle finger, and on the outer side of the ring finger.

5. *Deep.*—Passes deep-seated backward, upon, or through, the supinator brevis, and descends on the back of the fore-arm, between the extensors of the fingers, taking its course under the extensor digitorum and the extensor primi internodii pollicis, as far as the wrist, to the parts about which it is ultimately distributed. In its course it furnishes branches to the supinator brevis, extensores radiales, and to the extensors of the thumb and fingers.

VIII. *Median.*—The most considerable of the nerves from the *axillary plexus*, formed by fasciculi from *all the nerves* composing this plexus. It descends on the inner side of the biceps, with the brachial artery, situated on the inner and forepart of this vessel as far as the bend of the elbow, where it passes over the tendon of the brachialis internus, and descends through the forearm about midway between the radius and ulna. In the forearm, it takes its course first behind, or through the pronator teres, and continues its course between the flexors of the fingers. At the lower part of the forearm it commonly divides, the branches being continued behind the annular ligament of the wrist, between the tendons of the flexors, to the palm of the hand, and here subdividing into branches to the thumb and fingers. The *median*, in its course through the upper arm, furnishes only some inconsiderable twigs to the coats of the vessels. As it approaches the elbow it detaches:

1. *Branches*, to the pronator teres, palmaris longus, flexor carpi radialis, and flexor sublimis.

2. *Interosseous.*—Given off at the bend of the joint, which after giving off branches to the flexor profundus and flexor pollicis, descends upon the interosseous ligament, with the corresponding vessels, turns over the edge of the pronator quadratus, and terminates in that muscle.

3. *Palmar.*—A cutaneous branch given off near the wrist, and supplying the adjacent skin, and that of the back of the thumb.

The branches into which it divides in the palm of the hand are three or four in number, viz.

4. A *branch*, which divides into two, to the thumb, and one to the forefinger; the two former pass at the sides of the thumb to its extremity, and the latter takes its course along the outer side of the forefinger.

5. A *digital branch*, which passes to the interstice between the roots of the fore and middle fingers, and here divides into two, one of which passes along the inner side of the forefinger, and the other along the outer side of the middle finger, severally to the tip of each.

6. A *digital branch*, which passes to the interstice between the roots of the middle and ring-fingers, where it divides like the former into two branches, which are continued, the one along the inner side of the middle, and the other along the outer side of the ring-finger, to their tips. These and the preceding digital branches furnish twigs to the skin of the fingers, but are principally distributed to the skin of the tips of the fingers.

IX. Ulnar.—Somewhat smaller than the former. It is formed from the three undermost nerves of the plexus. As it descends it is inclined backwards, on the triceps muscle, with which it is connected. Near the elbow, it passes backwards behind the inner condyle of the os humeri, is situated in the groove between the condyle, and the olecranon process of the ulna, with the recurrent ulnar artery. It takes its course between the flexor carpi ulnaris, and flexor digitorum, and then descends on the inner side of the forearm with the ulnar artery, being situated on the inner side of the artery. It passes with this vessel *over the annular ligament* into the palm of the hand, and there terminates by dividing into a superficial and deep branch. In its course through the upper arm it detaches no branches, except, in some cases, the inner cutaneous nerve. In the forearm it gives off.—

1. *Branches* near the elbow to the flexor ulnaris and flexor profundus.

2. A *cutaneous branch*, which descends under the skin, in the course of the basilic vein, and is distributed to the skin as far as the hand.

3. A *dorsal* branch given off at the lower part of the forearm; it passes backward between the flexor ulnaris and ulna, and divides into twigs, supplying the skin of the back

of the hand, and the skin of the ring-finger and little finger, and forms junctions with twigs of the spiral nerve.

It terminates in the *superficial* and *deep palmar* branches.

4. The *superficial palmar* is connected by one or more twigs to branches of the median. It gives off :—

a. Branches distributed to the muscles of the little finger :

b. Digital branch, which is continued along the inner side of the little finger to its tip.

c. Digital branch, which passes to the interstice between the roots of the ring and little fingers, and there divides, sending one branch along the outer side of the little finger, and another along the inner side of the ring finger to their extremity. These branches are distributed like those of the *median*.

5. The *deep palmar* passes deep-seated between the flexor and abductor of the little finger, and is then directed transversely outward behind the tendons of the flexors, furnishing twigs to the lumbricales, the interossei, and adductor pollicis muscles.

THORACIC NERVES.

These consist of *twelve* pairs, and are comparatively of small size. The first pair has been already spoken of, with the lower cervical, as entering into the composition of the *axillary plexus* ; the remaining eleven only, therefore, remain to be described.

Immediately after passing out of the vertebral foramina, each nerve is connected by short branches with the nearest ganglion of the *sympathetic*,, and soon after divides into two branches, an *anterior* and a *posterior*.

I. *Posterior*.—Passes backwards between the transverse processes of the vertebræ, and is distributed to the *muscles* situated near the spine.

II. *Anterior*.—Takes its course under that rib, under which the trunk issues from the vertebral canal, between the layers of intercostal muscles, with the intercostal vessels, and more or less in the costal groove ; but, as it advances, it becomes farther removed from the upper rib, and, near the sternum, passes upon the exterior of the chest. In its course, it furnishes branches to the *intercostal muscles*, the upper part of the *abdominal muscles*, and twigs, which penetrating the intercostal muscles, are distributed to the muscles of the upper extremity, and skin covering the chest.

There are, however, some differences to be observed in these nerves. The first is the largest, the second is much smaller, and from the second they then increase in size, but not regularly, to the twelfth. There is also some difference in the distribution of the anterior, or intercostal branches.

The *first thoracic nerve* takes its course upwards and outwards over the first rib to join the axillary plexus; opposite that rib it divides into two branches, one of which joins with the axillary plexus, as above described, whilst the other smaller branch takes its course under the first rib like the other intercostal branches.

The *second* and *third* differ from the rest in detaching each a branch, called *intercosto-humeral*, to the skin of the upper arm. These two branches penetrate the intercostal muscles, under the second and third ribs, and are distributed to the skin of the axilla, and inner part of the arm as far as the elbow.

The *five uppermost* are distributed principally to the pectorales and serratus muscles. The seven lowermost principally to the abdominal muscles. The eleventh and twelfth distribute branches to the smaller muscle of the diaphragm, to the quadratus and the psoas muscle. The rest of their distribution is as before described.

The *twelfth dorsal* is connected by a small branch with the first lumbar.

LUMBAR AND SACRAL NERVES.

There are *five pairs* of *lumbar*, and *five pairs* of *sacral* nerves. The *lumbar* pass through the foramina formed by the lumbar vertebræ, and the last nerve, through the foramen formed by the last vertebra and the sacrum. The *sacral* take their course through the anterior sacral foramina, and the last, between the sacrum and the os coccygis. The *anterior* branches of these nerves, *ten* in number on each side, form by their connexions a kind of *plexus*, (to be immediately noticed) from which the nerves are derived, supplying the whole of the lower extremity; the roots of the nerves being here variously intermingled and connected. The anterior branches of the lumbar nerves, passing behind the psoas, are connected with each other; in addition, the first being joined to the last dorsal, and the last to the first sacral nerve, the anterior branches of the *sacral*, especially the three uppermost, contribute in the same way by their junction to the formation of this plexus.

Of the nerves which form this plexus, those which are situated in the middle are the most considerable, that is to say, the fifth lumbar and the first sacral, they then diminish in size upwards and downwards, but not with exactness, the first lumbar, and the third sacral, being nearly of the same size, and the two last sacral the least, especially the fifth, which is generally the smallest of all the spinal nerves. The *fourth* and *fifth sacral* nerves are connected with the crural plexus, but do not contribute to form the principal nerves arising from it.

From all the nerves which enter into the composition of the *crural plexus*, small *dorsal* branches arise which take their course backwards; those from the lumbar passing between the transverse processes of the lumbar vertebræ, and of the sacrum; those passing from the sacral through the posterior sacral foramina: they are distributed to the under part of the muscles of the back, to the gluteus maximus and the adjacent skin.

BRANCHES FROM THE PLEXUS FORMED BY THE LUMBAR AND SACRAL NERVES.

This plexus is sometimes called *lumbar, sacral, ischiatic*, or *crural plexus*.

Some of the branches are of small size, being derived only from one or two of the nerves, viz. the *external spermatic* nerves, the *branches* distributed to the muscles of the loins, and the *branches* to the skin about the hip and groin, the *gluteal nerves*, &c. The larger are formed by fasciculi from several nerves: they are the *obturator, pudic, crural*, and *ischiatic nerves*.

I. External spermatic.—Is derived from the *first* and *second lumbar*. It passes through the upper part of the *psoas muscle*, and descends on its anterior surface. It divides then into *two branches*, one of which accompanies the spermatic vessels, and distributes in the male, branches to the *scrotum*, *cremaster*, and *cord*, in the female to the *round ligament*, and in both, to the skin of the *pubes* and *groin*; the other branch passes behind Poupart's ligament, and is divided into branches to the integuments of the forepart of the thigh.

II. Branches from the first and second lumbar.—They are distributed to the *psoas*, *quadratus*, and *transversalis abdominis* muscles, and to the skin about the loins and hip. There are generally *one* or *two* long branches, which penetrate the psoas, take their course over the quadratus, and pass through the transverse, and internal oblique muscles of the abdomen, furnishing twigs to them; they are then continued through the tendon of the external oblique, and spread in the skin of the groin and scrotum.

III. External cutaneous.—Generally derived from the *third lumbar*. It takes its course between the psoas and iliacus, and descends upon the latter muscle. It is continued under the outer extremity of Poupart's ligament, and divides into branches, distributed to the skin of the fore and outer part of the thigh, as far as the knee.

IV. Superior gluteal.—Is formed by the *fourth* and *fifth lumbar*, (before their junction with the first sacral, to form the ischiatic.) It passes directly under the edge of the notch of the ilium, and is distributed to the small and middle gluteal muscles, some of the twigs extending as far as the tensor vaginæ femoris.

V. Inferior gluteal.—Is formed by the fasciculi from the *second* and *third sacral* nerves; it passes out of the pelvis, under the pyriform muscle, to which it detaches twigs, and is distributed to the large gluteal muscle.

VI. Common pudic.—Formed by fasciculi from the *fourth* and *fifth* lumbar, and from the three uppermost *sacral* nerves; it is of considerable size. It passes out of the pelvis through the under part of the notch of the ilium, then is continued into the pelvis again, between the two sacro-sciatic ligaments, and divides into a *superior* and *inferior* branch.

1. *Superior*.—Takes its course along the ramus of the ischium and that of the os pubis, giving off twigs to the obturator internus muscle, is then continued forwards under

the symphysis pubis, in the male as the dorsal nerve of the penis, in the female as the nerve of the clitoris, and in both distributes twigs upon the dorsum, and to the skin of the pubes and adjacent parts, and terminates in the glans.

2. *Inferior.*—Accompanies the superior for a short way, ascends then between the accelerator urinæ and erector penis, and is distributed to the skin and muscles of the perinæum, to the extremity of the rectum, to the skin of the scrotum, and to the urethra, and is connected by various twigs with the other branches supplying the groin, the rectum, and parts of generation.

VII.—Branches from the third, fourth and fifth sacral.—Arise from these nerves separately, are distributed to the rectum, to the sphincter and levator ani-muscles; to the bladder, uterus, and vagina, in the female; and to the bladder, prostate gland, and vesiculæ seminales, in the male; and assist in forming the *hypogastric plexus.*

VIII. Obturator.—Is derived from the anterior fasciculi of the second, third, and fourth lumbar nerves; passes downward and forward from behind the psoas muscle, takes its course in the direction of the linea ilio-pectinea, accompanied by the vessels of the same name, and is continued through the aperture in the ligament which fills up the obturator foramen. It then divides into an *anterior* and *posterior* branch.

1. *Anterior.*—Is distributed to the adductor longus and brevis, and the gracilis, and is connected by different twigs with the saphenus.

2. *Posterior.*—Is distributed to the obturatores, and adductor magnus muscles.

IX. Crural.—Is more considerable than the obturator; and is derived from the junction of the principal portions of the *four upper lumbar* nerves. It passes downward, and outward, between the psoas and iliacus muscle, to both of which it furnishes twigs; continues it course on the outer side of the psoas, descends into the thigh behind Poupart's ligament; and, being placed exterior to the sheath of the femoral vessels, on the outer side of the artery, and in the upper part of the thigh, it divides into branches distributed to the skin and muscles.

1. *Superior cutaneous*.—Comes off sometimes above Poupart's ligament, and is joined by other twigs, arising near that part. It divides into from *three* to *six* branches, which are distributed to the *skin* on the fore and inner part of the thigh, as far as the knee.

2. *Muscular branches*.—Are considerable in size and number, and are distributed to the *rectus, cruralis, vasti, adductores*, and *tensor vaginæ femoris* muscles.

3. *Inferior cutaneous*, or *nervus saphenus*.—Descends behind the sartorius muscle, to which it gives off some twigs, and on the inner side of the femoral artery, connected with and sometimes inclosed in the sheath, which contains this vessel. (N. B. There is a nerve accompanying the inferior cutaneous in its descent, which passes into the vastus internus, at the lower part of the thigh.) The *inferior cutaneous* continues its course through the tendon of the *triceps* on the inner side of the knee becomes subcutaneous, and accompanies the *saphena vein* in its course along the inner side of the leg to the inner and upper part of the foot. In its course, it distributes branches to the *integuments* of the knee and inner part of the leg and foot, as far as the great toe.

X. ISCHIATIC.—This is the largest nerve in the body, and is formed by the junctions of the largest portions of the *fourth* and *fifth lumbar* and of the *three uppermost sacral* nerves. It passes out of the pelvis, between the *pyriformis* and *gemini* muscles; sometimes penetrating the pyriformis muscle, a slip of which is occasionally interposed between its fasciculi. It takes its course over the rotator muscles, between the tuberosity of the ischium and trochanter major, covered by the large gluteal muscle; descends in the back part of the thigh, between the flexors of the leg and adductor magnus, and about the middle of the thigh divides into the *tibial* and *peroneal* nerves. The division is seldom lower, but sometimes much higher, and occasionally above the tuberosity of the ischium, so that its two branches are separated by the pyriform muscle. The branches which it gives off are:—

1. *Twigs* to the *obturator internus, gemini*, and *quadratus* muscles.

2. A *branch*, connected with the inferior gluteal nerve, to the *gluteus maximus*.

3. *Branches* to the *biceps, semitendinosus, semi-membranosus,* and *triceps* muscles ; these sometimes come off by a single trunk.

4. *Superior cutaneous.*—Is sometimes separated from the trunk near to its origin. It divides into *two* branches, one is continued forwards, and distributes twigs to the *skin,* about the tuberosity of the ischium and adjacent parts : the other descends along the back part of the thigh, and distributes twigs to the *skin,* as far as the calf of the leg.

5. *Inferior cutaneous.*—Is of small size, and distributed like the former.

Peroneal.—Passes downwards, on the inner side of the biceps, then winds forwards over the head of the fibula, and divides into a *superficial* and *deep* branch. Before this division it gives off a cutaneous branch : thus, the branches of this nerve are :

1. *Cutaneous.*—It takes its course downward along the outer part of the leg, between the gastrocnemius and skin, and after being connected with a branch of the tibial, distributes branches to the outer side of the foot, and terminates by dorsal branches to the fourth and fifth toes.

2. *Superficial.*—Passes downward and forward between he peroneus longus and brevis muscles, becomes subcutaneous about the middle of the leg, and is continued under the skin upon the dorsum of the foot. It furnishes twigs to the skin of the lower part of the leg and dorsum of the foot ; and terminates by *dorsal branches* to the outer side of the fourth, and to the three inner toes.

3. *Deep.*—It is continued forwards, above the former nerve, between the muscles, and divides into,

a. Recurrent branch distributed to parts about the knee-joint.

b. Muscular branches, to the *tibialis anticus, extensor longus digitorum, extensor proprius pollicis,* and *peronei* muscles.

c. Anterior tibial branch descends with the anterior tibial artery, before which it is placed, upon the dorsum of the foot, and divides into branches to the skin, to the *extensor brevis digitorum* and *interossei* muscles, one twig passing into the sole of the foot.

TIBIAL.—The inner and more considerable branch of the *ischiatic* is, sometimes, called the *popliteal nerve*, while in the ham. It descends along the edge of the semi-membranosus in the ham, and is situated more superficially than the vessels. It then becomes more deep seated, passes between the heads of the gastrocnemius, and continues its course through the leg between the superficial and deep-seated layer of muscles, accompanied by the posterior tibial artery, to the outer side of which it is placed. It is continued, with the artery, behind the inner malleolus, and, in the hollow of the os calcis, terminates by dividing into the *inner* and *outer plantar* nerves. It gives off in its course :—

1. *Communicating cutaneous branch*, which is sometimes a branch of the *peroneal* or *ischiatic*. It descends between the gastrocnemius and skin in the course of the vena saphena minor. At the lower part of the leg it is connected with the cutaneous branch of the peroneal, and is then continued behind the outer ankle and along the outer side of the foot, as far as the little toe, distributing in its course twigs to the skin.

2. *Branches* to the *gastrocnemius*, *soleus*, *plantaris*, and *popliteus* muscles.

3. *Branches* to the *tibialis posticus*, *flexor longus digitorum*, and *flexor longus pollicis* muscles.

4. *Cutaneous branch*.—Distributed to the *skin* about the *inner malleolus*, and to that of the back part of the *sole* of the foot.

INNER PLANTAR.—Commonly more considerable than the outer. It passes forward above the adductor pollicis, along the tendon of the flexor longus, and, after giving off branches to the muscles of the great toe, to the flexor brevis digitorum, the flexor accessorius, and to the lumbricales, divides into four *plantar digital* branches.

1. *First plantar digital*, which is continued along the inner side of the great toe to its tip.

2. *Second*, which is continued to the interstice between the first or great toe, and the second toe, where it divides into one branch which passes along the outer side of the great toe, and another which takes its course along the inner side of the second toe.

3. *Third,* which passes to the interstice between the second and third toes, where it divides to these toes in the same manner as the former.

4. *Fourth,* which divides to supply the third, and fourth toes, in like manner.

Outer Plantar.—Takes its course outwards and forwards with the artery of the same name, between the flexor brevis, and flexor accessorius ; and, after giving off twigs to these muscles and to the skin, divides into three branches, two *plantar digital,* and one *deep* branch.

1. The *fifth plantar digital,* divides at the interstice between the fourth and fifth toes into two branches, one of which is continued along the outer side of the fourth, and the other along the inner side of the fifth toe, to their extremity.

2. The *sixth* passes along the outer side of the foot, and after giving off twigs to the abductor of the fifth toe, is continued to its extremity.

3. The *deep* passes obliquely inwards and forwards, deep-seated between the tendons of the flexor longus digitorum and the interossei. It gives off twigs to the interossei, transversalis, lumbricales, to the muscles of the little toe, and to those of the great toe.

SYMPATHETIC NERVE.

This nerve is also called *intercostal, ganglionic,* &c. and is so distinguished from the other nerves of the body, that it may be described separately, or as a separate system of nerves.

It consists of a considerable number of *ganglia,* of which the number and size differ, not only in different individuals, but in the same individual, on the two sides of the body ; and of branches which, in part, connect these ganglia, or form junctions with the other nerves, and are, in part, distributed to the internal organs. It extends from the base of the skull, on each side of the vertebral column, through the neck, chest, and abdomen, as far as the cocyx, forming, from above to below, numerous ganglia ; these, in the neck, are few in number, but, in the rest of its course, it generally forms *one ganglion* between every two vertebræ ; these are severally connected, by one or more filaments, with each other, and with all the nerves of the spinal marrow; and the uppermost cervical ganglion is connected with most of the cerebral nerves. Lastly, it detaches filaments to the viscera, and those which are distributed in the abdomen form connexions with a numerous set of ganglia, in this cavity, which are placed about the trunks of the large vessels.

The *ganglia*, and their branches on each side of the spine, will be first described, and afterwards those of the abdomen. In tracing the *sympathetic nerve* from above, downwards from the base of the skull, by the side of the vertebral column, the description will be most conveniently begun by the

CERVICAL GANGLIA.

I. SUPERIOR CERVICAL GANGLION.—This is one of the most considerable. It is situated *behind* the *internal carotid artery*, and *before* the *transverse processes* of the *second* and *third cervical vertebræ*, and the *rectus capitis anticus major* muscle. On the inner side, are situated the *pneumo-gastric* and *lingual* nerves, with which it is connected by dense cellular membrane. Its form and size are subject to considerable varieties; it is most commonly of a spindle-like shape, but sometimes, has different contractions; its length is usually not more than that of the second and third vertebræ, but it sometimes reaches lower; occasionally, as far as the *sixth cervical vertebra*, varying in breadth and thickness. Various branches pass off from its circumference; they may be divided into *superior, inferior, external* and *anterior*.

1. *Superior*.—This is generally a single branch, which takes its course through the *carotid canal*, to join with branches of the cerebral nerves. It is situated behind the artery, and, in its course, divides into two branches, which continue their course through the canal, somewhat separated from each other. Whilst still within it, one of the branches joins with a branch sent off from the *external oculo-muscular* (*6th pair*) where passing through the cavernous sinus; sometimes the branch of communication is double; and sometimes there is a ganglion (*ganglion cavernosum*) at the point of the union. The other branch of the *sympathetic* joins with the recurrent branch of the *second divison of the fifth pair*, or the *Vidian nerve*. [Some anatomists describe

small branches also, which pass from the cavernous ganglion to the fifth pair or its divisions : and, of late, filaments have been described by Cloquet and Bock, which, continued from the above-mentioned ganglion with the opthalmic artery, join with the *lenticular ganglion* ; so that this ganglion is considered as belonging to the sympathetic. Indeed, Cloquet considers the ganglion-like enlargements of the spheno-palatine and lingual branches of the fifth pair as parts of the sympathetic, and the Vidian nerve as forming the connexions between them and the cavernous and superior cervical ganglia ; namely, by means of its superficial branch (which is continued as the *chorda tympani*) with the maxillary ganglion of the lingual, and by means of its deep branch with the spheno-palatine ganglion.]

2. *External branches.*—These are *four* in number, which sometimes come off by a single trunk. They pass over the rectus anticus major. The *two upper* join with the arch formed by the connexion of the *sub-occipital* and *first cervical nerves ;* the *third* joins with that formed by the *second* and *third cervical nerves* ; the *fourth*, given off sometimes below the ganglion, joins with the arch of connexion between the *third* and *fourth cervical*, and detaches twigs to the rectus capitis anticus major and scalenus anticus.

3. *Anterior branches.*—They are the most considerable in size, and number, and, from their softer texture, are called commonly the *nervi molles.* The upper, and shorter, ascend to join with the *lingual, pneumo-gastric,* and *facial nerves*, soon after they issue from the cranium. The *inferior*, and larger, pass downwards and forwards, and form a plexus of filaments which join with branches of the *pneumo-gastric*, and surround the divisions of the carotid as well as the common carotid itself, as far as its origin. The most considerable of the anterior branches is the following.

a. Superficial cardiac.—It is formed by several filaments from the forepart of the ganglion, or from the sympathetic below it. A slender nerve is thus formed, which descends on the outer side of the common carotid, before the sympathetic ; it gives some twigs to the *pharynx, œsophagus, thyroid gland*, and adjacent muscles, one or two of which are connected with branches of the *pneumo-gastric*, and terminates by branches which join with branches of the *recurrent laryngeal*. On the left side it reaches lower, and joins with the other cardiac nerves.

4. The *inferior branch* may be considered as the continuation of the trunk of the sympathetic. It varies in size and length. It descends on the *rectus capitis anticus major*, and *longus colli* muscles, at first, behind the *internal carotid*, then behind and to the outer side of the *common carotid* artery; and, sometimes, divides inferiorly into two branches. It detaches twigs which join with the *accessory* and *upper cervical nerves*, and with the superficial *cardiac* and *pneumo-gastric nerve*, and terminates in the following ganglion.

II. MIDDLE CERVICAL GANGLION.—It is situated near the inferior *thyroideal artery*, between the *sixth* and *seventh cervical vertebræ* upon the longus colli. It is not so constant as the superior, but is found in the greater number of instances. It varies in shape, is sometimes very small, and occasionally double. It sends off:

1. *External branches*, which join with the inferior cervical nerves, commonly with the *fourth, fifth, sixth* and *seventh*.

2. *Internal branches*, which accompany the *thyroideal artery*, and join with the *recurrent laryngeal* nerve.

3 *Anterior branches*, *five* or *six* in number, forming the *deep cardiac nerve*. This descends inwards, at first, along the *common carotid*, then, upon the *subclavian artery*, is connected by several filaments with the *pneumo gastric* nerve, and joins with the third cardiac nerve to form the cardiac plexus. The *right* descends from the *subclavian*, along the *unnamed artery*, and, where that vessel divides, joins, by means of a ganglion, with one or two branches of the pneumo-gastric, then passing between the arch of the aorta and the bifurcation of the trachea. The *left* joins with one or two branches from the inferior cervical ganglion, (so that the middle and inferior cardiac branches, which are separate on the right side, are joined on the left,) then passes behind the *arch of the aorta*, is connected by filaments with the *pneumo gastric*, and unites with the *right cardiac* branches to form the *cardiac plexus*.

4. *Inferior branches*.—Theref orm the continuation of the sympathetic; they are *five* or *six* in number. They descend, on the right side, before and behind the subclavian

artery, and on the left side, before and behind the aorta, to join with the *inferior cervical ganglion.* Sometimes, there is only one short trunk which connects the middle with the inferior cervical ganglion.

III. INFERIOR CERVICAL GANGLION.—Is more constantly found than the middle. It varies in size and figure, but is commonly of an irregular form. It is situated before the transverse process of the *seventh cervical vertebra*, and the neck of the *first rib.* It sends off :—

1. *External branches*, which are small. They surround the subclavian artery, and are connected with the undermost *cervical*, and *first dorsal* nerves.

2. *Internal branches*, which join with the filaments forming the *pulmonary plexus.*

3 *Anterior*.—Form the *inferior* or *lesser cardiac nerve*, which is commonly only found on the right side. It takes its course behind the subclavian artery, then, before the unnamed trunk, to the arch of the aorta is connected by filaments with the *pneumo-gastric*, passes between the aorta and pulmonary artery, and joins the *cardiac plexus.*

The *cardiac plexus* is formed by the cardiac branches above-mentioned, but principally by the deep cardiac nerves is situated between the *arch* of the *aorta*, and the *bifurcation* of the *trachea.* It sends filaments to the *aorta* and to the *pulmonary plexus*, but the principal part forms the *coronary plexus.* The left, and more considerable plexus, passes over the *left pulmonary artery*, and is distributed with the *left coronary artery.* The right passes between the aorta, and pulmonary artery, and accompanies the *right coronary artery*, and its divisions.

THORACIC GANGLIA.—In the cavity of the thorax, the sympathetic forms, between the transverse processes of each two vertebræ a ganglion called *thoracic* of an irregular and variable figure. These ganglia are not all of the same size, and often the middle are smaller than those above and below ; the uppermost thoracic ganglion is the largest. They are all connected with each other by considerable single branches and with the corresponding dorsal nerves, by double filaments. From the superior ganglion small filaments are detached to the *cardiac plexus*, and *pulmonary plexus.* The inferior form the *splanchnic* branches.

SPLANCHNIC.—This is formed, commonly, by filaments from all the ganglia between the *fifth* or *sixth* and the *eleventh*; but the number of its roots varies from *three* to *seven*. These unite to form a single trunk near the diaphragm. The *splanchnic* then passes through the lesser muscle of the diaphragm, into the abdomen, and terminates in the *semilunar ganglion*, or in some of the ganglia connected with it. Not unfrequently one or more of the inferior roots pass separately to the semilunar ganglion, or join with some of the abodominal plexuses.

LESSER SPLANCHNIC.—The two or three undermost roots of the *splanchnic* not unfrequently join to form this separate smaller trunk, which passes through the lesser muscle of the diaphragm, is joined by filaments from the upper lumbar ganglia, and terminates principally in the renal plexus.

LUMBAR GANGLIA.—Are situated on the lumbar vertebræ, and are placed more forwards than the dorsal. They are of an irregular figure, much smaller than the dorsal, are placed farther from each other, and are more variable in their situation. They become smaller from above to below, so that, frequently the undermost are not distinct, or are wanting. They are connected with each other, by slender filaments, which vary in size, and in number. Each also, is connected by slender filaments with the corresponding lumbar nerve; and filaments are sent inwards, to join with the *aortic plexus*.

SACRAL GANGLIA.—They are, generally, *four* or *five* in number, and are placed in a row which converges from above to below. The last is situated between the *sacrum* and the *os coccygis*, and is united with the opposite by a short slender filament. They are connected with each other, as well as with the last lumbar ganglion, by slender filaments, and, by similar threads, with the sacral nerves; and they send filaments to assist in forming the hypogastric plexus.

SEMILUNAR AND CŒLIAC GANGLIA, AND SOLAR PLEXUS.—These form the centre, from which nerves are distributed to the viscera contained within the abdomen. They are situated *before* the *abdominal aorta*, *behind* the *peritoneum*, *between* the *renal capsules*, and *surround* the trunk of the *cœliac artery*. There are commonly two considerable ganglia, called the *semilunar* from their figure, situated on each side, which are about an inch in length, and of considerable breadth and thickness. The *right* is commonly larger than the left, and is situated *between* the *vena cava inferior*, and the *right crus of the diaphragm*, contiguous to the *right renal artery*. The *left* is placed between the left crus of the diaphragm, and *left renal capsule* near the *pancreas*. These are connected by numerous filaments, which pass transversely between their inner edges, dividing and joining in their course. About these principal ganglia, between the cœliac and superior mesenteric arteries, are several smaller ganglia called the *cœliac*, connected with the *semilunar*, and with each other by cross filaments, from which numerous other filaments pass off; all these filaments form together an intricate web which has been termed the *solar plexus*.

Sometimes the *semilunar ganglia* are divided into several smaller ganglia, connected by numerous small filaments.—

From the *solar plexus*, numerous filaments are continued with the principal arteries forming junctions, with each other, and intermixed with cellular substance. Each of these sets of filaments is called a *plexus*, and a name is given to each, descriptive of its course or distribution. The plexuses are :—

1. *Hepatic plexus*—Passes downwards and to the right, accompanies the *hepatic artery*, and divides into two, a right and a left plexus, which take the course of the divisions of the artery, and penetrate the corresponding lobes of the liver. They are joined by filaments from the right pneumo-gastric, and detach filaments, which form the—

a. Inferior stomachic plexus, which is continued with the right inferior gastric artery along the greater curvature of the stomach.

b. Filaments to the pylorus, duodenum, and pancreas, accompanying the arteries to these parts.

2. *Splenic plexus*.—Consist of filaments which accompany and surround the *splenic artery*, along the *pancreas*. It furnishes the filaments to the *pancreas* and *stomach*, and passes then with branches of the splenic artery into the *spleen*.

3. *Superior mesenteric plexus*.—Is formed by filaments from the under part of the semilunar ganglia, and from the hepatic, and splenic plexus. It accompanies the trunk

and branches of the superior mesenteric artery, and is distributed to the *small* and a part of the *large intestines*, and to the *pancreas*.

4. *Renal plexus.*—Formed by five or six filaments from the upper and lateral part of the semilunar ganglion, on each side, and increased by filaments from the superior mesenteric plexus. It accompanies the *renal artery*, is intermixed with small ganglia, and distributes its filaments to the *kidney* and *renal capsule*. This plexus is connected by filaments with the inferior thoracic, and superior lumbar ganglia.

5. *Spermatic plexus.*—Is formed by filaments from the renal plexus, joined by others from the superior mesenteric plexus. It descends with the spermatic vessels, furnishes filaments to the *ureter*, and is continued in the male to the *testicle*, and in the female to the *ovary*.

6. *Aortic plexus.*—Is formed by filaments, which are continued from the superior mesenteric plexus along the aorta, joined by branches from the lumbar ganglia.

7. *Inferior mesenteric plexus*.—Is formed by filaments continued from the last mentioned plexus, which, intermixed with *ganglia*, accompany and form a web about the inferior mesenteric artery; and are distributed to part of the *colon* and to the *rectum*.

8. *Hypogastric plexus*.—The filaments from the aortic plexus descending into the pelvis, and joined by filaments from the *lumbar* and *sacral ganglia*, and from their connecting branches, form this plexus. It accompanies the pelvic vessels, and distributes twigs to the *rectum* and *bladder*; in the male to the *prostate gland* and *vesiculæ seminales*, and in the female, to the *uterus* and to the *vagina*.

TABLE OF THE NERVES.

NERVES FROM THE BRAIN.

I. OLFACTORY.—Dividing into—

Branches to the Schneiderian membrane.

II. OPTIC.—Forms the *retina*.

III. COMMON OCULO-MUSCULAR.—Its branches are :—

1. To the levator oculi and levator palpebræ superioris.
2. Branch to the adductor oculi.
3. Branch to the depressor oculi.
4. Branch to the obliquus inferior oculi.
5. Branch to the lenticular ganglion.
   From the lenticular ganglion, are given off the *ciliary nerves*.

IV. INNER OCULO MUSCULAR.—To the obliquus superior oculi.

V. TRIGEMINAL.—Forms the *semilunar ganglion*, and is divided into three branches, viz.

Ophthalmic.—Its branches are :—

1. Supra orbitar.
2. Nassal, giving of—
   a. *Branch to the lenticular ganglion.*
   b *Ethmoidal.*
3. Lachrymal.

Superior maxillary.—Its branches are :—

1. Malar.
2. Spheno-palatine.
3. Pterygoid, giving off :—
   a. *Superficial*, joining with the facial nerve.
   b. *Deep*, joining with the sympathetic nerve.
4. Palatine.
5. Alveolar.
6. Infra-orbitar.

Inferior maxillary.—Its branches are :—

1. Deep temporal.
2. Masseterine.
3. Buccal.
4. Pterygoid.
5. Temporal.
6. Dental.
7. Lingual.

VI. OUTER OCULO-MUSCULAR.—To the abductor oculi, and gives off :—

1. Branches which join with the sympathetic.

VII. AUDITORY,—To the internal ear.

VIII. FACIAL.—Its branches are :—

1. Chorda tympani.
2. To the auricle and parts about the angle of the jaw.
3. Temporal.
4. Superior facial.
5. Middle facial.
6. Inferior facial.
7. Descending.

IX. GLOSSO-PHARYNGEAL.—To the pharynx and tongue.

X. PNEUMO GASTRIC.—Its branches are :—

1. Small branches.
2. Pharyngeal.
3. Laryngeal, divides into—
   a. *External branch.*
   b. *Internal bronch.*
4. Filaments passing upon the carotid artery.
5. Cardiac.
6. Recurrent.
7. Pulmonary.
8. Œsophageal.
9. Coronary of the stomach.

XI. LINGUAL.—Its branches are :—

1. Descending.
2. To the tongue and its muscles.

NERVES FROM THE SPINAL MARROW.

They Consist of
THIRTY ONE PAIRS.
The ACCESSORY,
and
The SUB OCCIPITAL.

CERVICAL NERVES.

They consist of seven pairs, viz.

FIRST CERVICAL.—Its branches are :—

1. Anterior, forming branches of communication.
2. Occipital.

SECOND CERVICAL.—Its branches are :—

1. Anterior, dividing into—

a. Superficial of the neck.
b. Small occipital.

2. Posterior, forming branches of communication.

Third Cervical.—Its branches are :—

1. Anterior.
2. Posterior.

Diaphragmatic Nerve.—Formed by branches from the second, third, and fourth cervical nerves.

Fourth Cervical,
Fifth ,,
Sixth ,,
Seventh ,, and
First Dorsal.
} form the *axillary plexus.*

Branches from the Axillary Plexus.

I. Thoracic.

II. Scapular.

III. Articular.

IV. Inner Cutaneous.

V. Inner Small cutaneous.

VI. Outer cutaneous.

VII. Radial.—Its branches are :—

1. To latissimus dorsi and triceps extensor.
2. Cutaneous.
3. To supinator longus and extensors.
4. Superficial, giving off :—
   a. Palmar.
   b. Dorsal
5. Deep branch.

VIII. Median.—Its branches are :—

1. To the pronator teres, and the flexors of the hand.
2. Interosseous.
3. Palmar.
4. To the thumb and fore finger.
5. To the fore and middle finger.
6. To the middle and ring finger.

IX. Ulnar.—Its branches are :—

1. To the flexors of the hand and fingers.

2. Cutaneous
3. Dorsal.
4. Superficial palmar, giving off :—
   a. *Branches to muscles of little finger.*
   b. *Branch to little finger.*
   c. *Branch to ring and little finger.*
5. Deep palmar.

THORACIC NERVES.

They consist of twelve pairs. Their branches are :—

I. POSTERIOR, to the muscles near the spine.

II. ANTERIOR, to the intercostal muscles, &c.

III. INTERCOSTO-HUMERALES, from the second and third.

LUMBAR AND SACRAL NERVES.

Both consist of five pairs which communicate and form the crural plexus. Their branches are :—

I. EXTERNAL SPERMATIC, from the first and second lumbar.

II. BRANCHES to the psoas, quadratus, &c. from the first and second lumbar.

III. EXTERNAL CUTANEOUS, from the third lumbar.

IV. SUPERIOR GLUTEAL, from the fourth and fifth lumbar.

V. INFERIOR GLUTEAL, from the second and third sacral.

VI. COMMON PUDIC, from the fourth and fifth lumbar, and from the the three uppermost sacral. It divides into :—
   1. Superior branch, forming dorsal of the penis, or the nerve of the clitoris.
   2. Inferior to perinæum, rectum, &c.

VII. BRANCH to the rectum, organs of generation, &c. from the third, fourth, and fifth sacral.

VIII. OBTURATOR, from the second, third, and fourth lumbar.

IX. CRURAL, from the four upper lumbar, giving off :—
   1. Superior cutaneous.
   2. Muscular branches.
   3. Inferior cutaneous.

ISCHIATIC NERVE, divides into *peroneal* and *tibial*.

PERONEAL.—Its branches are :—

1. Cutaneous.
2. Superficial.
3. Deep branch, giving off :—
   a. *Recurrent.*
   b. *Muscular branches.*
   c. *Anterior tibial.*

TIBIAL, giving off :—

1. Communicating cutaneous.
2. Branches to gastrocnemii, &c,
3. Branches to the deep-seated muscles of the leg.
4. Cutaneous.

TIBIAL NERVE, divides into *inner* and *outer plantar*.

Inner Plantar.—Its branches are :—

1. Plantar digital, viz.
   a. *First*, to the great toe.
   b. *Second*, to the great and second toes.
   c. *Third*, to second and third toes.
   d. *Fourth*, to third and fourth toes.

Outer Plantar,—Its branches are :—

1. Plantar digital, viz.
   a. *Fifth*, to fourth and little toes,
   b. *Sixth*, to little toe.
2. Deep.

SYMPATHETIC NERVE.

Its ganglia, with the branches of the sympathetic connected with these, are :—

I. SUPERIOR CERVICAL GANGLION.—Branches from it are :—

1. Superior. They join with external oculo-muscular and Vidian branch of the trigeminal.
2. External. They join with sub-occipital, and first, second, third, and fourth cervical.
3. Anterior consisting of
   a. *Superior*, which joins with lingual, pneumogastric, and facial.

b. *Inferior.*
c. *Superficial cardiac nerve.*

4. Inferior.

II. MIDDLE CERVICAL GANGLION.—Branches from it are :—

1. External. They join with fourth, fifth, sixth, and seventh cervical.
2. Internal. Join with recurrent laryngeal.
3. Anterior. From deep cardiac nerve.
4. Inferior.

III. INFERIOR CERVICAL GANGLION.—Branches from it are :

1. External. They join with undermost cervical and first dorsal.
2. Internal. Join with nerves of pulmonary plexus.
3. Anterior. Form small cardiac nerve.

IV. THORACIC GANGLIA.—Branches from them are :—

1. Branches of connexion with each other.
2. Branches of connexion with dorsal nerves.
3. Branches from the first thoracic ganglion connected with the pulmonary and cardiac plexus.
4. Splanchnic, formed by filaments from the sixth, seventh, eighth, ninth, and tenth.
5. Lesser splanchnic.

V. LUMBAR GANGLIA.—Branches from them are :—

1. Branches of connexion with each other and last dorsal.
2. Branches of connexion with lumbar nerves.
3. Branches of connexion with aortic plexus.

VI. SACRAL GANGLIA.—Branches from them are :—

1. Branches of connexion with each other, and with the last lumbar nerve.
2. Branches of connexion with sacral nerve.
3. Branches to hypogastric plexus.

VII. SEMILUNAR and CŒLIAC GANGLIA.—Forming the solar plexus, from which are derived :

1. Hepatic plexus, giving off :
   a. *Inferior stomachic plexus.*
   b. *Filaments to pylorus, duodenum, and pancreas.*

2. Splenic plexus.
3. Superior mesenteric plexus.
4. Renal plexus.
5. Spermatic plexus.
6. Aortic plexus.
7. Inferior mesenteric plexus.
8. Hypogastric plexus.

PHYSIOLOGY OF THE NERVES.

Beings possessed of the very lowest degree of vitality appear to be furnished with a *nervous system*. This system is said to be, in all animals, essentially composed of two parts, viz. a central organ consisting of two parts, in the form of cords, one corresponding to each side of the body, and generally having nodular masses upon them, and a set of other cords called nerves derived from the central organ, and going to the sentient, or contractile parts of the animal. In animals having vertebræ the central organ consists of a double cord, or spinal marrow, the greater part contained in the vertebral canal, and having a smaller portion extending into the skull under the name of medulla oblongata, and communicating with the brain, or those nodular masses which have been mentioned as formed upon the cord.

The principle of improvement, in the nervous system, throughout the ascending scale of animals, is the progressive accumulation of nervous matter in large masses, upon that *central organ*, which is nearest the head or mouth.

OF THE MENTAL PROPERTIES OF ANIMALS.

The resemblance of many of the actions of inferior animals to those of human beings, indicates their being possessed of consciousness. It is difficult to estimate the extent of their consciousness, and it is sufficient to mention here, that all other animals are inferior to man in intelligence. There are, however, certain simple affections of the human mind, which appear to be participated in, by the inferior creatures. These may be said to be *sensation*, *volition*, *instinct*, *conception*, *memory*, *association*, *imitation*.

Sensation.—When adequate impressions are made upon our organs, we are conscious of sensation. When, for example, we are conscious of beholding a certain colour, or, in other words, when the rays of light of that colour fall upon the retina, the sensation of light, or *seeing*, is produced. The sense, through which the most powerful impressions are conveyed in the higher animals, is that of *smell*; in human beings, that of *hearing*.

Volition.—By this term is meant the mental desire, or attempt, to produce muscular action. Under ordinary circumstances, its exertion is followed by two effects; certain muscles act, and their action is attended with some degree of sensation.

Instinct.—Besides *sensation* and *volition*, another element appears to be wanted, for the purpose of informing us of the reason why voluntary motion should be required at one time, and not at another, and why in one class of muscles, and not in all. Instinct, therefore, appears to consist in a *natural tendency* to perform certain voluntary movements, without any previous conception of the object they are calculated to attain, upon the occurrence of particular sensations or states of inward feeling. The infant, at the breast or struggling when first plunged into water, employs muscular efforts for its sustenance, no less voluntary than those of an adult in drinking or swimming.

Conception.—This is the faculty of the mind, by which we image to ourselves *former* objects of sense, or impressions. There is every reason to believe, that the inferior animals are susceptible of this. A dog will whine, bark, &c. while asleep, doubtless from former objects of perception being again pictured before him.

Memory.—By memory, is meant the faculty of retaining former impressions on the mind, and of recognizing them when again presented to us, as former objects of perception and thought. This faculty is manifested in the attachments of animals to, and their knowledge of, the persons of particular individuals.

Association.—When the mind is not exclusively occupied with some particular sensation, former impressions recur and pass in review before it. The order in which they occur is not accidental, but there appears some relation between the ideas which connect them; the most remarkable being the relations between cause and effect, time and place, resemblance, &c. This faculty is indicated in animals by their avoiding places where they have been molested, or persons who have injured them. This faculty, however, in many instances, appears to overcome that of instinct, as may be seen from animals, usually considered as the natural enemies of each other, being taught to live together. Thus, hawks, and smaller birds, cats and mice, are taught to live peaceably together in one cage.

Imitation.—This is a principle which also supersedes instinct, and appears more especially vigorous in the early parts of life; the young of every species, having a remarkable tendency to imitate the habits of those around them. If singing birds are brought up exclusively with other birds of a different species, they acquire the notes of the latter instead of those peculiar to their own kind, while, if a bird be reared where it cannot hear the voice of any other, it will *instinctively* practice the notes of its species.

OF THE PARTS OF THE HUMAN NERVOUS SYSTEM.

The parts of the human nervous system may be said to be—1. the *spinal marrow*;—2. the *medulla oblongata*;—3. the *cerebrum* and *cerebellum*;—and 4. *forty pairs of nerves*, which arise from the spinal cord, and the medulla oblongata.

The spinal cord.—It extends from the margin of the foramen magnum of the occipital bone, where it is continuous with the medulla oblongata, to the first lumbar vertebra, where it terminates in a tapering point. The cord has the shape of a flattened cylinder; its breadth is greatest at the lower part of the neck, and at the lower part of the back, and its surface is of white nervous matter.

The spinal marrow is divided longitudinally by *two furrows*, one *anteriorly* and another *posteriorly*, into two half cylindric portions, a right and a left. Each of these portions has been lately proved to consist of *three* distinct longitudinal columns, which, as they correspond in direction to the *corpora olivaria*, *corpora pyramidalia*, and *corpora restiformia* of their respective sides, are considered as continuations of the same.

Mr. (now Sir C.) Bell, in his theory of the nervous system, first supposed the division of the spinal cord, and Mr. Mayo has proved it to consist of those enumerated. According to this view, the *corpus pyramidale* of the right side of the spinal marrow occupies its anterior and inner edge, from the *tuber annulare* to the lower termination of the spinal marrow; and, by previously hardening this organ in alcohol, it may be detached from the rest of the column without apparent laceration. The furrow which separates it becomes visible to the naked eye. From this *column*, at different points of altitude, come off all the nerves destined for *voluntary motion*.

The *corpora olivaria*, situated on the surface immediately behind the pyramidal bodies, and occupying the middle of the lateral aspect of the *medulla oblongata*, are, in like manner continued along the spinal cord downwards towards its extremity, touching, and parallel with, the *columns* of the *corpora pyramidalia*, and consisting like them of bundles of parallel fibres. The *middle-lateral column*, formed by the corpus olivare on each side, gives off, at different points of altitude, certain anomalous nerves, which have been called *respiratory*. The *phrenic*, the *thoracic*, or *external respiratory*, the *accessory nerves of Willis*, and the *nervus vagus* are the chief constituents of this class.

At the surface of the *posterior* and *interior* edge of the half cord, is found another and similar oblong body, which anatomists name *corpus restiforme*, from its resemblance to a rope. This body is, likewise, found to extend itself downwards into the spinal cord, forming a *posterior column*, the last of the three into which each half cylindrical portion of the cord is divided. From the *restiform column*, nerves subservient to *sense* only originate, at different parts of its height. The following then is Sir C. Bell's theory. "From "the anterior aspect of the spinal marrow, on each side, "proceed nerves of *motion*; from the posterior part cor res- "ponding arise nerves of *sense* merely; and from the mid- "dle or lateral column between these, and which coincides "with the transverse diameter of a horizontal section of "the chord, spring nerves of a peculiar function, and nam- "ed *respiratory*."

These different nerves however, appear confused from being placed together in one sheath; almost all the anterior and posterior spinal nerves uniting into one bundle, before giving branches to the surrounding parts, and forming organs of *sense* and *motion* united. The nerves of sense are *larger* than those of motion, and form a ganglionic enlargement a little before their union. Thus, nerves common to both sense and motion are seen to spring from two roots; namely, from a large and knotted posterior root, and a small and uniform anterior root, soon joining itself with the former.

Hence, it will be at once understood why some injuries of the spine produce *loss of sense*, others *loss of motion* only; and a third class, generally more severe, induces privation of both *sense* and *motion*.

OF THE STRUCTURE AND FUNCTIONS OF THE NERVES.

Nerves consist of the same material, as the white matter of the brain. This substance is wrought into delicate filaments contained in sheaths of the finest membrane, several of these being contained in a common sheath, forming nervous fibrils; and a nerve consists of more or fewer of these fibrils, connected by processes of the delicate membrane mentioned. This membrane is called *neurilema*, is very vascular, and may be compared with the pia mater of the brain. A nerve has also a dense white glistening membrane which is called its cellular tunic. The fibrils of a nerve are disposed parallel to each other.

Nerves extend from the spinal marrow and medulla oblongata, to sentient surfaces and irritable parts. The first of these is called their *origin*, the second their *termination*. The mode in which nerves terminate is not satisfactorily known, with the exception of the instance of the optic nerve, which expands within the eye-ball into a sheet of grey matter.

In several instances, the fibrils, of which adjacent nerves are composed, are reciprocally thrown across from one to another, forming what is termed a *plexus*. The nerves which again proceed from a plexus may be more or fewer in number, than those which enter it; but, the essential result is, that nervous fibrils from different sources are brought together to form a new trunk.

What have been termed *ganglia*, have been thought by many to be exactly of the nature of *plexuses*. A *ganglion* is a small nodule of an oval or circular shape, and of a reddish grey colour, which is found either on the trunk of a single nerve, or when two or more branches coalesce. The extreme minuteness, however, of the fibrils in a ganglion renders it very difficult to determine its exact nature.

When a spinal nerve is divided, in its course through the body, the parts supplied by it beyond the division lose *sense* and *motion*, or, are said to be *paralyzed*. But, if the two origins of the spinal nerves be exposed and separately divided, different effects are produced. The division of the *anterior root* deprives the part, which is supplied by the nerve, of *voluntary motion*, sense remaining; the section of the *posterior root* deprives the corresponding part of the body of *sensation*, the power of motion being left.

The *cerebral nerves* taken together are by no means so simple and uniform, either in their origin or distribution as the spinal nerves. Yet the uses of several of them have long been thought sufficiently explained, by reference to the parts which they supply; and modern experiments have thrown no permanent doubt upon the correctness of the opinions deduced from the consideration of anatomical structure. The cerebral nerves, the uses of which have been long known, belong either to *sense* or *motion*.

The nerves of sense included in these are the first, second, the soft portion of the seventh, and the small portion of the fifth, which is called the *gustatory* nerve, and has been considered as appropriated to the sense of taste.

The other cerebral nerves may be divided into nerves of *voluntary* and *involuntary* motion. Their actions however, are very complicated, and as yet by no means determined.

It will be seen that the *sympathetic nerve* supplies branches to the great vessels, to the heart, to the viscera of the abdomen; and, in the abdomen, branches which supply the pelvic viscera. Their function is unknown. The ganglions and nerve itself are, in a very low degree, if at all, sensible. The name of the nerve expresses the belief of anatomists, that it is used to associate the affections of the different parts. The nerve is in some way connected with almost every nerve in the frame, and has evidently some extensive function, although the nature of the agency kept up between this nerve and all the organs of the frame, is as yet conjectural.

OF THE STRUCTURAL DERANGEMENTS OF THE NERVOUS SYSTEM.

As the *spinal marrow* and *brain* are of a similar structure, the organic derangements of these organs are very analogous.

On account of the remarkable degree of sympathy and connexion between the spinal marrow and brain, diseases originating in the spinal marrow, may be propagated to the brain, or diseases of the brain, to the spinal marrow.

The spinal marrow may suffer not only from violence directly applied, but also from a shock communicated to it by a fall.

A violent blow upon the spinal marrow, produces different effects according to the part which is more immediately injured. A blow on the neck renders the *arms* paralytic. If the violence be inflicted on the loins, the *bladder* of *urine*, *rectum*, and *inferior extremities*, and other parts upon which the nerves of the lower part of the spinal marrow are distributed become paralytic, indicated either by *retention* or *incontinence* of urine, *numbness* of the thighs, &c.

The spinal marrow may, like the brain, be much injured, by the pressure of extravasated blood, or by any other cause, which diminishes the size of the spinal canal ; as by *inflammation* of the coverings of the cord, by *exostoses* by *curvature of the spine*, and by *fractures* or *dislocations* of the vertebræ.

Scrophulous tubercles also, frequently grow from the spinal marrow.

Dropsy, may also be mentioned among the diseases of the sheath of the spinal marrow. It is frequently complicated with *hydrocephalus*, and occasionally with an imperfection of the spinous processes of the vertebræ, in which case, there is a tumour in the back having sometimes a free communication with the spinal marrow and the head.

We are, however, still ignorant as to many of the diseases of the nerves.

There are many diseases which seem to be connected with derangements of the nerves, upon the nature of which no light is thrown by dissection, there being nothing visible to be described.

A nerve when punctured sometimes swells considerably and to some extent ; for instance, the cutaneous nerve of the arm when injured in bleeding ; but in other cases the swelling is circumscribed and limited to a small portion of the nerve.

The nerves are found sometimes to shrink. When the sight of an eye has been lost, the optic nerve of that eye is said to become evidently smaller than that on the opposite side.

Nerves cut asunder, if kept in contact, become re-united by nervous matter.

Nerves are subject to *inflammation*.

PART XI.

THE ABSORBENTS.

The system of absorbents consists of *vessels* and *glands*, the former generally passing through one or more of the latter, in their course towards their destination.

The vessels have been divided into *lacteals* and *lymphatics*, but without any practical utility. The former are those which take up the nutritious part of the food from the organs of digestion, for the purpose of conveying it into the blood, while, the latter designation has been given to small vessels in other parts of the body, similar to lacteals in structure and office, but filled with *lymph*, instead of the milky fluid from which the other set derives its name.

All the absorbent vessels of the body terminate in *two trunks*, which pour their contents into the venous system at two points; namely, at the junction of the *internal jugular* and *subclavian veins*, on each side. By far the greater number terminate in the trunk on the *left side*, called *the thoracic duct*. It receives the absorbents of the left half of the head and neck, of the left upper extremity, of both lower extremities, of the left half of the chest and its contents, and of the viscera of the abdomen, except some from the liver. Therefore, those which terminate in the trunk on the right side, are those only of the right half of the head and neck, of the right upper extremity, of the right half of the parietes and contents of the thorax, and of a part of the liver.

THORACIC DUCT.

This name is given to a vessel of a structure similar to that of the lacteals, of about the size of a small quill, and continued from its commencement in the abdominal cavity to where it terminates in the *left subclavian vein*. It passes between the pillars of the diaphragm, at the side of the aorta; it is then attached to the vertebral column until it is directed to the angle formed by the left internal *jugular* and left *subclavian* veins: sometimes it has been seen to open into the two subclavian veins, and sometimes only into the right. There is frequently an enlargement of the under extremity of the duct of an oval or pyriform figure, called the *receptaculum chyli*; an appearance found to be produced by the conglomeration of the numerous tortuous absorbent trunks, forming the thoracic duct, and intimately connected and covered by a dense cellular structure.

There is a vessel of a similar character on the *right side*, called the *right thoracic duct* (ductus thoracicus dexter), formed by the absorbents from the *upper* and *right part* of the body, and terminating on the right side, in the angle formed by the *right* internal *jugular* and *right subclavian* veins. It is said no more than about half an inch in length; and is often wanting.

ABSORBENT GLANDS OF THE HEAD AND NECK.

GLANDS OF THE HEAD.—Their number and size are inconsiderable. Their existence in the interior of the cranium has not been clearly ascertained. They are distinct on the external surface of the head, but are more numerous on the face than on the cranium.—1. On the cranium, there are two or three small glands placed behind the ear.—2. On the face: there are more numerous glands situated, some superficially upon the parotid gland, some deep seated upon the buccinator muscle, and some behind the parotid gland. Those most constantly found, are glands situated along the under edge of the lower jaw upon the anterior belly of the digastricus muscle.

GLANDS OF THE NECK.—There are a few of small size, but not always distinct, which are placed superficially in the course of the external jugular vein. The deeper seated glands are more considerable, both in size and number; there are one or two near the larynx, and some few at the back part of the neck, but the most considerable are situated at the sides of the neck, and are more numerous than any other set of glands in the body, excepting those of the mesentery. They form a chain in the course of the carotid artery and the internal jugular vein, covered by the sterno-mastoid muscle, from the mastoid process to the upper part of the chest. They are most numerous near the division of the trunks of the bloodvessels. There are also smaller glands situated in the space between the sterno-mastoid and trapezius muscles and the clavicle.

ABSORBENT VESSELS OF THE HEAD AND NECK.

SUPERFICIAL.

Superficial absorbents of the Cranium.—These unite to form an uncertain number of trunks. The anterior, three or four in number, accompany the temporal vessels, and enter some of the glands situated under the zygoma. The posterior, which are not more numerous, descend in the course of the occipital artery, pass through the small glands behind the ear, and unite with the superficial absorbents of the neck.

Superficial absorbents of the Face.—They are more numerous than the above, and accompany the blood vessels. Some pass through the glands on the buccinator muscle, but the greater number through the glands at the under edge of the lower jaw, and the glands at the upper part of the neck; and, at this part, the superficial absorbents of the cranium and face join with the deep vessels of the head, and are continued by three or four trunks, which accompany the internal and external jugular veins.

DEEP-SEATED.

Deep seated absorbents of the Cranium.—They have only been found on the *membranes* of the brain, but have never been traced into its *substance*. Their trunks pass out of the cranium with the bloodvessels, and unite with the superficial absorbent vessels of the head and neck.

Deep-seated absorbents of the Face.—Arise from the muscles and cavities of the nose and mouth. Their trunks accompany the bloodvessels, and enter the upper cervical glands.

All the trunks of the superficial and deep-seated absorbents of the head and neck pass through the cervical glands, freely communicate with each other, and with absorbents from the chest and upper extremity. They unite to form one or more trunks, which terminate in the upper part of the thoracic duct, at the angle formed by the internal jugular and subclavian veins, or in one of these veins.

ABSORBENT GLANDS OF THE UPPER EXTREMITY.

There are seldom any found *below* the elbow-joint.

Glands at the Elbow.—There are commonly two or three small glands anteriorly, near the inner condyle. Between the condyle and the cavity of the axilla, five or six glands are commonly found on the inner and forepart of the upper arm, in the course of the humeral artery.

Axillary glands.—The number and size of these are much more considerable than the above mentioned, being, sometimes, as many as twelve in number. They surround the trunks of the bloodvessels, and are situated principally between the serratus magnus, pectoralis minor, and the trunks of the axillary vessels, to which they closely adhere, but extend under the pectoralis major and clavicle.

ABSORBENT VESSELS OF THE UPPER EXTREMITY.

The superficial absorbents of the *trunk* are considered with these, as they all terminate in the *axillary glands*.

SUPERFICIAL.

Of the back of the Trunk.—The superficial absorbents of the whole surface of the back, from the neck to the loins, terminate in the axillary glands. The greater number of these pass upon the trapezius muscle, and are continued through it into the axilla.

Of the side and forepart of the Trunk.—The upper pass over the pectoralis major, and bend over its under edge to the axilla. The lower pass over the serratus magnus and obliquus externus abdominis to the axillary glands. Some of these penetrate the parietes of the chest, and join with absorbents in its interior.

Of the upper Extremity.—They arise from the fore and back parts of the fingers and hand. Those of the back part ascend upon the fore-arm, forming a considerable and freely communicating plexus; they separate then into two sets; one of which passes obliquely over the muscles on the radius, and the other over those on the ulna, to the fore and inner part of the fore-arm, so that near the elbow-joint they all are situated anteriorly. Those of the anterior part of the hand unite to form three or four trunks, which ascend on the forearm, and unite near the elbow with the posterior set. Most of the absorbents pass through the glands at the elbow, and, on the inner side of the upper arm, unite into fewer trunks, and terminate in the axillary glands. A few of the absorbents accompany the cephalic vein; and, after passing between the deltoid and larger pectoral muscles, also terminate in the axillary glands.

DEEP-SEATED.

These are much fewer in number. Two commonly accompany each principal artery in the fore-arm, and these are united into trunks, which ascend with the brachial artery. They communicate freely with the superficial set, and terminate in the axillary glands.

The above-described absorbent vessels of the upper extremity and surface of the trunk, which pass through the axillary glands, unite to form four or five trunks, which surround the subclavian vein. Where this vessel enters the chest, these again unite to form two or three larger trunks, which ascend behind the subclavius muscle, and over the subclavian artery, and terminate, either separately, or after having joined with the deep-seated absorbents of the head, on the right side in the right trunk, and on the left side in the thoracic duct.

ABSORBENT GLANDS OF THE LOWER EXTREMITY.

These are rarely found below the knee, although one has been occasionally noticed upon the upper end of the interosseous ligament connecting the tibia with the fibula.

Popliteal glands.—Are small in size, and their number rarely exceeds three or four. They are deep seated in the fat and cellular membrane, which surrounds the popliteal vessels.

Inguinal glands.—These, except the mesenteric, are the largest glands in the body. Some of them are situated superficially, and others deep seated They vary in size, and in number from eight to sixteen, but there are generally about twelve. The superficial are placed between the skin and fascia of the thigh, and the greater number of these close together about the termination of the vena saphena major, whilst others are situated lower on the fore-part of the thigh. The deep-seated are less numerous; they are placed under the fascia, and close to the femoral vessels.

External Iliac glands.—Are six or eight in number. They are placed in the course of the iliac vessels from Poupart's ligament to the lumbar glands.

Internal Iliac glands.—They vary in number, but are in general more numerous than the external. They are situated about the branches of the internal iliac vessels.

Sacral glands.—Are placed between the sacrum and rectum.

ABSORBENT VESSELS OF THE LOWER EXTREMITY.

With these are described, as in the upper extremity, some of the absorbents of the *trunk*, and in addition those of the external parts of the *organs of generation.*

SUPERFICIAL.

Of the under part of the Trunk—These arise from the under and forepart of the abdomen, from the loins, buttocks, and perinæum. They form communications with each other, and with the superficial absorbents of the lower extremity, and terminate in the inguinal glands.

Of the external parts of the Organs of generation.—In the male they arise from the scrotum and penis; in the female from the clitoris and labia. Those of the penis and clitoris, take their course along the dorsum and side of these parts in two or three trunks. They form various anastomoses at the upper part of the thigh and terminate in the inguinal glands.

Of the Lower extremity—They arise by an anterior and posterior set. The anterior set is formed by absorbents which arise from the upper part of the toes and foot, upon which they form a considerable plexus: the branches from these take their course upwards along the fore and inner part of the leg, to the inner part of the knee. The posterior set is formed by vessels which arise principally from the sole of the foot, and ascend on the posterior surface, but most of them during their course, pass obliquely over the fore and back part of the leg to join with the anterior set. From the branches of both sets larger trunks are formed, consisting of about twelve or fourteen vessels which ascend on the fore and inner part of the thigh, and terminate at the groin in the superficial inguinal glands. The superficial absorbents of the thigh take the same course, those from the back part passing round to join with the former, and terminate also in the inguinal glands.

DEEP SEATED.

They are much less numerous than the former, and accompany the blood vessels. In the leg one or two trunks are found accompanying each of the arteries, and arising from the parts to which the arteries are distributed. They pass with these to the ham, and there terminate in the popliteal glands. From these glands three or four larger trunks accompany the popliteal, and then take the course of the femoral artery, and receiving in their ascent some vessels, which accompany the deep arteries, terminate in the inguinal glands. Some of the deep seated absorbents of the thigh accompany the ischiatic and obturator arteries, and terminate in glands situated in the pelvis.

ABSORBENT GLANDS OF THE ABDOMEN.

These are more numerous than those of any other part of the body. They are situated principally in the doublings of the peritoneum, and may be divided into the *mesenteric*, *ventricular*, *cœliac*, and *lumbar*.

Mesenteric.—Are the most considerable both in size and number. Those of the small intestines are larger and more numerous than those belonging to the large intestines, and those corresponding to the jejunum exceed in both respects those of the other small intestines. There are generally about a hundred, but they vary in number, and many more have been sometimes counted. They are situated between the layers of the mesentery, and none nearer than from one or two inches from the intestines; they increase in size, and are placed more closely together towards the root of the mesentery. The glands of the large intestines are rarely more than thirty, and sometimes not more than twenty, in number; the greater number are found between the layers of the transverse meso-colon. They are situated nearer to the intestines than the former.

Ventricular.—Are situated along the greater and smaller curvature of the stomach; but they are of small size and few, seldom exceeding four or five in number.

Cœliac.—Are the glands situated about the vena portæ and the divisions of the cœliac and superior mesenteric artery. They vary in number.

Lumbar.—Are large and numerous. They surround the aorta and vena cava, and are situated on the forepart and sides of the lumbar vertebræ.

ABSORBENT VESSELS OF THE ABDOMEN.

Of the Parietes of the Abdomen.—The anterior accompany the epigastric artery, the lateral pass along the crista of the ilium and both terminate in the external iliac glands. The posterior pass to the lumbar glands; and those of the parietes of the pelvis are continued to the internal and external iliac and to the lumbar glands.

Of the Viscera of the Abdomen.—They may be divided into those of the *urinary* and *generative* organs, and those of the *chylo-poietic viscera.*

ABSORBENT VESSELS OF THE URINARY AND GENERATIVE ORGANS.

The superficial absorbents have been already described.

Of the Kidney.—The superficial arise from the external surface, pass towards the sinus, and after forming several trunks, join with the deep-seated. The deep-seated arise from the interior, take their course with the vessels to the sinus, and together with the superficial terminate in the lumbar glands.

Of the Renal capsule.—They unite partly with those of the kidney, and in part with those of the digestive organs at the upper part of the abdomen.

Of the Ureters—These join with those of the urinary bladder and kidneys, and terminate in the iliac and lumbar glands.

Of the Urinary Bladder.—They form a considerable plexus on its parietes, and are continued to the internal iliac glands.

Of the Penis and Clitoris.—The deep-seated absorbents of the penis and clitoris, pass with the bloodvessels into the pelvis and terminate in the pelvic glands.

Of the Testicle.—They are numerous and of large size; they form eight or ten trunks, which pass up in the spermatic cord, follow the course of the spermatic bloodvessels, and terminate in the lumbar glands.

Of the Prostate gland and Vesiculæ seminales.—They join with those of the bladder.

Of the Vagina and Uterus.—Those of the vagina and lower part of the uterus terminate in the iliac glands, except some which arise from the orifice of the vagina, and accompany the round ligament through the abdominal ring. Those of the upper and larger part of the uterus are joined by those of the ovaria, accompany the spermatic vessels and terminate in the lumbar glands.

ABSORBENT VESSELS OF THE CHYLOPOIETIC VISCERA.

They are distinguished into those of the *intestines*, *stomach*, *omenta*, *liver*, *spleen*, and *pancreas*. Those of the intestines are frequently called *lacteals*, from the milk-like fluid which they convey during the digestive process, but do not differ in fact from the absorbents at other parts of the body.

Of the Intestines.—Those of the small are much more numerous than those of the large intestines; and of the small those of the duodenum and jejunum are in greater number than those of the ilium. The *superficial* arise from the peritoneal and mascular coats; they run lengthwise on the intestines, and freely anastomose. The *deep-seated* arise from the villous coat, and form the orifices which absorb the chyle. They pass transversely on the intestinal canal which they surround, and anastomose freely with the superficial set. Both sets unite to form trunks, which run between the layers of the mesentery with the bloodvessels, and pass through the mesenteric glands. In their course they join into fewer but larger trunks, and near the pancreas unite with the absorbents of that gland, and of the spleen and liver, to form one of the large roots of the thoracic duct. The absorbents of the descending colon and rectum, terminate in the lumbar and sacral glands.

Of the Stomach and Omenta.—In the stomach, may be distinguished a *superficial* and a *deep seated* set. They follow the course of the principal blood vessels of the stomach. Those of the left extremity pass with the short arteries, and join with the absorbents of the spleen. Those of the upper part, arise from the upper part of the stomach; they pass to the left along the smaller curvature, and through the small glands of that part; then unite near the cardia, are continued to the right, and join with absorbent trunks from the liver. Those of the under part are formed by branches from the under part of both the surfaces of the stomach, and pass through the glands which are found in that situation: they take their course behind the pancreas in the neighbourhood of the cœliac and superior mesenteric arteries, and there join with the trunk of the absorbents of the intestines.

Of the Spleen and Pancreas.—The *superficial* absorbents of the spleen arise from its surface, and pass from its convex to its concave surface. The *deep seated* arise in its substance, and pass out at the sinus, where they are joined by the superficial. Both sets then accompany the splenic vessels to the right, and—join with the other absorbent trunks of the digestive organs.

Those of the pancreas join with the absorbents of the spleen and stomach.

Of the Liver.—The *superficial* absorbents of the upper surface are distributed into three or more sets, which have each a different course of termination. One set is formed by branches from the middle both of the right and left lobe, and consists of six or seven trunks, which ascend between the layers of the suspensory ligament, and pass into the chest between the diaphragm, and ensiform cartilage : they are continued through the anterior mediastinum receiving in their course absorbents from the diaphragm, pericardium, and thymus gland, and terminate commonly in the left trunk, but sometimes in the right, or both. Some of the absorbents of this set occasionally terminate in the thoracic duct before it has quitted the abdomen. The second set is formed by branches from the right lobe, the trunks, of which it is composed, ascend upon the right lateral ligament, pass through the diaphragm, are continued upon its convex surface near the ribs, and terminate in the trunks of the first set : some branches like those of the former terminate in the thoracic duct. The third set is formed by branches from the left lobe, its trunks pass to the left lateral ligament, join with the absorbents from the stomach, and terminate in the thoracic duct before it has quitted the abdomen.

The superficial absorbents of the under surface are less numerous ; those of the right and left lobe usually unite to form one set. They all anastomose with the superficial of the upper surface, and with the deep seated, and form trunks which are collected in the porta, descend with the hepatic vessels, and join with the absorbent trunks of the intestines.

The deep-seated absorbents accompany the bloodvessels and biliary ducts, are collected into trunks which pass out at the porta of the liver, join with the superficial of the under surface of the liver, with those of the stomach, spleen, and pancreas, and unite at the root of the mesentery with the absorbents of the intestines to form the middle root of the thoracic duct.

ABSORBENT GLANDS OF THE CHEST.

They consist of those of the parietes, of the mediastinum, and of the lungs.

Glands of the parietes.—They are small and irregular, both in number and situation. The greater number are placed between and layers of the intercostal muscles, and at the sides of the vertebræ on the heads of the ribs. There are some few in the course of the internal mammary artery.

Glands of the mediastinum.—Those of the posterior mediastinum are small, but often numerous. They are situated in the course of the aorta and œsophagus. Those of the anterior mediastinum are about eight or ten in number, and are situated upon the anterior surface of the pericardium.

Bronchial glands.—They are situated about the divisions of the bronchia, and are found to extend with their branches into the substance of the lungs. Their size and number are considerable. The largest are placed between the divisions of the trachea. At an early period of life, they are of a reddish colour; in the adult they assume a brownish hue, and as age advances become black.

ABSORBENT VESSELS OF THE CHEST.

They consist of those of the *parietes* and of the *organs* contained within the chest.

Of the Parietes.—Those of the sides consist of branches from all the parts which form the parietes of the chest. They unite into trunks, which accompany the bloodvessels in the intercostal spaces, and join at the side of the vertebral column with branches from the spinal canal, and from the muscles of the back. They pass through the glands at the side of the spine, and terminate in the thoracic duct. Those of the forepart arise from the upper part of the abdominal muscles and diaphragm, are united into trunks which take their course at the sides of the posterior surface of the sternum, pass through the glands, which are there situated, receive in their course branches from the intercostal spaces, and form one or two trunks, which ascend before the left subclavian vein. Those of the right side terminate in the right trunk or separately in the subclavian or jugular vein. Those of the left side terminate in the left trunk.

Of the Lungs.—The *superficial* arise from all parts of their surface, and form a complicated network, or plexus, upon their lobes. They form trunks which pass to the inner surface, and terminate in the bronchial glands. The *deep-seated* arise from the substance of the lungs, anastomose freely with the *superficial*, are united into trunks, which accompany the ramifications of the air-tube and blood-vessels, and terminate in the bronchial glands. The vessels which pass off from the bronchial glands, form two or three trunks, which ascend behind the internal jugular vein, and terminate on the right side in the right trunk, and on the left in the left trunk of the absorbents.

The trunks above described receive the absorbents of the pericardium and thymus gland, which ascend in the anterior mediastinum, where they pass through some small glands.

Of the Heart.—The absorbents of the heart accompany its vessels, ascend upon the aorta and pulmonary artery, and pass through several small glands in their course. They unite with the absorbents of the lungs, thymus gland, and anterior mediastinum, and terminate in the left trunk of the absorbents, or separately in the subclavian and jugular vein.

PHYSIOLOGY OF THE ABSORBENT SYSTEM.

Lacteals.—These as before mentioned consist, 1st, of *lymphatic*, or *lacteal* vessels belonging to the small intestines, and from their use called *chyliferous* ; 2d, of the *mesenteric glands* ; and 3d, of the *thoracic duct*.

The *chyliferous* vessels are very small, but very numerous. They arise from small imperceptible orifices at the surface of the *villi* of the internal mucous membrane, and are continued to the *mesenteric glands*, into the tissue of which they spread. They enlarge in size and diminish in number as they become distant from the intestine, and finish by forming insulated trunks, which proceed to the glands, along with the mesenteric arteries.

The *mesenteric glands* are small irregular lenticular bodies, the dimensions of which vary from two or three lines, to an inch or more. They are very numerous, and placed before the vertebral column between the two layers of peritoneum, which form the mesentery.

Their structure is still but little known. They receive many bloodvessels in proportion to their volume, and are endowed with much sensibility.

From the mesenteric glands spring a great number of vessels of the same nature as the chyliferous, but generally more voluminous. These are directed towards the vertebral column, attach themselves to the aorta and vena cavá, frequently anastomosing with each other during their course, and forming the origins of the thoracic duct.

This duct having collected the *chyle*, or nourishing liquid, prepared by digestion, pours it into the circulation, as already described, for the support of the animal frame.

In the interior of the thoracic duct and lacteal vessels, there are valves found, so disposed as to permit the fluid to go from the chyliferous vessels towards the subclavian-vein, but to prevent its return.

Lymphatics—The structure and disposition of the parts engaged in the conveyance of *lymph*, and those already described, as *chyliferous*, being strictly analogous, they are considered as parts of one system. The former are composed of *lymphatic vessels*, *lpmphatic glands*, and also the *thoracic duct*.

Lymphatic vessels exist in every part of the body ; they are not voluminous, they frequently anastomose, and have all a reticular disposition. It has been already seen, that they form two strata, or layers, one *superficial* and another *deep-seated*.

We are unacquainted with the form of lymphatics at their origin : many conjectures have been made on the subject. The most plausible is, that they spring from roots extremely fine, in the substance of the membranes, and of the cellular tissue, and in the parenchyma of organs where they appear continuous with the last arterial ramifications. It often happens that the injection thrown into an artery passes into a lymphatic beside it.

The *origin* and *absorption* of lymph is a subject, by no means well defined, and has been the cause of much discussion among physiologists. This is not a place to notice the arguments for, and against, the differences of opinion, that have been entertained.

The subject of *absorption*, whether performed by the lymphatics or *venous radicles*, appears to be still considered as undetermined, some physiologists admitting that it may possibly be performed by both.

The *origin* of the lymph appears to be equally involved in uncertainty. Magendie says, " In considering 1st, the " nature of lymph which has the greatest analogy to the " blood ; 2dly, the communication suggested by anatomy " between the termination of the arteries and the commencement of the lymphatics ; 3dly, the facility and " quickness with which colouring matter or saline sub-" stances introduce themselves into the lymphatic vessels ; " it becomes, in my opinion, very probable, that the " lymph is a part of the blood, which in place of return-" ing to the heart by the veins, follows the course of the " lymphatic vessels."

Of the *course* of the lymph, there is but little to be said ; physiologists having noticed it, only in a very vague manner.

According to the general disposition of the lymphatic apparatus, the termination of the thoracic duct, and of the cervical trunks in the subclavian veins, the form and arrrangement of the valves, Magendie considers, that the lymph flows from the different parts of the body, from which the lymphatics arise, towards the venous system ; but says, that the particular phenomena of this motion, its causes, variations, &c. have not been studied.

The use of the *lymphatic glands* is completely unknown; and it is perhaps on this account, that so many conjectures regarding them have been formed.

Notwithstanding what remains yet to be done, in investigating the above points regarding the lymphatic system, there is no doubt of its being engaged in performing some of the most important functions of the animal economy.

It is through the *lacteals* that the nutritious part of our food is carried into the blood, and it is by means of the *lymphatics* that the *bile*, *semen*, and other *secreted fluids*, are kept of their proper consistence, and thereby fitted for their several purposes, while they also appear to prevent the undue accumulation of fluids within shut cavities.

STRUCTURAL DERANGEMENTS OF THE ABSORBENT SYSTEM.

The coats, of the lymphatic *vessels* being similar to serous membranes, are subject to similar derangements, namely, *inflammation*, *adhesion*, *ossification*, &c. They sometimes also appear to become *varicose*, or may be ruptured.

The lymphatic *glands* are much exposed to disease, becoming *enlarged* from syphilis, scirrhus, scrophula, &c. The glands of the mesentery and intestines are very liable to obstruction, becoming filled with or converted into matter like cheese or chalk. This occurs more frequently in young subjects, and forms the affection known by the name of *tabes mesenterica*, or marasmus, names derived from the extreme emaciation which results from the obstruction of the course of the nourishing part of the food from the intestines to the blood.

THE END.