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THE

EDINBURGH DISSECTOR.

THE

EDINBURGH DISSECTOR:

OR

SYSTEM

OF

PRACTICAL ANATOMY;

FOR THE

USE OF STUDENTS IN THE DISSECTING ROOM.

BY

A FELLOW OF THE COLLEGE OF SURGEONS
IN EDINBURGH.

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ADVERTISEMENT.

The following work is exclusively intended for the student of anatomy whilst engaged in the dissecting-room. Besides containing a careful digest of the anatomical facts compiled by Winslow, Bichat, Soemmering, Cloquet, and Meckel, whose texts have been respected (and are here fully acknowledged) wherever it suited the practical nature of the work; the author hopes, that by the extent of its practical instruction, it will be found to supply that desideratum so much wanted by anatomical students, viz., a Dissector's Manual.

September, 1837.

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THE

EDINBURGH DISSECTOR.

PART I.

DESCRIPTION OF THE BONES.

INTRODUCTORY REMARKS.

A KNOWLEDGE of the anatomy of the human frame, which is now deemed essential to a right understanding of its diseased conditions, can be best acquired by combining attendance on the lectures of an experienced anatomist, and by actual dissections in practical rooms.* If the student be left to his own judgment in the selec-

* Schools of anatomy are of two kinds. 1*st,* Those taught by *medical men.* 2*d,* Those taught by persons who merely know the details of human structure; and who, having never applied the art to any practical purposes, *i. e.* having never practised as physician or surgeon, repeat in a formal and dull manner, often with much pomposity and in a Quixotic style, the opinions of others, at second hand of course, having no experience of their own; and they farther generally resort to empirical methods of teaching, such as by enlarged views or diagrams, artificial arrangements to aid the memory, &c. They are in fact mere grinding schools of anatomy; and although now a little hackneyed, and the trick is somewhat stale, they still succeed incredibly with the inexperienced student, who seldom reflects on the astounding fact that the lecturer may not only be a worse educated person than himself, but actually totally ignorant of the arts of surgery and physic.

tion of his teacher (which, however, is seldom the case), he ought to prefer the teaching of those who are known to have practised physic and surgery, and to have applied their anatomy to practical purposes. Those who study merely from lectures are frequently clear, distinct, and philosophic in their ideas of anatomy, but they cannot apply the art to surgery or physic; whilst those who have studied merely in the dissecting room, unaided by lectures, are generally throughout life narrow-minded, empirical, and behind the ordinary current of knowledge; they usually reason empirically, without elevated views, and despise the experience of others. The student is recommended to combine both methods of study throughout the whole course of his medical education.

2. The human skeleton, as usually first presented to the Student by the Lecturer on Anatomy, consists of the Bones of an adult person, which have been cleaned of all soft parts by long maceration in water, dried, and articulated: the entire skeleton, when not articulated, will go into a very small compass; a box twenty inches long by seven inches broad, and seven or eight inches in depth, will easily contain it. When articulated, it gives a very accurate outline of the human body when fully clothed with all the soft parts; and thus the student perceives how the skeleton has been described as a frame work, affording at once support and protection to the soft parts, giving to the body its general form, and lastly, when acted on by the muscles, serving the purpose of a series of levers, and hence denominated the passive organs of locomotion.

3. The student requires to study the bones in a great variety of ways. The osteology of the body must be described from a set of bones which have been simply macerated; the age of the individual to whom they may have belonged should be from 25 to 35 years of age, and who during life had been afflicted with no disease affecting the bones more particularly. The articular surfaces must be entire, untouched, and no artificial means used to whiten or polish the texture. The *articulated* skeleton, by which is meant the bones connected together by means of iron or brass wire, and suspended in a frame, must also be studied. Many of

the joints can thus be very successfully imitated, and the preparation is extremely useful—indeed essential, although in many points faulty. The flexibility of the spine, for instance, and cartilages of the ribs, &c. cannot be imitated.

4. In comparative, and to a certain extent in human anatomy, the bones are often preserved connected together by their own proper ligaments, and in this state constitute what is called the *Natural Skeleton*. If it were possible to preserve it without being dried, this would certainly be by far the most perfect; but this is evidently impossible with a bulky skeleton as that of the human adult; the process of drying alters altogether the natural appearance and properties of ligaments and cartilages, so that this preparation would be much less instructive than the artificially articulated one, and is never prepared excepting in fœtuses—children and small animals generally.

5. The bones prepared by maceration, if sound, are extremely hard, even when first removed from the macerating tub; but in consequence, no doubt, of the drying up of that cartilaginous substance, which forms the basis of all bones, in process of time they become considerably harder. They are also very light, having lost a large quantity of fluids, and, if well prepared, they are of a dull white colour, and free from all appearance of oil. When first removed from the macerating tub, however, a slight reddish tinge may be observed.

6. The student will, lastly, particularly remember that the maceration has, together with all the soft parts, destroyed a dense strong fibrous membrane (the periosteum) which every where invests the osseous texture. This membrane the student will find covering the fresh bones in the dissecting room.

SKELETON IN GENERAL.

7. When a section of a long bone is made, such as the thigh bone, the interior is observed to present a cellular appearance, particularly at the extremities; this is called the *cancelli*, *cellular* and *reticulated* structure of

bones, whilst to the section of a flat bone, exhibiting interiorly a finer net work, the term *diploe* or *meditullium* has been employed. The student requires to be informed, however, that during life the whole of the interior of all bones, even the cells which are perfectly microscopic, is lined by an extremely delicate membrane, in all probability mostly composed of blood vessels, whose office appears to be to secrete an oily and highly inflammable semi-fluid of a light cream colour. This substance is the marrow or medulla of bones. In certain diseases this oily juice seems to become entirely absorbed.

8. The osteogeny, or original growth of bone is unquestionably one of the most interesting subjects which can be presented to the anatomist. Its difficulty may be appreciated by glancing at the formidable lists of authors who have written on the subject, but it will be best understood by visiting the museum of an anatomical teacher. The number of preparations may readily exceed a thousand, and yet not elucidate a tenth part of the interesting phenomena connected with the healthy and diseased conditions of bone.

9. The skeleton is at the first, *i.e.* during the early part of fœtal life, cartilaginous, and in the areolæ or vacuities of this soft cartilaginous basis an inert salino-terreous substance, composed chiefly of phosphate of lime with a little carbonate of lime, is gradually deposited. This deposit is regulated by fixed laws, and takes place at various points, sometimes simultaneously, in other cases irregularly. The eminences observed surmounting most of the bones grow or rather harden from a central point proper to them, and at the age of 14 or 15, although the skeleton may have acquired its full bulk, these will be found separate from the greater mass of the bone. These separate portions, when found in this state, have received the name of *epiphyses.* At a more advanced age they all unite, so as to form one bone, but even then, presenting a rougher less finely finished appearance, their distinction from the body of the bone can readily be detected, and the term apophyses or process is given to most of them.

10. The following table had better be committed to memory by the student, or carefully studied at the very

commencement of his studies; it contains an enu- tion of the various processes found in the skeleton. These terms are in constant use in the dissecting room; and if the student is not perfectly familiar with them, he may actually know a deal of anatomy without being able to *name* a single part.

- **PROCESSES.** Destined for
  - Serve for articulations.
    - Those which belong to the moveable articulations: are
      - *Heads*, which are nearly hemispherical.
      - *Condyles*, which are broader in one direction than in the others.
    - Those belonging to the immoveable articulations: are
      - *Serræ* or *Dentations*, as in the bones of the cranium.
      - *Roots*, as in the teeth.
      - *Ridges*, as is seen in those articulations, called *schindyleses.*
  - The insertion of fibrous organs, whose points of attachment they multiply, are called,
    - According to their general form,
      - *Impressions*, irregular eminences, not much elevated, but rather broad; they are formed of a great number of small tubercles placed very close together, and separated by slight depressions.
      - *Lines*, unequal eminences, long but not very prominent.
      - *Crests*, eminences resembling lines, but broader and more prominent.
      - *Prominences*, when they are rounded, broad and smooth.
      - *Tuberosities*, when rounded and rough.
    - After the bodies to which they have been compared,
      - *Spinous processes*, that is the form of a spine.
      - *Styloid*, like a style.
      - *Coracoid*, like a crow's beak.
      - *Odontoid*, like a tooth.
      - *Mastoid*, like a nipple.
    - According to their uses,
      - *Trochanters*, or those which are subservient to the art of turning.
      - *Orbitar*, belonging to the orbit, &c.
    - According to their direction and relative situation.
      - *Ascending processes.*
      - *Vertical.*
      - *Transverse.*
      - *Superior*, &c.
  - The reflection of certain tendons which deviate from their original direction, are called.
    - *Processes of reflection.*
  - Corresponding to cavities existing on the surface of some organs, are called *Processes of impression.*

11. The bones also present various cavities on their surfaces, and it is equally essential for the student to be familiar with the terms employed by anatomists for these. The following table comprises the whole.

The external cavities of bones, when

- *Articular*, are called
  - *Cotyloid*, when they are hemispherical.
  - *Glenoid*, when broad and shallow.
  - *Trochleæ*, when they are grooved like pulleys.
  - *Facet*, when nearly plain.
  - *Alveoli*, when they are conical.
- *Non-articular*, are called,
  - Of *reception*, these are,
    - *Fossæ*, when the entrance is wider than the bottom.
    - *Sinuses*, when it is narrower.
  - Of *insertion*, these are,
    - *Impressions*, when they are wide, irregular, and shallow.
    - *Fissures*, when extended in length.
  - Of *impression*, which are called,
    - *Grooves for the passage of tendons.*
    - *Grooves*, *gutters*, or *channels*, when they correspond to arteries or veins,
  - Of *transmission*, named,
    - *Notches*, when superficial, and formed in the edges of bones.
    - *Foramina* or *holes*, when they pass through and through a thin bone.
    - *Canals* or *aqueducts*, when their passage is of great extent, or when formed by the superposition of several holes.
    - *Clefts* or *scissures*, if they are longitudinal and very narrow.
  - Of *nutrition*; they transmit vessels for
    - The medulla of the long bones.
    - The spongy tissue of the short bones, and of the extremities of the long bones.
    - The compact tissue.

12. The bones composing the skeleton are symmetrical, being either median and single (admitting of being divided into two equal halves), or lateral and in pairs, and which singly are not symmetrical.

The skeleton may be divided into

1. Trunk.
2. Extremities.

(1.) The trunk is subdivided into a middle part, with its upper and lower extremities or subdivisions. The middle part includes the cervical, dorsal, and lumbar vertebræ, ribs and sternum. The upper extremity of the trunk is the head; the lower extremity is the pelvis.

(2.) The extremities (in common language, arms, legs,) are in fact appendages to the trunk, and are

1. The superior—thoracic extremities or arms.
2. The inferior—pelvic extremities or legs.

13. The enumeration of the bones of the adult skeleton is as follows:—

7 Cervical vertebræ.
12 Dorsal vertebræ.
5 Lumbar vertebræ.

5 Sacral. 4 Coccygeal. 2 Ossa innominata.	These combined form the pelvis, which is thus composed of eleven bones.
24 Ribs. 1 Sternum.	These with the twelve dorsal vertebræ, form the thorax, which is thus composed of thirty-seven bones.

1	Occipital.	These form the cranium, which is thus composed of eight bones.
1	Sphenoidal.	
1	Ethmoid.	
1	Frontal.	
2	Parietal.	
2	Temporal.	
2	Superior maxillary.	These form the face, which thus includes fourteen bones.
2	Palate.	
2	Lachrymal.	
2	Turbinated.	
2	Nasal.	
2	Malar.	
1	Vomer.	
1	Inferior maxillary bone.	

To these, however, may be added the following in connexion with the head :—

2	Mallei.	These are included within the petrous portion of the temporal bone.
2	Incudes.	
2	Ossa orbicularia.	
2	Stapedes.	
1	Os hyoides, suspended to the temporal bone.	
32	Teeth, each jaw supporting sixteen of these.	

The superior, thoracic, pectoral extremities or arms, are each divided by anatomists into four regions, viz. Shoulder, Arm, Forearm and Hand.

1	Clavicle.	Constituting the shoulder.
1	Scapula.	
1	Humerus.	The arm.
1	Ulna.	The forearm.
1	Radius.	
1	Trapezium.	These eight bones compose the carpal region, and are arranged in two arches, one within the other; the more external arch is formed of five bones. The small internal arch is composed of three.*
1	Scaphoid.	
1	Semilunar.	
1	Pyramidal	
1	Pisiform.	
1	Unciform.	
1	Magnum.	
1	Trapezoides.	

5 Metacarpal bones composing the metacarpal region, and named in their numerical order, *first*, *second*, &c., counting from the radial or external side of the arm, towards the internal or ulnar.

* The usual way is to subdivide the carpal into two rows of four bones each, but that this is not a practical view, any one may satisfy themselves by examining the articulated carpal bones from the dorsal region.

14 Phalangeal bones enter into the composition of the fingers; each finger has three of these bones, excepting the thumb which has only two; and in reference to each finger the bones are designated *proximal, middle*, and *distal.*

There are always in the adult subject two small bones playing an important part in the articulation between the metacarpal bone and proximal phalanges of the thumb; but as in stout men similar bones are developed in the same situation in the fingers, they had better perhaps not be included in the enumeration.

The Inferior, Pelvic, Abdominal extremities or Legs, are divided by anatomists into three regions, viz. Thigh, Leg, and Foot.

1 Femur. Composing the region of the thigh.
1 Tibia.
1 Fibula. } Composing the region of the leg.
1 Astragalus.
1 Calcaneum.
1 Naviculare.
1 Cuboid.
1 Internal cuneiform.
1 Middle cuneiform.
1 External cuneiform. } These seven bones compose the tarsal region of the foot.
5 Metatarsal bones composing the metatarsal region of the foot, and named in their numerical order, *first, second*, &c., counting from the Tibial or internal side of the Leg towards the external or Fibular side.
14 Phalanges enter into the composition of the toes, each toe having three of these bones excepting the great toe which has only two; and in reference to each toe the bones are designated, *proximal, middle* and *distal.*
1 Patella or Rotula, Knee Cap. This bone is always articulated with, and enumerated by all anatomists as a bone of the skeleton. They have overlooked, however, many other bones of a similar nature which are found in the human body equally constant. The two alluded to in reference to the thumb, and a similar pair connected with the great toe, are bones in every respect analogous to the Patella.

The student will be struck with the great similarity of the Arms and Legs even in man. The Legs have each two bones fewer than the Arms, but the two Ossa Innominata connect the Legs to the Sacrum, and these are evidently strictly analogous to the shoulder, in which are included the scapulæ and clavicles.

ABSTRACT.

12. Thus the Adult Skeleton as generally seen in Museums, consists of

Vertebræ (Azygos bones) - - -	33
Ossa innominata (in pairs) - - -	2

Ribs in pairs, 24, and sternum (azygos) 1, - -		25
Cranial and facial (azygos) - -	6	
Ditto (in pairs) - -	8 = 16	
	—	22
Bones of the internal ear (in pairs) - -		8
Bone of the tongue - - - -		1
Teeth, bones of mastication - - -		32
Superior extremties (in pairs) - - -		64
Inferior extremities (in pairs) - - -		60
Sesamoid bones (*Osteides*) connected with both extremities		4
Total number -		251

OF THE VERTEBRAL COLUMN.

15. The *Vertebral* or *Spinal Column*, is a bony pillar, placed at the posterior and central part of the trunk, and extending from the head to the terminating coccygeal bone. It may be conveniently subdivided into two great divisions, a *superior* and *inferior*. The superior is flexible, and composed of twenty-four bones, or true vertebræ; the inferior usually more fixed, is composed of nine bones, or false vertebræ. Although superiorly capable of bending in all directions, it is yet very solid, and is excavated throughout its whole length by the spinal canal which lodges the spinal marrow. It is rounded in front, irregular behind, and perforated on the sides with a great number of holes.

16. The superior division of the column is composed of twenty-four short and very angular bones, placed one above the other, named *Vertebræ*, and twenty-two fibro-cartilages situated between the bodies of these vertebræ, at once connecting them firmly to each other, and contributing considerably to lengthen the column. The elasticity and flexibility of this part of the spine depends entirely on the presence of these fibro-cartilaginous bodies, and as they cannot be well preserved in the skeleton artificially articulated, some other means of connexion are used, such as pieces of cork, putty, &c. All these artifices have the great disadvantage of preventing the student noticing one of the most remarkable properties of the column, viz. its flexibility and elasticity. The inferior division of the spine is divided into two regions, a sacral and coccygeal. These in the adult are usually neither flexible nor elastic; the sacral vertebræ are peculiarly fixed.

OF THE VERTEBRÆ IN GENERAL.

17. The upper division of the vertebral column has been divided by anatomists into three regions, although the individual vertebræ composing it, are in a remarkable degree similar to each other. They *do* differ, however, and we shall select the first lumbar as presenting the general characters with fewest exceptions. We have a superior and an inferior surface, an anterior and posterior surface, and two lateral surfaces. A cylindrical or oval, thick and broad mass marks the anterior aspect, and it has been named the *body* of the bone, transversely convex in front, slightly concave from above downwards, flattened superiorly and inferiorly, and which flat surfaces are articular, corresponding to the inter vertebral fibro-cartilages. From the sides of this cylindrical body, right and left, arise a strong process named the *pedicle*, contracted superiorly and inferiorly, and these contractions receive the name of *incisuræ* or notches. These pedicles are separated from each other at their origin posteriorly, to the extent of about an inch, and this interspace formed by the body is here rather flattened, forming the anterior wall of the spinal canal. Projecting laterally nearly at right angles from the pedicles, we observed two transverse processes; from the same pedicles, but projecting upwards, we have two processes, *(superior articular,)* whilst other two processes project downwards, (*inferior articular,)* from these common roots two broad *laminæ* pass toward the mesial line, which uniting, form a projecting and more or less prominent *spinous process*. The whole of these processes thus united in the *spinous*, are set off from the body in such a manner as to leave a short but wide canal, named the vertebral foramen, when speaking of a single vertebra, but which, when the vertebræ are articulated with one another, concur to form the *spinal canal,* whilst the incisuræ or notches pointed out on the sides of the pedicles form the intervertebral foramina, or foramina of juxta-position (conjugalia,) and admit of the escape of the nerves from the medulla spinalis.

OF THE PARTICULAR VERTEBRÆ.

18. The *Cervical Vertebræ* (seven in number) are smaller than the others. They have their *body* elongated transversely, a little thicker anteriorly than posteriorly, and on the sides than in the middle; concave above, and surmounted laterally by two small projecting laminæ; convex below, and presenting two superficial notches on the sides, which correspond to the laminæ of the upper surface. Another peculiar character which the body of these vertebræ possesses, is, that its upper surface is broader than the lower, whilst in the other vertebræ it is the latter which is the more extensive. The body is also lower than in the dorsal and lumbar vertebræ. The *spinous process* is bifurcated, horizontal, and short. There is a hole for the passage of the vertebral artery at the base of the *transverse processes*, which are short, bifid at the summit, and present a channel above, in which lie the cervical nerves, after having escaped from the spinal canal. On account of the hole which passes through their base, these processes seem as if they had two roots, one of which arises from the body itself. The *inferior articular processes* are of an oval form, somewhat concave, and are directed forwards and downwards; the *superior* are also oval, but present opposite characters. The *Laminæ* of the cervical vertebræ are longer and narrower than those of the others, and concur to render the vertebral foramen proportionally larger, and of a triangular form, with the angles rounded. Their upper circumference is formed by a sharp edge, and is smaller than the lower, which seems to embrace the vertebra situated beneath. The *notches* are anterior to the articular processes.

19. The *First Cervical Vertebra* or *Atlas* is peculiar. It presents the form of a ring which is more or less thickened at the sides, and is formed anteriorly by a small compressed arch, which does not occupy more than a fifth part of the circumference. It is convex and tubercular anteriorly, concave in the opposite direction, where an oval articular surface is observed, which connects it with the tooth-like process of the second vertebra. This arch is thin above and below, and gives insertion to ligaments. Posteriorly, the ring is complet-

ed by a larger bony arch, which also gives attachment to ligaments above and below, and which is tubercular behind for the insertion of the posterior small recti muscles of the head. This arch is rounded and thick behind, but anteriorly, where it joins with the rest of the vertebra, it is depressed and marked above with grooves for the vertebral arteries and suboccipital nerves, and below for the second pair of cervical nerves. The atlas has moreover a large *vertebral foramen*, divided by a ligament into two portions; of which the posterior alone contributes to the formation of the spinal canal. Two irregular tubercles, on the inside of the upper articular processes give attachment to this ligament. The *notches* are here situated behind the *articular processes*, which are nearly horizontal and very broad. The *superior*, which is concave, oval, and inclined inwards, is articulated with the occipital bone; the *inferior*, which is nearly plain, is also inclined inwards, and is connected with the second vertebra. The *transverse processes* are very long, terminate in a more or less obtuse point, and rise by a double root, of which the anterior branch is more slender, the posterior longer and thicker. The hole in their base is larger than in the other cervical vertebræ.

20. The *Second Vertebra* or *Axis* is also peculiar. It has a nearly triangular circumference. The *body* is much higher than broad, and is marked anteriorly with a central ridge and two hollows for the longi colli muscles. From its upper part rises a long, rounded, vertical projection, named the *odontoid* or *tooth-like* process, which is articulated before with the anterior arch of the atlas, and is marked behind with a small convex surface for sliding on the transverse ligament. The *spinous process* is very large, and is marked below with a broad and deep channel. The *upper notches* are placed much farther back than the *lower*. The *superior articular processes* are nearly horizontal, inclined a little outwards, and convex: they are broader than the *inferior*, which are turned forwards and downwards. The *transverse processes* are short, and are neither bifurcated nor channelled; they seem to arise from the superior articular processes, and their base is perforated by a short canal, for the vertebral artery, which has

an oblique direction outwards. The *laminæ* are thick and strong.

21. The *Seventh Vertebra* (*vertebra prominens,*) differs from the rest only in being larger, and in having its spinous process more elongated, and commonly not bifurcated, as well as in the circumstance of the hole in the base of its transverse processes being generally smaller than in the other vertebræ, or even altogether wanting. The vertebral artery does not pass through this opening even when present, but the vein generally does.

22. The *Dorsal Vertebræ* (twelve in number) diminish in size from the first to the fourth or fifth, and then increase to the last, so that the fourth and fifth are always smaller than the rest. Their *body* has a greater diameter from before backwards than transversely, except in the two first, and two or three of the last, is thicker behind than before, and very convex at its middle and fore part: its upper and lower surfaces are flat, the former of which is narrower than the latter. On its sides it generally presents two demi-articular facets, the upper being the larger, to which the heads of the ribs are articulated. In the first nine dorsal vertebræ, the upper and lower surfaces of the body are heart-shaped; but in the rest they are rounded. The *spinous processes* are long, of the form of a triangular prism, tubercular at the summit, inclined downwards, and imbricated. The *transverse processes*, which are very long and thick, are directed a little backwards. Excepting in the two last, their summit presents a rough tubercle, surmounted by a concave and cartilaginous facet, to which is articulated the tuberosity of the ribs. This facet is placed sometimes higher, sometimes lower, according to the vertebræ; but in the upper vertebræ, it is generally directed downwards, and in the lower upwards. The *superior articular processes* are directed backwards, the *inferior* forwards; they are situated vertically above one another. The *notches* are larger than in the cervical vertebræ, and situated anterior to the articular processes. The *vertebral foramen* is no longer triangular, but of an oval form from before backwards, and is smaller than in the neck. The *laminæ* are broader and thicker.

23. In the dorsal region, there are distinguished as peculiar:

24. The *First Dorsal Vertebra,* of which the *body* is more extended transversely than from before backwards, and on the sides presents a complete costal impression above, and a half cavity of the same nature below, which, together with a similar half cavity in the second dorsal vertebra, forms a whole articular surface for the head of the second rib. The *spinous process* is thick and long, with a tubercular extremity, and is nearly horizontal in its direction. The *articular processes* are oblique.

25. The *Tenth Dorsal Vertebra,* has an entire articular surface on the upper part of either side of its body, for the tenth rib.*

26. The *Eleventh Dorsal Vertebra* is remarkable for its size. Its *body,* which is almost round, approaches much in its general appearance to the lumbar vertebræ, and presents on each side, towards the pedicle of the transverse and articular processes, a single entire depression for the eleventh rib. The *spinous process* is short, broad, and somewhat horizontal. The *transverse processes* have no articular surface at their extremity.

27. The *Twelfth Dorsal Vertebra* presents exactly the same characters as the eleventh, only its *transverse processes* are shorter, and the *lower articular processes* convex and turned outwards, like those of the lumbar vertebræ.

28. The *Lumbar Vertebræ* (five in number) are remarkable for their size. Their *body* has greater breadth than height, more extended in the transverse than in any other direction, the fourth and fifth thicker anteriorly than posteriorly, flat above and below, without lateral facets, concave from above downwards on its fore part, or rather bordered by two ridges, one above, the other below. The *spinous process* is broad, nearly horizontal, transversely flattened, and quadrilateral, the lower margin thicker than the upper. The *transverse processes* are thin, long, and also horizontal, and placed on

* When this is the case, the ninth vertebra must also differ from the others in having a half articular surface only, on the side of its body, and that too on the upper part; this surface is, however, pretty large.

a plane anterior to the transverse processes of the dorsal vertebræ. The *articular processes* are large and elongated; the *upper* are much separated from each other, concave, oval, and turned inwards; the *lower* are nearer each other, and embraced between the two upper ones of the vertebra beneath, are convex, oval, and directed outwards. The *notches* are large, especially below; the *laminæ* thick and broad, but shorter than in the other regions; the *vertebral foramen* broader than in the back, and of a triangular form.

29. The fifth lumbar vertebra is much thicker before than behind, the lower surface of its *body* being cut obliquely upwards, it articulates with the first sacral vertebra which we shall find cut obliquely downwards and backwards, and thus producing a remarkable and important angle, the sacro-vertebral angle, or promontory of the sacrum. The inferior division of the spinal column, composed of five sacral and four coccygeal vertebræ, ought properly to be described here; but unwilling to depart from the usages of most anatomists, we shall describe these vertebræ as a portion of the pelvis.

30. The spinal column in a child is nearly straight, and is very differently shaped from what it is in the adult. In the fœtus, or in a child shortly after birth, the broadest part of the column is superiorly or in the cervical region, and the apex is downwards or inferiorly in the sacral and coccygeal regions. In the adult, its general form is that of a pyramid also, but the base is below. Some have fancied it to represent three pyramids, and those persons do not include the sacrum as forming any part of the spinal column. The column, when articulated and viewed from before, will be observed to present in various parts contractions and lateral expansions. The first expansion occurs at the first dorsal vertebra, and here those persons find the base of two of their pyramids, one, including the five superimposed cervical vertebræ, the other formed by the four succeeding dorsal vertebræ; a contraction will be observed between the fourth and fifth dorsal vertebræ, (22) and here they find the apices of the second and third pyramids; from this point the bodies of the vertebræ increase in all their dimensions until the first sacral, where, of course, the base of the third pyramid is placed. View-

ing the sacrum and coccygeal bones, as component parts of the spinal column, we add another pyramid, composed of the sacral and coccygeal vertebræ, whose base is superior, and apex inferior, thus making four pyramids instead of three. The adult spinal column viewed laterally is convex in the neck, concave in the back, convex in the loins, and again concave in the pelvic region. The column should be perfectly perpendicular in one sense, that is when looked at from before or from behind, so that if divided with a saw in its long axis, the two sections will be perfectly symmetrical ; when it deviates to the right or left, however little, it is still a deformity, and is called *scoliosis* or lateral curvature ; this deformity is common in the dorsal part of the column, the convexity being to the right side, and the concavity to the left. The frequency of this and other curvatures of the spine has been ascribed to many causes, and undoubtedly does arise from a variety of causes, but we apprehend that a congenital want of symmetry in the two sides of the body is by much the most frequent source of the deformity. The posterior aspect of the vertebral column presents two long grooves called vertebral *grooves*, in these lie the large erector muscles of the spine. On its anterior aspect, are placed of course nearly the whole of the viscera, either laterally or directly upon it.

31. *Vertebral Canal.* This canal extends along the whole length of the spine, following its various curvatures, and placed nearer its posterior than its anterior part. Above, it is continuous with the cavity of the skull ; below, it is open posteriorly, in consequence of a deficiency in the osseous ring of the last sacral and of all the coccygeal vertebræ. The canal, whilst traversing the sacrum, is usually called the sacral canal. It is wide in the neck and in the upper part of the back, it then contracts to be again enlarged in the loins. It is triangular above and below, and rounded in the middle.

32. Anteriorly, it is formed by the posterior part of the bodies of the vertebræ, which are covered by the posterior vertebral ligament. Posteriorly, by the vertebral laminæ and the holes that occur between them ; and on the sides, the inner part of the transverse processes, and the intervertebral foramina, are the objects which it presents.

33. The spine, which combines lightness with solidity and flexibility, serves to support the head and chest. It is the seat of all the motions of the trunk, of which it transmits the weight to the pelvis. It lodges and protects the spinal marrow and the membranes which invest it. It gives passage to the spinal nerves and to many vessels. It affords insertion to numerous muscles and ligaments, both anteriorly and posteriorly.

34. No very accurate measurements exist of the length of the spinal column, but it is generally considered to be more than a third of that of the whole body,—the cervical region measuring 5 inches, the dorsal region 11 inches, the lumbar 7 inches, and the sacral and coccygeal $3\frac{1}{2}$ inches, but it must vary much in different individuals. There is no ratio of the comparative length of the spine and the extremities that can be depended on.* We have measured the length of the entire trunk, including the head and pelvis when covered with soft parts, and compared this with the total length and breadth of the body, and the results were as follow :—In these measurements the spine is placed on a horizontal plane, and measured without regard to its curves.

Sex.	Age.		Total length.		Greatest breadth.		Length of trunk.		Ratio of length of trunk to total length.
	Years.	Mo.	Feet.	Inch.	Feet.	Inches.	Feet.	Inches.	
Male	1	2	2	4	2	$1\frac{3}{4}$	1	$5\frac{3}{4}$	1.55
—	7	0	3	$10\frac{1}{4}$	3	9	2	2	1.77
—	45	0	5	$4\frac{1}{2}$	5	$10\frac{1}{4}$			
—	45	0	5	$8\frac{1}{2}$	5	8	2	10	2.
Female	80	0	5	5			2	9	1.97
Male	50	0	5	$6\frac{1}{4}$	5	$5\frac{1}{2}$	3	0	1.83

35. The development, *i.e.* change from the cartilaginous to the osseous state of a vertebra, proceeds from six or eight centres. At birth, if maceration is pushed far, we find a vertebra composed of *three* separate osseous parts, viz. the body, and two lateral parts of the arch. The extremities of these portions, when looked at, will

* Hence we doubt the accuracy of the medical evidence before the Poor Law Commission, which laboured to shew that the erect position so constantly maintained in cotton spinning factories tended greatly to shorten the spinal column. We believe this evidence to be founded upon no correct data.

present a rough grooved appearance, indicative of cartilages having been there. The laminæ have not united in the situation of the spinous process. The pedicles have not united to the body. As age advances, an osseous centre appears in the cartilaginous bases, in the situation of the spinous process in the *back* and *loins*. Similar centres appear at the summits of the transverse processes, and one on each of the articular aspects of the body. These all unite into one mass in the natural healthy arrangement, or they may remain separate to an advanced period of life.

36. The second cervical vertebra has an additional centre for its odontoid process. The seventh has always an additional centre in front of its transverse processes; this in most cases unites, and thus forms the broad transverse process; or, as has been observed by us, and of which the preparations are in our museum, may remain separate, and be developed as a distinct cervical rib.

THE THORAX, OR CHEST.

37. The *Thorax* is formed of the twelve dorsal vertebræ, (22) twelve pair of ribs, and the sternum.

38. The *Sternum* holds the same relation to the ribs anteriorly, as the vertebræ do posteriorly, and comparative anatomists draw a strong analogy between them. Its direction is from above downwards and forwards. It has been divided by anatomists into three parts, viz. a body in the centre, a manubrium, or handle, superiorly, a xiphoid, ensiform or sword-shaped appendix, inferiorly. It is nearly symmetrical, elongated, and flattened, varying in breadth and thickness. Viewed separately it presents an anterior slightly convex, and a posterior concave surface, two lateral irregular edges, and an upper and lower extremity. Its anterior surface is marked with four transverse lines; its posterior surface has a porous appearance, and also shews, though faintly, the four transverse lines; its upper extremity is thick, presents a semicircular notch in the centre. Proceeding from this notch on either side, we observe a shallow sigmoid articular surface, inclined outwards and backwards, corresponding, but very imperfectly, to the

sternal extremity of the clavicle; immediately below this, a rough irregular impression, or very commonly a portion of cartilage, the remains, in fact, of that belonging to the first rib; a sharp edge follows, and then an articular facet for the reception of the cartilage of the second rib, and from which the student will observe the first transverse line runs. This same arrangement will be observed throughout the whole extent of the lateral edges of the bone, the interspace between the five following articular facets becoming shorter and more blunted; the last articular facet being placed immediately at the narrow junction of the xiphoid appendix to the body.

39. The osteogeny of the sternum is most interesting. The original centres of ossification are undoubtedly nine, corresponding with the more highly finished chain of bones forming the sternum of many of the lower animals. In man, towards the inferior extremity, the development is evidently rudimentary, the xiphoid appendix assuming a great variety of forms; and whilst we can almost invariably see, in the young person, the separate centres of ossification in the upper part, inferiorly they are generally confounded and irregularly disposed. We have now before us a sternum nearly full grown, in which the centres of ossification are in pairs; and we lean to the opinion that this is always the arrangement, the sternum being open in the centre at a very early period of fœtal life. The four transverse ridges generally observed on the adult healthy bone indicate the situation where the various centres were latest in running together.

40. Twelve pairs of ribs (*costæ*) form the sides of the thorax. They present considerable variety in length, and are all more or less twisted on themselves. Anatomists reckon them, and name them numerically from above downwards; surgeons usually from below upwards. The eighth is the longest, and a gradual diminution takes place, not only towards the first but to the last. The eighth may be taken as presenting the more general characters in greatest perfection; and in it, as in the others, we find a body and two articular extremities; an external convex, and an internal concave surface; a superior blunt, and an inferior sharp edge. The posterior or vertebral extremity is recognised by

presenting two superficial articular facets, corresponding to each of the half cavities pointed out on the bodies of the vertebræ; the anterior, sternal extremity presents an oval, rough, cotyloid cavity, occupied in the recent subject by a cartilage, which will be seen to be intimately connected with the rib; so much so, indeed, as to resist putrefaction for a very long time, and in some cases remaining after all the soft parts have been removed by maceration. The external aspects of the rib proceeding from the sternal end presents a smooth convex surface, for about nine inches, (in the eighth rib), where an oblique transverse line crosses it, and the convexity of the rib becomes increased; this is named the *angle.* About two inches from the angle we observe a rough slightly projecting surface, the tubercle or tuberosity, presenting on its inferior surface an articular oval facet, corresponding to a similar one pointed out on the apices of the transverse processes of most of the dorsal vertebræ; between this articular facet and the vertebral extremity, there is an irregularly flattened, slightly contracted surface, named the *neck* (*cervix*) of the rib, which rests upon the front of the transverse process. The internal surface presents near its lower sharp edge a groove, deep posteriorly, where it commences near the *tuberosity,* gradually becoming superficial, and losing itself in the inferior edge, about the anterior third of the rib.

41. The first, second, eleventh, and twelfth ribs present slight differences. The eleventh and twelfth are evidently more rudimentary. They have no *tuberosity;* the *angle* is indistinct or wanting; the internal surface has no groove; the head presents only a single articular facet, indicating that they were supported on a single vertebra. They have been called *floating* ribs, from the circumstance of their cartilages of prolongation being short and not connected to the cartilages of the ribs above, but projecting merely amongst the abdominal muscles. In many instances these muscles are traversed by a tendinous line, precisely in the situation where a thirteenth rib would have been found, if it had been present. The first rib is of great importance, more particularly to the surgeon; it is short, seldom exceeding four inches in length, broader and thicker than the rest, and so slightly twisted, as to touch a horizontal plane

with its two extremities. From its peculiar position, the surface, which in the other ribs is *external*, is in it *superior*, and on it we find two important furrows, corresponding to the subclavian vein and artery, separated near the sternal extremity and upon its concave edge by an impression, to which the scalenus anticus muscle is attached; a superficial longitudinal ridge near the convex and outer edge marking the attachment of the scalenus medius muscle. The head of this rib presents a single articular facet, being usually supported on the body of the first dorsal vertebra only. The tuberosity is strong and well marked, but there is no angle or groove on the *internal* (here the *inferior*) surface.

42. The *Costal Cartilages* are twenty-four in number, twelve for each side, and are well designated cartilages of prolongation. They are in the recent fresh state of a dull white colour, a homogeneous texture, compact, somewhat flexible, and highly elastic; when dried they lose more than half their bulk, twist, and become wrinkled; are very brittle, and assume a brownish amber colour, slightly transparent. We have for many years been in the habit of exhibiting these cartilages in this state, and shewing the student that, by placing them for a short time in water (a day or two in winter,) they will regain all their former properties; and this may be done again and again with the *same* cartilage. They are intimately connected to the extremity of the rib by a union of substance (*synarthrosis*). The sternal connexion is as follows:—The first by a synarthrosis to the manubrium of the sternum. The six following present a distinct, convex, angular, and projecting articular surface, corresponding to the cavities pointed out on the sides of the sternum. The first seven pairs of ribs are hence called sternal, or true ribs. In the remaining five pair of ribs, the cartilages do not reach the sternum; those of the eighth, ninth, and tenth pairs being united by a pretty distinct ligamentous substance to the cartilage which immediately precedes them, whilst those of the eleventh and twelfth pairs remain isolated, and float amongst the intermuscular cellular tissue.

43. The osteogeny of the ribs seems simple; in the very young fœtus the whole apparatus of the thorax is carti-

laginous. Ossific deposition commences early in the ribs, and the whole gradually becomes hard, apparently from *one* centre. At the age of eighteen, however, we still find a lenticular epiphysis forming the tuberosity, and a thin separate plate forming the articular surface of the head. The cartilages are frequently partially ossified, although it appears that there is no fixed period for this change; but it is evidently hastened by disease or injury.

44. The *Thorax*, thus composed of an assemblage of bones and cartilages, assumes the form of a truncated cone, somewhat flattened before and behind, and having its base below; both sides ought perhaps to be perfectly similar, but this is in reality very rarely the case. The slightest lateral inclination of the spine destroys this symmetry, and in the most robust persons of both sexes the dorsal part of the spine presents a convexity more or less marked to the right side. In the situation of the eighth and ninth ribs also a superficial but pretty extensive depression occurs, particularly in females, which has led to the supposition that it was produced by the use of corsets, but we have distinctly observed this form to be congenital. The presence of the pectoral extremities conceals the real form of the thorax, and in the male particularly the upper part seems actually the broadest. It has always appeared to us that it is here where the teacher is least aided by his museum in conveying to the student a proper idea of the thorax as a whole. The articulated skeleton, with the very imperfect imitations of the cartilages, conveys an erroneous idea of the physiology of the region, and the *form* alone is correctly represented. It presents for examination an outer and an inner surface, a summit and a base. On the outer surface anteriorly we observe the sternum and xiphoid cartilage, with the sterno-costal cartilages, oblique from above downwards, more or less flat in different individuals; posteriorly, the inclination is nearly vertical, and the whole aspect very irregular. The spinous processes of the vertebræ occupy the mesial line, whilst right and left we observe the vertebral grooves—the articulations between the transverse processes and tubercles of the ribs—a series of surfaces belonging to the ribs, and lastly, the angles

of the ribs, marked by the transverse ridges we formerly pointed out, and which in the articulated thorax form an oblique line, interrupted from one rib to another by the intercostal spaces, and having an inclination downwards and outwards. The inner surface of the thorax presents anteriorly the inner or mediastinal surface of the sternum and sterno-costal cartilages. The ribs on each side, and posteriorly the bodies of the dorsal vertebræ, which protruding form an imperfect partition, concave vertically, and contracting greatly the antero-posterior diameter of the cavity. The lower circumference or base of the thorax is large, especially in the transverse direction; it is deeply notched anteriorly; the xiphoid appendix occupies the centre, whilst the cartilages of the five inferior pairs of ribs form a lateral convex border; posteriorly this base also presents two small notches, caused by the peculiar inclination of the ribs upon the vertebral column. The upper circumference or summit is small, transversely oval, and oblique in a direction from above downwards, and from behind forwards. It is bounded by the upper part of the sternum, the first rib right and left, and the vertebral column. The axis of the thorax is oblique from above downwards, in consequence of the nearly vertical direction of the spine, and the very oblique direction of the sternum; hence a line passed perpendicularly from the base will fall upon the upper part of the sternum, and very much anterior to the truncated apex of the cone.

THE HEAD.

45. The *Head* is a spheroid, and is placed at the upper extremity of the trunk. Like the pelvis, it is really an appendage of the trunk, and has been lately demonstrated to be constructed from the elements of several vertebræ highly developed. The *head*, without the lower jaw, when placed on a horizontal plane, rests upon the incisor teeth and occipital condyles, which are so disposed as to be opposite the middle of a line drawn from the incisor teeth to the most prominent point of the occiput. The centre of gravity of the head is in the middle of this line, and thus we see why the head, not-

withstanding its great weight is so easily supported on the spine. The head will be found, by a reference to our table, (13,) to comprehend the *cranium* and *face.* The anterior region of the cranium is named the *forehead*, or *synciput ;* the posterior, the *occiput ;* the upper part, the *top* or *bregma ;* the lateral parts, the *temples ;* and the lower region, the *base.* Of the bones which compose the cranium, four are single (azygos) bones, and two in pairs, making eight principal bones. The ossa wormiana are variable in number, or even sometimes not present ; the bones of the internal ear form a part of the organ of hearing, and are enclosed in the interior of the temporal bone.

46. The *Occipital Bone* is of a rhomboidal form, and curved upon itself, situated at the posterior, middle and inferior part of the cranium ; it presents a convex and a concave surface, an extensive irregular serrated edge, and is perforated by a large foramen, (the foramen magnum, The Great Occipital Hole.) Viewed externally, we observe that it is generally convex. The foramen magnum, dividing it into two parts ; the smallest portion, (pharyngeal aspect) is nearly horizontal, having rather a rough surface full of minute foramina for the passage of vessels, and mesially a projection, (*spina pharyngea*) this portion is named the *Bazilar surface.* On either side of the foramen there are two convex articular eminences ; they are of an oval form, elongated from behind forwards, and incline from without inwards, limited, externally, by rough surfaces into which are inserted the recti capitis laterales muscles behind, and in front by the condyloid fossæ, which fossæ are themselves perforated by the foramina condyloidea anteriora and posteriora : proceeding from the posterior margin of the occipital foramen, we have an extensive surface (spinal aspect), mesially a more or less distinctly marked ridge, (the *external occipital crest*) runs for the extent of rather more than an inch and a half, and is terminated by an eminence (*the external occipital protuberance*) *:* a smooth convex surface surmounts this *protuberance :* running from the protuberance right and left, are curved lines, (the *superior curved lines of the occipital bone,*) and about half an inch below these, two other lines (the *inferior* curved lines.) These lines

and the surfaces between them, are all occupied by the attachment of powerful muscles.

47. Viewed internally, the occipital bone is concave. We observe first, the internal orifice of the occipital foramen, from which a broad groove called *Bazilar*, runs along the bazilar portion of the bone ; whilst from the posterior and lateral margin of the foramen arises a crest, (*the internal occipital crest,*) corresponding in extent to the external crest, and surmounted by an eminence (*the internal occipital protuberance*) from this protuberance there runs a pretty sharp ridge as far as the superior extremity of the bone, having a channel (*sulcus medianus*) generally on the right side. From the *protuberance* right and left, there occurs a more or less distinct transverse channel (*sulci laterales dexter et sinister.*) These lateral sulci run between two pretty deep fossæ (*the superior and inferior occipital fossæ.*) The superior fossæ lodge a part of the posterior lobes of the brain, and are distinctly marked with mammillary eminences and digital impressions, whilst the inferior fossæ which correspond to the cerebellum, present marks of a more superficial character. On each side the foramen magnum, and near the root of the bazilar portion are placed, the internal orifices of the anterior condyloid foramina, partly surmounted by an eminence, external to which is a portion of a canal which lodges the end of the lateral sinuses, and generally contains the internal orifices of the *posterior* condyloid foramina. The occipital bone being symmetrical, the description of half its circumference will suffice. Mesially, the extremity of the *bazilar* portion of the bone presents a rough square surface, generally broken in separating the sphenoid bone from it. An intervening cartilage is found here previous to puberty, but about this period the connexion becomes osseous, and many anatomists have consequently very properly proposed to view these bones as one, for if the rough square surface of which we now speak, be entire and covered with cartilage, then the sphenoid will *not* be completely formed. Proceeding from this surface to the right or left, we observe an elongated rough vascular looking surface, which is followed by a deep notch whose surface is smooth ; this notch terminates the imperfect ca-

nal, (the termination of the lateral sinuses) alluded to in our view of the inner aspect of the bone. It forms a part of the jugular fossa, and immediately behind it we observe a square eminence (the *jugular* process,) covered with cartilage in the recent state. A deeply serrated edge of about four and a half inches in extent follows, and meets a similar edge from the opposite side, at the superior part of the bone, forming sometimes an acute angle, at other times instead of an angle we have a notch, and in this case the most uniform of the Ossa Wormiana must have been present; this supernumerary bone has received a peculiar share of attention from the comparative anatomist. It is often named the epactal bone, and the cranium of the lower animals generally presents an additional bone in this situation, named anterior occipital, or inter parietal. It is supposed that the epactal bone in man is a rudimentary structure in him. The occipital bone is perforated by five short canals, whose orifices are named foramina, these are the magnum, and the two anterior and posterior condyloid. Its processes are seven in number, viz. two condyles, two jugular, two tuberosities, and a bazilar. Its osteogeny is curious and very complex. At and for some years after birth, simple macertion in water will separate the bone into four portions;—the bazilar, which it will be particularly remarked, supports a small portion of the condyles with about a fifth of the margin of the foramen magnum; two portions, including the remainder of the condyles, and about three-fifths of the circumference of the foramen magnum; lastly, a large squamous portion, supporting somewhat less than a fifth of the foramen magnum. At an early period of the fœtal existence, each of these portions are observed to be developed from several centres. The foramen magnum is evidently analogous to the great vertebral foramen observed in all the vertebræ. The condyles seem to be analogous to the superior and inferior articular processes of two vertebræ; the squamous broad spinal portion is evidently highly developed laminæ and spinous processes, whilst the bazilar in its intimate structure, form, and mode of connection with the sphenoid, presents all the characters of the *body* of a vertebra.

48. The articulations of the occipital bone are the

sphenoidal, temporal, parietal, anterior occipito-atlantal, posterior occipito-atlantal.

49. The *Sphenoid Bone* has been supposed to resemble a bat, thus giving rise to the absurd names of wings to some of the processes. It is a single symmetrical bone, and is placed in the middle part of the base of the cranium. We shall view the bone in the following order,—viz., Occipital or posterior aspect; a Cerebral or upper aspect; an Orbito-nasal or anterior aspect; a Gutteral or inferior aspect.

50. The *occipital* aspect of the sphenoid presents mesially a quadrilateral rough surface, (*spheno-occipital suture*) the counterpart of that pointed out on the bazilar process of the occipital. They are connected to each other, in most cases, by an intervening cartilage, up to the age of 15 or 16, and maceration in water will destroy the medium of connexion and insulate the bones, although the union is so peculiar, that they would not separate in the fresh state without considerable violence and probable destruction of one or other of the osseous surfaces. After this period of life, the sphenoid and occipital rapidly form an osseous union, and the intervening cartilage disappears. Passing to the right or left, the surface is irregular, perforated with numerous holes, all of which, however, lead to the *body* of the bone, but about an eighth of an inch from the *spheno-occipital* surface, the posterior orifice of the vidian canal presents itself. This opening is flanked by a small eminence, which produces an irregular narrow groove, leading from the vidian towards the mesial line and gutteral aspect into a deeper groove, sometimes a canal called the *pterygo-palatine* canal, outside the vidian foramen. There are some asperities, which, fitting but imperfectly the anterior edge of the fibrous portion of the temporal bone, give rise in the fully macerated cranium to an opening in its base, called the *foramen lacerum medium*, and at the extreme limit of the aspect, we observe a sharp angular point, the *spine*.

51. The *cerebral aspect* of the sphenoid presents mesially proceeding from behind forwards, a flat surface continuing the *bazilar groove*, runs forward and terminates in two lateral processes, somewhat vari-

able in form, and named the posterior *clinoid processes*. These processes, and the intervening lamina of bone, are observed to be raised considerably, and to project over a deep depression of a square form, perforated with a number of minute holes. The depression is named the *sella Turcica*, from its being supposed to resemble a Turkish saddle, or better, *pituitary fossa*, as a body named pituitary lies in it. Anterior to the pituitary fossa, the *Olivary process*, sometimes named *middle clynoid*, which again is succeeded by a superficial transverse groove, *(optic sulci)* lodging the commissure of the optic nerves; these *optic sulci* curving slightly forwards, lead directly into the optic canals; lastly, we find a very superficial ridge, flanked by smooth slightly depressed surfaces, *(olfactory depressions;)* laterally the bone is concave, lodging a large portion of the middle lobes of the brain, and presenting several mammillary eminences and digital depressions. More minutely examined, and proceeding from behind forwards, we observe the following parts:—The *foramen spinosum*, an opening about the size of a crow-quill, giving passage to the middle meningeal artery. The *foramen ovale* giving passage to the third branch of the fifth pair of nerves. The *foramen rotundum* giving exit to the second branch of the fifth pair of nerves, externally to which there is a large concave surface, and on the inner side a broad groove which lodges the cavernous sinus,—the internal carotid artery, with the third, fourth, first division of the fifth and sixth pairs of nerves, most of which enter the orbit by an extensive fissure, (sphenoidal fissure,) whose boundaries will be more particularly described in speaking of the *orbito-nasal* aspect. Proceeding forward, we observe the transverse orbitar processes, or small wings of Ingrassias, a triangular depressed transverse eminence of considerable extent, smooth above where it corresponds to the anterior lobes of the brain, and forming part of the orbits below, and presenting posteriorly a narrow but smooth edge which penetrates into the fissure of Sylvius, a fissure of the brain; externally a pointed and free apex, internally and towards the mesial line it forms a thick tubercle (anterior clynoid processes,) projecting over the cavernous grooves, and whose base is traversed by the optic canals. The cerebral aspect is terminated anteriorly by an irregular, serrated, and narrow edge, (the *frontal edge*) and thus leads us to the examination of the

52. *Orbito-nasal*, or anterior aspect of the sphenoid. A vertical and sharp ridge, *(ethmoidal ridge)* surmountted by a minute but distinct flat quadrilateral articular surface, intersects this aspect mesially,—on either side of this ridge, there is an aperture *(foramina Bertinii)* leading to cavities formed in the interior of the adult sphenoid, named the *sphenoidal sinuses;* these apertures will be large or small according to the more or less perfect state of two triangular bones, described by Bertin, and named after him, the turbinated bones of Bertin. They are separate only in the young sphenoid, and ought not, therefore, to have been described as separate bones; they are of extreme delicacy, and often, as we think, imperfectly developed, giving rise to the supposition that they have been broken, and exposing to a great extent the sphenoidal sinuses, which it is singular and interesting to remark, do not exist in young persons. External to the openings of the sinuses, irregular surfaces indicate the lateral articulations with the sides of the ethmoid bone, and also with the palate bones inferiorly. Passing over the sphenoidal fissure, of which we shall presently speak, there occurs on each side an irregular quadrilateral surface, *spheno-orbitar plate* or *process,*—it is smooth and plain, and forms the outer wall of the orbit, and is bounded inferiorly by a horizontal free blunt ridge, *(spheno-maxillary ridge)* which forms the upper boundary of the spheno-maxillary fissure; internally, by a rounded edge, which belongs to the *foramen lacerum anterius* or *spenoidal fissure;* a notch, or sometimes a hole, is observed at the upper part of this edge, for the passage of a branch of the ophthalmic artery; and externally by a rough indented margin (malar); articulating with the malar bone. The anterior orifice of the *foramen rotundum* is seen beneath this surface, and still lower down from its inclination the anterior orifice of the vidian canal, which, however, may be more correctly described as being found on the

53. *Gutteral* or *inferior aspect* of the sphenoid.—Mesially we observe proceeding from before backwards, a ridge, (the *rostrum* or *azygous process*), continuous above with the septem of the sphenoidal sinuses, and received into the upper grooved edge of the vomer. On each side, proceeding from within outwards, a groove, which receives a plate of the vomer, and more externally another groove, which, when the palate bone is *in situ*, contributes to form the *pterygo-palatine canal*; a canal which commences in a minute groove on the occipital aspect of the bone, close to the posterior opening of the vidian canal, and to which we have already alluded, the more particularly as we have found good anatomists at a loss to point out this canal. The *pterygoid processes* are irregular projections, directed vertically downwards; internally, these pterygoid processes present a straight and smooth surface, lined by the pituitary membrane, and forming the lateral walls posteriorly of the aperture of the nasal fossæ. It here presents a pretty sharp ridge bifurcated inferiorly with rough edges, articulating with the palate bones, whilst at its root or base we observe a smooth triangular surface, which looks into the zygomatic fossa. The pterygoid process externally presents a broad surface, to which the external pterygoid muscle is attached, whilst posteriorly the process is deeply hollowed by the *pterygoid fossæ*, into which is inserted the internal pterygoid muscle, and which in this direction divides the process into two laminæ; the internal of these gives attachment to the superior constrictor muscles of the pharynx, and near the root, by the *scaphoid depression* to the external peristaphylin, or circumflex muscle of the palate. The base of this process is traversed by the videan canal, whilst into the bifurcation below is received the *tuberosity* of the palate bones; and on the inner branch of this bifurcation is the *hamular process*, over which plays the tendon of the external *peristaphylin*, or *circumflex* muscle of the palate, whose attachment we have pointed out in the *scaphoid depression*. On the outer and back part of the pterygoid processes we observe the external orifice of the foramina ovalia and the foramina spinosa, placed at the root of a sharp irregular spine; whilst towards the sides, the bone, branching out extensively,

presents, first an oblique concave surface, which belongs to the zygomatic fossæ; a transverse ridge separates this surface from a more extensive slightly concave quadrilateral surface, (temporal processes, or greater wings), forming a large portion of the temporal fossæ. The sphenoid bone is articulated to all the bones of the cranium, and the various articulations form the division between the four different aspects which we have endeavoured to describe. The sphenoid is also articulated with some of the bones of the face, viz. both malar bones, the two palate, in many cases with the two superior maxillary, and always with the vomer. The processes mentioned are fourteen in number, viz. two spinous processes, two posterior clinoid, one olivary, two anterior clinoid, two transverse orbitar, two spheno-orbitar, one azygous, two pterygoid, two hamular. The foramina are six in number,—two spinous, two oval, two round, two leading to the sphenoidal sinuses. The canals are six in number, (presenting, of course, two foramen each), viz. two videan, two pterygo-palatine, two optic. The sinuses are two, *sphenoidal*. The fissures are two, *sphenoidal*.

54. In the child, maceration will separate the sphenoid bone into three portions, one including the body and the wings of Ingrassias: two composed each of the two greater wings and pterygoid processes. By examining the growth of the bone in different fœtuses, at different ages, we observe that the bone hardens from at least *seven* centres of ossification. The state of ossification is particularly interesting about the seventh or eighth month, when the bone will be found to present the appearance of being divided into an anterior portion, or spheno-orbital, and a posterior, or spheno-temporal portion, a division which holds good in most of the lower animals long after birth, and in some throughout life, and constituting what are now called by comparative anatomists an anterior and posterior sphenoid.

55. The *Ethmoid Bone* (sieve-like bone) is single and symmetrical, placed in the mesial plane in the base of the cranium, immediately anterior to the sphenoid, and posterior to the frontal bone, into a notch of which, a large portion of the ethmoid is received. Its form is

nearly cubical, composed almost entirely of thin laminæ, extremely fragile, though hard. The laminæ are placed in a variety of ways, forming many cellules, all of which are lined by a continuation of the pituitary membrane, communicating with the nostrils on the one hand, and with the sphenoidal cells, by the apertura Bertini or oculus Morgagni, on the other. The fully macerated bone is extremely light, and as we have remarked, so fragile, as to give way under the most delicate touch, so that the student seldom has the satisfaction of having an ethmoid in his hand. We are satisfied, indeed, that many a surgeon has passed the public boards without having ever touched the ethmoid bone. One part is of extreme density, viz. the crista galli; and as the bone is really a very important one, we recommend the student to follow our plan. We drill a small hole through the crista galli, and twist a portion of brass wire through it, of sufficient strength to support the bone. We have by this means had the same ethmoid in frequent use for four or five years, and it is still entire! The *sphenoidal* or posterior aspect presents, in the middle, the *perpendicular plate*, extremely thin and retiring in this aspect; superiorly, upon a very reduced scale, a surface precisely similar to those by which the sphenoid and occipital were connected to each other, the continuation, in fact, of the system of the bodies of the vertebræ. A corresponding surface surmounts the ethmoidal ridge (52) of the sphenoid; an intervening cartilage existed in the young person. The perpendicular plate further meets the sphenoidal ridge, and lastly articulates with the vomer, and thus forms part of the septum narium. A deep narrow groove, the ethmoid groove, separates the perpendicular plate on each side from a more or less convex and very irregular surface, the ethmoid cells, being left open by the removal of the sphenoid above, the palate below, and the turbinated bones of Bertin (52) in the middle. Mesially, and looking towards the vertical plate, these irregular surfaces present various interesting objects for examination; superiorly, there is the *superior turbinated bone (concha superior)*, a small thin plate bent on itself from above downwards; beneath it a horizontal channel, the *superior meatus* of the nasal fossæ. This channel runs forward only a short way, and presents an aperture which leads into the *posterior ethmoid* cells, which, however, cannot be seen unless a section of the bone is made; it is thus that the sphenoidal cells communicate with the *posterior* ethmoidal; below this channel we observe the *middle turbinated bone (concha media)*, larger in its dimensions, but very similar to the *superior turbinated*. This middle turbinated bone forms in a great measure another channel, *the middle meatus*, which at its anterior extremity presents a second aperture, leading to the anterior ethmoidal cells; these have no direct communication with the posterior ethmoidal or sphenoidal cells, whilst one of them, named *infundibulum*, situated behind the other, and representing a sort of flexuous canal, directed forwards and upwards, communicates with the frontal sinuses.

56. The *nasal* or *inferior aspect* of the ethmoid presents a *vertical plate*, having a longitudinal direction and a blunt edge, which is articulated with the upper margin of the vomer and the triangular cartilage of the nose. On each side of the perpendicular lamina runs a deep narrow groove, leading to the inferior surface of the cribriform plate, and consequently beneath the olfactory canals. The upper half of the vertical plate will be observed, by a careful inspection, to be traversed by the *internal olfactory canals;* outside the grooves are the inferior horizontal free surfaces of the *middle* turbinated bones; then the *middle meatus;* and, lastly, several thin fragile laminæ, which articulate with or line the inner wall of the superior maxillary bone, and circumscribe the openings of the maxillary sinus. The naso-maxillary or anterior aspect, presents, mesially, the anterior margin of the *perpendicular plate;* laterally, the anterior extremities of the ethmoid *grooves;* external to these, an irregular osseous surface, the anterior ethmoidal cells, imperfect in consequence of the removal of the frontal and superior maxillary bones, which are here required to complete them. It will be observed that the vertical plate becomes thicker as it ascends towards the cribriform plate.

57. The *cerebral* or *posterior aspect* of the ethmoid presents the remarkable drilled appearance which has given the bone its name. Mesially, the crista galli *(ethmoid crest)* rises vertically in a graduated manner, having the form of a triangular pyramid; its anterior edge is short and nearly vertical, and is supported, as it were, on two small depressed eminences, which articulate with the frontal bone, and contribute to form the *foramen cæcum.* On either side is a channel *(olfactory channel)*, perforated in its whole extent, but especially anteriorly, by round irregularly distributed holes, named the *olfactory foramina.* These foramina are of two kinds; some large and distinct, situated close to the base of the crista galli, to the number of ten or twelve; the others are small, and occupy the middle space. The large foramina are in fact the superior orifices of short canals, which subdivide in their descent in the interior of the bone, and are continuous with those pointed out on each side of the upper half of the *vertical* plate. At the very base of the *crista galli*, and quite at the anterior extremity of the olfactory channels, which are here deep, is a small longitudinal fissure, which is traversed by the internal branch of the nasal nerve; more external to the olfactory channels, the surface being slightly elevated, is flattened superficially; it sometimes presents the appearance of an extremely delicate net-work, as is the case with the bone now before us; in others we observe half cellules. An extensive cellule is always observed anteriorly, which meets the frontal sinuses. These horizontal flattened surfaces are indeed completely concealed by the frontal bone when *in situ*, and two transverse grooves, dividing the space on each side into nearly three equal parts, are then converted into canals, the external orifices of which have received the name of internal orbital holes, *(foramina orbitaria interna)*,—they might be called the *ethmoido-frontal* canals. This aspect is terminated posteriorly and mesially by a pretty deep notch, in which we find that horizontally flattened surface forming the most intimate union with the sphenoid, and with which we commenced our description of the bone. We have still right and left, two orbital or lateral aspects. These are quadri-

lateral, plain in the greater part of their extent, but cut obliquely at their anterior and posterior extremities. The surface has received the name of the *os planum*, and forms a large portion of the inner wall of the orbits.

58. The ethmoid cannot be well understood without using a section, where the vertical plate has been left entire on one side, and entirely removed from the other, thus exposing at once the meatuses, and that surface of the vertical plate, not well seen when the bone is entire. Its development as a bone is very slow. The turbinated bones are not osseous until about seven years of age, nor are the cells present, the centre of the bone being till that age solid; it may be said to ossify from three centres, one for its middle part, and two for the lateral region; but we are of opinion that many more elementary centres of ossification enter into its composition. Its articulations are with the sphenoidal, frontal, nasal, superior maxillary, lacrymal, lower turbinated, vomer. It is rather a curious fact that it affords attachment to no muscles, although it is possible that occasionally a small part of the tensor tarsi might be found to touch the anterior edge of the orbitar process.

59. The *Frontal Bone* is symmetrical, of a more than semi-circular form, convex and smooth anteriorly, concave posteriorly, and unequal below. It is divided into the following parts:

60. *Orbito-ethmoidal or inferior aspect* of the *frontal*. This aspect presents in the middle the *ethmoid notch*. Around this notch, there are observed, anteriorly the *nasal spine* and the orifices of the frontal sinuses; on the sides, portions of cellules, which unite with similar portions belonging to the ethmoid bone; and small transverse grooves formed between these cellules, which contribute to form the *internal orbitar canals*. On each side of the ethmoidal notch, there is a triangular concave surface, which forms the vault of the orbit (*orbitar processes*), presenting anteriorly and to the outside, a small cavity (*fossa lachrymalis*) which receives the lachrymal gland: in the same direction, and to the inside, a slight inequality to which is attached, in the recent subject a cartilaginous pulley, through which the tendon of the superior oblique muscle of the eye is reflected.

61. The *frontal, anterior*, or *pericranial aspect* of the frontal bone is marked in the middle with a longitudinal line, commonly not very distinct, occupying the place where the two portions, of which the bone consisted at an early age, are united; before this union a suture is always observed. At the lower part of this line is the *nasal protuberance* in old persons, perforated by a number of small holes. Farther down there is seen the nasal notch, which is articulated with the nasal bones in the middle, and on the sides with the nasal processes of the superior maxillary bones. This notch itself surmounts the *nasal spine*, on the sides of which are two small longitudinal grooves, forming part of the roof of the nasal fossæ. The nasal spine is articulated anteriorly to the nasal bones, and behind to the vertical plate of the ethmoid bone. On either side, and proceeding from above downwards, there are: a broad and smooth surface, covered by the frontalis muscle; the *frontal protuberance*, which is very distinct in children; a slight depression; a transverse eminence, slightly curved, more prominent internally than outwards, named the *superciliary arch*, from its corresponding to the eye-brow, and giving attachment to its muscle; another prominent line, also curved, which proceeds from both sides of the nasal groove, and is named the *orbital arch* or *margin*. It is terminated by two processes, the outer of which, thick and prominent, joins the malar bone; while the inner, which is thin and broad, is articulated with the lachrymal bone: these processes are called the external and internal *orbitar* or *angular* processes. At the inner third of this arch, there is observed a hole, or a notch converted into a hole by a ligament, the *supra-orbital foramen*, and which gives passage to the frontal vessels and nerves. Above the external orbitar process, there is a curved prominent line, running in a direction upwards and backwards. It forms the limit of a small depressed surface, part of the temporal fossa, and gives attachment to the temporal muscle. The *cerebral, posterior*, or *internal aspect* is concave, in contact with the dura mater, and presenting in the middle a groove (*sulcus longitudinalis*) in which is lodged the commencement

of the superior longitudinal sinus; the margins of this groove unite below, forming a ridge to which the summit of the falx is in part attached, and which terminates at a hole called the *foramen cæcum*. This surface of the bone also presents on each side a great number of inequalities, corresponding generally to the convolutions of the brain, named *mamillary eminences* and *digital impressions*. There are also observed upon it several arterial furrows, and the *frontal fossæ*, which correspond to the protuberances of the same name. The *Upper margin* is thick, uneven, more than semicircular, cut obliquely at the expense of its inner plate above, and of the outer below. It is articulated with the parietal bones in such a manner, that, with the aid of this obliquity of its edge, it rests upon them above, and supports them below. It terminates on each side by a broad rough triangular surface, which joins the great wings of the sphenoid bone. The *Lower margin* is straight, thin, interrupted in its middle part by the ethmoidal notch, and cut obliquely so as to sustain the transverse orbitar processes (wings of Ingrassias) of the sphenoid bone. The frontal bone is thick towards the nasal protuberance and the external orbital processes, but very thin and even transparent in its orbital region. It is formed of diploe contained between two compact laminæ, and presents in its substance two cavities, the *frontal sinuses*. These sinuses vary in size in different subjects, and are rarely absent: they have their orifice anterior to the ethmoïdal notch, and from thence extend into the frontal region of the bone, sometimes even as far as the external orbital processes. They are generally separated from each other by a septum. They communicate with the anterior cellules of the ethmoid bone. They are developed as the person advances to maturity. The frontal bone is articulated with the following bones—parietal, sphenoid, ethmoid, nasal, upper maxillary, lachrymal, and the malar bones. Its development takes place by two points of ossification, which begin, about the forty-second day of gestation, to make their appearance on the frontal protuberances, or rather in the orbital arches, and from thence send out radii towards the circumference of the bone. The suture (*sutura frontalis*) by which the two lateral halves are at first united, generally disappears a few years after birth, although not at any very regular period.

62. The *Parietal Bones* are of an irregularly quadrilateral form, concave internally, convex externally, and occupy the lateral, upper, and middle parts of the cranium. They each present the following parts:—An *outer aspect,* convex, smooth, and covered by the epicranial aponeurosis in its upper half, somewhat uneven in its lower half, where the temporal muscle is inserted, and where there are sometimes observed slight furrows for the deep temporal arteries. This surface is perforated, above and behind, by the *parietal foramen*, when present; it gives passage to small vessels which establish a communication between those of the dura mater and pericranium. In the middle of this aspect there is observed an eminence, prominent in children, named the *parietal protuberance;* it surmounts a curved line, which is continuous with the ridge observed on the frontal bone and with the upper root of the zygomatic process, giving attachment to the temporal aponeurosis. The *inner* or *cerebral aspect* is concave, covered by the dura mater, and marked over its whole extent with deep furrows, which lodge the divisions of the middle meningeal artery. It presents cerebral impressions, but they are indistinct, especially above. In the middle is a depression called the *parietal fossa,* corresponding to the protuberance. At the upper part, near the edge of the bone, there is observed a half groove running in a longitudinal direction, which, united to a similar half groove in the other parietal bone, is continued into the groove on the inner surface of the frontal bone. Near this, there are observed small irregular cavities, varying much in number and arrangement, which receive the bodies called *glands of Pacchioni.* The bone presents four *edges.* The *upper* or *sagittal* is the longest; it is straight and denticulated, and joins that of the opposite bone, with which it forms the sagittal suture. The *lower* or *temporal* edge is the shortest; it is concave, and surmounted externally by an oblique surface, marked with prominent radiating striæ, which is connected with the upper edge of the temporal bone, forming the squamous suture. The

anterior or *coronal* edge is denticulated, and is cut obliquely at the expense of its inner table, except to a small extent superiorly, where it is at the expense of the outer; it joins the frontal bone. The angle which it forms above with the upper edge is truncated in children, and substituted by a membranous part belonging to what is named the *upper fontanelle*. The angle formed below by its junction with the lower edge is prolonged downwards and forwards, obliquely curved at its summit, and articulated with the sphenoid bone; at its internal part, it presents a deep groove or canal, which lodges the middle meningeal artery. The *posterior* or *occipital* edge is very unequal; its indentations are irregularly disposed, and retain among them many of the small bones called ossa Wormii; it is articulated with the upper edge of the occipital bone. The angle which it forms below with the lower edge is truncated, and articulated to the mastoid portion of the temporal bone; the angle which it forms with the upper edge is the most obtuse. Internally the angulus mastoideus is hollowed by a portion of a canal which is continuous with that existing on the occipital and temporal bones, for the lodgment of the lateral sinus of the dura mater. The parietal bone is in general thin, although somewhat thicker at its upper and back parts, and consists of diploe contained between two compact plates. It is developed by a single point of ossification, which makes its appearance at the parietal protuberance, over a pretty wide extent, and under an areolar form. The parietal bone is articulated to that of the opposite side, and to the frontal, occipital, temporal, and sphenoid bones.

63. The *Ossa Wormiana* are extremely variable as to size, situation, form, number, and other circumstances. In the suture between the occipital and parietal bones they are most commonly met with; and perhaps that one found at the upper angle of the occipital bone deserves most attention. The analogy in the skeleton of all mammiferous animals strikes even the non-professional with surprise. The comparative anatomist often speaks of an inter parietal bone, or an anterior occipital. We see the rudiments of this in the small irregularly developed bone now alluded to.

64. The *Temporal Bones* (*ossa temporum*) contain in their interior the organs of hearing, and occupy the lateral and inferior parts of the cranium. They are commonly divided into three portions, viz. the *squamous*, the *mastoid*, and the *petrous*. They present an *auricular* or *external aspect*, slightly convex, smooth, and entirely situated at the outside of the cranium. Its anterior and upper part is broad, marked by several grooves in which branches of the deep temporal arteries are lodged; it gives attachment, nearly over its whole extent, to the temporal muscle, and forms part of the temporal fossa. A strong zygomatic process, broad at its commencement, but gradually becoming narrower; and twisted upon itself as it removes from the rest of the bone. The upper edge is thin and straight, and gives attachment to the temporal aponeurosis; the lower edge is thick, concave, and serves for the insertion of the masseter muscle; its outer surface is convex, and lies immediately under the skin; its extremity is cut obliquely downwards and backwards, and is denticulated for its articulation with the malar bone. Its base, is turned backwards, and hollowed above by a superficial groove, in which a great part of the fibres of the temporal muscle slide, gives rise to two prolongations named *Roots*. One is inferior, transverse, concave from within outwards, and convex from before backwards, and articulates with the lower jaw; where this root joins with the base of the process, there is a rough surface, to which the external lateral ligament of this articulation is attached; the other, which is superior and longitudinal, is directed backwards, and divides into two. Its upper subdivision, by describing a curve, gains the circumference of the bone; the lower descends a little inwards, and terminates at the outer extremity of a very narrow fissure which opens into the cavity of the tympanum (*Scissura Glaseri*); through this fissure there pass, the tendon of the external muscle of the malleus, some vessels, and a nerve called *Corda Tympani*. The anterior segment of this fissure, whose direction is inwards and a little downwards, is covered with cartilage in the recent state, and is articulated with the condyle of the inferior maxillary bone; the posterior segment is covered with periosteum, and does

not form part of the joint. Behind and to the outside of the glenoid cavity, between the two divisions of the upper root of the process, is the orifice of the *external auditory canal* (*meatus auditorius externus.*) This canal seems formed of an osseous plate rolled upon itself, blending above with the rest of the bone, and forming below an unequal rugged edge, more or less prominent, which gives attachment to the cartilage of the ear. The canal has a direction from behind forwards, and from without inwards, is a little curved downwards, and narrower in the middle than at either extremity. Beyond the meatus auditorius there is observed a conical eminence, named the *Mastoid Process*, giving attachment to the sterno-mastoideus, and is surmounted by a rough surface, into which that muscle is inserted, together with the splenius and trachelo-mastoideus. The *Foramen Mastoideum* commonly occurs here, although it varies much in its position, being sometimes met with in the occipital bone, and not unfrequently in the suture by which that bone is joined to the temporal. On the inside of, and behind, the mastoid process, is a longitudinal depression named the *Digastric Groove*, and farther back another groove, less deep, in which runs the occipital artery. The *Cerebral* or *Internal Aspect* presents at its upper part an articular surface cut obliquely, and deeply striated, connecting the lower edge of the parietal,—is much broader in its middle part than behind, and especially than before, where it runs into the circumference of the bone. Under it, there is observed a concave uneven space, marked with several arterial furrows, and cerebral impressions. A pyramidal, triangular process, *Petrous Process* (*pars petrosa*), having its summit directed forwards and inwards, rises from the middle of the aspect, and as it includes the special sense of hearing, requires and deserves a minute description, we observe on it: 1°, An *upper* and *anterior surface*, which presents in its middle a small irregular aperture, named *Hiatus Fallopii*, through which a nervous filament from the spheno-palatine ganglion, and a small artery, are transmitted to the aqueduct of Fallopius. Anteriorly to this hole, there is observed a small single or double groove, which is straight and shallow, and lodges the nerve and artery just mentioned; behind it, is a prominence, which indicates the position of the superior semicircular canal. 2°, A *posterior surface*, covered like the preceding, by the dura mater, on which there is seen, at its upper and fore part the *internal auditory (meatus auditorius internus,)* a wide and oblique aperture, with rounded edges; this leads to a short canal, whose direction is forwards and outwards, and is abruptly terminated by a vertical bony plate, in the upper part of which there is a small opening, leading into the aqueduct of Fallopius, for the passage of the facial nerve: beneath this opening is a crest, surmounting a number of pores, through which pass the filaments of the portio mollis to the labyrinth. Behind the aperture of the meatus auditorius internis, there is observed an irregular cavity, into which is fixed a prolongation of the dura mater; behind this there is a narrow, triangular, and very short slit, in which the aqueduct of the vestibule *(aquæductus vestibuli)* terminates; a pretty distinct groove descends from this slit toward the jugular fossa. This surface is separated from the upper part by a blunt edge, presenting internally a semilunar depression, on which rests the trifacial nerve, and marked in its whole length with a superficial channel, in which is lodged the superior petrosal sinus of the dura mater. 3°, A very complex *inferior surface*, placed on the outside of the cranium: internally, it presents a very rough space, into which are inserted the fibres of the levator palati and tensor tympani muscles, and which is bounded externally by the orifice of the *carotid canal*, and by a cavity which occurs behind it: this cavity, is named the *jugular fossa*, and lodges the commencement of the jugular vein, it is limited posteriorly by a small quadrilateral surface, tipped with cartilage in the recent state for its articulation with the jugular process of the occipital bone; between this facet and mastoid process, there is a hole, named *stylo-mastoid (foramen stylo-mastoideum)*, which terminates the *Fallopian aqueduct*, and transmits the facial nerve from the interior of the cranium. Anterior and internal to this aperture, there is observed the *styloid process*, its base is embraced by a bony lamina, called the *vaginal process*, which forms the posterior limit of the glenoid cavity. Upon the crest dividing the jugular fossa from the inferior opening of the carotid canal, is an opening leading upwards and backwards; This is the commencement of the *canal* of *Jacobson*. A branch of the glosso-pharyngeal nerve passes into it. The canal subdivides ultimately into three branches;—leading, 1st, To the groove for the vidian; 2d, The groove running parallel with it; and 3d, To the carotid canal. This surface is separated from the upper *surface* by a very short edge, which is articulated with the sphenoid bone, and is not very distinct on account of its irregularity; from the posterior, by an unequal edge, in which there is posteriorly a notch, frequently divided into two portions by a small bony plate, concurring with the occipital bone to form the foramen lacerum posterius. At the middle of this edge is a triangular aperture, which is the external opening of the aqueduct of the cochlea. The summit of the petrous process is very uneven, obliquely truncated, a portion of the circumference of the foramen lacerum medium belongs to it; it presents the internal orifice of the *carotid canal*, *(canalus caroticus)*. The *Aqueduct of Fallopius*, whose commencement we have already pointed out in the bottom of the internal auditory canal, and which we have seen terminating in the stylo-mastoid foramen, is a narrow canal, remarkable for its length, which transmits the portio dura of the seventh pair of nerves. Immediately after its commencement, it ascends outwards and backwards, to the upper part of the petrous process, where it is perforated by the *hiatus Fallopii*; it then proceeds directly backward over the cavity of the tympanum, and descends first obliquely, then vertically, in the inner wall of that cavity, to end in the stylo-mastoid hole; this canal is lined by a very thin fibrous prolongation, and is perforated in its passage by several apertures, independently of that of the hiatus Fallopii, the principal of which is a canal which transmits the corda tympani; there are also some small canals for nervous filaments which are distributed to the muscles of the small bones of the ear. Behind the petrous process, and on the cerebral aspect of the mastoid portion of the temporal bone, there is a deep channel which presents the internal orifice of the mastoid hole, and lodges a portion of the lateral sinus of the dura mater. The circumference of the bone is mostly articular. It commences by a retiring angle, at the place where the anterior edge of the petrous process unites with the rest of the bone. This angle, which receives the spine of the sphenoid bone, presents at its bottom two apertures, separated by a bony lamina, and placed one above the other. The upper, which is less marked, gives entrance to the inner muscle of the malleus; the lower is the orifice of the bony portion of the *Eustachian Tube.* The circumference is now cut obliquely at the expense of its outer surface, and becomes thick and denticulated to be joined with the sphenoid bone, directing itself forwards and upwards. It then becomes thin and sharp, and proceeds backwards, describing a semicircle; here it is articulated with the parietal bone, forming what is called the *Squamous Suture.* Above the mastoid process it is again marked with a retiring angle, becomes thickened, and unites with the inferior and posterior angle of the parietal bone. Lastly, it descends forward, still thick and denticulated beneath the mastoid process, and terminates at the petrous portion near the stylo-mastoid hole. This part of the circumference is articulated with the upper portion of the lower edge of the occipital bone. The petrous process is formed of a very dense and white compact tissue; next to the teeth, it is the hardest part of the skeleton; and from this circumstance it has derived its name. The mastoid process is filled with large cells of two kinds, viz. The medullary cells found in all bones and cellules lined with a mucous membrane continuous with that lining the tympanum, the Eustachian canal, and mouth. The temporal bone is articulated to the sphenoid, occipital and parietal bones, the malar bone, the lower jaw, and hyoid bones. Its development takes place by six points of ossification, one for the petrous process, one for the circumference of the external auditory canal, one for the squamous portion, one for the mastoid process, one for the zygomatic, and one for the styloid process. The fourth and sixth make their appearance long after the rest. In certain cases, there are two osseous nuclei for the squamous portion.

65. In the interior of the petrous process of the temporal bones, we find the apparatus constituting the organ of hearing; various sections are made in order to display this very complex structure. The dissection on the fresh subject requires a very favourable one, *i.e.* young and free from fat; instruments which are not generally in a dissecting case, are required to break up the bone. Perhaps the tympanum will be best seen and understood by the student, by following the Eustachian tube into its interior. A description is given in another part of the work, *(Organ of Hearing)*,—and we shall merely here allude to the four bones found in the interior, and forming a part of the apparatus. Maceration destroys the membrane of the tympanum, and the four small bones are readily picked out from their situation.

66. The *Malleus* is divided into three parts, the *head*, *neck*, and *handle*,—the head presents two slight depressions, which are articular, separated by a prominence; the neck is short, and supports, in the well prepared and complete specimen, a short process, and besides this, an elongated slender process, named after the celebrated anatomist, "Raw's process;" this process lies in the glenoid fissure; gives attachment to the anterior muscle of the malleus, and is almost invariably broken in the removal of the bone from its situation. The handle of the malleus adheres to the inner surface of the membrana tympani.

67. The *Incus* presents a body and two branches. The body has two unequal tubercles, both articular, corresponding to those articular depressions pointed out on the head of the malleus. The shortest of the two branches, which is cone-shaped, projects into the entrance of the mastoid cells. The longer and more slender branch is placed nearly parallel to the handle of the malleus, and presents at its summit a slight articular cavity, corresponding to a similar one on the

68. *Os Orbiculare.*—This bone does not exceed in size the head of a small pin, and in general remains attached to the incus in such a manner as to appear as if it were merely an epiphysis of that bone; it presents an articular surface, which corresponds to a similar one on the

69. *Stapes.*—This bone has been named from its strong resemblance to a stirrup-iron. It presents a head, two branches, and a base. The head presents the articular depressed surface for the play of the os orbiculare. The base is a thin broad oval plate, convex on one, (the internal aspect), and concave on the external. This plate is let into the opening called the fenestra ovalis, and generally so nicely fitted as to remain in its place after maceration and water have removed the others from the tympanum; indeed, in some animals we have observed that it is larger than the hole filled up by the membrana tympani, and thus cannot be removed.

OF THE FACE.

70. By a reference to section 13, it will be observed, that this region of the skeleton is composed of a greater number of bones, though of less extent, than the cranium. We divide it into an upper and lower jaw.

71. The *Superior Maxillary Bones* are large, and of a very irregular form, occupy the middle and anterior part of the upper jaw, enter into the composition of the orbit, nasal fossæ, and mouth, give passage to various nerves and vessels, and afford insertion to numerous muscles. The *outer* or *orbito-facial aspect*, is surmounted internally by a flat oblong process, called *nasal*, which is smooth and concave from above downwards, and presents several vascular apertures. This process, which forms part of the outer wall of the nasal fossæ, presents, internally, at its upper part, irregularities which are connected with the lateral masses of the ethmoid bone, below which is a channel belonging to the middle meatus of the nostrils, and farther down, a horizontal crest, united to the inferior turbinated bone, also some arterial furrows. The nasal process terminates above in a truncated summit, furnished with denticulations, to be articulated to the nasal notch of the frontal bone; anteriorly, in a thin oblique edge, which rests upon the nasal bones; behind, in a groove, which is broader and deeper below than above; the posterior edge of which is articulated with the lachrymal bone, and the anterior is free, and continuous with the lower

margin of the orbit. On the outer and back part of the nasal process is a smooth triangular surface, inclined downwards, forwards, and outwards, forming part of the floor of the orbit. About its middle and back part, it presents a channel which soon changes into a canal, named the *infra-orbitar*, which lodges the vessels and nerves of the same name; this canal, as it proceeds forwards and inwards, divides into two subordinate ones; the posterior of which is the smaller, and descends, under the name of the *superior and anterior dentar canal*, in the anterior wall of the maxillary sinus, where it sometimes opens; it affords a passage to nerves and vessels which bear the same name. The other, or anterior division, which is wider and shorter, follows the original direction of the canal, and terminates at the infra-orbitar hole. This surface is limited: behind by a rounded edge, which concurs to form the spheno-maxillary fissure; internally, by a thin and uneven edge, which is notched before, to be articulated with the lachrymal, and behind, with the palate bones, whilst in the middle it is connected with the ethmoid; anteriorly, by a third edge, which is rounded, and of small extent; it forms part of the contour of the orbit. Between this edge and the posterior, there is a triangular and very rough eminence, named *malar (processus malaris)*, which is articulated to the cheek-bone. From the outer angle of this process, there descends vertically a blunt prominent edge, concave from above downwards, behind which is a portion of the bone belonging to the zygomatic fossa, while before it is a pretty distinct depression, called the *infra-orbitar fossa*, perforated above by the infra-orbitar foramen, which gives passage to the infra-orbitar vessels and nerves, and affording attachment below to the levator anguli oris muscle. Anteriorly, this fossa is bounded by the *myrtiform fossa*, an indistinct depression, into which is inserted the depressor of the wing of the nose. The *inner* or *naso-palatine aspect*, is concealed in the nasal fossæ superiorly; inferiorly, it forms part of the arch of the palate. It is divided into two portions of different extent, by a broad flat horizontal eminence, very thick before, which is named the *palatine process (processus palatinus)*. The nasal aspect presents at its fore-part one of the superior apertures of the anterior palatine canal, and is concave and smooth. The inferior or buccal aspect, is rough, uneven, and marked with a great many small apertures and several furrows; the latter of which are sometimes converted posteriorly into small bony arches, more or less complete, under which the palatine nerves and vessels pass. Posteriorly, it is bounded by a sloped and denticulated margin, which sustains the palate bones; internally, it unites with the opposite bone by a thick striated edge, presenting anteriorly a channel which occupies only the lower half of its thickness, and is directed obliquely downwards and forwards; by uniting with a similar channel in the other bone, it forms the *interior palatine incisive canal.* This edge is also surmounted by a ridge, deflected a little outwards, more prominent before than behind, which constitutes the half of a groove, into which the vomer is received. Beneath the palatine process, there is observed a concave surface of small extent, uneven, and covered with furrows. Above it, on the contrary, is seen a broad vertical surface, in the middle of which is a large and very irregular opening, with thin and ragged edges; this opening leads into a large cavity, which is named the *maxillary sinus* or *antrum Highmorianum.* This sinus corresponds, above, to the floor of the orbit, and contains in its upper wall the infra-orbitar canal; before, to the canine fossa and the upper and anterior dentar canal, which frequently forms a remarkable prominence in its interior; behind, where it presents the mark of the posterior dentary canals, to the maxillary tuberosity; below, by a surface less broad than in the other directions, to the alveoli of the molar, and sometimes of the canine teeth; the roots of these teeth often raise up the thin bony plate which forms the floor of the sinus, and perforate it. Entirely to the outside, the summit of this cavity is formed in the malar process, and the bony plate, by which it is separated from the cheek-bone, is so thin as to be frequently broken when that bone is separated. The orifice of the sinus, which is sometimes double, and communicates with the middle meatus of the nose, is articulated, above, with the ethmoid bone; below and before, with the inferior turbinated bone; behind, with the palate bone, by all of which it is very much contracted: this cavity is lined by a prolongation of the pituitary membrane. At the lower part of the aperture of the sinus, there occurs an oblique slit, directed forwards and outwards, which receives a plate of the palate bone; the posterior lip of this slit is inclined into the sinus, and the anterior toward the nasal fossæ. At the upper part of the same aperture, there are portions of cells which unite with those of the ethmoid bone; before it is a deep channel, narrower at the middle than at its extremities, directed obliquely downwards, backwards, and inwards, continuous with the lachrymal groove, and forming the greater part, sometimes even the whole, of the *lachrymal canal.* Behind the orifice of the sinus, there are observed an uneven surface, which is united to the palate bone, and a superficial groove which proceeds downwards and forwards, and contributes to form the *posterior palatine canal.* The two aspects of the upper maxillary bone are separated by an uneven eminence, which is called the *maxillary tuberosity.* It is much more prominent in young than in old subjects, because it contains the growing wisdom tooth. It is perforated by the *posterior dentar canals,* which open externally in the form of two or three small holes, and which, as well as the anterior, disappear as they approach the alveoli, and leave the nerves and vessels to descend from one cellule to another, in the diploe of the bone. Anteriorly, between the two aspects of the bone, there is observed a free edge, deeply concave at its upper part, which forms a portion of the anterior aperture of the nasal fossæ. At its lower part it is prominent, and articulates with the bone of the opposite side, and in its middle presents an eminence which forms the half of the *anterior nasal spine.* This edge unites above with that which terminates anteriorly the nasal process, forming a more or less projecting angle with it. At the lower part, the two aspects of the bone are separated from each other by the *alveolar process.* This is thick, less so, however, before than behind, where the buccinator muscle is inserted; it describes in its course a portion of a parabola, and is hollowed by deep conical cavities for the teeth, named *alveoli* or *sockets;* the form and dimensions of these alveoli vary according to the kind of teeth which they lodge; and when the teeth have several roots, they are divided into a similar number of subordinate cavities by particular septa. The alveolus of the first incisor is deeper and broader than that of the second, but much less so than that of the canine tooth, which is generally flattened, and ends in a very sharp point. Those of the small molares are not so deep; the most variable is the last. Each maxillary bone has eight of these alveoli, the partitions of which are formed of a cellular tissue, which is found to be less and less compact posteriorly. Externally, the alveolar process presents prominences and depressions corresponding to the alveoli and their partitions: on the inside, it is perforated with a great number of small holes, which transmit vessels to the walls of these cavities. The upper maxillary bone is cellular only toward its different processes, and in the alveolar margin. It is hollow, and as it were inflated in nearly its whole extent, on account of the presence of the sinus which is in its interior. It is articulated to the ethmoid, the frontal, the nasal, the lachrymal, and the palate, the inferior turbinated bones, the vomer, the opposite maxillary bone, the teeth of the upper jaw, and sometimes the sphenoid bone. Its development is very complicated. At an early period there appear some osseous nuclei, which commence the formation of the upper alveolar arch. The sinus is only developed with age, and sometimes, though rarely, is not formed at all. The palatine process also arises from a separate germ, which forms the inner wall of the alveoli of that part corresponding to the molar and canine teeth; and other two centres anteriorly, or that corresponding to the incisive teeth, constituting in many persons true inter-maxillary bones. The malar and orbitar processes are also each produced by a separate point. In many cases also an isolated small bone forms the upper part of the nasal canal.

72. The *Palate Bones* were long considered by anatomists as portions of the upper maxillary bone. Each of them seems formed by the union of two plates joined at a right angle, one horizontal and inferior, the other vertical and superior. The *horizontal* or *palatine portion* is quadrilateral. Its *upper surface* is smooth, and

forms part of the floor of the nasal fossæ. The *lower surface* is rough and uneven, and presents posteriorly a transverse ridge, and forms part of the arch of the palate; the inferior orifice of the posterior palatine canal is seen in this aspect. Anteriorly, this portion of the bone rests upon the palatine process of the upper maxillary bone, by means of an oblique edge; posteriorly, it is terminated by a second edge, named the *guttural*, which is free, sharp, and notched, and gives attachment to the velum palati; this edge, by its union with the inner one, forms a projecting angle, which, on being united with that of the opposite side, constitutes the *posterior nasal spine.* Internally, it presents an uneven edge, much thicker than the others, articulated to the corresponding bone, and surmounted by a thin crest, which contribûtes to the formation of a groove into which the vomer is received. The *vertical* or *ascending portion,* is of an oblong form, slightly inclined inwards, broader and thinner than the horizontal, and rests upon the upper maxillary bone. Its *inner surface*, which enters into the composition of the nasal fossæ, presents below a broad and superficial depression, belonging to their inferior meatus, which is separated from another depression situated above, and forming part of the middle meatus, by a rough horizontal ridge *(crista turbinalis inferior)*, united to the inferior turbinated bone. Its *outer surface* is in general uneven, and is articulated with the inner surface of the maxillary bone: it presents, posteriorly, a groove more or less deep, which contributes to the formation of the posterior palatine canal, and above, a small smooth triangular surface which is seen in the zygomatic fossa. The *anterior edge* of this portion of the bone is very uneven and thin, and is prolonged inferiorly into a very brittle bony plate, which contracts the entrance of the maxillary sinus, and is received into the slit of which we have made mention in describing that orifice. The *posterior edge*, which is equally uneven with the last, rests in a great measure upon the inner side of the pterygoid process; in order to be articulated to it, it is even frequently hollowed, in nearly its whole length, by a narrow groove, broader below than above. At its union with the guttural edge of the horizontal portion, there is observed a very prominent pyramidal eminence, inclined outwards and downwards *(processus pyramidalis)*, which fills up the bifurcation of the two wings of the pterygoid process. Superiorly and internally, this process is hollowed by three channels, the two lateral of which uneven, and furnished with slight asperities, receive the summit of these wings, while the middle one, which is smooth and polished, completes the pterygoid fossa; the inner groove is the deepest. Below, it presents a narrow surface belonging to the palatine arch, in which are seen the orifices of accessory posterior palatine canals. Externally, it forms part of the zygomatic fossa; and here the posterior palatine canal, ceasing to be in part formed in the maxillary bone, is entirely formed in its substance. The *upper edge* is surmounted by two eminences, the anterior of which is larger than the other, a little inclined outwards, and is named the *orbitar process;* it is supported by a contracted portion, forming a sort of *neck* or pedicle, on the inner side of which there are observed a slight ridge *(crista turbinalis superior)*, which is articulated with the ethmoidal turbinated bone, and a small channel belonging to the superior meatus of the nasal fossæ; the form of this process is such as to present five distinct surfaces: 1° An *anterior*, uneven, inclined downwards and outwards, which is articulated to the maxillary bone; 2° A *posterior*, deflected inwards and upwards, united to the sphenoid bone by means of some rugosities surrounding a cellule, palatine sinus, in the substance of the process, which is continuous with the sphenoidal sinuses; 3° An *outer*, smooth, inclined backwards, forming part of the zygomatic fossa; 4° An *inner*, inclined downwards, concave, frequently hollowed by a cell, and united to the ethmoid bone; 5° An *upper,* smooth and plain, forming the innermost part of the floor of the orbit, separated from the outer by a small blunt edge, which contributes to the formation of the spheno-maxillary fissure. The other eminence of this edge is small, broad, and laterally flattened, and named the *sphenoidal process.* Internally, it is smooth and concave, and forms part of the nasal fossæ; externally, it enters into the composition of the zygomatic fossa; at the upper part, where it is very narrow, it unites with the sphenoid bone, and presents a groove which forms the pterygo-palatine canal; in this direction, also, it is articulated with the ossa Bertini, portions of the sphenoid. These two processes are separated from each other by an almost circular notch, converted by the sphenoid bone into a hole, named the *spheno-palatine*, which corresponds to the nervous ganglion of the same name, and gives passage to nerves and vessels which penetrate into the nasal fossæ. Sometimes the sphenoid bone does not in any degree contribute to the formation of this hole, which is entirely formed in the palate bone, a bony plate then stretching horizontally from one process to the other; very generally also the sphenoidal turbinated bone closes its summit. *Structure and Development.*—The palate bones are very thin, and almost entirely formed of compact tissue, presenting cellular tissue only in the processes and horizontal portion. Their development, which is yet but little known, appears to take place by a single point of ossification, situated at the union of the vertical, horizontal, and pyramidal portions. *Articulations.*—This bone is articulated with the sphenoid and ethmoid, the sphenoidal turbinated bones, the upper maxillary bone, the lower turbinated bone, the vomer, and the opposite palate bone.

73. The *Lachrymal Bones* are placed at the inner and fore part of the orbit, occupying a quadrilateral irregular space situated between the frontal, ethmoid and superior maxillary bones. They present an *orbitar aspect*, which is external, smooth, divided longitudinally and in the middle, into two portions, by a thin and prominent ridge, forming a sort of hook at its lower extremity. Before this ridge, there is a channel perforated with numerous small holes, and entering into the composition of the *lachrymal groove;* it is covered by the walls of the lachrymal sac. Posteriorly, there is observed a plain surface, broader but shorter, and not cribriform. The *nasal aspect* presents in its middle a groove, corresponding to the ridge of the orbitar aspect. Anteriorly to this groove, there is an uneven surface, forming part of the middle meatus of the nasal fossæ; and behind it, there are rugosities which correspond to the anterior cells of the ethmoid bone, and

which cover them. The *upper edge* is short, uneven, and articulated to the internal obitar process of the frontal bone. The *lower*, is divided into two portions by the extremity of the external ridge: it unites anteriorly with the lower turbinated bone, by a thin plate, curved inwards, and elongated downwards, which contributes to form the nasal canal; and behind, with the inner edge of the orbitar surface of the upper maxillary bone; sometimes, the middle hook of this edge is wanting, and in that case, it is substituted by a small unciform supernumerary bone, which unites with the upper maxillary bone, on the outside of the superior orifice of the nasal canal. The third edge, which is *posterior* and very thin, joins the anterior edge of the orbitar surface of the ethmoid bone. The fourth, which is *anterior*, is marked with a small groove, into which is received one of the portions of the posterior edge of the nasal process of the upper maxillary bone. The lachrymal bone is entirely compact, extremely thin, and even transparent. It is developed by a single point of ossification; and is articulated to the frontal, the ethmoid, the upper maxillary, and the inferior turbinated bones.

74. The *Maxillo-Turbinated or Inferior Turbinated Bones*, are of a very irregular form, elongated from behind forwards, rolled up upon themselves, wrinkled at their surface, and differently formed in different individuals. Each bone is suspended over the inner surface of the upper maxillary and palate bones of each side, in the nasal fossæ, where it determines the limits of the middle and inferior meatus. Its *inner* or *nasal aspect* is convex and prominent, especially in the middle: it is reticulated and traversed in its whole length by two arterial furrows. Its *outer* or *maxillary aspect*, which is smoother than the other, and free like it, is concave, and belongs to the inferior meatus of the nasal fossæ. The *lower edge* is free, spongy, rolled on itself from beneath upwards, and thicker at the middle than at the extremities. The *upper edge*, which is articular and uneven, presents behind a sort of spinous crest, which unites with a similar part of the palate bone, and before, a small and very thin margin, furnished with minute asperities, which are articulated to the crest on the base of the nasal process of the upper maxillary bone; in the

middle, it is surmounted by a small pyramidal eminence, (*processus lachrymalis*), which ascends toward the lachrymal bone, and which completes with it the nasal canal, by some papyraceous laminæ, (*processus ethmoidales*), which unite with the ethmoid bone, and by a kind of scale curved downwards in the form of a hook, (*processus maxillaris*), which partly contracts the orifice of the maxillary sinus in which it is engaged. The two edges of this bone unite so as to form two *angles*, a *posterior* and an *anterior*. The former of these angles is the sharper and more elongated; both are joined to the ridges, which the corresponding superior maxillary and palate bones present.

75. The *Nasal Bones* are of a small size, quadrilateral, and occupy the interval existing between the two ascending processes of the maxillary bones; they are thick at the upper part, thin below. The *anterior aspect* is concave from above downwards, convex transversely. The *posterior* or *nasal aspect*, which is concave, uneven, especially at the upper part, and narrower than the anterior, presents more distinct furrows. The *upper edge* is denticulated, short, inclined backwards, thick, and united to the nasal notch of the frontal bone. The *lower edge* is longer, thin, sharp, and inclined obliquely backwards and downwards. It joins the lateral cartilage of the nose, and presents in its middle a narrow notch for the passage of the terminating branch of the internal nasal nerve. The *outer edge*, which is very long, uneven, and sloped, supports the ascending process of the maxillary bone, and is often furnished below with two or three small prominences in the form of teeth, which are received into holes formed on that process. The *inner edge*, which is broad above, and narrow below, is articulated with the bone of the opposite side, forming a ridge with it behind, in which there is a groove for receiving the anterior extremity of the perpendicular plate of the ethmoid bone, and the nasal spine of the frontal. The nasal bones present cellular tissue in almost their whole extent, but especially at their upper and inner edges. They are developed by a single point of ossification.

76. The *Malar*, *Os Jugale*, or *Cheek Bones* are of an irregular square form, situated on the upper and lateral

parts of the face, forming the orbit externally, and constituting the region of the cheek. The *outer aspect* is convex anteriorly, flat posteriorly, smooth, quadrilateral, and presents in its centre one or more small holes, named *malar*, for the passage of vessels and nerves. These holes are the orifices of canals, whose course is very vague and little known. The *upper aspect* is smaller, concave, and smooth, and constitutes part of the orbit; it forms a right angle with the outer aspect, behind and above which it is situated; the posterior orifice of one of the malar holes is observed upon it. It is circumscribed posteriorly, by an edge which is ragged above, where it is articulated to the frontal and sphenoid bones, and below, where it unites with the upper maxillary bone, but smooth in an angle formed at its middle part, which enters into the formation of the spheno-maxillary fissure. The *posterior aspect* is also concave, is smooth behind, where it forms part of the temporal fossa; but anteriorly it presents a rough triangular surface, by which it is articulated to the malar tuberosity of the upper maxillary bone. In its posterior half, there is observed the orifice of a small malar canal. Of its four *edges*, two are *anterior* and two *posterior*. Of the two anterior, the *upper* is smooth, concave, rounded, and forms part of the circumference of the orbit; while the *lower* is uneven, rough, and connected with the maxillary bone. Of the two posterior, the *upper* is thin over the greater part of its extent, more or less twisted in the form of the letter *S*, and gives attachment to the temporal aponeurosis; the *lower*, thick, especially at its fore part, uneven, and nearly straight, affords insertion to the masseter muscle. These four edges form an equal number of angles by their junction. The *upper* angle is very prominent, thick, and denticulate, and joins the external orbitar process of the frontal bone. The *lower* angle, which is much shorter, is articulated to the malar tuberosity of the upper maxillary bone. The *anterior* angle, which is very thin and sloped, forms the same connexion on the edge of the orbit; and the *posterior*, which is longer and more acute than the others, supports the summit of the zygomatic process of the temporal bone, with which it forms the zygomatic arch. The malar bone is in general thick and cellular; its development commences by a single centre of ossification; and it is articulated to the frontal, temporal, sphenoid, and upper maxillary bones.

77. The *Vomer* is a symmetrical azygous bone, forming the posterior part of the septum of the nasal fossæ. It is thin, flat, quadrilateral, and smooth on its lateral surfaces, which only present vascular furrows, and a narrow groove at the lower part which marks the passage of the naso-palatine nerve. The *sphenoidal edge* is the thickest part of the bone, and is divided into two laminæ, (*alæ vomeris*), which enter into the grooves on the guttural aspect of the sphenoid bone, and which receive into the cavity formed by their separation, the rostrum situated between these grooves. The *supra-palatine edge* is the longest. Broad, obtuse, and uneven anteriorly, thin and sharp posteriorly, it is received into the groove which exists between the united maxillary and palate bones, as we have already said. The *guttural* or *posterior edge* is free, thin below, thick and bifurcated above, straight or notched; it separates the two posterior apertures of the nasal fossæ. The *ethmoidal* or *anterior edge*, is marked in its whole extent, or at least in its upper half, by a deep irregular channel, which receives the lower edge of the perpendicular plate of the ethmoid bone above, and the triangular cartilage of the septum naris below. This channel is continued into that of the the sphenoidal edge. Sometimes it is wanting, and then the cartilage slightly overlaps the vomer on each side. The vomer is thin, compact, and transparent in almost its whole extent, and presents some traces of cellules at its upper part only. It originates by a single centre of ossification, which is composed of two laminæ. It is articulated to the maxillary and palate bones, to the ethmoid and sphenoid, also to the turbinated bones of the latter.

78. The *Inferior Maxillary Bone* is symmetrical, and of a parabolical form; but the extremities of the curve which it describes are raised at nearly a right angle to the rest of the bone. The middle and horizontal portion is named the *body*, and the parts which are vertical and situated behind are termed *branches* (*rami.*) It forms the lower jaw, and may be divided into the following parts for description:—The *outer* or *cutaneous*

aspect, is placed almost immediately under the skin at the fore part, but is more deeply seated behind. It is convex, and presents, in the median line, the *symphisis of the chin*, a sort of vertical line which indicates the point of union of the two pieces of which the bone consists in childhood; below this, there is a projecting surface, rough, and of a triangular form, with the summit turned upwards, termed the *mental process*. Above it, on each side, there is a superficial cavity, into which is inserted the *levator menti muscle*, and more outwardly, immediately beneath the first or second small grinder, the external orifice of the lower dentar canal, named the *mental foramen*, which gives passage to the vessels and nerves of the same name; it is oval, and directed obliquely backwards. From the two inferior angles of the mental process, there arises, on either side, a slightly prominent line, which at first follows a horizontal direction, and afterwards rises obliquely backwards, to be continued into the anterior edge of the coronoid process: this line, which is rather indistinct in the middle, is the *external oblique line*. Along its margin, by the side of the alveoli, there runs a channel, which terminates at the inner side of the coronoid process, and gives attachment in its posterior half to the buccinator muscle. Lastly, at the back part, is the external surface of the ramus of the jaw, which is quadrilateral, and somewhat uneven. The *inner* or *lingual aspect* is concave, directed towards the cavity of the mouth, furrowed in the middle by the symphysis of the chin, beneath which are observed four eminences named the *genial processes*. They are placed in pairs above each other, the two upper giving attachment to the genio-glossi muscles, the two lower to the genio-hyoidei. Above, and on each side of the genial processes, are two cavities, which lodge the sublingual glands, and under them, two rough depressions for the insertion of the digastric muscles; while, just at their level arise the *internal oblique lines*, more prominent than the outer, especially at the back part, where they form a sort of rounded prominence. They ascend toward the coronoid processes, and give insertion anteriorly to the mylo-hyoidei muscles, and posteriorly to the superior constrictors of the pharynx. Beneath the inner oblique line, and posteriorly, there is observed an oblong superficial cavity in which the sub-maxillary gland is placed. In this cavity is also seen a furrow, which ascends towards a pretty large irregular foramen, which forms the entrance of the *maxillary* or *inferior dentar canal;* this foramen presents a very distinct spine above, and in the rest of its circumference, several inequalities for the insertion of the internal lateral ligament of the jaw; it gives passage to the vessels and nerve of the same name, a branch of which runs along the furrow situated under it. This orifice occupies the centre of the inner surface of the rami of the jaw, which is marked at its lowest part with inequalities, to which are attached the fibres of the pterygoideus internus. The *lower edge*, named the *base of the jaw*, is horizontal, rounded, obtuse before, contracted behind, and traversed at the distance of two-thirds of its length from the chin, and opposite the second large molar tooth, by an ascending channel, which lodges the facial artery. It presents a remarkable bulging in the middle of its course, and gives attachment to the platysma myoides. The *upper* or *alveolar edge* is of considerable breadth, more so, however, behind, where it is a little deflected inwards, than before, where it retains its straightness. In its substance there are formed sixteen *alveoli*, which are intended for the reception of the inferior teeth, and constitute together the *lower alveolar arch*. As in the upper jaw, the alveoli here vary in their form according to the kind of teeth which they receive: the two middle are the smallest and narrowest; those which succeed them are a little larger; but the third on each side, which contains the canine tooth, is evidently the deepest; those of the small grinders, which come next, are shorter, and are commonly single; the sixth on each side, which is square and generally divided into two, is the widest; the seventh has nearly the same dimensions and form; but the eighth is smaller, somewhat triangular, and in general presents two or three cavities, and sometimes only one; its inner wall forms a remarkable prominence above the oblique line, and is much thinner than the outer. All these cavities are perforated, at their summit, by small apertures for the passage of vessels and nerves which are distributed to the teeth. The alveoli, and the partitions which separate them, form prominences and depressions of various sizes on both sides of the dentary arch, which are always most distinct in the middle and anteriorly, than on the sides and posteriorly, where they are sometimes not seen at all. These parts are covered by the gums. The alveolar arch is surmounted posteriorly by the *coronoid process*, a triangular eminence, slightly inclined outwards at its summit. It seems to arise anteriorly from the union of the outer and inner oblique lines, which approach each other as they ascend, leaving in their interval a groove into which the buccinator muscle is inserted. The internal oblique line is prolonged on its inner surface, and forms there a pretty considerable projection. The *posterior* or *parotideal edge* is free, blunt, nearly vertical, and forms, with the lower edge, the *angle of the jaw.* The posterior edge is covered nearly in its whole extent by the parotid gland, becomes gradually broader towards its upper part, and is terminated above by an oblong convex eminence, higher within than without, bent forwards, and directed obliquely inwards and backwards, so that its axis, if prolonged, would form an angle of from 110° to 146° with that of the opposite side: this eminence is the *condyle,* and serves to articulate the lower jaw with the temporal bone. At the back part, it gradually loses its convex form; anteriorly it is somewhat curved, and presents an uneven ridge; externally, it presents a small tubercle, which gives attachment to the external lateral ligament of the joint. The condyle is supported on a contracted neck, which is marked anteriorly by a depression into which the pterygoideus externus is inserted, and gives attachment, externally and above, to the external lateral ligament. It is separated from the coronoid process by the *sigmoid notch.* The lower maxillary bone is formed of a thick plate, bent upon itself, compact externally, cellular within, and traversed in the greater part of its extent, by the *inferior dentar canal.* This canal, whose position varies at different periods of life, passes obliquely through the substance of the bone, gradually diminishing in size as it proceeds, at the base of the coronoid process and under the summits of the alveoli, from the middle of the inner surface of the rami of the jaw to the incisive teeth; after which it turns back upon itself, forming an angle, and terminates at the mental hole. From the angle formed by its reflection there arise two small subordinate canals, one inferior, the other superior, which lose themselves in the cellular tissue of the jaw. The dentar canal is lined in its whole extent by a plate of compact tissue, which is especially apparent near its orifices, for in the middle part it is so perforated with holes as to appear cellular; of these holes, some which are larger penetrate into the alveoli so as to perforate their summit; the others transmit vessels into the areolar tissue of the bone which is very abundant. Sometimes the partition, which separates the canal from the alveoli, happens to be wanting, in which case the canal is exposed when the teeth are taken out. The walls of the alveoli and their partitions are very spongy. It ought also to be remarked, that the dentar canal is nearer the inner surface of the jaw in the two posterior thirds of its course, and approaches the outer surface in the remaining third. Ossification originates by two centres, which unite at the symphisis of the chin. In very young fœtuses, there is observed moreover a bony plate which forms the lower edge of the bone, and a separate nucleus for the coronoid process. It is articulated to the temporal bones by the condyles, and to the sixteen lower teeth.

OF THE ORBITS.

79. The *Orbits* have the form of a pyramid with the base turned forwards, but whose axis, being directed obliquely inwards, causes the summit to incline in that direction. Their walls represent four triangular surfaces. The *upper wall* or *vault* is slightly inclined backwards; it is concave and formed anteriorly by the frontal bone, posteriorly by the process of Ingrassias; near its summit, and to the inside is the optic hole, directed obliquely backwards and inwards, so that were its axis prolonged, it would intersect the one on the other side at the pituitary fossa. Before it, is a portion of the sphenoidal suture of the cranium, anteriorly, and to the outside, the small fossa which lodges

the lachrymal gland, and internally the inequalities to which the cartilaginous pulley of the obliquus superior muscle of the eye is attached. The *lower wall* or the *floor of the orbit* is nearly plain, and inclined outwards and downwards. Formed at its fore part by the cheek bone; in the middle by the orbitar surface of the upper maxillary bone; posteriorly and inwards, by one of the small surfaces of the anterior process of the upper edge of the palate bone; and it is intersected at the point where these three bones meet, by two sutures whose denticulations are not very distinct, and of which the posterior is of very small extent. At its posterior and external part, is seen the infra-orbitar groove, to which succeeds the infra-orbitar canal. The *outer wall* is plain, and formed in two posterior thirds, by the sphenoid bone, and in the anterior third by the malar. A vertical suture, with large serratures, marks the place where these two bones unite, and at its fore part are observed the internal orifices of the malar holes. The *inner wall* is of much smaller extent than the others; smooth and perfectly plain; three bones enter into its composition; the lachrymal before, the ethmoid in the middle, and the sphenoid behind. Two vertical sutures result from the juxtaposition of these bones, and present themselves under the appearance of two slightly uneven and very narrow slits. The *upper wall* in uniting with the inner and outer, forms two retiring angles. The first of these angles contains, anteriorly, the suture which results from the articulation of the frontal and lachrymal bones, and a little behind this, the ethmoidal suture of the cranium, in which are seen the internal orbitar foramina, to the number of two or three. The second presents posteriorly the sphenoidal fissure; in the middle, a part of the sphenoidal suture of the cranium, and anteriorly the articulation of the frontal to the malar bone. The *lower wall* also forms two retiring angles where it joins the inner and outer walls. The first presents the suture which results from the articulation of the upper maxillary and palate bones to the lachrymal and ethmoid. The second is perforated posteriorly by the *spheno-maxillary* or *inferior orbitar fissure.* This fissure is formed at its upper part by the sphenoid bone, below by the upper maxillary bone, anteriorly by the malar bone, and posteriorly by the palate bone. It is less wide in the middle than at its extremities, is closed up by fat in the recent state, and gives passage merely to a few vascular and nervous ramifications. The *circumference* of the orbit, or its base, is irregularly quadrilateral, wider externally than internally, directed obliquely downwards and outwards, and presents, at its upper part, the orbitar arch and superciliary hole, and at its lower, the articulation of the malar tuberosity with the cheek bone. It presents externally a short, denticulated suture formed by the cheek bone and the external orbitar process of the frontal bone; and internally the *lachrymal groove,* formed by the os unguis and the nasal process of the upper maxillary bone, and consequently divided into two portions by a longitudinal suture. This groove, which lodges the lachrymal sac, terminates below in the *nasal canal.* The circumference of the orbit gives attachment particularly to the orbicularis palpebrarum. The *axis* of the orbit, which forms a slight angle with that of the optic hole, is however, like it, placed so obliquely that it would meet posteriorly that of the opposite side, but at a point behind the intersection of the axes of the optic holes. The inner wall alone proceeds directly backwards, parallel to that of the other orbit. The three others are inclined. The bones entering into the composition of the orbit, are the sphenoid, ethmoid, frontal, upper maxillary, palatine, lachrymal and malar bones.

OF THE NASAL FOSSÆ.

80. The *Nasal Fossæ* present anterior and posterior apertures. The *anterior* is heart-shaped, broader below than above, and formed by the nasal and upper maxillary bones. It is sharp and generally uneven in its upper part, and rounded below; in the middle it presents a prominence, formed by the union of the nasal bones, and limited laterally by the small notches which give passage to the branches of the internal nasal nerve. Below, it presents the *anterior nasal spine*, which surmounts a vertical suture, on the sides of which suture are the myrtiform fossæ. The *posterior aperture* of the nasal fossæ is of an elliptical form,

divided mesially and vertically by the vomer, and bounded *above* by the body of the sphenoid; *laterally*, by the internal lamina of the pterygoid processes; and *inferiorly* by the horizontal plates of the palate bones; to the margins of the latter is suspended the velum pendulum-palati; and to the *posterior* nasal spine, which is placed in the middle of this margin, is attached the levator uvalæ. The *cavum nasi—nares internæ* are of an irregular form, broader below than above, but longer in the latter direction, higher in the middle than before and behind, and presenting several appendages, which are formed by the different sinuses that exist in the bones of the head. Separated from each other by an intermediate septum (*septum narium*), formed by the perpendicular plate of the ethmoid bone above, and the vomer below and at the back part; they occupy the space situated beneath the anterior part of the base of the cranium, above the mouth, between the orbits, the canine, temporal, and zygomatic fossæ, and before the guttural cavity. Their walls are four in number, terminating anteriorly at the nose, and posteriorly at the throat. The *upper wall* or *vault* of the nasal fossæ is disposed in three different directions; anteriorly, where it is formed by the bones of the nose, it looks backwards and downwards; in the middle, where there is seen the cribriform plate of the ethmoid bone, it is horizontal; posteriorly, where it belongs to the body of the sphenoid bone, it is turned forwards and downwards. In the first portion, is observed the inner surface of the nose, much narrower than the outer, surmounted by a crest towards the middle line, concave transversely, straight from above downwards, marked with a furrow for the internal nasal nerve, and perforated with one or two small vascular apertures. It presents externally the suture, which joins the nasal process of the upper maxillary bone to the nasal. At the union of the anterior with the middle portion, there is observed a somewhat indistinct suture, formed by the nasal notch of the frontal bone and the bones of the nose; then a small concave longitudinal surface, marked on the sides of the nasal spine of the frontal bone, and applied posteriorly upon the cribriform plate, the holes and small fissures of which are perceived farther back. This part of the vault is very thin and narrow. Posteriorly, the cribriform plate forms a suture with the sphenoid bone and its turbinated bone. It is there that the third portion commences, in which are observed the lower and inner surfaces of the sphenoidal turbinated bone, and the orifice of the sphenoidal sinuses; this aperture in this view is narrow and regulary rounded, and always occupies the upper region of the sinus. Lastly, beneath this latter, is the articulation of the vomer with the sphenoid bone. This region of the nasal fossæ is extremely thick, and of much greater extent than it seems at first sight to be, on account of the existence of the sinus, which prolongs it behind, and thus augments its surface. The *lower wall* or *floor* of the nasal fossæ is rectilinear, and does not vary its direction like the vault. It is concave transversely, and slightly inclined backwards. Behind the superior orifice of the anterior palatine canal, it descends a little forwards, after being slightly raised, anteriorly it is prolonged a little more on the inner side than on the outer by the anterior nasal spine. There is observed upon it the orifice of the anterior palatine canal: and just at the point of junction of the vomer with the maxillary bone is seen the entrance of the small canal for the naso-palatine nerve. Toward the posterior third of this wall, there is a squamous suture, formed by the palatine and upper maxillary bones, and which is here much less distinct than it is on the palatine arch. Posteriorly, it is terminated by a notched edge, which is somewhat raised, and by the posterior nasal spine. The *inner wall* of the nasal fossæ is the least complicated, and is formed by one of the surfaces of the septum which separates these cavities. This septum is often deflected to the right side, and then the inner wall of the left nasal fossa is concave, and that of the right convex. In other circumstances, on account of the vertical plate of the ethmoid bone being laterally united to the anterior edge of the vomer, there occurs on one side a prominent oblique line, and on the other a corresponding groove; or there may also be observed an aperture of greater or less size. This septum is composed of the vomer, the perpendicular plate of the ethmoid bone, a crest of the frontal bone, another of the nasal bones, and a third formed by the upper maxillary and palate bones. It is marked by numerous vascular and nervous furrows; presents at its upper part the lower orifices of the internal olfactory canals; is cut anteriorly by a large triangular notch; and is terminated behind by the guttural edge of the vomer. The *outer wall* of the nasal fossæ presents most important objects of examination. At its upper and fore part, there is observed the union of some transparent and irregular lamellæ of the ethmoid bone with the frontal bone, and the nasal process of the upper maxillary bone, of which the internal surface is seen a little beneath, where it forms part of the middle meatus. A little farther back is a rugose and quadrilateral surface of the ethmoid bone, perforated by a great number of olfactory canals, shaped like the point of a pen, more or less long and oblique. The surface becomes convex posteriorly, and directs itself outwards to unite with the sphenoidal turbinated bone, and with the sphenoid bone itself. From this arrangement, there results a vertical channel between the body of the sphenoid bone and the lateral masses of the ethmoid, which ends above at the orifice of the sphenoidal sinus, and below at the superior meatus. This same surface is prolonged forwards over the middle turbinated bone: but, posteriorly, it is suddenly limited by the *superior turbinated bone*, which is formed by a thin plate of the ethmoid bone, inclined downwards and backwards, convex internally, concave outwards, limited anteriorly by a cul-de-sac, gradually terminated behind towards the vertical channel, and below, determining the form and extent of the *superior meatus*. This meatus is a horizontal channel, occupying only the posterior part of the wall under consideration, perforated anteriorly by one or two apertures, which lead into the posterior cells of the ethmoid bone, and posteriorly by the *spheno-palatine hole*, which is formed by the palate bone, the sphenoid bone, and frequently by its turbinated bone, which is sometimes double, and which always perforates directly the outer wall of the nasal fossæ from within outwards. This hole gives passage to the nerves and vessels of the same name, and opens into the spheno-maxillary fossa. Beneath the superior meatus, is the *middle* or *ethmoidal turbinated bone,* larger and more curved than the upper, thin above and thick below, convex inwards, and concave externally; its surface is wrinkled, and sometimes the small olfactory channels are prolonged as far as its lower edge. It belongs to the ethmoid bone, and is terminated behind by free inequalities. It occupies only about the middle third of the outer wall of the nasal fossæ, and principally forms their *middle meatus.* This meatus is of much greater extent than the upper, and presents from before backwards, 1°, A portion of the inner surface of the nasal process of the upper maxillary bone; 2°, A suture which it forms with the lachrymal bone; 3°, The anterior part of the inner surface of the latter bone, the pores with which it is perforated, and its union with the ethmoid bone; 4°, A portion of this latter, which has a lacerated appearance, and is articulated to the upper maxillary bone; 5°, The *infundibulum,* which leads into the anterior ethmoid cells, and frontal sinus; 6°, The entrance of the maxillary sinus, which is contracted by the ethmoid bone, the inferior turbinated bone, and the palate bone, and situated toward the posterior third of the wall, always above the floor of the sinus; this aperture is sometimes double, and is further contracted, in the recent state, by a glandular organ, lodged in the substance of the pituitary membrane. Beneath the middle meatus is the *inferior turbinated bone* suspended by its unciform process, which penetrates slowly into the maxillary sinus. This bone lies over the *inferior meatus,* which consists of a horizontal channel, concave from above downwards, and straight from before backwards, formed above by the inferior turbinated bone, anteriorly, where it is broader, by the upper maxillary bone, and posteriorly, when it is contracted by the palate bone. In this meatus is the inferior orifice of the *nasal canal,* which is situated anteriorly, and concealed by the lower turbinated bone: this aperture is inclined a little obliquely backwards, and varies much as to its position with respect to the entrance of the nostrils, being sometimes but a line or two distant from it, and sometimes upwards of a finger's breadth. The *nasal canal* is formed by the upper maxillary bone, together with the lower turbinated and lachrymal bone:

it ascends towards the lachrymal canal by describing a slight curve, the convexity of which is turned forwards and outwards; it is narrower at the middle than at the extremities; its diameters are not all equal, it being a little compressed: it is lined by a mucous membrane. The bones of which these cavities are composed, are the sphenoid, ethmoid, sphenoidal turbinated, frontal upper maxillary, palate, nasal, inferior turbinated, and the vomer.

OF THE SUTURES FORMED BY THE UNION OF THE CRANIUM AND FACE.

81. Almost all the points at which these two parts come into contact present sutures with very distinct denticulations. Thus there is one situated transversely above the nose, and formed by the meeting of the nasal and upper maxillary bones with the frontal bone; it is continued laterally into those of the internal orbitar processes and lachrymal bones; then there is observed, to the outside of the orbit, the suture which the frontal and sphenoid bones form with the malar bone; then that of the malar bone and the zygomatic process of the temporal bone; and lastly, the suture formed between the ascending portion of the palate bone and the pterygoid process; the latter is vertical, and very indistinctly marked. We ought also to include among the sutures of this class those which result from the articulation of the vomer with the sphenoid bone, of the inferior turbinated bones with the ethmoid, and of the latter bone with the palate and upper maxillary bones, always observing, that for the most part they present but very indistinct serratures, and that some of them even are nothing more than mere juxtaposition of surfaces.

OF THE TEMPORAL, ZYGOMATIC, AND SPHENO-MAXILLARY FOSSÆ.

82. When the head is entire, the *Temporal Fossæ* is limited below by the *zygomatic arch*, (*arcus zygomaticus*): this arch is directed forwards, has a double curvature, so as to be at once convex above and convex outwards, and is separated from the rest of the bones by a large empty space, filled up by the temporal mus-

cle; in its middle it presents a suture resulting from the union of the two bones forming it, and so disposed that the temporal rests upon the malar, their edges being here oblique: this suture is distinctly serrated. Before, the zygomatic arch, the temporal fossa is completed by a portion of the posterior aspect of the malar bone, in which are seen two or three small vascular apertures. Posteriorly, a transverse ridge, formed upon the sphenoid bone, separates this fossa from the zygomatic.

83. *Zygomatic Fossa* comprised between the posterior edge of the outer wing of the pterygoid process and the ridge which descends from the malar tuberosity. The maxillary tuberosity is separated above from the pterygoid process, by a fissure which gives passage to the internal maxillary artery, and which Bichat named the *pterygo-maxillary* fissure: it is vertical, broad above, and narrow below; it unites in the former direction, nearly at a right angle, with the spheno-maxillary fissure; and below, it is continued into two small vertical sutures, very close to each other, only separated a little below, formed by the articulation of the palate bone with the pterygoid process on the one hand, and the maxillary tuberosity on the other. The pterygo-maxillary leads into:

84. The *spheno-maxillary fossa.* This fossa, which is deep and narrow, and is continued behind the orbit, is formed by the sphenoid bone behind, the upper maxillary bone before, and by the palate bone to the inside. The sphenoidal, spheno-maxillary, and pterygo-maxillary fissures terminate in it, and seem to run into each other; there are moreover observed five apertures in it, which are, posteriorly and from above downwards, the anterior orifices of the foramen rotundum and of the vidian and pterygo-palatine canals; to the inside, the spheno-palatine hole, and at the lower part, the upper orifice of the posterior palatine canal. This fossa contains a part of the superior maxillary nerve, the ganglion of Meckel, &c.

THE TEETH.

85. The *Teeth* require for their elucidation an extensive series of preparations, both in human and in comparative anatomy, and a constant appeal, therefore, to extensive museums; but the following brief outline o

their natural history, derived chiefly from the works of Mr. Hunter, will, it is hoped, be found interesting and useful. By taking a little trouble, many of the facts about to be mentioned may be verified in the dissecting room.

86. *Structure.*—A human tooth is composed of two substances, viz. enamel and ivory. The *enamel*, likewise called the cortical part, is found only upon the body of the tooth. It is by far the hardest part, entering into the composition of the body, and the hardest and best tempered saw makes its way through it simply by chipping off minute particles of it. When broken, it appears fibrous or striated, and all the striæ are directed from the circumference to the centre. The enamel is thickest on the grinding surface and cutting edges or points of the teeth, becoming gradually and insensibly thinner towards the neck. When exposed to the fire, it becomes very brittle, cracks, and grows black; but still it stands fire better than the bony part. It is in no shape vascular; and when dissolved in a weak acid, it shews no soft animal texture as a basis. The structure, therefore, of the enamel is crystalline. Berzelius, who gave its chemical analysis, thinks there is a small trace of animal matter.* The remaining part of the tooth is called the ivory part, but it is in reality still harder than any of the bones composing the skeleton. It composes the interior part of the body, the neck, and the whole of the root of the tooth. This substance is composed of two structures, the calcareous part and an animal substance; the analysis may be made by steeping it in an acid.† Mr. Hunter concluded, from his experiments, that the structure as now described, viz. the

* Chemical analysis:—

	Enamel.		*Osseous Texture.*
Phosphate of Lime,	85·3		54·0
Fluate of Lime,	3·2	and Sulphate of Lime,	3·0
Carbonate of Lime,	8·0		10 0
Phosphate of Magnesia,	1·5		1·0
Soda and Muriate of Soda,	1·0	(no Muriate)	1·3
Animal matter and Water,	1·0	Cartilage,‡	30·7
	100·0		100·0

† The ivory or bony part of a tooth does not appear to have been analysed.

‡ Chemical analysis:—

Coagulated Albumen,	98·0
Common Salts,	2·0
	100·0

enamel and ivory part of the tooth, have no circulation in them, *i. e.* have no vascular living connection with the rest of the body. After having long maintained this opinion, as unanswerable and unanswered, we are now willing to admit that there are certain difficulties in the way of this hypothesis, which it is impossible to explain away in the present state of our knowledge,—such as the appearance of red patches in the ivory part of a tooth, and the deep tinging of the whole of a yellow colour in cases of jaundice. In addition to these facts, which have been long noticed, but which, after all, are not conclusive against the hypothesis of Hunter, since the discolouration might be effected by imbibition, we may mention the still more important and curious fact, that in certain carious teeth the ivory part becomes red and seemingly soft. If there be no deception in this, it argues vital changes going on in the substance, incompatible with the notion of its being inorganic. Upon the whole, a striking analogy appears to us to subsist between this part of the tooth and the osseous labyrinth of the ear.

87. *Cavity of the tooth.*—Every tooth has an internal cavity extending nearly the whole length of its bony part. It commences by a small opening at the point of each root, and therefore has one or more of these openings into it, according to the number of their roots. By these openings there pass blood-vessels and nerves into the interior of the cavity, which is moreover filled with a pulp. The pulp is enclosed by a membrane. A membrane, usually called *periosteum*, lines the alveolar cavity, and invests the root of the tooth nearly as high as the neck. The *number* of the teeth in the adult ought to be thirty-two, sixteen being placed in each jaw. The *body* of a tooth is that part which projects above the gum; the *root* or *fang*, that part enclosed by the alveolar cavity of the jaw; and the *neck* is the somewhat contracted part between these two. The teeth are of three classes,—*incisors* or cutting teeth, *canine* or *cuspidati*, and *grinders*, of which the two anterior are called bicuspidati, or small molar, and the three posterior, molares, large molar, or multi-cuspidati. Little need be said of the form and situation of the incisors and canine. There are eight of the former, and four of the latter. The twenty remaining teeth are usu-

ally termed molar or grinding teeth. The two anterior molar teeth of each side in each jaw, also termed *bicuspidate,* are remarkable both for their smallness, and from the circumstance of their having been preceded by milk teeth, which does not happen in regard to the other molars (the *multicuspidate*). The masticating surface of these molar teeth is tubercular, and the form of these tubercles, number, &c., form striking characteristics in the natural history of animals. The *articulation* of the teeth is by gomphosis, and resembles a nail driven into a piece of wood.

88. The alveolar processes are covered by a red vascular substance called the gum, which has as many perforations as there are teeth, and moreover sends slips or partitions between each, thus limiting the external and the internal gum. The loss of this substance by disease, or when removed by a surgical operation, causes the teeth to appear longer than they usually seem to be, by exposing the neck, and a portion of the root of the tooth; hence, also, in the skeleton, from the absence of the gum, the teeth appear unusually long.

89. We cannot do better than quote Mr. Hunter's admirable description of the *formation of the teeth in the fœtus:*—

"The depressions or first rudiments of the alveoli observable in a fœtus of three or four months, are filled with four or five little pulpy substances, which are not very distinct at this age. About the fifth month both the processes themselves and the pulpy substances become more distinct, the anterior of which are the most complete. About this age, too, the ossifications begin on the edge of the first incisores. The cuspidati are not in the same circular line with the rest, but somewhat on the outside, making a projection there at this age, there not being sufficient room for them.

"About the sixth or seventh month the edges or tips of all these five substances have begun to ossify, and the first of them is a little advanced; and besides these, the pulp of the sixth tooth has begun to be formed: it is situated in the tubercle of the upper jaw, and under and on the inside of the coronoid process in the lower jaw So that at this age, in both jaws, there are in all twenty teeth which have begun to ossify, and the stamina of twenty-four. They may be divided into the incisores, cuspidati, and molares, for at this age there are no bicuspides, the two last teeth on each side of both jaws having all the characteristics and answering all the purposes of the true molares in the adult, though when these first molares fall out, their places are taken by the bicuspides.

"The teeth gradually advance in their ossification, and about the seventh, eight, or ninth month after birth, the incisors begin to cut or pass through the gums, first, generally, in the lower jaw. Before this time the ossifications in the third grinder, or that which makes the first in the adult, have begun.

"The cuspidati and molares of the fœtus are not formed so fast as the incisors; they generally all appear nearly about the same time, viz. about the twentieth or twenty-fourth month; however, the first grinder is often more advanced within the socket than the cuspidatus, and most commonly appears before it.

"These twenty are the only teeth that are of use to the child from the seventh, eighth, or ninth month, till the twelfth or fourteenth year. These are called the temporary, or milk teeth, because they are all shed between the years of seven and fourteen, and are supplied by others."

90. We shall next proceed with the consideration of the *permanent teeth.* It is here that the views of Mr. Hunter have been deemed "exceedingly imperfect." How far this language can apply to any research in which Mr. Hunter was ever engaged, we have exceedingly strong doubts. That some minute points in the history of the development of the permanent teeth have been more completely elucidated, and even a new fact or two made out by the labours of Dr. Blake and others, may readily be conceded. To these facts, such as they are, we shall of course give due consideration; but it seems to be a duty we owe to Mr. Hunter's memory, to submit to the student his views in the first place, which, however imperfect they may be, most undoubtedly contain few or no inaccuracies:—

"In this inquiry, (Mr. Hunter remarks,) to avoid confusion, I shall confine the description to the teeth in the lower jaw, for the only difference between those in the two jaws is in the time of their appearance, and generally it is later in the upper jaw. Their formation and appearance proceed not regularly from the first incisor backwards to the dens sapientiæ, but begin at two points on each side of both jaws, viz. at the first incisor and at the first molaris. The teeth between these two points make a quicker progress than those behind.

"The pulps of the first adult incisor and of the first adult molaris begin to appear in a fœtus of seven or eight months; and five or six months after birth the ossification begins in them. Soon after birth the pulps of the second incisor and cuspidatus begin to be formed, and about eight or nine months afterwards they begin to ossify. About the fifth or sixth year the first bicuspis appears; about the sixth or seventh, the second bicuspis and the second molaris; and about the twelfth, the third molaris, or dens sapientiæ.

"The first five may be called the permanent teeth: they differ from the temporary in having larger fangs. The permanent incisors and cuspidati are much thicker and broader; and the molares are succeeded by bicuspides, which are smaller, and have but one fang.

"All these permanent or succeeding teeth are formed in distinct alveoli of their own, so that they do not fill up the old sockets of the temporary teeth, but have their new alveoli formed as the old ones decay.

"The first incisor is placed on the inside of the root of the corresponding temporary tooth, and deeper in the jaw. The second incisor and the cuspidatus begin to be formed on the inside, and somewhat under the temporary second incisor and cuspidatus. These three are all situated much in the same manner with respect to the first set, but as they are larger they are placed somewhat further back in the circle of the jaw.

"The first bicuspis is placed under, and somewhat further back than the first temporary grinder, or fourth tooth of the child.

"The second bicuspis is placed immediately under the second temporary grinder.

"The second molaris is situated in the lengthening tubercle in the upper jaw, and directly under the coronoid process in the lower.

"The third molaris, or dens sapientiæ, begins to form immediately under the coronoid process.

"The first adult molaris comes to perfection and cuts the gums about the twelfth year of age, the second about the eighteenth, and the third, or dens sapientiæ, from the twentieth to the thirtieth; so that the incisores and cuspidati require about six or seven years from their first appearance to come to perfection, the bicuspides about seven or eight, and the molares about twelve.

"It sometimes happens that a third set of teeth appears in very old people; when this does happen it is in a very irregular manner, sometimes only one, at other times more, and now and then a complete set comes in both jaws. I never saw an instance of this kind but once, and there two fore teeth shot up in the lower jaw.

"I should suppose that a new alveolar process must be also formed in such cases, in the same manner as in the production of the first and second sets of teeth. From what I can learn, the age at which this happens is generally about seventy. From this circumstance, and another that sometimes happens to women at this age, it would appear that there is some effort in nature to renew the body at that period.

"When this set of teeth which happens so late in life is not complete, especially where they come in one jaw and not in the other, they are rather hurtful than useful, for in that case we are obliged to pull them out, as they only wound the opposite gum."

91. It has been objected to this view, that the formation of the permanent teeth, although essentially proceeding upon the same general principles, and produced by a similar structure as that by which the temporary teeth are formed, yet differ in some points. The rudiments of the permanent teeth, it is said, instead of being original and independent, like those of the temporary, are in fact derived from them, and remain for a considerable time attached to, and intimately connected with them. The authors of these remarks forget that there must be twelve teeth to whose formation no such statement can apply, and that therefore the remark cannot be true of *all* the permanent teeth, but only applies to some of them. At an early period in the formation of the temporary teeth, the investing sac or capsule gives

off a small process like a bud, and this process contains a portion of the essential rudiments, viz. the pulp, with its investing membrane, blood-vessels and nerves. Now, this process or bud of the original or temporary pulp, constitutes the rudiment of the future permanent tooth. Attached to the parent sac by a pedicle or foot-stalk, the new rudiment is contained within the same alveolus as its parent; by degrees, however, a distinct cell is excavated for its reception, and as the rudiment continues to increase, becomes gradually separated from the parent sac, by the osseous cell being more and more deeply excavated in the substance of the bone, and also by the deposition of a bony partition between them. Notwithstanding that the new rudiment is shut up in its proper socket, it is still connected with the temporary tooth by the cord or process of the capsule just described. It is thus supposed that no new set of vessels is required for the new or permanent pulp. Thus formed, the sac above, attached to the gum, and the pulp beneath, covered by its proper membrane, connected by its vessels with the jaws, the rudiment of the permanent tooth comes to have nearly the same relation as those of the temporary. It is undoubtedly true that certain of these facts have been made out; and in the young jaw, say within a year old, there may be seen behind the temporary teeth a row of openings in the alveolar process, leading into cavities in which are contained the growing permanent teeth, already considerably advanced; but whether the cord or pedicle which is supposed to connect the pulp of both sets together, passes through this opening, has not been very clearly made out. We may here take the liberty of remarking, that Mr. Hunter is slightly in error when he thinks that the orifice in the alveoli, just described, enlarges sufficiently to allow the permanent tooth to pass up through it, the fact being that the osseous partition is simply broken down, and the two orifices become one; at least this is the appearance presented by numerous specimens now before us.

92. Mr. Hunter next proceeds to the manner in which a tooth is formed; and here we shall find his description equally admirable and equally unobjectionable.

We cannot, therefore, do better than quote his opinions in his own words,—

"The body of the tooth is formed first, afterwards the enamel and fangs are added to it. All the teeth are produced from a kind of pulpy substance, which is pretty firm in its texture, transparent, excepting at the surface, where it adheres to the jaw, and has at first the shape of the bodies of the teeth which are to be formed from it. These pulpy substances are very vascular: they adhere only at one part to the jaw, viz. at the bottom of the cavity which is to form the socket, and at that place their vessels enter, so that they are prominent and somewhat loose in the bony cavity which lodges them.

"They grow nearly as large as the body of the tooth before the ossification begins, and increase a little for some time after the ossification has begun. They are surrounded by a membrane, which is not connected with them, excepting at their root or surface of adhesion. This membrane adheres by its outer surface all around the bony cavity in the jaw, and also to the gum where it covers the alveoli.

"When the pulp is very young, as in the fœtus of six or seven months, this membrane itself is pretty thick and gelatinous. We can examine it best in a new-born child, and we find it made up of two lamellæ, an external and internal: the external is soft and spongy, without any vessels; the other is much firmer and extremely vascular, its vessels coming from those that are going to the pulp of the tooth: it makes a kind of capsule for the pulp and body of the tooth. While the tooth is within the gum there is always a mucilaginous fluid, like the synovia in the joints, between this membrane and the pulp of the tooth.

"When the tooth cuts the gum, this membrane likewise is perforated, after which it begins to waste, and is entirely gone by the time the tooth is fully formed, for the lower part of the membrane continues to adhere to the neck of the tooth, which has now risen as high as the edge of the gum."

93. It has been objected by a London dentist to Mr. Hunter's statement, "that the bone of a tooth is pro-

duced from the pulp," "is erroneous." All that can possibly be objected to Mr. Hunter is, that the exceedingly delicate membrane or epithelum investing the pulp seems either to have escaped his notice, or to have been omitted by him in his description, or finally, to nave been confounded by him with the capsule forming the enamel; for in the above description he has undoubtedly described, and very clearly too, the capsule of the enamel, but not so clearly the capsule of the pulp; it would seem to be upon the outer surface of this membrane of the pulp that the osseous deposit constituting the ivory part of the tooth is formed; but some have thought that it may take place between the layers of this very delicate membrane; this latter opinion, however, is not a very probable one. The double investing sac, described in the above passage by Mr. Hunter, is generally esteemed to be the organ which secretes the enamel; and in animals having compound teeth, as the elephant, it also forms the crusta petrosa.

94. The *ossification of a tooth* upon the *pulp* is thus described by Mr. Hunter:—

"The beginning of the ossification upon the pulp is by one point, or more, according to the kind of tooth. In the incisores it is generally by three points, the middle one being the highest, and the first that begins to ossify. The cuspidatus begins by one point only; the bicuspis by two, one external, which is the first and the highest, and the other internal. The molares, either in a child or an adult, begin by four or five ossifications, one on each point, the external always the first. Where the teeth begin to ossify at one point only, that ossification gradually advances till the tooth is entirely completed; but if there is more than one point of ossification, each ossification increases till their bases come in contact with one another, and there all unite into one, after which they advance in growth as one ossification.

"The ossifications in their progress become thicker and thicker where they first began, but increase faster on the edges of the teeth; so as thence to become more and more hollow, and the cavity becomes deeper. As the ossification advances, it gradually surrounds the pulp till the whole is covered by bone, excepting the under surface; and while the ossifications advance, that part of the pulp which is covered by bone is always more vascular than the part which is not yet covered.

"The adhesion of the pulp to the new-formed tooth or bone is very slight, for it can always be separated from it without any apparent violence, nor are there any vessels going from the one to the other; the place, however, where it is most strongly attached is round the edge of the bony part, which is the last part formed. When the bone has covered all the pulp, it begins to contract a little and becomes somewhat rounded, making that part of the tooth which is called the neck; and from this place the fangs begin. When the fangs form, they push up the bodies of the teeth through the sockets, which waste, and afterwards through the gum, which also wastes, as has been explained upon the cutting of the teeth; for before this time the rising of the teeth is scarce observable, as the pulp was at first nearly of the size of the body of the tooth itself, and wasted nearly in proportion to the increase of the whole ossification.

"The pulp has originally no process answering to the fang; but as the cavity in the body of the tooth is filled up by the ossification, the pulp is lengthened into a fang. The fang grows in length, and rises higher and higher in the socket till the whole body of the tooth is pushed out. The socket at the same time contracts at its bottom, and grasping the neck or beginning fang, adheres to it and rises with it, which contraction is continued through the whole length of the socket as the fang rises; or the socket which contained the body of the tooth, being too large for the fang, is wasted or absorbed into the constitution, and a new alveolar portion is raised with the fang; whence in reality the fang does not sink or descend into the jaw. Both in the body and in the fang of a growing tooth, the extreme edge of the ossification is so thin, transparent, and flexible, that it would appear rather to be horny than bony, very much like the mouth or edge of the shell of a snail when it is growing; and indeed it would seem to grow much in the same manner, and the ossified part of a tooth would seem to have much the same connexion with the pulp as a snail has with its shell.

"As the tooth grows, its cavity becomes gradually smaller, especially towards the point of the fang. In tracing the formation of the fang of a tooth we hitherto have been supposing it to be single, but where there are two or more it is somewhat different and more complicated.

"When the body of a molaris is formed, there is but one general cavity in the body of the tooth, from the brim of which the ossification is to shoot, so as to form two or three fangs. If two only, then the opposite parts of the brim of the cavity of the tooth shoot across where the pulp adheres to the jaw, meet in the middle, and thereby divide the mouth of the cavity into two openings; and from the edges of these two openings the two fangs grow.

"We often find that a distinct ossification begins in the middle of the general cavity upon the root of the pulp, and two processes coming from the opposite edges of the bony shell join it; which answers the same purpose.

"When there are three fangs, we see three processes coming from so many points of the brim of the cavity, which meet in the centre and divide the whole into three openings; and from these are formed the three fangs. We often find the fangs forked at their points, especially in the bicuspides. In this case the sides of the fang as it grows come close together in the middle, making a longitudinal groove on the outside; and this union of the opposite sides divides the mouth of the growing fang into two orifices, from which the two points are formed.

"By the observations which I have made in unravelling the texture of the teeth when softened by an acid, and from observing the disposition of the red parts in the tooth of growing animals interruptedly fed with madder, I find that the bony part of a tooth is formed of lamellæ placed one within another. The outer lamellæ is the first formed and is the shortest; the more internal lamellæ lengthen gradually towards the fang, by which means, in proportion as the tooth grows longer, its cavity grows smaller, and its sides grow thicker."

95. Mr. Hunter was the first to explain how the *enamel* was formed :—

" From its situation and from the manner in which the teeth grow, one would imagine that the enamel is first formed ; but the bony part begins first, and very soon after the enamel is formed upon it. There is another pulpy substance opposite to that which we have described : it adheres to the inside of the capsule, where the gum is joined to it, and its opposite surface lies in contact with the basis of the above-described pulp, and afterwards with the new-formed basis of the tooth. Whatever eminences or cavities the one has, the other has the same, but reversed, so that they are moulded exactly to each other.

" In the incisores it lies in contact, not with the sharper cutting edge of the pulp or tooth, but against the hollowed inside of the tooth ; and in the molares it is placed directly against their base, like a tooth of the opposite jaw. It is thinner than the other pulp, and decreases in proportion as the teeth advance. It does not seem to be very vascular. The best time for examining it is in a fœtus of seven or eight months old.

" In the graminivorous animal, such as the horse, cow, &c., whose teeth have the enamel intermixed with the bony part, and whose teeth, when forming, have as many interstices as there are continuations of the enamel, we find processes from the pulp passing down into those interstices as far as the pulp which the tooth is formed from, and there coming into contact with it.

" After the points of the first-described pulp have begun to ossify, a thin covering of enamel is spread over them, which increases in thickness till some time before the tooth begins to cut the gum.

" The enamel appears to be secreted from the pulp above described, and perhaps from the capsule which incloses the body of the tooth. That it is from the pulp and capsule seems evident in the horse, ass, ox, sheep, &c., therefore we have little reason to doubt of it in the human species. It is a calcareous earth, probably dissolved in the juices of our body, and thrown out from these parts, which act here as a gland. After it is secreted, the earth is attracted by the bony part of the tooth which is already formed, and upon that surface it crystallizes.

"The operation is similar to the formation of the shell of the egg, the stone in the kidneys and bladder, and the gall stone. This accounts for the striated crystallized appearance which the enamel has when broken, and also for the direction of these striæ.

"The enamel is thicker at the points and basis than at the neck of the teeth, which may be easily accounted for from its manner of formation; for if we suppose it to be always secreting, and laid equally over the whole surface, as the tooth grows, the first formed will be the thickest; and the neck of the tooth, which is the last formed part inclosed in this capsule, must have the thinnest coat; and the fang, where the periosteum adheres, and leaves no vacant space, will have none of the enamel.

"At its first formation it is not very hard; for by exposing a very young tooth to the air, the enamel cracks and looks rough; but by the time that the teeth cut the gum, the enamel seems to be as hard as ever it is afterwards; so that the air seems to have no effect in hardening it."

96. The only remark we shall make respecting Mr. Hunter's account of the enamel is, that the peculiar pulpy substance spoken of by him, and which he considers as an organ secreting the enamel, has been found long ago to be merely the inner layer of the capsule itself, assuming a strong vascularity for the special purpose of secreting enamel; at the same time, it is right to mention that many accurate observers still adhere to the precise opinion of Mr. Hunter on this subject.

97. The growth of the two *Jaw Bones* explains many circumstances in the shedding of the teeth. The jaw increases in all points till twelve months after birth, but it never afterwards increases in length between the symphysis and the sixth tooth; nor does the alveolar process ever become a section of a larger circle. After this time the jaws lengthen only towards their articular extremities. The jaws of the very young and the very aged resemble each other, particularly towards the angles which are obtuse. It is an admitted fact that the teeth fill up as the crown is worn away.

This readily enough happens so long as the central pulp and its membrane have not been destroyed. Mr. Hunter does not believe in the *continual growth* of the teeth; this opinion was probably founded on certain facts observed in the teeth of the rodentia and other graniverous animals. Perhaps the more correct statement is to say that the teeth are never perfect, inasmuch as the corona or crown is formed before the roots; and whilst these are completing, the former is continually wasting by mastication and consequent trituration. Teeth are sometimes found very fully developed imbedded in the alveolar cavity, and which, having never appeared above the gums, must present at least a tolerably perfect form. It is very probable, however, that the natural progress of a tooth throughout life is gradually to lengthen at the root until this process be completed, and then for its central cavity to fill up. This, though not constant, yet frequently happens, and in the teeth of some animals uniformly. In the meantime the corona is wearing down. No rational cause has been assigned for the *shedding of the teeth*. In their usual healthy condition it is probable that the sensibility of the teeth depends on the nerves of the pulp; but when diseased, it seems probable that the *bony* or *ivory* part of the tooth may acquire a morbid sensibility. The human teeth do not readily arrange themselves under any particular zoological class; they are specific, and do not suit the definitions of carniverous nor graniverous; like man himself, they form a class apart.

98. The crust which forms upon the teeth is composed of a large proportion of earthy phosphates combined with mucus.

THE HYOID BONE.

99. The name of *Hyoid Bone* (*os Hyoides; ossa Lingualia*) is given to a bony arch, of a parabolical form, convex anteriorly, suspended horizontally from the styloid process of the temporal bone in the midst of the soft parts of the neck, between the base of the tongue and the larynx, composed of five distinct bones, and connected by ligaments moveable on each other. The piece which occupies the centre of the arch

is the largest and broadest; it is flattened from before backwards, and is of a quadrilateral form. Its *anterior aspect* is uneven and convex in the middle. The *posterior aspect* is concave and smooth; and is filled by a yellowish cellular tissue, which separates it from the epiglottis. Its *lower edge* is longer and more unequal than the upper. On each of the *lateral edges*, which are less sharp than the upper and lower, there is placed a slightly convex articular facet which is joined to the lateral pieces. Of the lateral pieces, two are long and two are short. The longer are called *cornua inferiora* or *laryngea*; they are broader and stronger before than behind, contract in the middle, and terminate posteriorly in a small rounded head, covered in the recent state by a cartilaginous substance. Anteriorly, they present a plain surface which corresponds to that of the lateral edges of the middle bone. At the upper part they are limited by a smooth and sharp falciform edge, into which are inserted the hyoglossus and constrictor pharyngis medius. The two upper pieces *(cornua styloidea, styloid horns,)* are short, pyramidal, inclined backwards and upwards, and terminated by a more or less prolonged point; they give attachment below to some fibres of the genio-glossus muscle, and above to the stylo-hyoid ligament.

THE PELVIS.

100. The *Pelvis* terminates the trunk inferiorly, forms at once a powerful bony girdle for the articulation of the inferior or pelvic extremities, and a deep nearly circular cavity, in which is lodged a portion of the intestines and many of the urinary and genital organs. It is composed posteriorly by a continuation of the spinal column, under the names of *sacrum* and *coccyx*; latterly, by two broad and flat strangely twisted bones, named the *ossa innominata*, which meeting in front are strongly articulated together. The descriptive anatomy of this region of the skeleton might be made very simple and short; but its importance and surgical relations are so great and numerous, that we shall run the risk of shortening the description of some other part rather than omit any thing regarding the pelvis.

101. The *sacrum* is composed of five vertebræ united

together in such a manner as to form a symmetrical triangular mass, situated at the posterior part of the pelvis, fixed between the two ossa innominata like a wedge, with its base above articulating with the last lumbar vertebra, and its apex below articulating with the first coccygeal bone; a canal, named the *sacral canal*, traverses its whole length from its base to its apex, and is simply the continuation of the great spinal canal. Viewed separately, and fully macerated, it presents an anterior concave, a posterior convex aspect, a right and left lateral edge, a base and an apex. The anterior aspect is smooth, although traversed by four slightly prominent lines, indicating the situation of the inter-vertebral fibro-cartilages and the union of the bodies of five vertebræ. Laterally to the right and left, we observe four foramina (*anterior sacral foramina*) large and rounded, but diminishing from above downwards. Outside these foramina is a surface which gives to the sacrum its triangular form, being broad superiorly, and diminishing gradually in breadth towards the coccyx. The posterior aspect is convex and rough; in the mesial line we remark the rudimentary spinous processes, called the *Sacral ridge*. The *laminæ* belonging to the fifth sacral vertebra seldom unite, thus leaving the spinal canal open, and forming two tubercles, absurdly named the horns of the sacrum; to the right and left of these sacral spines we find superficial channels—continuations in fact of the vertebral grooves, and bounded externally with a series of slightly marked tubercles, the remains evidently of the articular processes; more externally, right and left, four foramina (*posterior sacral*). Externally to these foramina we remark a series of eminences strictly analagous to the transverse processes of the vertebræ, and still external to and above them will be observed two rough depressions into which are inserted the sacro-iliac ligaments. The lateral aspects are very uneven, broad above and narrow below. A surface of a remarkable form (the *facies auricularis*), and corresponding to a similarly shaped surface on each os innominatum, marks the powerful articulation with these bones. The remainder of these aspects is rough, and gives attachment to the sacro-sciatic ligaments. The *base*, we remark, corresponds precisely to the upper surface of a vertebra, and articulates with the inferior surface of the last lumbar vertebra. It presents therefore a vertebral foramen (the top of the sacral canal), articular processes, laminæ, and all the parts common to it as a vertebra. The *summit* is directed downwards and forwards, presents an oval articular surface corresponding to a similar one found on the first coccygeal bone. The *coccygeal bones* are commonly four in number, and are evidently four vertebræ becoming more and more rudimentary. The first, or that which articulates with the apex of the sacrum, presents posteriorly the remains of the articular processes in the shape of two tubercles named *horns,* and occasionally transverse processes uniting in such a way with the sacrum as to form two additional foramina. The union of the coccygeal bones with the sacrum, and with one another, takes place earlier in the male than in the female—a fact much dwelt upon by the accoucheur. The osteogeny of the sacrum and coccygeal bones is thus extremely complex, indeed more so than it would at first sight appear. The vertebræ all follow one law in their progress towards ossification, and thus we have, in the first place, the elements of nine vertebræ in this portion of the body, but how are the sacral foramina and broad base of the sacrum formed? We possess preparations which clearly shew that the transverse processes not only unite, but that short ribs are also formed in front of the transverse processes of the three superior sacral vertebræ, which also unite, and contribute to extend the base, and by their union constitute the *facies auricularis.* By this means the sacral foramina come to be divided into two sets, anterior and posterior; but they are strictly analagous in use, &c. to the foramina conjugalia. These foramina give passage to the spinal nerves of the sacrum, and the bone shews grooves posteriorly, leading from the foramina in which the nerves are situated. The first sacral vertebra bears sometimes the closest resemblance to the last lumbar, and might be mistaken for it, but for the great size and breadth of its lateral processes. Moreover, the body of this vertebra is slightly convex, whilst the remainder are concave. The sacrum in the male is comparatively long and straight, in the female broad and curved, but the consideration of its sexual differences fall more properly to be considered in describing it as a constituent part of the pelvis.

102. Each *Os Innominatum* would have, if flattened out, an irregular oblong quadrilateral form, contracted in the middle, but it is not only bent upon itself but twisted. In the young person it is divided into three bones by simple maceration in water, and our oldest and best descriptions speak of it as being composed of three bones—*ilium*, *ischium*, and *pubis*. The ilium is the uppermost, and forms the margin and prominence of the haunch. The pubis constitutes the anterior part of the os innominatum, and sustains the external organs of generation. The ischium is the lower portion, and more immediately supports the body when seated. The articular surfaces observed in the adult os innominatum are three in number, two of which are not easily recognised by the student. Perhaps the most striking feature of the bone is the deep hemispherical, cotyloid, articular cavity for the reception of the head of the femur. The ischium, ilium, and pubis, all contribute in the formation of this cavity,—the ischium forming rather more than two fifths, the ilium less, and the pubis a little more than one fifth. The portions of these three bones, which thus contribute to form the acetabulum, are called their *bodies*. This cavity has a diameter of about two inches, and is circumscribed by a prominent margin (*supercilium*), particularly superiorly and externally, a deep notch interrupting it inferiorly. Starting from this cavity as a central point, we observe that the bone presents three projecting portions. The largest (the *ilium*) is, generally speaking, convex externally, and in a well marked bone is traversed by two lines (*superior* and *inferior curved lines*). The large convex smooth surface below and anterior to the inferior curved line is occupied by the insertions of the gluteus minimus; the space between the two curved lines give attachment to the gluteus medius, and the gluteus maximus (the most superficial of the three) occupies the rough and uneven surface above and behind the superior curved line. The portion below the acetabulum is less extensive than that

above, and presents, in the first place, a large foramen (*foramen obturatorium*), of an oval or triangular form, the angles being rounded off; the osseous circumference of this foramen varies from an inch and half to half an inch, and is entirely occupied with the attachment of muscles. The ischium and pubis contribute nearly equal shares in forming the boundaries of the obturator foramen. The abdominal, inner aspect of the os innominata presents, particularly in the female, a remarkable degree of smoothness. Dividing the whole surface into an upper and lower part we remark a concave, broad and rounded line (*linea innominata* or *ileo pectinea.*) Above this line is a broad but shallow cavity, the iliac fossa, and posteriorly a very irregular surface presenting first, an ear shaped space corresponding to a similar one pointed out on the sides of the sacrum and a rough, very irregular surface, to which powerful ligaments (*sacro-iliac*) are attached. In the division below the *linea innominata*, we observe the inner orifice of the obturator foramen, behind which is a pretty extensive smooth surface of bone, formed entirely by the ischium; whilst anterior to the foramen, we have a smaller triangular and pretty smooth osseous surface, formed entirely by the pubis, the straight inferior margin of the foramen being formed by the union of the descending ramus of the pubis, and the ascending ramus of the ischium. We come now to speak of the edges or margins of this os innominatum. That portion formed by the ilium presents a thick convex edge, twisted upon itself like an italic *S*, passing the finger along this edge or crest (*iliac crest*), which in the adult female, may measure eight inches in length, it is found rather suddenly to form an angle particularly anteriorly; this angle is smooth, and constitutes the *anterior superior spine* of the ilium, a superficial notch of about two inches in length follows, which is again terminated by a rounded eminence, the *anterior inferior spinous process* of the ilium. A second deep notch follows this, and which is again succeeded by a rounded eminence (*eminentia ilio-pectinea*) in which the ilium and pubis unite, proceeding still towards the mesial line, and following the edge of the bone, we find a triangular smooth horizontal space (horizontal *ramus* of the pubis), directed obliquely downwards and forwards, and broader externally than towards the mesial line, where indeed it comes to an apex; the posterior edge of this space is thin and sharp, forming a ridge completing the *linea innominata* anteriorly. The space is an important one in the anatomy of the soft parts, we have said it forms a sort of apex mesially, and just here a pretty distinct and often sharp spine (the spine of the pubis) is formed. From the *spine* mesially, we observe a rough horizontal surface, extending for about half an inch; this part has received the name of the *crest* of the pubis, and here the edge we have been following, suddenly forms a right angle, the *angle of the pubis*, and descends. A rough oblong surface first presents itself, an inch and six-eighth deep by six-eighths broad, gradually coming to a point inferiorly; this surface by uniting with that of the opposite side, forms the symphysis of the pubis; a thin and sharp crest in the male, blunt and everted outwards in the female, follows this; its extent may be about three inches, the descending ramus of the pubis, and ascending of the ischium unite about its middle; its inclination and form is extremely important: it is terminated inferiorly by an eminence (*tuberosity of the ischium*). The direction of our line is here again changed, and we begin to ascend. The tuberosity of the ischium, we may remark, presents posteriorly, or as we ascend, a flat rather smooth surface, indicating the presence of a bursa mucosa provided for the protection of the gluteus maximus muscle; a little above this is a groove in which is occasionally lodged the tendon of the obturator externus muscle. Proceeding to ascend, we find a notch (*incisura ischiadica inferior, the smaller sciatic notch,*) presenting an almost articular appearance. The tendon of the obturator internus muscle slides over this surface as over a pulley, and it is here where the common pubic artery is very readily displayed. A thin, pointed, triangular and compressed eminence, having generally an irregular broken appearance follows; this is the *spine* of the ischium, the anterior sacro-sciatic ligament is attached to its summit. A very deep notch (*incisura ischiadica superior, the larger sciatic notch*), follows this, which again is limited by a projecting rough eminence, the *posterior inferior spinous process* of the ilium, having a broken looking sharp edge; a small notch, and another projecting eminence, the *posterior superior spinous process* of the ilium, (which with the adjoining large surface is sometimes called the iliac tuberosity) succeeds and brings us back to the crest of the ilium, from which we started. The journey is a long one, the objects of attraction numerous, and as the student will find, important. The *acetabalum*, with which we commenced our description of the surfaces observed on the ossa innominata, receives the rounded head of the femur, and these are so nicely adapted to each other that the whole body may be suspended by the limb after all the soft parts and ligaments have been cut through. The notch pointed out in its lower part leads to a rather extensive rough surface which is not covered with cartilage in the living body. A quantity of adipose membrane with some fatty bodies called the glands of Havers lie here, and into the centre of the space is fixed a strong inter-articular ligament.

103. The peculiar nomenclature of the ossa innominata compelled us to begin its description as it were with its osteogeny, we have still to remark on this subject, that several years after birth, an osseous plate is developed all along the crest of the ilium, another embraces the sciatic tuberosity, a third occupies the anterior and inferior spinous process of the ilium, a fourth in the symphysis pubis, a fifth has been seen on the *spine* of the pubis, and lastly, about the age of eleven, a sixth is observed in the acetabulum just at the point where the three bones unite to form it. The ossa innominata present great differences as to thickness, and consequently as to strength at different points. Thus the iliac portions are remarkably thin in the iliac fossæ where there is scarcely any diploe.

104. The *Pelvis* must be viewed by the student as a division of the skeleton, and no student of a month's standing, should be without one. The position it holds in the articulated skeleton, is different from what the student would suppose if hestudies it separately, in the entire skeleton its figure is that of a conoid, compressed before and behind, and having its two extremities cut obliquely, so as to be always more or less inclined forwards. The upper extremity has an inclination

upwards and forwards, presents laterally the two iliac crests, posteriorly a projecting angle, (*the sacro-vertebral angle*), anteriorly, an extensive notch, in the centre of which we find the upper part of the symphysis pubis. If we look into the interior of the pelvis, we observe a strait (*the upper or abdominal strait*), having the form of an ellipse, whose greatest axis is transverse, and whose circumference is interrupted posteriorly by the projection of the sacral promontory ; this strait divides the interior of the pelvis into first, the great pelvis (false pelvis) above, and into the *small* pelvis (true or pelvic excavation *cavum*) below. The linea innominata and promontory of the sacrum, forms this important strait, which in the well formed female pelvis, ought to have certain diameters. The usual measurements are as follows :—

1*st*, Antero-posterior or sacro-pubic	4.290 inches.
2*dly*, Transverse or iliac....	5.460 inches.
3*dly*, Two oblique....	4.680 inches.
4*thly*, Circumference....	14.820 inches.

105. The *small or true pelvis* is somewhat more capacious than the strait leading to it, its walls generally form smooth planes. It seems to constitute a curved canal, dilated in the middle. Posteriorly, we find the concave surface of the sacrum; anteriorly the symphysis pubis, two smooth osseous surfaces, and the two obturator foramina; on the sides, the great sciatic notches. The dimensions of this important part in the well formed female, are as follows :—

1. Height of the posterior wall....	4.836 inches.
2. — — anterior wall	1.560 inches.
3. — — lateral wall....	3.705 inches.
4. Thickness of the symphysis pubis....	.546 inch.
5. Depth of the cavity of the sacrum....	.702 inch.
6. Length of the coccygeal bones....	.975 inch.
7. Length of the concavity of the sacrum beneath the arch of the pubes....	4.875 inches.

106. The lower extremity of the conoid to which we have likened the pelvis, has received the name of the *Lower Strait* of the pelvis (*exitus seu apertura pelvis inferior*,) it is directed downwards and outwards. Its form in the skeleton is irregular and difficult to be deter-

mined, because its edges are deeply notched and inclined in two different directions; it in fact presents three large eminences separated by an equal number of deep notches. The sciatic tuberosities form the two anterior eminences, which are placed wider asunder in the female than in the male, and which descend lower than the posterior and middle eminences, which is represented by the coccygeal bones. One of the notches is placed before, and is named the *pubic arch*, or *arch of the pubis*, it is formed on each side by the descending rami of the pubis, and the ascending rami of the ischium. This triangular space or arch between the bones is wider and shorter in the female than in the male; the apex which is acute in the male is wide and rounded in the female; the edges, moreover, as we have already noticed, are everted in the female, and sharp and straight in the male; an imaginary line running from one tuberosity of the ischium to the other, constitutes the base. Through the upper part of this triangular space passes the urethra, and there is stretched across it, in the male subject particularly, a strong aponeurotic membrane through which the urethra runs. At the summit of the arch we have the symphysis pubis, and the arch in the female really deserves the name of arch, measuring as much as an inch and half; whilst in the male, it assumes so much that of the Gothic, as to resemble more *an angle* than *an arch*. The other two notches mentioned as being seen in the lower strait of the pelvis, are named the *great sciatic notches*, and are each divided into three portions by the sacro-sciatic ligaments, and thus a pelvis with the ligaments is a preparation which every right professional person must possess. The diameters of the perinæal aperture are important, and are best taken when the ligaments are present. They are as follows:—

1. Antero-posterior (coccy-pubic) diameter, varies by reason of the mobility of the coccygeal bones, from.................................4.290 to 5 inches.
2. Ischiatic or transverse..............4.290 inches.
3. Oblique..............................4.290 inches.*

* One extremity of this diameter is the centre of the greater sacro-sciatic ligament.

107. From the peculiar manner in which the pelvis is connected to the trunk, the axis of the pelvis differs greatly from that of the body, and the axis of the entrance into and exit from the true pelvis or cavum also differ from that of the body, and from each other. This fact is of the very last importance to the accoucheur when called upon to use the forceps. The axis of the circumference or base of the pelvis cannot be very accurately given, owing to the great deficiency in front, and as it appears to alter much in the reclining or standing position of the body. In *the standing posture* a line drawn horizontally backwards from the upper edge of the pubis falls nearly on the last sacral vertebra, and the inclination of the abdominal or superior strait is 35°; whilst the inclination of the inferior strait will not be more than 15°. The inclination of the upper and lower straits being different, their axis will of course differ also; thus, a line passed in the axis of the abdominal strait will fall on the third coccygeal bone; whilst a line passed in the axis of the inferior strait or exit will strike the sacro-vertebral angle, and these two lines will cross each other about the middle of the pelvic excavation forming anteriorly a very obtuse angle. Thus, whilst the axis of the base of the pelvis is nearly vertical, that of the superior strait is so oblique from below upwards and forwards, that a line passing through it would fall upon the umbilicus.

OF THE EXTREMITIES OR LIMBS.

108. The *Extremities* or *Limbs* (*membra*), are appendages of the trunk, and are four in number, disposed symmetrically in pairs, connected to it by one of the extremities, and otherwise free and composed of a series of bones representing contiguous levers, all cut obliquely at their extremities.

THE SUPERIOR OR THORACIC EXTREMITIES.

109. The *Clavicle* or *Collar Bone*, is placed nearly transversely on each side, at the upper and fore part of the thorax, between the sternum and acromion process of the

scapula, so as to cross obliquely the direction of the first rib. It is twisted in the form of an Italic *ſ*, less curved and longer in the female than in the male; prismatic and triangular, or irregularly rounded in its two inner thirds, contracted in the middle, broad and flat at the outer part. The *Body* or *Middle Part* is rounded, presenting on its *lower surface*, at its inner part, a rough impression for the insertion of the costo-clavicular ligament, and at the middle a longitudinal groove, where the hole is observed that gives passage to the nutritious vessels of the bone, and which receives the fibres of the subclavius muscle; at its outermost part there is a prominent ridge, running obliquely from within outwards, and from behind forwards, to which are attached the coraco-clavicular ligaments. The *Sternal* or *Internal Extremity* is inclined downwards and forwards, and is considerably thicker than the rest of the bone. There is observed upon it a triangular, broad, uneven articular surface, corresponding to a narrow surface, which we have already mentioned as occurring at the upper extremity of the sternum. The *Acromial* or *External Extremity* passes over the coracoid process, and inclines backwards and upwards. It is articulated to the acromion by a narrow articular surface, oblong from behind forwards, inclined obliquely from above downwards, and from without inwards. The clavicle makes its appearance at a very early period in the fœtus, and commences its ossific development by a single point for the body; but at a more advanced period, when that part has nearly acquired its full size, there is formed at each extremity a thin epiphysis, which ultimately unites with the rest of the bone. It presents two articular surfaces, a sternal and a scapular.

110. The *Scapula* or *Shoulder-blade*, (*Omoplata*,) is situated at the posterior and upper part of the thorax, from about the seventh rib to the first, forming the posterior part of the shoulder. It has a triangular form, and is flat and thin over the greater part of its extent. The *Posterior* or *Dorsal Aspect* is divided transversely into two parts by a flat triangular eminence, situated about its upper third, named the *Spine*. Near the inner edge of the scapula, it presents a smooth and polished triangular space, on which the aponeuro-

sis of the trapezius muscle slides. Externally, the spine of the scapula is terminated by a thick and short concave edge, and these two edges uniting, give rise to a considerable eminence named the *Acromion ;* flattened in a direction contrary to that of the *spine*, its *outer surface* is directed upwards and backwards, is convex and uneven, and covered by the skin. The *inner surface* is smooth and concave, and inclines downwards and forwards. Its *upper edge* is directed inwards, gives attachment to the trapezius, and presents anteriorly a small oval articular surface, with which the outer extremity of the clavicle is connected. The *lower edge* is uneven, and gives attachment to some fibres of the deltoid muscle. Its summit affords insertion to the acromio-coracoid ligament. Above the spine is the *Fossa Supra-spinata;* below, is the *Fossa Infra-spinata*, larger than the preceding, somewhat prominent in the middle, but concave outwards, and upon it a longitudinal ridge, giving insertion to an aponeurosis, common to the infra-spinatus, teres major and minor muscles. Between this ridge, and the axillary edge of the scapula is a long surface, broader above than below, divided into two parts by another ridge, which descends from that edge, and joins the preceding at an acute angle; the upper and narrow portion of this surface gives attachment to the teres minor; the lower, to the teres major. The *Interior* or *Costal Aspect*, is inclined inwards, and concave, forming what is called the *Subscapular Fossa*, towards the spinal edge of which, are observed, above and below, two plain surfaces, giving attachment to the serratus magnus. The *Upper Edge* is thin and short, it presents a notch, converted into a hole by the coracoid membrane through which pass the supra-scapular nerve, and sometimes the vessels of the same name. Anteriorly to this notch, a narrow elongated projection, curved upon itself, having always more breadth than thickness, at first passing from below upwards, and presently directing itself from behind forwards, and from above downwards: this projection is named the *Coracoid Process*, the *upper surface* of which is convex and uneven, and gives attachment to the coraco-clavicular ligaments: the *lower surface* is smooth and concave. The *Spinal* or *Vertebral Edge*, named also the

Base, approaches the vertebral column above, from which it retires at the lower part. At its union with the upper edge, it forms a projecting angle, which is embraced by the levator anguli scapulæ, and which is named the *Posterior, Superior,* or *Cervical Angle.* The *Outer* or *Axillary Edge* named also the *Inferior Costa,* inclines downwards and forwards, and is much thicker than the others. It is marked with a groove into which the long portion of the triceps extensor cubiti is inserted. At its lower part, it receives the teres major; and by uniting with the posterior edge, forms an angle named the *Inferior* or *Costal,* which is thick and rounded; this angle is embraced as it were by the teres major, and is overlapped by the upper margin of the latissimus dorsi, to some fibres of which it occasionally affords insertion. The axillary edge is surmounted by a thick truncated concave and articular angle, named *Glenoid.* This articular surface is superficial, of an oval form, broader below than above; its great diameter is vertical, and a little inclined downwards and outwards; its circumference in the recent state, is surrounded by a fibro-cartilaginous rim; at its upper part, it gives attachment to the long portion of the biceps muscle. It is supported by a contracted part, named the *Neck.* The development of the scapula takes place by six or seven points of ossification:

111. The *Humerus,* (*Os Humeri, Os Brachii*) is suspended, as it were, to the shoulder, and terminates at the elbow; it is irregular and of a cylindrical form. The *Body* or *Middle Part,* is nearly cylindrical at the upper part, becoming prismatic and flattened from before backwards at the lower, and appears as if twisted upon itself in its middle region. Its *posterior surface* is rounded above, and turned a little inwards, while below it looks outwards, and is broad and flattened. Its *inner surface* is narrow. Superiorly, there is observed a longitudinal depression, covered with cartilage in the recent state, deep above, and gradually disappearing as it descends; this is the *bicipital groove,* lower down, some inequalities to which the coraco-brachialis is attached, and the medullary foramen, which is directed from above downwards. At its lower part the bone is rounded, inclines a little forward, and gives attachment in

part to the brachialis internus muscle. Its *outer surface* is also rounded; but, near its upper third, it presents the *deltoid impression*, a sort of scabrous surface, and which surmounts a broad and superficial depression, (the spiral groove) inclined obliquely from above downwards and from behind forwards, marking the passage of the radial or musculo-spiral nerve, and one of the principal branches of the humeral artery. These three surfaces are separated from each other by three prominent lines. The *outer*, not very distinct at its upper part, is traversed in the middle by the spiral groove of the radial nerve, and becomes very prominent and a little curved forwards at the lower part, into which the internal intermuscular partition is fixed. The *upper* or *scapular extremity*, is the largest part of the bone, and is formed by three eminences. The upper is inclined inwards and backwards, of a nearly hemispherical form, is an articular surface, and named the *Head*. It is supported by a contracted part or *Neck*, a little longer and more distinct forwards, downwards, and inwards, than at its upper and outer part, where it resembles a mere groove. The axis of this neck is placed obliquely to that of the bone, and forms an obtuse angle with it. The other two eminences are named the *greater* or *smaller tuberosities*. The greater is situated posteriorly, is rounded, and presents three plain surfaces. The smaller tuberosity, is much narrower, but a little more prominent. They are separated from each other by the commencement of the bicipital groove, which is directed downwards and inwards. The *lower* or *anti-brachial extremity*, is flattened and curved forwards; its transverse diameter is the greatest. At the outside it presents an eminence, named the *external condyle*, into which is inserted the external ligament of the elbow joint. Internally, there is observed the *internal condyle*, more prominent than the preceding, turned a little backwards. Between these two eminences is an articular surface, turned forwards, descending below them, and formed from the radial to the ulnar side; 1st, by the *Small Head of the Humerus*, *(superficies articularis radialis)*, a rounded eminence, which is received into the cavity of the upper extremity of the radius; 2dly, by a groove which corresponds to the margin of that cavity; 3dly, by a sharp semicircular crest, which is lodged between the ulna and radius; 4thly, by a pulley, *(superficies articularis ulnaris)*, situated beneath the level of the small head, which articulates with the large sigmoid cavity of the ulna. It is on account of the greater projection of this pulley, that the humerus inclines outwards, when it is placed by its lower extremity on a horizontal plane. At the fore part of this extremity, and above the articular surface, is a superficial cavity, *(fossa anterior major)*, which lodges the coronoid process of the ulna when the fore arm is bent; and at the back part, is observed a deeper fossa, which receives the olecranon when the fore arm is extended. Lastly, above the small head, is a depression, into which the edge of the upper cavity of the radius is received during the forced flexion of the joint. The humerus is compact in its body, spongy and cellular at the extremities, and contains a large medullary canal. It is articulated to the scapula, the radius, and the ulna; and is developed by eight points of ossification, one for the body, a second for the head, a third for the large tuberosity, a fourth for the small tuberosity, a fifth for the pulley of the lower extremity, a sixth and seventh for each of the condyles, and commonly an eighth for the small head.

112. The *Ulna* or *Cubitus* is situated at the inner part of the fore-arm, and although our investigation into comparative anatomy leads us to consider the *radius* the most important bone of the two composing the anti-brachial region in the human subject, the ulna in reference to the elbow-joint deserves the preference in description. We divide it into a body and two extremities. The *body* is curved forwards at its upper part, backwards and outwards at the lower, while its middle region is strait. Its *anterior surface* is concave above, and gives attachment at its upper part, where it is broad, to the flexor profundus, and presents the orifice of a canal for the passage of vessels into the bone, which is directed upwards. The *posterior surface* is divided into two parts by a longitudinal prominent line; the *inner*, which is broader, gives attachment, from above downwards, to the anconeus and extensor carpi ulnaris; while the *outer*, which is narrower, receives, in the same direc-

tion the insertions of the supinator brevis, extensors of the thumb, and extensor indicis. The *inner surface* is broad and somewhat concave at the upper part, is covered in its three upper fourths, by the flexor profundus; while at the lower part, it is much contracted, and becomes sub-cutaneous. These three surfaces are separated by as many edges. The *outer* is sharp in the three upper fourths of its length, rounded below, and gives attachment to the interosseous ligament. The *anterior edge*, which is more rounded, gives insertion, at its upper part, to the flexor profundus, and, below, to the pronator quadratus. The *posterior edge* is very distinct in its three upper fourths, and there gives attachment to an aponeurosis common to the flexor carpi ulnaris, flexor profundus, and extensor carpi ulnaris; it gradually becomes obliterated below. The *upper* or *humeral extremity* is large, of an irregular form, and presents for consideration two processes. One of these, the *olecranon*, *(processus anconeus)*; is situated posteriorly, at its upper part it gives attachment to the triceps extensor; posteriorly, it presents a narrow triangular surface, covered by the skin, which is here provided with a bursa; anteriorly it is concave and invested with cartilage. The other process, which is named the *coronoid* (*processus coronoideus*), is situated before and beneath the olecranon; at its upper part it is cartilaginous and inclined backwards; but below, it is directed forward, and presents an impression for the attachment of the brachialis muscle. On the inside, it gives attachment to some fibres of the pronator teres and flexor sublimis, together with the internal lateral ligament of the elbow joint. Externally, it presents an oval articular cavity, with its greatest diameter from before backwards, named the *smaller sigmoid cavity*, this cavity is articulated with the upper extremity of the radius, and is continued above into the *larger sigmoid cavity*, which rolls upon the trochlea of the humerus, and which is formed by the anterior surface of the olecranon, and the upper surface of the coronoid process, which unite very nearly at a right angle; a transverse line notched at the extremities indicates the situation of this union, the olecranum being an epiphysis in the young subject, and in some cases not forming an osseous union with the body of the bone. Its posterior and vertical portion is larger than the anterior, which is horizontal. The larger sigmoid cavity is divided by a prominent line, which passes from the upper part of the olecranon to the summit of the coronoid process, into two lateral portions, the inner of which is the larger. The *lower* or *carpal extremity* is small, and presents two eminences. The outer, named the *head*, is articular and rounded, and received externally into the cavity of the lower extremity of the radius. The inner, or *styloid process*, is more prominent, and is placed a little backwards; it is conical and slightly turned outwards; its summit gives attachment to the internal lateral ligament of the wrist-joint. Posteriorly these two eminences are separatde by a groove, in which the tendon of the extensor carpi ulnaris passes, and below by an uneven depression, into which a triangular fibro-cartilage is inserted. The ulna is developed by four points of ossification,—one for the body, a second for the olecranon, a third for the coronoid process, a fourth for the head and styloid process.

113. The *Radius* is situated at the outer part of the fore-arm, and is shorter than the ulna; it expands at its lower part, and is slightly curved inwards about the middle. The *body* or *middle part* is prismatic and trigonal. Its *anterior surface* becomes gradually broader as it descends, is plain, in the greater part of its extent concave, and about a third from the upper extremity presents the orifice of the medullary canal, which is directed upwards; the three upper fourths of this surface give attachment to the flexor longus pollicis manus, and its lower fourth to the pronator quadratus. Its *posterior surface* is convex, its upper third is covered by the supinator brevis; in the middle receiving the insertions of the extensors of the thumb; and inferiorly covered by the extensor communis digitorum, extensor proprius indicis, and extensor secundi internodii pollicis. The *outer surface* is rounded and convex, gives attachment at its upper part to the supinator brevis; in the middle, where a rough impression is observed, to the pronator teres; and, at its lower part, is covered by the tendons of the radial extensors of the carpus. These three surfaces are separated by an equal number of edges,

of which the *posterior* is rather indistinct at its upper and lower parts, although pretty obvious at the middle. The *inner* is very distinct, thin and sharp, and somewhat arched in the middle, gives attachment to the interosseous ligament. The *anterior* is less prominent; it is rounded, especially at its lower part, and at its upper part affords insertion to the flexor sublimis, flexor longus proprius pollicis, and supinator brevis; while at its lower part, it receives first the pronator quadratus, and afterwards the supinator longus. The *Upper* or *humeral extremity* presents a superficial circular articular cavity, into which is received the small head of the humerus. The circumference of this cavity, which is also articular, is broader internally, where it is articulated with the small sigmoid cavity of the ulna; in the rest of its extent, it is connected with the annular ligament. This articular part of the radius is supported by a round contracted *neck*, about a finger's breadth in length, and inclined a little outwards, terminating downwards and inwards at the *bicipital tuberosity*, an eminence which is smooth and contiguous externally with the tendon of the biceps flexor, to which it affords attachment internally by a rough surface. The *Lower* or *carpal extremity*, is larger than the upper, and presents an articular surface, which is traversed from before backwards by a somewhat indistinct line, dividing it into two articular surfaces, of which the outer is triangular, and of greater extent, the inner square, and less elongated. Anteriorly, this extremity of the bone gives attachment to the anterior ligament of the wrist joint. Posteriorly, it presents two vertical grooves, of which the outer is narrow, passes a little obliquely outwards, and contains the tendon of the extensor secundi internodii pollicis, while the inner, which is broader and superficial, affords a passage to the tendons of the extensor communis digitorum and extensor indicis. Internally, it presents an oblong articular cavity, which is articulated to the lower extremity of the ulna; and on the outside is marked with two other grooves, the anterior for the tendons of the extensor ossis metacarpi pollicis and extensor primi internodii pollicis, the posterior for the tendons of the radial extensor muscles. The edge by which these grooves are separated terminates below in a pyramidal eminence, named the *styloid process*, which is itself terminated by a blunt summit, into which the external lateral ligament of the wrist joint is inserted. The radius is articulated with the humerus and ulna, and the scaphoid and semilunar bones, and is developed by four points of ossification, one for the body, a second for the head, and two more for the carpal extremity.

114. The *Hand*, by referring to our table, (sec. 7,) will be observed to be composed of twenty-nine bones, (including the two sesamoid bones connected with the flexor brevis of the thumb,) and its subdivision into three regions is essential for facilitating description. The *carpal region* comprises eight bones, and we would recommend the student to view them in the first place articulated with each other and as a whole; indeed the term *carpus* is particularly applied to the eight bones thus connected: the carpus is transversely oval, flattened from before backwards, and slightly curved forwards; the posterior surface is convex, and traversed by an unequal depression particularly striking on the radial margin, presenting a very beautiful arrangement by which a great extent of motion is acquired. The anterior or flexor aspect is concave, showing a much less extent of *non*-articular surfaces than the posterior. The scaphoid and trapezium projecting on the radial margin, and the pisiform and os unciform on the ulnar margin, and having a powerful ligament, (*anterior annular*) attached to them, form a short canal in which the tendons of the flexor muscles of the fingers, together with the nerves and vessels pass. On the radial margin, the *carpus* forms a semilunar arch, of which a part, namely the central, is articular; the scaphoid and os lunatum here combine to form two articular surfaces precisely corresponding to those pointed out on the distal or carpal extremity of the radius. It will be now observed by the careful student, that the eight bones are really not arranged in two rows, as most anatomists persist in having it, but as two arches, one within the other, the first composed of five bones, the second of three. The carpus towards the metacarpal bones, presents a series of four rather irregular flattened articular surfaces, and which support the five metatarsal bones. The pisiform bone supports no metacarpal.

The student must now proceed to examine each bone of the carpus separately, and he will be much struck with their irregular form. We call his attention particularly to the *articular* and *non*-articular surfaces, it is an excellent mental exercise, and appears to us the only mode of becoming acquainted with each bone. The *non*-articulating surfaces will be observed to be few in number, and the most extensive of them will invariably indicate that aspect which looked to the dorsum of the hand, or the radial or ulnar margins. Commencing on the external margin of the carpus, we find, first, the *trapezium* (*os multangulum magus.*) The *non*-articular surfaces observed on this bone are pretty extensive and very irregular. A well marked groove will attract the student's attention; this groove is on the flexor aspect of the bone, and receives the tendon of the flexor carpi radialis muscle. The articulating surfaces are four; the first concave in the transverse direction of the bone, and convex in the opposite direction, (the metacarpal bone of the thumb plays on this surface.) The remaining three are continuous with each other, although lying on different planes; the central one is most extensive, and articulate with the trapezoides; this surface is flanked on the one side by a small and obscurely marked surface, supporting very slightly the second metacarpal bone, and on the other by a well marked concave articular surface for the reception of a part of the *Scaphoid* bone, (*os naviculare.*) This bone is nearly altogether articular; being placed on different planes, however, the articular surfaces are divided into four; the first triangular, playing partly in the surface last mentioned on the trapezium; the second decidedly concave, receiving a portion of the head of the os magnum; the third convex, corresponding to a similar surface on the radius; the fourth, a narrow, semilunar and ill-defined surface, which however connects the bone with the *Semilunar*, (*os lunatum*, crescent-shaped bone). This bone presents four articulating surfaces. The first corresponding to the one last mentioned on the scaphoid, is similar in form, and will scarcely be recognised as having been articular; the second well marked, concave, receiving the greater portion of the head of the os magnum; the third extensive and convex, connected to the radius; the fourth flat, and rather quadrilateral, connecting this bone with the *Cuneiform (os triquetrum, pyramidal)*. This bone presents three articular surfaces; the first, flat, corresponding to that last mentioned on the semilunar; the second, irregularly concave, articulating with the unciform bone; the third, a circular slightly convex surface, supporting entirely the *Pisiform Bone.* This bone is nearly rounded excepting on one portion, viz. the only articular surface which it presents; this surface is circular, slightly concave, and corresponds exactly to that last mentioned on the cuneiform bone. We thus complete what we consider the superior arch, and the three remaining bones will be found to fill up this arch; two of these bones are nearly equal in size, and are easily recognised, proceeding from the ulnar side, we shall select the *Unciform Bone*, so named from a hook-like process which it presents on its anterior aspect. We observe three distinct articular aspects; the first irregularly quadrilateral, but twisted on itself, having a very slight ridge traversing it; this surface corresponds to two bones, viz. cuneiform entirely, and semilunar partially, the play being very considerable in the movements of the hand from side to side; the second articular surface presents an oblong square aspect divided into two unequal parts by a superficial ridge, these support nearly entirely the fourth and fifth metacarpal bones; the third is a flat and nearly circular surface upon the same plane with which we observe an uneven notched surface; these correspond precisely to a similar aspect presented by the *Os Magnum*, (*os capitatum*). This bone is the largest of the carpus, and is readily distinguished from the others by having a rounded articular head; we observe on it *four* articular surfaces; first, an extensive flattened surface, partly articular, and corresponding very accurately to that last pointed out on the unciform; the second, the rounded head, which is received into a concave surface, formed by the scaphoid and os lunatum, (and it is in this situation, no doubt, that most of the delicate movements of the wrist joint are performed); thirdly, an extensive surface divided into four portions by three elevations; the most extensive surface supports the third metacarpal bone; the second in extent supports a portion of the fourth metacarpal bone; the next in extent touches the second metacarpal; and lastly, a surface which we observe to be continuous with the rounded head, supports the *Os Trapezoides* (*os multangulum minus.*) This is perhaps the most difficult bone to recognise in the carpal region, but if the student leaves it to the *last* as we have done, he can have little difficulty; for ourselves, we think it an easily recognised bone, if the surfaces are contemplated as we have already recommended. The articular surfaces presented are four in number, continuous with each other, but lying on different planes; first, that articulating with the os magnum is elongated, concave, the concavity being produced as it were by a twist given to the bone; secondly, an elongated pretty extensive surface, decidedly convex in its short diameter, this supports the second metacarpal bone; thirdly, a well marked, flattened, slightly convex surface, articulates with the trapezius; and lastly, a narrow quadrilateral facet contributes to form a surface in which the scaphoid performs very extensive movements. The development or ossification of these eight bones is slow, commencing at a late period of the fœtal life, and not completed for a very considerable period after birth. In this respect they resemble strongly the nature of the epiphyses of the long bones; and a section shews a still more striking resemblance, the interior being spongy, the exterior a very thin layer or compact tissue, the non-articular surfaces perforated with many openings, and no medullary cavity. The pisiform bone is not completely ossified until about twelve years of age. They are all, so far as can be observed in the human subject, developed from one centre of ossification, except the unciform which has two.

115. The skeleton of the *metacarpus* consists of five elongated bones, resembling each other in many respects. The extremities are thicker than the centre, and are articular; the proximal extremities are nearly flat with the exception of the first, and of course perform very limited motions; the *distal* or metacarpo-digital extremities present a rounded condyloid head, admitting of flexion and extension of rather more than a semicircle, and even of a slight rotation, although we

shall find strong lateral ligaments. When viewed in the articulated skeleton, it will be observed that the first is placed on a plane, anterior to the remaining four, and its movements are much more extensive; it differs also in form. Anteriorly, they are all decidedly concave; posteriorly, convex. The anterior aspect presents the appearance of a median line, flattened out towards their proximal extremity; the posterior surface also presents a median line, but which commencing near their proximal extremity, bifurcates, forming ultimately the sides of a flat triangular surface; into the ridges thus formed, we have inserted the interossœi muscles. The flat triangular surface on the posterior aspect, and the ridge anteriorly forming prominent features in a deeply dissected hand. We distinguish these bones from each other by attending to the proximal articular surfaces. The *first* is concave in one direction, convex in the other; it is supported upon a similar surface pointed out on the trapezius, and being placed on a plane anterior to the other fingers, can easily oppose each in all the motions of flexion. The proximal extremity of the *second* is divided by two ridges presenting in the centre a deep notch into which a corresponding ridge of the trapezoides passes, the bone also articulates with the trapezius, os magnum, and with the *third* metacarpal bone. The proximal extremity of the *third* metacarpal is nearly flat, and supported altogether on the os magnum; towards the ulnar side we observe an articular surface slightly notched in the centre, corresponding to a similar surface on the *fourth* metacarpal bone. The proximal extremity of the *fourth* metacarpal is divided into two unequal parts by a ridge, the largest articulating with the unciform bone, the smallest with the os magnum; on the ulnar side, a flat concave surface corresponds to a similar one observed on the *fifth* metacarpal bone. The proximal extremity of this bone presents a flattened surface, articulated with the os unciform, on the ulnar side a projecting heel to which the extensor carpi ulnaris takes an attachment. The ossification of these bones is interesting, and has received a great share of our attention. In the child, and in some rare instances in the adult, we find the body and proximal extremity of the *second, third,* *fourth* and *fifth* as one bone, whilst the distal extremity presents an epiphyses, and the striking peculiarity is, that this order is reversed with regard to the *first* or that supporting the thumb; this fact has led many good anatomists to consider it *not* as a metacarpal bone, but as a phalynx whose progress of ossification seems to follow the same law. The truth is, that these bones have all an epiphyses at each extremity like the other long bones, but their union to the body follow different laws. A case of congenital deformity now before us, proves nearly to a demonstration, that it is the middle phalynx of the thumb which is always wanting.

116. The skeleton of the *fingers* is composed of fourteen phalanges, each finger having three except the thumb which has only two. The posterior (dorsal) surface of all the phalanges is convex and slightly arched; the anterior (palmar) surface is also arched, but from before backwards, hollowed from side to side, the sheath of the flexor tendons being attached to its edges, and thus constituting a semi-osseous semi-aponeurotic canal for the play of these powerful tendons. Viewing the whole from the radial to the ulnar aspect, we observe they are arranged in rows, a proximal, a middle, and a distal. The finger tapers from its proximal to its distal extremity, and although it would be difficult to distinguish one phalanx of the *same* row from another, yet the bones of each *row* are easily distinguished. The proximal row, five in number, present each on their proximal extremity a hollow articular orbicular surface for receiving the round condyloid head of the corresponding metacarpal bone, whilst the distal extremities are surmounted by two condyles, separated by a groove more prolonged anteriorly than posteriorly, and corresponding with the proximal end of the *middle* phalanges. The *middle* row of phalanges are only four in number, the first or thumb wanting this bone. The proximal extremities of these, present two lateral depressions with a central elevation; the distal extremity again, is not unlike that of the proximal phalanges, so that the form of the proximal extremities forms the only guide to recognise them. The *distal phalanges*, five in number, are very peculiar; they support the nail, and that nervous cushion constituting the most delicate part of the sense of touch;

their distal extremity is rounded, compressed, tubercular, and broader than the body; their proximal extremity presents two cavities with a central eminence corresponding to the distal extremity of the middle phalynx. The thumb in man has a strength peculiar to himself, and the want of a phalynx causes no deficiency in its usefulness; at the metacarpo-phalangeal articulation, and on its anterior (palmar) aspect, we always have two bones named sesamoid, provided especially for the more advantageous play of the flexor brevis muscle; they are connected to the other bones by strong ligaments, and are developed in a fibro-cartilage; they are in every respect similar to the pisiform bone of the carpus or the patella in the knee-joint, all of which have the strongest analogy to the epiphyses of long bones. The ossification of the phalanges proceeds as in the metacarpal bones from three points, but in them the distal epiphyses unites at a very early period with the body. The distal phalanges, or those supporting the nail ossify from two centres only.

THE INFERIOR OR PELVIC EXTREMITIES.

117. The *Femur* is the longest, largest, and heaviest bone of the skeleton; it consists of a body and two articular extremities. The *body*, which is pretty thick above, contracted in the middle, and greatly enlarged below, is slightly twisted upon itself, and presents a very distinct curvature, of which the convexity is anterior. It is somewhat triangular in its three upper fourths, and is flattened from before backwards in the lower fourth. Its *anterior surface* is convex, broader above and below than in the middle, and slightly twisted upon itself. The *outer surface* is narrow, slightly concave above, convex below. The *inner surface* is broader than the preceding, nearly plain, and covered by the vastus internus, to which it gives attachment in its two upper thirds. These surfaces are separated by three *edges*, two *lateral*, rounded, rather indistinct; a third, *posterior*, very prominent, rough, and furnished with distinct asperities, has received the name of *linea aspera*. This line, whose direction is parallel to the axis of the bone, is much more distinct at its middle

part than at the extremities. It has besides a certain breadth, and presents two lips or edges, separated by an interval, and retiring to a great distance from each other at the upper and lower parts of the bone, which makes it appear bifurcated at its two extremities. It gives attachment externally to the vastus externus and the short head of the biceps. Internally, it receives the insertion of the vastus internus; while its middle part receives a portion of the fibres of the three adductor muscles of the thigh. The external branch of the upper bifurcation of the linea aspera ascends to the trochanter major; it is very rough, and gives attachment externally to the vastus externus, internally to the adductor magnus, and in the middle to the tendon of the gluteus maximus. The internal branch is not very distinct, passes upwards and inwards to the trochanter minor, and gives attachment to the pectineus and vastus internus. The quadratus femoris and adductor magnus cover the triangular interval existing between these branches. The branches of the lower bifurcation of the linea aspera are longer than those of the upper; they descend toward the posterior part of the condyles, above which they terminate by very distinct impressions, and are more widely separated than those of the upper bifurcation. The external branch, which is more prominent than the inner, affords insertion to the vastus externus and biceps flexor muscles; the internal, which is depressed at its upper part, and even almost entirely effaced toward the middle for the passage of the femoral artery, which runs across it, gives attachment to the vastus internus and adductor magnus. These two lines are separated by a triangular flattened surface, which corresponds to the popliteal vessels and nerves, and is limited at its lower part, and laterally by rough impressions, which are placed immediately above the posterior extremity of the condyles, and which give attachment to the tendons of the gastrocnemius externus muscle. The *upper* or *pelvic extremity* is angularly curved from its union with the body of the bone, and of a very irregular form, presenting three large processes. One, the *head*, is articular, of a spherical form, and directed obliquely upwards, inwards, and a little forwards. At the middle, or a little below it, there is an uneven depression, which gives attachment to the round ligament of the hip joint; it is supported by a long *neck*, which forms a more or less obtuse angle outwards with the axis of the body of the bone. It is longer and smaller below and behind, than above and before. The head is separated from the neck by a variously contorted line, which corresponds to the circumference of the cartilage by which the head is invested: two other broad and scabrous lines, directed obliquely inwards and downwards, proceeding from the great to the small trochanter, and situated the one before (*linea intertrochanterica anterior*), the other behind (*linea intertrochanterica posterior*) the base of the neck, indicate its junction with the body of the bone, and give attachment to the capsular ligament. The part of the neck which is next the head, is rounded and smaller; in the rest of its extent, it has the form of a triangular prism, with very blunt angles. The second process is named the *great trochanter*, and is a broad, thick, rough, quadrilateral eminence, flattened from within outwards, situated at a lower level than the head. It is broad and convex; externally the tendon of the gluteus maximus plays over it, having a synovial bursa interposed. It is terminated below by a rather prominent ridge, which gives attachment to the vastus externus muscle. Its *inner surface* presents at its upper part an irregular depression, named the *digital cavity*, into which are inserted the tendons of the pyriformis, superior and inferior gemelli, obturator internus, and obturator externus muscles. The *anterior edge* of the great trochanter is broad and rough, giving insertion to the tendon of the glutæus minimus. Its *posterior edge* receives the tendon of the quadratus femoris. Its *summit* is short, thick, and very rough. The *small trochanter* is situated beneath and behind the base of the neck of the femur, and much lower than the great trochanter; its form is pyramidal, and its direction obliquely inwards and backwards. From its base, which is triangular, there proceed three prominent lines; two superior, of which the one ascends obliquely outwards to the great trochanter, while the other proceeds obliquely inwards, to be continued into the lower part of the neck; and one inferior, which directs itself toward the linea aspera, and forms the inner branch of its superior bifurcation. The *lower* or *tibial extremity* is larger than the upper, flattened from before backwards, and thinner in its middle part than on the sides, which are formed of two considerable eminences, named *condyles*. These condyles articulate with the tibia, and are distinguished into internal and external, being separated posteriorly by a deep notch (the *fovea intercondyloidea posterior*), whilst anteriorly their articular surfaces are continued into each other, forming a pulley (the *fovea intercondyloidea anterior*); their form is convex from above downwards, concave transversely, more prominent and higher externally than internally, the outer condyle forming nearly the whole of the articular surface. The *internal condyle* is narrower, less prominent anteriorly, more oblique, more prolonged backwards than the other, and also descends lower when the femur is placed in a vertical direction, but remains on the same level with it when the bone is restored to its natural obliquity. Internally an uneven projecting eminence, named the *internal tuberosity*, gives attachment to the internal lateral ligament of the knee-joint, and to the tendon of the adductor magnus. The outer condyle presents externally the *external tuberosity*, uneven, rough, convex, and giving attachment to the external lateral ligament of the knee-joint. Beneath this tuberosity, there is observed a groove, which receives the tendon of the popliteus muscle in the flexed position of the joint. The femur in a fœtus of about the fourth month, now before us, presents the appearance of a cylinder, terminated at each extremity by a cartilage, which includes superiorly the head, neck, and both trochanters, and inferiorly the condyles. In the young person, say about seven, and in some cases throughout life, maceration will separate the femur into five portions, viz. 1*st*, the body; 2*d*, head; 3*d*, trochanter major; 4*th*, and minor; 5*th*, condyles. A longitudinal section of the adult femur exhibits an extensive medullary canal, compact tissue of great thickness and strength where the canal is most distinct, becoming papiratious towards the extremities, where the centre of the bone is composed of cancelli. The canal for the passage of the medullary artery commences in the line of the linea aspera, between the upper and middle third of the bone. The extremities of the bone are also perforated by innumerable minute openings for the passage of vessels.

118. The *Tibia* is the largest and longest of the two bones of the leg, of which it occupies the inner and fore part. The *body* is prismatic and triangular; its thickness diminishes from the upper part to the lower in a general manner, but the place where it is smallest is below the middle third. Independently of its being twisted upon itself, it presents a double curvature, which is such that internally its two upper thirds are slightly convex, while the lower is a little concave. Its *inner surface* is directed obliquely forwards, convex, and broader above than below, is covered at the upper part by the tendinous expansions of the sartorius, gracilis, and semitendinosus muscles, while in the rest of its extent it lies immediately under the skin. Its *outer surface*, which is also broader above than below, is concave in its two upper thirds, where the tibialis anticus is inserted, and convex in the remaining third, which is covered by the tendons of that muscle, of the extensor communis digitorum, extensor proprius pollicis and peroneus tertius. Its *posterior surface* is also broader above than below, and convex in its whole extent. Its upper part is traversed by a prominent line, which directs itself obliquely downwards and outwards, giving insertion to the popliteus, soleus, tibialis posticus, and flexor communis digitorum pedis. The portion of the posterior surface of the tibia which is situated above this line, is of small extent, of a triangular form, and covered by the popliteus muscle: that which lies beneath it, being of greater size, is covered by the tibialus posticus and flexor longus digitorum, to which it gives attachment. These surfaces are separated by three edges. The *anterior edge (crest)* is more prominent at its middle part than above, and especially than at the lower part, where it is rounded and disappears altogether, is twisted like the body of the bone, and gives attachment to the aponeurosis of the leg. The *inner edge* is thick, rounded, more distinct below than above, where it gives attachment to the internal lateral liga-

ment of the knee-joint. To this edge are also attached the popliteus, soleus, and flexor longus digitorum pedis. The *outer edge (interoseal,)* is thin and sharp, and gives insertion to the interosseal ligament: it is bifurcated at the lower part. The *upper* or *femoral extremity,* which is larger than the lower, is transversely oval; presenting superiorly, two concave articular surfaces, corresponding to the posterior parts of the articular surfaces of the condyles on the distal extremity of the femur. The inner, which is deeper than the other, is of an oval form from before backwards. The outer, which inclines a little obliquely downwards and outwards, has a nearly circular form. A pyramidal process, with a broad base, inclined obliquely upwards and inwards, surmounted by two tubercles, situated at a greater distance from the fore than the back part of the bone, and named the *spine of the tibia*, separates these two articular surfaces, and presents anteriorly and posteriorly two uneven depressions. The upper extremity of the tibia is limited anteriorly by a triangular, somewhat convex surface, directed obliquely forwards and downwards, presenting a great number of vascular apertures, and at its lower part a *tubercle* to which is attached the ligamentum patellæ. Posteriorly there is observed a more or less deep notch. On the sides two considerable eminences are met with, which are named the *tuberosities of the tibia;* the inner is larger and more distinct than the outer, gives attachment to the internal lateral ligament of the knee-joint, and posteriorly to the tendon of the semimembranosus muscle. The outer presents at its back part a small rounded articular surface, somewhat convex, nearly circular, directed downwards, articulating with the upper extremity of the fibula. The *lower* or *tarsal extremity* has a nearly quadrilateral form, and presents anteriorly a broad convex surface, which gives attachment to ligaments. Posteriorly, there is observed another surface, nearly plain, but traversed by a superficial groove, in which slides the tendon of the flexor longus pollicis pedis; at its lower part it also receives insertions of ligaments. To the outside is seen a concave triangular surface, rough above where a ligament is attached to it, broad, smooth, and polished below, to be connected with a similar surface of the lower extremity of the fibula; it is at the summit of this surface that the outer edge of the body of the tibia terminates. Internally there is seen a thick triangular process, the *malleolus internus,* directed downwards, and flattened from within outwards. It is not placed in the same plane with the internal tuberosity of the tibia, but is a little anterior to it, which appears to depend upon the twisting of the body of the bone. This process is convex and subcutaneous internally; externally it presents a small triangular articular surface, which unites nearly at a right angle with the lower articular surface of this extremity of the tibia, and is connected with the astragalus. Anteriorly and posteriorly, it is terminated by two thick edges, of which the anterior is convex, and gives attachment to ligaments, the posterior marked with one, or sometimes two superficial grooves, directed downwards and inwards, in which slide the tendons of the tibialis posticus and flexor longus digitorum. The summit of the malleolus internus is broader, and descends less behind than before; it gives attachment to the internal lateral ligament of the ankle joint. Inferiorly, the tarsal extremity of the tibia is terminated by a concave quadrilateral surface, broader externally than inwards, separated into two parts by a very superficial prominence which transverses it from before backwards. This surface, which is limited internally by the external surface of the malleolus internus, and externally by the notch which receives the lower extremity of the fibula, is articulated to the upper surface of the astragalus. The tibia in the fœtus now before us presents a cylindrical appearance, terminated at each extremity with a very extensive cartilage, that on the superior extremity includes both tuberosities, the tubercle, and consequently the ligamentum patellæ, with a cartilage representing that bone, the lower surface includes the whole of the malleolus internus, and that portion which articulates with the fibula; in brief, all the articular surfaces. Maceration will divide the bone of a young person; and in some cases, that of an adult into three parts. In the adult bone, the entrance of the canal for the passage of the medullary artery, is placed in the posterior surface between the upper and middle third, and a section exhibits a very extensive medullary canal, and a similar arrangement of the osseous texture with the femur.

119. The *fibula (perone)* is a bone placed externally to the tibia, and the student finds difficulty in learning it, owing to its irregular form; and indeed it is not easy to get a well-marked bone. The one before us is fifteen inches in length, with a diameter of $\frac{5}{8}$, the extremities broadening out, give a measurement of about an inch, —weight $2\frac{1}{4}$ ounces. The proximal extremity (*head,*) is rounded, presenting a concavity inclined inwards and forwards, in which there is a rounded articular facet, corresponding to one pointed out on the external tuberosity of the tibia. The whole surface is rough, giving attachment to ligaments, and is surmounted by a small pyramidal process. Leaving this extremity, the bone becomes contracted and rounded, forming what surgeons call the *neck*, and the most striking feature we now observe, is a sharp ridge running in the axis of the bone, which, after a course of about $4\frac{1}{2}$ inches bifurcates. The internal division runs towards a rough surface, which is connected to the tibia, whilst the external division, after a course of about 5 inches more, again bifurcates, including a triangular surface of about $2\frac{1}{4}$ inches in length, which in the living body is covered only by integuments, looks outwards and forwards,—thus we have the ridge terminating inferiorly in three divisions; the centre division should be considered by the student attentively, it forms the true continuation of the ridge, as throughout this whole line the interosseus membrane is attached to it; dividing the bone into anterior and posterior surfaces, external and internal margins. The upper half of the bone presents other two edges not so sharp as the one we have just described. One external and anterior, named the *crest*, is lost about the middle third of the bone, which becomes smooth, leads to a groove at the inferior and external extremity of the bone; this groove lodges the tendons of the peronæ muscles, and lies just behind the triangular subcutaneous surface already alluded to; superiorly between these two ridges the extensor muscles are attached. The third and last ridge is on the posterior aspect of the bone, it is

well marked, until about the lower third of the bone where it is lost, or becomes continuous with the first offset from the internal or inter-osseous ridge. The interspace where both these ridges are particularly well marked, we observe a very distinct concavity in the longitudinal direction of the bone, to which surface the tibialis particus is principally attached. The lower or tarsal extremity of the bone is flattened from within outwards, and terminated by a pointed process into which the internal middle lateral ligament is fixed, it forms the outer ankle, which is larger, and descends lower than the inner ankle. The external surface the student will recognize as the sub-cutaneous triangular surface already so much dwelt upon. The internal surface presents, first, a triangular articular facet articulated to the astragalus; secondly, a rough well marked depression into which the posterior external ligament of the ankle joint is fixed; the edge dividing these two surfaces is rather thin, but rough anteriorly for the insertion of ligaments, posteriorly it equals six-eighths in breadth, and presents the groove for the play of the lateral peronei muscles. The fibula in the fœtus now before us, presents a cylindrical bone extensively cartilaginous at each extremity. Maceration separates it in the young or scrofulous person into three parts, viz. 1. the body. 2. A portion, including the upper and articular part of the head. 3. A portion including all the articular part of the malleolus externus. The medullary artery penetrates the bone between its upper and middle third, its course is from above downwards, a section of the bone shews a medullary canal proportioned to the size of the shaft.

120. The *Patella (Rotula)*, occupies the anterior part of the knee. Its form is that of a triangle rounded on the angles. Its *anterior surface* is convex, uneven, covered with a great number of small vascular apertures and longitudinal striæ, which indicate the direction of the fibres of the bone: it is covered by tendinous and aponeurotic expansions, by the skin and subcutaneous bursa. The *posterior surface* is separated into two portions, by a prominent line which descends obliquely inwards from the base of the bone towards its lower angle. Of these two portions, the outer is larger

and deeper than the inner, in conformity to the disposition of the articular part of the corresponding condyle of the femur. Beneath them is seen a small triangular rough surface, into which is inserted the ligament of the patella. The *base of the patella* is thick, directed upwards, and cut obliquely downwards and forwards, gives attachment to the tendon of the rectus femoris. Its two *lateral edges*, which are thin, convex, and prominent, receive aponeuroses from the triceps extensor. Its *summit* is sharp and directed downwards. *Structure.* The patella is almost entirely formed of very dense cellular tissue, traversed by longitudinal bony fibres, and covered with a very thin layer of compact tissue. It ossifies from a single centre, and remains long cartilaginous.

121. The *Foot* is composed of twenty-eight bones (including the two sesamoid bones connected with the flexor brevis of the great toe), and is divided into tarsal, metatarsal, and phalangeal regions. The *tarsus* in the human subject is composed of seven bones. They are all, strictly speaking, short bones; have no medullary cavity, but are internally entirely composed of a close concellated laminæ covered externally with a thin plate of the compact texture. Their arrangement in the human foot when well formed, (and there are great differences in this respect,) yields in beauty and perfection to no part in the human body. This part of the skeleton seems indeed perfected in man. The seven bones are pretty nearly arranged in three rows, of which arrangement the surgeon avails himself in performing the partial amputation of the foot. The *Astragulus* (*talus*) in form is exceedingly irregular, but it may be at once recognized by its articular surfaces, which are numerous. The tibial aspect is pulley shaped, broader towards the extensor aspect of the limb, and traversed by a shallow groove, corresponding to the extremity of the tibia: this articular surface is flanked by two others of a triangular shape, the smallest of these two triangular articular surfaces articulates with the malleolus internus, which the student will remember is a process of the tibia; the other or fibular is of a decided triangular form, corresponding to the malleolus externus; these surfaces are all articular and

continuous, but lie on very different planes. The scaphoid articular surface of the astragalus is rounded, and hence called its *head* or *caput ;* set of from the other part of the bone, on a round contracted rough *neck (collum)*, and articulated with the os naviculare or scaphoid. The calcaneo-articular aspect of the astragulus is divided by a very distinct rough groove, into which are inserted powerful ligaments connecting the astragulus to the os calcis, and which may in fact be called inter-articular, being not unlike the crucial ligaments of the knee joint: of these articular surfaces, one is concave, the other convex, traversed by a very superficial ridge, and becoming continuous with the scaphoid articular surface. The *Os Calcis (calcaneum)* is of an elongated square form slightly compressed on each side. Its articular surfaces are two in number,—viz. astragalo and cuboid. The *astragalo* corresponds precisely to the surface we have just described on the astragalus; it is divided by a deep rough groove, into which powerful ligaments are inserted: one of these articular surfaces is broad and convex; the other is narrow, oblong, and slightly concave, and is formed upon a projection of the bone called the *small process*, into which the internal lateral ligament of the ankle joint is fixed. The *cuboid* aspect is a concave articular surface, supported on a rough contracted projection of the bone, and called the *great process of the calcaneum.* The plantar and flexor aspect of the bone is rounded and narrow, the one extremity of which is convex in all directions, smooth, and as it were polished where a bursa allows the *tendo Achillis* to play over it, and close to the plantar surface presenting inequalities marking the point of insertion of the tendo Achillis. Two tuberosities affording insertions for the superficial muscles of the sole of the foot, and the surface still contracting terminates by a rough tubercle, into which is inserted the inferior calcaneo-scaphoid ligament. The inner aspect is a broad concave surface, forming an arch when the plantar aspect is placed on the ground, by which means the tendon of the flexor longus digitorum pedis, tibialis posticus, and flexor longus pollicis pedis, reach the plantar aspect of the foot. The tendon of the flexor longus pollicis pedis passes in a very distinct groove occupying the upper part of this surface, immediately under the *small process*, and also seen partially on the posterior part of the astragalus. The *fibular aspect* presents two superficial grooves, separated by a spine into which the external lateral ligament of the ankle-joint is fixed, whilst in the grooves play the tendons of the lateral peronei muscles. The greater part of this surface is subcutaneous, terminating in the *great process* of the calcaneum where slight inequalities mark the insertion of the *extensor* brevis digitorum pedis. The *Os Naviculare, os Scaphoides tarsi* is on the tibial margin of the foot, and is one of the two tarsal bones, forming, as it were, the second of the three rows into which the whole tarsus has been divided by practical surgeons; it is of an oval form, and has articular surfaces, astragalo and cuneen. The articular surface for the astralagus is concave, articulating in a strong and peculiar manner with the head of the astragalus; the cuneen aspect presents a convex surface, divided into three facets, by rather indistinct angular lines. The non-articular surface may be called the circumferences of the bone, upon which a small articular surface may sometimes be observed for a corresponding articular surface on the os cuboides. Its plantar and internal aspect presents a prominent rough tubercle, into which the tendon of the tibialis posticus is inserted. The *Os cuboides* is on the fibular margin of the foot, and completes, with the navicular bone, the second row into which the tarsal bones have been divided. Its articular surfaces are three in number; calcaneo, metatarsal, cuneen. The first (*calcaneo*) is slightly concave. The second (*metatarsal*) is divided into two by a transverse ridge, one square, articulates with the fourth metatarsal bone, the other distinctly triangular, and placed on the fibular margin of the foot, articulating with the fifth metatarsal bone. Ligaments are attached to the greater part of its *non-articular* surfaces; on its plantar aspect we observe an eminence, to which is attached the inferior calcaneo-cuboid ligament, and close to this a groove, in which plays the tendon of the peroneus longus muscles. The external margin is short and narrow, the internal margin presents an articular facet for the external cuneiform bone, and in some cases a very indistinct surface where it touches the scaphoid. The *Ossa Cuneiformia* are three in number, all wedge-shaped, contributing greatly in the formation of the arch of the human foot, they are placed on the tibial margin of the foot, and we shall distinguish them most readily by an attentive examination of their articular surfaces. The *First* (*internal and largest*) *cuneiform bone*, has three articular surfaces; navicular, metatarsal, and cuneen. The navicular articular surface is triangular, smooth, concave, corresponding to the first of the three facets described on the navicular bone; the metatarsal present two articular surfaces not divided, but placed at right angles to each other; one at the extremity of the bone has a crescent form, to which the *first* metatarsal bone is articulated, and connected with the convex edge and at right angles with it, we find the articular surface perfectly continuous, and presenting a surface articulated with the second metatarsal bone. Upon the same aspect of the bone, and divided from this by a rough depression, we observe another smooth flat articular surface connected with the middle cuneiform bone. A leading feature, however, of this cuneiform bone is, that one entire aspect of it, and that large and flat, is non-articular; this surface is subcutaneous, and distinguishes the bone at once from the two following cuneiform bones. The convex rough surfaces which we know to form its plantar aspect, gives attachment to the tendon of the tibialis anticus, and to a portion of the tendon of the tibialis posticus. The *Second* (*smallest,*) *cuneiform bone*, presents the form of the most perfect wedge. It has four articular surfaces; a navicular, corresponding to the middle facet pointed out in describing that bone; an articular surface corresponding very accurately with the proximal end of the second metatarsal; a rough flattened irregularly articular surface, corresponding to that pointed out on the internal cuneiform; and a similar aspect, but presenting a very limited extent of articular surface meeting one on the *Third* (*external*) *cuneiform bone*. The corresponding articular surface on this bone is of very limited extent, the rough depressions giving attachment to powerful inter-articular ligaments; an extensive flat articular surface supports the third metatarsal bone ; a broad, partly articular surface, corresponds to the cuboid, and by a surface altogether articular, but the smallest of the four surfaces corresponds to the external facet pointed out on the navicular bone. The entirely *non*-articular surfaces of these cuneiform bones gives the student the key for ascertaining to what foot they belonged, the more extensive surface indicating the dorsum of the foot, the narrow wedge-shaped surface indicating the plantar aspect.

122. The *Metatarsus* consists of five bones resembling each other a good deal in general form. They are all, properly speaking, long bones, although in man they are actually not above two inches and three-fourths in length, and little or no medullary cavity found in the interior. Yet their mode of development is precisely similar to the long bones. We shall describe them, and recognise them by their articular surfaces. They are all slightly concave towards their flexor aspect ; they have a body and two extremities both articular. The *first* (*Os Metatarsi Pollicis Pedis*) is comparatively large, and presents, on its proximal extremity, a cresent shape slightly concave articular surface, articulated with a corresponding surface on the first cuneiform, and towards the plantar aspect of the bone, we observe a tubercle into which the tendon of the peroneus longus is inserted. The body of the bone presents three ridges running in its axis, to which a strong aponeurosis enveloping and giving attachment to muscles, is fixed. The distal (phalangeal) extremity is an oblong rounded surface, improperly termed *head*, (*capitulum*) ; at each side of this oblong articular surface are impressions for the attachment of lateral ligaments. Towards the plantar aspect of the bone, a prominence running in the axis of the bone, divides the articularsurface into two parts, assuming the appearance of depressions, and on which two sesamoid bones play, as connected with the flexor muscles of the great toe. The *second Metatarsal Bone* presents on its tarsal extremity a triangular surface, slightly concave, articulating with the second cuneiform bone, and as the second cuneiform bone in the articulated foot, is shorter than the first and third, in its antro-posterior axis the second metatarsal gets jammed in between the

first and third cuneiform bones, and is articulated with the whole three; accordingly, continuous with the proximal articular extremity, but at right angles to it, we observe on its inner margin a single flat articular surface, corresponding to a similar facet on the first cuneiform; and on the opposite or external aspect a linear facet, connecting it with the third cuneiform bone, and two distinct articular surfaces (having a depression between them for the attachment of ligaments) corresponding to two similar surfaces on the inner margin of the third metatarsal bone. The convex or dorsal aspect of the bone is rough and broad near its tarsal extremity, gets narrow about the middle, and is traversed by a ridge into which a strong aponeurosis is attached, dividing and giving attachment to interossei muscles. The phalangeal extremity of the bone is articular, convex, transversely compressed, more extended on its plantar aspect; depressions on each side of this articular surface show the situation of the lateral ligament of the joint. The *third Metatarsal Bone* presents on its tarsal extremity a triangular articular surface, articulating with the third cuneiform bone, and a good deal resembles that of the second metatarsal bone; continuous with this extremity, but on the inner margins of the bone, we observe two small articular surfaces nearly divided by a rough depression articulating with corresponding surfaces on the external margin of the second metatarsal bone. On the fibular margin, a single concave articular surface connected with a similar facet on the fourth metatarsal bone. The dorsal aspect of the bone, and the phalangeal extremity exactly resemble the second metatarsal, and the only distinguishing marks of this bone is the position of the lateral articular facets on its proximal extremity. The *fourth Metatarsal Bone* presents on its tarsal extremity a cubical form, having a square slightly concave surface, articulated with a corresponding facet on the os cuboides; continuous with this, but on the inner margin of the bone, we observe two articular surfaces, the one very narrow articulating with the third cuneiform bone, the other larger and convex, articulating with a corresponding facet on the external margin of the third metatarsal bone. The body and phalangeal extremity exactly resemble those of the second and third metatarsal bones, and the cubical shaped articular tarsal extremity forms its only distinguishing mark. The *fifth Metatarsal Bone* presents on its tarsal extremity, which is of a pyramidal form, a triangular convex surface, articulating with a corresponding facet on the os cuboides, and continuous with this, but on the inner margin of the bone, a concave surface, articulating with a corresponding facet on the external margin of the fourth metatarsal bone. On the external margin we observe a very prominent tubercle to which are attached (besides ligaments,) the tendon of the peroneus brevis, and a portion of the abductor minimi digiti. The distal (phalangeal) extremity is small and much compressed. The tubercle on the external margin, which is readily felt in the living subject, and is an important guide to the surgeon in partial amputations of the foot, will always enable the student easily to distinguish the fifth metatarsal bone from the others, so that upon the whole the second and third are the only two difficult to be recognised, and that owing to their great similarity.

123. The *Skeleton* of the *Toes* is composed of fourteen phalanges, each toe having three bones, with the exception of the first or great toe, which has only two. The five proximal phalanges partake all of the nature of long bones, they have a body and two extremities, both articular. The proximal (metatarsal) extremity in each presents a concave rounded facet, receiving the rounded phalangeal extremity of the corresponding metatarsal bone. Their distal or phalangeal extremity presents two condyloid prominences separated towards the plantar aspect by a distinct groove, in which plays a corresponding ridge seen on the proximal extremity of the *middle* phalanges, and which eminence or ridge, forms the distinguishing mark of the middle phalanges from the proximal or metatarsal.* The *Middle Phalanges* are of the nature of long bones, although not exceeding two-eighths of an inch in length, and have a body and two extremities both articular. The proximal extremity presents a concave surface, divided in the middle with a vertical prominence, corresponding to the groove observed on the *phalangeal* distal extremity of the proxi-

* We consider the middle phalanx wanting in the great toe.

mal or metatarsal phalanges; the distal extremity presents two condyloid prominences separated by a vertical groove corresponding to an eminence on the proximal extremities of the distal phalanges. The bodies of these phalanges have ridges traversing them in their axis to which the sheathes for the tendons of the flexor muscles are attached, and also giving attachment to the interossei muscles. The *Distal Phalanges* are five in number. Their form is somewhat pyramidal; the proximal extremity is articular, presenting a concave surface divided in the middle by a vertical prominence corresponding to the groove observed on the distal extremity of the middle phalanges. The distal extremity is fungiform compressed vertically, having a rounded rough margin connected with the pulp of the toes. Into the body of these bones, and at the base of this fungiform extremity, are inserted on the dorsal aspect of the foot, the tendons of the extensor of the great toe and the extensor communis digitorum. On the flexor (plantar) aspect, we observe a tubercle into which the tendons of the flexors of the great toe and the flexor communis (perforans) are inserted.

PART II.

DISSECTION OF THE ARTICULATIONS.

124. THE anatomy of the joints is examined with most advantage to the student, immediately after the dissection of the muscles and other soft parts. Many of the joints, indeed, such as the knee and shoulders, depend nearly altogether for their strength and security on the muscles and their tendons. Throughout our description of the bones, we have constantly called the student's attention to the articular surfaces, so that although we admit that no part in the anatomy of the body is more important to the practical surgeon than the joints, still, from having made the surfaces of the bones, which are articular in many cases, the principal part of our description, we shall endeavour to *repeat* as little as possible. During the dissection of the ligaments they may be put on the stretch, and very carefully cleaned with a scalpel, whose blade should not exceed an inch in length, so that the fingers of the student may get near the surface he wishes to inspect. Many of the ligaments are delicate and readily divided. Thin and infiltrated subjects are the best not only for dissection, but for making preparations of these parts.

125. The structures entering into the composition of the joints are various. 1st, The *ligaments* are dense fibrous bundles round or flat, of a glistening white colour, their tissue contains a large proportion of water, becoming hard, transparent, elastic, and brittle when dried. 2d, *Cartilages of incrustation* (covering those surfaces of the bones which we have denominated articular,) are found to be composed of fibres, arranged like the pile of velvet, and attached perpendicularly to the surface of

the bone; its fixed surface or connexion with the bone is still but little understood; its free surface is covered by the synovial membrane giving it a smooth homogenous polished appearance. 3d, *Inter-articular cartilages* are fibro-cartilages, in form and properties intermediate to the ligaments and cartilages; they are formed of a hard tenacious, dense, and compact fibrous base, in the meshes of which is deposited a true cartilaginous substance, upon which their remarkable elasticity depends; when dried they become shrunk, hard and brittle. Maceration in water and boiling greatly increases their volume. 4th, *Synovial capsules* are transparent and of extreme tenuity, although denser and less pliant than serous membranes. They form bags without apertures, and are applied over all the parts which enter into the composition of a joint without containing any of them. Their internal surface is free, contiguous to itself, smooth, sometimes furnished with fimbriated prolongations, and lubricated by an albuminous fluid named *Synovia;* their external surface is cellular, attached to all the neighbouring organs as ligaments, fibro-cartilages, capsular ligaments, &c.

126. The articulations are naturally divided into two general classes, the moveable or *diarthrosis*, and the immoveable *synarthrosis*.

(1.) Diarthrosis or moveable, presents the following sub-division or species.

Amphiarthrosis,....*Example.*—The junction of the bodies of the vertebra.

Enarthrosis,.........*Ex.*—Hip-joint, ball, and socket.

Arthrodia,...........*Ex.*—Articulation of the lower jaw with the temporal bone, or bones of the tarsus.

Ginglimus............*Ex.*—Elbow-joint hinge.

(2.) Synarthrosis or immoveable, also present the following subdivisions.

Harmonia,..........*Ex.*—Nasal bones with each other.

Suture,..............*Ex.*—Parietal bones.

Gomphosis,.........*Ex.*—The teeth in the alveoli.

Schindylesis,........*Ex.*—Rostrum of the sphenoid bone and vomer.

127. There also exists in various parts of the skeleton a ligamentous connexion, simply without any articular surfaces or synovial membranes, but allowing a certain degree of laxity to the parts thus connected. This mode of union has been denominated *syndesmosis.*

CRANIAL ARTICULATIONS.

128. The twenty-two bones entering into the composition of the head, are all (with the exception of the lower jaw,) united by *suture.* The various sutures seem mostly to proceed from portions of the sphenoid bone.

Sphenoidal suture is very extensive, and connects the sphenoid with the ethmoid, frontal, &c.
Bazilar suture connecting the sphenoid with the occipital bone.
Spheno-temporal suture.
Petro-sphenoidal.
Spheno-parietal.
Coronal suture, or fronto-parietal.
Squamous suture, temporo-parietal.
Petro-occipital.
Mastoid suture, mastoido-occipital.
Occipito-parietal, ... } Lambdoid suture. Sagittal suture.
Fronto-ethmoidal,...... Ethmoidal suture.

129. The mode of union of the bones of the face with each other, and with the cranium, is very similar to that observed in the cranium itself, and might be named in a similar way; in many instances, however, they present but very indistinct serratures, some of them being nothing more than mere juxta-position of surfaces, and which we have designated *harmonia.*

130. The *Temporo-maxillary articulation,* or that connecting the lower jaw to the head, and which belongs to the order of arthrodiæ, is double, but it is the same on both sides. It is formed by the fore part of the glenoid cavity of the temporal bone and the tuber articulare on the one hand, and the condyle of the inferior maxillary bone on the other. The cartilages of incrustation are thin, and the joint is provided with two synovial capsules, an inter-articular fibro-cartilage, an external lateral, and an in-

ternal lateral ligament.* The dissector seldom sees this articulation in a perfect state, the external part is reached at his commencement of the dissection of the head and neck, and the joint generally opened into. Lastly, if the zygomatic arch is rudely broken for the display of the temporal muscle, few remains of the articulation will be subsequently seen. In point of fact, all this is the result of pure carelessness ; with caution, the articulation may be perfectly preserved and dissected, although the internal lateral ligament may not be seen for weeks, after the external aspect has been exposed by the dissection of the parotid gland, &c. The *external lateral ligament* is a thin, short, and narrow fasciculus, a little broader at its upper part than below. It is attached above to the rough surface, which separates the commencement of the roots of the zygomatic process, and descends from thence obliquely backwards, to terminate at the outer side of the neck of the inferior maxillary bone. Its *outer surface* is covered by the skin and parotid gland ; the *inner* is applied against the synovial capsules and inter-articular fibro-cartilage. The *internal lateral ligament* is thinner and longer than the outer. It arises from the spinous process of the sphenoid bone and the parts in its vicinity, and descends obliquely forwards, becoming broad and membranous as it proceeds, and is attached to the inner and foreside of the orifice of the inferior dentar canal. Its fibres are divergent, especially below. Its *outer surface* corresponds above to the synovial capsules and external pterygoid muscles ; the internal maxillary artery passes between it and the neck of the condyle ; and the inferior dentar vessels and nerve have connections with it farther down, and separate it from the ramus of the lower maxillary bone. Its *inner surface* rests upon the internal pterygoid muscle, so that this ligament separates the two muscles of this name from each other. The *synovial capsules* are two in number, because this

* An aponeurotic cord passing from the styloid process of the temporal bone to the angle of the jaw, is named, we think improperly, *the stylo-maxillary ligament*, and a broad aponeurosis passing from the superior to the inferior maxillary bone, external to the molar teeth, has been named the *inter-maxillary* ligament.

articulation contains in its interior an intermediate fibro-cartilage. The *upper*, after being expanded over the cartilage of the glenoid cavity, and tuber articulare, is continued downwards over the upper surface of the fibro-cartilage; while the *lower*, after investing the inferior surface of the same organ, covers the condyle of the jaw, being a little more prolonged posteriorly than anteriorly. These two synovial capsules have no communication together, unless the fibro-cartilage is perforated at its centre, which sometimes happens. *Externally*, they correspond to the external lateral ligament; *posteriorly*, to the parotid gland; *anteriorly*, to the external pterygoid muscle; *internally*, to adipose cellular tissue. Their posterior part is very loose, and strengthened by an irregular fibrous layer, which is perforated by a great number of holes for vascular twigs. The *Inter-articular Fibro-cartilage* presents the form of a thin lamina, transversely oval, separating from each other the two synovial membranes, to which it adheres strongly by its two surfaces. Its *upper surface* is concave from before backwards, a little convex transversely at its anterior and posterior parts, and is thus accommodated to the disposition of the glenoid cavity. The *inferior surface* is concave, and covers the condyle. Its *circumference* lies between the fold of the two synovial membranes; it adheres externally to the external lateral ligament; gives attachment anteriorly to some fibres of the external pterygoid muscle; and, posteriorly, is penetrated by a considerable number of small vessels. It is thicker throughout, and especially behind, than at the middle part, which is often perforated with a hole.

131. The *Hyoid Bone* or apparatus is connected with the styloid processes of the temporal by a slender and very elongated fasciculus, broader below than above, formed of parallel, whitish and glistening fibres, which descend obliquely forwards and inwards from the styloid process of the temporal bone to the small horns of the os hyoides, to which it is attached so as to form an extremely acute angle with the great horns. The texture is frequently full of bony granulations, varying in size and number, and sometimes completely ossified; and consequently, in all probability, differing entirely

in its nature from the true ligamentous texture, but partaking more of the fibrous expansion, passing from one portion of bone to another.

ARTICULATIONS OF THE HEAD WITH THE VERTEBRAL COLUMN.—OCCIPITO-ATLOID.—OCCIPITO-AXOID.—ATLOIDO-AXOID.

132. Previous to these articulations being reached by the dissector, weeks may have elapsed since his commencement of the dissection of the head and neck; and various sections have been made of the osseous surfaces. To obtain a view of the construction of the pharynx, the soft parts remaining after the dissection of the neck, are cut across, and raised from off the surface of the cervical vertebræ. The scullcap having been previously removed, a saw has then to be carried obliquely through the mastoid process of the temporal bone toward a point in the bazilar process of the occipital bone, about a quarter of an inch anterior to the foramen magnum; this section divides the base of the cranium into an anterior and posterior segment. The student has the pharynx, &c. entire for his examination from behind of the constrictor muscles, together with the larynx, meatuses of the nose, &c. on the anterior segment; and upon the posterior segment he has the longi colli, recti majores, and other muscles, and the ligaments connecting the head to the spine. The dissector will remove with the saw that part of the occipital bone above the inferior curved line, and any portions of the temporal and parietal bones which may still remain. The ligaments are numerous, and unless studied systematically, will never be clearly understood and remembered. We shall include the first three vertebræ in our description of them, and shall describe them as near as possible in the order in which they will require to be dissected.

133. The *Anterior Occipito-Atloidal Membrane* is situated between the anterior arch of the atlas and the corresponding part of the margin of the occipital hole, and is composed of two distinct fasciculi. One of these, which is narrow, round, thick, superficial, and formed of vertical fibres, parallel to each other, has

been named the *anterior cervical ligament;* it descends from the basilar process to the tubercle of the anterior arch of the atlas. The other portion is much thinner, broad, and membraneous, extends transversely from the outer extremity of one of the occipito-atlantal articulations, to the corresponding point on the opposite side; its tissue is dense and compact, and the fibres of which it is composed are with difficulty distinguished; it gives rise, by its sides, to a fibrous arch, the concavity of which is directed upwards, and which is attached to the fore part of the occipital condyle on the one hand, and on the other to the jugular surface of the same bone; this ligamentous arch is traversed by the pneumo-gastric and spinal accessory nerves, and by the internal jugular vein. The *posterior surface* of this membrane rests upon the odontoid process, its ligaments, and on the synovial capsules of the articulation itself. The *Posterior Occipito-Atloidal Membrane* is broader, and formed of two laminæ placed the one before the other, which proceed together from the posterior part of the circumference of the occipital hole, between the condyles, separating as they descend; the anterior, which is thick and presents very distinct vertical fibres, is interlaced with the dura mater of the vertebral canal; while the other, which is of a looser and apparently cellular tissue, is attached to the great arch of the atlas. Between these two laminæ there is a slight layer of cellular tissue, traversed by a great number of nervous filaments and vascular twigs, which pass through small holes formed in the midst of the fibres. The *anterior surface* of this membrane corresponds to the dura mater. Its *extremities* form with the upper notches of the vertebra two apertures, through which pass the vertebral arteries and sub-occipital nerves. Precisely the same arrangement will be observed connecting the atlas with the axis. Anteriorly we have the *anterior atlanto-axoidal ligament*, similar in every respect to the anterior occipito-atlantal; and posteriorly we have the *posterior atlanto-axoidal ligament*, a repetition of the posterior occipito-atlantal.

134. The dissector will now proceed with a saw to remove cautiously that part of the occipital foramen posterior to the condyles, the portion in fact which

corresponds to the lamina and spinous processes of the vertebræ; he will remove also the posterior arch of the atlas, and the laminæ and spinous processes of the second and third vertebræ, together with the dura mater, which he will find passing down the canal; the cerebral aspect of the bazilar process, together with the posterior aspect of the first, second, and third vertebræ, will be exposed, connected together by the following structures. The *occipito-axoidal membrane*, arising by a convex margin from the bazilar process, between the internal openings of the anterior condyloid foraminæ, becoming gradually contracted, is inserted into the body of the axis, becoming apparently continuous with the great posterior vertebral ligament (a structure of which we shall afterwards speak). The student will next cautiously cut across this occipito-oxoidal membrane near its insertion into the body of the axis, reflect the upper portion, and he will then expose the following very beautiful system of ligaments and articulations. In reflecting the occipito-oxoidal membrane, the dissector will observe that it is attached more or less strongly to the transverse ligament, and some anatomists dissect it in such a manner, as to form what they call the *apparatus ligamentosus*.

135. The *Transverse* or *Cruciform Ligament* of the atlas, is a thick, strong, and firm bundle of fibres, flattened from before backwards, and a little broader in the middle than at its two extremities, extending from the inner part of one of the lateral masses of the atlas, to the corresponding point of the opposite side, passing behind the odontoid process. It describes in its course a fourth of a circle, and completes, with the anterior arch of the atlas, a ring in which the odontoid process turns. Its *posterior surface* is convex; the *anterior surface* is concave, is contiguous to the odontoid ligaments, to the odontoid process, and is a little covered by the posterior synovial capsule of the same process. This ligament is very strong, dense, and thick, is composed of transverse, parallel, close fibres, commonly separated by narrow intervals, filled with cellular tissue, into two or three distinct bundles, placed above each other.

136. The *Occipito-Odontoid Ligaments* connect the occipital bone to the odontoid process of the second ver-

tebra (*axis*), and are two short, thick, round, and very strong fasciculi, with parallel and close fibres, longer below than above, which represent each a sort of cone, whose truncated summits embrace the sides near the apex of the odontoid process, while their bases are inserted in small uneven fossæ, formed on the inside of each condyle of the occipital bone; their direction is obliquely outwards and slightly upwards. They touch *anteriorly* a mass of cellular tissue and the anterior occipito-atlantal ligament, and *posteriorly* the occipito-axoidal ligament. which has been removed indeed to expose them. From their functions, they have been called regulating or check ligaments of the head.

137. The student must now attend to the articulations properly so called, *i. e.* the osseous surfaces which meet each other, and are covered with cartilage. The condyles of the occipital bone are of this nature; they correspond to the superior articular cavities of the atlas. An extensive and very loose synovial capsule invests these surfaces; anteriorly, it lines the anterior occipito-atlantal membrane; posteriorly and externally, it is connected with much cellular membrane; internally it covers the extremity of the transverse ligament, a part of the corresponding odontoid ligament, and small masses of adipose cellular tissue, supposed to be synovial glands. The flexion and extension of the head is performed by means of this articulation. The head, however, has an extensive power of a rotatory kind, and this is effected between the first and second vertebræ. The inferior articular processes of the first, or atlas, correspond to the superior articular processes of the second, or axis; those of the axis are much broader than the corresponding processes of the atlas; they are encrusted with a very thin cartilage, and an extensive synovial capsule invests them. The odontoid process of the second vertebra presents distinctly two articular surfaces—an anterior and a posterior. The anterior plays on the posterior surface of the arch of the atlas; the posterior plays on the anterior part of the transverse ligament: both these articulations are provided with ample synovial capsules.

VERTEBRAL ARTICULATIONS OR COMMON ARTICULATIONS OF THE VERTEBRÆ.

138. Each vertebra, from the third cervical to the last lumbar inclusive, is placed in contact with that which precedes or follows it, by its body and articular processes; the laminæ and spinous processes of all the vertebræ being moreover connected by ligaments. There results from this, that the common articulations of the vertebræ present themselves under the appearance of an amphiarthrosis for their bodies, and of a plain arthrodia with obscure motions for their articular processes, and that they are further strengthened by accessory ligaments, capable of great resistance. We also observe that each vertebra has, on the one hand, isolated and peculiar means of union, as the ligamenta flava and the fibro-cartilages; and on the other, participates in the use of common organs, which extend at once over the whole vertebral column, or at least the greater part of it, such as the anterior and posterior vertebral ligaments. Any portion of the vertebral column may be selected by the dissector for his examination of these ligaments; but perhaps the four last dorsal and two first lumbar will shew him all the ligaments to best advantage. The *great anterior vertebral ligament*, or *longitudinal facia* occupies the anterior part of the vertebral column, from the axis to the upper part of the sacrum. It is membraniform and of a glistening appearance, and presents very distinct longitudinal striæ, which separate so many bundles of fibres, between which there exist small intervals, irregular as to form and position, for the passage of blood-vessels and cellular tissue. This membrane is very narrow in the neck, broader in the back, still broader in the lumbar region, and so disposed as to cover the greater part of the bodies of the vertebræ. The fibres which constitute this membrane do not occupy its whole length; they even have not all the same dimensions. The superficial fibres cover the bodies of four or five vertebræ; those which are intermediate, are lost beyond the third vertebra below that from which they have risen; the deepest are still shorter, and only go from one ver-

tebra to that which is immediately below it. It is also to be observed, that in general these fibres arise in much greater numbers from the fibro-cartilages than the vertebræ themselves.

139. The student will now, with a small fret saw, or bone nippers, cut across all the pedicles or roots of the processes, and thus remove the posterior part of the spinal canal in a mass. On the posterior aspect of the bodies of the vertebræ thus exposed, he will observe the *great posterior vertebral ligament,* or *longitudinal facia.* It extends at the back part of the bodies of the vertebræ, from that of the axis to the sacrum. It is broader in the neck and back, than in the lumbar region, where it is so narrow as not to be more than two lines broad in all parts of its course, it is broader opposite each intervertebral substance, than on the bodies of the vertebræ themselves, which gives it the form of a long band contracted at intervals. It is smooth, and of a very shining pearly white. It is in general denser and more compact than the anterior facia, rather thin in the lumbar and cervical regions, and thickest in the back. This membrane, like the anterior, is composed of superficial fibres, occupying the interval of four or five vertebræ or fibro-cartilages, and of deep fibres, extended over two vertebræ only, or even over a single vertebra and its fibro-cartilage.

140. The dissector will next remove entirely these membraniform ligaments, and thus bring into view the *Inter-vertebral Fibro-cartilages.* These organs resemble sections of cylinders, of a whitish colour, firm, and possessed of great flexibility. They are situated between the bodies of the vertebræ, from the interval which separates the second and third, to that which exists between the last lumbar vertebra and the sacrum. Their form corresponds to that of the bodies of the vertebræ with which they are connected, being oval in the neck and loins, while in the dorsal region they are circular. Those of the neck and upper part of the back, are much thinner than those of the lower part of the back and loins, the latter having a thickness of half an inch. But each of them has not an equal thickness in all parts of its extent; in the loins and neck, they are thinner behind than before, and the reverse in the

dorsal region; which constitutes one of the principal causes of the triple curvature of the spine. By their *upper* and *under surfaces*, the fibro-cartilages, closely adhere above and below to the corresponding surfaces of the vertebræ; in subjects which have not exceeded twenty years, they are united to the epiphyses of these bones, with which they are easily removed. The inter-vertebral fibro-cartilages are formed in their circumference by very close fibres, and laminæ of the nature of ligaments; the fibres never direct themselves perpendicularly from one vertebra to another; but the outermost ascend from right to left, and cover a layer which has an opposite direction, and which is itself applied against other layers having a different direction. The laminæ, which are concentric, are numerous anteriorly and laterally, but in less number at the back part; they intersect each other, diminish in thickness, and leave between them wider intervals, in proportion as they approach the centre of each fibro-cartilage. Their vacuities are filled with a soft, pulpy, homogeneous viscid substance, of a greyish colour; and at the centre itself there is only a very soft, spongy, elastic, areolar tissue, plentifully supplied with the substance in question: this disposition is much more apparent in the lumbar region than in any other part of the vertebral column. In children, this substance is whitish, transparent, and much less abundant than in adults, in whom it has more consistence and is of a yellowish colour. In old people it diminishes still more in quantity, and the fibro-cartilages lose much of their thickness. These bodies when soaked in water, swell and increase very much in their vertical extent, frequently acquiring a whole inch of thickness; but it is especially towards the centre that the increase is effected, and if one of them is cut horizontally between two vertebræ, each portion rises in the form of a cone having its base toward the external laminæ of the fibro-cartilage, which acquire a red colour on remaining sometime in water. By desiccation, on the contrary, these organs are rendered much thinner, especially in the middle part, which is then reduced to a line of thickness. In the recent state the elasticity of these fibro-cartilages is extremely remarkable, and restores to its direction the vertebral column after it has been variously bent in a dead body. If a vertical section is made of several vertebræ, the tissue of this body expands and surpasses the level of the osseous surfaces. Their tenacity or power of cohesion is also very great, and even exceeds that of the bones with which they are connected.

141. The posterior segment of the spinal canal, which was directed to be removed in order to see the great posterior vertebral ligament, will now be examined by the student. On the internal aspect, most conveniently and almost without dissection, he will observe the *Ligamenta subflava*. These occupy the interlaminar spaces of the vertebræ, from that which exists between the second and third, to that which separates the last from the sacrum, and complete the vertebral canal behind; they are formed of a strong, firm, and elastic tissue, of a yellowish colour, and composed of vertical fibres. Each of them is divided into two portions, the one right, the other left, angularly united toward the base of the spinous process, but in such a manner as to leave between them a small fissure, which is closed by a cellular tissue. At the upper part of the neck they are thin and narrow; they become thicker and broader in proportion as they descend, and in the loins acquire very considerable dimensions. Their *upper edge* is attached to the inner surface of the laminæ of the vertebra which is situated above; the *lower edge* is fixed to the very margin of the vertebral lamina beneath. The spinous processes of the dorsal and lumbar vertebræ are connected together by two sets of ligaments, those by which the apices of the spinous processes are connected, *Supra-spinal* and the *Interspinal ligaments* which occupy the intervals of the spinous processes. The inter-spinal ligaments are *lateral*, and correspond on either side of the median line, to the erector muscles of the spine. One of their *edges* is attached *above* to the lower edge of the upper process, and another *below*, to the upper edge of that situated beneath. *Posteriorly*, they are connected with the ligament by which the apices of the spinous processes are connected, and anteriorly with the yellow ligaments. They are composed of irregular bundles of fibres, which follow different directions, but generally proceed obliquely, and in an opposite direction to the

inferior process and the next ligament, so as to cross each other. Each vertebra, the student will recollect, has two superior and two inferior oblique articular processes, the inferior of one vertebra articulating with the superior of the other. These surfaces are incrusted with a very thin layer of cartilage, each being provided with a synovial capsule, and in many instances with strengthening bundles of ligamentous fibres.

STERNAL—COSTO-STERNAL—COSTO-VERTEBRAL ARTICULATIONS.

142. The student generally sees the chest or thorax under great disadvantages. The skeleton, when *artificial*, is a good preparation certainly, but the chest, in most instances, is very wretchedly imitated. The *natural* skeleton, when dried, gives perhaps, even a worse idea of the thorax, in consequence of the change produced upon all cartilages and ligaments by drying. The dissector should therefore avail himself of every opportunity of examining the chest when *recently* stripped of soft parts. Large portions of the ribs are always removed in the dissecting room, in order to see the thoracic viscera, and the sternum in every instance is either cut longitudinally for the purpose of injecting the subject, or raised in such a manner as to display the mediastinæ, still these sections leave the articulations in a very fit state for examination. The seven superior pairs of ribs are articulated with the spine and sternum, and are hence called the *sternal*;—the five inferior pairs are also articulated with the spine, but have only an indirect connection with the sternum, and are called *asternal*. The student must endeavour to secure the sternum entire with the cartilages of the ribs connected.

143. The *Anterior Ligament* is broad, thin, membranous, triangular, and composed of fibres which proceed in a radiating manner from the inner extremity of the cartilage, to be expanded over the anterior surface of the sternum, where they are interlaced with those of the ligaments of the opposite side, and of those situated immediately above and beneath, with the periosteum of the bone, and with aponeurotic fibres of the pectora-

lis major. The direction of the fibres of this ligament is such, that the upper fibres pass obliquely upwards, the lower obliquely downwards, and the middle fibres horizontally; they are not all of the same length, the superficial being longer than the deep-seated, which are shorter the nearer they are to the joint. From the mutual interlacing of the fibres of all the anterior ligaments, there results a membrane of considerable thickness (*membrani sterni anterior*), which entirely covers the sternum, and which is much more apparent at its lower part than above: in some subjects, it even forms at the lower part a kind of triangular plane, separate and distinct. The anterior ligament is covered anteriorly by the pectoralis major. The *posterior ligament* is not so thick as the preceding, and its fibres are not so apparent, although their disposition is absolutely the same. By their mutual interlacing, they form on the mediastinal surface of the sternum, a membrane (*membrana sterni posterior*), as thick as that formed by the anterior ligaments, but smooth, polished, without distinct fibrous fasciculi, unless it be merely a few which extend over its whole length, which would seem to indicate that it does not entirely originate from the posterior ligaments. It is traversed by a considerable number of small blood-vessels. The *ligament of the ensiform cartilage*, or *costo-xiphoid ligament*. Besides having the same ligaments as those of the other cartilages of the true ribs, the cartilage of the seventh is connected with the ensiform cartilage by a particular ligament, whose dimensions vary much in different subjects. This ligament generally presents itself in the form of a small elongated and very thin fasciculus, which, arising from the lower edge of the cartilage, descends obliquely inwards, and expands over the anterior surface of the sternal appendage, uniting with that of the opposite side. It is covered by the rectus abdominis. The sixth and seventh cartilages meet each other by their contiguous edges, by means of small oblong surfaces. The cartilage of the eighth rib, and sometimes that of the ninth, presents similar surfaces. Each of these articulations is furnished with a small synovial bursa, much looser and more apparent than that which exists at the junction of the preceding cartilages with the sternum; each is also strengthened anteriorly and posteriorly by oblique and irregular fibres, which proceed from one cartilage to the other, much more distinct in the former than in the latter direction. Moreover, the inner extremities of the three or four inferior ribs are connected by a kind of small ligamentous cord, with the lower edge of the next cartilage above. The corresponding extremity of the cartilages of the two last ribs in general, and of the last rib always, are connected solely with the abdominal muscles. The outer extremity of the sterno-costal cartilage is intimately united to that of the ribs; but there is no ligament of any kind to keep these surfaces in connexion, as they do not admit of motion.

144. The student should now remove the ligaments just described, and thus expose the articular surfaces pointed out on the sides of the sternum and extremities of the cartilages,—they are each provided with a very close delicate synovial capsule, with the exception of the first pair of ribs in which there is a perfect continuity of substance between the costal cartilage and sternum. The careful dissector will also sometimes find in the articulation of the second pair of ribs, a fibrous fasciculus proceeding from the projecting angle of the cartilage to the retiring angle of the sternal cavity,—an inter-articular ligament in fact. The student will select a portion of the spinal column with two or three of the superior ribs attached to it; clear away every thing which may be upon the anterior or visceral aspect of the bodies of the vertebræ, and at the sides he will particularly strip off the pluræ, and he will thus, with little trouble, display the *Radiated Ligament* consisting of three flat and thin fibrous fasciculi, which are fixed separately to two vertebræ, and the fibro-cartilage, which concur to form the articular cavity, and which, converging, attach themselves all round the anterior part of the head of the rib; they constitute an irregularly quadrilateral fasciculus, with radiating fibres, of which the superficial are longer than the deep-seated. The small middle fasciculus which comes horizontally from the fibro-cartilage is the least distinct. In the first, eleventh, and twelfth ribs, this

ligament is not thus divided, presenting only a single order of fibres: part of that of the first rib is attached to the last cervical vertebra, and those of the two others also extend to the neighbouring vertebræ. Reflect this ligament, and remove a very thin portion of the anterior surface of the head and neck of the rib, together with a slice of the inter-vertebral fibro-cartilage, and thus display a very curious mechanism; viz. *first*, the *Synovial capsules*, which are two in number, though generally indistinct, and containing but little synovia; *secondly*, the *Inter-articular ligament*, a small fibrous fasciculus of a very close texture, fixed on the one hand to the prominent line separating the articular surfaces of the head of the rib into two portions; and, on the other hand, to the angles of the cavity which receives it, where, in fact, it is continuous with the inter-vertebral fibro-cartilage. Thus, two ligaments connect the *head* of the ribs to the bodies of the vertebræ, but the ribs are also connected with the transverse processes, not only by strong ligaments, but also by a proper moveable articulation; first, an *Inferior Costo-Transverse Ligament* attached to the lower edge of each transverse process descending inwards, is inserted broad into the upper edge of the neck of the rib; beneath, it is very commonly composed of two fasciculi; secondly, a *Posterior Costo-Transverse Ligament*, of a quadrilateral form and flat, about two lines broad, with close and parallel fibres, which are a little longer below than above; it arises from the summit of each of the transverse processes of the dorsal vertebræ, and proceeds nearly transversely outwards towards the non-articular portion of the tuberosity of the corresponding rib. Its deep-seated fibres are shorter than the others; it is shorter and more oblique in the upper ribs than in the lower: in fact, the last descends a little forwards; that which precedes it is nearly horizontal, and the rest are ascending. Lastly, a *Middle Costo-Transverse Ligament* only seen when the rib is forcibly separated from the transverse process, and its fibres torn asunder, or when a horizontal section of these two parts is made, while they are still in their natural place. It seems formed of a cellular substance in which there are perceived some irregular fasciculi of fibres of a reddish colour, which occupy the interval situated between the rib and the anterior surface of the corresponding transverse process.

PELVIC ARTICULATIONS.

145. The left *Os Innominatum* is commonly, and indeed should always be removed during the dissection of the soft parts, in order to obtain the lateral view of the pelvic viscera. The joint should not be cut into, but the left os pubis should be sawn through vertically, about three-fourths of an inch from the symphysis pubis, or mid-way between it and the foramen obturatorium. The articulation of the sacrum (which we have shewn to be composed of five vertebræ,) with the fifth lumbar vertebra, is in general perfectly similar to those of the vertebræ, and takes place by three different points; viz. by the oval surface which is at the middle of the base of the sacrum, and which is connected with the inferior surface of the body of the last lumbar vertebra, forming an amphiarthrosis; and by the two articular surfaces, seen behind the entrance of the sacral canal, which constitute a double arthrodia with the inferior articular surfaces of the last lumbar vertebra. The means of union which are met with here are also the same as in the vertebral column, the *sacro-vertebral ligament* being the only ligament not equally observable in the vertebral column. It is a very short and strong fasciculus of fibres, which arising from the anterior and inferior part of the transverse process of the last vertebra, descends obliquely outwards towards the base of the sacrum, where it attaches itself, intermixing with irregular fibres placed before the sacro-iliac articulation. Some minute anatomists have shewn ligaments existing between the transverse processes of the vertebræ, and this sacro-vertebral seems to be one of those on a large scale.

146. The *Coccygeal Vertebræ* are, as we have shewn in our description of the bones, four in number, becoming more and more rudimentary. We have a continuation of the great anterior and posterior longitudinal facia or common ligaments, and inter-vertebral fibro-cartilages: the arches not being developed, the spinal

canal would have been open posteriorly, were it not for the presence of a membrane called the *Posterior Sacro-coccygeal ligament*, it arises from the margin of the inferior orifice of the sacral canal, and descends over the posterior surface of the coccyx, into which it is inserted. An *Anterior Sacro-coccygeal ligament* is also described, it is simply a repetition of the great common vertebral ligament, but from the *rectum* lying upon it, deserves particular attention from the student.

147. The *Ossa Innominata* are connected with the lumbar, sacral, and coccygeal vertebræ in a very powerful manner. Of the three portions which compose each *os innominatum,* two, viz. the iliac and sciatic are directly connected with the spinal column, and the ligaments have received names accordingly.

148. The *Ilio-Lumbar Ligament* arises from the summit of the transverse process of the fifth lumbar vertebra, and passing transversely outwards, is inserted into the posterior third of the crest of the ilium. A few irregular aponeurotic fibres will be observed running from the sides of the sacrum to the ilium anteriorly, or on the visceral aspect of the pelvis, they seem almost continuous with the periosteum, and have received no particular name, so that the dissector should proceed to examine the ligament on the external aspect of this important region. The *Long Posterior Sacro-iliac Ligament* (*Ligamentum sacro-spinal ilei*) is attached to the posterior and superior spine of the iliac and to the lateral, posterior and inferior half of the sacrum. It consists of a very strong, long, flat, nearly vertical fasciculus broader above than below; the superficial fibres, being longer than those placed deeper. The *Short Posterior Sacro-iliac Ligament** is very irregular, very short, and occupies posteriorly the space which the sacrum and ossa innominata leave between them, before the mass of the muscles of the vertebral grooves. The fibres which constitute it are much shorter before, near the articulation, than behind; they cross each other in a number of different directions, and are very close, and possessed of great firmness; they are attach-

* Mr. J. Cloquet, in his plates, includes the long and short sacro-iliac ligaments under one name (posterior sacro-iliac).

ed on the one hand to the two first eminences of the posterior aspect of the sacrum, and to the sides of that bone at their upper part; and on the other, to the internal surface of the iliac tuberosity. Such is their adhesion to these parts, that if the sacrum and os innominatum be forcibly separated, the surface of one or other of these bones is detached along with them, without their being ruptured.

149. The articular and non-articular surfaces which these ligaments bind together, are, first, the semilunar, notched, slightly convex, and uneven surfaces, particularly pointed out in describing the lateral surfaces of the sacrum, and the internal surfaces of the ossa innominata. The true articular surfaces present the appearance of the human ear, and are hence called the *facies auriculares;* these are each invested by a thin cartilaginous lamina, which however do not come into immediate contact, there being placed between them a soft yellowish substance, disseminated in insulated flakes, very different from synovia, although performing its function. The dissector will take up his notion of this structure, by examining the left side of the sacrum, from which the left os innominatum would be torn off in his early dissection of the pelvic viscera.

150. The sacrum is connected with the sciatic portions of the ossa innominata, by two powerful ligaments on each side. These ligaments may be said to complete the inferior aperture of the pelvis; (an aperture of the very last importance to the accoucheur); and include much of the anatomy of this region. We are of opinion, indeed, that it is the want of a clear view of these ligaments (in themselves very simple), which causes this whole region of the body to assume so much complexity to the student. The *Great Sacro-Sciatic Ligament* is placed at the posterior and inferior part of the pelvis; it is of a triangular form, thin, flat, narrower in the middle than at its extremities. It arises by a broad base from the posterior and inferior iliac spine, the long sacro-iliac ligament, the last posterior tubercles of the sacrum, the lower part of the lateral surface of that bone, and the edge of the coccyx, and directs itself obliquely outwards, downwards, and a little forwards. As it advances, it loses much of its breadth,

but its thickness increases in the same proportion; it is at length attached to the tuberosity of the ischium, becoming broader a second time, and intermingling with tendinous fibres of the biceps femoris and semitendinosus muscles. Here there is detached a small fibrous prolongation, named by some anatomists the *falciform ligament*, which winds around the inner part of the tuberosity, attaches itself above it by its convex edge, and with its concave edge covers in part the obturator internus muscle, for which it forms a sort of channel, as it ascends along the ramus of the ischium. The *posterior surface* of this ligament gives attachment in its whole extent to fibres of the glutæus maximus; the *anterior* is united internally to the small sacro-sciatic ligament, and is separated from it externally by a triangular interval, through which the tendon of the obturator internus passes, and pudic vessels and nerve. Its fibres, which converge from the sacrum toward the os innominatum, and are more oblique as they are higher, are so disposed that at the middle of their length the inner cross the outer; they form several planes, separated from each other by cellular tissue, between which pass pretty considerable branches of the sciatic artery. The *small sacro-sciatic ligament* is smaller than the preceding, before which it is situated, and therefore must be dissected and examined from the internal aspect of the pelvis; internally it is broad, fixed to the sides of the sacrum, and to a small portion of the edge of the coccyx; from this it proceeds outwards and forwards towards the spinous process of the ischium, to which it is attached, contracting and becoming thicker as it approaches its insertion. These ligaments divide the great sciatic notch, as seen in the fully macerated skeleton, into two holes; the upper and larger of which is traversed by the pyriformis muscle, the glutæal vessels and nerve, and the sciatic vessels and nerves, while the lower and smaller gives passage to the obturator internus, and the pudic vessels and nerve. These two ligaments, while they serve to connect the sacrum and os innominatum, also contribute to the formation of the walls of the pelvis; their inner edge sends towards the anus an aponeurotic expansion which supports the levator ani muscle.

The pubic portions of the two ossa innominata are articulated with each other mesially; the articular convex, oval surfaces, particularly alluded to in describing the pubis, under the term symphysis, form this articulation; the term symphysis is more strictly applicable, however, to the articulation: we find the *inter-pubic fibro-cartilage* placed between them, precisely analagous to that between the bodies of the vertebræ; it is thick anteriorly, and posteriorly forms a prominence, very distinct in the female, and greatly increased in some diseases of the osseous texture. Two ligaments strengthen this articulation; 1°. the *anterior pubic ligament* is an irregular fibrous expansion, partly intermingled with the aponeuroses of the abdominal muscles, partly with the periosteum of the bones of the pubis; it appears to be formed of several superimposed layers, which all pass before the articulation; the most superficial of these layers proceeds from the upper part of the symphysis, expanding and separating into fasciculi, to the fore part of the rami of the pubic arch; the deep fibres are transverse, and unite in their passage with the laminæ of the fibro-cartilage. 2°. The *sub-pubic ligament* is much stronger than the preceding; it is a thick and triangular bundle which occupies the upper part of the arch of the pubis, to the upper and inner part of the rami of which it is attached on either side; its fibres, which are of a yellowish colour, very close, transverse, and a little curved so as to present their concavity below, are very short above, and are continuous with the laminæ of the symphysis (inter pubic fibro-cartilage); they become longer in proportion as they are lower.*

* Surgical authors speak of a *triangular* sub-pubic ligament. Mr. E. Stanley, in a work on the lateral operation of lithotomy, published in London, 1829, gives a view of this structure. We have repeatedly satisfied ourselves of the correctness of Mr. Stanley's delineation, but we think the term "ligament," ought on no account to be applied to it. The texture has always appeared to us, aponeurotic, filling up the sub-pubic notch or triangle; (sec. 116,) strong, immediately under the true sub-pubic ligament, but gradually degenerating into cellular membrane towards its base where stretched between the right and left sciatic tuberosities. The urethra, where called the "membranous portion," passes through it, and the strength of this sub-

The *obturator membrane* (misnamed *ligament*) almost entirely closes the obturator foramen, to the circumference of which it is attached, excepting at the upper part, where there is a more or less distinct notch for the passage of the obturator vessels and nerve; its fibres are interlaced in various directions, and are always more marked toward the notch; its *anterior surface* corresponds to the obturator externus muscle, and the *posterior* to the obturator internus, both of which are in part attached to it.

ARTICULATIONS OF THE SUPERIOR (PECTORAL) EXTREMITIES.

151. *Clavicular Articulations.* The clavicles are connected to each other, with the thorax and with the scapulæ, in a very secure manner. The *inter-clavicular ligament*, placed transversely above the upper extremity of the sternum, and running between the heads of the two clavicles: this is a very distinct and in some cases a very strong fasciculus, but always in part incorporated with the neighbouring ligaments and tendons. Proceeding from the lower, and rather internal surface of the clavicle, a very strong bundle of ligamentous fibres, having a rhomboidal form, proceeds to be inserted into the upper edge of the first rib, hence named the *costo-clavicular ligament*. The *anterior sterno-clavicular ligament*, broad, and consisting of divergent fibres; it is fixed by its narrow extremity to the fore part of the head of the clavicle, whence it proceeds downwards and inwards over the edges of the articular cavity of the sternum, where it is attached by its broadest extremity. A *posterior sterno-clavicular ligament*, narrower and weaker than the preceding; its fibres are also less divergent; it is attached, on the one hand, to the posterior part of the inner extremity of the clavicle, and on the other, to the posterior and superior part of the sternum, on the edges of the articular cavity. The student must divide the anterior sterno-clavicular ligament mesially, and reflect it carefully to the right and left,

pubic aponeurosis is so great, as to offer an almost insuperable obstacle to the passage of a catheter into the bladder, unless the operator is aware of its existence and true nature.

and thus expose the *inter-articular fibro-cartilage ;* this is a nearly circular plate, fitted to the articular surfaces of the sternum and clavicle, between which it lies; it is thicker at its circumference than in the centre, which is sometimes perforated; the *circumference* is united to the ligaments described above, especially the anterior and posterior; above and behind, where it is very much thicker, it is fixed to the head of the clavicle; inferiorly and internally where it is very thin, it is attached to the union of the sternum with the cartilage of the first rib, partly confounding itself with the perichondrium of the latter. The structure of this organ is perfectly similar to that which we observed in the fibro-cartilage of the temporo-maxillary articulation; its fibres are also much more apparent at the circumference than at the middle part, where they cannot be distinguished. The *Synovial Membranes* are two in number, on account of the disposition of the inter-articular fibro-cartilage. The scapular extremity of the clavicle is connected to the acromion process of the scapula by means of five ligaments. The *Superior acromio-clavicular Ligament* forms a broad and thick fasciculus, of a quadrilateral form, flat, shorter before than behind, which covers the whole upper part of the articulation, and which is itself covered by the interlaced aponeurosis of the deltoid muscle and trapezius; it is composed of parallel fibres, directed obliquely from within outwards, and from behind forwards, which are attached, on the one hand, to the upper part of the outer extremity of the clavicle, and on the other to the upper part of the acromion. The *inferior acromio-clavicular ligament* resembles the superior in form, and is nearly as distinct; its fibres, which are laxer and less numerous, frequently leave intervals between them, and are attached to the lower edges of the two surfaces; anteriorly, it is continuous with the preceding ligament, but is separated posteriorly from it by a space which is filled with cellular tissue. The *synovial capsule* contains very little synovia, and is sometimes double, on account of the presence of an inter-articular fibro-cartilage; its disposition is very easily conceived in the two cases, and its outer surface is only in contact with the two ligaments of the articulation, and with cellular tissue. The clavicle is connected to the coracoid process of the scapula by two ligaments. The *coraco-clavicular ligament*, composed of two strong bundles of ligamentous fibres, whose direction is different and separated from each other anteriorly, in a distinct manner, by an angular space filled with cellular tissue; they are seen when the clavicle has been cut across, and the extremity entirely removed from the trunk; the clavicle then raised and twisted backwards, will bring into view, first, the *posterior* and *inner fasciculus*, sometimes named *conoid*, has the form of a reversed cone: it is shorter than the other, with close and divergent fibres, and is attached by its base to a tuberosity which the lower surface of the clavicle presents externally, and by its summit to the broadest part of the coracoid process. The *anterior* and *external fasciculus*, named *trapezoid*, is placed at the distance of an inch from the scapulo-clavicular articulation, is longer and broader than the posterior; it is also thinner, and has a quadrilateral form; its fibres, which are shorter behind than before, are separated by small cellular spaces; it is attached superiorly to an oblique line, which proceeds from the above tuberosity to the extremity of the clavicle, and inferiorly to the inner and posterior part of the upper surface of the coracoid process; it unites posteriorly with the preceding ligament, forming a very distinct projecting angle, but anteriorly they are more apart, owing to the presence of the subclavius muscle whose costal attachment intervenes between them. Each scapula has strong aponeurotic flattened fasciculi, running from one point of the bone to another, in other words, proper or belonging to the scapula; they are three in number. 1st, The *Acromio-coracoid Ligament* or *Membrane*, triangular, broad, thin, and flat, and stretched transversely between the coracoid process and the acromion, broader at the end next the coracoid attachment than at the other; it is indeed attached to the whole extent of the outer edge of the coracoid process by two fasciculi, at first separated by cellular tissue, and afterwards united into a common bundle, which becomes narrower and thicker as it approaches the summit of the acromion into which it is inserted; one of the two roots of this bundle is anterior, shorter, broader and thinner, and directed transversely outwards; the other, which is posterior, longer, narrower and thicker, is directed obliquely backwards and outwards; both are, however, connected by a slight fibrous membrane, and completes the vault formed by the acromion and coracoid process above the head of the humerus. 2d, The *Coracoid Ligament* or *Membrane* is a thin and flat fasciculus attached to the base of the coracoid process, stretched across the notch in the cervical margin of the scapula, and attached to the posterior part of that notch. The supra-scapular nerve very generally passes under this membrane. 3d, The *Membrana cervicis scapulæ* is attached to the upper part of the neck of the scapula, and lays hold of the concave margin of the spine of the scapula, where it is surmounted by the acromion process, under this membrane creeps a large branch of the supra-scapular artery to anastomose in the fossa infra-spinata with the subscapular artery; it also separates the supra-spinatus from the infra-spinatus muscle; this ligament was well represented in the plates of the Caldanis.

152. *Shoulder Joint* (*Scapulo-Humeral*). The osseous articular surfaces are the head of the humerus and the glenoid cavity of the scapula. The acromio-coracoid membrane, however, must be taken into view in studying the joint. The whole of the surfaces entering into its composition, are in a great measure covered by the deltoid muscle; immediately under this muscle, a large and extensive bursa mucosa is always found, and often leads the student into the mistake that the cavity into which he has opened in his section of the deltoid is really the joint, or if left in shreds, obscures the true capsular ligament. The joint will be best seen if the acromion process has been divided from the spine of the scapula, leaving it still attached to the coracoid process; this section is necessary in order to see the supra-spinatus muscle. The capsular muscles, viz. the supra-spinatus, infra-spinatus, and sub-scapularis must be dissected with the greatest care, for their tendons become intimately incorporated with the capsular ligament of the joint. The *Capsular* or *Orbicular Ligament* has the form of a hollow conoid, truncated, the summit of which embraces the contour of the glenoid cavity of the scapula, while its base is fixed around the neck of the humerus, the

circumference of which has more extent than that of the glenoid cavity; its looseness, when the surrounding capsular muscles have been reflected, is very remarkable, permitting the osseous surfaces to separate from each other more than an inch. Its *upper edge* is attached around the glenoid cavity, beyond the glenoid ligament; its *inferior edge* is fastened to the base of the neck of the humerus, expanding and prolonging itself considerably beneath this portion of the bone at its lower part; between the two tuberosities of the humerus, this edge is interrupted by the passage of the tendon of the biceps flexor muscle, which traverses this, the capsular ligament, in order to reach the superior part of the glenoid cavity into which it is inserted. The *Coraco-humeral* or *Accessory Ligament;* it is situated at the upper and inner part of the articulation, and is formed by a very dense fasciculus, which arises from the outer edge of the coracoid process, and proceeding forwards and outwards, is attached to the anterior part of the great tuberosity of the humerus, mixing its fibres with those of the tendon of the infra-spinatus muscle; its inner surface is intimately united to the capsule in the greater part of its extent. The student will divide the capsular ligament on its internal aspect by two incisions crossing each other, and he will thus be enabled to look into the joint, and see the *Glenoid Ligament.* This is a fibro-cartilaginous rim, increasing the depth of the glenoid cavity; it is especially formed by the fibres of the tendon of the long portion of the biceps muscle, which bifurcates at the upper part of this cavity, embracing it, in the interval between its two branches; there are also distinguished in it, proper fibres; it has a somewhat prismatic and triangular form; its thickest portion is fixed upon the circumference of the cavity; its free edge, thin and sharp: the synovial membrane covers this ligament. The *Synovial Capsule,* after lining the glenoid cavity and the ligamentous rim which surrounds it, is reflected backwards over the neck of the scapula to reach the inner surface of the capsular ligament, which is entirely covered by it; and where the fibres of this ligament separate, it is applied immediately upon the side of the tendon of the subscapularis muscle, rendering it almost impossible entirely to dissect off this muscle and tendon without opening the joint; after arriving at the neck of the humerus, it is reflected to proceed over the cartilage of its head; where this reflection takes place, it furnishes a prolongation which descends for about an inch along the bicipital groove, ascending again upon the tendon of the biceps muscle, enveloping it on all sides, to the glenoid cavity, and forming inferiorly a cul-de-sac, which prevents the synovia from flowing out. By this arrangement, the tendon of the biceps traverses the articulation freely, but is not contained in the interior of the synovial membrane. The dissector finds at first great difficulty in understanding how the tendon of the biceps muscle, whilst in the joint comes to be surrounded on all sides by the synovial capsule, and yet not actually enclosed within the sac. The German anatomists think it easily explicable by changes which take place in the growth of the fœtus—the tendon being in the very early fœtus connected to the wall of the joint by a process like a mesentery, which process becoming ruptured and obliterated, leaves the tendon quite free within the joint, and surrounded as it would seem on all sides as in a sheath, by the synovial capsule.

153. *Elbow-joint, (Humero-cubital).* This articulation constitutes a perfect angular ginglymus, formed by the meeting of the superior extremities of the ulna and radius with the inferior extremity of the humerus. These different parts present in their aggregate two transverse rows of eminences and cavities, which fit into each other in a very close manner, and all whose surfaces are invested with cartilages; that of the cavity of the radius is continued thinner over the cylindrical circumference of its extremity. The cartilage of the great sigmoid cavity of the ulna is prolonged over the small cavity of the same name; it is interrupted at its middle part by a transverse depression, widened at its extremities, where it is converted into notches. Four ligaments serve to keep together the surfaces of this articulation, which are lined in their whole extent by a synovial membrane. The *anterior ligament*, thin, composed of oblique fibres, separated from each other by intervals filled with cellular tissue; it covers

nearly the whole of the articulation anteriorly; its superficial fibres, which are very numerous, pass from the internal tuberosity of the humerus to the annular ligament of the radius, with which they are incorporated; the middle fibres, which are vertical, arise from the humerus between its two condyles, and are lost among the preceding; the deep fibres which are also vertical, are collected into isolated fasciculi; they proceed from the coronoid cavity of the humerus, and gradually disappear upon the synovial membrane. The *posterior ligament* can only be well seen when the fore arm is bent upon the arm, and is much weaker than the anterior; it is formed of two separate fasciculi. One of these, which is internal, is nearly parallel to the posterior fasciculus of the internal lateral ligament, and ascending from the summit of the olecranon, is inserted into the inside of the pully or trochlea of the humerus, and the edge of its olecranal cavity: the other fasciculus, which is external, is a sort of fibrous band, extended between the two tuberosities of this bone, immediately behind the olecranal cavity. The *external lateral ligament* consists of a short flat triangular fasciculus, arising from the most prominent point of the external condyle of the humerus, and inserted into the annular ligament of the radius, a strong portion of its fibres passing over this ligament to be inserted into the outer edge of the ulna. The *internal lateral ligament* is triangular in form, and composed of two distinct bundles, one running from the internal condyle of the humerus, to the inside of the coronoid process of the ulna, the other also proceeds from the internal tuberosity of the humerus, but is inserted into the inner part of the olecranon. The *synovial membrane*, is common to the humero-cubital articulation, and that of the two bones of the fore-arm at their upper part; applied behind the anterior ligament of the articulation, from which it is separated by a great quantity of cellular tissue, this membrane descends towards the neck of the radius, around which it forms a sort of cul-de-sac, directing itself from the inner surface of its annular ligament; it then ascends into the cavity of the head of the radius, passing between the inner side of its circumference and the smaller sigmoid cavity of the ulna; it is then continued into the larger sigmoid cavity, and from thence proceeds to the internal surface of the tendon of the triceps extensor, of the lateral ligaments, and of the posterior ligament, to arrive at the olecranal cavity whence it proceeds to the different articular surfaces of the inferior extremity of the humerus, which it covers, and then arrives at the coronoid cavity, whence it finally proceeds to the point from which we have imagined it to set out.

154. *Cubito-Radial Articulation.* The anterior ligament of the elbow joint must be cut transversely and reflected, this will exhibit the course of the *synovial capsule*, together with the following ligaments:—The *annular* or *orbicular ligament*, a very strong, flat, fibrous band, about two lines broad, very dense and sometimes cartilaginous, with circular fibres more apparent at the extremities than in the middle part; it surrounds the neck of the radius, and with the small sigmoid cavity forms a sort of ring in which the radius turns; the ligament forms about three-fourths of this ring, and is attached, on the one hand, to the anterior edge of the small sigmoid cavity, and on the other, to its posterior edge. The *Lower Radio-cubital Articulation* is formed by the reception of the head of the ulna into a concave articular surface which the radius presents at its lower and inner part. The principal means of union observed here is the *Triangular Fibro-Cartilage*, placed transversely between the lower extremity of the radius and ulna; denser and more cartilaginous at its circumference than at the centre, thinner and broader externally than internally, and formed of fibres more apparent below than above; its *upper surface*, which is concave and smooth, is contiguous to the lower part of the head of the ulna; the *lower*, which is also concave and smooth, is in connexion with the cuneiform bone; its *anterior* and *posterior edges* are connected with the ligaments of the wrist-joint; its *base* is inserted into the prominent edge, which separates the carpal cavity of the lower extremity of the radius, from that which receives the ulna; sometimes it is only connected with it by means of the synovial membranes; lastly, its *summit* is attached to the depression, which separates

the styloid process of the ulna from the articular surface of that bone; this structure will be properly seen and best understood when the carpus has been removed, and the student looks on the distal extremity of the radius and ulna. The *synovial membrane* is remarkably loose anteriorly and posteriorly, where it is covered by some oblique and irregular fibres; it passes from the ulna to the radius, forming between them a very loose cul-de-sac, and from the latter bone is reflected over the upper surface of the triangular fibro-cartilage; the quantity of synovia which it contains is always very great. The radius and ulna, in addition to these distinct articulations, are connected to each other by a thin aponeurotic membrane, the *Membrana Interossea Anti-Brachii;* this membrane is intimately incorporated with the periosteum covering these two bones, and by its means to two ridges particularly dwelt upon in their description, it very nearly fills up the interspace between the radius and ulna, leaving a deficiency, superiorly, however, through which pass the posterior interosseous vessels, whilst the anterior interosseous vessels and nerves pass through an oval aperture in it inferiorly. On a plain, anterior to the interosseous membrane, we find a bundle of aponeurotic fibres attached to the root of the coronoid process of the ulna, descending parallel to the inner edge of the tendon of the biceps, and inserted immediately beneath the bicipital tuberosity of the radius; this aponeurotic bundle has received from some anatomists the name of the *round ligament, membrana transversalis cubiti, oblique ligament, &c.*, it is rendered tense when the hand is supined, and thus seems to limit that action.

155. *Wrist-joint, (Radio-Carpal Articulation.)* The osseous articular surfaces entering into the composition of this joint, are the distal extremity of the radius on the one hand, the scaphoid and semilunar bones on the other. The triangular fibro-cartilage we have mentioned as connecting the radius and ulna together inferiorly, is so placed as to lie between the lower end of the ulna and cuneiform bone. The student should divide the bones of the fore-arm about an inch above the wrist-joint, clearing away entirely the interosseous membrane. The *anterior ligament* of the wrist-

joint is delicate, reticular, and membraniform, arises from the fore part of the lower extremity of the radius, and is attached to the palmar aspect of the scaphoid, semilunar, and cuneiform bones. The *posterior ligament* is exceedingly delicate, arises from the posterior part of the lower extremity of the radius, and descending obliquely, is attached to the posterior non-articular surface of the semilunar and cuneiform bones. The *external lateral ligament* has a triangular form and is very strong, readily felt in the living body; it descends from the summit of the styloid process of the radius to the outer non-articular part of the scaphoid, its fibres diverge—the anterior are long, and are continuous with the retinaculum of the carpus, extending as far as the trapezium. The *internal lateral ligament* passes from the summit of the styloid process of the ulna, to the inner side of the cuneiform bone; it is also slightly connected with the retinaculum and pisiform bone. The *synovial capsule* is ample and always contains a considerable quantity of synovia; it is reflected over all the articular surfaces and ligaments forming this joint, and covers the inferior surface of the triangular fibro-cartilage.

156. *Carpal Articulations.* Our description of the carpal bones will be found confined very nearly to that of the articular surfaces; the joints it might be concluded will be very numerous, and so in truth they are, but it is a fact, that one synovial capsule nearly covers the whole. The head of the os magnum forms, as it were, the centre of the movements performed by the carpus. The *synovial capsule* lines this rounded head extensively, sending processes right and left, and particularly *two* upwards on each side of the semilunar bone,—it sends three prolongations downwards, thus reaching and investing the articular surfaces between the carpus and metacarpus, and of the superior metacarpal articulations, between the latter in various culs-de-sac. These carpal bones are bound together in a very powerful manner by short ligamentous fibres laying hold of and covering all the non-articular surfaces both of the anterior and posterior aspects, and hence named *dorsal* and *palmar ligaments.* When the bones of the carpus are articulated, the

student will also observe, that a variety of surfaces, although non-articular are yet opposed to each other, but do not come into close contact; we find here a system of short but very strong ligamentous fibres approaching almost a fibro-cartilage, called *interosseous ligaments,* running from one bone to another. The *Pisiform Bone* is connected to the other carpal bones by two very strong distinct ligaments, one is external and goes to the hook-like process of the unciform bone, the other is internal and terminates at the upper part of the fifth metacarpal bone.

157. *Carpo-Metacarpal* and *Metacarpal Articulations.* The metacarpal bones are not only articulated with the carpal, but with each other; prolongations of the same synovial capsule which invested the carpal bones cover also their proximal extremities, with the exception of the thumb, and third and fourth, where small separate synovial bags exist; they are secured by short but strong ligamentous fibres running in a variety of directions, and receiving the names of *transverse, oblique, anterior, posterior, &c.,* according to their course and position. The articulation of the first metacarpal bone, or that of the thumb with the trapezium, is very peculiar; the joint is a good specimen of an arthrodia: the thumb possesses an almost universal motion, it has not only a distinct *synovial membrane,* but even a *capsular ligament:* this ligament is formed of longitudinal fibres, more distinct externally and behind than in other directions, and passes from the upper extremity of the metacarpal bone, to that of the articular surface of the trapezium. The distal extremities of the second, third, fourth, and fifth metacarpal bones are not in direct contact with each other, but are connected together on the palmar aspect by a very peculiar and powerful fibrous band about two lines broad: the superficial fibres are long and embrace the heads of these four metacarpal bones, whilst the deeper are short, going only from one bone to another: this structure has received the name of the *transverse metacarpal ligament.*

158. *Metacarpo-Phalangeal Articulations.* These articulations are formed by the reception of the heads of the metacarpal bones into a concave and superfi-

cial surface, presented by the proximal extremities of the five proximal phalanges. The surfaces are all covered with cartilage, but those of the phalanges are much less extensive than those of the metacarpal bones. When the hand is closed, the rounded heads of the metacarpal bones project and form what are vulgarly called the knuckles; from want of attention to this, few students, even of some standing, can point out the precise position of these joints. An ample *synovial capsule* invests the surfaces entering into the composition of these joints. The *anterior ligament* is a fibrous half-ring, embracing the anterior part of each articulation: the transverse metacarpal ligament is intimately connected with this structure: it is in this *anterior ligament* that we find osteides developed, in the thumb always, and often in the other fingers, particularly in the hands of stout men accustomed to hard work, as the blacksmith, &c.; we see this structure in its highest state of development in the elephant, where every finger and toe has its pair of osteides connected with this joint. The *lateral ligaments* arise from the lateral parts of the head of each metacarpal bone, in a small depression, and descend obliquely forward, to be attached to the two sides of the upper extremity of the phalanx; they are thick, broader above than below, rounded, and composed of longitudinal, parallel and very numerous fibres.

159. The *Phalangeal articulations* are perfect angular ginglymi, and are all very much alike in respect to their articular surfaces and ligaments. The thumb has only one, while each of the other fingers has two. The condyles of the distal extremity of the proximal and middle phalanges are incrusted with cartilage, as well as the corresponding cavities of the middle and distal phalanges. Each of these articulations has an anterior ligament, two lateral ligaments, and a synovial capsule. The *anterior ligament*, which is of the same form as that of the preceding articulation, is attached to the two sides of the extremity of the phalanx above, and receives anteriorly a great number of dense and glistening fibres, which proceed from the sheath of the flexor tendons; it is less marked in the proximal, than in the distal phalangeal ar-

ticulations. The *lateral ligaments* are precisely similar to those of the articulations of the metacarpal and proximal phalanges. Lastly, the *synovial membrane* also resembles that of the above mentioned articulation; it is intimately connected posteriorly with the tendons of the extensor digitorum as in the last articulation.

ARTICULATION OF THE INFERIOR (PELVIC) EXTREMITIES.

160. *Hip-joint, (Coxo-Femoral).* This articulation is an enarthrosis, resulting from the reception of the head of the femur, into the cotyloid cavity of the os innominatum: these two surfaces are covered by a very distinct diarthrodial cartilage; that of the head of the femur is much thinner at its circumference than in the middle, where it is interrupted by a depression which gives attachment to the round ligament; the cartilage of the cotyloid cavity which presents the reverse arrangement as to thickness, is deficient at its bottom, where a body supposed glandular is situated. This articulation is furnished with a synovial membrane, a capsular ligament, an inter-articular ligament, and a cotyloid ligament. The *capsular ligament* embraces the whole articulation, and extends downwards and outwards, from around the margin of the cotyloid cavity to the base of the neck of the femur; its thickness is very considerable, especially at the fore and upper part, where it is strengthened by a fibrous band which descends from the anterior and inferior spine of the os innominatum, incorporates with the capsule, and terminates at the anterior line of the base of the neck of the femur, becoming much broadened: the student will observe that this ligament is attached to the os innominatum in such a way as completely to conceal the cotyloid cavity, and cotyloid ligament; it takes strengthening bands from both the anterior spinous processes of the ilium, and thus approaches close to the brim of the pelvis; it ascends higher externally than internally, and is strengthened considerably by the curved tendon of the rectus femoris muscle: its femoral attachment merits most particular attention, and ought to be made out by the dissector in the clearest manner; its limits are, an-

teriorly and posteriorly, the two inter-trochanteric lines, and the trochanters themselves above and below, and thus the student will remark, by a reference to the bones, includes not only the head, but also the neck of the femur. The student will now pince up a small fold of the outer and upper part of the capsular ligament, make a small opening into the joint, and introducing the blade of a pair of scissors, divide the outer capsule by a circular incision, reflect the cut portions right and left, and he will then see the following structures. The *inter-articular (round) ligament* extending from the extremities of the inferior notch of the cotyloid cavity to the rough depression on the head of the femur; it is enveloped by a very loose sheath of the synovial membrane; its *base* is formed of two flattened bands, of which the upper and smaller comes from the corresponding extremity of the cotyloid notch, internally of the ligament of the same name, while the inferior, which is larger, comes from that of the opposite side: these two bands are united by a fibrous membrane, and are blended together towards the head of the femur. The *cotyloid ligament* is applied upon the bone by a base about three lines broad, and presents a free and sharp edge, inclined a little inwards, which embraces the circumference of the head of the femur when *in situ;* this structure is broader opposite the notches of the cavity than in their intervals, and is not continuous with the diarthrodial cartilage, there existing a very distinct circular groove between them; at the notch of the cotyloid cavity it passes from one of its extremities to the other, and thus transforms it into a true hole. Two bundles of ligamentous fibres are attached in addition beneath the fibro-cartilage to the two sides of the cotyloid notch, forming two planes which cross each other; the deeper (internal) of these planes comes from the upper side, and is partly attached to the lower, where it is blended with the cotyloid ligament; the other (external) is superficial, ascends towards the upper part of the notch, is incorporated with the same ligament, and also with the obturator membrane. The *synovial capsule* is expanded over the cartilage of the head of the femur, and neck of that bone, investing a dense, thick membrane, with longitudinal and separated fibres, called by some the *retinaculum of the capsular ligament*, and which is a most important structure in the pathology of this articulation; it has been also termed the *reflected ligament* of the neck of the femur; but after all may be merely periosteum greatly strengthened: at the base of the cervix femoris the synovial capsule is reflected over the capsular ligament, which it lines in its whole extent; from the circumference of the cotyloid cavity, it may be traced over the two surfaces of its fibro-cartilaginous rim, entering into its interior, covering a reddish cellular tissue which occupies the fovea, adhering strongly to it, and lastly, reflected along the round ligament to the cartilage of the head of the femur. Beneath this synovial membrane, in the back part of the bottom of the cotyloid cavity, is a flattened mass of reddish cellular tissue, mingled with a soft and unctuous substance, forming the largest of the organs that have been described under the name of *synovial glands*; it receives a great number of arterial ramifications, which arise from a small branch of the obturator artery which enters the cavity by its inferior notch; some of these ramifications lose themselves on the membranous sheath of the inter-articular ligament; these vessels are accompanied by a nervous filament of the same name, and are surrounded by a layer of more or less dense adipose tissue, disappearing on the edge of the mass itself, which is surmounted by very large fringes. The whole circumference of the head of the femur, is moreover surrounded with numerous small grains, of the same nature as those which we have already pointed out in several of the articulations; there is one very large grain of this kind, which raises the synovial membrane close to the insertion of the inter-articular ligament, at the centre of the head of the femur.

161. The *Knee-Joint* (*Femoro-Tibial*) is an angular ginglymus; the condyles of the femur, the upper extremity of the tibia, and the posterior surface of the patella are the articular osseous surfaces entering into its composition. The dissector will observe in dissecting the muscles, that the expanded tendons of many of these contribute greatly to strengthen this joint, and must recollect that many of them are lined

by the delicate synovial capsule, and cannot be dissected off, without opening into that capsule. He will particularly attend to the tendon of the semi-membranosus muscle, which he will find intimately connected with, if not forming the posterior ligament. The muscles or tendons being cut short, and the whole trimmed, the following structures should be viewed in succession. The *Ligament of the Patella.* This ligament seems the continuation of the tendon of the extensor muscles of the leg, having in its substance an osteid (the patella.) Careful dissections have satisfied us that the patella is developed in a cartilage, and is connected to the tibia by a distinct ligament, which, however, is most intimately blended with the tendons of the extensor muscles; the whole forming a flat bundle, narrower at the middle than at its extremities, extending from the inferior angle of the patella, and the depression at the lower part of its posterior surface, to the tubercle of the tibia; its *anterior surface* is covered by the skin, and a prolongation of the fascia lata; the *posterior surface* rests at its upper part, on an adipose mass of considerable size, and at its lower part is separated from the tibia by a small bursa mucosa, which is extremely loose, and rather plentifully supplied with synovia. The *Long External Lateral Ligament* is a strong, rounded, fibrous cord, which descends vertically from the tuberosity of the external condyle of the femur, to the outer part of the head of the fibula: another ligamentous bundle appearing accessory to this, passes, behind, and parallel to it, from the lower part of the external condyle of the femur to the summit of the upper extremity of the fibula. The *Internal Lateral Ligament* descends from the tuberosity of the internal condyle of the femur to the upper part of the inner edge and surface of the tibia; it is flat and membranous, thicker anteriorly than posteriorly, much broader below than above. The *Posterior Ligament* (*Ligamentum posticum Winsloii.*) Some anatomists consider this ligament as a division of the aponeurosis of the semimembranosus muscle. It appears, however, rather to form a distinct ligament, which is deeply seated at the back part of the articulation, and directed obliquely from the internal tuberosity of the tibia to the outer condyle of the femur. Its fibres are irregular, and present frequent separations for the passage of vessels. It is covered by an aponeurotic plane, which really comes from the semimembranosus, and is applied upon the crucial ligaments, from which it is separated by a great quantity of fat, and by the middle articular vessels. The dissector will now proceed to open the joint, so as to see the remaining structures, and trace the *synovial capsule.* We prefer carrying a saw vertically through the patella, completing (with a knife) the division of the *ligamentum patellæ* and tendon of the extensor muscles. This section will enable the student to trace all the intricate reflections of this very complex synovial capsule. The *synovial capsule* will then be observed forming a very loose and distinct cul-de-sac, behind the tendon of the extensor muscles, it then passes over the posterior surface of the patella, but leaving the ligament of the patella, rests on a quantity of fat, and forms a prolongation which traverses the articulation, and passes to the space between the condyles of the femur: returning to the point of reflection from the ligamentum patella, it may be traced over both surfaces of the semilunar cartilages, over the articular surface of the tibia, and forming two folds, which have received the name of *alar*, it invests the crucial ligaments on three sides, reaches the condyles of the femur, covers them, and thus the student returns to the point from whence he started. Having carefully viewed this very complex but most important structure, the dissector should cut it away freely, and also cut across, and reflect the ligament of the patella, the internal and external lateral, the posterior ligaments, and thus see in a clear and precise manner, not only the structures which he has thus divided, but those which still remain to be seen. The *Anterior Crucial Ligament* is attached to the inner and back part of the external condyle of the femur, whence it proceeds obliquely towards the uneven depression, which is situated on the fore part of the spine of the tibia, where it is continued into the anterior extremity of the internal semilunar fibro-cartilage. The *Posterior Crucial Ligament* arises from the outer and fore part of the inner condyle of the femur, crosses the direction of the anterior crucial ligament, proceeding obliquely outwards and backwards, to the posterior part of the spine of the tibia; its inferior extremity seems divided into two fasciculi, of which one is attached to the tibia, while the other is continued into the posterior extremity of the external semilunar fibro-cartilage. The *Semilunar* or *Inter-articular Fibro-cartilages* are two crescent-shaped fibro-cartilaginous laminæ, thick at their convex margin, and thin at their internal concave margin; situated between the condyles of the femur, and the articular cavities of the upper extremity of the tibia, of which they only occupy about the two external thirds, so that the middle of each articular cavity is free; the *internal* semilunar cartilage is nearly semicircular, a little elongated from behind forwards, and broader posteriorly than anteriorly; its *convex* margin, which is directed inwards, is partly united to the internal lateral ligament; the *anterior extremity* is attached to the fore part of the spine of the tibia, and is continuous with the anterior crucial ligament; the *posterior extremity* is attached behind the same eminence. The other fibro-cartilage is *external;* it forms nearly an entire circle; it is broader before than behind; its *convex margin*, which is directed outwards, is contiguous posteriorly to the tendon of the popliteus muscle, and more anteriorly, affords points of attachment to the posterior fasciculus of the external lateral ligament; its *anterior extremity* is attached to the rough depression, which exists at the fore part of the spine of the tibia, but this insertion takes place much farther back than in the preceding cartilage; its *posterior extremity* is attached behind the spine of the tibia, before the insertion of the other cartilage, posteriorly to that of the posterior crucial ligament, with one of the two fasciculi of which it is continuous. These fibro-cartilages are composed of concentric fibres, longer externally than in the interior, less compact towards the extremities than at the middle: they are connected anteriorly to each other by means of a small ligamentous fasciculus (*ligamentum transversum*), sometimes wanting, about a line broad, and surrounded by soft and yellowish adipose substance; their *upper sur-*

face is concave, the *lower* nearly plain; their *concave edge* is thin, sharp, and free, and their middle part is hollowed.

162. *Tibio-Peroneal Articulations.* The *Anterior Ligament* of the *superior tibio-peroneal articulation* descends obliquely outwards, from the fore part of the external tuberosity of the tibia, to the fore part of the head of the fibula, and is strengthened and covered in a great part by the tendon of the biceps flexor cruris. The *posterior ligament* is less marked, and much weaker than the anterior, and is composed of closer fibres; it presents the same arrangement behind the articulation, as the other ligament does at its fore part; it is covered by the popliteus, and sometimes the synovial membrane of the knee joint extends to it. The *synovial capsule* is always contiguous with that of the knee joint. The *tibio-peroneal interosseous membrane* occupies the interval between the tibia and fibula; at the upper and outer part, this membrane presents a pretty large aperture for the passage of the anterior tibial vessels, and inferiorly presents a hole, which gives passage to a branch of the peroneal artery. The convex articular surface of the inferior extremity of the fibula is fitted to a concave surface of the tibia, forming the *inferior tibio-peroneal articulation.* An *anterior ligament* is attached to the fore part of the lower extremity of the fibula, and is inserted into the fore part of the neighbouring portion of the tibia. A *posterior ligament* is attached on the one hand, behind the tarsal extremity of the fibula, and on the other, to the neighbouring part of the tibia. A *posterior* and *inferior ligament*, continuous with the preceding, is inserted behind the malleolus externus, and directs itself transversely to that of the tibia, passing to the posterior part of its articular surface, and forming a very distinct fibrous fasciculus; it forms part of the cavity, which receives the articular pulley of the astragalus in the ankle joint. The *inferior interosseous ligament* fills up the interval left by the osseous surfaces of the articulation above their cartilages; it is a dense tissue, intermingled with some adipose flakes; its fibres are very short, and adhere strongly to the bones; it seems to be continuous above

with the superior interosseous ligament, and can only be well seen on separating the two bones by force.

163. The *Ankle Joint* (*Tibio-Tarsal*) is a perfect angular ginglymus; the fibula and tibia form together a cavity which receives the astragalus, and whose depth is increased by the two malleoli. The tibia and fibula have each their articular cartilage, which is prolonged over their malleoli, and the surface by which they touch each other. The articular pulley of the upper surface of the astragalus, and its lateral articular surfaces, are also invested by cartilage. A synovial membrane is extended over all the parts of this articulation; to which belong two lateral ligaments, two anterior, and a posterior. The *internal lateral ligament* is a broad quadrilateral band, descending obliquely backwards from the summit of the malleolus internus and its depression, to the inner part of the astragalus and calcaneum, sending also some fibres to the fibrous sheath of the tendon of the flexor longus digitorum pedis. The *external lateral ligament* is round, narrow, very strong, and of great length; it arises from the summit of the malleolus externus, descends vertically to be inserted into the upper and middle part of the outer surface of the calcaneum. The *anterior peroneo-tarsal ligament* is attached to the fore part, and near the summit, of the malleolus externus (smaller than the preceding, sometimes divided into two fasciculi, but always regular and quadrilateral, with close and very strong fibres), passes obliquely forwards to be inserted into the anterior edge of the external articular surface of the astragalus. The *posterior peroneo-tarsal ligament* passes obliquely downwards and inwards from the depression which exists behind the external malleolus, to the posterior part of the astragalus, towards the outer edge of the groove for the tendon of the flexor longus pollicis pedis; its fibres are numerous, and are divided into distinct fasciculi. The *tibio-tarsal ligament* is an assemblage of some irregular fibres, which do not form a distinct fasciculus, immersed in adipose cellular tissue, and covered by the tendons of the tibialis anticus, extensor proprius pollicis, and extensor communis digitorum; they descend obliquely from within outwards, from

the anterior part of the tarsal extremity of the tibia, to the fore part of the articular pulley of the astragalus. The *synovial capsule* extends over the cartilaginous surfaces of the fibula and tibia, and ascends between these two bones into their inferior articulation; it is prolonged on the interior of the two malleoli, lines the ligament which we have described, and is reflected upon the lateral articular surfaces, and over the cartilaginous pulley of the astragalus; it is very loose anteriorly and posteriorly, where it is in contact with a great quantity of adipose cellular tissue.

164. *Tarsal Articulations.* In our description of the tarsal bones, the student will observe that we have, in many instances, taken the articular surfaces as forming their leading features. The astragalus is articulated with two bones of the tarsus, viz. the calcaneum and scaphoid; and 1°. of that with the calcaneum. The *posterior calcaneo-astragalien ligament* consists of a few parallel fibres, which, running obliquely inwards from the posterior part of the astragalus, is attached to the calcaneum. The *interosseous ligament* is attached in each bone to the non-articular uneven depression pointed out as separating the two opposing articular surfaces; it is found most readily on the external aspects of the foot; an ample synovial capsule invests the articular surfaces. 2°. The astragalus is articulated with the scaphoid (navicular); the opposing surfaces are peculiar, and altogether deserve the particular attention of the student; it is here where considerable movements take place in walking, particularly tending to lengthen the foot. The synovial capsule is ample, particularly inferiorly and internally, where it forms a pretty extensive cul-de-sac. The only distinct ligament will be observed to arise from the upper part of the neck of the astragalus, and pass to the upper non-articular part of the scaphoid. The scaphoid, though not articulating directly with, is still very powerfully attached to the calcaneum by two ligaments, viz. 1*st*, the *inferior internal calcaneo scaphoid;* this is a flat very thick fibro-cartilaginous elastic fasciculus, passing from the anterior part of the small tuberosity of the calcaneum to the inferior surface of the scaphoid; it is lined

superiorly with a reflection of the synovial capsule between the astragalus and scaphoid, and receives the head of the astragalus in walking, or under heavy pressure; its elasticity under these circumstances produces the phenomenon of the elongation of the foot. The *external calcaneo-scaphoid ligament*, like the preceding, in part supports the astragalus; its fibres are very numerous, and can only be seen in a very deep dissection. The scaphoid or navicular bone may be considered as a keystone to the arch which the well-formed foot (particularly in the female) presents, it touches all the bones of the tarsus excepting the calcaneum to which, however, it is connected by the important and very beautiful structure we have already mentioned, viz. the inferior, internal calcaneo-scaphoid ligament. The rounded head or convex articular surface of the scaphoid, presents three articular surfaces, and supports in succession the internal, middle and external cuneiform bones; these cuneiform bones are also articulated with each other, but one synovial capsule answers for the whole: the *ligaments* are named *dorsal* and *plantar* from their situation, and are short but strong fasciculi attached to the non-articular surfaces so carefully pointed out in our description of the bones. The cuboid bone articulates with the calcaneum, external cuneiform bone, and supports the fourth and fifth metatarsal bones, a similar arrangement of flat aponeurotic fasciculi on the dorsal aspect particularly, connects the cuboid to the surrounding bones and to the metatarsal. The cuboid is also strongly attached to the scaphoid by a kind of interosseous ligament, seen only when the dissector is disarticulating the foot. On the plantar aspect, the ligaments connecting the calcaneum to the cuboid, are thrown prominently into view on account of running along the outer margin of the foot; the more superficial filaments are of great length, being prolonged over the cuboid, and attached to the proximal extremity of the third and fourth metatarsal bones. The *Inferior and Superficial Calcaneo-Cuboid Ligament*, (*Ligamentum Longum Plantæ*), is the longest and strongest of the ligaments of the foot; its thickness, pearly lustre, and the longitudinal direction of its fibres are very remarkable; it arises from the posterior and inferior part of the calcaneum, and passing directly forwards, terminates in part at the oblique tuberosity observed at the inferior surface of the os cuboides; the rest of its fibres, which are much longer than the others, pass below the fibrous sheath of the peroneous longus, and divide into several fasciculi which go to the posterior extremity of the third and fourth metatarsal bones, and give insertion to muscular fibres; this ligament corresponds below to the deep-seated muscles of the sole of the foot. The *Inferior and Deep Calcaneo-Cuboid Ligament;* this ligament, which is shorter and situated higher than the preceding, and separated from it by a great quantity of adipose cellular tissue, arises from the calcaneum before the superficial ligament, and proceeding a little inwards, is inserted wholly into the tuberosity of the os cuboides. The *Synovial Membrane* is sufficiently simple, as it only covers the two cartilaginous surfaces; upper, and inferior deep ligaments between the calcaneum and cuboid bone; it is seen exposed in several of the interstices in the former; externally, corresponds to the sheath of the peroneus longus, and internally to a fibrous and cellular tissue.

165. *Tarso-Metatarsal* and *Metatarsal articulations.* The metatarsal bones are five in number, and are articulated in a very secure manner with the three cuneiform and cuboid of the tarsus; the articular surfaces are flat, admitting of little motion, but at the same time so fashioned as to contribute greatly in forming the arch of the foot. The synovial capsules are four in number, and the ligaments are placed on the dorsal and plantar aspects. The *plantar oblique cuneo-metatarsal ligament* (remarkable for its strength,) runs from the anterior part of the base of the first cunieform bone to the second metatarsal. The other tarso-metatarsal ligaments are either *dorsal* or *plantar*, and, as in the hand, named from the bones which they connect. The distal extremities of these five metatarsal bones are connected together by the *transverse metatarsal ligament;* it is placed on the plantar aspect, and though strictly analagous to that described in the hand, differs in connecting that of the great toe to the others.

166. *Metatarso-phalangeal* and *Phalangeal articulations.* The phalanges of the toes are in number, form,

and articulations precisely like those of the fingers; they are much smaller, however, and the ligaments are consequently minute, requiring great care in their dissection; their arrangement is precisely similar to that observed in the hand.

DISLOCATIONS.

167. *Dislocations of the Spine*, in any part of the column, *unaccompanied with fracture* must be very rare, since no instance occurred in the extended experience of Sir Astley Cooper. We have examined about six fatal cases of dislocation of the cervical vertebræ, but they were all complicated with fracture of some part or other of the vertebræ themselves. Nevertheless, the authority of Sir Charles Bell is in favour of the opinion, that a dislocation may happen in the neck, unaccompanied by any fracture, and Mr. Liston states, that one case of complete and pure dislocation in the cervical region of the spine, occurred to him. *Displacement*, Mr. Liston remarks, may take place without producing any very serious consequences; two cases occurred to him; one, a boy who fell over a high rock, the other a woman who fell from a window, both lighted on the breech, and the trunk was bent forward. The lad remained stout, but his trunk was deformed by an excurvation; the woman recovered perfectly. "In these cases there was evident laceration of the interspinal ligaments, though, probably, not of the ligamenta subflava, for the spinal chord must be stretched or otherwise injured when these are torn." The fracture of the processus dentatus, is an accident usually caused by caries of the bones, either originating in the sides of the atlas, and causing the transverse ligament to give way, when almost instantaneous fatal results follow; or at the root of the odontoid process, in which case the individual, it would appear from the cases on record, enjoys a precarious existence for some time. When dislocations with fracture happen above the third cervical vertebra, this accident is also almost immediately fatal; this is ascribed to the origin of the phrenic nerves being implicated by the accident. Fractures, with dislocation lower down in the column, are not so immediately fatal, but life is often prolonged for a considerable period. The severity of the symptoms following dislocation with

fracture in various parts of the spine, is pretty nearly in the ratio of their height, those nearest to the head being always most dangerous. The more ordinary symptoms of these accidents are loss of voluntary powers over the extremities, also loss of sensation at most points below the injury, retention of urine, erection of the penis, involuntary discharge of the feces, terminating at last in death, but not unfrequently after the expiry of a period extending to ten or twelve months.

168. *Dislocation of the Ribs*, most practical surgeons seem to think impossible, unless accompanied with fracture; the *luxation* of the rib being a mere consequence of the fracture. The portions of the sternum in young persons may suffer *displacement*.

169. *Dislocations of the Pelvis* have not been met with by practical surgeons without an accompanying fracture. The natural security given to the skeleton here is truly wonderful, as the application of great violence is necessary to the production of either fracture or dislocation. A person falling astride on a beam, Mr. Liston remarks, may produce partial diastasis of the symphisis pubis. We have had an opportunity of examining the pelvis of four females who had died during or soon after delivery. "In one female subject (we quote from notes taken at the time of dissection,) who died on the second day after delivery at the full term, we had an opportunity of verifying for the fourth time a fact we had previously noticed, viz. that in all those who die soon after delivery, the symphysis pubis is not only moveable, but the bones may be separated from each other to the extent of about half an inch. (Ambiguous) The sacro-iliac joints were also moveable in all. As it might be supposed (and some have said so,) that this moveable condition of these joints is rather a diseased condition, and not the usual state of the pelvis during and soon after delivery, we have to remark, that in none of these persons was the pelvis unusually small, neither was there the slightest appearance of disease in any of them. The measurements of the pelvis, in one case, were unusually large. From these considerations we feel disposed to think, that there occurs at every delivery a relaxation to a greater or less extent of the symphysis pubis, and likewise of the sacro-iliac joints."

170. In dislocation of the *Lower Jaw,* both condyles are most frequently dislodged. This can take place only in one direction, viz. forwards into the temporal fossa. The accident may occur from over opening of the jaws, or from powerful muscular action during depression of the lower jaw alone. The accident is recognised by the mouth remaining widely open, the chin being depressed downwards and backwards. The *partial luxation* of the lower jaw is distinguished by the chin being thrown to the opposite side of the luxation, and the incisive teeth are no longer in a line with the axis of the face. *Subluxation of the jaw* is not unfrequent in cases of great relaxation. In this case, the jaw passes in front of the inter articular cartilage, but is usually reduced without the aid of the surgeon.

171. The *Sternal End* of the *Clavicle,* notwithstanding its apparent mobility, is but rarely dislocated. When dislocation occurs, the extremity of the bone passes in front of the sternum, and is easily felt. The accident is generally produced by violence applied to the point of the shoulder; the anterior sterno-clavicular ligament, must either give way, or the end of the clavicle is pushed through it. The reduction is troublesome, and seldom satisfactory, generally leaving permanent deformity. The presence of the sterno-clavicular fibro-cartilage, and its very complex articular relations, may be sufficient to explain the difficulties which the surgeon encounters here in his practice. The *scapular extremity of the clavicle* is pretty frequently displaced. The extremity of the clavicle generally rises above the acromion and the ligaments injured are the superior acromio-clavicular, and in severe cases, the coraco-clavicular (conoid and trapezoid) ligament is torn, in which case the end of the clavicle not only rises, but projects, pushes out the deltoid muscle and produces flattening of the shoulder; the arm falls forward. The reduction is effected by raising the arm and carrying the scapula backwards. The cure is seldom or never complete, a slight projection of the clavicle always remaining, even in the most experienced hands.

172. In dislocations of the *Shoulder-Joint,* it is the head of the humerus which quits its situation, and the direction which it takes is most commonly *towards*

the axilla. The dislocation is in almost every instance produced by violence applied to the distal extremity of the humerus. The capsular ligament, and its synovial capsule, are lacerated; the long tendon of the biceps muscle must in all cases be very much stretched or torn. The mobility of the joint and apparent laxity of the capsular ligament, have led some surgeons to think that *dislocation* might occur without laceration of the ligament, but this idea must have arisen from circumscribed views, or a want of experience; the joint and its capsule is in truth only lax in the dead body, when all the capsular muscles have been removed. When dislocation has taken place, the shoulder is flattened, and a depression is evident under the acromion process. The elbow cannot be brought close to the side without great suffering to the patient.

173. Dislocation of the *Elbow Joint* is not uncommon, and owing to the number and extreme complexity of the articular surfaces and ligaments entering into the composition of this joint, it is perhaps the most trying and troublesome case which a surgeon can be called upon to treat. Great numbers of persons amongst the poorer classes are met with, who have received injury in this joint, and not being able to procure proper medical aid, carry about a dislocated and comparatively useless arm all their lives. The accident is most common in young persons, whilst in fact the bones are neither fully formed, and whilst all the extremities of the bones entering into the composition of the joint are in the state of epiphysis. The most common luxation is a displacement of the bones of the forearm *backwards*, usually tending slightly towards the ulnar side. The coronoid process places itself in the cavity for the reception of the olecranon, and the head of the radius places itself behind the external condyle of the humerus; the arm is shortened and remains in a slightly flexed state, between pronation and supination: all attempts at movement are extremely painful, and the slightest flexion is impossible. Great swelling rapidly takes place after the accident, and now the surgeon's knowledge of anatomy is put fairly to the test. Delays here are not to be allowed, as the parts very rapidly accommodate themselves to their new situation. The ligaments most materially injured, will be the *anterior* and

posterior, but these are thin and very loose, so that these and the muscles, particularly the biceps and brachialis, will be either very much stretched or even torn. In *reducing* this dislocation, extension must be made, and then the forearm bent, the surgeon at the same time placing his thumb on the anterior aspect of the extremity of the humerus, and his fingers posteriorly on the displaced extremity of the ulna thus pushing them into their proper position. In stout persons, the reduction may require considerable force, and the surgeon should in this case apply extension and counter-extension by placing the patient on his face on a couch, the surgeon then lays hold of the patient's wrist with both hands, and placing his heel against the axillary margin of the scapula acquires great power over the arm, and can *consequently* graduate that power to what extent he pleases.

174. The *Radius* alone may be dislocated, the displacement being *backwards* on the outer condyle. We have had an opportunity of examining a case of this kind of very long standing; the head of the radius rolled on the outer condyle, and projected under the integuments which were thin and much altered in texture. The bone was found on dissection to have made its way through the origin of the extensor muscles, and to be surrounded by a kind of aponeurotic ring of great strength; the head of the radius was much rounded off, and the articular surface of course completely changed, and the ligaments were changed evidently by inflammation and subsequent wasting, to such an extent as not to be made out. The whole arm and hand was evidently deformed in consequence of the accident, and presented the very characteristic twisted appearance mentioned by practical surgeons. The movements of the joint were free. The radius is sometimes displaced *forwards*, and the deformity is considerable when the arm is extended. The ligaments torn in a case of this kind must be numerous and important, particularly the annular ligament of the superior cubito-radial articulation; the anterior ligament of the elbow joint will also be partially lacerated. By observing the very evident, and we might almost say mechanical purpose of the annular ligament, the dissector will perceive the cause of the difficulty encountered in effecting a good cure in dislo-

cation here. We remember assisting Dr. Barclay in reducing a case of dislocation of the radius forwards, in a fine little boy of about seven or eight years old: the bone was replaced with great ease, and the patient gave it all manner of fair play afterwards, but notwithstanding he returned in about a week with the head of the radius as much displaced as ever; its reduction was again very easy, but it was now evident that it as readily quitted its proper position with the slightest movements of the arm.

175. The *Wrist Joint* is rarely *dislocated;* when it occurs, it would appear from the writings of practical surgeons, that they consider the bones of the forearm to be displaced, but we should consider that it must be those of the carpus which most generally suffer displacement. Thus, in falling on the hand, the carpus will be driven up either before or behind the extremities of the radius and ulna, but in accidents of this kind, the bones of the carpus themselves are commonly fractured. A sudden wrench may throw the carpus behind the radius, when the extremity of the radius will be most readily felt riding over the upper and extensor aspect of the carpus, and will thus appear the displaced bone. The ligaments lacerated will be the anterior and posterior *radio*-carpal, and in all probability the external lateral ligament. When the accident occurs in consequence of a fall on the palm of the hand, both bones of the forearm project on the extensor side, whilst those of the carpus will be found under the flexor tendons. The reduction is easy, but the treatment is not so. Extensive laceration of ligaments, and even tendons, must have preceded the displacement of the bones. Violent inflammation is sure to supervene, and the treatment will more resemble that required for fracture than simple dislocation. We have seen the extremity removed in a compound dislocation of this sort, where the vessels and nerves had suffered very slightly, and certainly did not necessitate amputation, and the case will in all probability be brought before a *Jury*, although for ourselves we know of only two or three practical surgeons in Britain who could give any thing like a sound judgment in the case.

176. The *Carpal* bones, notwithstanding their admirable form and arrangement, are sometimes displaced.

The displacement is generally toward the back of the hand, and the displaced bone is generally quite loose and moveable; extensive laceration of the ligaments, which are short and powerful, must have taken place, and although the bone is in general easily replaced, yet displacement sooner or later again takes place. The metacarpal bones have not been observed to be liable to simple dislocation.

177. The *Fingers* are sometimes dislocated. The proximal and distal phalanges are the bones most commonly displaced; their extremities resting on the dorsal extremities of the corresponding bone. There is really no posterior ligament in these joints, and the displacement therefore lacerates few parts. The *reduction* is easily effected by extension and coaptation.

178. The *Thumb,* however, is liable to a variety of dislocations, and they have given rise to a deal of argument amongst surgeons. Their treatment is in truth, difficult, and the thumb is of great importance to the individual, very slight displacement rendering the whole hand comparatively useless. In cases of dislocation, the base of the proximal phalanx is thrown backwards upon the distal extremity of the metacarpal bone; the thumb is shortened, deformed, and almost immoveable. The base of the bone, (there being no ligament to oppose its passage backwards,) gets displaced, and the lateral ligaments (which are strong,) are thrown into a state of complete tension; and cases have occurred where it has been deemed advisable to divide the external of the lateral ligaments. The joint was by this means preserved, and no deformity followed. The carpo-metacarpal articulation of the thumb has also been seen dislocated; in these cases the metacarpal bone is the one displaced, being thrown inwards towards the palmar aspect, between the trapezium and root of the metacarpal bone supporting the forefinger.

179. In dislocation of the *Hip-Joint* (*Coxo-Femoral Articulation*); it is the head of the femur which suffers displacement, and this may take place in four different directions. 1st, *Upwards* and *backwards*, the head of the femur lies on the dorsum of the ilium; the limb is shortened from one to two and a half inches, the toes are turned in, the thigh is slightly bent upon the pelvis, and firmly fixed; the capsular ligament and synovial

capsule will be lacerated, and the inter-articular ligament (*ligamentum teres*) will have been torn across. 2d, Displacement *forwards ;* the head of the femur rests on the body of the pubis; the ligamentous and synovial capsules will be lacerated, but the inter-articular ligament may escape unless the displacement is great; the limb in this case is not much shortened, and the toes are everted or turned outwards; the head of the femur may be seen and felt prominent in the groin; the injury is attended with much distress, a paralysis of the limb sometimes supervening; the femoral vessels and nerves are stretched over the head of the femur. 3d, Displacement *downwards ;* the head of the femur gets upon the obturator membrane; the ligamentous and synovial capsules will of course be lacerated, but the inter-articular ligament may escape; the limb is elongated considerably, and advanced outwards; the trochanter major is depressed, and the whole extremity immoveably fixed. 4th, Displacement *backwards ;* the head of the femur gets into the greater sciatic notch; the ligamentous and synovial capsules will be extensively lacerated, and the inter-articular ligament will in all probability be also torn across; the limb is slightly shortened, and the toes are turned inwards in a very remarkable manner. *Morbus coxarius* and simple fractures of the neck of the femur and trochanter often give rise to very similar symptoms and displacement, so that the anatomical knowledge of the surgeon is often put to the test in cases of this kind. Sir A. Cooper remarks that it is scarcely possible to mistake between the effects of disease and accident, as the *history* of the case will at once point out its nature. We ask who ever received a correct history of morbus coxarius from their patient?

180. The *Knee-Joint* (*Femoro-tibial articulation*) Sir A. Cooper states, can be dislocated in four directions, two of these are incomplete and *lateral*, the others are perfect luxations, the tibia being displaced *backwards* or *forwards*. In dissecting the ligaments of the knee-joint, the student will find that the osseous articular surfaces are kept very closely together by means of the ligaments, and unless in very relaxed habits, can scarcely admit of dislocation without such extensive accompanying injury as to render the joint ever after

useless. Mr. Liston states accidents of this kind to be of rare occurrence, and when they do happen, as sooner or later requiring amputation in consequence of the great laceration and injuries necessarily accompanying the displacement. *Sublaxation* arising from laceration of the internal lateral ligament is not unfrequent; it occurs mostly in females, and is easily reduced, but requires an apparatus to be worn by the individual for the subsequent support of the limb. It will of course be the tibia which will suffer displacement in all these cases. The patella may be dislocated *laterally*. This may occur without laceration of any ligaments, and is readily recognised and easily reduced. A peculiar laxity of the entire apparatus about the knee-joint sometimes exists, and requires the support of a well-fitted knee-cap.

181. The *Ankle Joint* (*Tibia-Tarsal Articulation*) is so constructed as to render simple dislocation *without* fracture nearly impossible.* *Subluxation* or sprain not unfrequently happens; the foot may be luxated *forwards* or *backwards*, and even here, if the displacement is great, one or other of the malleoli will be found fractured. The *Tarsal bones* may be displaced; the astragalus is sometimes pushed completely out of its situation, passing either to the *dorsum* of the foot or *backwards;* although the ligaments torn and injury done to the whole apparatus of the joint must be very great, yet we cannot agree with those surgeons who propose the immediate removal of the displaced bone. Mr. Liston does not approve of the removal of the bone, and we ourselves have seen a case where the astragalus had been displaced forwards, and thrown on the dorsum of the foot, in which, although the deformity was permanent it was not great, and the use of the limb was scarcely if at all interfered with: the individual was in the habit of performing very long pedestrian excursions. Mr. Liston records a case where the astragalus was thrown *backwards*, in which he allowed the bone to remain, having in vain attempted its reduction, and the limb in a few months was as useful as ever, little deformity resulting from the accident.

182. The articulations of the foot are seldom *dislocated* by accident; but we think *subluxation* and con-

* The bone usually fractured is the fibula, about two inches above the joint.

siderable *displacement* is often produced by ill-made shoes, particularly in the *first* metatarso-phalangeal articulation, or that of the great toe. The toe is turned outwards, either above the second toe or below it, and the rounded distal extremity of the first metatarsal bone projects (though not the bone actually displaced) to a greater or less degree, causing in some cases very great deformity; and we suspect, in consequence of an erroneous diagnosis, leading to a very great deal of bad surgery.

183. We cannot conclude our very imperfect observations on *dislocations*, without extracting a single remark or two from the splendid Treatise on the subject by Sir Astley Cooper. Sir Astley defines a *simple* dislocation to be "a displacement of the articulatory portion of a bone from the surface on which it was naturally received." A *compound* dislocation "is that in which not only the articulatory surfaces of a bone are displaced, but also in which the cavity of the joint is laid open, by a division of the skin, the ligament, and the synovial membrane." A considerable share of anatomical knowledge (Sir Astley further remarks,) "is required to detect the nature of these accidents, as well as to suggest the best means of reduction; and it is much to be lamented that students neglect to inform themselves sufficiently of the structure of the joints. They often dissect the muscles of a limb minutely, and then throw it away, without an examination of the ligaments, a knowledge of which, in a surgical point of view, is of infinitely greater importance; and from hence arise the errors of which they are guilty, when they embark in the practice of their profession. Even our hospital surgeons, mistake these accidents, for I have known the pullies applied to an hospital patient, in a case of a fracture of the neck of the thigh bone, which had been mistaken for a dislocation. It is therefore proper that the form of the extremities of the bones, their mode of articulation, the ligaments by which they are connected, and the direction in which their most powerful muscles act, should be well understood." These opinions were recorded in 1822, and we are sorry to add, that the records of surgery prove their reprint in 1837 most essential.

PART III.

DISSECTION OF THE MUSCLES OF THE BACK.

184. The dissection of the muscular system should almost uniformly be commenced on the back. The subject being placed on its face, a block of moderate height under the centre of the thorax, and a second under the abdomen, the students engaged in this dissection (generally three on each side) should make an incision through the integuments commencing at the external occipital protuberance, and terminating at the lower end of the sacrum; from this long incision carry one out laterally from the external occipital protuberance to the back of the external ear; a second from about the first dorsal vertebra to the acromion scapulæ; a third across the trunk, commencing about the ninth or tenth rib; and a fourth from the termination of the long incision at the bottom of the sacrum, around the crest of the ileum as far as nearly to its superior and anterior spinous process; these incisions should merely traverse the integuments, and that made across the occipital bone must be made with much caution.

185. The whole region may be subdivided into three parts—its cervical, dorsal, and lumbar portions; accordingly the students dissecting the head and neck, the upper extremity and the abdomen, will all have a share in this dissection, and they ought mutually to assist and examine each other's dissections, since nearly all the muscles run from one region to another, so that a part belongs to one and a part to another.

186. The student's next care is to carry the incision at one or two points through the subcutaneous cellular membrane, until he sees the muscular fibres, and proceed then to clean the muscles in the usual way, by raising the flaps upwards and downwards; this will expose the trapezius and latissimus dorsi muscles. Previous to examining the descriptive anatomy of these muscles, the following points merit attention. The integuments of the back are much denser than over most parts of the body, and this is not peculiar to man, but common to him with most animals. In the neck may be observed a pretty strong ligament (*ligamentum nuchæ*), extending mesially from the external occipital protuberance to the last cervical and first dorsal vertebræ. Of this ligament the student at first sees merely the external posterior margin, for it extends quite down to the spinous processes, to most of which it is attached. It thus forms a septum or division in the neck, between the muscles of the right and left sides, separating them from each other, and affording them some points for their origin or attachment. It also supports the head, and is of great strength in many of the lower animals, passing down the spine as far as the lumbar region, and is then called the *pax-wax*. It is not included in our description of the proper ligaments, but seems to us to be continued down the spinal column, under the name of *supra-spinal ligament*. 2*d*, From the fifth cervical to the fifth dorsal vertebræ, the tendinous origin of the trapezii are broad, and present an oval figure, to which the very improper name of *cervical aponeurosis* has been given. It is merely a portion of the tendinous origins of the trapezii. In the loins a broad and flat tendinous surface will be observed, which is usually called the *lumbar fascia;* but as the superficial lamina of this lumbar fascia is really nothing more than the tendon of the latissimus dorsi muscle, the student will find it described along with that muscle. During the dissection of the trapezius and latissimus dorsi muscles, the dissector will generally expose the following parts:—First, in the cervical region, the superior portion of the sterno-mastoid muscle; second, in the dorsal region the base of the scapula, a small part of the rhomboideus major muscle, two or three tendons of

the sacro-lumbalis, a portion of the vertebral aponeurosis; and, lastly, a triangular space mesial to the base of the scapula, below the rhomboideus and trapezius, and above the margin of the latissimus dorsi, in which space he will find portions of the seventh, eighth, and ninth ribs, and of their corresponding intercostal muscles, covered only by the integuments and subcutaneous cellullar substance; this exposed space may be enlarged by throwing the arms forward across the chest, and diminished by the opposite action of bringing the scapulæ together, towards the spine; third, in the lumbar region there will be exposed the back part of the obliquus abdominis externus muscle.

187. TRAPEZIUS, thin, triangular, situated at the posterior part of the neck and back, and at the upper part of the shoulder; the base of the triangle is towards the spine, the apex towards the shoulder. It arises from the inner third of the upper curved line of the occipital bone, from the whole length of the ligamentum nuchæ, the spinous processes of the seventh cervical and all the dorsal vertebræ, as well as from the supra spinal ligaments by which they are connected. All these origins take place by aponeuroses; that from the occipital bone presents a thin and broad aponeurosis, the fibres of which are frequently more than an inch in length; along the ligamentum nuchæ the fibres of these aponeuroses are short, but from the sixth cervical to the third dorsal vertebra inclusive, they acquire considerable size, and form a membrane which represents the half of an ellipse; they then shorten again, to be elongated a second time at the lower part of the back. The fleshy fibres succeed these aponeuroses; those which come from the occipital bone and ligamentum nuchæ, descend obliquely outwards and forwards, turn upon themselves, and terminate at the outer third of the posterior edge of the clavicle; those which arise from the last cervical vertebra and the upper dorsal are shorter than the others, and proceed horizontally outwards, to be attached to the acromion, the acromio-clavicular ligament, and the spine of the scapula, by strong aponeurotic fibres; all the others, which are the more oblique the lower they are, ascend outwards toward the inner extremity of the

spine of the scapula, and there degenerate into a triangular aponeurosis, whose summit is attached to a small tuberosity; this aponeurosis slides, with the assistance of a very loose cellular tissue, over a smooth surface, pointed out in our description of the scapula. This muscle is covered by the skin, from which it is separated by a cellular tissue containing little fat, and denser above than below: it covers, at its upper part, the complexus muscle; farther down, the splenius, levator anguli scapulæ, and serratus posticus superior; and at its lower part, the supra-spinatus, infra-spinatus, rhomboideus, latissimus dorsi, sacro-lumbalis and longissimus dorsi muscles, and the inner extremity of the spine of the scapula. When the whole of the trapezius contracts at once, it carries the shoulder and clavicle backwards; its upper fibres elevate the tip of the shoulder directly, the lower indirectly; when both trapezii act together, the two scapulæ are brought nearer each other, and carried backwards; when the shoulder is fixed, it extends the head, and inclines it laterally.

188. Latissimus Dorsi, broad, thin, and irregularly quadrilateral, situated upon the posterior, lateral, and inferior region of the trunk, extending from the lower part of the back to the arm, passing over the inferior angle of the scapula, and the posterior part of the axilla. The greater part of its fleshy fibres are inserted along the outer edge of the lumbar facia, which is contracted at its upper part, but very broad below, where it is incorporated with that of the serratus posticus inferior, and the obliquus internus abdominis. This aponeurosis, which is formed of fibres interlaced in all directions below, and following the direction of the fleshy fibres above, arises from the last five, six, seven, or eight spinous processes of the back, from all those of the loins and sacrum, from the asperities of the sacral grooves, and from the posterior part of the iliac crest, and iliac protuberance, where it is continuous with aponeurotic fibres of the glutæus maximus and sacro-lumbalis.* The

* Many anatomists, and we are of the number, prefer viewing the superficial layer of the lumbar facia, as seen on removing the integuments, simply as the tendon of the latissimus dorsi muscle, and in that case we describe it as arising from the same origins as

other fleshy fibres of the latissimus dorsi come from the outer surface of the last three or four ribs by digitations, at first aponeurotic, which are laid the one over the other so as to present an imbricated appearance from above downwards, and which are interlaced with digitations of the obliquus externus abdominis, with which they form a pretty acute angle. After thus commencing, the fibres of the muscle, which are so much the shorter and less oblique the higher they are, converge and proceed to the lower angle of the scapula, where the muscle presents little breadth, but much thickness, and often receives a small fleshy bundle from the scapula; then contracting considerably, it continues its progress upwards and outwards, at first applied upon the teres major, it afterwards turns round it, so as to be nearly covered in its turn by that muscle. Near its attachment to the humerus, the fleshy fibres of the latissimus dorsi give rise to a tendon about three inches long and an inch broad, which crossing the direction of the teres major, is at first contiguous with that tendon, separated from it only by cellular tissue, and afterwards by a small synovial capsule, it generally unites with it at last, to be inserted at the same time into the posterior lip of the bicipital groove. An aponeurotic band about two lines broad, descends from the small tuberosity of the humerus to these tendons, which send out from their lower edge another fibrous expansion which throws itself into the brachial aponeurosis, and some bundles which line the bicipital groove in conjunction with the tendon of the pectoralis major. This muscle is everywhere covered by the integuments, excepting at its upper and inner part, where the trapezius overlaps it. The muscle itself covers the oblique muscles of the abdomen, the serratus posticus inferior, sacro-spinalis, levatores costarum, the inferior intercostal muscles, the serratus magnus, rhomboideus, teres major, infra-spinatus, the lower ribs, and the inferior

we have now given to the facia. The only difficulty encountered in taking this view, is, that the tendinous origin of the serratus posticus inferior, and one lamina of the transversus abdominis will be found inseparably connected to it; and thus we have to speak of it as being composed in a great part of *three* laminæ.

angle of the scapula. The *anterior surface* of its tendon, united with that of the teres major, is in connexion with the axillary vessels, the brachial plexus, and the coraco-brachialis. The *posterior* is contiguous to the upper and inner part of the humerus, where a thin synovial capsule facilitates its motions. The latissimus dorsi carries the arm backwards by lowering it, and making it turn upon its axis from without inwards. It also draws the tip of the shoulder backwards and downwards. It applies the inferior angle of the scapula against the thorax, and brings the arm strongly against the walls of that cavity when it acts simultaneously with the pectoralis major. When a person is suspended by the hands, and an effort is made to raise himself, it pulls the trunk upon the arms. By taking its fixed point upon the humerus, it can also raise the ribs to which it is attached, and thus become a muscle of inspiration.

189. Let the student next cut through the trapezius, commencing at its lower margin, and opposite to the angle of the scapula; let him carry this incision to the spine, and then upwards to the occipital bone, taking care to clean the rhomboideus major and minor as the trapezius is being removed, otherwise it cannot be done well, the cellular membrane investing these muscles being very delicate. Some, however, prefer cutting the trapezius directly across the middle, at about the distance of an inch and half, or two inches from the spine, leaving a small part of its exterior margin; this may afterwards be found of use in studying the surgical anatomy of the neck. The latissimus dorsi should be cut where it lies over the more prominent part of the ribs. A very extensive dissection follows the raising of these two muscles.

190. Rhomboideus, (*major and minor*,) broad, flat, nearly square, occupying the upper part of the back and lower part of the neck. It is divided by a cellular line into two portions, which have been considered as distinct muscles; of these, the upper is smaller, the lower larger. It arises by aponeurotic fibres, longer below than above, from the lower part of the ligamentum nuchæ, the spinous process of the last cervical, and the first four or five dorsal vertebræ, and from the corresponding supra-spinal ligaments. The

fleshy fibres, which are all parallel, descend a little outwards, to the spinal edge of the scapula, where they are attached superiorly and inferiorly; but in the middle, they are inserted along an aponeurotic arch, vertical and parallel to the edge of the scapula, with which it is only connected by its two extremities, being separated from it in the rest of its extent by cellular tissue traversed by vessels. The *posterior surface* of the rhomboideus is in a great part covered by the trapezius; inferiorly it is covered by the latissimus dorsi, and between these two muscles, is in contact with the skin. The *anterior surface* covers the serratus posticus superior, the splenius, sacro-spinalis, and part of the intercostales externi; it is also applied over some of the ribs. Its *upper edge* is covered, in nearly its whole extent, by the levator anguli scapulæ. The rhomboideus in action brings the scapula toward the trunk, and in this way the rhomboid muscles of the opposite sides draw the shoulders forcibly towards each other; it also lowers the tip of the shoulder, by bringing the lower angle of the scapula toward the vertebral column. These muscles may now be detached from the spine and ligamentum nuchæ: great caution must be here used, otherwise the dissector will most certainly also raise a muscle which lies below it, viz. the serratus posticus superior.

191. Levator Anguli Scapulæ, long and thick, situated at the lateral and posterior part of the neck. It is attached to the posterior tubercles of the transverse processes of the first three, four, or five cervical vertebræ, by as many small tendons, frequently united with the splenius and scalenus posticus. Each of these tendons gives rise to a fleshy bundle; that of the atlas is the longest and thickest; the others become more slender as they are more inferior. They are at first isolated, but unite below into a single bundle, which descends obliquely backward and outwards, to be inserted by short tendinous fibres, into the posterior angle of the scapula, and the inner part of its upper edge. Its *outer surface* is covered at its upper part by the sterno-cleido-mastoideus, in the middle by the skin, and below by the trapezius. The *inner* is applied upon the serratus posticus superior, sacro-lumbalis, transver-

salis colli and splenius. Its *posterior edge* covers a portion of the upper edge of the rhomboideus. This muscle in action raises the posterior angle of the scapula, at the same time depressing the shoulder. When it acts in concert with the trapezius, the shoulder is directly raised. It may also incline the neck to its side, or fix it in the erect position, when it acts in conjunction with its fellow.

192. SERRATUS POSTICUS SUPERIOR of an irregularly quadrilateral form, flat and very thin. It is attached to the lower part of the ligamentum nuchæ, to the spinous processes of the last cervical, and two or three of the upper dorsal vertebræ, by a very delicate aponeurosis, extending to the half of its length. The fibres of this aponeurosis are parallel and directed obliquely from above downwards, and from within outwards; the fleshy fibres follow the same direction, and separate into four or five digitations, which are attached to the outer surface and upper edge of the second, third, fourth, and fifth ribs, outside their angles. The *posterior surface* of this muscle is in connexion with the rhomboideus, angularis scapulæ, serratus magnus and trapezius. The *anterior* is applied upon the splenius, longissimus dorsi, transversalis colli, sacro-lumbalis, the ribs and external intercostal muscles. It raises the ribs to which it is attached, and is consequently subservient to inspiration. It also keeps down in some measure the vertebral muscles over which it passes.

193. SERRATUS POSTICUS INFERIOR. This muscle is exposed by reflecting the inferior segment of the latissimus dorsi towards the spine. It is broader but equally thin, and has nearly the same form as the serratus posticus superior. It is situated at the lower part of the back, and in the lumbar region. Arising from the last two spinous processes of the back, and the first three of the loins, as well as from the corresponding supra spinal ligament, by a broad aponeurosis, with parallel fibres directed obliquely upwards and outwards, which is intimately connected with that of the latissimus dorsi or fascia lumborum; it divides, after a short passage, into four or five distinct muscular bundles. The first, which is broad, is attached to the outer lip of the lower edge of the second floating rib, over an extent of four or five

inches, and by its lower border covers the upper edge of the third. The other three, which become successively narrower and shorter, are attached in the same manner; but are directed upon the ribs farther from the angle than the first, so that the fourth is attached not only to the bony part, but also to the cartilage, of the last rib. Their edges also overlap each other, presenting (to use a botanical phrase) the appearance of *imbrication*. The *superior surface* is covered by the latissimus dorsi. The *anterior* rests upon the three last ribs, the corresponding external intercostal muscles, and posterior lamina of the aponeurosis of the transversalis abdominis, which separates it from the sacro-lumbalis, longissimus dorsi and transverse spinal muscles. The muscle in action lowers these ribs to which it is attached, and thus contributes to increase the capacity of the chest.

194. Vertebral Aponeurosis connects the inferior margin of the serratus superior with the upper margin of the serratus inferior. This aponeurosis varies much in strength, and sometimes resembles a continuation of the muscles themselves, composed however merely of aponeurotic fibres. It extends laterally from the spinous processes of the vertebræ to the angles of the ribs, and thus binds down the great erector muscles of the spine.

195. Splenius (*Musculi Splenius Capitis, et Splenius Colli.*) This muscle is exposed by reflecting towards the shoulder the whole of the trapezius and that portion of the sterno-mastoid which is attached to the superior curved line of the occipital bone. The dissector must be careful here not to encroach too much on the lateral aspects of the neck, otherwise the important dissection of the anterior aspect of this region will be destroyed. The *splenius* is an elongated, flat, but thick muscle, broader above than below, situated obliquely at the back of the neck and upper part of the back. It arises by aponeurotic fibres, which are longer below than above, from the spinous processes of the first five or six dorsal vertebræ, from their interspinal ligaments, from the spinous process of the last cervical vertebra, and from the ligamentum nuchæ as far as the third cervical vertebra. From these different points of attachment, the fleshy fibres arise, which form a bundle whose thickness and breadth conti-

nue to increase as it recedes from them. It ascends outwards, leaving between it and its fellow a triangular interval, in which the complexus is seen. At the middle part of the neck, it separates into two portions. The lower and outer of these, (*splenius cervicis,*) is narrower, and is itself divided into three small bundles, which are attached by an equal number of thin and slender tendons, longer internally than externally, to the transverse processes of the three upper cervical vertebræ. The other portion, which is superior and internal, is called the *splenius capitis ;* it is larger, continues to ascend, and terminates, by short aponeurotic fibres, at the outer half of the rough impression between the two curved lines of the occipital bone, at the mastoid portion, and the whole outer edge of the mastoid process of the temporal bone, below the insertion of the sterno-cleido-mastoideus. The *posterior surface* of the splenius is covered above by the sterno-cleido-mastoideus; in the middle by the trapezius and levator anguli scapulæ; below, by the serratus posticus superior, and rhomboideus. The *anterior surface* lies upon the complexus, longissimus dorsi, trachelo-mastoideus and transversalis colli. In action it extends the head, inclining it laterally, and if only one muscle acts, say the right, it will turn the face to the right shoulder. When the two muscles act together, they extend the head directly.

196. The muscles filling the vertebral grooves may now be examined : the various accounts of them given by a variety of anatomists, from Winslow to Portal, and even later, have greatly tended to confuse this part of the subject, so that there are few anatomists who can describe them, and very few surgeons who understand them : this ignorance has greatly influenced the surgical treatment of spinal disease, and spinal curvature, reducing it throughout the kingdom to the most deplorable empiricism. The student will do well not to neglect these muscles; upon a good anatomical basis he can alone found a correct physiology, and this again is the only secure basis for the practice of physic and surgery. The splenius will be best raised by cutting across its spinal attachments, and reflecting it outwards. In the lumbar region the broad lumbar facia will be divided by a longitudinal incision carried within half an

inch of the mesial line. Reflect the outer part of this fascia fully, and now observe that it is really composed of *three layers* inseparably connected; the most superficial is the broad expanded tendon of the latissimus dorsi, next that of the serratus posticus inferior; and, lastly, the posterior of three divisions, into which the posterior tendon of the transversus abdominis muscle divides on the external margins of the sacro-lumbalis and quadratus lumborum muscles. The muscles thus exposed extending throughout the entire length of the spine, may be considered as the third layer found on the dorsal aspect of the body. A quantity of very delicate cellular substance, with numerous vessels and nerves, must be dissected from off the muscles, and the whole range viewed as composed of three great divisions, viz. a lumbo-sacral, a dorsal, and a cervical. The spinous processes of the vertebræ and ligamentum nuchæ occupying the mesial line, divides the right from the left side. The dissector will first examine the lumbar portion. He will first observe the common origin of the *sacro-lumbalis* and *longissimus dorsi muscles.* They are inseparably united with each other as high as opposite to the last rib, and they are also united close to the spine, but towards the upper part of the lumbar region, to the *spinalis dorsi*, which muscle we shall describe afterwards. Tracing the sacro-lumbalis (the more external of these muscles) upwards, to about the middle of the dorsal region, the student must next separate it cautiously and carefully from the longissimus dorsi, and on its inner side that is nearest to the longissimus dorsi, he will find a series of small muscles running in the opposite direction, but firmly attached to the sacro-lumbalis; these are the *musculi accessorii.* Still higher up in the neck and upper part of the thorax, the student will find on the inner side of the upper part of the sacro-lumbalis, another muscle strictly analagous to the musculi accessorii; this is the *cervicalis descendens.* The student should view all these muscles, viz. the sacro-lumbalis, musculi accessorii, and cervicalis ascendens or descendens, merely as one and the same set of muscles. Their origins, course, and termination are as follows.

197. SACRO-LUMBALIS arising in common with the

longissimis dorsi by a broad, strong, dense, and thick aponeurosis of a white and glistening appearance, formed of fibres interlaced and separated from space to space by openings traversed by nerves and blood-vessels. (Mr. Cloquet includes in the origin of the sacro-lumbalis the large fleshy mass lying beneath this aponeurosis, but we do not think this a judicious mode of viewing these muscles; these fibres run in a different direction, and more properly belong to another muscle.) This aponeurosis is attached to the posterior part of the iliac crest, the sides of the notch which terminates the sacral canal, the whole middle ridge of the sacrum, and to the spinous processes of the lumbar vertebræ, more particularly the three inferior ones. From this aponeurosis, both from its superior and deeper surface there arises a fleshy mass, which afterwards divides into the sacro-lumbalis and longissimis dorsi, properly so called. This separation takes place nearly opposite to the last rib; the fleshy fibres constituting the sacro-lumbalis proceed upwards nearly vertically, but a little outwards, and terminate by twelve flat tendons, which are inserted below the angles of the ribs. (Mr. Cloquet thinks that the superior five tendons belong to the musculi accessori and cervicalis descendens; this is not a very practical way of viewing the muscle, and moreover we think it to a certain extent incorrect.) These tendons, by being connected to each other, constitute superiorly a thin tendinous aponeurosis. Tracing the inside of the muscle into the cervical region, the student will find the *cervicalis ascendens* or *descendens*, arising as it were by tendons from the transverse processes of four or five of the inferior cervical vertebræ; these tendons form a series of fleshy bundles seen on the inside of the sacro-lumbalis, which descending through the thoracic portion terminate in a series of five tendons, inserted into seven or eight of the ribs, above the angles. These fleshy bundles, described by the older anatomists by the names of *musculi accessorii* and *cervicalis descendens*, are the means by which the sacro-lumbalis is continued upwards into the dorsal and cervical regions.

198. LONGISSIMUS DORSI and TRANSVERSUS COLLI. These muscles should be examined together. On the

back of the sacrum, the longissimus dorsi, like the sacro-lumbalis, is tendinous; in fact they have a common origin, which has been already described. The longissimus dorsi, being set free from the sacro-lumbalis opposite to the last rib, proceeds nearly vertically upwards between the sacro-lumbalis and spinalis dorsi, elongated, flattened, very thick and square behind, but slender and pointed above. It divides, as it ascends, into a great number of fleshy tongues terminating in tendons; these form two distinct rows, one external on the side of the sacro-lumbalis, the other internally along the edge of the spinalis dorsi. The innermost tendons are twelve in number, and are attached to the transverse processes of the dorsal vertebræ; the outermost tendons vary in number, being seven, eight, or more; they are attached to the ribs between the tubercles and angles. Having examined this muscle, the student should proceed directly to the dissection of the *transversus colli*, which lies upon its inner and upper part, and has the same relation to it that the cervicalis descendens has to the sacro-lumbalis.

199. TRANSVERSALIS COLLI lies on the inner side of the longissimus dorsi, and arises by six small tendons from the transverse processes of the 3d, 4th, 5th, 6th, 7th, and 8th dorsal vertebræ, and terminates by tendons, which are attached to the posterior tubercles of the 2d, 3d, 4th, 5th, and sometimes 6th of the cervical vertebræ. This muscle is flat and thin; internal to it are placed the *semi-spinalis colli*, *complexus* and *trachelo mastoideus*, with which muscle it is frequently most intimately united, and hence the difficulty the student has in clearly dissecting and understanding these muscles. The uses of the sacro-lumbalis and longissimus dorsi are to prevent the vertebral column from yielding to the weight of the organs placed before it; in other words, to erect or raise the trunk, and bend it backwards, when they act in conjunction with those of the opposite side. The uses of the *cervicalis descendens* and *transversalis colli* must be nearly similar, excepting in so far that the former is attached to the ribs, which it will necessarily occasionally act on; the latter extends the vertebræ of the neck, and inclines them to its own side, if acting singly.

200. The SPINALIS DORSI, internal to the *longissimus dorsi*, and close to the spine, arises by three or more tendons from the spinous processes of the dorsal vertebræ from the second or third downwards; inserted by two or three tendons to the spinous processes of the uppermost lumbar vertebræ. The inferior margin of these tendons is generally inseparably united with the common tendinous origin of the longissimus dorsi and sacrolumbalis. There are several circumstances in the history of this muscle which anatomical works have neglected to explain, and hence the difficulty experienced by the student in not merely understanding this muscle, but in the subsequent dissection of all which lie near or below it. 1° In aged persons the muscle seems mostly tendinous, and is so small, that it escapes notice altogether. 2° The lower part is, as has been mentioned, incorporated with the tendon of the longissimus dorsi; these tendons must be artificially separated with the knife. About the centre of the muscle there is a fleshy and tendinous slip sent from the longissimus dorsi to the spinalis dorsi so uniformly that it may be considered as a constant appearance; little or no notice is taken of this broad and fleshy slip by anatomical writers. The student, after examining it, should cut it through, and thus entirely separate these muscles from each other. The two following muscles lie beneath the splenius, but they must be examined now.

201. TRACHELO-MASTOIDEUS, situated external to the complexus, on the sides of the neck; long, slender, and flattened, arises from the last four transverse processes of the neck, and two or three of the back, by small tendons which vary much in size. Inserted behind the mastoid process of the temporal bone by a flat tendon. The muscle is frequently intersected by aponeuroses. Superiorly, it covers the posterior extremity of the digastricus and the occipital artery. It inclines the head a little without rotation, or reverses it slightly when both muscles act.

202. The COMPLEXUS, thick, elongated, situated under the splenius, but not entirely covered by it. It arises from the transverse and articular processes of the last four or five cervical, and from the transverse processes of the first four or five dorsal vertebræ, by as many small tendons whose fibres are strongly interlaced

with the fleshy fibres, and more distinct below than above. To all these tendons succeed the fleshy fibres, which, from being at first disposed in isolated fasciculi, are soon intimately incorporated. Those which come from the third, fourth, and fifth transverse processes of the back, form a separate band, which ascends obliquely inwards, and terminates anteriorly by a small tendon, broader at its extremities than in the middle, which occupies the middle third of the inner edge of the muscle, and sends from its upper part other fleshy fibres which ascend to the occipital bone. The fleshy fibres which proceed from the transverse processes of the neck and the two first of the back, ascend less obliquely, and have an aponeurotic intersection in the form of the letter V, more distinct internally than externally, and directed transversely, which occurs about the middle of the muscle and occupies its whole breadth. From the upper edge of this intersection proceed other fleshy fibres which ascend a little inwards, and are attached to the inner part of the impression which is observed between the two curved lines of the occipital bone, by aponeuroses prolonged very far among the fleshy fibres. The complexus, when both right and left act, draw the head forcibly backwards, but when only one acts, say the right, it will turn the face towards the left shoulder, and thus in rather an unexpected manner oppose the splenii muscles. The student should next cut across the complexus and reflect it, remove entirely the spinalis dorsi and longissimus dorsi.*

203. SEMI-SPINALIS COLLI, SEMI-SPINALIS DORSI, SEMI-SPINALIS LUMBORUM. These muscles are called in France the *transverse spinal muscles*. The cervical portion, which is very strong, (*semi-spinalis colli*), arises

* In removing the latter inferiorly, the knife must be carried cautiously through the strong tendinous origin connecting it to the spinous processes of the lumbar and sacral vertebræ. In doing this he will observe a powerful fleshy mass occupying the vertebral and sacral grooves which most anatomists have considered as a portion of the longissimus dorsi,—but this opinion is evidently erroneous; the muscular fibres we speak of are separated only, it is true, by cellular tissue from the strong tendon of the longissimus dorsi and sacro-lumbalis, but the muscular fibres run in a quite different direction, and evidently belong to the following system of muscles.

from the spinous processes of the second, third, fourth, and sometimes the fifth cervical vertebræ, and proceeding downwards and outwards, is attached to the transverse processes of the fifth or sixth superior dorsal vertebræ. The dorsal portion (*Semi-spinalis dorsi,*) arises from the spinous processes of the last two cervical vertebræ, and three or four of the uppermost dorsal, and descending obliquely outwards and downwards, is attached to the transverse processes of the sixth, seventh, eighth, ninth, and tenth dorsal vertebræ. The lumbar portion (*Semi-spinalis Lumborum*) arises from the spinous processes of most of the lumbar and sacral vertebræ, and descending obliquely, is inserted into the articular processes of the lumbar vertebræ, and into the tubercles of the sacrum which correspond to the articular processes; into the backmost part of the cresta ilii. This long chain of muscular fasciculi, occupies the vertebro-spinal grooves; strong in the neck, weak in the back, and very strong in the loins: their use is to support the vertebral column generally, and to impress on its separate portions minute actions or motions. Beneath them may no doubt be found a series of muscular fasciculi lying close to the vertebral laminæ, to which Steno and Winslow gave the names of *multifidus spinæ*, but it is now generally admitted, that these ought not to be described as separate muscles.

204. The Interspinales Cervicis are twelve in number, and occupy, in two parallel rows close to each other, the intervals between the spinous processes of the cervical vertebræ, from that of the second and third to that which exists between the last vertebræ of the neck and the first of the back. Each space contains two. They are so many thin, flat, quadrilateral fasciculi, arising, by short aponeuroses, from the sides of the lower edge of the spinous process of the vertebra above, and terminating in the same manner at the upper edge of the vertebra below.

205. The Inter-transversales Colli are small, quadrilateral, thin, flat bundles, placed two and two in the intervals of the transverse processes of the neck, excepting between the first and second, where there is only one. They are distinguished into anterior and posterior; the former are six in number, the latter five. The two muscles of each interval

are attached separately, the one to the anterior, the other to the posterior edge of the groove, which is observed on the transverse process below. They then ascend parallel to each other, and separated by the anterior branches of the cervical nerves, to be attached to the lower part of the transverse process above; these insertions take place by means of short aponeurotic fibres. The *anterior* inter-transversales colli are covered *anteriorly* by the rectus capitis anticus major. The *posterior* are covered *behind* by the splenius, transversalis colli, and sacro-lumbalis.

206. The Inter-transversalis Lumborum are all fleshy, and are ten in number, five on each side, resemble the preceding in their general disposition, only they are less distinct, and are not placed in two rows, each inter-transverse space containing only one. The first occupies the interval which exists between the transverse processes of the first lumbar, and the last dorsal vertebra: and the last occurs between those of the third and fifth lumbar vertebræ. Their *posterior surface* corresponds to the sacro-lumbalis; the *anterior* to the quadratus lumborum. Their *lower* and *upper* edges are attached to the corresponding edges of the neighbouring transverse processes, by means of very short aponeurotic fibres.

207. Rectus Capitus Posticus Major, situated behind the articulation of the head with the vertebral column; attached by short aponeuroses, above the obliquus capitus inferior, to the tubercle of the spinous process of the axis, whence it ascends outwards and a little backwards, to terminate in a radiating manner, under the inferior curved line of the occipital bone, between the rectus minor and obliquus superior.

208. Rectus Capitis Posticus Minor, situated before the rectus posticus major, and has nearly the same form, but is shorter; attached to the tubercle of the posterior arch of the atlas by a short tendon with radiating fibres, from whence it proceeds nearly in a vertical direction, becoming broader towards the occipital bone, where it is inserted into the impressions observed near its crest, and below its lower curved line, not far from the occipital hole.

209. Obliquus Capitis Inferior is the strongest of these small muscles, attached by indistinct aponeu-

rotic fibres to the tubercle of the spinous process of the axis near the rectus major; it then proceeds backwards, outwards and upwards, and is inserted to the lower and back part of the summit of the transverse process of the atlas, by means of aponeurotic fibres, which are also indistinct. It impresses a rotatory motion upon the first vertebra, which turns the face towards its own side.

210. Obliquus Capitis Superior is situated on the sides and behind the articulation of the head, and is an elongated and flat muscle, narrower below than above. It arises by a small tendon from the summit of the transverse process of the atlas, before the preceding, with which it is a little united. It then ascends backwards and inwards, becoming broader and arrives beneath the outer part of the superior curved line of the occipital bone, and sometimes at the mastoid process of the temporal, where it is fixed between the splenius and rectus capitus posticus major, by distinct aponeurotic fibres. Its *posterior surface*, which is inclined downwards, is covered by the complexus, the trachelo-mastoideus, and by the splenius. The *anterior* passes over the occipital bone, the vertebral artery, and the attachment of the rectus capitis posticus major.

211. The vessels and nerves which occur in the dissection of this extensive region are few and unimportant. In the cervical region, the student will find the posterior branches of the cervico-spinal nerves, the nervus-occipitalis magnus more especially, and a few branches of the spinal accessory supplying the trapezius muscle. In the dorsal part of the region, the posterior branches of the dorso-spinal nerves, and in the lumbar and sacral regions, the posterior branches of the corresponding nerves. The arteries and their corresponding veins differ, of course, in respect to the regions of the back in which they are examined. In the *neck*, the occipital artery and its branches, deep cervical, and some branches of the vertebral; in the *back*, the posterior branches of the intercostal arteries, and in the *loins*, of the lumbar arteries. The veins generally follow the course of the corresponding arteries. Beneath the rhomboid and levator anguli muscles, the student will find branches of the posterior scapular artery.

PART IV.

DISSECTION OF THE ARM, (THORACIC, PECTORAL, SUPERIOR, EXTREMITY.)

212. The ARMS are connected to the trunk mostly by means of muscles; the clavicle alone articulating with the sternum, and even this articulation is dispensed with in some of the largest animals, such as the horse and elephant, which have *no* clavicle. The advanced student will require to take a surgical view, not only of the neck, but of the axilla, and he therefore may commence his dissection on the anterior aspect of the body: but the beginner in anatomy has principally to do with the muscles, and we recommend him by all means to dissect first those on the back. Nine muscles connect each extremity to the trunk, of these, five, viz. trapezius, levator anguli, rhomboideus major and minor, and latissimus dorsi, are dissected on the back, and described in Part III. sec. 185, &c. To dissect the muscles proceeding from the anterior aspect of the trunk to the arm, the subject must be placed on its back, the shoulders raised by means of a narrow block of six or eight inches in depth, so that the arm may hang freely over the sides of the table, and the head at the same time be depressed. Extend the arm nearly at right angles with the body, and make an incision through the integuments in the mesial line the full length of the sternum—a second incision from the middle of this one, obliquely outwards, to the upper and fore part of the arm; two flaps are thus formed which must be dissected, the upper one from below upwards, and the lower from above downwards. The student will do well to make the incisions carefully: in dissecting of the upper flap of integuments, the lower fibres of the platysma myoides, or la-

tissimus colli, will be found embedded in the subcutaneous cellular substance immediately below the clavicle passing over the anterior surface of that bone, and descending a short way towards the breast and shoulder. This muscle will be described afterwards. In the hollow below the deltoides and pectoralis major muscle may be seen the upper or terminating portion of the cephalic vein; this vein should be cleaned and preserved in order to examine it afterwards with the veins of the arm. A little lower down, and met with in reflecting the lower flap of integuments, lies the *mammary gland* in the female; the male has merely a rudiment of this structure.

213. Mammary Gland. The skin covering the mammæ is smooth, soft, and semi-transparent; in the healthy state, no wrinkles or folds can be noticed in them. Towards the central part of each mamma, the skin abruptly changes its colour to a rosy tint in young girls, or a reddish brown one in women who have suckled several children. This circle, where the skin is remarkable for its extreme tenuity, presents a wrinkled appearance, owing to the presence of sebaceous glands, and is called the *areola* of the *nipple*. These glands, varying from four to ten, are disseminated over the whole areola, or form a regular circle near its circumference. They present near their summit, two, three, or four small apertures, the orifices of their excretory ducts. They furnish an unctuous fluid calculated to protect the nipple against the action of the saliva of the child. In the middle of the areola is the *nipple* (*papilla*), a conical eminence, of a rosy tint, susceptible of a kind of erection during life, and at the surface of which there open the lactiferous vessels. The skin which covers this nipple is wrinkled, reticulated, and furnished with a great number of fine papillæ. The orifices of the lactiferous ducts, which are observed at its surface, are surrounded by excessively minute hairs. The *mammary gland* lies in a layer of adipose tissue, before and near the inferior margin of the pectoralis major muscle, it is of an oval form, an irregularly circumscribed base, convex anteriorly, convex towards the chest; its anterior surface is uneven, and there are observed upon it prominences in the form of ridges more or less

voluminous, and depressions in which are lodged pellets of adipose cellular tissue. The tissue of the gland results from the assemblage of several lobes or lobules of different sizes, closely connected with each other by dense cellular membrane. These lobes are near each other, and more numerous towards the centre than at its circumference. Each of them is composed of several lobules, themselves formed of rounded granulations of a rosy white colour, and of the size of a poppy seed. The microscope, shews that these grains, themselves so small, are formed by the union of a number of small vesicles. These glandular grains rise to the radicles of the *lactiferous ducts*, which uniting, form twigs and trunks becoming gradually larger. They collect towards the centre of the gland; they are flexuous, very extensile and semitransparent. Those of the different lobes do not communicate with each other, so that there are as many series of vessels as lobes in the gland. They all terminate in *sinuses*, placed near the base of the nipple, which are commonly from fifteen to eighteen in number. These sinuses have not all the same capacity; the largest are two or three lines in breadth, while others are not much larger than the trunks which form them. They are short, of a conical form, and connected with each other by cellular tissue. From their summits proceeds a bundle of other canals which occupy the centre of the nipple, do not communicate together, and open separately at its surface. All these vessels are destitute of valves, and Bichat thought them lined by a particular mucous membrane. The arteries of the mammæ come from the thoracic, axillary, intercostal, and internal mammary. Their deep veins accompany the arteries; others are subcutaneous, and follow a different course. Their nerves are furnished by the intercostal nerves and brachial plexus. Their lymphatics are numerous, and form two layers; they communicate with those of the abdomen and thorax, and go to the axillary glands. The cellular tissue penetrating and enveloping the mammæ, becomes in most cases impregnated with fat, and increases the size of the organ very much. Having attentively observed the position of the mammæ, the dissector will clean the whole of the subjacent important muscle.

214. PECTORALIS MAJOR, large, flat, triangular, narrower and thicker externally than internally: situated at the fore part of the thorax, and before the axilla. It arises from the inner half of the clavicle, from the anterior surface of the sternum, the cartilages of the second, third, and fourth ribs, and over an extent so much the larger the lower these attachments are, from a small part of the bony portion of the fifth rib, and lastly, from an aponeurosis which forms a continuation of that of the abdomen. The clavicular attachment is by short aponeurotic fibres; but the sternal attachment presents long, thin, and loose radiating aponeurotic fibres, interlaced with those of the opposite muscle. *Inferiorly*, the insertions of the muscles are intermixed with the obliquus abdominis externus, and often with the rectus or its sheath. Succeeding these different aponeurotic attachments, the fleshy fibres approach each other, proceeding outwards, and following a different direction. Those of the clavicle, which are the shortest, are inclined downwards, forming a bundle, thick at its commencement, and separated from the rest of the muscle by a cellular line. The muscular fasciculi forming the middle division of the muscle are longer, and proceed horizontally, whilst the lower, which are the longest, proceed obliquely upwards, and approach the more to the vertical direction the lower they are. These fleshy fibres gradually converge toward each other, and the muscle becomes narrow and thick at its outer part, it becomes slightly twisted, and gives rise to a powerful tendon which is inserted into the humerus. This tendon is folded upon itself from before backwards, and from below upwards, and seems thus composed of two laminæ, placed one before the other, separated above, and united below. The posterior lamina is broad, receives the inferior fleshy fibres of the muscle, which cross the direction of the superior fibres. *Above*, it sends off an aponeurotic prolongation, which ascends before the bicipital groove of the humerus to unite, upon the larger tuberosity of that bone, with the tendon of the supraspinatus, and it sends into the same groove a fibrous lamina, continuous with that detached from the tendon of the teres major and latissimus dorsi. The two

laminæ of the tendon of the pectoralis major, are at first separated by cellular tissue, but afterwards intimately unite, and are inserted together into the anterior edge of the bicipital groove, sending off from their lower edge a considerable number of fibres to the brachial aponeurosis. The *anterior surface* of the pectoralis major is covered above by the platysma myoides, at the middle by the corresponding mamma, and inferiorly by the skin. Its *posterior surface* covers, from within outwards, a part of the anterior surface of the sternum, the cartilages of the ribs, and a part of their bony portion, the thoracic vessels and nerves, the subclavius, the pectoralis minor, inter-costales externi, serratus magnus, rectus abdominus, and obliquus abdominis muscles: toward the hollow of the axilla, this surface is in contact with a great quantity of adipose cellular tissue, with lymphatic glands, the axillary vessels, and the nerves of the brachial plexus: close to its insertion into the humerus, it passes before the coraco-brachialis and biceps. It is separated from all these parts by a layer of cellular tissue, which becomes so much the thicker the nearer it is to the axilla. The *inner edge* or origin of the pectoralis major is interlaced with that of the opposite muscle as far as the ensiform cartilage, and is then gradually lost in the linea alba of the abdomen. Its *upper edge* is contiguous externally with the deltoid muscle, from which it is separated by an interval broader above than below, and in which the cephalic vein and some branches of the acromial thoracic artery are lodged in the midst of cellular tissue. Lastly, its *inferior edge* which is free, is thin internally, much thicker externally and at the upper part, forming the anterior edge of the hollow of the axilla. The pectoralis major has two modes of action; it moves the arm, or assists in respiration by acting upon the ribs; when the arm is hanging by the side of the body, it carries it inwards and forwards; when it is raised, it lowers it; when in rotation outwards, it turns it inwards. Its clavicular portion entering into action by itself, slightly raises the humerus; the opposite effect is produced by its low fibres, which also depress the tip of the shoulder. On the other hand it acts upon the thorax, when the humerus is fixed; it then draws the ribs and sternum upwards, which renders it a muscle of inspiration. It even raises the trunk upon the limbs, as in the action of seizing the branches in climbing a tree, &c. Raise the pectoralis major by making a circular incision through the whole thickness of the muscle, at the distance of about an inch and a half from its clavicular and sternal organs; reflect the divided portions, and several parts will be brought into view.

215. PECTORALIS MINOR, thin, flat, triangular, attached by its base, which is directed inwards, to the upper edge and outer surface of the third, fourth and fifth ribs, by as many thin aponeurotic laminæ, continuous with the fibrous plane that covers the external intercostal muscles; the lowest of these digitations is also the largest. From these aponeuroses, the fleshy fibres ascend convergingly upwards and outwards, so that the muscle becomes gradually narrower at the same time that it increases in thickness. Towards the axilla, they form a tendon, attached to the anterior part of the inner edge of the coracoid process of the scapula as far as its summit, where it unites with the coraco-brachialis and biceps. The *anterior surface* of the pectoralis minor is generally entirely covered by the pectoralis major. Its *posterior surface* is applied upon the ribs, the external intercostal muscles, the serratus magnus, the axillary vessels, the brachial plexus, and several lymphatic glands. Its *upper edge* is shorter than the *lower*, which are both free margins. In action this muscle draws the shoulder forwards and downwards, and carries the lower angle of the scapula backwards. It may act upon the ribs in the same manner as the pectoralis major.

216. SUBCLAVIUS MUSCLE, round, slightly compressed from before backwards, slender at its extremities, which are tendinous, and bulging in the middle which is fleshy; it is concealed by the subclavian aponeurosis.* The muscle is extended obliquely at

* Some anatomists have viewed this texture as a ligament (Ligamentum Bicorne, Weitbrecht), coraco-clavicular, coraco-costal aponeurosis, &c. &c. It extends from the cartilage of the first rib outwards and upwards to the clavicle and coracoid process; its lower part is very strong, supporting the whole extremity after the clavicle, &c has been divided.

the upper and fore part of the thorax, between the cartilage of the first rib and the clavicle. It originates from the cartilage and sometimes even from the osseous part of the rib, before the costo-clavicular or rhomboid ligament, by a flat tendon, which, after being prolonged behind the fleshy body, loses itself in its interior. It then ascends obliquely outwards and backwards, and is lodged in the groove which is observed at the lower surface of the clavicle. It then terminates by aponeurotic fibres, which proceed outwards to the coraco-clavicular ligament, and frequently to the coracoid process itself. The *anterior surface* of the subclavius muscle is covered by the subclavian aponeuroses and pectoralis major. Its *posterior surface* is applied upon the axillary vessels and the nerves of the brachial plexus; it corresponds to a triangular space, circumscribed by the sterno-cleido-mastoideus and trapezius. Its *lower edge* is free, and separated from the first rib by the axillary vessels and brachial plexus, over which, together with the subclavian aponeuroses it forms an arch; the *upper* is fixed to the clavicle in its two outer thirds. In action the subclavius lowers and carries forward the clavicle; it can also raise the first rib.

217. Dissection of the AXILLA. The first year's student should not attempt any more minute dissection of the axilla than merely to examine the position of the great vessels and nerves, and get the demonstrator of the rooms to name them for him. When the arm is extended and drawn from the side previous to any dissection, the student will observe in the angle between them a conical cavity, named the axilla or arm-pit. The inferior rounded margins of the pectoral muscles and latissimus dorsi, as they proceed from the trunk to the humerus, may be felt forming its anterior and posterior boundaries; the serratus magnus and the ribs forming its inner boundary; its *apex* is above and opens into the cervical region between the clavicle, scapula, and first rib; its *base* is below and formed of the integuments. This region contains the following important parts, which, upon the section of the pectoral muscles being made, may be examined in

this order. 1°. Lymphatic glands (the axillary glands) and vessels, surrounded by much loose cellular substance. 2°. The *axillary vein,* enclosed by a kind of sheath, and overlapping the axillary artery; the vein changes its position on being traced downwards, at first lying over the edge of the first rib, and below the subclavius muscle it gets more in front of the artery as it descends; in its course through the axilla, it is joined by the external thoracic and cephalic veins; inferiorly, the subscapular, venæ comites, and other veins contribute to form it. 3°. The *axillary artery* should next be examined, passing over the first rib in a particular groove, behind the scalenus anticus muscle; previous to passing the first rib, this artery is called the subclavian; having passed through the axilla, it then gets the name of humeral, whilst in the axilla it gives off the external thoracic arteries, the subscapular and circumflex arteries. 4°. Behind the artery in the upper part of the axilla, lies the *brachial plexus of nerves,* from which are derived the nerves which ultimately supply the arm with sensibility and the power of motion. The plexus nearly surrounds the artery, and gives off the following nerves: the external and internal cutaneous, the median, ulnar, musculo-spinal, axillary or circumflex and subscapular. All these branches will be particularly described in the section on the nervous system. Towards the lower part of the axilla, two branches of the plexus going to form the median, generally embrace the artery, whilst the external cutaneous is on its humeral side, the internal cutaneous and ulnar towards its inner side; the muscular spiral and circumflex behind; the median rather in front. Across the axilla about its middle, pass the two intercosto-humeral nerves, (humeral branches of the second and third dorso-spinal nerves) these come from within the chest, and are generally two in number; the first passes between the second and third ribs, but close to the inferior margin of the second, the inferior nerve passes between the third and fourth ribs; there is sometimes a third. The lymphatic glands receive small blood-vessels, and are moreover connected to the margins of the pectoral muscles, but they do not occupy any particular space. The removal of those lying on the edge of the subscapular artery requires the greatest attention in the living body. Having carefully examined the axilla, next proceed with the dissection of the serratus magnus. Saw through the clavicle about its centre; cut through the axillary artery, vein, and plexus of nerves, about an inch below the edge of the subclavius muscle; cut through the subclavius itself, and proceed then to clear the anterior surface of

218. The SERRATUS MAGNUS. This is a very broad, thin, irregularly square formed muscle, placed altogether behind the axillary vessels and nerves, and is properly a muscle of the shoulder. It arises by eight or nine fleshy slips from the superior ribs; these fasciculi ascend obliquely backwards, and are inserted into the whole inner edge of the base or spinal margin of the scapula. For the sake of description and of rightly understanding its use, it may be divided into three portions; a superior, middle and inferior. The superior, thick, short and strong, arises from the two uppermost ribs; it lies more forward than the second or middle portion of the muscle, which is thin, aponeurotic, and not unfrequently in great part wanting; the inferior division is the broadest and largest; the central portion of the serratus is connected to the scapula not unfrequently by an aponeurotic arch. In action it moves the scapula forwards; it is likewise a muscle of inspiration when the shoulders are fixed, and the nerve supplying it (the posterior external thoracic branch) has been of late called the external respiratory nerve of the chest. This nerve lies upon the anterior surface of the muscle, crossing its fibres nearly at right angles. A great quantity of loose cellular substance connects this muscle to the adjoining ones, particularly to the subscapular and walls of the chest. If the muscles connected with the arms on the posterior aspect of the body have been dissected, (sec. 185, &c.) and the surgical anatomy of the neck completely finished by the dissector of that region, the arm may now be removed by dividing vertically and in its middle the serratus magnus muscle. Place the arm on a horizontal plain surface, secure it with hooks, and proceed to examine the surgical anatomy of

219. The BEND of the ELBOW and BRACHIAL APONEUROSIS. Remove the integuments from off the fore-

part of the extremity as far as the middle of the fore-arm, by an incision carried directly down the centre, and crossed by one made cautiously across the bend of the elbow ; dissect off the flaps, and examine the superficial veins of the arm. These veins will be found imbedded in the superficial fascia, along with many branches of the cutaneous nerves. The more external vein is the cephalic, which is formed chiefly by the superficial radial veins. The inner one is the *basilic* vein ; this is formed chiefly by the superficial ulnar veins ; it passes through the aponeurosis of the arm to join the deep veins generally about the middle of the arm, but sometimes higher up ; a middle vein is usually found, called the median, from which, about the bend of the elbow, there proceed two branches like the short legs of the letter Y to join the cephalic and basilic ; these communicating branches are called median-cephalic and median-basilic ; the former may be opened with most safety in phlebotomy, as the latter runs over the course of the humeral artery. Besides these there is a thick communicating branch connecting these veins with the deep humeral veins. Accompanying and sometimes crossing these veins are branches of the cutaneous nerves. After having dissected and examined these nerves and vessels, let the student next dissect the *Brachial Aponeurosis*. This is a pretty strong aponeurosis which embraces the muscles of the whole of the upper extremity, with the exception of the fingers, and besides enclosing them generally, furnishes to most of them separate sheaths. In the arm it is called the brachial aponeurosis, in the fore-arm the anti-brachial, in the hand the palmar and dorsal aponeurosis ; the retinacula which bind down the tendons, are considered by many anatomists as appendages of this aponeurosis. It varies in thickness and strength, being also composed of fibres running in two opposite directions, and has many openings in it for the passage of vessels and nerves. The student should trace it at first from the top of the shoulder to the middle of the fore-arm. On the deltoid it is thin, and looks like cellular substance; on the back of the scapula it is connected to the spine of the scapula, where it is remarkably strong, the posterior part of the deltoid being, as it were, expanded into it.

It here covers the infra-spinatus and teres minor muscles, and receives slips from the pectoralis major, and latissimus dorsi muscles. It next invests the arm anteriorly and posteriorly, and as it descends sends strong tendinous partitions deep to be attached to the lateral ridges of the humerus which run to the condyles; these are called the internal and external inter-muscular septa. These separate the exterior from the flexor muscles. At the bend of the elbow a strong somewhat semilunar slip is sent from the inner edge of the tendon of the biceps to this fascia, or rather to that part of it called the anti-brachial aponeurosis. This strong slip crosses the humeral artery and median nerve, to be afterwards expanded over the surface of the pronator teres muscle. It separates the humeral artery from the median basilic vein, the vein being superficial to it, the artery in general immediately beneath it. It is here where the artery is most usually wounded in phlebotomy, giving rise to a dangerous effusion of arterial blood, which surgeons have mistaken for an aneurism, founding on these mistaken ideas, false practical views. Although it be usual in anatomical works, to speak of the muscles of the shoulder, arm, fore-arm, and hand, as if they were quite distinct, yet, in point of fact, the arrangement is altogether artificial and vicious; the muscles run almost uniformly from one region into another, and some even through three regions. The student being cautioned in this respect, may proceed with the dissection of the remaining muscles of the upper extremity, in the following order.

220. The Deltoid Muscle is thick, flat, triangular, broader above than below, curved upon itself to embrace the shoulder joint, whence it descends to the outer side of the arm, as far as its middle. It is composed of seven fleshy bundles, separated by grooves more or less deep, and divided into two orders. Those of the first order, to the number of four, are broad and fleshy above, contracted below, and terminate by strong tendons. One of them, strengthened behind by a transverse fibrous band which unites the acromio-coracoid ligament to the pectoralis major, arises from the outer third of the anterior edge of the clavicle, by small aponeuroses, and descends obliquely outwards. Another

is inserted externally into the acromion by various aponeurotic fasciculi, which are more or less prolonged in or over the fleshy fibres; it descends vertically. The two last proceed from the posterior edge of the spine of the scapula, where they are attached by means of an aponeurosis which unites with those of the trapezius and infra-spinatus, and are directed obliquely downwards and forwards. The bundles of the second order, to the number of three, are placed in the interval of these latter, between which they seem to ascend, to terminate in a point at the commencing aponeurosis. All these different bundles, which are themselves formed of fleshy fibres disposed in secondary bundles, are united below into a very strong triangular tendon, broad and thick, little apparent externally, but prolonged to a great length upon the inner surface of the muscle, where each bundle furnishes a portion to it; this tendon is attached to the deltoid impression of the humerus, over an extent of about an inch and a half. At its termination, it is embraced by a bifurcation of the brachialis muscle. The *outer surface* of the deltoid is convex, and covered by the skin and platysma myoides above. The *inner surface* is concave and covers in whole or in part, the infra-spinatus, teres minor, and triceps extensor muscles, the tendon of the supra-spinatus, acromio-coracoid ligament, subscapularis, pectoralis minor, biceps, and coraco-brachialis muscles, coracoid process, capsule of the joint, upper third of the outer surface of the humerus, circumflex nerve and vessels, and tendon of the pectoralis major. The *posterior edge* of the muscle is thin above, and thick below. The *anterior* is separated above from the pectoralis major by a cellular interval occupied by the cephalic vein, and below is parallel to the outer edge of the biceps. The deltoid raises the arm directly, or carries it at the same time forwards or backwards, according to the direction of the bundles which act. When the arm is raised, its posterior fibres can lower it. If the arm is fixed, it depresses the shoulder. In removing the deltoid, it ought to be cut directly through, about an inch below its origin, and the upper and lower portions raised from the adjacent parts. Divide with a saw the acromion process, forcibly remove the clavicular portion in connexion with the clavicle and coraco-acromial ligament, and proceed with the dissection of the

221. SUPRA-SPINATUS, long, thick, triangular, pyramidal, broader within than without; and kept in position by a thin aponeurosis, which arising from the whole length of the upper lip of the spine of the scapula, is attached behind the upper edge of that bone, and to the upper part of its inner edge. The fleshy fibres arise from the posterior part of this aponeurosis, and from the two inner thirds of the fossa supra-spinata by short tendinous fibres. They proceed outwards, converge towards each other, and are inserted obliquely round a broad aponeurosis, which, after being concealed among them, contracts, becomes thicker, and entirely emerges from them, passing under the coraco-acromial ligament; it forms a strong tendon, which, curving over the shoulder joint, becomes identified with its capsular ligament, and is also attached to the upper surface of the large tuberosity of the humerus. The *posterior surface* is covered by the trapezius and deltoides, and by the coraco-acromial ligament. The *anterior* is applied upon the fossa supra-spinata; (from which it is separated, in its outer third, by cellular tissue, and the supra-scapular vessels and nerve,) and the capsular ligament. It assists the deltoid muscle in raising the arm. If the arm is fixed, it acts upon the scapula.

222. INFRA-SPINATUS, broad internally, narrow externally, thick and triangular. It is covered posteriorly by a thin aponeurosis, but strong. Some of the fleshy fibres come from this aponeurosis internally; but the greater number arise from two inner thirds of the fossa infra-spinata. Of these, the upper proceed outwards, and the rest ascend more, and are longer the lower their position is. They go to a broad aponeurosis concealed beneath them, situated nearer the posterior surface of the muscle than the anterior, which, towards the humerus, becomes a strong and thick tendon, which is attached to the middle surface of the large tuberosity of that bone, after being identified with the fibrous capsule of the articulation, and in part incorporated with those of the supra-spinatus and teres minor. The *posterior surface* is covered externally by

the deltoid muscle, internally by the trapezius, below by the latissimus dorsi, in the middle by the integuments. The *anterior surface* covers the fossa infra-spinata, from which it is separated, in its outer third, by much cellular tissue, and by the superior scapular nerves and vessels. It is also applied upon the capsular ligament of the shoulder joint. The muscle, when the arm is lowered, turns it outwards by rotation. When raised, it draws it backwards.

223. Teres Minor, an elongated narrow muscle, flattened from above downwards in its inner half, and from behind forwards in the outer. It is situated beneath the preceding, and arises from a rough triangular surface, which limits the fossa infra-spinata near the axillary edge of the scapula, and from two aponeurotic laminæ which separate it from the teres major and infra-spinatus. From thence, it ascends obliquely outwards, in company with the infra-spinatus, to which it is often united. Its fleshy fibres terminate, near the humerus, on the anterior surface of a flat tendon which commences by aponeuroses on the posterior surface of the muscle, and is inserted into the inferior surface of the great tuberosity, where it is united with the capsule of the joint. Some of the lower fibres are directly attached to the humerus, beneath the great tuberosity. Its *posterior side* is covered by the deltoid muscle and the skin. The *anterior* covers the dorsal scapular artery, a portion of the long head of the triceps, the fibrous capsule of the joint, and a small part of the scapula.

224. Teres Major, flat, broader than the preceding, arises by short aponeurotic fibres, from a quadrilateral surface which terminates the fossa infra-spinata inferiorly, and from fibrous partitions that are met with between it and the subscapularis on the one hand, and the infra-spinatus and teres minor on the other. From thence its fleshy fibres, which are all parallel, proceed obliquely outwards running along the teres minor; then twisting upon themselves, separate from that muscle, and give rise to a broad and flat tendon, more distinct below than above, and before than behind. This tendon, which is about an inch broad, follows the direction of the muscle, is applied by its anterior surface

upon that of the latissimus dorsi, unites with it, and is attached to the posterior edge of the bicipital groove of the humerus. Its *posterior surface* is covered internally by the latissimus dorsi, and in the middle by the skin. Externally, it corresponds to the humerus and the long portion of the triceps. The *anterior surface* is in connexion with the subscapularis, latissimus dorsi, coraco-brachialis and biceps muscles, and with the axillary vessels and brachial plexus. Its *lower edge*, which is covered by the integuments, forms with the latissimus dorsi the posterior edge of the hollow of the axilla. The *upper edge*, which is united to the teres minor internally, but separated from it in the middle by the long portion of the triceps, corresponds externally with the subscapularis muscle, and the circumflex vessels and nerve. This muscle rotates the humerus inwards. When its action is combined with that of the latissimus dorsi and pectoralis major, it applies the arm against the thorax.

225. The SUBSCAPULARIS is thick, triangular, occupying the whole of the subscapular fossa, from the three inferior fourths of which it arises, both from its periosteum, and from three or four aponeurotic partitions between the fleshy fibres, which are themselves attached to the oblique bony ridges presented by the scapula at this place. The fleshy fibres are disposed into five or six distinct bundles which converge together, and proceeding outwards, are attached to the two surfaces of a broad and flat tendon, which, contracting and becoming thicker, terminates at the small tuberosity of the humerus by embracing it, and extends a short way on the shaft of the bone. It adheres strongly to the capsule of the joint. The *anterior surface* is separated from the serratus magnus, with which it forms the hollow of the axilla, by a very thick layer of cellular tissue. Its outer part corresponds to the brachial plexus, axillary artery, and coraco-brachialis, biceps, and deltoid muscles. When the arm is abducted from the body, the subscapularis draws it toward it, or abducts it; it can also turn the arm inwards, and when raised, depresses it. It also strengthens the shoulder joint. A low and narrow block placed under the axilla will enable the student to dissect most of the muscles in

the region of the shoulder. The arm should now be placed on the anterior (flexor aspect), and the muscles of the *arm* dissected.

226. The TRICEPS EXTENSOR is divided superiorly into three portions or heads, viz. a scapular or long head, and two shorter or humeral heads: the scapular is also called the middle head; the second as to length is external and posterior; the third as to length is internal and somewhat anterior. The scapular head arises from the highest part of the axillary margin of the scapula, by a flat tendon, which separates into two aponeuroses, an outer, short; and an inner, which extends much farther downwards. The fleshy fibres of this portion of the muscle, arising from the outer and back part of the tendon just mentioned, form a bundle, which descends vertically between the teres major and teres minor, behind the shoulder joint, then increases in size, and is united to the *outer portion* about the upper third of the arm, and to the *inner* about its middle. The *outer portion* (*caput externum*) arises, by a pointed extremity, from the upper part of the outer edge of the humerus, beneath the great tuberosity of that bone, and almost immediately below the insertion of the teres minor muscle. Its fleshy fibres shorten as they descend, and come from the outer edge of the humerus over a larger extent, and from the *external inter-muscular partition* or *ligament*, common to them with those of the deltoid muscle and brachialis. The inner portion (*caput breve*) commences under the tendon of the teres major and latissimus dorsi by a pointed extremity, which is attached to the inner edge of the humerus, and receives additions in succession from an aponeurosis which covers it above, from the posterior surface of the humerus, the *internal inter-muscular ligament*. After their union, these three portions form a thick and broad bundle, and terminate by a strong, broad, and thick tendon, which is attached to the posterior and upper part of the olecranon process of the ulna. Besides the fleshy fibres furnished to the tendon by each of the three portions, the common bundle receives a number of others, which arise along the lower third of the posterior surface of the humerus, to near the

olecranal cavity, and descend obliquely backwards upon the anterior surface of the tendon. The *outer* side of the tendon and of its aponeurotic origins serves for the insertion of several others, which come from about the lower fourth of the outer edge of the humerus, where they leave between them a small aperture for the passage of the musculo-spiral nerve, and its accompanying vessels. The *posterior surface* of the muscle is covered above by the teres minor and deltoid, and in the rest of its extent, by the brachial aponeurosis and the skin. The *anterior surface* superiorly covers in part the subscapularis, teres major, and latissimus dorsi, and fibrous capsule of the shoulder joint; inferiorly, the posterior surface of the elbow joint. In action the muscle extends the fore-arm upon the arm, and in certain circumstances the arm upon the fore-arm. When the fore-arm is extended, its long portion carries the arm backwards. It may also sometimes move the scapula upon the humerus. Place the arm on its posterior (extensor) aspect, and dissect the flexor muscles.

227. The CORACO-BRACHIALIS is long, thin, flat, and narrow, especially at its extremities, and is situated at the upper and inner part of the arm. It arises from the summit of the coracoid process, between the short head of the biceps and the pectoralis minor, with which it is united; this origin takes place by means of an aponeurosis, which also belongs to the short portion of the biceps, is extended before their common fibres, then interposed between the two muscles, and separates into two portions, one for each of them. It is from the posterior surface of this aponeurosis that the fleshy fibres arise. In their upper third they are incorporated with those of the biceps, afterwards separate, and form a bundle which increases in size to its middle part. Near the humerus, they terminate in an aponeurosis, which is fixed to the middle part of the inner surface and edge of the humerus, between the brachialis and triceps. The muscle is generally traversed at its middle part by the external cutaneous nerve. Its *anterior surface* is covered by the deltoid, pectoralis major, and biceps. The *posterior* is applied upon the subscapularis muscle, the united tendons of the latissi-

mus dorsi and teres major, the axillary artery, the external cutaneous and median nerves, and the brachial artery. In action, it raises the arm and carries it forwards and inwards.

228. The BICEPS FLEXOR CUBITI is situated on the fore and inner part of the arm, long, broad, and thick at its middle part, and divided above into two portions. The *outer* is long, arises from the upper part of the edge of the glenoid cavity of the scapula, by a long, flattened tendon, continuous with the glenoid ligament. This tendon turns over the head of the humerus, crosses the articulation obliquely inwards, and advances to the interval between the two tuberosities of the humerus, surrounded by a sheath which is furnished by the synovial capsule. It then becomes rounded, contracts, and enters the bicipital groove, still accompanied by the synovial membrane, and kept down by a prolongation of the fibrous capsule; emerging from this groove, it continues to descend vertically, expands, and gives rise to fleshy fibres. The *inner portion* is short, attached to the summit of the coracoid process, descends, approaching the other, and becomes fleshy sooner than it. These two fleshy bundles approach each other as they descend, and are at length intimately incorporated toward the lower third of the arm. The bundle which results from this junction continues to descend, contracting, and near the elbow-joint forms a tendon, appearing sooner on the outside than internally; at first broad and thin, it is in a great measure concealed by the fleshy fibres. When fairly emerged from them, it becomes narrower and rounded, turns obliquely outwards, and then sinks between the supinator longus and pronator teres, and on arriving beneath the elbow, twists upon itself to terminate by embracing the bicipital tuberosity of the radius, at its back part. The *anterior surface* of the biceps is covered superiorly by the deltoid and pectoralis major; in the rest of its extent, by the brachial aponeurosis and the integuments. The *posterior surface* rests upon the humerus, the coraco-brachialis and brachialis muscles, and the external cutaneous nerve. Its *inner edge* is united above with the coraco-brachialis; in the middle and below, it is accompanied by the brachial

artery, median nerve, and venæ comites, or deep humeral veins. A thin loose bursa invests the fore part of the bicipital process and neck of the radius, and no doubt contributes to facilitate the motions of the fore-arm. In action the biceps bends the fore-arm on the arm, supinates the hand when it is prone, or bends the arm upon the fore-arm when the latter is fixed. It may bring the humerus and scapula closer together, and strengthens the shoulder joint by means of the tendon of its long portion.

229. The Brachialis Flexor is deeply seated at the lower and fore part of the arm, before the elbow-joint, flat, broader in the middle and at its upper part than below. It arises from the anterior aspect of the humerus, over a space extending from the deltoid impression to near the elbow-joint, and also along the inner edge of that bone, and from the aponeurotic inter-muscular partitions. From these origins it descends, increasing to its middle part, then becomes a little thinner, passes obliquely inwards over the elbow-joint, and terminates at the rough impression beneath the coracoid process of the ulna, by a broad and thick tendon, which commences by several portions at a considerable distance above the joint, in the substance of the muscle, especially on the outer side. Its *anterior surface* is covered above by the brachial aponeurosis and the skin; below and externally, by the supinator longus, which is lodged in a depression which it presents; at the middle by the biceps muscle and the external cutaneous nerve; internally, by the brachial artery, the median nerve and the pronator teres. The *posterior surface* covers the lower part of the humerus and elbow-joint. Its *upper extremity* presents a notch which embraces the tendon of the deltoid muscle. It bends the fore-arm upon the arm, or the latter upon the former. The axillary artery, having given off the branches already enumerated (p. 206), passes in front of the tendon of the latissimus dorsi muscle, here changes its name for *humeral* or *brachial*, and proceeding downwards as far as the bend of the elbow, there divides into two branches, the *radial* and *ulnar*. In its course, the humeral artery is enclosed in a sheath of loose cellular substance, along with the

median nerve and the *deep humeral veins* (*venæ comites*), which frequently anastomose with each other, both in front and behind the artery. In the upper part of the arm the great artery is placed upon the inner margin of the coraco-brachialis, and inferiorly upon that of the biceps; it passes below that portion of the fascia which is sent from the tendon of the biceps across the pronator teres muscle, and rapidly sinking deeper at this spot, soon after divides into its radial and ulnar branches. The vessel in its course through the arm is naturally subjacent to the aponeurosis; the ulnar nerve runs somewhat parallel to it, but not quite so, and gradually recedes from it, passing more inwards towards the internal condyle of the humerus, whilst the humeral artery preserves more the direction or axis of the centre of the arm. Moreover the vessel is placed superiorly upon a small part of the triceps, but inferiorly chiefly upon the brachialis flexor. The branches which it sends off in this course are few comparatively: 1*st*, Those proceeding from the external side of the artery have no particular names; they are merely muscular branches supplying the adjacent muscles. 2*d*, Those from the internal side of the artery are, the profunda humeri superior, profunda inferior, and arteria anastomotica magna. Finally, there is a small artery proceeding also from the humeral, somewhat below the middle of the arm, and which, after perforating the tendon of the coraco-brachialis, enters the osseous canal leading to the medullary cavity of the humerus: this artery is the *arteria nutritia humeri*. The *nerves* found in the arm are some of those already mentioned as coming from the brachial plexus. 1*st*, The *musculo-spinal,* or radial nerve, passing between the humeral heads of the triceps, and winding round the humerus in a groove which the bone presents, will be found by the student between the upper part of the supinator longus and brachialis flexor; from this it may be traced on the radial side of the fore-arm to the fingers. 2*d*, The *median*, which has been already mentioned, and traced so far as the bend of the elbow, into which it passes a little to the inner side of the humeral artery. 3*d*, The *ulnar*, descending on the triceps and brachialis as far as the inner condyle, behind which it passes to the fore-arm; a small artery generally accompanies it. *4th,* The *circumflex,* or axillary, which more properly belongs to the description of the axilla and shoulder. It passes between the long head of the triceps and the surgical neck of the humeris, accompanied by the internal circumflex artery and vein. *5th,* The external cutaneous, or *perforans casserii,* which will be found passing through the coraco-brachialis muscle, or closely connected with it. *6th,* The internal cutaneous, already spoken of in describing the axilla and superficial veins of the arm. There is a second or smaller internal cutaneous, and two intercosto-humeral nerves, some of whose branches are met with in this dissection, but their minute history belongs rather to that of the *nervous* system. The dissection of the extensor muscles should precede those of the flexors, and the student will therefore carefully stitch up the integuments, or take other means to preserve the parts exposed on the anterior aspect of the arm, so that the extremity may be placed on that aspect. Make an incision through the integuments from the elbow to the root of the fingers, reflect the skin to the right and left, and with it the subcutaneous cellular tissue, in which will be found imbedded some superficial veins and nerves; next dissect the anti-brachial aponeurosis, of which we have already said a good deal. On the posterior aspect of the forearm it is strong, and extends as far as the roots of the fingers; the fibres run in several directions, but chiefly in two. Connected superiorly to the condyles of the humerus, and receiving a strong tendinous expansion from the triceps, it descends, investing the muscles generally and particularly, sending partitions between most of them, which proceeding deep, are attached to the bones of the forearm. The *posterior annular* ligament of the *carpus* (*retinaculum* tendinum musculorum) binding down the extensor tendons, is connected to the styloid process of the ulna, and passing across from one bone to the other, is equally attached to the styloid process of the radius. The aponeurosis of the forearm seems to pass over this annular ligament and to form a very thin covering on the back of the hand, but as it proceeds over the ligament, it is intimately connected with it. The *retinaculum* which looks like a single, strong band of ligamentous fibres, externally presents a quite different appearance on the side which touches the tendons; it sends partitions inwards, so as to enclose in *separate sheaths* the following tendons. 1°, The tendon of the extensor carpi ulnaris. 2°, The tendon of the extensor minimi digiti. 3°, The tendons of the extensor communis digitorum and extensor indicis. 4°, The tendon of the extensor secundi internodii pollicis. 5°, Those of the extensores carpi radiales. 6°, The tendons of the extensor ossis metacarpi pollicis and primi internodii pollicis; even these two are partially separated from each other by a partition. All these sheaths formed by the annular ligament have bursæ within them to favour the action of the muscles and tendons to prevent friction, but they will be better examined at a later period of the dissection. The bodies of the muscles themselves are also enclosed in separate sheaths, as the student will observe in the process of cleaning them. Having carefully surveyed this aspect of the anti-brachial aponeurosis, proceed to raise it from the muscles.

230. ANCONEUS, short, thick, triangular, and placed behind the elbow joint. Arises tendinous from the outer condyle of the humerus, and descending becomes fleshy, the fibres following different directions. The upper are short, continuous with those of the triceps, nearly transverse, and terminate by short aponeuroses at the outside of the olecranon. The lower, longer and more oblique the lower their position is, are inserted, also by short aponeuroses, into the upper fourth of the posterior edge of the ulna, forming a sharp point below. The anconeus is applied upon the articulation of the forearm, annular ligament of the radius, supinator brevis and the ulna It assists the triceps extensor muscle, and may be considered a continuation of it.

231. EXTENSOR CARPI ULNARIS is long, fusiform, arises from the outer condyle of the humerus, by a common tendon, from the aponeurotic septum placed externally between it and the extensor minimi digiti, from the aponeurosis of the fore-arm, and from about the middle third of the posterior edge of the ulna, below the anconeus muscle. From thence it descends at first ob-

liquely inwards, and then vertically behind the ulna, and becoming tendinous sooner apparent behind than before, gets engaged in a particular groove, under the posterior annular ligament near the lower extremity of the ulna. It passes behind the cuneiform bone, in a sort of fibrous canal, attached to that bone, the pisiform bone, the os unciforme, and the styloid process of the ulna. It passes under the abductor minimi digiti, enlarges a little, and terminates at the inner and back part of the upper extremity of the fifth metacarpal bone, whence it sends some aponeurotic fibres over the opponens minimi digiti. The *posterior surface* of this muscle is covered by the aponeurosis of the fore-arm, to which it adheres above. The *anterior* is applied upon the supinator brevis, extensor ossis metacarpi, and extensor secundi internodii pollicis, and extensor proprius indicis muscles, and upon the ulna. Its *outer edge* is united above to the extensor proprius minimi digiti; the *inner* is contiguous at its upper part to the anconeus. It extends the hand upon the fore-arm, inclining it a little upon the ulna.

232. Extensor Minimi Digiti, situated to the outside of the extensor communis, long, but slender. It arises from the outer condyle, by a common tendon, the aponeurotic septum which separates it from the preceding muscle, that which is placed, internally, between it and the extensor carpi ulnaris, and from the aponeurosis of the fore-arm. Its fleshy fibres form a small bundle, which descends and passes very obliquely to within a short distance of the carpus, on the anterior surface of a tendon at first concealed in their substance, and entirely free near the posterior annular ligament, which presents a fibrous canal for it, opposite the lower radio-cubital articulation; this canal is directed obliquely downwards and inwards, lined by a synovial capsule, and about two inches in length. Before passing into this canal, the tendon of the muscle divides into two portions, which remain contiguous and connected by cellular tissue; but towards the upper part of the metacarpus, again becomes single and enlarges. It then arrives at the little finger, to the phalanges of which it is attached. This muscle covers the supinator brevis, extensores pollicis, and extensor indicis. Its

outer edge is united above to the extensor digitorum communis; the *inner* to the extensor carpi ulnaris. It extends the little finger.

233. Extensor Communis Digitorum, long, round, fleshy and simple at its upper part, terminating below in four tendons, arises, superiorly, from the outer condyle, by a tendon, common to it and the other three preceding muscles, internally, from a long aponeurotic partition, sent off from that tendon, which separates it from the extensor proprius minimi digiti; externally, from a shorter partition placed between it and the extensor carpi radialis brevior; posteriorly, from the aponeurosis of the fore-arm. From these different origins, its fleshy fibres proceeding obliquely, form a bundle, which divides into four portions, at first united by cellular tissue, and terminated each by a tendon at first concealed by their substance, and accompanied by the fleshy fibres to near the wrist, particularly in those of the ring and little fingers. These tendons vary in size: that of the ring finger is the strongest and thickest; the next is that of the middle finger, and the little finger has the smallest. They pass along with the tendon of the extensor indicis in a groove, formed behind the carpal extremity of the radius, where they are kept down by the posterior annular ligament. Beneath this ligament, the tendons diverge, become broader, and proceed to the base of the metacarpal bones. The last three are commonly split longitudinally, and send small aponeurotic bands, varying in size, and more or less oblique, to each other. Opposite the articulations of the metacarpal bones with the phalanges, they contract and become thicker. They then become broad again, and receive the tendons of the lumbricales and interossei, forming with them an aponeurosis which covers the whole posterior surface of the fingers. Towards their extremity, they divide into three portions, the middle of which passes behind the articulation of the proximal and middle phalanges, to be inserted into the posterior surface of the latter, while the two lateral pass over the sides of the same articulation, contracting and separating from each other; they then approach and re-unite, forming a flat tendon which is attached to the posterior and upper part of the distal phalanx. The muscle is

covered posteriorly by the aponeurosis of the fore-arm, with which it is intimately united, *anteriorly* it covers the supinator brevis, extensores pollicis, extensor indicis, the wrist joint, the posterior surface of the carpus, metacarpus and fingers, and the interossei dorsales muscles. Between its *outer edge* and the extensor carpi radialis brevior, is an interval in which the extensor ossis metacarpi and extensor primi internodii pollicis are seen. The tendons as they pass under the annular ligament, are embraced by a synovial membrane. This muscle extends the phalanges of the last four fingers upon each other, and upon the metacarpal bones, the hand upon the fore-arm, or the fore-arm upon the hand. Divide the extensor communis and extensor minimi digiti about the middle of the fore-arm, reflect the inferior tendinous portions towards their attachment, and proceed to examine the deep layer of muscles.

234. Extensor Indicis Proprius (*Indicator*) arises by short aponeuroses, from the posterior surface of the ulna, and from the interosseous ligament, forming a tendon inclosed in its substance, which becomes free towards the posterior annular ligament of the wrist, unites with those of the extensor communis digitorum, by means of a membraniform cellular tissue, passes into the same groove with it, is embraced by the same bursa, and, on arriving at the back of the hand, is situated to the outside of that which the extensor communis sends to the fore-finger. It is incorporated with it behind the articulation of the second metacarpal bone with the first phalanx of the fore-finger, to terminate in the manner indicated. (233) This muscle lies on the ulna, the interosseous ligament, the extensor secundi internodii pollicis, the inferior extremity of the radius, and the back of the hand. It arises in common with the extensor secundi internodii pollicis. In action it extends the three phalanges of the fore-finger.

235. Extensor Secundi Internodii Pollicis arises from about the middle third of the posterior surface of the ulna, and from a small portion of the interosseous ligament. It descends outwards, and terminates in a tendon which first appears behind, and is isolated near the lower extremity of the radius, where it passes under the posterior annular ligament, in a special osseous

groove, cut much deeper than the general groove for the tendons of the extensor communis, and to a certain extent, distinct from it; its outer edge presents a short elevated ridge calculated to retain the tendon in its situation, and to act as a staple. When the tendon has arrived at the back of the hand, it passes over the tendons of the radial extensors, crosses their direction, descends at the posterior and inner part of the first metacarpal bone, joins the tendon of the extensor primi internodii pollicis near the articulation of that bone with the first phalanx, receives in the same place two aponeurotic expansions from the abductor and flexor brevis pollicis, and is inserted at the back part of the phalanx of the thumb. The muscle lies upon the extensor ossis, metacarpi pollicis and extensor primi internodii pollicis, the two bones of the fore arm, the interosseous ligament, the wrist joint, the tendons of the radial extensors, the first metacarpal bone, and the phalanges of the thumb. In action it extends the last phalanx of the thumb upon the first.

236. Extensor Primi Internodii Pollicis arises from a small portion of the ulna, from the interosseous ligament, and more especially from the posterior surface of the radius. It becomes on the outer side of the forearm, a slender tendon, more apparent externally than internally, which passes into a groove on the outer side of the distal extremity of the radius and in which the tendon of the extensor ossis metacarpi is also lodged. On issuing from this groove, it separates from the extensor ossis metacarpi pollicis, descends behind the first metacarpal bone, and is inserted at the upper and back part of the first phalanx of the thumb. In its course this muscle adheres so closely to the extensor ossis metacarpi pollicis, that the student is apt to overlook it. The muscle covers a small portion of the ulna, the interosseous ligament, and the posterior outer surface of the radius, the first metacarpal bone and its articulation with the thumb. In action it extends the first phalanx of the thumb, and also assists in supination.

237. Extensor Ossis Metacarpi Pollicis, long, and flat, broader in the middle than at its extremities. It arises by a pointed extremity from the posterior surface of the ulna, beneath and in common with the supi-

nator brevis; then by short aponeurotic fibres, from a ridge on its posterior surface, and also from a line directed obliquely downwards and outwards, and from the interosseous ligament. Its fleshy fibres form a fusiform bundle which descends obliquely outwards behind the fore-arm, and terminate upon the posterior surface of a tendon, at first concealed among them, which they accompany to the inferior extremity of the radius; there, the tendon passes into a groove, on the outer side of the radius, which is common to it and the extensor primi internodii pollicis. On issuing from this groove, the tendon divides into two or three portions, and goes to be inserted into the outer part of the superior extremity of the first metacarpal bone, also into the trapezium, occasionally sending a small prolongation to the abductor pollicis. This muscle at its lowest part, is in connexion with the aponeurosis of the fore-arm. It covers a small portion of the ulna above; the interosseous ligament and the posterior and outer surface of the radius, the tendons of the radial extensors, the radial artery, and the wrist joint below. In action it carries the thumb outwards and backwards, and contributes to supination. Place the arm on its internal or ulnar margin, secure it by means of hooks, and examine the muscles on the radial margin.

238. Supinator Longus, elongated, fusiform, flattened from before backwards in its upper fourth, and transversely in the rest of its extent, arises, by short tendinous fibres, and over an extent of about two inches, from the external ridge of the humerus, between the brachialis and triceps, and from its external inter-muscular septum, terminating by a flat tendon, which, at first lying upon its anterior surface, becomes free about the middle of the fore-arm. This tendon is thin and broad above, becomes thick and narrow as it descends, runs along the outer edge of the radius, and is inserted near the base of its styloid process, sending off a fibrous elongation, which lines the groove in which the extensor ossis metacarpi and extensor primi internodii pollicis glide. The *anterior side* of this muscle is covered by the skin, and aponeurosis of the fore-arm. The *posterior* covers the supinator brevis, extensor carpi radialis longior, pronator teres, flexor carpi radialis, flexor sublimis digitorum,

flexor longus pollicis, and the radial artery and nerve. The *inner side* is applied above, upon the brachialis flexor, and the radial nerve. Upon the ulnar side of its tendon may be found the radial artery in the lower third of the arm. In action this muscle supinates the hand, and assists in bending the fore-arm upon the arm. Reflect the supinator longus, by dividing it in the middle of its fleshy belly, and thereby expose the *long radial extensor muscle*.

239. Extensor Carpi Radialis Longior, nearly of the same form as the supinator longus, beneath which it is situated, arises farther down, from the same ridge of the humerus, and from its inter-muscular septum; it also receives some fibres from the upper part of the outer condyle. It forms a bundle at first flat, then larger and rounded, descends vertically on the outside of the fore-arm, and terminates in a tendon at first thin and broad, becoming narrow and thick, which turning backwards, passes beneath the extensor ossis metacarpi, and extensor primi internodii pollicis, and covers the tendon of the extensor carpi radialis brevior, both entering a particular groove, formed behind the lower extremity of the radius, where they are fixed by the posterior annular ligament of the carpus. On emerging from this groove the two tendons separate. That of the extensor carpi radialis longior passes over the wrist joint, and is inserted at the posterior and outer part of the upper extremity of the second metacarpal bone. The *anterior surface* of this muscle is covered by the aponeurosis of the fore-arm, the supinator longus, extensor ossis metacarpi, and extensor primi internodii pollicis. The *posterior* covers the elbow-joint, the supinator brevis, and extensor carpi radialis brevior muscles. In action it extends the hand upon the fore-arm. Divide this muscle, and expose the

240. Extensor Carpi Radialis Brevior, precisely similar to the preceding, behind which it is placed. It arises from the outer condyle by means of a common tendon, which sends an aponeurotic prolongation over its inner surface, and an aponeurotic partition between it and the extensor communis digitorum. It descends in the same direction as the extensor carpi radialis longior, forms a tendon of the same length and form, which

passes into the same groove, and is attached to the posterior and outer part of the upper extremity of the third metacarpal bone. In action it extends the hand upon the fore-arm. The student must have observed, that although these muscles are called *carpal*, they really send their tendons to the metacarpal bones, but at the same time they act principally on the wrist-joint and carpal articulation. Divide this muscle, and expose the

241. SUPINATOR BREVIS, broad, thin, and triangular, embracing the head of the radius; arising from the outer condyle of the humerus by a broad thick tendon, from the external lateral ligament of the elbow-joint, from the annular ligament of the radius, and by distinct aponeurotic fibres, from a longitudinal ridge observed upon the posterior surface of the ulna. Its commencing tendon expands over the outer surface of the fleshy fibres, which are short and nearly vertical before, long and more oblique the more posterior they are, and all twisted round the radius, to the fore, outer, and back part of which they are attached by distinct aponeuroses, deeply concealed in their substance. It covers the outer part of the elbow-joint, and superior radio-cubital articulation. Its *posterior edge* covers the upper part of the extensor ossis metacarpi, and extensor secundi internodii pollicis. The *anterior* is notched above for the passage of the tendon of the biceps flexor, and is covered below by the pronator teres. These two edges unite, forming an acute angle, which is attached to the outer side of the radius, above the insertion of the latter muscle. In action it turns the radius upon its axis from before outwards, and brings the hand into supination.

242. The dissection of the flexor muscles of the hand, together with the vessels and nerves, falls next to be examined. They cannot be considered in an insulated way, as has been almost uniformly the practice heretofore, for most of the structures in the anterior part of the fore-arm terminate in the hand. Reflect the integuments from off the entire surface, as far as the extremities of the fingers, and thus expose the superficial fascia, imbedded in which will be found many superficial veins, the origins of those already alluded to, and the branches of the external and internal cuta-

neous nerves. After removing these the aponeurosis of the fore-arm and of the hand will be exposed. On the fore-arm the aponeurosis is strong, and the fibres run in various directions. As it passes over the wrist-joint, it is intimately united to the *anterior annular ligament,* (*Retinaculum Tendinum Musculorum,*) but does not form it. It then proceeds into the hand where it forms the palmar aponeurosis. Of this palmar aponeurosis very minute descriptions have been given by surgical anatomists. It may be divided into three portions, a middle, external, and internal. Of these, the middle is by much the strongest, and composed of very strong glistening fibres, continuous with the aponeurosis of the fore-arm, and with the expanded fibres of the palmaris longus when present. This portion is of a triangular shape, and occupies the hollow of the hand; narrow at its commencement, it gradually spreads out, and a short way from the roots of the fingers, divides into four fasciculi, each of which again bifurcates to be finally attached to the sheaths of the tendons of the flexor muscles. These fasciculi are crossed by strong aponeurotic fibres posteriorly, and, moreover, they are attached to the metacarpal bones and inter-osseal muscles. Their importance has only been rightly appreciated since the discovery of M. Dupytren, that their contraction occasionally gives rise to permanent flexion of the fingers. This splitting of the central portion of the palmar aponeurosis into fasciculi, is supposed to be necessary to allow of the tendons of the flexor muscles, the digital arteries and nerves to proceed to the fingers. The external portion of the palmar aponeurosis is thin, and covers the muscles of the ball of the thumb; the internal portion is also thin, it covers the muscles connected with the little finger.

243. Palmaris Brevis arises from the iner edge of the middle portion of the palmar aponeurosis, and from the annular ligament beneath it, and terminates in the integuments and subjacent cellular substance. It is usually composed of three or more small fleshy bundles, but sometimes fewer than these. They cross the abductor and flexor muscles of the little finger. There is no analogous muscle in the foot. The ulnar artery and nerve lie beneath it.

244. Retinaculum Tendinum Musculorum, (*Ligamentum Annulare Anterius*,) is usually considered as a continuation of the aponeurosis of the fore-arm, but it is evidently not so. This is a strong and broad fibrous band, of a quadrilateral form, broader transversely than from above downwards, extended at the fore part of the carpus, and converting into a canal the groove which that part presents, It is attached externally to the forè part of the trapezius and scaphoides, and furnishes insertions to the abductor, opponens, and flexor brevis of the thumb. Internally, it is attached to the pisiform bone, the process of the os unciforme, and a ligament which descends from the one to the other. It affords some points of origin to the opponens minimi digiti, and receives a prolongation of the tendon of the flexor carpi ulnaris. Its *upper edge* and anterior surface are connected with the aponeurosis of the fore-arm; the *lower* with the palmar aponeurosis. Its anterior surface is also covered by the tendon of the palmaris longus, which is intimately united to it; by the palmaris brevis muscle, the skin, and the ulnar nerve and vessels. The *posterior surface* contributes to the formation of a canal, in which the tendons of the two common flexors, and of the flexor longus pollicis, and the median nerve pass. The fibres of this tendinous band are numerous, transverse, and close upon each other. Beneath this ligament is a most extensive and highly complicated bursa, in which there form not unfrequently those small rounded foreign bodies which Lænnec and others have called acephalocysts. Proceed next with the muscles.

245. Pronator Teres, extended obliquely at the upper and anterior part of the fore-arm. Short, broad at its commencement, arising from the inner condyle of the humerus by a tendon common to it with the flexor carpi radialis, palmaris longus, flexor carpi ulnaris and flexor digitorum sublimis; from the coronoid process by another small distinct tendon, the median nerve passes between it and the first; from an aponeurotic septum which separates it internally from the flexor carpi radialis; from a similar partition placed between it and the flexor sublimis, and lastly, from the aponeurosis of the fore-arm. Its fleshy fibres, which are all

parallel, descend obliquely outwards, to the middle of the outer surface of the radius, where they are attached by a broad and thick tendon, at first concealed in their substance, and afterwards expanded in the form of a membrane over their anterior surface. Covered anteriorly in its two upper thirds, by the aponeurosis of the fore-arm and by the skin; in the lower third, by the supinator longus, the radial nerve and vessels, and the radial extensor muscles. *Posteriorly* it covers the brachialis flexor and flexor sublimis muscles, the median nerve and ulnar artery. Its *outer edge* is separated above from the supinator longus, by a triangular space in which are lodged the tendon of the biceps, the brachial artery and the median nerve, thus forming the inner boundary of the hollow at the bend of the elbow; inferiorly, it is parallel to the anterior edge of the supinator brevis, which it covers a little. In action it turns the radius upon the ulna from without inwards, and thus turns the hand prone.

246. Flexor Carpi Radialis is long, fusiform thick and fleshy above, thin and tendinous below, situated internally of the pronator teres. It arises above from the inner condyle of the humerus by a common tendon; anteriorly, from the aponeurosis of the fore-arm; posteriorly, from an aponeurotic septum separating it from the flexor sublimis, and which afterwards descends some way upon its posterior surface; externally and internally, from two similar partitions which separate it, in these two directions, from the pronator teres and palmaris longus. Its fibres form a bundle, large in the middle and slender at its extremities; they descend outwards, and near the upper third of the fore-arm, form a tendon, which descends in the original direction of the muscle, passes over the wrist, enters, behind the abductor and opponens pollicis, a groove of the trapezium, in which it is retained by a ligamentous sheath and by a small prolongation of its own fibres, and is attached to the fore part of the upper extremity of the second metacarpal bone. The tendon cannot be fully traced to its termination until the muscles of the hand have been dissected. The *anterior surface* of the flexor carpi radialis is covered externally by the supinator longus, and in the rest of its extent, by the aponeurosis of the fore-

arm. The *posterior* is applied upon the flexor digitorum perforatus, flexor longus pollicis muscles, and the wrist-joint. Its two edges are connected above with the pronator teres and palmaris longus. In the lower third of the arm the radial artery will be found between the tendon of this muscle and that of the supinator longus. In action it bends the hand upon the fore-arm, turning it a little inwards.

247. Palmaris Longus. Placed internally to the preceding, arises above from the inner condyle by the common tendon; behind, externally and internally, from aponeurotic partitions which that tendon sends between it and the flexor perforatus and flexor carpi radialis; anteriorly, from the aponeurosis of the fore-arm. The fleshy fibres descend vertically, and terminate by a thin, flat, slender tendon, which loses itself in the upper part of the palmar aponeurosis, after sending some fibres to the anterior annular ligament of the wrist. Its two edges are united above, the one with the flexor carpi radialis, the other with the flexor perforatus, which muscle it also covers. In action it stretches the palmar aponeurosis, and bends the hand on the fore-arm.

248. Flexor Carpi Ulnaris. Situated internally of the preceding muscles, at the fore part of the inner edge of the fore-arm, long, thin, flat, semi-penniform, broader above than below, arises from the inner condyle of the humerus, by the common tendon, and from the inner side of the olecranon; between these two origins the ulnar nerve passes, covered by an aponeurosis which goes from the one to the other. It also takes origin, externally, from a short aponeurotic septum which separates it from the flexor perforatus; internally, from the aponeurosis of the fore-arm, which presents for this attachment very distinct and strong fibres, proceeding to the posterior edge of the ulna, and there fix the muscle over a great extent. From these different points the fleshy fibres descend, the outer nearly vertically, the inner obliquely forwards and outwards. The first terminate at the upper extremity, the others along the whole posterior surface of a long tendon, which, however, only becomes free from muscular fibres at the lowest part of the fore-arm, and is inserted into the pisiform bone. At its termination, some fibres are

detached from it, of which one set descends before the abductor and flexor minimi digiti, while the others pass over the ulnar artery and nerve, to be continued into the upper part of the anterior annular ligament of the wrist. This muscle covers the flexor perforans, the ulnar artery and nerve, and the pronator quadratus. Its *outer edge* is united above with the flexor perforatus, from which it is separated below by an interval, where the ulnar nerve and vessels are seen, and thus the tendon forms a guide to ascertain the position of the artery. In action it bends the hand upon the fore-arm, inclining it a little toward the ulna. Divide the three last described muscles, reflect their tendons towards their insertion, and proceed with the dissection of the

249. Flexor Digitorum Sublimis or Perforatus, elongated, thick and flattened. Simple above, separating into four tendons below, arising from the inner condyle, by the common tendon; from the internal lateral ligament of the elbow-joint, from the coronoid process of the ulna; from two aponeurotic partitions which exist between it and the flexor carpi ulnaris internally, and the pronator teres, palmaris longus, and flexor carpi radialis, anteriorly. From these different points there proceeds a rather thin fleshy bundle, which descends a little obliquely outwards, and receives another broad, thin, and flat muscular plane, which comes from the anterior edge of the radius, where it is attached by distinct aponeurotic fibres, between the supinator brevis and flexor longus pollicis. The muscle then increases in breadth and thickness, and is frequently farther augmented by another portion, arising separately from the inner condyle; it descends vertically, and soon divides into four portions, which proceed, one to each of the last four fingers. Two are anterior, united to each other by their edges, and belong to the middle and ring fingers; two posterior, one for the fore finger, the other for the little finger; the latter is the smallest, while that of the middle finger is the broadest and thickest. They are all terminated by tendons proportioned to their size, which are connected together, and with those of the flexor perforans, by loose cellular tissue. These four tendons pass into the concavity presented by the anterior aspect of the carpus, and are there kept

down by the annular ligament, beneath which they separate from each other to descend into the palm, behind the palmar aponeurosis, and before the tendons of the flexor perforans and the lumbricales. They then enlarge a little, are enveloped by a loose cellular sheath, and engaged toward the heads of the metacarpal bones, between partitions formed by the palmar aponeurosis, and are lodged in a groove which the anterior surface of the phalanges presents, where they are retained by a peculiar fibrous sheath, (only one of which should be opened at this stage of the dissection.) Before arriving at these sheaths, (250) the tendons exhibit the appearance of a middle longitudinal division, and present posteriorly a sort of concave channel, which receive the corresponding tendons of the flexor profundus; but, towards the lower part of the first phalanges, they split in the middle to afford a passage to these latter, and divide into two portions, which separate at first, then turn and approach each other, so as to form anteriorly a second channel, which is filled by the tendon of one of the portions of the flexor profundus. These two portions unite towards the articulation of the proximal and middle phalanges, and send off to each other small fibrous bands which decussate. Lastly, they separate again, contract and terminate on the sides of the anterior surface of the middle phalanx, near its centre. At their first separation, these portions are attached to the anterior surface of the proximal phalanges by one or two long and slender ligamentous bridles. This muscle covers the flexor profundus, flexor longus pollicis, the median nerve, the ulnar artery, the lumbricales muscles, and the phalanges of the fingers. In action, it bends the middle phalanges upon the proximal, and the latter upon the metacarpal bones, and lastly the hand upon the fore-arm.

250. The Fibrous Sheaths of the Fingers form with the anterior surface of the phalanges, a true canal, half bony and half fibrous, which lodges portions of each of the tendons of the two flexor muscles. They commence beneath the inferior metacarpal ligament, from which several fibres are sent off to join them, and terminate at the distal phalanx by interlacing with the expansion of the tendon of the flexor profundus, being

in their whole extent attached along the edges of the phalanges. The *anterior surface* is covered by the skin, and collateral vessels of the fingers; the *posterior* is smooth, and lined by a synovial bursa. The tissue of these sheaths is compact; they are formed of interlaced transverse fibres, of a pearly colour, and very thick at the middle of the proximal and middle phalanges, but opposite their articulation, disappear entirely, so as to leave the synovial bursa exposed. The latter proceeds from the wall of the sheaths over the tendons, forming above and below very distinct culs-de-sac, and having enveloped these tendons, is reflected posteriorly to the anterior surface of the phalanges by a triangular fold, formed of two laminæ placed back to back. The separation which exists between the two terminal slips of the tendons of the flexor perforatus, is filled by prolongations of the bursæ. Divide the flexor sublimis about its middle, and make a careful section mesially in the axis of the arm, of the anterior retinaculum. The fibrous sheaths of all the fingers may also now be slit up.

251. Flexor Digitorum Profundus or Perforans, is a thick, flattened, elongated muscle, simple and fleshy above, separated into four tendons below. It arises from the three upper fourths of the anterior surface of the ulna, and from the interosseus membrane, below the coronoid process, where it bifurcates so as to surround the insertion of the brachialis, sending at the same time a prolongation over the sides of the olecranon; it also arises from the aponeurosis which goes from the flexor carpi ulnaris to the ulna, and from the upper third of the inner surface of that bone. From these different origins, which are all aponeurotic, the muscle, thin at first, thicker in the middle, and becoming thin again, descends vertically and divides into four portions, the three inner of which are not very distinct. Each of these portions is terminated by a broad tendon, separated into several slips concealed in the substance of the fleshy fibres, and appearing upon their anterior surface toward the middle of the fore-arm. These tendons become free near the anterior retinaculum, under which they pass along with those of the flexor sublimis, into the palm, where they

descend, separating from each other. At first round and giving rise to the lumbricales, they become broader towards the articulations of the proximal phalanges with the metacarpal bones, present traces of a longitudinal division, pass into the fibrous sheaths of the fingers, through the fissure in the tendons of the flexor perforatus, lodged in the channels which limit it above and below, and are at length inserted, previously becoming flat, into the fore part of the distal phalanges of the fingers. Its covers the fore and inner surfaces of the ulna, the interosseous ligament, the pronator quadratus, the wrist-joint, the fore part of the metacarpus, the flexor brevis and adductor pollicis, and the last two palmar interossei muscles. Its *outer edge* corresponds above to the interior interosseous artery. In action, it bends the distal phalanges upon the middle, the latter upon the proximal, and these upon the metacarpus, and the hand upon the fore-arm.

252. The accessory muscles of the deep flexors, are called *lumbricales*. These muscles occupy the middle palmar region, but had better be described here. The LUMBRICALES, four small, slender, elongated, fusiform fleshy bundles, situated in the palm of the hand, and distinguished into first, second, third, and fourth, according to their relative position, counting from the radial to the ulnar side of the arm; they diminish in size in the same order. They arise towards the upper part of the hand, the first from the fore and outer part of the tendon of the flexor profundus, which goes to the fore-finger; the three following from the separation of the other tendons of the same muscle, so as to be attached to two of them at once. From thence they descend, following different directions; the middle two vertically, the outer outwards, and the inner inwards; and having arrived at the outer side of the articulation of the metacarpal bones, with the proximal phalanges of the fingers, they become very thin, and terminate by flattened tendons, which proceed behind the three phalanges, become broader, join the tendons of the corresponding interossei, and go, along with them, to be inserted into the outer edge of the tendons of the extensor digitorum communis. These tendons vary much in their dispo-

sition; they frequently divide into two, and one of their branches is attached to the phalanx; covered anteriorly by the tendons of the flexor digitorum sublimis, by the palmar aponeurosis, and by the collateral vessels and nerves of the fingers. The *posterior surface* lies upon the interossei, the inferior transverse metacarpal ligament, and the phalanges. In action they bend the fingers upon the metacarpus, carry them a little outwards, and fix the tendons of the extensor communis digitorum. The tendons of the flexor sublimis and profundus and the lumbricales separate the superficial palmar arch from the deep palmar arch.

253. The Flexor Longus Pollicis Manus is elongated, thin, flattened, thicker internally than externally, situated upon the radius, from the three upper fourths of the anterior surface of which it arises by short aponeurotic fibres, as well as from the neighbouring portion of the interosseous membrane, and even frequently from the coronoid process of the ulna, by a particular prolongation, fleshy in the middle, and tendinous at its extremities. The fleshy fibres, which are all oblique and about an inch long, form a bundle which descends vertically, and are inserted at the back part of a tendon, which they accompany until opposite the pronator quadratus. This tendon then becomes free and rounded, passes before the carpus, under the annular ligament, with the tendons of the two common flexor muscles. It then descends obliquely outwards between the two portions of the flexor brevis pollicis, passing between the two sesamoid bones. It now passes into the fibrous sheath of the thumb, and terminates by being expanded over the anterior surface of the distal phalanx of the thumb. Its *anterior surface* is covered by the flexor digitorum sublimis, flexor carpi radialis, and supinator longus muscles, the radial artery, and the anterior retinaculum. The *posterior surface* lies upon the radius, part of the interosseous membrane, the pronator quadratus, the wrist-joint, the fore part of the carpus, and the flexor brevis pollicis. Its *inner edge* lies upon the flexor digitorum profundus. In action it bends the distal phalanx of the thumb upon the proximal, and that upon the corresponding metacarpal bone, and the latter upon the carpus. This

muscle and the preceding may now be cut across, which, with a little dissection, will expose the

254. PRONATOR QUADRATUS, of a quadrilateral form, thin and flat. It lies upon the lower part of the fore-arm, and arises by a very thin aponeurosis expanded over its inner third, from the lower fourth of the anterior surface and inner edge of the ulna, passes transversely outwards, and terminates at the fore part of the lower fourth of the radius by indistinct aponeuroses. Its *anterior surface* is covered by the flexor digitorum profundus, flexor longus pollicis, flexor carpi radialis, and flexor carpi ulnaris muscles, and by the radial and ulnar arteries. The *posterior surface* covers the two bones of the fore-arm, and the lower part of the interosseous membrane. In action it turns the radius upon its axis from without inwards, and thus pronates the hand. The remaining muscles on the flexor aspect are mostly confined to the palm of the hand, and are generally esteemed difficult. We seldom see the student in his first year make much of them.

255. ABDUCTOR POLLICIS, short, triangular, arises externally by short aponeurotic fibres from the anterior surface of the os scaphoides; internally, from the anterior retinaculum. From thence it descends obliquely outwards; its fibres converge toward each other, and terminate by a short and flat tendon, concealed at first in their substance, afterwards receiving a portion of the flexor brevis pollicis, and inserted at the outer edge of the upper extremity of the proximal phalanx of the thumb, over the back of which it transmits some aponeurotic fibres to the tendon of the extensor secundi internodii pollicis; *anteriorly*, covered by a portion of the palmar aponeurosis and by the skin; *posteriorly*, it covers the opponens, and flexor brevis pollicis. In action it abducts the thumb. Divide the abductor about the middle, and reflect the two portions; this will expose

256. OPPONENS OR FLEXOR OSSIS METACARPI POLLICIS, triangular, arising internally from the fore part of the anterior retinaculum, by long aponeurotic fibres; externally, from the outer edge of the groove in the trapezium; and posteriorly, from an aponeurotic septum interposed between it and the

flexor brevis pollicis. From these different places, the fleshy fibres, which are so much the longer and more oblique the lower they are, proceed downwards and outwards, and terminate by short aponeuroses all along the outer edge of the first metacarpal bone, and sometimes partially on the tendon of the extensor ossis metacarpi pollicis: *anteriorly*, partly covered by the preceding muscle and by the skin; *posteriorly*, applied upon the anterior retinaculum, the articulation of the trapezium with the first metacarpal bone, part of the anterior surface of the latter bone, and the flexor brevis pollicis muscle. It opposes the thumb to the fingers. The inner edge of this muscle is almost uniformly inseparably connected with the outer portion of the flexor brevis pollicis. Their separation therefore is quite artificial.

257. FLEXOR BREVIS POLLICIS. Within and beneath the two preceding muscles, short, of an irregular form, and bifurcated at its two extremities, this muscle has two separate origins. One arises anteriorly and externally, from the fore and under part of the anterior retinaculum, from the trapezium, and from an aponeurotic septum interposed between it and the opponens pollicis. The other origin, which is posterior, is from the lower part of the os magnum, from the upper extremity of the third metacarpal bone, and from the ligaments by which they are united. The two portions of the muscle descend outwards, separated at first from each other, but soon united behind the tendon of the flexor longus pollicis, to which they afford a longitudinal channel. Arrived at the lower extremity of the first metacarpal bone, they separate anew; the outer joins the tendon of the abductor pollicis, and is attached to the fore part of the upper extremity of the proximal phalanx of the thumb, and to the outer sesamoid bone of its articulation; the inner is united to the summit of the adductor pollicis, and in like manner goes to be attached to the phalanx and to the inner sesamoid bone. These two insertions take place each by a pretty strong tendon. Anteriorly, covered at the middle by the tendon of the flexor longus pollicis; internally, by those of the flexor profundus and by the first two lumbricales; externally, by an aponeurosis,

the skin, and abductor pollicis. The *posterior surface* corresponds to the first metacarpal bone, to the first two dorsal, and to the first palmar interossei and tendon of the flexor carpi radialis. Its *outer edge* joins the opponens pollicis, and the *inner* the adductor. In action it bends the proximal phalanx of the thumb upon the first metacarpal bone, and the latter upon the trapezium.

258. ADDUCTOR POLLICIS, broad, thin, and triangular, is still more deeply seated than the flexor brevis. It arises from the three inferior fourths of the anterior surface of the third metacarpal bone, between two of the interosseous muscles, by short aponeuroses, to which the fleshy fibres succeed, which descend outwards converging, and terminate in a tendon united to that of the preceding muscle, and attached, along with it, to the inner and upper part of the proximal phalanx of the thumb. It often sends a fibrous prolongation to the tendon of the extensor secundi internodii pollicis; *anteriorly*, covered by the tendons of the flexor profundus, the first two lumbricales, and the skin; *posteriorly*, corresponding to the first three interossei, and also to the skin. In action it carries the thumb inwards, and brings it near the other fingers.

259. ADDUCTOR (*Abductor*) MINIMI DIGITI, flat, broader at its middle part than at the extremities; arises from the anterior and inferior parts of the os pisiforme, by aponeurotic fibres, continuous with the tendons of the flexor carpi ulnaris. From thence it descends along the inner edge of the fifth metacarpal bone, and is attached to the inner side of the upper extremity of the proximal phalanx of the little finger, by a tendon, which is united to that of the flexor brevis, and sends some fibres to join the inner edge of the tendon of its extensors: *anteriorly*, covered by the palmaris brevis, a very thin aponeurosis, and the integuments; *posteriorly*, covering the opponens minimi digiti. In action it carries the little finger inwards and forwards, and separates it from the other fingers. Detach this muscle from the pisiform bone, and reflect it.

260. FLEXOR BREVIS MINIMI DIGITI, thin and narrow, arising, by aponeuroses, from the anterior re-

tinaculum, and anterior edge of the process of the os unciforme, descends outwards, unites to the outer part of the tendon of the preceding muscle, and terminates along with it. In action it bends the first phalanx of the little finger. Detach this muscle also.

261. OPPONENS MINIMI DIGITI (*Adductor Ossis Metacarpi* of Cloquet) has nearly the same form and disposition as the opponens pollicis. Having the same origins as the preceding muscle, its fleshy fibres, so much the longer and more oblique the lower they are, descend inwards, and terminate along the inner edge of the fifth metacarpal bone, by distinct aponeurotic fibres. Its *anterior surface* corresponds to the adductor and flexor brevis of the little finger, and an aponeurotic expansion, sent off by the tendon of the extensor carpi ulnaris. The *posterior surface* is applied upon the last interosseous muscle, the fifth metacarpal bone, and the tendon of the flexor sublimis. In action it carries the fifth metacarpal bone forwards and outwards, thus augmenting the cavity of the palm of the hand. Most of the soft parts may now be so far removed as to expose the *interossei muscles*; but previous to this, the student may re-examine the arteries and nerves of the *arm*, *fore-arm*, and *hand*, of which he will find an account towards the close of this section.

262. INTEROSSEI. These muscles occupy the intervals between the metacarpal bones, and are divided into two sets, palmar and dorsal. The *Palmar Interossei*. The *first palmar* is thin and prismatic, arises from the two upper thirds of the inner side of the second metacarpal bone, and from the ligaments by which that bone is connected with the trapezoides, forms a tendon, appearing sooner internally than externally, which is inserted into the inside of the upper extremity of the proximal phalanx of the index, and to the extensor tendon of the same finger; anteriorly, covered by the flexor brevis and adductor pollicis; internally, corresponding to the second dorsal interosseous muscle. It carries the fore-finger inwards. The *second palmar interosseous muscle* is also prismatic, arises from the two anterior thirds of the outer surface of the fourth metacarpal bone, and from the ligaments by which it is connected with the neighbouring bones.

Its inferior tendon is attached to the outer side of the proximal phalanx, and extensor tendon of the ring finger; covered anteriorly by the lumbricales and the tendons of the flexor profundus. It carries the ring finger outwards. The *third palmar interosseus muscle* is of the same form as the others, and inserted into the two anterior thirds of the outer surface of the fifth metacarpal bone, and into the ligaments by which it is connected with the os unciforme. Its tendon is attached to the outside of the upper extremity of the proximal phalanx, and of the extensor tendon of the little finger. Its *anterior surface* is covered by the opponens minimi digiti; the *outer* corresponds to the fourth dorsal interosseous muscle. It carries the little finger outwards. The *Dorsal Interossei* are four in number. The *first* is the largest of the interossei, and is sometimes called the *abductor indicis.* It is of a triangular form, thin, and flat, and arises along the outer edge of the second metacarpal bone, and from the upper half only of the inner edge of the first, as well as from the ligaments which connect these bones with the trapezium. Between these two origins, there exists, superiorly, an interval through which the radial artery passes, forming a remarkable analogy with what takes place in the foot. The two fasciculi which arise from them unite, and terminate in a tendon partly attached to the outside of the upper extremity of the proximal phalanx, partly to the extensor tendon of the index. Its *posterior surface* is covered by the skin; the *anterior* by the first lumbricalis, the flexor brevis, and abductor pollicis, and by the skin. It draws the fore-finger outwards, and the first metacarpal bone forwards. The *second dorsal interosseus muscle* has the form of a triangular prism, arising from the inner side of the second metacarpal bone, behind the origins of the first palmar interosseus muscle, (separated by a thin cellular line,) from the outer side of the third metacarpal bone, from the ligaments which connect these bones with each other and with the neighbouring bones. Its *upper extremity* is perforated for the passage of an artery. The *lower* is terminated by a tendon, which, like the preceding, is attached to the outer side of the proximal phalanx of the middle finger, and of its extensor tendon. Its *posterior surface,* is covered by the skin and the tendons of the extensor muscles of the fore finger, as well as by an aponeurosis which passes from the second metacarpal bone to the third. The *anterior surface* is narrow, and concealed under the flexor brevis and adductor pollicis. It carries the middle finger forwards. The *third dorsal interosseus muscle* has the same form as the preceding. It arises from the inner side of the third metacarpal bone, from the posterior part of the outer side of the fourth, and the ligaments by which they are connected. At its upper part it is bifurcated for the passage of an artery. Below, it terminates, like the others, in a tendon which is attached to the inner side of the upper extremity of the proximal phalanx, and of the extensor tendon of the middle finger. Its *posterior surface* is covered by the skin and tendons of the common extensor of the fingers. It carries the middle finger inwards. The *fourth dorsal interosseus muscle* is triangular and prismatic, and arises from the whole inner side of the fourth metacarpal bone, and from the posterior part of the outer edge of the fifth, as well as from the ligaments by which they are connected. Its *upper extremity* is traversed by an artery; the *lower* terminates in a tendon which is attached to the inner side of the ring finger. Its *posterior surface* is covered by an aponeurosis which goes from the fourth to the fifth metacarpal bone, by the extensor tendons of the little finger, and by the skin; the *anterior* is concealed above, beneath the interosseus muscle of the little finger, and appears below, between it and the second palmar interosseus muscle. In action, it carries the ring finger inwards. Thus all the palmar interossei have single, and all the dorsal have double origins. From their connexions with the tendons of the extensors of the fingers, the interossei and lumbricales may contribute to extend the fingers. In the dissection of the fore-arm and hand, the more advanced student should attend to the course of the following vessels and nerves. First, The radial artery, following a tolerably straight course from the bend of the elbow to near the styloid process of the radius, placed about the middle of the fore-arm on the pronator teres muscle, and next on the flexor proprius pollicis; it next passes to the back of the carpus beneath the tendons of the extensor ossis metacarpi pollicis, and extensor primi internodii pollicis, towards the interval betwixt the first and second metacarpal bones. It here sinks deep between the separate origins of the first dorsal interosseal muscle, (the abductor indicis,) and in this way gets into the palm of the hand to form the deep palmar arch. The artery crosses the palm of the hand, proceeding from the radial to the ulnar side, situated deep beneath the tendons of the flexor profundus perforans, and after giving off many branches, it anastomoses by a pretty strong *ramus communicans* with the ulnar artery. This anastomosis takes place beneath the opponens minimi digiti muscle. The branches given off by the radial artery from above downwards, are 1st, the recurrens; 2d, several muscular branches; 3d, superficialis volæ, a small branch which passes over the origins of the small muscles of the thumb, and generally joins the superficial palmar arch (the ulnar artery); 4th and 5th, the anterior and posterior arteries of the carpus; 6th, the art. magna pollicis; 7th, radialis indicis; 8th, palmaris profunda. The deep radial veins accompany the artery and lie close to it; a branch of the musculo-spiral nerve is found running parallel with it, but not close to it; in fact, the radial artery is not accompanied by any nerve. The *ulnar artery* is more difficult of dissection than the radial, and is much deeper than it at first in respect to the muscles, but it becomes superficial lower down. Coming off from the humeral, as has been already mentioned, it passes towards the inner side of the arm to follow somewhat the direction of the ulna. It ultimately forms the superficial palmar arch of arteries, whence are supplied the arteries of the fingers. Placed at first beneath the pronator teres and superficial flexors, and on the flexor profundus, it passes down the fore-arm in its lower part, parallel with the tendon of the flexor carpi ulnaris, upon the radial side of which it is placed. It next passes over the anterior annular ligament of the carpus, covered, however, by an expansion of the aponeurosis of the fore-arm, and placed upon the radial side of the pisiform bone. Having thus passed into the hand, still beneath the aponeurosis it forms the superficial palmar arch, a vessel proceeding from the ulnar side to the radial side of the hand, and placed above the tendons of the muscles. In the upper third of the fore-arm, the ulnar nerve is separated from the artery by a considerable interval, but they approach each other about the middle of the fore-arm, and afterwards continue nearly the same course; the nerve lies generally on the ulnar side of the artery. The deep ulnar veins accompany the artery throughout its course. The branches given off by the ulnar are difficult of dissection. 1st and 2d, The recurrents, improperly called anterior and posterior, they ought to be named superior and inferior. The first is distributed in front of the condyle, the other behind it. 3d, The interosseal artery, the largest branch given off by the ulnar. This artery follows the space between the bones, and is placed close to the anterior surface of the *membrana interossea*, between the flexor proprius pollicis longus and flexor profundus. It descends as low as the upper margin of the pronator quadratus, and there subdivides into two branches. Superiorly, it sends back a strong branch called the posterior interosseal; this passes through the opening in the upper part of the interosseal ligament, and then follows the course of the extensor communis digitorum. 4th, The ulnar gives off many muscular branches. 5th and 6th, The anterior and posterior carpal arteries. 7th, It terminates by becoming the superficial palmar arch. 8th, It gives off the ramus communicans which connects it with the deep palmar arch; this artery generally passes through the opponens minimi digiti. The digital arteries arise from the convexity of the superficial palmar arch.

263. In respect to the nerves found in the fore-arm and hand, they are of course the continuation of some of those already spoken of. The cutaneous nerves are removed at an early stage of the dissection: the *median* passes beneath the heads of the pronator teres, descends beneath the flexor sublimis, passes along with its tendons under the anterior retinaculum, enlarges a little at this point, and ultimately gives off branches to supply the thumb, fore finger, middle finger, and one side of the ring finger. In the fore-arm it gave off the

interosseal and several branches to the muscles. The *ulnar nerve* may be traced from behind the internal condyle, at first between the heads of the *flexor carpi ulnaris*, next on the anterior surface of the flexor profundus towards the middle of the fore-arm, where it places itself at the side of the ulnar artery, and from this point follows its course. In the hand, it supplies branches to one side of the ring-finger and the little finger, previous to which it sends a considerable branch to the back of the hand. The *musculo-spiral* may be traced from the surface of the supinator brevis along the radial side of the arm, following the course of the radial artery; its ultimate distribution is to the back of the hand, and superiorly it gives off the posterior interosseal.

PART V.

DISSECTION OF THE THORAX AND ITS CONTENTS.

264. The dissection of the THORAX should be undertaken immediately after that of one of the extremities. In the division of the subject usual in dissecting rooms, the thorax and its contents fall to be dissected after the removal of the arms, or thoracic extremities; thus all the great muscles covering or adhering to its osseous walls, have probably been entirely removed.

265. THORAX VIEWED EXTERNALLY. The student for the first time, perhaps, gets a view of its actual form when the shoulders and limbs have been removed, and he will find it quite unlike what he anticipated, unless indeed he has previously given the skeleton a more than ordinary share of his attention. If the student has really neglected this part of the articulated skeleton, he will find it an unprofitable waste of time to dissect the recent subject. If the cavity of the abdomen happen to have been previously laid open by another dissector, the student about to examine the

thorax, should explore the position of the *diaphragm* (*septum transversum*, *midriff*) and how far it ascends into the chest, contracting, as it were, that cavity most where least expected, separating it from the cavity of the abdomen, and thus forming its base. At this period of his dissection, he should carefully go over with the demonstrator, or with a more advanced student, the *attachments* of all the muscles to the osseous walls of the thorax; and he should, by clearing these attachments, endeavour to verify all the facts, and to make himself master of the precise insertions or attachments of those muscles, and the limits of each. The muscles which have an attachment to the osseous walls of the thorax are as follows: Trapezii; splenii; complexi majores; spinales dorsi; sacro-lumbales; longissimi dorsi; semi-spinales lumborum; serratii postici superiores, inferiores, et magni; rhomboidei; intercostales interni, externi; scaleni; sterno-mastoidei; sterno-thyroidei; sterno-hyoidei; triangulares sterni; levatores costarum; external and internal abdominal oblique muscles; transversi abdominis; recti, psoæ, quadrati lumborum; diaphragm; pectorales majores et minores. Having gone over these two or three times, and studied their actions, (the only way by which he can ever hope to remember them,) let him next, having surveyed the form of the osseous thorax upon a skeleton, proceed to the dissection of the intercostal muscles.

266. Intercostales Externi, eleven in number, situated in the intercostal spaces, from the vertebral column to the union of the ribs with their cartilages; thin, and borrowing their form and breadth from each of the spaces receiving them; attached above to the outer lip of the lower edge of the rib above, posteriorly to the transverse process of the vertebra with which that rib is articulated; tendinous bundles are prolonged between them, and multiply their points of insertion; they descend from thence obliquely inwards and forwards, and terminate at the upper edge of the lower rib, partly in the periosteum and partly in small aponeuroses with which they are interlaced; those of the upper intercostal muscles are less oblique than those of the lower, and they are more so posteriorly than before. A delicate aponeurosis continues the muscle,

as it were, as far as the sternum, by occupying its place: the fibres of this aponeurosis are occasionally very distinct. Externally, covered by the two pectoral muscles, the serratus magnus, obliquus externus abdominis, serratus posticus, superior and inferior, sacro-lumbalis, and longissimus dorsi, the pleura lining their internal aspect from the tuberosity to the angle of the ribs. Where the pleuræ are reflected, the external corresponds to the internal intercostal muscles, separated by a thin layer of cellular tissue, and by the intercostal vessels and nerves.

267. Intercostales Interni, eleven in number, like the external intercostals in form and breadth, but only extending from the angle of the ribs to the sternum. Their fleshy fibres are equally intermingled with aponeuroses: but they descend obliquely backwards, and thus decussate the external, or take an opposite direction, and are inserted above into the inner lip of the lower edge of the ribs and their cartilages, and below into the inner part of the upper edge of the ribs and cartilages; they are less oblique than those of the external intercostal muscles. Externally covered by the preceding muscles, and in connexion with the intercostal vessels and nerves, which are placed between the external and internal intercostal muscles; *internally* lined by the pleura, and a thin layer of a nearly fibrous cellular tissue. The intercostales externi and interni have the same uses; they raise or depress the ribs, in the motion of inspiration or expiration, according as the upper or lower rib is the point from which they act. On the back part of the chest, running from the transverse processes of the dorsal vertebræ to the ribs, the levatores costarum are met with.

268. Levatores Costarum. Each rib receives from the summit of the transverse process situated above that with which it is articulated, a small, flat, thin triangular fleshy bundle; these, to the number of twelve, form a series which extends along the posterior part of the trunk: they are directed obliquely downwards and forwards, and attached by aponeuroses intermingled with the fleshy fibres, to the upper edge of the rib below, and occasionally to that of the next by means of an appendage which passes over the posterior

costo-transverse ligament. The upper are smaller and thinner than the lower, and the first arises from the last cervical vertebra. There are also observed, in various places of the inner surface of the thorax, small muscular planes, which vary much in respect to number, size and situation; they descend obliquely backwards from one rib to that which is beneath, or to that which follows it, and have been named *infracostales*. In action they raise the ribs, and are subservient to inspiration.

269. THORAX VIEWED *internally*. The interior of the thorax is not so extensive as its external dimensions would lead one to suppose; this is owing to the ribs shutting in as it were, and forming or assisting to form the hypochondria, and thus contributing (though indirectly) to form a part of the abdominal parietes likewise. The cavity itself extends from the lower part of the neck to the abdomen, and contains, 1°. The lungs. 2°. The pleuræ, two in number. 3°. The heart and pericardium. 4°. A considerable number of arteries, veins, lymphatics and nerves, either belonging to the chest itself and its contained organs, or passing through it in an upward or downward direction; thus portions of very important organs are found within it, such as the greater part of the gullet or œsophagus, of the aorta, of the thoracic duct, &c. The boundaries are as follows: *anteriorly*, the sternum and costal cartilages; *laterally* and *posteriorly*, the ribs, intercostal muscles, and dorsal portion of the spinal column; *inferiorly*, the diaphragm; *superiorly*, the cavity of the thorax would open into the lower part of the neck, were it not for the pleuræ, the scaleni and other muscles, and the passage of the trachea, gullet and large vessels filling up the rather contracted passage called the superior aperture of the chest. Upon the whole, now that the extremities are removed, the thorax will be found to resemble a cone somewhat truncated above, flattened behind, expanded below, with an extremely sloping basis (the diaphragm) towards the abdomen. Through the *superior aperture* of the thorax whose boundaries are the first ribs and their cartilages, the sternum and inter-clavicular ligament, there pass the following parts: the sterno-hyoid and thyroid mus-

cles, the venæ innominatæ, the phrenic, and eighth pairs of nerves, the sympathetic system of nerves, and the anterior branch of the first dorsal, the brachio-cephalic artery, left carotid and left subclavian arteries, and the superior intercostal vessels, the trachea, the gullet, the thoracic duct, the longi colli muscles and the anterior common ligament of the vertebral column. Occasionally also may be seen ascending the middle thyroid vessels. Through the *inferior or base,* the vena cava inferior, and the gullet; the aorta, thoracic duct and azygos vein pass from the thorax into the abdomen, but behind the diaphragm. The boundaries of the circumference of the basis or inferior aperture of the thorax are anteriorly and laterally the xiphoid process of the sternum, the cartilages of the seventh, eighth, ninth, tenth, eleventh and twelfth ribs, and behind the spinal column.

270. The thorax requires to be opened systematically, and we recommend the following procedure to be adopted; cut through the cartilages of the second, third, fourth, fifth and sixth ribs on each side, close to their connexion with the ribs; likewise the intercostal muscles and pleuræ in the same line of incision, introduce the fingers cautiously into the opening so made, in order to protect the diaphragm inferiorly, and carefully tear through any adhesions which may exist between the contained organs and the walls of the thorax. Divide the first pair of intercostal muscles on each side till within about two or three inches of the spine; next saw the ribs a little anterior to their angles so as to allow of the removal of a large portion of the walls of the chest; by this means the student exposes the interior of the chest most favourably for taking up a correct idea of the mechanism of the interior, the position of the lungs, the nature of the partition dividing the chest into two cavities having no communication with each other. As soon as he has thus removed a sufficiently large portion of each side of the walls of the chest, leaving the first and last two ribs untouched, the student may proceed to examine the pleuræ, and the form and position of the lungs themselves.

271. The PLEURÆ (two in number) are serous membranes investing the interior of the chest, and giving a partial covering to the lungs and to other organs situ-

ated within the cavity. A pretty firm cellular substance connects their external surface to the intercostal muscles, the ribs, the lungs, the pericardium, or whatever parts they invest; on their inner surface they are uniformly smooth, thin, and as it were polished, and farther bedewed with a seriosity as all serous membranes are. Each pleura, if dissected from every part it covers, would present an empty sac without an opening into it; this was first proved by Mr. Hunter. The older anatomists not understanding this mechanism, called that part of each pleura covering a great part of the lungs, the *pleura pulmonalis*, and the portion connected with the ribs, *pleura costalis*; these terms, as conveying inaccurate ideas, ought to be discontinued. The pleuræ vary in thickness at different parts, as the student will observe on dissection. It will be proper for the student to trace each pleura in the following manner:—Proceeding from the sternum, the pleuræ direct themselves outwards, line the inner surface of the ribs, their cartilages and the muscles which occupy their intervals, separated, however, from the latter by the intercostal vessels and nerves, and by adipose cellular tissue. They thus advance as far as the vertebral column, reflected inferiorly over the diaphragm, where connecting the inferior lobe of each lung to that muscle, there is a process of pleura called the *Ligamentum Latum Pulmonis*; they cover the thoracic surface of the diaphragm, and superiorly pass under the upper ribs, behind and above which they form a cul-de-sac for lodging the summits of the lungs. Towards the articulations of the ribs with the vertebræ, they are applied upon the thoracic nervous ganglia and their branches, and then direct themselves over the lateral parts of the bodies of the vertebræ. There, the pleura of the right side approaches to that of the left, but there remains between them a narrow and irregular triangular space named the *Posterior Mediastinum*. Anterior to this space, the pleuræ, though very close to each other, do not yet come into contact, but pass to the sides of the pericardium, cover it at first over a small extent, and are reflected over the posterior part of the pulmonary vessels and over the lungs themselves, covering at first their convex surface, their summit and base, diving deeply into the interlobular fissures. From thence they return upon their plain surface, the anterior part of the pulmonary vessels, and the other portion of the sides of the pericardium, at the fore part of which they again approach each other. They then gain the posterior surface of the sternum, and the point whence we have considered them as setting out, intercepting between them a space not parallel to the sternum, but inclined from above downwards and from right to left, broader below than above, very narrow at its middle part, named the *Anterior Mediastinum*, (273.) The pleuræ are easily detached from the sternum, ribs, intercostal muscles, and sides of the vertebral column, but are united in a more intimate manner to the surface of the lungs, although there exists between them and the parenchyma of the organ, a rather dense membrane composed of cellular tissue. They are connected in a loose manner with the anterior and posterior parts of the lateral surfaces of the pericardium, but on their middle region, and opposite the pulmonary vessels, they adhere with extreme firmness. The *inner surface* of the pleuræ is smooth, polished, moistened by a serous fluid, and free of all adhesion in the natural state. By boiling, they lose their transparency, and acquire an opaque opaline tint. On the sides of the diaphragm, they present small adipose appendages (*appendices epiploicæ of the pleuræ*) similar to those described as occurring on the large intestine, and they are a little thicker at the posterior surface of the chest than at the anterior. By inflammation, very close adhesion may take place any where betwixt the smooth surfaces of the parietal and visceral portions of the pleuræ, so as entirely to obliterate what is called the cavity of the pleura. Such adhesions render penetrating wounds of the thorax more dangerous than they otherwise would be. The arteries of the pleuræ come from the intercostal, internal mammary, phrenic, inferior thyroid, thymic, pericardiac, and bronchial arteries. The veins exactly correspond to the arteries. A prodigious quantity of lymphatics is perceived in these membranes; but no nervous filaments have yet been traced in them. The student will by this time have remarked that there must exist a space between the right and left pleuræ, extending from the internal surface of the sternum to the front of the dorsal vertebræ; this space contains the pericardium, heart, &c., and is generally called *Mediastinum* or *Mediastina,* for there are two, and according to some, three. The best mode of examining these cavities intermediate of the pleuræ, and which form by their walls a partition of varying breadth across the centre of the chest from before backwards, is as follows:

272. Mediastina. The mediastina then are three in number: 1°. The *anterior*, lying behind the sternum and before the pericardium. 2°. The *middle*, containing the pericardium and heart, and bounded before by the anterior mediastinum, behind by the posterior one. 3°. The *posterior*, lying in front of the vertebral column. But the walls of these cavities are simply formed by the pleuræ passing backwards from the sternum to the spine.

273. The Anterior Mediastinum. Saw the sternum across in the lower part of its body, a little above the ensiform process, and begin to raise it up, the cartilages at the ribs having been already cut through. As this is being done, the pleuræ forming the right and left walls of the anterior mediastinum must be cut cautiously, and the student looking in below the sternum as he raises it up, will see a cavity gradually unfold itself: this is the cavity of the anterior mediastinum. The sternum may then be removed in this way altogether, and the region being fully exposed, its form may be examined. It does not exactly follow the axis or direction of the sternum, but inclines to the left side, owing to the position of the heart and pericardium, (the right wall being nearly straight, and the left descending rather to the left side,) broad above, behind the manubrium, narrow in the middle where the pleuræ all but touch each other, and broader again below, immediately above the diaphragm. It almost forms two triangular spaces, the base of the one being above, that of the other below, and the common apex in the centre. It has been very incorrectly compared to the letter X, whereas it is precisely of this shape)(. On the inner side of the manubrium of the sternum just removed, the student will find the attachments of the sterno-hyoidei and sterno-thyroidei muscles, and some remains of the thymus gland, lie in this part of the mediastinum: like-

wise a few lymphatic glands, and much cellular substance; laterally and close to the sternum the internal mammary vessels, and triangulares sterni muscles.

274. TRIANGULARIS STERNI, arising from the edge of the ensiform cartilage and sternum, up to the articulation of that bone with the fourth cartilage, by means of aponeurotic fibres which are prolonged among the fleshy fibres; from thence ascending outwards, to be attached by so many digitations to the edges and inner surface of the cartilages of the third, fourth, fifth, and sixth ribs. Covered anteriorly by the cartilages of the four last true ribs, the inner intercostal muscles, and the internal mammary vessels; the *posterior surface* rests upon the pleura, and in a small part of its extent upon the diaphragm; its *inferior edge* or *base* is contiguous to the transversalis abdominis. In action it draws the cartilages of the ribs, to which it is attached, backwards, inwards, and downwards, and assists exspiration.

275. The cautious dissection of each pleura from the pericardium, as far back as the root of the lungs, should now be made, and the close adhesion of these two membranes at certain points, (towards the middle) and the laxity above and below, cannot fail to be noticed. It is here that the pleuræ are thinnest.

276. MIDDLE MEDIASTINUM. This cavity is easily understood; it contains the pericardium, heart, and a portion of the large vessels, on its outer side. The phrenic nerves and *arteria comes nervi phrenici* may be seen lying betwixt the pleuræ and pericardium.

277. The POSTERIOR MEDIASTINUM extends from about the third dorsal vertebra to the tenth behind the pericardium, and in front of the spine. It ought to be examined in three ways; 1°. from the right side by drawing the right lung upwards and forwards out of its cavity; 2°. from the left side by drawing up in like manner the left lung; 3°. after the examination of the heart *in situ*. The student having removed that organ altogether, may then examine the posterior mediastinum, by cutting through the back part of the pericardium, and dissecting it from the front backwards towards the spine. He thus cannot fail to understand the mechanism of this cavity. Its walls are formed by the pleuræ; *posteriorly* it is bounded by the bodies of the

dorsal vertebræ; *anteriorly*, by the back of the pericardium. In it there lay the œsophagus, the descending portion of the thoracic aorta, the eighth pair of nerves, the thoracic duct, the vena azygos of the right and left sides, the splanchnic nerves, towards the lower part, several lymphatic glands; the division of the trachea inferiorly, and the commencement of the bronchial tubes. The course of these important parts, and their connexion with each other, will be best understood after the dissection of the heart and pericardium, but the student may previously to the complete examination of the contents of the posterior mediastinum, dissect and examine that cavity on the right side and on the left side; and, first, on the right side, draw the right lung out of its cavity, and lay it over towards the left side; make an incision through the right pleura, close to the root of the lungs, and reflect it towards the ribs; clear away a little cellular substance, and expose the following parts. The *œsophagus* will be observed close to the front and mesial part of the column; it enters the thorax from the neck behind the trachea, and to its left side, passes under and behind the arch of the aorta, and descends mesially and to the right of the aorta, until it reaches the diaphragm, through which it passes to enter the stomach. The orifice in the diaphragm through which it passes, is called the *œsophageal orifice,* and is formed anteriorly by the cordiform tendon, laterally by the pillars of the diaphragm; posteriorly the decussating fibres separate it from the aorta. Whilst in this course the eighth pair of nerves, the œsophageal plexus, and cords (portions of the eighth pair,) are united with it by cellular substance; inferiorly it dilates somewhat before joining the stomach. The student should distend the gullet with air to have a good view of it. The eighth pair of nerves are also proceeding towards the stomach, and pass through the diaphragm by the same opening with it, the left nerve more anteriorly, the right more posteriorly.

A. The THORACIC DUCT, lying towards the right of the gullet, imbedded in cellular and adipose membrane, and so close to the pleura as to be very often removed along with it by the incautious dissector; behind it lie the right intercostal arteries, and some of the left intercostal veins, more especially a small portion of the left vena azygos; the right azygos vein lies close to it, but towards the right side. Although the full description of this vessel properly belongs to the absorbent system, where the student will find its minute descriptive anatomy, it may not be amiss to offer a brief account of it here. The thoracic duct is the great terminating vessel of nearly the whole of the absorbent system of vessels, including lacteals and lymphatics. It commences in the abdomen on the second or third lumbar vertebra, and behind the aorta by a dilatation, called *receptaculum chyli ;* contracting in calibre to about the size of a crow quill, it passes from the abdomen into the thorax by the aortic opening of the diaphragm, gets into the posterior mediastinum to the right side of the aorta ; it then ascends between the aorta and the vena azygos imbedded in fat, but anterior to the intercostal vessels, as already mentioned ; opposite to about the fifth dorsal vertebra, it passes obliquely behind the gullet, and arch of the aorta, and ascends in the neck behind the left jugular vein and left carotid artery, as high as the sixth cervical vertebra, thus passing from the right side of the thorax to the left side of the neck ; it next bends downwards and enters the left subclavian vein, near the point of its junction with the corresponding jugular vein. The thoracic duct abounds with strong valves, allowing the contents to pass only in one way, that is from below upwards ; by opening it low down in the thorax, the student may distend it with air, by blowing from below upwards ; its tunics are nearly transparent, although they have by some been supposed to be muscular.

B. The RIGHT VENA AZYGOS (*vena sine pari*, Eust.) is also found in the posterior mediastinum on the right side : it commences in the abdomen by a branch or two from some one of the superior lumbar veins, or from the inferior cava or right common iliac vein, enters the thorax behind the diaphragm by its aortic opening, covered by the right pleura, and running up parallel with the thoracic duct, it arches forward opposite the third or fourth dorsal vertebra, over the root of the right lung and right bronchus, and opens into the superior vena cava just as that vessel is about to pass through the fibrous pericardium. In this course, the right vena azygos, like most of the deep veins of the trunk, has no valves, and may be injected with air from above downwards, in order to shew its course, and the branches or veins which pour their blood into it. These are the bronchial, œsophageal, and many of the intercostal veins, and a vein, or sometimes two, which come from the left side opposite to about the sixth dorsal vertebra, viz. the left azygos; this passes behind the aorta to join that of the right side.

C. The SPLANCHNIC NERVES lie somewhat in the posterior mediastinum, towards its lower extremity. These *nerves* are merely filaments of communication between the thoracic ganglia of the sympathetic system of nerves and the great abdominal semilunar ganglion and solar plexus. They commence by four or five filaments from the fifth, sixth, seventh, and eighth of the thoracic ganglia; these unite to form a single trunk, which passes through the diaphragm at varying points, enters the abdomen, and there joins the semilunar ganglion; a smaller splanchnic generally arises from the tenth and eleventh thoracic ganglia, whose course resembles the greater splanchnic, but usually joins the renal plexus.

D. The THORACIC GANGLIA and SYMPATHETIC SYSTEM OF NERVES. These ganglia will be found external to the posterior mediastinum and pleura; there is usually a ganglion opposite to the head of each rib, and a filament of communication with the one preceding and the other following, thus connecting all these ganglia invariably with each other, and the first one with the last cervical ganglion of the same system of nerves; the last thoracic ganglion sending a communicating filament through into the abdomen, behind the diaphragm, connects the last thoracic ganglion with the first lumbar: I have found this connection *invariable*, contrary to the opinions of Bichat and Haller. The sympathetic system of nerves thus enters the thorax from the neck, close to the cervix of the first rib, and quits it by passing behind or through the diaphragm, but usually behind the internal ligamentum arcuatum, close to the inner margin of the psoas, as has been described. The right bronchial tube and the division of the trachea had better be examined whilst examining the lungs, after the dissection of the pericardium and heart. Besides the organs already described, the student will find on the right side of the chest, the corresponding aortic intercostal arteries between the intercostal spaces, also the dorso-spinal nerves; and in the upper part of the chest, descending over the neck of the first rib, the subclavian intercostal artery. This vessel supplies two or more of the superior intercostal spaces. The anterior branch of the first pair of dorsal spiral nerves ascends upwards over the same rib to join the brachial plexus. In order to examine the posterior mediastinum on the *left* side of the thorax, raise up the left lung, drawing it over towards the right side; remove the pleura, and find the following structures: 1°. The descending portion of the thoracic aorta. 2°. The left vena azygos. 3°. The splanchnic nerves. 4°. The thoracic ganglia of the sympathetic and their communicating filaments. 5°. The left dorso-spinal nerves. 6°. The left intercostal arteries and veins. The description of all these parts (excepting the aorta and left vena azygos) resembles, with but trifling differences, that of the analogous parts on the right side, and need not therefore be repeated. The aorta and left vena azygos require a separate brief description at this stage of the dissection. The descending portion of the thoracic aorta enters the posterior mediastinum about the left side of the third, sometimes the fourth, or even the fifth dorsal vertebra, on the body of that bone; it not unfrequently makes a distinct impression and descends along the left side of the bodies of the remaining dorsal vertebræ; on the eleventh and twelfth, it passes betwixt the crura of the diaphragm into the abdomen, of course altogether behind the muscle, and losing its name is called, from this point downwards, the abdominal aorta. In this course there arise the following arteries from it: 1°. The bronchial arteries. 2°. The œsophageal. 3°. The aortic intercostals. These vessels will be carefully described immediately.

E. The LEFT VENA AZYGOS arises in the abdomen from some one or other of the lumbar veins;

like that of the right side, it has no valves. The lower intercostal veins generally contribute to form it, and there is sometimes a *descending azygos* of this side collecting the upper intercostal veins; they then cross behind the aorta to the right side, and enter the right vena azygos about the middle of the chest. It has been already remarked, that before the student can complete his view of the posterior mediastinum and its contents, the pericardium and heart must be dissected and examined. In this examination there are two stages; 1st, the examination of each part *in situ;* 2d, the removal of the heart from the pericardium, by carefully cutting through its great vessels just as they are about to pass through the pericardium.*

278. The PERICARDIUM, or fibro-serous envelope of the heart, is a membranous bag, composed of two laminæ, an *outer* or fibrous, an *inner* or serous, which envelopes the heart and the arterial and venous trunks which issue from, or enter into it. It is lodged in the middle mediastinum (276), above the central aponeurosis of the diaphragm, to which it is strongly united. Its external form is, at first sight, that of a cone, with the base directed downwards and a little to the left, while the summit looks upwards, backwards, and to the right; but when freed of the fat in which it is, as it were, immersed, it is found to be exactly moulded upon the heart. *Anteriorly*, the pericardium is covered by the pleura, excepting in its middle part, where it corresponds to the anterior mediastinum and to the thymus gland, and by intervention to the sternum and cartilages of the last sterno-costal ribs of the left side, from which it is separated laterally by the fore part of the lungs. *Posteriorly*, it is of a very small extent, and rests upon the bronchi, œsophagus,

* Although, in accordance with the usual descriptions of authors, we have spoken of the anterior and posterior mediastinum as extending up as high nearly as the level of the upper part of the manubrium of the sternum; yet in point of fact, there is no natural division of the cavity lying immediately behind the manubrium of the sternum; or in other terms, it is the pericardium and heart which, properly speaking, separate the anterior from the posterior mediastinum; above this the division would be perfectly artificial.

and descending aorta. *To the right and left*, it is connected by cellular substance with the pleuræ, the phrenic nerves, and the internal surfaces of the lungs. *Inferiorly*, it corresponds to the aponeurotic centre, and a little to the left, to the fleshy fibres of the diaphragm. The *outer* or *fibrous membrane* is intimately united below with the aponeurosis of the diaphragm, it ascends around the heart, which it embraces as far as its base, and there is continued to a greater or less distance upon the great trunks of the vessels, dividing into several distinct sheaths which accompany them to a certain distance. The pericardium, therefore, is in one sense not perforated to allow these vessels to pass, as many anatomists have alleged; but its fibrous lamina loses itself insensibly on their walls, and even seems to be united with them. These sheaths are eight in number; one, which is very short, for the vena cava superior; four, still shorter, for the pulmonary veins; one, which is indefinitely prolonged, for the aorta; two for each branch of the pulmonary artery. The vena cava inferior penetrates the diaphragm, and immediately enters the right auricle of the heart, and has thus no fibrous sheath. This membrane presents the greatest resemblance to the dura mater in its structure, only it is not so thick. Its colour is pearly and aponeurotic. Its fibres are sometimes isolated, often collected in distinct bundles, of variable thickness and breadth, irregularly disposed, and crossing each other in all directions. The greater number, however, ascend vertically and parallel to the axis of the pericardium. To examine the *inner* or *serous* membrane of the pericardium, the bag must be laid open extensively on its anterior surface; in this way the student opens the cavity of the pericardium, by cutting through both its layers, and is enabled to examine and trace its serous layer. The serous membrane has a much more extended course than the fibrous membrane, as, after lining its inner surface, it is reflected over the heart and covers it entirely, without, however, containing it in its interior, in which respect it is similar to the other serous membranes existing in joints, and the pleuræ in the thorax; but it has always appeared to us, that the fibrous layer is interposed between the serous layer and the diaphragm.* Lining the parietes of the fibrous membrane to the place where the latter is prolonged upon the great vessels of the base of the heart, it is reflected upon the aorta, above its first curve ; to the left upon the pulmonary artery, before its bifurcation ; to the right upon the vena cava superior, about an inch above its entrance into the auricle, and on the right pulmonary veins, immediately after their issuing from the lung. It covers the surface of all these vessels, penetrates into their intervals to a greater or less distance, and invests the aorta and pulmonary artery in their whole circumference, excepting the place where they are in immediate contact. It also covers, between them, the ductus arteriosus, or the ligament by which it is substituted. In the place where this membrane is reflected, the separation of the two laminæ of the pericardium may be very distinctly seen, a very perceptible triangular space existing between them. Having arrived at the base of the heart, the serous membrane proceeds directly from the pulmonary artery over the ventricles, and from the vena cava over the right auricle. On leaving the aorta, it is prolonged into a depression which exists between that artery and the right auricle, whence it also directs itself towards the ventricles. From the summit and edges of the heart, it goes to its posterior surface and covers it, ascends again to its base, embraces it to the right and below the vena cava inferior, to the left and above the left pulmonary veins, and is reflected over the posterior part of the fibrous membrane. This membrane dives into all the irregularities which the heart presents at its surface, where it is so thin and transparent, especially upon the ventricles, that it becomes very difficult to demonstrate its existence, excepting in the places where it is separated from the fleshy fibres by adipose tissue. It adheres intimately to the fibrous membrane, and can only be detached from it in points of small extent, or at the place of its reflection. It has very little attachment to the vessels, and can easily be raised from their surface. The inner

* Mr. H. Cloquet thinks that it is applied directly, and in a very close manner, upon the aponeurosis of the diaphragm.

surface of this membrane, which is everywhere in contact with itself, is smooth and polished, and continually moistened by a serous fluid, the liquor pericardii. This liquor may amount to several ounces, and yet not constitute the hydrops pericardii. The arteries of the pericardium are very small, and arise from the thymic, phrenic, bronchial, and œsophageal arteries, the coronary arteries of the heart, the internal mammary arteries and the aorta itself. Its veins correspond to the arteries, and partly terminate in the vena azygos. Its lymphatic vessels go to the glands which surround the vena cava superior, and the origin of the aorta. Nervous filaments have not yet been traced into the substance of its laminæ.

279. The HEART (*Cor*), should first be examined *in situ*, all its parts named, and its relative position direction, form, &c. carefully noted The following description may be read over before the student commences cutting into any part of it. The heart is the centre of the circulation ; it is a hollow muscular organ of an irregular conical or pyramidal form placed obliquely between the lungs, inclined forwards, downwards, outwards and from right to left, flat posteriorly and inferiorly, convex anteriorly and superiorly, and lodged in the pericardium. Its volume varies much in different individuals. Its mass, compared with that of the body, is very small ; but, in general it is so much the greater the younger the subject is. Although it is retained by the pericardium, the mediastinum and large vessels, its situation changes every moment during life, because its weight drags it in different directions, according to the position that is assumed, and must also be slightly affected by the motions of the diaphragm and the different states of inspiration and expiration. Its *anterior surface*, which is turned a little upwards, is convex, and presents, in its middle, a groove which traverses it obliquely from above downwards, and from left to right, and in which are lodged the anterior coronary artery and vein, in the midst of a considerable quantity of adipose tissue. The portion of this surface which is situated to the right of the groove, is much broader than that to the left. This groove marks the position of the septum ventriculorum. Its *posterior surface* is

directed downwards, and is nearly horizontal. It is flat, and rests upon the aponeurotic centre of the diaphragm, from which it is separated by the pericardium, but according to Cloquet by its serous membrane only. It is traversed nearly vertically by a groove which receives the posterior coronary artery and vein, and which joins the preceding at the apex of the heart. The portion of the posterior surface of the heart which is to the left of the groove is much broader than that which occupies its right side. The *right margin* of the heart is at the same time inferior. It is thin and sharp, longer than the left, and resting upon the diaphragm. The *left margin* is directed backwards and upwards; it is obtuse, rounded, very thick; the posterior coronary artery may be seen on it. The *base of the heart*, which is situated above, behind, and to the right, slightly inclined from above downwards, and from left to right, is separated from the vertebral column by the aorta and œsophagus, and is connected with the pericardium through the medium of arteries which issue from, and of veins which go to, it. There is observed upon it an oblique groove, which indicates the junction of the auricles and ventricles. The *summit* or apex, which looks forwards, downwards, and to the left, is lodged in a notch of the lung of that side, corresponds to the interval of the cartilages of the fifth and sixth ribs, under which the pulsations of the heart may be easiest felt; close to the apex, but always rather to the right side, is a depression, in which terminate the sulci or grooves seen upon the anterior and posterior surfaces of the heart. Thus, the apex of the heart is to a certain extent bifid, more so in some individuals than in others, but much less so in man than in certain of the lower animals, as in the dugong. The heart consists of four cavities, named *ventricles* and *auricles*. The two auricles occupy its base, or its superior and posterior region, the two ventricles its inferior part. An auricle and a ventricle are placed to the right, and to the left the same disposition is observed. On each side, the auricle communicates with the corresponding ventricle; but the right cavities seldom communicate directly with the left in the natural state and after birth. In the right cavities there is found black blood, which is to be submitted to the action of the air in the lungs. In the left, there is found red blood which has already undergone this action. The circulation of the blood through the heart may readily be traced by the student in this manner. Before laying open any of the cavities of the heart, blow air into the superior vena cava, and compress the inferior cava as it passes through the diaphragm. He will thus distend these veins, the right auricle, the right ventricle, the pulmonary artery, and its right and left branches proceeding to the lungs, and thus prove that the dark blood proceeding from the body into the right auricle of the heart by the two venæ cavæ, passes readily from the auricle into the ventricle, and from the ventricle into the pulmonary artery, and through its ramifications into every part of the lungs. It (the blood) is there altered by exposure to the action of atmospheric air, and from being dark becomes of a florid red colour, in short, from being venous blood, becomes arterial, or is arterialized. It returns from the lungs by the right and left pulmonary veins, (which the student will notice at the root of the lungs,) to the left auricle, is poured by it into the left ventricle, which again by its violent action drives it into the aorta and its branches, and in this way the arterial blood reaches every part requiring nourishment, to return again altered and wasted by the processes of nutrition through the veins, to the right auricle of the heart from which we have just traced it. This is the double circulation of the blood discovered by Harvey.

A. Right Auricle. The *right auricle* (*Auricula dextra* seu *anterior*) occupies the inferior, right, and anterior part of the base of the heart, and rests upon the diaphragm; its form is very irregular and difficult to be described; transversely elongated, it presents its greatest breadth to the right and behind, its narrowest part before and to the left, in which latter direction it is prolonged by a flattened loose appendage (*proper auricle*), terminating in a point, irregularly dentated on its edges, and placed transversely between the aorta and the right ventricle; it is in general wider than the left auricle. Its *outer surface* is free externally; but internally it is united with the left auricle, below with the right ventricle, behind with the orifices of the two venæ cavæ. Anteriorly, it is surmounted by the appendage mentioned above. Lay open its interior by an incision in its long axis, cautiously avoiding coming too near the orifice of the inferior cava. Its *inner surface* presents *posteriorly* at its upper part the orifice of the vena cava superior, directed obliquely forwards and downwards, and furnished with a rounded, thick, and fleshy projecting edge, more distinct and stronger posteriorly than anteriorly; this orifice is narrower than that of the vena cava inferior, which is situated below and more behind it, and which is directed obliquely upwards and inwards. These two apertures are very close to each other, and are even continuous by a portion of their circumference; in this common portion there is sometimes observed a more or less distinct tubercle (*Tuberculum Loweri*), which is merely a prominence formed by fat or by a fleshy bundle. Near the orifice of the vena cava inferior, and to the left side, is the *Eustachian Valve*. The breadth of this valve varies much in the adult, but can never entirely close the aperture of the vein; its dimensions are more considerable in children, and especially in fœtuses, and it becomes gradually obliterated with age, so as to be very indistinct in old persons; its position is nearly vertical, and its form semilunar; its *posterior surface*, which is directed backwards, to the right and upwards, corresponds to the cavity of the vena cava inferior; the *anterior*, which has an opposite direction, corresponds to the cavity of the auricle; its *free edge*, which looks upwards and backwards, is sometimes reticular; it is more or less concave, but is always very thin; its *right extremity* is connected with the circumference of the vena cava inferior, while the *left* is prolonged upon the inner wall of the auricle, and is continuous with the anterior pillar of the fossa ovalis, of which we shall presently speak. Under the Eustachian valve, and above the entrance of the ventricle, is the common aperture of the coronary veins, which is also furnished with a semilunar valve, the valve of Thebesius broad enough to cover it entirely, the free edge of which is directed downward. 2°. *Anteriorly* at its upper part the small cavity of the appendage, remarkable for the prominences which are formed in it by a multitude of fleshy columns (*musculi pectinati*) crossing each other, and inferiorly, the wide aperture by which the two right cavities of the heart communicate (*right auriculo-ventricular opening.*) This aperture is circular when the heart is full, elliptical when it is empty. A cartilaginous ring surrounds this orifice. 3°. The *outer side* presents nothing remarkable but a great number of irregular prominences, formed by muscular bundles which leave between them spaces of various dimensions, and of which the principal are in general directed from behind forwards. These prominences are commonly less numerous than in the appendage. 4°. *Internally* there is a septum separating the right auricle from the left (*septum auricularum.*) In the adult it presents under its middle part a depression (*fossa ovalis* s. *vestigium foraminis ovalis*), which is more distinct above than below, where it disappears insensibly, becoming continuous with the vena cava inferior. The surface of this depression is sometimes smooth, sometimes uneven and reticulated. It does not appear to have any fixed limit behind; but, anteriorly, it presents a kind of very thick semilunar valve or annulus of which the inferior extremity is continuous with the Eustachian valve. By its inner surface, this valve corresponds to another valve which projects in the left auricle, and forms of itself the bottom of the fossa ovalis. On pushing from behind forwards the handle of a scalpel or a fine probe between these two valves, a passage is, for the most part, easily obtained from the right auricle into the left. In the space occupied in the adult by the fossa ovalis there is in the fœtus an aperture, the *foramen ovale* (*Foramen of Botal*), and which sometimes remains open after birth. Its use is to transmit, before the period of birth, the blood of the vena cava inferior directly into the left auricle. There are observed moreover, in the whole extent of the inner surface of the right auricle, a great number of small orifices not furnished with valves (*foramina Thebesii*), which are supposed to belong to the veins of the walls of the heart.

B. The Right Ventricle (*Ventriculus dexter* seu *anterior.*) Wider and broader, but less extended in length than the left, at the right and anterior part of which it is situated, the right ventricle has a considerable resemblance to a triangular pyramid, of which the base is turned upwards and backwards, and is confounded with the corresponding auricle; it has more extent on the anterior surface of the heart than on the posterior. Open this ventricle on its anterior surface about an inch below the origin of the pulmonary artery, introducing the fingers of the left hand, and continue the incisions through the walls of the ventricle, so as to do the least injury possible to the fleshy columns and tendinous chords, which are felt in the interior of the ventricle. Its *anterior and outer wall* is rather thin and very concave. The *posterior and inner* is formed by a septum, which equally belongs to the left ventricle: their thickness is unequal in the different parts of their extent; both are pretty smooth towards their base; but in the rest of their extent, they present a great number of muscular bundles, (*Columnæ carneæ*,) which vary much as to size, length, and direction; their disposition is in general rather irregular, some directing themselves vertically from the summit to the base, while the others cross them in all directions, and form with them a confused net-work. Of these columns, from three to eight or nine, are much larger than the others; they are rounded, and differ so much in length, that some of them resemble mere tubercles, while others have an extent of nearly an inch. All arise from some point of the walls of the ventricle, direct themselves, becoming larger, from its summit towards its base, and terminate abruptly, each by several small tendons, (*chordæ tendineæ*) which are inserted into the points of the tricuspid valve, diverging sensibly from, and sometimes anastomosing, as it were, with each other. Some of these tendons are bifurcated, and most of them enlarged at their termination. Other fleshy columns of the right ventricle, more numerous than the preceding, are attached to its walls by their two extremities, but are free in their circumference. Others again are attached to the walls in their whole extent, and in the manner of pilasters. These are the most numerous and the thinnest. They pass in all directions, and are interlaced with each other, so as to represent a net-work, leaving between them depressions, differing in form and dimensions. The *base* of the right ventricle is perforated by two apertures. One of these, the *Right Auriculo-ventricular Orifice*, which is situated posteriorly, is separated from the other by an interval of about an inch, communicates with the auricle, and is furnished with a membraneous fold, named the *Tricuspid valve.* One of the surfaces of this valve is turned towards the walls of the ventricle, and the other towards the cavity of the auricle; its adherent edge is attached to the circumference of the orifice, and surrounds it without interruption; its free edge is connected with the chordæ tendineæ; it is very irregular, and presents variable intersections, among which, however, there are always remarked three of larger size than the rest. One of these, which is triangular, longer and broader than the others, and directed upwards and forwards, exactly closes, when laid down, the entrance of the pulmonary artery. This valve, which is thin and transparent in its whole extent, becomes decidedly thicker at its free edge, for the attachment of the small tendons, of which we have spoken. The other aperture of the base of the ventricle is of smaller size than the preceding, and leads to the pulmonary artery.

c. The Pulmonary Artery, (*Art. Pulmonaris*), carries into the lungs the blood to be submitted to the action of respiration, arises from the upper and left part of the right ventricle, within which its orifice is surrounded by a cartilaginous ring, marking the limit of the fleshy fibres of the heart; but, externally, these fibres descend upon the artery, over an extent of about half a line. In this orifice are the *Sigmoid* or *Semilunar Valves*, three membraneous folds adhering to the artery by their whole convex and inferior surface, and presenting above a free, horizontal, and straight edge, on the middle of which there is a small prominent tubercle, of a fibro-cartilaginous consistence (*corpusculum Arantii*). They are in contact at their extremities, and are thin and transparent. When let down, they completely close the artery, and prevent the blood which it contains from returning into the ventricle. To expose these valves, and likewise the anterior of the artery, the student has only to continue the incision he previously made into the ventricle, upwards through the walls of the artery as high as its division. The pulmonary artery directs itself obliquely upwards and to the left, crossing the course of the aorta, anterior to which it is placed first, and to which it is united by an adipose cellular tissue. It then places itself to the left of the aorta, and at the end of a course of two inches, at the height of the second dorsal vertebra, it divides into two trunks, one for each lung. These trunks separate from each other almost transversely, and at the point of separation there ascends from the pulmonary artery to be attached to the concave side of the aorta, a rounded cord of cellular tissue. This is the remains of the *ductus arteriosus* or ascending middle branch of the pulmonary artery in the fœtus, by which branch the blood in the fœtus is diverted from passing into the lungs, but being transmitted directly into the aorta is thus sent through the body. The left recurrent nerve (*nervus laryngeus inferior*) a branch of the eighth pair, will be found passing around the arch of the aorta, close to the left side of the ligamentum arteriosum. The right pulmonary trunk, which is longer and smaller than the left, passes transversely behind the aorta and vena cava superior, forms an arch which embraces anteriorly the corresponding bronchus (282); reaches the lung, towards the upper part of the root of the lungs, and divides into three principal branches. The left pulmonary branch passes obliquely before the aorta and below its arch, embraces the bronchus of its side, and enters the upper part of the root of the lung, divides into two branches only, one for each lobe of the lung. Once entered into the lungs, the first divisions and the successive ramifications of the pulmonary artery accompany the bronchi to their last extremities, multiplying like them, so that there is no part of the organ however small which does not receive twigs from them. At their termination these minute twigs are supposed to anastomose with the roots of the pulmonary veins, and with the bronchial arteries and veins. The pulmonary artery has the same structure as the aorta, but its walls are weaker, and it partly collapses when empty.

D. The Pulmonary Veins (*Venæ Pulmonares*) are supposed to arise from the extremities of the pulmonary arteries, and are collected into small twigs and branches, becoming successively larger, which accompany the divisions of the bronchi and those of the arteries, it being observed that in general the venous twig is placed beneath, and the arterial above, the bronchial twig. At length all the branches of the pulmonary veins unite into four trunks which leave each lung, two and two, at the middle of its internal surface, and penetrate into the pericardium. The *superior right pulmonary vein* emerges under the bronchus, directs itself obliquely downwards, and opens into the upper and right part of the left auricle of the heart. The *inferior* comes from the lower lobe of the lung, and ascends obliquely towards the inferior and right part of the same auricle. They are both difficult to be exposed, being concealed by the vena cava superior and the neighbouring part of the right auricle. The two *left pulmonary veins* follow a similar course, and are merely a little nearer each other. The pulmonary veins have the same structure as the other veins of the body, from which they differ in the circumstance that during life they contain red blood. A few fleshy fibres may be seen on their outer surface derived from the left auricle. These veins are easily found, seeing that their orifices terminate in the left auricle.

E. The Left Auricle, (*Auricula Sinistra* s. *Superior.*) Situated at the upper, posterior, and left part of the heart, is almost entirely concealed by the great vessels of the base of that organ, so that, at first sight, there is nothing perceived but its appendage (*proper auricle*), near the left side of the pulmonary artery. Its form is somewhat cubical, while that of the right auricle may be in some measure compared to a segment of an ovoid. Its capacity is about a fifth less than that of the latter. *Posteriorly*, it rests upon the vertebral column from which it is separated by the pericardium; *anteriorly* and internally it is united to the rest of the heart. From its inner and upper part there is seen rising an appendage similar to that of the right auricle, but smaller and directed to the right; its edges are equally jagged, but its form is triangular. It may be laid open and its interior examined by an incision commencing in the proper auricle and extending through the whole of the division called *sinus venosus*. Its *inner* *surface* presents four walls or sides for examination:— 1°. The *posterior* which is smooth, receiving the right pulmonary veins above. 2°. The *anterior* presents, below, a wide aperture leading into the left ventricle, and, above, the cavity of the appendage, containing much fewer *musculi pectinati* than that of the right appendage. 3°. The *right* is smooth and formed by the inter-auricular septum, (279. B.). There is here a semilunar valve forming the bottom of the fossa ovalis. 4°. The *left* is perforated by the two corresponding pulmonary veins, the orifices of which are very near each other, and even sometimes joined.

F. The LEFT VENTRICLE (*Ventriculus Sinister* s. *Posterior*) a little narrower, but longer than the right, and thus forms the apex of the organ. Its form is that of a pyramid a little flattened; but, as its walls are very thick, it never presents the same falling in as the opposite ventricle. It should be laid open much in the same way as the right, by making an incision into its fleshy walls sufficient to allow the introduction of a finger or two, and cutting cautiously on these, avoiding any incisions into the mitral valve. Internally, there are columnæ carneæ similar to those of the right ventricle, but less numerous and less irregularly disposed. Two of these fleshy bundles, which are larger than the others, and free at their circumference, arise, the one before, the other behind, and a little beneath the middle part of the walls of the ventricle, by several distinct and smaller bundles, ascend obliquely towards the base of the heart, and terminate by a rounded or bifurcated extremity, from the summit of which proceed a multitude of very slender divergent tendons, frequently crossing each other, which attach themselves to the free edge of the mitral valve. In the base of the left ventricle there are two apertures. One of these, the *Left Auriculo-ventricular Orifice*, which is posterior and larger, leads into the auricle, and is nearly elliptical. Like that of the right side, it is surrounded with a cartilaginous zone, and furnished with a membraneous fold, called the *Mitral Valve*, because its free edge is divided into two slips, to which are attached the chordæ tendineæ; one of these slips is applied upon the mouth of the aorta, which it almost entirely closes when the ventricle is dilated.

This valve is thicker than the tricuspid valve, and frequently contains small hard fibro-cartilaginous tubercles, and sometimes even bony plates. The other aperture to the right and anteriorly of the latter leads into the aorta, here there are three *Semilunar Valves,* similar to those at the entrance of the pulmonary artery. Above their free edge the orifices of the two coronary arteries of the heart are seen. This orifice of the aorta is surrounded with a cartilaginous ring, forming the true boundary between the tissue of the heart and that of the artery. Outside the semilunar valves, the walls of the aorta are dilated, forming three prominences (*Sinuses of Valsalva*) at the exterior.

G. ORGANIZATION OF THE HEART. 1°. *Muscular Tissue of the Auricles.*—The walls of the auricles are much thinner than those of the ventricles. In the *Right Auricle*, the muscular tissue constitutes a pretty thick layer of longitudinal fibres towards the point of union of the two venæ cavæ, where it is separated from the serous lamina of the pericardium by a considerable quantity of fat. In the rest of the auricle, this tissue only presents itself in the form of thin bundles crossing each other, in the intervals of which the serous lamina of the pericardium is in immediate contact with the inner membrane of the cavity. These bundles, although smaller, are more numerous in the appendage. One of them surrounds the orifice of the vena cava superior in a circular manner. The disposition which we have just pointed out causes a part of the right auricle to appear transparent. In the *Left Auricle*, the fleshy layer is much thicker and more uniform than in the right; the muscular fibres seem to come from the pulmonary veins, on which they begin to appear by parallel bundles when these vessels issue from the lungs; on the auricle itself, they retain their original direction at the surface, and form a transverse plane; but more deeply, they cross each other irregularly, without however being disposed in isolated bundles as in the right auricle. Between the two auricles, the muscular tissue forms a thicker and more uniform layer, from which results the inter-auricular septum. 2°. *Muscular Tissue of the Ventricles.* The walls of the *right ventricle* are rather thin; a uniform fleshy layer invests it externally; more deeply, the muscular tissue collects into bundles disposed like those of the auricles, but stronger and more numerous; several of these, detached from the walls of the cavity, give rise to the columnæ carneæ. The *Left Ventricle* has much thicker walls than the right; its superficial fibres seem directed longitudinally from the base to the summit; the middle fibres are intermingled in an inextricable manner; the deeper contribute to the formation of the columnæ carneæ. 3°. In the septum, the muscular fibres of the right ventricle are interlaced with those of the left, forming very acute angles. They may be separated, however, so as to divide the heart into two portions, the one right and the other left. 4°. The muscular fibres of the heart are extremely numerous and very close upon each other; their red colour is less florid and darker than that of the muscles of locomotion; their direction is very difficult to be determined: they intermingle with each other, without any cellular tissue being interposed, as happens in the other muscles, to form distinct bundles. But although not distinctly arranged in fasciculi, there is a sufficiency of very fine cellular tissue amongst the fibres generally. They are fleshy in their whole length, the internal columnæ alone being terminated by tendons. 5°. *Membrane of the Right Cavities of the Heart.* This is evidently continuous with the membrane which lines the vessels destined for the circulation of the black blood. On leaving the venæ cavæ it lines the whole extent of the auricle, being applied upon the muscular bundles, and, in their intervals, against the serous lamina of the pericardium, to which it is united by a dense but spare cellular tissue. Beneath the vena cava inferior it is folded upon itself to form the Eustachian valve, and afterwards that of the coronary vein of the heart. At the circumference of the auriculo-ventricular orifice, it is separated from the muscular tissue by a layer of thin and semi-fluid fat, which constitutes the white zone of which we have spoken. There also, it is folded upon itself, on leaving the walls of the organ, to give rise to the tricuspid valves; after which it lines the whole ventricle, becoming excessively thin, introduces itself into the pulmonary artery, forms at its origin the three semilunar valves, and is continued to the last ramifications of that vessel. 6°. *Membrane of the Left Cavities of the Heart.* It forms part of that which lines the walls of the vessels that carry red blood. It commences at the extremities of the pulmonary veins, lines them in their whole extent, and the whole cavity of the auricle without presenting any fold, and penetrates into the ventricle. At the entrance of the latter, its thickness increases a little, and it is folded upon itself to form the mitral valves, but afterwards becomes very thin. It leaves that part to proceed into the aorta, and from thence into all the arteries of the body. It is of it that the three semilunar valves are formed, which are found in that vessel near its origin. The arteries of the heart are two in number, rising immediately from the aorta, and called *Coronary.* The coronary vein enters the right auricle. The orifices of the veins of Thebesius are seen in the interior of the heart, but these have not been very satisfactorily demonstrated. The coronary veins of the heart have valves, but they are rudimentary and very imperfect. Its lymphatics are numerous, go to the lymphatic glands situated before the arch of the aorta and left bronchus. Its nerves are numerous, and come from the cardiac lymphatic glands. The *cardiac nerves* are small with reference to the size of the organ; they come from two sources; 1st, From the cervical ganglions of the sympathetic; 2d, The cardiac filaments of the pneumo-gastric. Lastly, a portion of the serous lamina of the pericardium may be considered as entering into the composition of the heart, the outer surface of it being invested by it in its whole extent.*

* Some farther remarks respecting this important organ may be useful to the student. *Volume.* A healthy heart should, according to Laennec, be about the size of a closed fist of the individual, and this, though a coarse approximation, is tolerably just. If enlarged by dilatation, the disease is called aneurism; if enlarged by thickening it is called hypertrophy; if much diminished it is said to be atrophied. *Weight.* The medium weight of the empty heart is from seven to eight ounces; the atrophied heart is sometimes so low as two ounces; and the hypertrophied may occasionally weigh twenty-two ounces. *Measurements.* The height or length of the ventricles measured anteriorly is about three inches three lines; but posteriorly only two inches three lines. Its circumference at the base when moderately injected, is about ten inches. *Fibrous Zones of the Heart.* These zones

280. The AORTA. The student is now prepared to trace the course of the aorta through the chest; at its origin from the left ventricle of the heart, it is covered

are four in number. 1°. Auriculo-ventricular. 2°. Arterial. Each auriculo-ventricular zone is a kind of circle surrounding the orifice of communication between the auricles and ventricles. It is a very peculiar structure, but was well understood by the most ancient anatomists. In the left auriculo-ventricular zone in certain of the lower animals, there is frequently a bone developed, as in the ox, deer, &c., but not in the horse. Galen knew these facts perfectly, and his successors ventured to apply them to the anatomy of the human heart, but in this they committed a great error. The presence of the bone in the auriculo-ventricular zone of the heart in ruminating animals is a *specific structure* and not a pathological phenomenon as M. Cruvillhier supposed. It is present in the calf, fawn, &c.; as it is absent in the horse, it is evident that its presence or absence is not caused by any necessity for strengthening the part in the larger animals, else it would be present in all. To return to the human auriculo-ventricular zones; from each of the circles they form, there proceeds an expansion of the same nature occupying the thickness of the tricuspid and mitral valves, and into these fibrous circles proceed directly or indirectly most of the cordæ tendinæ of the ventricles.

2°. *Arterial Zones.* These are also two fibrous circles somewhat less than the orifice of the arteries which they surround at their junction with the heart. From these zones proceed, 1°. Three very thin but strong prolongations filling the angular intervals of the festoons which the aorta and pulmonary arteries have at their origins. 2°. Three other prolongations to the sigmoid valves of these vessels. The posterior half of the aortic circle is intimately united to both auriculo-ventricular zones. All these parts may readily be seen by laying open the orifices of the great arteries at their connexion with the heart.

It is difficult to describe to the elementary student the course of the muscular fibres of the heart. The only way perhaps to understand these is, to follow the fibres layer by layer upon the ox's heart, which has been boiled for several hours. The following statement has been given by M. Cruvillhier is an approximation to the truth. *The heart is formed of two muscular sacs contained in a third, common to both ventricles.*

All the muscular fibres of the heart arise from the fibrous zones, and all terminate in these zones. The muscular fasciculi are of great length ascending and descending; they are disposed in successive layers, and the fibres cross each other at right angles; they may also be divided into common and proper. All the superficial fibres are common to both ventricles; they are oblique and spiral towards the point.

The *cause* of the sounds of the heart has been much disputed; it is a purely physiological question.

for a considerable extent by the pulmonary artery ; it ascends obliquely forwards, and to the right side to a level with the cartilage of the second rib ; opposite to about the second dorsal vertebra it leaves the pericardium, and shortly after proceeds transversely backwards ; it next descends until about a level with the fourth dorsal vertebra, from which point it follows, as has been already described, the course of the vertebral column but rather towards the left side. The portion of the aorta from its commencement to the level of the fourth dorsal vertebra, is called the *arch of the aorta*, and is subdivided into three portions ; viz. 1°, an ascending ; 2°, transverse ; and 3°, a descending portion. The first portion is the longest, and can be best seen by cutting away the pulmonary artery and carefully cleaning the aorta. It lies chiefly within the pericardium, and is mostly covered by the serous layer of that membrane. It is here that the aorta is very liable to ulceration and consequent rupture and sudden death, caused by the filling of the pericardium with blood. In this position, also, the student will observe its greater calibre than the other parts ; the orifices of the coronary arteries : the sinuses of Valsalva or Morgagni lying exterior to the semilunar valves. The 2d, or *transverse* portion of the arch is chiefly external to the pericardium and above it, and in front of the trachea ; it gives origin to the arteria brachio cephalica, the left common carotid and left subclavian arteries ; if another artery be found arising from this part of the arch, it will usually happen to be the left vertebral. The 3d, or *descending portion of the arch*, is remarkable for occasionally presenting a slight contraction, and it is here that the aorta has been known to become spontaneously obliterated. To the commencement of this portion, but on its concave side, the ligamentum arteriosum is usually attached. Passing through below the arch of the aorta, the student will find the right branch of the pulmonary artery, the left bronchus, and the left recurrent nerve. For a more particular account of the branches of the aorta, the student should at this stage of the dissection consult the account of the vascular system.

281. The Lungs (*Pulmones*) are two spongy, cellu-

lar, expansible organs, contained within the cavity of the thorax, separated from each other by the mediastina and the heart, partially surrounded by the pleuræ, they are the essential organs of respiration. Although the lungs are to appearance separate and distinct, they are yet really connected with each other, since they receive the air by a single canal, and as the blood is transmitted to them by a single vessel. Their volume is not equal however, but on account of the projection of the diaphragm on the right side caused by the liver, and the obliquity of the mediastinum to the left, the right lung is thicker than the left, which in its turn has a greater vertical extent; the left lung is also a little smaller than the right. The volume of the lungs is exactly proportioned to the capacity of the cavity of the thorax. They follow the motions impressed upon its walls, against which they are always applied, and dilate and contract like them; nor does any vacuity ever exist during life between that part of the pleura which covers the lungs and that part investing the walls of the chest. It is here, however, *i. e.*, in the so named cavity of the pleuræ, that water sometimes accumulates, forming the hydro-thorax; and purulent matter, forming the disease called empyema, and sometimes even air, as in the pneumo-thorax; but all these are diseased conditions of the organs. The lungs are proportionally much lighter than the other organs; they never sink in water so long as they are in their natural state, and this lightness depends upon the air which penetrates their whole tissue. In infants which have never breathed, the lungs generally sink in water. But the absolute weight of the lungs varies much in different individuals in which they are examined, which may depend upon the greater or less quantity of blood that remains in them at the moment of death, or upon a larger development. It is also to be observed, that in children which have not breathed, the lungs are, with respect to the total weight of the body, in the variable relation of 55, or 70 to 1; whereas the proportion is as 28, or 35 to 1, when respiration has taken place. The act of respiration, therefore, diminishes their gravity in a great degree, a circumstance which it is of importance to know with reference to medical jurisprudence. The colour of the lungs in the healthy and adult state, is a pale yellowish red, more or less approaching to white or grey. The younger the subject the lungs will be the redder. This tint is equally observed in the interior, and at the exterior of the organ. But if the blood happen to be too much accumulated in its parenchyma, the colour is a dark red or purple, uniformly diffused, or only dispersed in patches, which produces a marbled appearance. It is for this reason that the lungs are always more coloured on the side on which a dead body has lain. The reddish, or greyish colour of the lungs, is interrupted by small black and brown spots, irregularly dispersed at their surface, and more or less numerous; they are exactly defined, and in general affect a linear form; they are seldom isolated from each other: some are entirely superficial, others penetrate more or less deeply into the tissue of the lungs, and there are some which seem limited to the pleura or membrane which immediately envelopes these organs, in the substance of which they also occur. Buisson considers them as analogous to the lymphatic glands of the bronchi. Of the solid organs of the body, the lungs are those which have the smallest density; they may be compressed with the greatest ease, and only resume their original state imperfectly; although flexible and soft, however, they have a tissue which is not easily torn. The form of the lungs is not very easy to be described. It may, however, in a general manner, be likened to that of a cone, having its base directed downwards, and its summit upwards, and flattened internally. The right lung is divided into three unequal lobes, by two oblique fissures; the left presents only a single fissure, and consequently has but two lobes. Their *outer surface*, which is convex, especially behind, and nearly plain anteriorly, is free *in its whole extent*, and corresponds to the walls of the thorax, from which it is separated by the costal layer of the pleuræ. It is smooth and polished, and constantly bedewed with a serous fluid. On the left lung, it presents a fissure which descends obliquely from the posterior to the anterior edge, and divides the organ into two lobes, a superior and anterior, which is smaller, and a posterior and inferior which is larger:

this fissure nearly penetrates through the whole thickness of the organ. A similar fissure is observed on the right lung; but in it the upper lobe is divided into two portions by a secondary fissure running obliquely downwards and outwards, and consequently in a direction the reverse of the great fissure, and which varies much as to depth and extent. In the two lungs, the upper lobes, which are large above, terminate below in a point, while the contrary takes place in the lower lobes, which are always larger. In the right lung, the middle lobe is triangular, presenting its summit outwards, and its base inwards, and is smaller than the other two. The *internal surface* (roots of the lungs) of the lungs, which is plain or slightly concave, to accommodate itself to the shape of the heart, corresponds, posteriorly, to the mediastinum, and the vertebral column. About the middle of its height is seen the insertion of the bronchi and pulmonary vessels. Its two anterior thirds are contiguous to the pericardium and thymus gland. Anteriorly to the roots, lie the phrenic nerves, and a few filaments of the eighth pair; posteriorly, the pulmonary plexus of the same pair of nerves. The dissection of the roots of the lungs a little anteriorly or posteriorly, consists merely in stripping off the pleura and removing a little cellular substance; when this has been done, the branch of the pulmonary artery proceeding to each lung, will be found superiorly and posteriorly; the pulmonary veins below, but anteriorly the bronchial tubes lie superior to these, more especially the right one. The *anterior edge* of the lungs is thin, sharp, especially below, oblique, sinous, more or less uneven, directed obliquely downwards and forwards, and notched on the left side only, to receive the point of the heart. Their *posterior edge* is thick, rounded, nearly vertical, and lodged in a groove which the ribs form on the sides of the vertebral column. Their *base*, which is slightly concave, rests upon the upper surface of the diaphragm, and is inclined a little downwards, and outward on each side. It is circumscribed by a sharp and sinuous edge, which is lodged between the ribs and the insertions of the diaphragm, and on which there occurs the end of the interlobular fissure. Lastly, their *summit*, which is narrow, obtuse, and a little bulged, is situated generally in the neck, a little above the level of the anterior part of the first rib. *Organization of the Lungs.* The tissue of the lungs is very complicated. It sems essentially composed of prolongations and successive ramifications of the bronchi, and pulmonary arteries and veins, which stick together in all their divisions, and are sustained by a very fine cellular tissue, so as to constitute a series of lobules which are covered and united by the pleuræ, and interspersed with nerves, vessels, and lymphatic glands. Reseissen thought that the bronchial tubes terminate in air cells. *Proper Tissue of the Lungs.* We have already, to a certain degree, an idea of the intimate structure of the lung, as we know several of the organs which enter into its composition. But when we come to consider it with some attention, without reference to its constituent parts, we find that it is divided into several lobules distinct even at the exterior, and separated from each other by small whitish grooves. They are especially very well seen on tearing the tissue of the organ after it has been boiled. They vary much as to volume and form. They present, in general, a number of small surfaces, bounded by prominent angles, and present in their intervals a loose, filamentous cellular tissue, destitute of fat, very extensible, and capable of becoming emphysematous with the greatest ease, whether during life, by the rupture of a division of the bronchus, or after death, by insufflation. Each of these lobules is divided into smaller, without its being possible to discover the precise termination of this division. The intimate structure of these last lobules is unknown. Willis asserted that they have a racemiform arrangement around the ramifications of the bronchi, which, however, does not appear to be the case. It is only very probable that they are formed by the union of the last extremities of the bronchi, vessels and nerves which are distributed in the lungs. At this stage of the dissection the student should get permission from those who may be dissecting the neck, to examine the anatomy of the *trachea* throughout its whole course. Let him first remove the great blood-vessels placed over its lower part, and clean it carefully downwards to its division into the bronchi; dissect these carefully towards each lung, preserving as well as he can the bronchial glands, the bronchial arteries, and pulmonary plexus and nerves.

282. The TRACHEA (*Aspera Arteria*, windpipe), is a cylindrical, cartilaginous and membraneous tube, a little flattened posteriorly, placed before the vertebral column, extending from the lower part of the larynx to opposite the second or third dorsal vertebra, in the posterior mediastinum. Running along the median line of the body, symmetrical and regular in its whole extent, slightly mobile and extensible, the trachea has a uniform diameter of about eight or ten lines, which varies only according to the age and certain individual peculiarities. The *anterior side* of the trachea is convex, and covered above by the thyroid gland, inferior thyroid veins, and sterno-hyoidei and sterno-thyroïdei muscles, from which it is separated by a layer of loose cellular tissue; inferiorly, it corresponds to the thymus gland, the left vena innominata, the arteria innominata, and the arch of the aorta; its *posterior side* is flattened, covers the œsophagus, and a little to the right, the bodies of the vertebræ, which is owing to the obliquity of the œsophagus; *laterally*, it is contiguous to the common carotid arteries, the internal jugular veins, the pneumo-gastric nerves, and the communicating twigs of the cervical ganglia, which are separated from it by a mass of adipose cellular tissue. Inferiorly the trachea bifurcates, dividing into the two *Bronchi*, which are distinguished into right and left, and which separate from each other, directing themselves downwards and outwards, at nearly a right angle. The *Right Bronchus* is wider, shorter, and more horizontal than the left, and is a little anterior to it. It penetrates into the lung opposite the fourth dorsal vertebra, is embraced in its course by the curve of the vena azygos, and by the arch which the right branch of the pulmonary artery forms. The *Left Bronchus*, which is a little smaller, but longer and more oblique, is embraced by the aorta and left branch of the pulmonary artery. The bronchi enter the lungs by their internal surface, and divide into two branches, which, after a very short course, subdivide, and thus give out branches becoming gra-

dually smaller, which take all kinds of directions. These ramifications seem to divide the whole tissue of the organ into lobules separated from each other by cellular tissue, and absolutely exist in all points. It is extremely difficult to trace them to their termination. Malpighi thought that they end by rounded and membraneous vesicles, which, according to Willis, are pedicellate. Senac imagines the lobules of the lungs to be composed of polyhedral vesicles, the sixth of a line in diameter, into each of which a twig of the bronchi opens. But it appears demonstrated, on the contrary, that the divisions of the bronchi ultimately terminate by a small undilated cul-de sac, and that it is from the union of several of these minute twigs, kept together by the cellular tissue in which they are immersed, that what is called the *Pulmonary Lobule* results.

283. Organization of the Trachea and Bronchi; composed of 1°. cartilaginous rings; 2°. membranes; 3°. arterial and venous vessels; 4°. lymphatics; 5°. nerves; 6°. mucous follicles; 7°. *Bronchial Glands.* 1°. The *Cartilaginous Rings* are from sixteen to twenty in number; they are not complete rings in man, being interrupted in their posterior third. They are placed horizontally above each other, and separated by narrow membraneous intervals; curved upon themselves, and flattened in the plane of their direction, they have all the same length, but vary as to breadth; their form approaches that of a very elongated right-angled triangle, when they are stretched out; they are commonly thicker at their middle part than at their extremities, which are sometimes bifurcated. By their convex surface, they correspond to a fibrous membrane, and by the concave are in connexion with a mucous membrane; their rounded edges give attachment to the first of these membranes, and project a little more on the inner than on the outer surface of the canal; sometimes also several of them are seen to unite. The first is commonly very broad, and sometimes joins the cricoid cartilage; the last is still broader, and very different from the others; it is triangular, and its middle part is prolonged inferiorly, bending a little backwards, to accommodate itself to the origin of the bronchi. In the first ramifications of the bronchi, the cartilaginous

rings are entirely similar to those of the trachea, only thinner, smaller, and sometimes formed of several pieces; but in the secondary ramifications they are merely small irregular grains, varying in form, united or separate, which gradually diminish, so as to disappear entirely in the ultimate divisions of these canals. The colour and consistence of the cartilages of the trachea and bronchi are the same as in those of the ear, the apertures of the nose, &c. Their elasticity is very remarkable. They seldom ossify, even in the most advanced old age. 2°. The *Fibrous* or *Outer Membrane* comes from the inferior circumference of the cricoid cartilage, and is prolonged to the last extremities of the bronchi, becoming gradually thinner to an excessive degree; it is formed of longitudinal and parallel fibres, of which the more superficial are reddish, the deeper white. This membrane alone forms posteriorly the solid portion of the trachea, which gives that canal a square form in this place. Anteriorly it is continually interrupted by the cartilaginous rings which appear developed in its substance, and it only sends before them a very small number of fibres; externally and behind we observe granules, varying in figure, named mucous follicles; their excretory ducts traverse the whole substance of the canal to open upon its inner surface. Internally, and in the intervals of the cartilages, to the mucous membrane, from which it is separated by a multitude of other smaller granulations, varying in colour, which also appear to be follicles. But posteriorly, it is immediately applied upon the muscular layer, attached to the extremities of the rings, composed of fibres, passing transversely from one cartilage to another, but, contrary to the assertion of Andral and others, forming a uniform layer between the mucous and fibrous membranes. This muscular layer is best dissected from the inside. These fibres are disposed in small bundles, and form a perfectly distinct plane. The *Mucous* or *Inner Membrane* is a continuation of the membrane of the larynx, and extends to the termination of the bronchi. Thin, reddish, and plicate in the direction of its length, especially at the back part, where it is applied against the fibres of muscular appearance which we have just noticed, it corresponds in the rest of its extent, to the inner surface of the cartilaginous rings, and, between them, to the fibrous membrane. It has in general little adhesion to these different parts. Its inner surface is perforated by the excretory orifices of its mucous follicles, which constantly pour out a rather thick and not very plentiful fluid. Its organization presents nothing remarkable. To examine it, the trachea must be cut open longitudinally and anteriorly from near its commencement, quite to its division into the bronchi, and these also should be laid open in the same direction. 3°. The vessels of the trachea come from the superior and inferior thyroid. Its nerves are furnished by the pneumo-gastric nerves, and cervical ganglia. The bronchi have arteries which bear their name, and which arise immediately from the aorta; they are commonly two in number, a right and a left. They have corresponding veins, which empty their contents, to the right into the vena azygos, and to the left into the superior intercostal vein. Their nerves are supplied by the two pulmonary plexuses. 4°. The *Lymphatic Glands* are very numerous, and are situated before the bifurcation of the trachea, around the bronchi, and even in the interior of the lungs, where they are irregularly disseminated. Their form presents numerous variations, being sometimes oval, or rounded, sometimes lobular, and varying much as to size; the larger are lodged above the trachea, the smaller in the intervals of the bronchi. Their colour is black, or of a dark brown in the adult, reddish in children. Their tissue has in general little consistence; when crushed under the fingers, they stain them deeply. When cut directly across the trachea remains always open.

284. The THYMUS is an organ whose uses are unknown. Its description, however, naturally enough, comes to be considered in this place. No excretory duct has ever been discovered. In the fœtus this organ extends nearly from the thyroid body to the vicinity of the diaphragm, and thus occupies the greater part of the anterior mediastinum. Gradually diminishing with age, whilst the other textures increase, it can scarcely be seen in the adult. *Behind* it are situated the trachea, the great blood-vessels, and the pericardium; *before* it the manubrium of the sternum and lower part

of the sterno-thyroidei muscles; by its edges it touches the pleuræ below. It is notched and grooved anteriorly. A thin *cellular capsule* proceeds into its interior, separating it into lobules, and these again shew vesicles filled with a milky and slightly viscous fluid; these cavities seem to communicate with each other. Its arteries arise from the inferior thyroid, internal mammary, bronchial, mediastinal, and pericardiac arteries, and are pretty numerous, that is in the young person, before the age of ten or twelve. A few nervous filaments proceed to it from the eighth pair, the phrenic and inferior cervical ganglia.

285. The Œsophagus, although properly belonging to the digestive organs, will be best described in this place. It is a musculo-membranous canal, extending from the lower part of the pharynx to the cardiac or superior orifice of the stomach. It commences opposite to the fifth cervical vertebra (at the back part of the cricoid cartilage, which may be felt in the living body), and terminates between the crura of the diaphragm, and consequently in the abdomen. At first it is mesial, but gradually inclines to the left side, a little lower down: but in entering the thorax, it becomes again mesial about the upper and back part of the bronchi, and continues so until it leaves the thorax. Whilst passing into the abdomen, it once more inclines a little to the left, and terminates in the stomach. A loose cellular tissue connects it to the surrounding parts; excepting where covered by peritoneum, it is very firmly fixed to the diaphragm; this cellular tissue contains some lymphatic glands. The gullet may be subdivided, for the sake of its more careful examination, into two portions, viz. a *cervical* and *thoracic;* the third portion, or *abdominal,* being too short to merit attention in this way. The *cervical portion* has anteriorly, to a certain extent, the lower part of the larynx, the left half of the trachea, the left inferior thyroid vessels, and the sterno-thyroidei muscles; posteriorly, the great anterior vertebral ligament, and the left longus colli muscle; laterally, at first, to the common carotid arteries and internal jugular veins; and afterwards, on the right side, to the trachea, and on the left, to the recurrent nerve and carotid artery of that

side. In the thoracic portion, the gullet is entirely contained within the posterior mediastinum; in front, it touches the trachea and left bronchus, the posterior part of the pericardium; posteriorly, it touches the vertebral column, the curve of the vena azygos, the thoracic duct, and at its lower part the aorta. In diameter, it is somewhat less than an inch. It is composed, according to some, of two tunics; according to others, of four. The indisputable ones are the muscular tunic, and the mucous or inner membrane: the two less certain are, the nervous or cellular, and the epidermis. To examine the gullet carefully, the student may remove two or three inches of its thoracic portion, and distend it with air, having first secured it with ligatures. The muscular tunic is external; there are two layers of fibres, viz. the longitudinal, which are seen first, and the circular, which can only be exposed by removing the others. They are well marked, the gullet being much more muscular than any other part of the digestive tube, excepting the rectum. The redness of the muscular fibres of the gullet diminish gradually as we descend towards the stomach. On the stomach the longitudinal fibres of the gullet expand and spread out in a remarkable way, but the circular fibres soon cease. A layer of condensed cellular tissue lies between the muscular tunic and the mucous tunic; this is analagous to the lamina nervosa, cellulosa, or vasculosa of the intestines. To see the *mucous membrane*, it is necessary to lay open the gullet longitudinally; it is soft, spongy, delicate, continuous above with that of the pharynx, below with that of the stomach. Several longitudinal folds may be observed upon it, and mucous follicles (œsophageal glands), which lie exterior to the membrane. Some believe that it is lined throughout, as far as the cardiac orifice of the stomach, with an epidermis. The arteries are not large; in the neck they come from the inferior thyroid arteries; in the thorax from the bronchial, and directly from the aorta; in the abdomen, from the subdiaphragmatic, and from the coronary of the stomach. The veins terminate in the thyroid; the superior cava, the internal mammary, the vena azygos, the bronchial, phrenic, and coronary veins of the stomach. Its lymphatic vessels go to the adjoining glands; the nerves are furnished chiefly by the eighth pair, and their recurrent branches. These nerves form a plexus around it. By bending the head backwards, the student will find that a straight and unyielding instrument may be introduced from the mouth directly down to the stomach; in this position the gullet, mouth, and pharynx must be nearly in a straight line, as was proved by the Indian jugglers, who exhibited in this country a few years ago the very singular feat of passing a sword directly down into the stomach of a living person.

286. The SUPERIOR ORIFICE OF THE THORAX presents many anatomical relations, important not only to the physician, but above all to the surgeon. Immediately above the manubrium of the sternum is the cervical fascia; beneath it the sterno-hyoid and sterno-thyroid muscles, ascending through the aperture; behind these a quantity of cellular substance, and a little lower down the remains of the thymus; then the venæ innominatæ, the right being short and straight in its course, the latter crossing over from the left to the right side, to join with the right, and thus form the vena cava superior, whose course through the pericardium, until it terminates in the right cavity, has been already described. The union of these two veins (venæ innominatæ) correspond to the cartilage of the second rib on the right side. Behind these veins, the phrenic nerves and par vagum enter the thorax, but anterior to the subclavian arteries, thus passing between the veins and arteries, the phrenic more external, the nervi vagi more internal. The course of the phrenic nerves to the diaphragm, between the pleura and pericardium, and anterior to the root of the lungs, has been already described; likewise the course of the nervi vagi behind the root of the lungs, and ultimately terminating in the stomach. Behind these veins and nerves lie the three great arteries arising from the aorta, viz. 1st, the brachio-cephalic or innominata, more anteriorly than the others. 2d, The left common carotid. 3d, Deeper and farther back, the left subclavian. Behind these lie the trachea, entering the thorax and its bronchi lower down; their course and position have been already carefully de-

scribed: so also has the gullet, which is found, behind the trachea, entering the thorax close to the spine. To the left of this tube in the situation we now advert to, will be found the upper part of the thoracic duct, ascending from the thorax to the neck between the left carotid and subclavian arteries. On either side lie the recurrent nerves. External to this nerve also, on each side will be found the sympathetic nerve; from its inferior cervical ganglion, filaments pass in front and behind to each subclavian artery. Posterior to the gullet, the longi colli muscles are next observed, also the anterior common ligament of the vertebræ; and to the right and left, the superior intercostal arteries, and anterior branch of the first pair of dorso-spinal nerves. These ascend to join the axillary plexus.

PART VI.

DISSECTION OF THE INFERIOR EXTREMITIES.

287. The muscles of the pelvian or lower extremity constitute not unfrequently the first part dissected by the student, and as the fore and upper part of the thigh contains much difficult dissection, and is in an especial way connected with the anatomy of the surgical disease called *Crural Hernia*, the student ought uniformly to commence his dissection on the back part of the haunch and thigh.* The subject being placed upon its anterior

* Previous to turning the subject, the student should dissect with the greatest care the muscles on the back of the thigh, take a surgical view of the popliteal space and the aponeurosis on the back of the leg, together with the veins and superficial nerves. All this will require more than usual industry, as the parts on the

surface, and a block placed below the pelvis, detach by a series of incisions the integuments from the back of the hip and thigh, from the crest of the ilium downwards, as far as the middle of the calf of the leg. Beneath the skin will be found the subcutaneous cellular substance or fascia, in which are several cutaneous nerves, branches of the lumbar, and some superficial veins. These veins run in different directions, and present in different subjects a good many varieties. First at the lower part on the calf of the leg will be found the upper portion of the posterior or short saphena vein. This vein ascends from the direction of the outer ancle and heel, collecting the veins on both sides as it proceeds upwards, anastomosing with the long saphena vein. Having reached the popliteal space, (to be afterwards described,) or shortly before this, it plunges through the aponeurosis to join the popliteal vein. On the back of the thigh will also be found several veins: of these, some wind round the limb to join the long saphena, others pass deep at once to join the deep branches of the perforating veins, and one more remarkable than the others is sometimes found descending the limb, either to unite with the short saphena, or to pass separately to the popliteal vein. I have seen this a remarkable vein in point of size. On removing the superficial fascia, there will next occur the

288. Femoral or Crural Aponeurosis (*posterior aspect.*) This is sometimes called the *Fascia lata Femoris*, an extremely improper name; though as it were consecrated by antiquity, it ought to be laid aside. The femoral or crural aponeurosis, like that occurring in the superior extremities, covers nearly the entire limb, extending from the crest of the ilium, quite down to the heel. The description of that part of the aponeurosis which the student has just dissected is as follows: The fascia lata, or femoral part of the crural aponeurosis is the strongest in the body. It is very dense posteriorly, and has origins from the sacrum and coccyx, and espe-

posterior aspect of the head and trunk present few objects of interest, and are soon gone over by the students engaged in examining those parts, and who, of course, demand the subject to be turned.

cially from the crest of the ilium. Where it covers the gluteus magnus it is thin, but anterior to this it is remarkably strong and inseparably united to the tendinous origin of the gluteus medius. In descending over the back of the thigh, it is remarkably strong and bound down, particularly to the outside, where it proceeds to be attached to the femur; internally and superiorly it is continuous with the ligament of the symphysis pubis, with the periosteum of the scatic tuberosity, and with the ramus of the ischion and pubis. It is inserted into the whole length of the outer lip of the linea aspera of the femur, by a lamina firmly united to the vastus externus, ascending between it and the short portion of the biceps, and finally receives many fibres from the gluteus maximus. Inferiorly the aponeurosis is continued over the popliteal space to the leg; is attached to the tuberosities of the tibia, and proceeding downwards, constitutes the aponeurosis of the leg. Small filaments proceed from the aponeurosis to the skin, and many small vessels and nerves pass generally obliquely through it, carrying sheaths of cellular substance along with them. It is this circumstance which makes the aponeurosis somewhat difficult of dissection, particularly in fat subjects. It envelopes in one sheath the flexor muscles on the back of the thigh, and also sends a prolongation beneath the deep surface of the gluteus magnus muscle. This will be best understood during the dissection of these muscles.

289. Glutæus Maximus.—Broad, thick, and quadrilateral. It especially forms the hip. Attached above by short aponeurotic fibres to the posterior part of the crest of the ileum; to the tuberosity of the ileum, and to the rough surface posterior to the superior curved line upon the outer surface of that bone; to the posterior sacro-iliac ligament, on which it is continuous with the aponeurosis of the sacro-lumbalis and latissimus dorsi (lumbar fascia); in the middle, to the inequalities of the posterior surface of the sacrum, to the circumference of the notch which terminates the sacral canal, and to the lateral parts of the coccyx, as far as the summit of that bone; externally and inferiorly, to the posterior sacro-sciatic ligament. The fleshy fibres from these different places collect into distinct fasciculi, separated

from one another by lines filled with cellular tissue; all these fasciculi, which are parallel to each other, and longer the nearer they are to the lower part of the muscle, descend obliquely outwards and forwards, towards the great trochanter; the upper fasciculi terminate at the upper part of a tendon, very thick and narrow below, broad and thin above, and so incorporated externally with the fascia lata, as to be inseparable from it. This tendon, as it descends, receives the other fleshy fibres in succession along its posterior edge, from the level of the great trochanter, and is inserted, in an extent of three inches, into a rough impression, which proceeds from the base of the great trochanter to the linea aspera of the femur, and into the upper part of that line, between the adductor magnus and vastus externus; *posteriorly* covered by a thin lamina of the fascia lata, and connected with the skin by a layer of thick adipose tissue; *anteriorly*, applied upon the os innominatum, the sacrum, the coccyx, the common origin of the sacro-lumbalis and longissimus dorsi, the glutæus medius, pyriformis, gemelli, obturator internus, and quadratus femoris muscles, the sciatic nerve, the tuber ischii, the posterior sacro-sciatic ligament, the upper extremity of the biceps and semitendinosus, the great trochanter, and the adductor magnus and vastus externus muscles. Its *upper edge* thin, connected with the glutæus medius by a prolongation of the fascia lata; the *lower edge* long and free; the *outer* united in its whole extent to the fascia lata. The muscle has considerable analogy to the deltoid; on its external surface rests the singular cushion of elastic fat which characterizes some African nations, and more especially the Boschjiman race. De Blainville asserts that a similar cushion is found in the same race over the deltoides muscle, thus rendering the analogy still more striking. Remove the glutæus maximus by an incision carried across its centre, thus dividing it into two equal parts: reflect these cautiously, taking care not to cut away the great sciatic ligament. The articulated pelvis, with its ligaments, should be placed before the student during the whole of this dissection. Between the glutæus maximus and the trochanter major will be found an extensive *Synovial*

Bursa, expanded upon the outer surface of the trochanter, the neighbouring portion of the vastus externus, and the inner surface of the tendon of the glutæus maximus, the motions of which it facilitates. The glutæus maximus extends the thigh upon the pelvis, and the pelvis upon the thigh; it rotates the thigh outwards, and acts very powerfully in standing and progression.

290. Glutæus Medius, broad, strong, radiated, triangular, thinner than the preceding, under which it is partly situated. It arises by short aponeurotic fibres from the outer surface of the os innominatum, between the two curved lines, from an aponeurotic arch which prevails along the inferior curved line, from the three anterior fourths of the iliac crest, and from the inner surface of the portion of the fascia lata which descends from the superior and anterior iliac spine. Proceeding from these different points, the fleshy fibres descend converging, and following different directions, the anterior, obliquely backwards; the middle, vertically; and posterior, obliquely forwards. They terminate upon the two surfaces of a broad aponeurosis, which is concealed in their substance, and is longer posteriorly than anteriorly. This aponeurosis contracts and becomes thicker as it descends; it is left by the fleshy fibres towards the great trochanter, where it forms a tendon thinner before than behind, which is inserted into the upper edge of that eminence, prolonging itself a little upon its fore and outer part, and uniting with the glutæus minimus; *externally*, covered in its posterior half by the glutæus maximus, and in its anterior by the fascia lata; *internally*, applied upon the os innominatum, the glutæus minimus muscle, and the gluteal artery. It slightly overlaps the pyriformis muscle. Its *anterior edge* is connected above with the tensor vaginæ femoris, from which it is separated below by an interval, in which there occur a great quantity of cellular tissue and branches of the external circumflex artery. The *posterior edge* is, at its upper part, parallel to the pyriformis muscle, whose direction it crosses below, the gluteal artery and nerves lying between them. The two tendons are here separated by a synovial bursa. In action it draws the thigh outwards. By its anterior part, it

rotates the femur inwards, and in the contrary direction by the posterior part. It also acts in standing, and in progression. Its uses were particularly adverted to by Winslow, and Mr. Guthrie has explained by it how the toes are inverted in certain fractures of the femur. Detach the glutæus medius from the ileum, and thus expose

291. The GLUTÆUS MINIMUS; smaller than the medius, and situated under it; flat, triangular, arising by short aponeurosis, from the inferior curved line of the os innominatum, and from the anterior region of its crest, beneath the glutæus medius, from the whole space comprised between these parts, nearly to the edge of the cotyloid cavity. Proceeding from thence, the fleshy fibres converge, and descend; the middle ones, vertically; the anterior and posterior, obliquely. The middle and posterior go to the inner surface of a broad aponeurosis, whose outer part receives some bundles from the glutæus medius, which is accompanied by the anterior fibres of the glutæus minimus, as far as the great trochanter, where it forms a strong and thick tendon, embracing the anterior region of that eminence. A small synovial capsule, in most cases, favours its motions; *externally*, covered by the preceding in the greater part of its extent, and a little, posteriorly, by the pyriformis; *internally*, covering the os innominatum, the fibrous capsule of the hip joint, and the curved tendon of the rectus femoris. Its *upper edge* is convex; the *anterior* is a little connected below with the glutæus medius; the *posterior* is covered above by the pyriformis, to which it is parallel below. Its uses are the same as those of the preceding muscle.

292. PYRIFORMIS, of an elongated conical form, flattened from before backwards; situated in the pelvis, and at the upper and back part of the thigh; its origin, therefore, can only be seen when the limb has been detached from the trunk; it arises by digitations from the anterior surface of the sacrum, to the outside of the anterior sacral holes, and in the spaces by which they are separated from each other; it is also attached to the lower part of the great sacro-sciatic ligament, and to the upper and back part of the ileum. From thence it proceeds outwards, downwards, contracts, leaves the pelvis by the sciatic notch, runs along the

glutæus medius and glutæus minimus, and terminates by a tendon, at first broad and concealed by the fleshy fibres, and separated from the tendon of the glutæus medius by a synovial bursa, it is united by its lower edge with the tendon of the gemellus superior, and inserted, above the latter muscle, into the digital cavity of the great trochanter. Sometimes the pyriformis is split longitudinally, by the passage of *the fibular portion* of the great sciatic nerve through it; this explains what the older writers mean by several pyriform muscles. I have never seen the ischiatic nerve pass through this muscle, as is stated by some writers, and only once a small division of the small sciatic nerve. In the pelvis, it lies on the sacrum; its *anterior surface* is covered by the rectum, the sciatic plexus, and hypogastric vessels. After leaving that cavity, it is applied upon the os innominatum, the capsule of the hip-joint, and the glutæus minimus. Its *posterior surface* is covered by the sacrum and the glutæus maximus. Upon the superior margin of the muscle will be found the gluteal artery, and vein, and nerves; below its inferior margin the ischiatic and pudic arteries, great sciatic and smaller sciatic and pudic nerves; it thus separates these important parts from each other. A great quantity of loose cellular substance surrounds all these parts, and investing them and the following muscles:—

293. Gemellus Superior, elongated, flattened, broader and thicker at its middle part than its extremities, arises from the outer lip of the sciatic spine, proceeds transversely outwards, is confounded with the tendon of the obturator internus, and inserted at the upper part of the inner surface of the great trochanter. Its *posterior surface* is covered by the sciatic nerve and glutæus maximus; the *anterior* covers the os innominatum, and the capsule of the hip joint. It rotates the thigh outwards, and draws it from the other.

294. Gemellus Inferior, has the same form, connexions, and uses as the preceding muscle; but is attached on the one hand to the upper and back part of the tuber ischii, and, on the other, in the digital cavity of the great trochanter, above the obturator externus. This is not unfrequently much larger than the gemellus superior, which is sometimes altogether wanting, in

which case the inferior has double the usual breadth. The two tendons of the gemelli unite behind that of the obturator internus, so as to present a kind of groove for it. To see these muscles properly, the ischiatic artery and great sciatic nerve must either be cut across or fully drawn aside.

295. Obturator Internus, almost entirely situated within the pelvis, and therefore can only be seen properly when the limb, together with one side of the pelvis, has been detached from the trunk. It is flat and triangular, and reflected upon itself as it leaves the pelvis, to proceed to the upper and posterior part of the thigh; arising from the posterior surface of the pubes, within and above the obturator hole, from the obturator ligament, excepting towards the aperture through which the obturator vessels and nerve pass, where it is connected with a small fibrous arch, and from the bony surface which separates the obturator hole from the sciatic notch, immediately beneath the upper strait of the pelvis; the fleshy fibres converge, and descend to below the sciatic spine. But before they reach that point, four or five tendinous slips appear upon its outer surface, approach each other, and turn outwards over the edge of the small sciatic notch, as over a pulley, where they are lodged each in a small groove incrusted with cartilage; on emerging from the pelvis, these slips unite into a thick and flat tendon, which is horizontal, separated from the fleshy fibres, situated between the two gemelli, connected with their tendons and inserted along with them, into the cavity of the trochanter, between the pyramidalis and obturator externus; *externally,* applied within the pelvis against the os innominatum and obturator ligament. The extra pelvic portion is covered by the sciatic nerve and glutæus maximus upon its inner surface. The pelvic portion of the muscle is covered by the pelvic fascia, and partly by the levator ani muscle, which, however, is not in contact with it. Where the obturator muscle turns over the sciatic notch, there is a synovial capsule, plentifully moistened, which covers the cartilage with which that notch is incrusted, and is reflected over the slips of the tendon, and a little over the outer surface of the muscle, especially at its outer part. To see this bursa, the tendon

of the obturator must be cut through. It rotates the thigh outwards, and abducts it.

296. Quadratus Femoris, situated transversely at the posterior and upper part of the thigh; thin, flat, and quadrilateral; arises, by pretty long aponeurotic fibres, from the outer side of the sciatic tuberosity before the semi-membranosus; proceeds horizontally, between the gemellus inferior and adductor magnus, to the lower part of the posterior edge of the great trochanter, where it is inserted by aponeurosis. It crosses somewhat in its insertion the inter-trochanteric line, and occasionally looks much like a continuation of the adductor magnus, to which muscle it is analogous. Its *posterior surface* is covered by the sciatic nerve, and by the glutæus maximus, semi-membranosus, and adductor magnus muscles. The *anterior* covers the obturator externus, the extremity of the tendon of the psoas magnus, and the posterior part of the small trochanter, from which it is separated by a synovial bursa. The superior margin runs parallel with the margin of the gemellus; the inferior is separated from the upper margin of the adductor magnus, by cellular tissue and some branches of the internal circumflex artery. Its uses are the same as those of the gemelli.

297. Obturator Externus. On cutting through the quadratus femoris, the student will observe the tendon of the obturator externus; but this muscle cannot be dissected at this stage of the dissection, and will therefore be more fully described in the dissection of the deep anterior region of the thigh, to which it properly belongs; nevertheless, it is in some respects a capsular muscle of the hip joint, and may be arranged physiologically with the preceding muscles. During the preceding dissection, several vessels and nerves must have been remarked, and although many of their branches will by this time have been cut away, the student may revise them advantageously.

a. The Gluteal Artery, the largest branch of the internal iliac, leaves the pelvis by the upper part of the great sciatic notch, between the pyriformis and gluteus medius muscles, and soon divides into the following branches; a *superficial* and a deep branch. Mr. John Bell tied the gluteal artery in a case in which it had been punctured; this splendid operation required great anatomical knowledge, and the greatest presence of mind, and deservedly placed Mr. Bell at the very head of the operating surgeons of his day. The branches of the gluteal artery supply the surrounding muscles.

B. The ISCHIATIC ARTERY leaves the pelvis below the inferior margin of the pyriformis, sometimes by itself, and sometimes as a common trunk, from which also the pudic artery may arise. This artery divides into three branches, viz. coccygeal, nervi comes ischiadici, and muscular branches.

C. The COMMON PUDIC ARTERY, (*arteria pudenda communis*), leaves the pelvis at the same point with the isciatic, but is a little deeper, crosses the posterior surface of the spine of the ischion, and returns into the pelvis by the smaller sciatic notch. It is accompanied in its course by the corresponding vein and nerve. The other arteries have also their corresponding veins, emptying themselves into the iliac veins. The pudic artery will be best traced while dissecting the pelvis. The nerves occurring during this dissection are,

D. The COMMON PUDIC NERVE, of which a very small portion only can be seen; it comes from the sacral plexus, and follows the course of the artery.

E. The SUPERIOR GLUTEAL NERVE supplies the gluteus medius, minimus, and tensor fasciæ latæ. It leaves the pelvis above the edge of the pyriformis muscle, and dips between the gluteus medius and minimus.

F. The INFERIOR GLUTEAL NERVE, more generally called the *smaller* sciatic nerve. This also comes from the sacral plexus, and leaves the pelvis below the pyriformis by the great sciatic notch. It divides into many branches, such as the gluteal twigs, supplying the gluteus maximus, the sciatic twig, passing under the tuber ischii, the crural twig, which becomes cutaneous, and may be traced as far as the popliteal space.

G. The GREAT SCIATIC NERVE, the largest nerve in the body, is properly divisible into two distinct portions, a large and a smaller; these are merely connected to each other by cellular substance, and may readily be separated. The larger portion becomes ultimately the posterior tibial nerve, the smaller becomes the fibular nerve. These are generally united so as to constitute apparently but one nerve, to about the upper part of the popliteal space, where they naturally separate from each other. This great nerve comes from the sacral plexus, leaves the pelvis by the great sciatic notch beneath the pyriform muscle, and passes behind the gemellus superior, obturator internus, gemellus inferior, and quadratus femoris muscles; it afterwards passes in front of the flexor muscles placed on the back of the thigh, viz. the biceps and semi-tendinosus and membranosus muscles. Superiorly, it is covered by the glutæus maximus. At the point where the nerve lies between the tiber ischii and greater trochanter, is the usual seat of the neuralgic affection so ably described by Cotunnius. Remove the integuments from the back of the leg quite to the heel, and examine the course of the posterior saphena vein and its accompanying nerve. The vein commences on the back of the foot, and towards the direction of the outer ankle, and proceeding up the limb, at first above the aponeurosis, but afterwards beneath it, finally joins the popliteal vein.

H. The Posterior Saphenus Nerve is formed of two branches; one from the posterior tibial (communicans tibialis), and another from the fibular (communicans fibularis;) these unite in various manners in different subjects, sometimes higher up, sometimes scarcely at all, and quite low down the limb. They come off from their respective nerves towards the upper part of the popliteal space, at first deep and beneath the fascia, but afterwards pass through it and become superficial.

298. The Crural Aponeurosis in the leg presents several openings, and one more especially towards its lower part, for the passage of the shorter or posterior saphena vein. This aponeurosis may also be observed adhering to the fibula and tibia, and dividing inferiorly into two layers, one passing over and embracing the tendo achillis, the other passing between it and the deep layer of flexors; beneath this *second layer*, midway between the tendo achillis and tibia in the lower half of the leg, will be found the posterior tibial artery,

vein, and nerve; hence the difficulty of finding the artery in the living subject. Open the aponeurosis, and reflect it as low as the middle of the leg.

299. Biceps Flexor Cruris. This muscle is simple below, separated above into two bundles, one long and round, attached to the upper and outer part of the tuber ischii by a tendon, common to it and the semi-tendinosus, which afterwards becomes an aponeurosis extending to the middle of the thigh; this bundle descends from thence outwards, becoming larger, and is incorporated with the other bundle, which is shorter, flattened, quadrilateral, broader at the middle than the extremities, and attached by short aponeuroses to a large portion of the outer lip of the linea aspera, between the adductor muscles and vastus externus, from which it is separated by a lamina of the fascia lata. The two portions of the muscle are connected by means of an aponeurosis, which terminates in a common tendon. This tendon bifurcates to be inserted into the top of the fibula, embracing the lower extremity of the external lateral ligament of the knee-joint. The anterior branch of this bifurcation sends off a prolongation which passes over the superior tibio-peroneal articulation. Covered posteriorly by the glutæus maximus and fascia lata; this muscle lies upon the semi-membranosus, vastus externus, and adductor magnus muscles, the sciatic nerve, the femur, and the external lateral ligament of the knee. The long portion moreover covers the short, which is applied upon the external superior articular artery, and the external head of the gastrocnemius. Its *inner edge* concurs with the semi-membranosus muscle to form the ham, and its tendon forms the outer ham-string. This muscle bends the leg upon the thigh, or the latter upon the leg. Its long portion is capable of extending the thigh upon the pelvis, or of keeping the pelvis erect. It also rotates the leg outwards.

300. Semi-tendinosus, long, slender, tendinous, and rounded below; thin, fleshy, flattened, and broader above. It is extended obliquely at the back part of the thigh, and arises behind the semi-membranosus, from the tuberosity of the ischium, by a membraneous tendon, which, for the extent of about three inches, is

common to it and the long portion of the biceps. The fleshy fibres arise from the anterior surface of this tendon, and descend in a converging manner a little obliquely inwards; the bundle which they form, contracting and becoming thicker; when it has arrived at the middle part of the thigh, after being generally traversed by an aponeurotic intersection, it forms a slender and round tendon, which descends behind the inner side of the knee-joint, between the internal head of the gastrocnemius and semi-membranosus, turns forward upon the tibia, becomes broader, and is united to the posterior edge of the tendon of the gracilis, as well as with the inner surface of that of the sartorius, to terminate with them upon the tibia. Its *posterior surface* is covered by the fascia lata, and a little at its upper part by the glutæus maximus; the *anterior* is applied upon the semi-membranosus and adductor magnus. A bursa mucosa occurs between its upper part and the biceps and semi-membranosus, and another at its lower part between the internal lateral ligament of the knee and its tendon, united with those of the sartorius and gracilis. It bends the leg, and turns it inwards by rotation. It also bends the thigh upon the leg. In standing it keeps the pelvis erect, and sometimes even contributes to draw it backwards. Together with the next muscle, it contributes to form the inner hamstrings, and bounds the popliteal space in this direction.

301. SEMI-MEMBRANOSUS, placed beneath the preceding muscle, flat, thin, narrow, and aponeurotic in its upper third, broader, thicker, quadrilateral, and fleshy in the rest of its extent, excepting at the very lowest part, where it is rounded, this muscle arises from the tuber ischii, behind the quadratus and before the semi-tendinosus and biceps, by a flat tendon, whose outer edge is much thicker than the inner, which descends very low upon the outer and back part of the fleshy body, to be afterwards concealed in its substance. The fleshy fibres are short and parallel, and directed obliquely inwards; they form a pretty long bundle, thin at its extremities, and thick in the middle, and terminate successively in a tendon which occupies their inner edge. This tendon, which is isolated behind the knee-joint, thick and round, is contiguous an-

teriorly with that of the internal head of the gastrocnemius, from which it is separated by a synovial capsule, and divides into *three portions:* the *outer*, thin and narrow, ascends obliquely backwards and outwards upon the synovial capsule of the knee-joint, which it contributes to strengthen, and is attached above the outer condyle of the femur; the *middle* portion, which is broad and thick, is attached to the back part of the internal tuberosity of the tibia, and sends a very distinct aponeurotic expansion over the popliteus; the *inner* portion, which is larger and rounded, descends from behind forwards over the internal tuberosity of the tibia, and is inserted into it. It is contained by a fibrous sheath which is lined by a very delicate synovial membrane. Its *posterior surface* is covered by the biceps and semi-tendinosus, and by the fascia lata: the *anterior* covers the quadratus, from which it is separated by a bursa mucosa, the adductor magnus and internal head of the gastrocnemius, the popliteal artery, and the knee-joint; its *outer edge* is accompanied by the sciatic nerve, and concurs with the biceps to form the cavity of the ham; the *inner edge* is partly covered by the gracilis and the fascia lata. Its uses are the same as those of the preceding muscle.

302. Popliteal Space. As the tendons of the muscles just described contribute to form the popliteal space, we may here describe its limits; its contents will be examined more carefully afterwards. Anteriorly, the space is bounded by that triangular flat surface of the femur, extending from the groove for the popliteal artery to the intercondyloid notch by the back of the joint, the posterior ligament of Winslow, and the popliteus muscle; externally and superiorly, by the tendon of the biceps; internally and superiorly, by the tendons of the semi-membranosus, semi-tendinosus, and gracilis; externally and inferiorly, by the outer head of the gastrocnemius muscle; internally, by the inner head of the same muscle; posteriorly, it is shut in by the aponeurosis and the integuments. It thus occupies about a fourth of the lower part of the thigh, and a fifth or sixth of that of the leg. The fascia, by its union with the condyles of the femur and

tibia, and more especially with the tendons of the flexor muscles of the leg, limits and confines the space on all sides, and especially above, thus giving to it a pointed form above and below.

In the course of this dissection, the student may observe branches of the following arteries,—sciatic, internal circumflex, perforating of the profunda, and articular. These last are in the popliteal space; finally, the popliteal artery, which is merely the continued trunk of the superficial femoral. The veins accompany the arteries, for the most part. The principal nerve in this region is the great sciatic, whose course was formerly traced as low as the inferior margin of the quadratus femoris. It here passes before the biceps and semi-tendinosus, but inferiorly, on getting into the popliteal space, it is covered only by the integuments and aponeurosis; anterior to it, about the middle of the thigh, is the adductor magnus. Towards the upper part of the popliteal space, the sciatic nerve, which we have already described as being composed of two great divisions, here separates into those divisions, viz. the peroneal, fibular, or smaller, and the posterior tibial. (There is no such thing as "a *popliteal nerve:*" such language is extremely confused and incorrect.) The posterior tibial nerve follows the line of the original course of the sciatic, of which it forms the larger division; it descends through the middle, as it were, of the popliteal space, to reach its ultimate position on the inner side of the malleolus internus:* this nerve lies behind the vessels. The peroneal or fibular branch of the great sciatic follows the more oblique course of the outer hamstring, adhering close to its inner side, and partly overlapped and concealed by it. The smaller nerve ultimately follows the course of the smaller bone of the leg; the larger follows more the line of the tibia. The ultimate course of the peroneal nerve is rather complex; it passes below the head of the fibula, *outside the neck* of that bone, and afterwards supplies the integuments and muscles on the outer side of the limb and back of the foot; the posterior tibial nerve, on the other hand,

* Where it subdivides into two branches, the internal and external plantar.

is destined rather to the muscles on the back of the leg and sole of the foot. Whilst these nerves are passing through the popliteal space in the way just described, they give off several branches; the more remarkable of these are the muscular branches from the posterior tibial, which supply the heads of the gastrocnemii and solens muscles; and a branch sent from each division, which follow a remarkable course. These I venture to call the *communicans tibialis*, arising from the posterior tibial nerve, and the *communicans fibularis*, arising from the fibular or peroneal nerve. These two branches proceed down the back of the leg, at first below the aponeurosis, but afterwards above it; they follow the course of the posterior saphena vein, and *uniting*, sometimes high up, sometimes low down, constitute what for some years I have called the posterior saphenus nerve: they have been already spoken of, in describing the aponeuroses on the back of the leg. In the celebrated plates of Walter, this union is represented very low down, but this is not the more common arrangement. The posterior saphenus nerve follows the course of the vein so named, and proceeds, consequently, in the direction of the heel and outer ankle. In tracing the popliteal artery through the popliteal space, it will be found to run pretty much in the axis of the limb. The accompanying vein is intimately united to it by a common sheath. The artery is deepest; the vein behind, and rather to one side; the nerve a good way behind these, and most superficial. The artery first appears in the upper part of the popliteal space, as it passes through the opening in the adductor magnus; it then descends vertically through the popliteal space, but inclining gradually in its course from within outwards, resting on a cushion of adipose and cellular tissue, interposed betwixt it and the posterior part of the femur and back of the knee-joint, more especially behind the ligamentum posticum of Winslow. It next gets between the heads of the gastrocnemius muscle, and crosses behind the popliteus muscle, which can scarcely be seen at this stage of the dissection. It afterwards, a little below the inferior margin of this muscle, divides into two branches, the posterior tibial and fibular, after having sent off a very large branch anteriorly, viz., the anterior tibial. In this course the popliteal artery gives off the following branches: 1°. Several muscular branches to the vasti and cruræus. 2°. The external and internal superior articular. 3°. The azygous articular. 4°. Sural or muscular branches to the gastrocnemii muscles. 5°. The external and internal articular arteries. These vessels may readily be found in the following situations; the sural descend to the heads of the gastrocnemii, and after being examined, should be cut away to allow of the proper examination of the deeper parts. The superior articular lie above the condyles of the femur: the azygous articular perforates the ligament of Winslow; the inferior external articular, will be found between the external lateral ligament and the joint; the inferior internal articular occurs between the internal lateral ligament and the tibia. Lastly, in the popliteal space, there are generally a few lymphatic glands not far from the great vein. The space just described, has lost much of its importance in a surgical point of view since the celebrated improvement which Mr. Hunter made on the operation for popliteal aneurism. But even so late as 1814, the operation was performed in the old way in Paris by M. Boyer. He took an hour and twenty minutes to perform an operation, which in England, even at that time, was frequently done in four minutes. The old operation of tying the artery in the popliteal space for aneurism there, is now universally exploded.*

303. Superficial Facia of the Groin. This important fascia is continuous with that found under the integuments of the abdomen, but in passing over Poupart's ligament, it is connected by a thin cellular tissue to the ligament. This cellular tissue has been esteemed

* The subject should here be turned, and the dissection of the anterior aspect of the thigh commenced; place a block below the pelvis and extend the limb. Next make an incision through the integuments, from the spine of the pubis to the anterior and superior spinous process of the ilium, and a second from the same spinous process of the ilium, downwards to a little above the knee joint. From the termination of this second incision, carry one across the thigh towards its inner side. Reflect this square flap of skin merely, and thereby expose the superficial fascia.

by some a separate fascia. Imbedded in the superficial fascia, will be found a great number of superficial nerves: of these, some come from the muscular and cutaneous branches of the lumbar plexus, others from the anterior crural nerve, which likewise comes from that plexus. It is in this fascia that the superficial veins of this part of the limb are mostly imbedded, as it furnishes sheaths to them; by dissecting these sheaths previous to taking off the fascia, they will be best exposed and understood. The most important of these is the *vena saphena magna*, or interna; this vein will afterwards be found ascending on the inner part of the foot and leg from the direction of the inner ankle, and ascending in this direction to within an inch of Poupart's ligament. Here it passes through the fascia lata or aponeurosis, by an opening much larger than is required for it, but which is filled up, or shut in to a great extent by the *fascia cribriformis;* the opening through this, left for the passage of the saphena vein, is in the lower part of the *fascia cribriformis.* A pretty firm sheath of cellular substance from the edge of the opening follows the saphena downwards, and prevents the student at first from seeing the opening. Next trace the veins joining the saphena; these run in various directions, some from the inside, others from the outside of the thigh; besides these, two or three will be found descending from the abdominal parietes; these are the superficial epigastric and superficial circumflex vein of the ileum. Lying imbedded in the superficial fascia, a little below Poupart's ligament, the student will find the superficial inguinal glands; they are situated partly above and partly below the fascia, and receive lymphatic vessels from the lower extremity, and from the organs of generation. Hence, their inflammation in venereal diseases, and in injuries of the foot, leg, &c. Other glands lie below the fascia, upon, and in, and also beneath the fascia lata. These will be examined presently. Next remove the superficial fascia from without inwards, using great caution whilst approaching the saphenic opening, and taking care to leave the saphena vein, and the *fascia cribriformis*, which is situated between the upper part of the saphena and Poupart's ligament. This will expose the

304. Femoral Aponeurosis (fascia lata femoris); strong and tendinous externally, but much weaker internally. Its attachments are, 1°. To the crest of the ileum, and as has been already remarked, to the sacral and coccygeal vertebræ. 2°. To Poupart's ligament throughout its whole length. Some anatomists consider the femoral aponeurosis and Poupart's ligament as *quite continuous*, but this seems incorrect; they are merely united to each other. This may be proved by cutting away Poupart's ligament with a very sharp knife, when it will be found that the femoral aponeurosis is as tense as ever in consequence of a deeper connexion with the *facia transversalis* which lies beneath Poupart's ligament. 3°. To the rami of the ischium and pubis. In short, as we have seen, it encloses all the muscles of the thigh, sending numerous partitions or prolongations inwards between them to lay hold of the femur, then giving to most of them a general covering, and a particular sheath. It also forms extensively the sheaths of the great vessels, and more especially of the superficial femoral artery as it passes through the thigh. These important points in its anatomy will be perfectly understood by the student, if he dissects the muscles properly. Next cut through the saphena vein at the distance of about four inches below Poupart's ligament, and raise it up; directed by it, the dissector will be led to examine carefully the inferior border of the saphenic opening. The student may next cut through the *cribriform fascia*, and laying it over towards the pubis, he thus exposes the common femoral vein, into which the saphena vein passes; also, the crescentic margin or duplicature of Mr. Burns, running upwards and forwards to Poupart's] ligament. By opening the fascia lata a little to the outside of the femoral vein, he will expose the common femoral artery, and at a short distance on the iliac side of the artery, he will find embedded below the fascia lata, the *crural nerve*. Returning to the crescentic margin, or falciform process, which presents two portions, a longer one looking towards the pubes, a shorter one looking upwards towards Poupart's ligament, it is easy to see that several different views may be taken of the nature and formation of the *cribriform fascia*. 1°. It may be considered as a layer of cellular

substance filling up the space between the iliac and pubic portions of the fascia lata, derived either from one source or from several, but forming the outer wall of the sheath of the femoral vein, and furnishing a partition between the vein and artery, and between the vein and the sac of the crural hernia when this disease occurs. 2°. It may be considered merely as the sheath of the great vessels descending from within the pelvis. 3°. It may be viewed as the anterior layer of the fascia lata, which, on the iliac side of the femoral artery, has divided into two layers, a deeper, strong and fibrous, passing behind the vessels, and appearing on their inner side to form the pubic portion of the aponeurosis, covering the pectinæus muscle, and a superficial layer, thin and cellular passing over these vessels, and joining the pubic portion and deeper layer on their inner or pubic side. The fascia cribriformis has several apertures in it besides that for the saphena; in one or two of these lie lymphatic glands; small blood vessels likewise pass through these openings. Farther, it may be observed, that whilst the iliac portion of the fascia lata adheres to Poupart's ligament, the pubic portion passes deeper, as being behind the vessels having attachment to the spine of the pubes and to the linea pectinea. It has been already shewn that the iliac portion of the fascia lata, besides being connected to Poupart's ligament, is likewise intimately united to the fascia transversalis beneath it; this is also the case with the *fascia cribriformis.* Lastly, the *cribriform fascia* forms, according to some, the anterior wall of a short canal, to which the name of *crural canal* has been given.

305. Tensor Fasciæ Latæ. Make an incision through the aponeurosis directly over the middle of the muscle, and throughout its whole length. Reflect the fibrous sheath thus opened, and clear the surface of the muscle at the same time.* The muscle, situated at the

* This mode of opening the sheaths of the muscles directly over their centre, should be followed in the dissection of all the muscles of the thigh and leg. The opposite practice which universally prevails in the dissecting rooms of this country, of removing the fascia lata as a sheath uniformly extended over the thigh, thus neglecting and overlooking the various partitions it transmits between them to the bones, implies complete ignorance

upper and outer part of the thigh, is flat, broader and thinner below than above, and arises externally from the anterior and superior iliac spine, between the sartorius and glutæus medius, by a short tendon. The fleshy fibres descend vertically, diverging as they proceed, and about three inches below the great trochanter terminate in a separation of the two laminæ of the fascia lata, and thus have no fixed attachment inferiorly to any bone. Covered *externally* by a thin lamina of the fascia lata; the *inner* surface is separated by another, from the rectus femoris and vastus externus; it also covers the glutæus medius and glutæus minimus a little; its *anterior edge,* is parallel above to the sartorius, and separates from it below; the *posterior* is united above to the glutæus medius. This muscle rotates the thigh inwards, and carries it outwards, separating it from the other. Its principal action, however, has been supposed to stretch the aponeurosis by which the muscles of the thigh are enveloped. It may act on the pelvis.* It has lately, in some dissecting rooms, been fashionable to make an artificial dissection of the aponeurosis below the muscle, leaving a long stripe of it descending to the fibula. This stripe has been exhibited as the tendon of the tensor. Next dissect the

306. SARTORIUS. This is the longest muscle in the human body, and resembles a band, a little broader at its middle than at the extremities, lying obliquely along the inner part of the thigh. It arises by a short tendon, equally expanded over its two surfaces, from the anterior and superior iliac spine, between the tensor vaginæ femoris and iliacus, and a little from the notch which separates the two anterior spines of the ilium. From thence it descends, becoming broader, obliquely inwards and backwards, as far as the upper third of the thigh; it then proceeds vertically, preserving the same breadth to the inferior third; and lastly, opposite the knee, it contracts, and passes obliquely forwards and outwards, to the inner part of the upper

on the part of the teacher of the real structure of this important aponeurosis. Hence the origin of numerous errors in practice.

* The notions regarding the action of this muscle entertained by the author of the "Animal Mechanics," has been refuted by Dr. Arnott.

extremity of the tibia, where it is inserted by a long flat tendon, whose anterior edge, arising high upon the fleshy fibres, is united to the fascia lata surrounding the knee, while the posterior contributes to form the aponeurosis of the leg. At its lower extremity, this tendon expands into a strong aponeurosis which passes over the tendons of the semi-tendinosus and gracilis, uniting with them, and terminates upon the tibia before them. *Anteriorly*, covered by the fascia lata; *posterior* applied, from above downwards, upon the united psoas magnus and iliacus, the rectus femoris, vastus internus, adductor longus, adductor magnus and gracilis muscles, the superficial femoral artery and vein, and, at its lower part, the internal lateral ligament of the knee-joint. Its *inner edge* forms above with the adductor longus, a triangular space, in which is lodged the crural artery, with the vein and nerve of the same name. In action it bends the leg upon the thigh, and brings its inferior extremity toward that of the opposite side, so as to make them cross each other; by continuing to act, it bends the thigh upon the pelvis; if the leg cannot be bent, it draws the whole inferior extremity upon the pelvis, turning it outwards in rotation; it prevents the pelvis from falling backwards, or bends it upon the thigh.

307. Rectus Femoris. The *Rectus Femoris, (Venter prior musculi quadricipitis femoris,)* is an elongated muscle, flattened at its extremities, slightly rounded and broader at the middle, and exactly fusiform. It lies vertically at the anterior part of the thigh, and arises from the iliac bone by two tendons. One of them is straight and embraces the anterior and inferior spine of that bone; the other, which is longer, broader, and curved, turns round the edge of the cotyloid cavity, to the upper part of which it is attached, sending some fibres into the capsule of the articulation. These two tendons, as may be seen by forcibly raising up the iliacus which overlaps them, after a short passage, unite into a single tendon, which descends vertically, and almost immediately expands into an aponeurosis, occupying the fore part of the upper third of the muscle, and gives rise posteriorly to the fleshy fibres. These form a vertical and bulging bundle, and are inserted

successively into the fore part of another aponeurosis, which lies upon the posterior surface of the muscle, from the place where the other terminates. This aponeurosis, after becoming narrower and thicker, separates and forms a flat tendon, which is united with those of the three following muscles. The *anterior surface* is covered by the fascia lata, and by the iliacus and sartorius muscles; the *posterior* is applied upon the hip-joint, the external circumflex vessels, and the cruralis. It extends the leg upon the thigh, or the thigh upon the leg; if the leg is extended, it bends the thigh upon the pelvis, or the pelvis upon the thigh; when one is standing, it fixes the pelvis, and prevents it from falling back.*

308. VASTUS EXTERNUS. (*Venter externus musculi quadricipitis femoris*) thicker above than below, and attached to the base and fore part of the great trochanter, as well as to the outer lip of the linea aspera, and, together with the glutæus maximus, to the ridge by which it is connected with the great trochanter, by a broad aponeurosis, expanded over its outer surface to near the middle of the thigh, thick and dense at its upper part, thin and with separated fibres below. The fleshy fibres of the muscle arise from the inner surface of this aponeurosis, and another aponeurotic lamina placed between it and the short portion of the biceps, and from the outer surface of the femur; they are directed obliquely downwards and forwards, and longer above than below, where they become nearly transverse; the last fibres even take their origin from the two upper thirds of the line which descends to the outer condyle of the femur; they form together a mass, broader and thicker at its middle part than at the extremities, which is at first separated from the cruralis by a thin layer of cellular tissue, becomes inferiorly inseparably united with it.

* On dividing the rectus in the middle, and reflecting it and the sartorius, which may either be removed from the spine of the ilium or cut across; all the front and sides of the femur, nearly from one extremity to the other, will be found enveloped by a very powerful muscle which the older anatomists considered as three, under the names of vasti and cruræus. Properly speaking, however, they form but one, and as such they will one day be no doubt described. We may still continue to speak of them as three.

309. VASTUS INTERNUS. (*Venter internus m. quadricipitis femoris,*) is seldom distinct from the following muscle, and is much smaller than the preceding; it appears more bulky below than above. It is attached to the anterior and inferior part of the base of the small trochanter, and to the inner lip of the linea aspera, by aponeurosis, and which descends to the middle of the thigh. The fleshy fibres come from the inner surface and anterior edge of this aponeurosis, as well as from the inner surface of the femur, and from the two upper thirds of the ridge which descends to the inner condyle; they are directed obliquely downwards, forwards, and outwards; the upper are longer than the lower, which are united along the linea aspera with the adductor muscles.

310. CRURALIS. (*Venter posterior m. quadricipitis femoris,*) arises from the fore part of the base of the neck of the femur, along the oblique ridge which proceeds from the great to the small trochanter, and from the three upper fourths of the anterior surface of the body of the femur. Its fleshy fibres form a mass which descends, increasing in size, and which, at first isolated, soon mix with the two preceding muscles, but first with the vastus internus. These three muscles, the vastus externus, the vastus internus, and cruralis, are thus united by broad aponeuroses. One of these commences high upon the inner surface of the first: the other rises about the same level upon the outer surface of the second, and the last appears toward the middle of the anterior surface of the third. They approach each other as they descend, become intimately united, and form a tendon at first broad and thin, afterwards narrower and thicker, and at last intimately united with that of the rectus femoris with which it is inserted into the whole upper part of the patella, sending off laterally two fibrous expansions embracing that bone, and are attached to the tuberosities of the tibia, along with portions of the fascia lata. The fleshy fibres of the vastus internus accompany it to near the patella. The *anterior surface* of the vastus externus is covered above by the tendons of the glutæus minimus and glutæus maximus; farther down, by the fascia lata and its tensor muscle, and at its lowest part, by the short portion

of the biceps. The *anterior surface* of the cruralis is in connexion with the iliacus and rectus femoris, and with the external circumflex vessels. The fascia lata, the crural artery, and the sartorius muscle are applied upon the *anterior surface* of the vastus internus. The *posterior surface* of these muscles covers extensively the surface of the body of the femur, from which it is separated below by a considerable quantity of adipose cellular tissue, and the knee-joint.

311. SUBCRURÆUS a few detached muscular fibres, frequently found under the lower part of the cruralis, and attached to the *synovial capsule* of the knee-joint, have been described as a separate muscle, under the name of *Subcruræus* or *articularis genu*. When the knee is extended, it seems to draw up the capsule of the joint from between the end of the bones. To expose the subcruræus, the vasti and cruræus must be removed. These muscles contribute powerfully to extend the leg upon the thigh, and the latter upon the former. Along the inner and outer sides of the femur few muscular fibres adhere.

312. GRACILIS is situated on the inside of the thigh, long flat, thin, broader above than below; arises, over a space of about two inches, by aponeuroses much longer before than behind, from the anterior surface of the pubis, close to the symphysis, from the ramus of that bone, and of the ischium, being thus situated between the triceps adductor and erector penis. From thence it descends vertically on the inside of the thigh, contracts rapidly, and when near the knee, forms a rounded tendon, which commences on the posterior edge of the muscle at the middle of the thigh, and is accompanied anteriorly by fleshy fibres as far as the knee. There it becomes free, passes behind the inner condyle of the femur, enlarges, descends from behind forwards over the upper and inner part of the tibia, unites with the tendon of the semi-tendinosus, and is attached to the bone behind that of the sartorius. By its posterior edge it sends a fibrous expansion to the aponeurosis of the leg. Its *inner surface* is covered by the fascia lata, and below by the sartorius; it is superficial nearly throughout its whole extent. The *outer* covers the adductor and semi-membranosus muscles,

and the internal ligament of the knee joint. In action it bends the leg upon the thigh, or the thigh upon the leg.

313. PECTINEUS, or MUSCULUS-LIVIDUS, elongated, flat, triangular, broader above than below, situated at the upper and fore part of the thigh. It arises by short aponeurosis from the horizontal ramus of the pubes, between the spine of that bone and the ileo-pectineal eminence. It descends from thence obliquely outwards and backwards, contracts, and opposite the small trochanter turns upon itself to be inserted, by means of a flat tendon, into the ridge which descends from that process to the linea aspera, immediately beneath the insertion of the psoas magnus and iliacus internus. Its *anterior surface* is covered by the pubic portion of the fascia lata, and the crural vessels lie upon it *inferiorly*. The *posterior* lies upon the horizontal ramus of the pubes, the hip joint, the obturator externus and adductor brevis muscles, and the obturator vessels and nerve. Its *inner edge* is slightly covered by the long adductor; the *outer* is parallel to the psoas. The internal circumflex and first perforating arteries are situated, the one close to the inner and upper margin of the muscle, the other close to the lower margin. The pectineus muscle bends the thigh upon the pelvis. It brings it towards that of the opposite side, or turns it outwards in rotation. It also bends the pelvis upon the thigh or keeps it in its natural position. The crural or femoral hernia descends upon that portion of the aponeurosis which covers the pectineus. Poupart's ligament is stretched over its upper edge, and the ligament of Gimbernat approaches close to the inner edge of its origin.

314. ADDUCTOR LONGUS,* long, flat, thick, triangular, broader below than above, situated before the other two adductors, at the inner and upper part of the thigh. It arises, by a narrow but strong tendon, from below the spine and from the anterior surface and symphysis pubis. It is prolonged for a time under the form of an aponeurosis, over the inner edge of the fleshy body,

* The older anatomists, who described the triceps extensor of the leg (vasti et cruræus) as three muscles, although they really constitute but one, were equally wrong in respect to the *three* adductors, which they spoke of as one, although they really are three quite distinct muscles.

which descends obliquely outwards and backwards, becoming broader and thicker as far as its middle part, but which then becomes thinner, to terminate between two aponeurotic laminæ uniting into a single one, attached to the middle part of the interstice of the linea aspera, over a space of about three inches, between the vastus internus and adductor magnus, with which it is firmly united. This aponeurosis sends some fibres to the tendon of the latter muscle, which concur, with it, to form an aperture through which the crural artery passes. The *anterior surface* is covered by the fascia lata, the sartorius, and the crural artery and vein inferiorly. The *posterior* covers the other two adductor muscles, (and the lower part of the arteria profunda femoris), and is firmly united to them below. Its *outer edge* is parallel to the pectineus muscle; the *inner* is concealed by the gracilis. It brings the thigh toward that of the opposite side, bends it a little, and carries it outward by rotating it. When one stands upon a single foot it keeps back the pelvis. Cut through the adductor longus about an inch below its origin, and after reflecting it towards the femur, dissect the

315. Adductor Brevis, placed behind the preceding, and smaller and shorter. It is triangular, flattened from within outwards in its upper third, and from before backwards in its two lower thirds, and rises, by short aponeuroses, from almost the whole space which separates the symphysis pubis from the obturator hole, whence it descends outwards and backwards, becoming broader and thinner, to be inserted, by a less developed aponeurosis than that of the preceding muscle, which aponeurosis is traversed by the perforating arteries, into the middle part of the linea aspera, for a space of about three inches, proceeding from the small trochanter. At this insertion, the adductor brevis is incorporated with the adductor longus, adductor magnus, and the pectineus. This muscle is covered anteriorly by the preceding, and by the pectineus; *posteriorly*, it is applied upon the adductor magnus; *internally*, it is connected with the gracilis, and *externally*, with the tendon of the psoas magnus and iliacus, and with the obturator externus. Its uses are the same as those of the preceding muscle.

Cut through the origin of this muscle, and next dissect the

316. ADDUCTOR MAGNUS, triangular, like the other adductors, but of much greater extent. It arises, by a broad and thick tendon, which sends an aponeurosis behind its fleshy fibres, from the base of the tuberosity of the ischium, and by short aponeuroses from its ramus. The fleshy fibres which arise from these different origins become longer in proportion as they are examined more internally; the upper are nearly transverse, and much twisted, and frequently seem to form a distinct muscle; they come from the ramus of which we have just spoken, and are attached to the upper fourth of the linea aspera of the femur, and to the ridge which unites it to the great trochanter, passing before the rest of the muscle. The middle fibres, which are longer and more oblique, terminate in the three inferior fourths of the linea aspera, by a pretty long aponeurosis, which is confounded with the insertions of the two other adductors, and is perforated by several apertures for the perforating arteries; but, at the end of the linea aspera, it bifurcates in such a manner, that one of its portions ends in a point between the vastus internus and the short head of the biceps, while the other proceeds towards a tendon, which terminates the vastus internus. Between these two portions, there is an interval or fibrous canal traversed by the crural artery and vein. Lastly, the inner fibres are inserted into a tendon which commences high upon the inner edge of the muscle, sends a fibrous prolongation before the crural artery, unites with the aponeurosis of the adductor longus, and is attached to the tuberosity of the internal condyle of the femur, where it is incorporated with the inner edge of the vastus internus. The *anterior surface* of this muscle is covered by the two preceding, by the sartorius, and by the crural artery. The *posterior* covers the semi-tendinosus, semi-membranosus, biceps, and glutæus maximus muscles, and the sciatic nerve. The *inner edge* is in connexion with the fascia lata, the gracilis and sartorius muscles. Some branches of the internal circumflex artery pass in the cellular space between this muscle and the lower margin of the quadratus femoris. This muscle brings the thigh powerfully toward that of the

opposite side, keeps the pelvis in its natural position, and has the same uses as the other adductors.

317. Obturator Externus.—To expose this muscle fully, nearly all the others just spoken of must be divided and reflected towards the femur, being still left attached by their femoral attachments. The sartorius may be divided about the middle; the pectineus, adductor longus, and adductor brevis, near their origins; the adductor magnus in the same manner. On clearing away the cellular substance and blood-vessels, the obturator externus will be exposed. This muscle is situated at the upper and inner part of the thigh, and of the form of a flattened conoid; arises from the lamina of the os innominatum which limits the obturator hole anteriorly, and from the inner part of the anterior surface of the obturator membrane. From thence, it descends outwards, becoming narrower, then ascends behind the neck of the femur, where its fleshy fibres terminate upon a tendon, which comes from several slips that had existed in the substance of the muscle, contracts, becomes thicker, and is inserted into the cavity of the trochanter beneath the inferior gemellus, after contracting strong adhesions with the capsular ligament of the hip joint. Its *anterior surface*, which is inclined downwards, is covered by the pectineus, the adductors, and quadratus. The *posterior* is applied upon the os innominatum, the obturator membrane, from which it is separated by cellular tissue externally, and upon the fibrous capsule of the hip-joint; its *upper edge* corresponds internally to the obturator nerve and vessels; the *lower edge* is placed, also internally, above the attachment of the adductor magnus. This muscle rotates the thigh outwards, and draws it towards the other. During the dissection of the anterior aspect of the thigh, the following vessels and nerves will be met with.

a. The Common Femoral Artery is a continuation of the external iliac; it passes under the crural arch, about midway between the spinous process of the ilium and the symphysis pubis. After a short course, which varies, however, in different subjects, it subdivides into two great arteries, called *superficial femoral* and *deep femoral*.

b. The Superficial Femoral merely passes through the thigh on its way towards the leg, (to which it more particularly belongs), and having passed through the adductor magnus, it gets the name of *popliteal artery.*

c. The Deep Femoral Artery (*Ar. Profunda Femoris*), in its course is deeper than the superficial femoral, and ultimately runs beneath the adductor longus, and perforates the adductor magnus. In the course of these great arteries, the following branches are usually given off, subject, however, to considerable varieties. From the common femoral arise, 1°. the Art. Epigastrica Superficialis. 2°. Arter. Pudicæ Externæ. 3°. Arter. Circumflexa Ossis Ilii. 4°. Arteria Femoralis Superficialis. 5°. Arteria Femoralis Profunda. From the superficial femoral artery arise very few branches of consequence; a few muscular branches, and an artery called the *anastomotica magna*, just before the principal trunk passes through the adductor magnus, or while it is passing. The arteria profunda femoris gives off in general the arteriæ circumflexa interna and externa, three and sometimes four perforating arteries, besides several muscular branches. The veins follow pretty nearly the course of the arteries, and have similar names. Beneath the pectineus will be found the terminating branches of the obturatrix artery, and the accompanying veins. The nerves met with throughout the *dissection of the* anterior aspect of the thigh are chiefly the crural and its branches, and the obturator. A remarkable branch of the crural, (the *nervus saphenus longus*), follows the superficial femoral artery throughout a part of its course, but leaves it as the artery is passing through the tendinous sheath of the adductor magnus, afterwards accompanying the vein of this name. The student is referred for a particular account of the blood vessels and nerves to the sections on the anatomy of the arteries and nervous system.

318. Aponeurosis of the Leg. This aponeurosis is exposed by removing the integuments and superficial fascia; in the facia, or subcutaneous cellular membrane, will be found a few superficial veins, and numerous branches of the fibular nerve. The aponeurosis on the anterior aspect of the leg is strong, and gives a general covering to the whole, with the exception, perhaps, of the inner surface of the tibia. The superficial

nerves and vessels imbedded in the subcutaneous cellular substance, separate it from the integuments; a fine cellular substance separates it from the muscular fibres where they do not absolutely adhere to or arise from its inner surface. From this inner surface there arise 1°. an aponeurotic partition separating the muscles of the prætibial region from the peroneal muscles; 2°. another principal partition separating these peroneal muscles from the posterior muscles of the leg. There are thus three great sheaths formed by the fibrous envelope of the leg. Anteriorly, the aponeurosis of the leg is continuous with that of the thigh over the anterior surface of the patella; it adheres also to the external border of the anterior tuberosity of the tibia, to the head of the fibula, and laterally to the tendon of the biceps. Its connexions and course posteriorly, will be described when examining the muscles on the back of the leg. Inferiorly, it is attached to the anterior annular ligament of the tarsus, and seems even to pass over it, thus becoming continuous with the dorsal aponeurosis of the foot. The fibres of the aponeurosis of the leg run in different directions, some being circular, others oblique. The *anterior annular ligament of the tarsus* arises from the calcaneum, by a narrow thick extremity proceeding afterwards from without inwards, and subdivides into two principal bands, viz. 1°. one superior belonging to the tibialis anticus muscles, also binding down the tendons of the extensor communis digitorum, and of the peroneus tertius, when that muscle is present; (between these two complete sheaths there is an incomplete one for the tendon of the extensor proprius pollicis.) 2°. The *inferior band of the annular ligament* proceeds across the instep to the inner side of the tarsus and foot generally, and becomes continuous with the internal division of the plantar aponeurosis. The inferior band is merely a second annular ligament, furnishing a fibrous sheath to the tendons of the muscles already mentioned. Beneath these fibrous sheaths of the anterior annular ligaments (which are really *retinacula*) there are synovial bursæ. The dorsal aponeurosis of the foot is a delicate layer connected superiorly to the annular ligament, and seemingly continuous with that of the leg.

It furnishes a general covering to the muscles and tendons of the dorsum of the foot, and terminates anteriorly towards the extremity of the metatarsal bones; there are likewise four dorsal *interosseal* aponeuroses, lying between the metatarsal bones, and covering the interosseal muscles. The *external and internal annular ligaments* will be described along with the peroneal muscles and flexors of the toes. The plantar aponeuroses will be best considered along with the muscles of the sole of the foot.

319. Tibialis Anticus. Long, thick, fleshy, arises from the external tuberosity and upper half of the outer surface of the tibia by short aponeurotic fibres, from the upper and fore part of the interosseous membrane, from an aponeurotic partition which separates it from the extensor digitorum, and from the upper part of the inner surface of the aponeurosis of the leg; it descends obliquely inwards and forwards, becoming at first a little thicker and then diminishing; terminating about the middle third of the leg by a flat tendon which descends before the anterior extremity of the tibia, passes over the ankle joint, in a groove of the anterior annular ligament of the tarsus, proceeds over the back of the foot, becomes broader, and arrives at the inner side of the internal cuneiform bone, where it divides into two portions: the posterior of which is larger, slides over the bone by means of a small synovial membrane, and is inserted at its base; while the other, which is anterior and smaller, is attached to the inner and lower part of the posterior extremity of the first metasarsal bone. Externally corresponding to the extensor communis digitorum above, and the extensor proprius pollicis below, from which it is separated posteriorly by the anterior tibial nerve and vessels. Its *posterior edge* covers the interosseous membrane, the tibia, the tibio-tarsal articulation, and the upper and inner part of the tarsus. The tibialis anticus bends the foot upon the leg, and directs its point inwards at the same time that it raises its inner edge. It also bends the leg upon the foot. Draw this muscle aside, and clean

320. Extensor Proprius Pollicis Pedis. Fleshy, broad, thick, and transversely flattened above, slender

and tendinous below, and situated to the outside of the preceding. Arises, by short aponeuroses, from the fore part of the inner surface of the fibula, over an extent of five or six inches proceeding from the lower part of its upper third, and from the neighbouring region of the interosseous ligament. The fleshy fibres descend, form a bundle of fibres, all about two inches in length, terminating successively upon a tendon which becomes free toward the ankle, passes into a groove beneath the annular ligament of the tarsus, runs along the inner edge of the foot, slides over the proximal phalanx of the great toe, with which it is connected by two fibrous expansions, and is inserted into the distal phalanx, over which it is expanded. The tendon is sometimes cartilaginous where it passes over the proximal extremity of the distal phalanx. This tendon, which is broader near its insertion and upon the tarsus than in the rest of its course, is surrounded by a synovial capsule whilst passing under the annular ligament. Internally corresponding to the tibialis anticus, and to the anterior tibial nerve and vessels. *Externally* applied against the extensor communis digitorum. Its *anterior edge* is concealed above between the tibialis anticus and extensor digitorum, and covered below by the tibial aponeurosis and the skin. The *posterior edge* lies upon the fibula, the interosseous membrane, tibia, anterior tibial artery, ankle-joint, and back of the foot and great toe. This muscle extends the distal phalanx of the great toe upon the first, and the latter upon the first metatarsal bone. It also bends the foot upon the leg, or the leg upon the foot.

321. Extensor Longus Communis Digitorum Pedis. Elongated, thin, transversely flattened, simple and fleshy above, divided into four tendons below. Arises from the external tuberosity of the tibia, between the tibialis anticus and peroneus longus, from the two aponeurotic partitions which separate it from each of these muscles, from the anterior ligament of the upper tibio-peroneal articulation, from the interosseous ligament, from the fore part of the fibula over a space of five or six inches, and from the tibial aponeurosis at the upper part of its inner surface; the fleshy fibres proceeding from these different insertions follow various

directions. The upper are vertical, the lower more and more oblique; they form a mass which descends obliquely inwards, and is larger in the middle than at its extremities; they are all inserted into a tendon which is at first concealed in their substance, and appears upon their anterior surface about the middle of the leg, being accompanied by them posteriorly as far as the annular ligament of the tarsus. Before arriving there, the fleshy fibres and the tendon are divided into three contiguous portions, which pass beneath it in a groove invested with a distinct synovial capsule, common to them with the tendon of the peroneus tertius. The inner portion bifurcates, so that upon the back of the foot there are perceived four tendons which separate from each other, directing themselves toward the four last toes, and crossing the direction of the extensor brevis digitorum; the inner is obviously stronger than the others, and the outer frequently receives a fibrous prolongation from the tendon of the peroneus brevis. Upon the upper surface of the phalanges, the first three are united with the inner edge of the tendons of the extensor brevis, and they are all strengthened by a prolongation of the tendons of the lumbricales and interossei. They then become broader, and form an aponeurosis which covers the whole upper surface of the toes, dividing and terminating precisely in the same manner as the tendons of the extensor communis digitorum manus (233.) The *anterior edge* of this muscle is covered by the tibial aponeurosis to which it adheres above, the annular ligament of the tarsus, and the skin. The *posterior* covers the fibula, the interosseous ligament, the tibia, the ankle-joint, the extensor brevis digitorum, and the toes. The *inner* corresponds to the tibialis anticus and extensor proprius pollicis, and is united above with the former. The *outer* is confounded above with the peroneus longus, at the middle with the peroneus brevis, and below with the peroneus tertius. It extends the three phalanges of the last four toes, and bends the foot on the leg, or the leg on the foot.

322. PERONEUS TERTIUS is not always present, and might at all times be regarded as an appendage of the extensor communis, situated at the anterior and infe-

rior part of the leg, elongated, thin and compressed. Arises from the lower third of the fore part of the fibula, the interosseous ligament, and an aponeurotic partition which separates it from the peroneus brevis; descends a little inwards, and degenerates into a tendon which lies at first upon its anterior surface, then becoming isolated, passes under the annular ligament of the tarsus, in the same groove with those of the extensor communis, turns outwards on the back of the foot, crosses the course of the extensor brevis digitorum pedis, becomes broader, and is inserted at the outer edge of the posterior extremity of the fifth metatarsal bone, and into the neighbouring part of its body, sending a prolongation to the outer tendon of the preceding muscle. Cut through and reflect the tendons of the extensor communis, and dissect the

323. Extensor Brevis Digitorum Pedis, thin and fleshy behind, terminated anteriorly by four tendons. Arises from the upper surface of the calcaneum, before the groove which lodges the tendon of the peroneus brevis, from the external ligament of the calcaneum and astragalus, and from the annular ligament of the tarsus, divides into four portions, the two inner of which are larger and shorter; each of these is terminated by a thin and flat tendon, which cross the direction of those of the extensor longus, passing under them, and crossing the metatarsal region obliquely. The first, near the articulation of the metatarsus with the phalanx of the great toe, becomes broader and is inserted at the upper part of the posterior extremity of its proximal phalanx. The other three pass over the upper surface of the proximal phalanges of the second, third, and fourth toes, and join the outer edge of the tendons of the extensor longus muscle to terminate along with them. In the dissection of these muscles, the following parts besides the muscles and their tendons may be observed. 1°. The anterior tibial artery and its accompanying veins. 2°. The anterior fibular artery. 3°. Certain branches of the peroneal nerve. The anterior tibial artery may be considered either as a branch of the popliteal artery, or as one of its terminating branches. It is first met with in this dissection at the upper part of the interosseal space,

having passed through the opening found at the top of the interosseal ligament. It is here placed between the tibialis anticus and extensor communis digitorum ; the nerve is separated from it by the fibula. Lower down the artery, still lying on the interosseal ligament, is found between the tibialis anticus and extensor proprius pollicis, and still lower down between the tendon of the proprius pollicis and of the extensor communis. It next passes under the anterior annular ligaments of the tarsus, lying successively on the tibia, the ankle joint, the astragalus, navicular, and cuneiform bones, proceeding towards the space between the first and second metatarsal bones, into which it sinks near the proximal end of the space, and ultimately communicates with the *external plantar* artery. In this course it gives off the following branches: 1°. The recurrent branch ; 2°. Several muscular branches ; 3°. The two malleolar branches ; 4°. The tarsal ; 5°. The metatarsal arteries. It then divides in the space between the metatarsal bones into two branches ; the smaller supplies the great toe, the larger becomes the ramus communicans, connecting it through the external plantar with the circulation in the posterior tibial artery. Veins accompany all these arteries and their branches. The *anterior peroneal* artery is a *branch* of the *common peroneal* or *fibular*. It may be a large artery or a small one ; it usually perforates the interosseal ligament from an inch to two inches above the external malleolus, anastomoses with the anterior tibial, or with some of its branches, and not unfrequently takes its place. The *nerves* met with at this stage of the dissection come from the fibular. This large nerve, after winding round the neck of the fibula, divides into several branches, of which the most remarkable are the anterior tibial and the musclo-cutaneous branches. To understand these nerves properly, the student, after having examined the muscles, should trace the nerves through the substance of the peroneus longus and extensor communis, and between these muscles and the fibula.

324. Aponeurosis of the Leg, *external* or *peroneal aspect*. The aponeurosis on the peroneal aspect of the limb is strong. The external annular ligament of the tarsus is met with in this dissection, and is a power-

ful *retinaculum*, binding down the tendons of the peroneal muscles. It extends from the malleolus externus to the calcaneum; it afterwards subdivides into separate sheaths, for each of the peroneal tendons. Internally it is completed by the external lateral ligaments of the joint.

325. PERONEUS LONGUS, placed at the outer part of the leg, and under the sole of the foot. Arises from the upper part of the tibial aponeurosis, the upper third of the outer surface of the fibula, a small part of the tibia, two aponeurotic partitions which are placed between it and the soleus and flexor longus pollicis, on the one hand, and the extensor communis digitorum on the other. It descends obliquely backwards, enlarging in the middle, and terminates by a tendon which commences very high upon its outer and anterior side, and only becomes free about two thirds down the leg. This tendon continues to run along the fibula, directing itself however a little backwards, and behind the external malleolus enters a groove, common to it with that of the peroneus brevis, in which it is kept down by a retinaculum or annular ligament: the synovial capsule which it contains is common to the two tendons, to the retinaculum itself, the surface of the external lateral ligament, and the groove of the fibula. Beneath the malleolus it quits the tendon of the peroneus brevis, and passes into a groove on the outer surface of the calcaneum, where it is again kept down by a particular fibrous sheath, but lined by the same synovial membrane, which forms a cul-de-sac towards the os cuboides. It then turns over the side of that bone, penetrates into the deep groove which it presents, and is there bound down by another ligamentous sheath, which also contains a distinct synovial membrane. It then directs itself inwards and forwards, and is inserted upon the lower and outer part of the posterior extremity of the first metatarsal bone. A sesamoid bone is often met with in its substance, to the outside of the os cuboides, and another is occasionally observed behind the malleolus externus, or along the calcaneum. This part of the tendon which crosses the sole of the foot obliquely cannot be seen until after the dissection of the muscles in the sole of the foot. In the leg, the *outer surface* of the peroneus longus is covered by the tibial aponeurosis;

the *inner* is applied upon the fibula, and the extensor digitorum communis and peroneus brevis; the *posterior* corresponds above to the soleus, and is united below to the flexor longus pollicis. It extends the foot on the leg, turning its point outwards, and raising its outer edge. It also acts upon the leg, which it extends upon the foot. Pull aside or cut through the peroneus longus, and clean

326. The Peroneus Brevis. Arises from the lower half of the outer surface of the fibula, and from two aponeurotic partitions, which separate it anteriorly from the peroneus tertius and the extensor communis digitorum, and posteriorly from the flexor proprius pollicis. It descends obliquely outwards, and, at the lower part of the leg, forms a tendon which had commenced very high upon its outer side. Behind the malleolus externus, the tendon enters a groove, common to it and the peroneus longus, and on emerging leaves the tendon of the peroneus longus, passes above it over the outer surface of the calcaneum, where it is separated from it by a fibrous partition, becomes broad, and is inserted at the upper part of the posterior extremity of the fifth metatarsal bone, frequently sending a prolongation to the extensor tendon of the little toe. Its *outer surface* is covered by the peroneus longus and tibial aponeurosis. The *inner* covers the fibula, and corresponds to the extensor digitorum communis and peroneus tertius, and at its lowest part to the flexor longus pollicis. The synovial membrane which envelopes its tendon and that of the preceding muscle behind the malleolus, is prolonged into the particular sheath which contains it alone opposite the calcaneum, so that it seems bifurcated at its lower part. It extends the leg and foot mutually upon each other, raising the outer edge of the latter a little.

327. Posterior Region of the Leg. Make an incision from the popliteal region down the centre of the back of the leg, (if not already done,) over the calcaneum, and continue this incision through the centre of the sole of the foot quite to the toes; reflect the integuments by making convenient flaps. Beneath the integuments over the malleolus externus, there is a subcutaneous bursa discovered by Beclard. Next examine the plantar aponeurosis, and particularly that part of the

general aponeurotic covering which lies between the malleoli and the calcaneum. The internal annular ligament may be described as composed of two layers; a first or general one, covering in and protecting the plantar arteries and nerves, the tendons of the flexor communis, tibialis posticus, and flexor proprius pollicis. Beneath this runs the termination of the posterior tibial artery, terminating in the plantar arteries, likewise the posterior tibial nerve terminating in the plantar nerves, and the veins corresponding to the arteries. But the tendons lie still deeper, bound down by a fibrous sheath or proper retinaculum, with which the fibrous covering of the vessels has nothing to do. Thus the sheath of the nerves and vessels may be laid open and yet none of the tendons exposed. The same may be said of the tendons. Generally speaking, the connexions of the aponeurosis and of the retinacula are to the calcaneum and to the malleolus internus. The order, then, in which these parts are situated, is as follows: 1°. About the middle space, and superficially, as compared with the situation of the tendons, run the arteries and nerves; 2°. close behind the malleolus internus, and bound down by their own retinaculum, are the tendons of the tibialis posticus, and flexor communis; whilst, 3°. still deeper in the hollow of the calcaneum, and also having its own retinaculum, will be found the tendon of the flexor proprius pollicis. All these fibrous sheaths have their synovial bursæ, and are quite independent of each other. The retinaculum of the peroneal tendons has been already examined whilst describing these muscles. Next dissect the

A. PLANTAR APONEUROSIS. This may be almost considered as composed of *three;* an internal, middle, and external, having a similar arrangement to what takes place in the hand; but the relation of those aponeuroses of the foot and hand to the muscles, arteries, and nerves which lie above them, is widely different; so that while the greatest caution is requisite in laying open the middle palmar aponeurosis, to allow of the escape of deep-seated purulent matter, and to relieve inflammations, little or none requires to be observed in respect to that of the foot. Having cleaned the plantar aponeurosis, proceed to their careful examination; first, undisturbed, or *in situ,* and afterwards by slitting them open longitudinally. The middle plantar aponeurosis is extremely strong, is fixed into the internal tuberosity of the calcaneum; at first contracted, it spreads out without becoming much thinner, and having arrived at the distal extremities of the metatarsal bones, it then divides into four bands, which again subdivide, embracing the flexor tendons of the four small toes, forming for them a sheath almost complete, and which is inserted into the upper and latteral edges of the anterior ligament of the metatarso-phalangeal joints, and becoming continuous with the fibrous sheaths of the toes. These four sheaths are separated by three arches, under which pass the lumbricales and interosseal muscles, likewise the plantar vessels and nerves. The edges of this aponeurosis curve upwards to inclose partly the flexor communis digitorum brevis, to be intimately united to the external and internal aponeuroses, and thus to form septa, or partitions, complete at some parts, incomplete at others. The transverse fibres are remarkable anteriorly; and the aponeurosis not only serves the purpose of one, but likewise acts as a powerful ligament. The flexor communis brevis at its origin, arises in common with it from the os calcis. The *external plantar* aponeurosis, is very strong posteriorly, weaker anteriorly; superiorly, it gives attachment to the abductor minimi digiti and bifurcates on a level with the proximate extremity of the fifth metatarsal bone. The internal plantar aponeurosis is thin compared with either of the others. It begins posteriorly by a kind of arch, extending from the malleolus externus to the calcaneum; it is also attached to the inner edge of the tarsus, is continuous with the dorsal aponeurosis; externally, it is intimately connected to the middle plantar aponeurosis, and by the partition formed between them, completes the sheath for the abductor pollicis muscle. The aponeuroses just described, thus form three sheaths for the muscles of the sole of the foot; the *external plantar sheath* incloses the abductor minimi digiti and flexor brevis; the middle plantar *sheath* incloses the flexor communis digiti brevis, the tendon of the flexor communis longus, the musculus accessorius, the lumbricales, the tendon of the flexor proprius pollicis longus, the adductor pollicis, and the transversus pedis, the external plantar vessels and nerves. There is, moreover, a thin aponeurotic layer separating superiorly the flexor communis from the accessorius and tendons of the long flexors. The adductor pollicis has a thin sheath of its own, so likewise has the transversus pedis. These are muscles which the student will afterwards meet with in the course of his dissection of the foot.

328. The GASTROCNEMIUS, (*Gemellus*), is composed of two fleshy masses, called the outer and inner heads, resembling each other in form, separated above, and united below by means of a common aponeurosis. Their direction is nearly vertical, and their form elliptical; they are convex behind, flat before. The inner is always larger, and descends lower than the outer. The latter arises from the back part of the outer condyle of the femur, by a pretty strong tendon which descends on the outer edge of the muscle over an extent of about two inches, and then becomes an aponeurosis which descends very low upon its posterior surface. The inner arises from the back and upper part of the inner condyle of the femur, by a broader and thicker tendon, which descends upon its inner edge, and becomes, in like manner, an aponeurosis. The fleshy fibres arise from these two tendons and their aponeuroses; they are rather short, pass obliquely downwards and forwards, and terminate successively on the posterior surface of a broad aponeurosis, which is at first divided so as to correspond to each bundle, and then becomes simple, and unites them with each other and with the soleus, but much sooner externally than internally. By their separation, the two heads contribute to the formation of the hollow of the ham. The inner is covered above by the semi-membranosus, and in the rest of its extent by the aponeurosis of the leg, which entirely covers the outer. Their *anterior surface* is applied above upon the condyles of the femur, and the synovial membrane of the knee-joint, which lines their tendons a little. The *outer* is in connexion at this place with the popliteus, and the *inner* with the semi-membranosus, from which it is separated by a small bursa, the popliteal artery, and the popliteus and plantaris muscles: In the rest of its extent, the anterior

surface of the gartrocnemius lies upon the soleus. Cut through the two heads of the gastrocnemius about an inch below their origin; this will expose

329. The SOLEUS, broad and thick in the middle, contracted at the extremities, and of an oval form. Three distinct aponeuroses give rise to its fleshy fibres, which are very numerous. The first, which is broad and thin, is attached to the upper extremity of the fibula, and to its outer edge; it descends very low upon the outer edge of the anterior surface of the muscle. The second is a kind of fibrous arch, whose convexity is directed downwards, under which, that is in front of which, the popliteal vessels pass; it unites the preceding aponeurosis to the third, which is attached to the posterior oblique line of the tibia, and the middle third of the inner edge of that bone, and is expanded over the inner and fore part of the muscle. From these origins, the fleshy fibres descend in a converging manner, and terminate successively at the fore part of a broad and thin aponeurosis which extends over their posterior surface, almost from their upper extremity, and sends into their interior a sort of fibrous partition or *raphe*, into which they are inserted, like the barbs of a feather into the shaft. Inferiorly, this aponeurosis unites with that of the gastrocnemius, and contributes to form the tendo Achillis. The *posterior surface* of the soleus is covered by the gastrocnemius and plantaris, and by the aponeurosis of the leg. Its *anterior surface* covers the peroneus longus, popliteus, flexor longus digitorum, flexor longus pollicis, and tibialis posticus muscles, a portion of the posterior surface of the fibula, and the popliteal, posterior tibial, and fibular vessels. The *tendo Achillis* results from the union of the inferior aponeuroses of the gastrocnemius and soleus which we have just described. Narrower and more rounded in the middle than at its extremities, broader at its upper than its lower part, formed of very distinct fibres, it descends vertically behind the lower part of the leg, where it forms a remarkable prominence. It slides over the upper half of the posterior surface of the calcaneum, by means of a cartilaginous surface and a synovial capsule, and is inserted into its lower half. It is covered *posteriorly* by the skin; *anteriorly*, it is sepa-

rated from the muscles of the posterior and deep region of the leg by the deep layer of the crural aponeurosis, and by a great quantity of adipose cellular tissue, and receives fleshy fibres from the soleus until near the calcaneum. The gastrocnemius and soleus extend the foot upon the leg, and the leg upon the foot. The gastrocnemius by itself can bend the leg and thigh on each other. The section of the gastrocnemius will also have exposed

330. The PLANTARIS (wanting in some subjects,) is extremely slender. Arises by a small tendon, behind the outer condyle of the femur, from the posterior ligament of the knee joint, and from the tendon of the outer head of the gastrocnemius. It forms behind the joint a small rounded and conical fleshy bundle, which descends obliquely inwards, and, after passing along a space of two or three inches, terminates in a thin and narrow tendon, which passes between the soleus and gastrocnemius, and about the lower fourth of the leg, adheres to the inner side of the tendo Achillis, which it accompanies to the calcaneum, where it is inserted by expanding. Raise up the blood-vessels cautiously from the back of the knee-joint having first examined the articular arteries, and proceed with the dissection of

331. The POPLITEUS, behind the knee-joint, short, flat, nearly triangular, arising by a thick and strong tendon, upwards of an inch in length, from the anterior part of a depression that is observed upon the tuberosity of the outer condyle of the femur, beneath the attachment of the external lateral ligament of the knee-joint. This tendon, which is embraced anteriorly by the synovial membrane of that articulation, adhering to the external semilunar cartilage, is converted into an aponeurosis which descends for some extent on the fore part of the muscle, and is afterwards concealed among its fleshy fibres. The latter, which are so much the longer and more oblique the lower they are, are directed downwards and inwards, and terminate on the posterior and superior triangular surface of the tibia, on the inner edge of that bone, and on a thin aponeurosis, detached from the tendon of the semi-membranosus which covers it posteriorly. The *posterior surface* of this muscle is covered by the gastrocnemius and plantaris muscles,

the popliteal vessels, and the posterior tibial nerve. The *anterior* is applied upon the articulation of the tibia and fibula, the tibialis posticus muscle, and the tibia. Its *outer edge*, which is longer than the inner, is connected above by a thin membrane with the upper part of the fibula and the soleus. This muscle is said to bend the thigh and the leg upon each other, and draws the point of the foot inwards, making the tibia turn upon its axis. Detach the soleus from its tibial and fibular origins; this will expose the following muscles:—*

332. Flexor Communis Longus Digitorum Pedis, extended at the back part of the leg and beneath the foot; long, flat broader in the middle than at its extremities, fleshy and simple above, and terminated by four tendons below. It arises from the posterior surface of the tibia, extending from its upper oblique line to its lower fourth, and from an aponeurotic partition which is common to it with the tibialis posticus and flexor longus pollicis. From thence its fleshy fibres descend, and are all inserted in succession, upon the sides of a tendon which, toward the lower part of the leg, becomes free. The tendon then passes behind the malleolus internus, in a groove common to it and that of the tibialis posticus, from which it is however separated by a fibrous septum, and behind which it is placed. These two tendons are kept down in this place by a retinaculum fixed to the groove of the tibia, the malleolus internus, the astragalus, and under the small tuberosity of the calcaneum; internally of this sheath, two distinct synovial capsules are met with, one for each tendon; the whole apparatus is continued under the arch of the calcaneum, where the tendon sinks to advance again obliquely from behind forwards and from within outwards, under the arch of the foot, crossing at first the direction of the flexor longus pollicis, under which it lies, and communicating with its tendon by a fibrous slip. There it

* Previous to commencing the dissection of the three following muscles, the student ought to clear the plantar aponeurosis, and even to dissect and examine three of the muscles placed immediately above it, viz. the abductor pollicis pedis, the flexor brevis communis, and the abductor minimi digiti. Having examined these, he may then return to the examination of the deep muscles of the leg.

broadens, and presents traces of four divisions; here also upon its outer edge it receives the fibres of the flexor accessorius, an account of whose anatomy will be found along with the other muscles in the sole of the foot. Farther on, it divides into four tendons, thin and slender compared with the size of the toes to which they belong, which separate from each other, give origin to the lumbricales muscles, issue from above the plantar aponeurosis opposite the articulations of the metatarsal bones and phalanges, enter beneath the toes into a fibrous sheath precisely similar to that of the fingers, (250), which also receives the tendons of the flexor brevis digitorum pedis, pass through the slits in these tendons opposite the middle of the first phalanges, and are attached to the posterior and inferior parts of the third phalanges of the last four toes. In the leg, the *posterior surface* of this muscle is covered by the soleus muscle, the tibial aponeurosis, and the posterior tibial artery. The *anterior* covers the tibia and the tibialis posticus muscle. Its *outer edge* is connected with that muscle, and with the flexor proprius pollicis. In the foot, it is in connexion, by the *inferior surface* of its tendons, with the adductor pollicis, flexor brevis digitorum, and abductor minimi digiti muscles, and with the plantar nerve; and by the *upper surface*, with the deep-seated muscles of the sole of the foot. Its uses are to bend the three phalanges on each other, and the toes on the metatarsus, and to extend the foot on the leg. It acts much in standing. Detach the muscle at a few points by which it adheres intimately to the next muscle, and proceed with its dissection.

333. TIBIALIS POSTICUS, elongated, flat, much thicker above than below, bifurcated at its upper part to allow a passage to the anterior tibial vessels. The outer and smaller branch of this bifurcation, arises from the inner and back part of the fibula; the other, which is larger, is attached to the oblique line of the tibia, to its posterior surface, and to the interosseous ligament. From thence the muscle descends at first nearly vertically and afterwards a little inwards, successively receiving fibres which come from an aponeurotic septum, placed between it and the flexor communis digitorum and flexor proprius pollicis; it increases

in size to its middle part, and diminishes farther down. It forms a tendon which commences high upon its inner and fore side, and which, after becoming free, passes into the groove formed behind the malleolus internus, where it increases much in breadth, to be inserted at the lower and inner part of the os scaphoides, and by a prolongation into the base of the internal cuneiform bone. The portion of this tendon which passes under the head of the astragalus contains a sesamoid bone. The *anterior surface* of this muscle covers the fibula, the tibia, a large extent of the interosseous ligament, and the inferior calcaneo-scaphoid ligament. The *posterior surface* is covered by the soleus, flexor longus digitorum, and flexor proprius pollicis muscles, and by the malleolar fibrous sheath. It extends the foot upon the leg, raising its inner edge. It also extends the leg upon the foot. This muscle may be left in its place, whilst the next is exposed.

334. Flexor Longus Pollicis, fleshy, thick and flattened above, slender and tendinous below, arises from the two lower thirds of the posterior surface of the fibula, from the interosseous ligament, and from two aponeurotic partitions which separate it from the two preceding muscles on the one hand, and on the other from the peroneus longus and peroneus brevis. It descends vertically behind the fibula, becoming larger as far as its middle, and then contracting again. Arrived at the lower part of the leg, it terminates by a tendon at first concealed among its fleshy fibres until opposite the ankle joint. There it becomes nearly horizontal, enters a groove formed behind the inferior extremity of the tibia and the posterior surface of the astragalus, where it is kept down by a ligamentous sheath lined by a synovial bursa, which accompanies it under the arch of the calcaneum in a particular depression; it is there placed to the outer side of the tendon of the flexor communis digitorum. This tendon, which was at first broad, becomes narrower as it leaves the fleshy fibres, passes over that of the flexor communis, communicates with it in a variety of ways, sometimes by a positive bifurcation, one division of which proceeds to the second toe, and sometimes by a mere tendinous expansion; next proceeds over the

inner edge of the foot, between the two portions of the flexor brevis pollicis, passes between the two sesamoid bones of the first articulation of the metatarsal bones and phalanges, opposite which it enlarges, to penetrate into the fibrous sheath of the great toe, in which it is enveloped by a synovial membrane. At the entrance of this sheath, it contracts, presents traces of a longitudinal division, and is expanded at its extremity, which is attached to the lower and posterior part of the distal phalanx of the great toe. In the leg, the *posterior surface* of this muscle is covered by the soleus and the tibial aponeurosis, and the fibular artery passes into its substance, in its course from above downwards. The *anterior* is applied upon the fibula, the tibialis posticus and flexor longus communis muscles, the interosseous ligament and the tibia. Its tendon is surrounded by synovial membranes behind the ankle joint and under the great toe, and by the flexor brevis pollicis under the sole of the foot.*

The following three muscles will have been already dissected and removed, but a re-examination may be useful at this stage of the dissection.

335. ADDUCTOR (*Abductor*) POLLICIS PEDIS, situated at the inner part of the sole of the foot. Arising from the posterior, internal, and inferior part of the calcaneum; from an aponeurotic partition which separates it from the flexor brevis digitorum; from the internal annular ligament of the tarsus, and from the posterior part of the plantar aponeurosis. The fleshy fibres proceed forwards and a little inwards, and are inserted upon the upper surface of a tendon which they conceal for some time, which afterwards appears beneath them. The fleshy fibres of the inner portion of the flexor brevis are intimately united to this tendon, so that they almost uniformly seem to constitute

* It may farther aid the student's recollection of these muscles, to have it pointed out to him that the muscle, whose tendon proceeds to the great toe, occupies the fibular or opposite side of the leg; and that the muscle, whose tendons proceed to the small and to the other toes, lies on the tibial side of the leg: thus the tendons of these muscles are respectively necessitated to cross each other in the foot, and thus also a good deal of the obliquity of their action is corrected.

but one muscle; it is more convenient, however, for the student to consider them as two. The common tendon is ultimately attached to the lower and inner part of the base of the first phalanx of the great toe, adhering strongly to the ligaments by which it is connected with the first metatarsal bone. Its *inferior surface* covers the plantar aponeurosis, to which it intimately adheres behind. The *upper surface* is covered by the accessorius and flexor brevis pollicis muscles, the tendons of the flexor longus digitorum, flexor longus pollicis, tibialis anticus, and tibialis posticus, and by the plantar vessels and nerves. It carries the great toe inwards, and bends it a little.

336. Flexor Brevis Digitorum Pedis Perforatus, arising from the posterior and inferior part of the calcaneum, between the adductor pollicis and abductor minimi digiti, from which it is separated by two aponeurotic partitions; from these, as well as from the plantar aponeurosis, some of its fibres also arise; it directs itself forwards, and at the middle of the sole of the foot, divides into four distinct bundles, the inner of which are the largest. These bundles successively cover each other from within outwards, and are each terminated by a tendon, which appears sooner above than below. These tendons advance beneath the heads of the metatarsal bones, pass between the slips of the plantar aponeurosis, are engaged along with those of the flexor longus in the fibrous sheath placed under the toes, split to allow them to pass, exactly in the same manner as those of the flexor sublimis of the fingers (249), and are inserted, by two slips, upon the sides of the second phalanx of each of the last four toes. Its *inferior surface* covers the plantar aponeurosis, with which it is intimately connected behind. The *upper surface* is covered by the lumbricales and accessory muscle of the flexor longus, by the plantar vessels and nerves, and by the tendons of the flexor longus. Its *inner edge* is connected posteriorly with the abductor pollicis, from which it is separated anteriorly by the tendon of the flexor longus, and by a portion of the flexor brevis of the great toe. The *outer edge* is united posteriorly with the abductor minimi digiti, and contiguous anteriorly to the flexor brevis

minimi digiti. It bends the second phalanges of the toes upon the first, and these upon the metatarsal bones. It also augments the concavity of the arch of the foot.

337. The ABDUCTOR MINIMI DIGITI PEDIS arises from the inferior surface of the calcaneum, on the outside of the flexor brevis digitorum, by short aponeurotic fibres; from a fibrous partition which separates it from the flexor brevis digitorum; from the plantar aponeurosis, and from the posterior extremity of the fifth metatarsal bone, by a tendon, which is continuous with that aponeurosis; from thence, it advances beneath the inferior surface of that bone, diminishing in size; its fibres then terminate successively upon a tendon which is inserted into the outside of the corresponding extremity of the proximal phalanx of the little toe. Its *inferior surface* covers the plantar aponeurosis, to which it is strongly united behind. The *upper* is covered by the accessorius muscle, the inferior calcaneo-cuboid ligament, the tendon of the peroneus longus, the posterior extremity of the fifth metatarsal bone, and the flexor brevis minimi digiti, which is seen anteriorly between its *inner edge* and the flexor brevis communis, which is united to it behind. It carries the little toe outwards, and bends it a little. Remove these muscles by cutting them through at their origins, and reflecting them from behind forwards; next clean the following muscle if not previously exposed.

338. MUSCULUS ACCESSORIUS, is of a quadrilateral form, flat and thin, arising by means of aponeurotic fibres, and by two distinct bundles, from the lower and inner surfaces of the calcaneum, whence it proceeds forwards and a little inwards, in a horizontal direction. Its fibres, which are all parallel, terminate on the outer and upper part of the tendon of the flexor longus digitorum pedis, near the point where it divides. They frequently present there an aponeurosis prolonged upon their inner edge, while that by which they are attached to the calcaneum is more distinct at their outer edge. Its *inferior surface* covers the abductor pollicis, flexor brevis digitorum, and abductor minimi digiti, as well as the plantar vessels and nerves. The *upper surface* is covered by the calcaneum, the inferior and superficial calcaneo-cuboid ligament, and by the extremity of the

abductor minimi digiti. This muscle serves as an auxiliary to the flexor longus, and rectifies its obliquity. It used formerly to be called the *Massa Carnea Jacobi Sylvii*, having been first described by Jaques de la Bois.

339. LUMBRICALES, are four small muscles extending from the tendons of the flexor longus to the last four toes. The first, which is the longest and largest, arises from the inner edge and upper surface of the flexor tendon of the second toe; the other three, which diminish successively in volume from within outwards, arise from the interval which the four tendons of the flexor longus leave between them at their separation. They all proceed horizontally forwards, diverging a little, and terminate each by a tendon, appearing at first on one of their surfaces, and afterwards becoming isolated, which passes between the slips of the plantar aponeurosis, runs along the inner edge of the last four metatarso-phalangeal articulations, and is at length inserted into the inner and lower part of the base of the first phalanx of each of the last toes, sending a thin aponeurosis to their extensor tendon, in the same manner as in the hand. Their *inferior surface* covers the plantar aponeurosis. The *upper* lies beneath the adductor pollicis, transversus pedis, and the interossei plantares. They carry the toes a little inwards, and contribute to bend the first phalanges, and extend the second and third. Having removed these muscles together with the long flexor tendons, the following muscles shew themselves.

340. TRANSVERSUS PEDIS, thin, long, and flat, and extends transversely beneath the heads of the last four metatarsal bones. It is about an inch in breadth, and arises, by distinct and fasciculated aponeurotic fibres, from the ligaments of the last four metatarso-phalangeal articulations; there result from this, four small parallel slips, more distinct behind than before, which unite together, and are attached, along with the adductor pollicis, to the outer edge of the base of the first phalanx of the great toe. Its *inferior surface* covers the tendons of the flexor longus and flexor brevis digitorum, the lumbricales, and the collateral nerves and vessels of the toes. The *upper surface* corresponds to the interossei.

This muscle carries the great toe outwards, and brings nearer to each other the heads of the metatarsal bones.

341. Flexor Brevis Pollicis Pedis, arises from the anterior and inferior part of the calcaneum, and from the last two cuneiform bones and their ligaments by a pretty thick tendon, at least an inch in length, which extends nearly over the whole of its upper surface. Several of its fibres also arise from the aponeurotic partition which separates it from the abductor pollicis. They are all short and oblique, and advance a little inwards, forming a bundle which increases in size, presents at its under surface a groove for lodging the tendon of the flexor longus pollicis, and divides into two portions, at first united by cellular tissue, and afterwards isolated; the inner unites with the tendon of the abductor pollicis, terminates along with it at the first phalanx of the great toe, and is moreover attached to the inner sesamoid bone of the articulation. The outer portion, which is thinner, and confounded with the adductor pollicis, is inserted along with it into the lower and outer part of the base of the first phalanx of the great toe, and the outer sesamoid bone. Its *inferior surface* rests upon the tendon of the flexor longus pollicis, the plantar aponeurosis, and the abductor pollicis, with which it is partly confounded. The *upper surface* has above it the tendon of the peroneus longus and the first metatarsal bone. Its *outer edge* is united anteriorly with the adductor pollicis. It bends the first phalanx of the great toe upon the first metatarsal bone.

342. Abductor (Adductor) Pollicis. Arises from the inferior surface of the os cuboides, the ligamentous sheath of the peroneus longus, and the posterior extremity of the third and fourth metatarsal bones, and from the ligaments by which they are connected; it proceeds forwards and inwards, to be attached to the outer and under part of the proximal phalanx of the great toe, and its outer sesamoid bone, by an aponeurosis which occupies its inferior surface. Its *inferior side* covers the flexor longus digitorum, the accessorius muscle, the lumbricales, and the plantar aponeurosis. The *inner side* corresponds to the flexor brevis pollicis, the tendon of the peroneus longus, and the outer edge of the first metatarsal bone. The *outer edge* is in con-

nexion with the interossei and external plantar artery. It carries the great toe outwards, and bends it a little.

343. Flexor Brevis Minimi Digiti. Arises from the under part of the posterior extremity of the fifth metatarsal bone, and from the ligamentous sheath of the tendon of the peroneus longus; and is inserted, by aponeurotic fibres appearing upon its under surface, into the lower and outer part of the base of the proximal phalanx of the little toe. Its *inferior surface* covers the plantar aponeurosis and the abductor minimi digiti; the *upper* is covered by the fifth metatarsal bone, and by the last plantar interosseous muscle. It bends the first phalanx of the little toe. Remove the transversus pedis and abductor pollicis; this exposes the

344. Interossei Pedis; similar in number, form, and disposition to those of the hand (262). Six belong to the three middle toes, and one to the little toe; the great toe has none. Four are situated on the back of the foot, and three on the sole. The *First Internal Plantar Interosseous Muscle* (*adductor digiti tertii*). Arises from the two lower thirds of the whole inner surface of the third metatarsal bone, and from the ligaments by which it is united inferiorly to the tarsus. Its fleshy fibres are inserted upon the outer surface, and a little upon the inner edge of a tendon which terminates, like those of the preceding muscles, at the inner side of the third toe. The *upper side* of this muscle is placed between the third metatarsal bone and the abductor of the second toe. The *lower side* is applied upon the transversus pedis and abductor pollicis. The *Second Internal Interosseous Muscle* (*adductor digiti quarti*). Arises from the lower part of the inner surface of the fourth metatarsal bone, and from the ligaments by which it is connected with the tarsus; its tendon is inserted upon the inner side of the fourth toe. The *Third Internal Interosseous Muscle* (*adductor quinti digiti*), arises a little from the fibrous sheath of the peroneus longus, and from the two inferior thirds of the inner surface of the fifth metatarsal bone, and terminates on the inner surface of the fifth toe, by a tendon which the fleshy fibres accompany as far as the articulation. The student will remark in regard to these interossei, that they lie rather in the hollow of the bones, than be-

tween them, and that they arise each from a single metatarsal bone.

345. The DORSAL INTEROSSEI arise each from two metatarsal bones. The *first dorsal interosseous muscle* (*adductor digiti secundi*), is the largest of the interossei of the foot; its form is that of a triangular prism. It arises from the whole extremity of the inner side of the second metatarsal bone, and from the outer side of the posterior extremity of the first. The latter portion is separated from the first by an interval in which the anterior tibial artery passes. Its fleshy fibres are attached to the two sides of a tendon concealed in their substance, and which they accompany to the extremity of the metatarsus; this tendon is partly inserted into the inner side of the base of the first phalanx of the second toe, and partly upon the corresponding extensor tendon. Its *upper surface* is covered by the skin. The *inferior* corresponds to the adductor pollicis; and its *sides* are applied upon the first two metatarsal bones. The *second dorsal interosseous muscle* (*abductor digiti secundi*), arises from the whole outer side of the second metatarsal bone, and from the upper part of the inner side of the third; it is terminated by a tendon, which has the same insertions on the outer side of the second toe, as the adductor on the inner. Its *upper surface* is covered by the skin, by a thin aponeurosis which goes from the second to the third metatarsal bone, and by the extensor tendons of the toes. The *lower surface* corresponds to the adductor pollicis. The *third dorsal interosseous muscle* (*abductor digiti tertii*), arises from the whole outer side of the third metatarsal bone, from the upper part of the inner side of the fourth, and from the ligaments by which they are united, and terminates by a tendon precisely similar to those of the other interossei. Its *upper surface* is covered by an aponeurosis which goes from the third to the fourth metatarsal bone. The *lower* covers the transversus pedis and the tendons of the flexor muscles. The *fourth dorsal interosseous muscle* (*abductor digiti quarti*), arises above from the inner edge of the fifth metatarsal bone, and from the whole outer surface of the fourth, and terminates on the outer side of the fourth toe.

346. The student may re-examine advantageously

the course of the principal arteries, veins, and nerves which occur in the posterior region of the leg, and in the sole of the foot. As they are, generally speaking, continuous, they had better be examined together. The popliteal artery having given off the anterior tibial, near the inferior margin of the popliteus muscle, divides into two branches, the *fibular* and *posterior tibial*. Of these the posterior tibial is usually the larger. The fibular proceeds outwards and downwards, along the posterior surface of the fibula, and is soon concealed by the flexor proprius pollicis. A short way above the malleolus externus, the artery divides into two branches, the anterior fibular and the posterior. The former has been already traced; the latter descends behind the malleolus externus to the heel. Deep veins accompany this artery: these join the popliteal. The posterior tibial artery follows the direction of the popliteal; it passes first in front of the soleus, and behind the tibialis posticus and flexor communis, to the hollow between the calcaneum and malleolus externus. It here subdivides into *internal* and *external plantar* arteries. Previous to this it has given off many muscular branches, but it is sometimes very small, or even wanting. The internal plantar artery, the smaller of the two, chiefly supplies the muscles and soft parts on the inner side of the foot. The external, on the contrary, is the important branch; it crosses from the inner to the outer side of the foot, above the first layer of plantar muscles, as an arch of arteries, from which arise the vessels supplying the toes. In its course it becomes comparatively superficial opposite to the proximal end of the fifth metatarsal bone, and lying in the line of the external partition; but it recrosses the foot very deep, and at last unites with the anterior tibial between the two heads of the first dorsal interosseal muscle. Deep veins accompany all these arteries. The nerves in this region are the posterior tibial and plantar; these follow pretty closely the general course of the arteries.

PART VII.

DISSECTION OF THE ABDOMEN.

347. Cavities of the Abdomen and Pelvis.—These form but one great cavity internally, as may be observed by an inspection of the skeleton, and they must always be dissected together, both in the male and female subject. We shall first describe the male abdomen, noticing afterwards, in a separate section, the peculiarities of the female and of the fœtus. The abdomen contains most of the principal viscera of the body, and is divided into several regions. Its walls, or containing parts, come to be considered first; and their dissection should be commenced on the back, where the student will find the long and other muscles of the back shutting in this cavity in the lumbar region, and filling the vacant space which he will observe in the skeleton between the spine, last ribs, and crest of the ilium. The description of these muscles and other soft parts he will find at 159; and the student had better turn to these at once, and dissect them accordingly. So soon as this preliminary step to the right understanding of the abdominal walls is done, let the subject be now laid on its back, with a block under the loins, so as to put the anterior and lateral parts of the walls of the abdomen on the stretch. Make an incision through the integuments only from the ensiform process of the sternum to the *symphysis pubis*, noting the umbilicus which lies in the course of this incision, and measuring its distance from the pubis and sternum,—a second incision from the summit of the crest of the ilium, across the abdomen, to meet the former vertical one at right angles,—and a third from a few inches above the umbilicus, outwards and upwards, towards the axilla, but keeping about a hand's-breadth below this region. Dissect off these flaps of skin merely, taking care to leave through-

out the whole extent of the dissection the subcutaneous cellular membrane, which here gets the name of

348. The SUPERFICIAL ABDOMINAL FASCIA.—To examine and understand this fascia properly, dissect the integuments downwards from off the upper surface of the thigh, for about two inches; but this can only be done with the permission of the student who may at the same time be examining the lower extremity of the corresponding side. The subject being male, prolong the incision through the integuments nearly to the extremity of the *penis*, and another downwards, quite to the bottom of the *scrotum;* (if a female subject, these incisions may be prolonged into the greater labium of the corresponding side). The *superficial fascia* is a layer of adipose cellular membrane, continuous every where with the investing cellular membrane of the body. It is connected to the integuments which lie above it by numerous vessels, nerves, and prolongations of its own substance; where covering the abdomen, it is called the superficial fascia of the abdomen, and as it extends over Poupart's ligament into the inguinal region of the thigh uninterruptedly, it there gets the name of the superficial fascia of the thigh. However loaded with fat where it lies on the abdominal walls, its adipose portion suddenly ceases at the root of the penis, but the condensed cellular layer which is continued over this organ is called the sheath of the penis; its descent into the scrotum is quite evident, and here likewise it lays aside its adipose tissue, and assuming a fibrous, and in some subjects even a muscular character, it here gets the name of *dartos.* (Some anatomists consider the dartos and superficial fascia as distinct, but this view renders the matter unnecessarily complex.) Imbedded in this fascia the student will observe the superficial epigastric artery, circumflex of the ileum, and their accompanying veins; these arteries proceed from below upwards, as they come from the common femoral artery, but their origins cannot be seen at present. To examine the texture and connexions of this important fascia, let the student next make an incision through it from the crest of the ilium, or anterior superior spine of that bone, towards the umbilicus, and a second from the umbilicus to the pubes, extending along the dorsum

of the penis. As he raises up the fascia from off the abdominal muscles, and then the tendons, he will observe it to be composed of several layers, easily separable with the knife, if necessary ; but the dissector had better not do this, as it will embarrass him in his future surgical views of these parts. The texture of the fascia is firm and almost elastic in some subjects, extremely dense, close, and thin ; in others of great thickness, being loaded with fat. Beneath the fascia, as he gradually removes it, he will find a layer of cellular substance connecting it with the subjacent parts, which may be left or removed along with the fascia ; but if he removes it along with the fascia, he must be very careful in noting the manner in which it connects the fascia with the subjacent parts. As he continues to take off the fascia, proceeding from above downwards, he will find that it forms at the root of the penis the suspensory ligament of that organ, which is here intimately connected to the linea alba ; it next covers the spermatic chord and inguinal ring. On its way down into the scrotum, and as it passes over Poupart's ligament to the thigh, the cellular substance which connects it to Poupart's ligament, has been improperly called Scarpa's fascia, a name adopted as the result of some pathological dissections made by that distinguished surgeon and anatomist. The superficial fascia may now be traced into the thigh. It here covers the fascia lata, both on its iliac and pubic portions, the inguinal lymphatic glands, some of which lie imbedded in it, and is intimately incorporated with the cribriform fascia, already described. Lastly, it extends into the perineum, where it constitutes the *superficial fascia* of that region, adhering pretty firmly to the rami and tuberosities of the ischium. The student may now pay attention to those superficial arteries to which we formerly alluded : the *ar. circum. ossis, illi externa, epigastrii ex.* and *pudica ex.*; these come from the femoral artery, and ascend over the crural arch, (also named Poupart's ligament—ligament of Fallopio), lying imbedded in the superficial fascia, and ramifying chiefly in the skin. The ex. circumflex proceeds in the direction of the spine of the ilium, the epigastric towards the umbilicus, and the pudic towards the organs of generation ; the accompanying veins are usually small, but have been known to become exceedingly varicose. The uses of the *superficial fascia* are to support the abdominal walls, besides forming an integral part of the great investing cellular membrane of the whole body.

349. External Oblique (*obliquus abdominis externus*).—In cleaning this muscle, which must be done by dissecting in the course of its fibres, the student had better remove along with the *superficial fascia*, the thin cellular layer which immediately invests the muscular and tendinous fibres; this is the *proper fascia* of the muscle, and is often confounded with the *superficial fascia*, giving rise to difficulties and disputes: it is quite distinct from it, and serves a totally different purpose, belonging in an especial manner to the muscle itself; and unless carefully removed, along with the superficial fascia, the muscle can scarcely be cleaned afterwards. Moreover, at the edges of the hypochondria, and close to the sternum, great care must be taken not to remove the tendon of the external oblique itself, which is here extremely thin. The *external oblique*, like the internal and transverse muscles, which lie below it, is formed of two great portions, a fleshy and a tendinous. On the Continent, it has been usual to describe the tendinous portions of these muscles as a great abdominal aponeurosis, quite distinct from the fleshy portion. This view, though correct and practical, has not been generally adopted in this country, and as it has no peculiar advantages over the other, we do not mean to insist on it here. The *external oblique* muscle of the abdomen arises by fleshy slips from the lower edge of the fifth and sixth ribs, where they seem to join the pectoralis major; from the outer surface of the seventh, eighth, and ninth ribs; and from the inferior edge of the tenth, eleventh, and twelfth, by digitations, covered by those of the latissimus dorsi, with which they are interlaced. The digitations connected with the seventh, eighth, and ninth ribs are interlaced with those of the serratus magnus; these fleshy digitations lie upon the outer surface of the ribs, their cartilages, and the intercostal muscles; they form together a curved line, the concavity of which is turned downwards and forwards, and the convexity upwards and

backwards. From these origins the fleshy fibres proceed in a direction generally downwards and forwards, to be inserted chiefly into an expanded tendon, constituting the external layer of the great abdominal aponeurosis of the French writers and surgeons; but, secondly, a great number of the fibres are inserted into the two anterior thirds of the outer lip of the crest of the ilium. The *use* of the muscle is to compress the abdomen, and by depressing and carrying the ribs backwards, it acts in strong inspiration, and likewise makes the thorax perform a rotatory motion, which turns it to the opposite side; it draws up the trunk when it has been bent backwards, or maintains it in its erect position; when the two muscles act together, they bend the thorax forward; when lying on the back, these muscles raise the pelvis and inferior extremity, and they also assist in the evacuation of the urine and fœces. This muscle covers portions of the ribs and their cartilages, and of the intercostal muscles, and the internal oblique muscle; its tendon covers many important parts, but it had better be examined separately.

350. Abdominal Aponeurosis. The broad tendon in which the external oblique muscle ends occupies, with its fellow of the opposite side, nearly all the anterior and lower part of the abdomen, from the sternum and over the hypochondria to the pubes, and from the anterior and superior spinous process of one ilium to that of the opposite side. It is broad inferiorly, narrow about the middle, in the situation of the umbilicus, and somewhat broader in the epigastric region as it ascends; it unites intimately with its fellow of the opposite side along the middle plain of the abdomen, and assists in forming, by uniting with the subjacent tendons, a strong tendinous chord, called the *linea alba;* in this line occurs the opening of the umbilicus, through which passed in the fœtus the umbilical arteries, the umbilical vein, and probably the urachus. It is in this line that surgeons puncture the abdomen in the dropsy, called ascites; the urinary bladder may be punctured, also in the linea alba, or even cut into, for the removal of stone from it. The tendon of the external obique muscle is fixed to the ensiform process of the

sternum, and along the linea alba, to the tendon of the opposite side, also to the crest of the ilium, to the spine of the pubes, and to the symphysis pubis, where its fibres decussate with those of the opposite side. The part of the tendon which extends from the anterior superior spinous process of the ilium to the spine of the pubes, is called the crural arch, Poupart's ligament, &c. The portion attached to the spine of the pubes is called the external pillar of the outer abdominal ring, the portion attached to the symphysis pubis is called the inner or upper pillar of the ring; the triangular shaped space between these pillars is called the external abdominal ring, although it be not at all circular. To expose the aperture, the student must cut through a thin layer of a fascia, at times cellular, but approaching at other times the fibrous character, extending from the edges of the pillar, and from the surface of the abdominal aponeurosis, a short distance upwards and downwards over the spermatic chord towards the scrotum, this is called the *inter-columnar facia;* and on being divided, the finger or a director may readily be introduced into the aperture, leading upwards and outwards beneath the tendon of the external oblique muscle. The space into which the finger will thus be introduced is termed the inguinal canal, and the aperture itself is the *external abdominal ring*. It is of a triangular form, the base being at the pubis, the apex upwards and outwards; the lateral margins are the pillars or columns already described. The chord passing through the aperture is the spermatic chord; the muscular fibre accompanying it is the cremaster muscle: the aperture is much larger generally in the male than in the female, in whom there passes only by this aperture the round ligament of the uterus. All those parts will be examined more carefully at a future stage of the dissection, Let the student next turn his attention to *Poupart's ligament*. This ligament, most frequently called the *crural arch*, is now usually considered merely as the inferior margin of the broad tendon of the external oblique muscle. It is strong and tense, when the limb is stretched and the toes turned out; but it may be greatly relaxed by bending the thigh and rotating the limb, at the same time turning the toes inwards. The effect of this is to relax the aperture or abdominal ring, and to facilitate the reduction of hernia. Viewed as a part distinct from the tendon of the external oblique, although it be not so, it is usually described as extending from the anterior superior spinous process of the ileum to the spine of the pubis; its insertion into this part is called the outer pillar of the ring: it has, however, a deeper insertion, which cannot be readily examined at this stage of the dissection, being best seen after the cavity of the abdomen has been laid open; it should therefore be examined upon a preparation. This insertion is usually called the ligament of Gimbernat, although it is doubtful if it be precisely the part to which Gimbernat alluded in his coarse description of these parts. It is broad, triangular, and presents a crescent-shaped form looking towards the femoral vein or outwards: its base is attached to the commencement of the linea ilea pectinea, which in this place is not unfrequently raised into a prominent crest: the anatomy of Gimbernat's ligament is peculiarly concerned in the anatomy of the crural hernia, as it forms the inner margin of the superior aperture of the crural canal, by which femoral hernia descends into the upper part of the thigh, and is the part, which, together with the neck of the sac, requires to be cut in the operation for strangulated crural hernia. This insertion of the crural arch has, moreover, been supposed by Dr. Monro to be broader in the male than in the female; this opinion however is erroneous. The direction and connections of Poupart's ligament merit particular attention. Commencing with the anterior superior spinous process, it at first descends inwards and downwards towards the middle of the thigh, and is throughout this, its outer half nearly, intimately connected to the fascia lata. It is this intimate union with the fascia lata, which renders it tense when the limb is extended and the toes everted. From this point Poupart's ligament changes its direction somewhat, and proceeds upwards and inwards, to be fixed into the spine of the pubes. This inner half is more of a rounded form, and forms a sort of canal internally, in which is partially lodged the spermatic cord and cremaster muscle.

The connections of this inner half of the crural arch are more particularly with the fascia transversalis and fascia lata (which the student has not yet examined at this stage of the dissection), and but little with the fascia lata, excepting close to the spine of the pubis. The crural arch is thus stretched over a great number of important parts: these are, the iliacus muscle, the anterior crural nerve, the psoas magnus muscle, the common femoral artery and vein, the top of the pectineus muscle, and the crural hernia, when present. When the epigastric and circumflex artery of the ileum arise rather lower than usual, the crural arch is also stretched over these. In the great tendon of the external oblique muscle thus described, there are many small apertures for the passage of blood-vessels. The fibres composing its intimate structure run in two directions, and in two layers; the more numerous from above downwards, in the direction of the muscular fibres; the others transversely, and in a sweeping semi-circular direction: these are chiefly found inferiorly, towards the apex of the external abdominal ring, and are often continuous with the intercolumnar fascia already described. But this fascia is not derived solely from these fibres.

351. Internal Oblique, (*Obliquus Internus* or *Ascendens.*) To expose this muscle, remove the external oblique by an incision carried through its costal origins, leaving about half an inch of each attached to the ribs; next detach the part of the muscle fixed to the crest of the ilium, and carry an incision across its tendon, as far as possible towards the linea alba, beginning at the anterior and superior spinous process of the ilium. Reflect the lower part of the tendon towards the thigh, and by this means expose the inguinal canal, cremaster muscle, and spermatic cord; and remove the remaining portion from the ribs, the intercostal muscles, and the internal oblique, taking care as much as possible to clean the fibres of the internal oblique, whilst the external is being removed. Poupart's ligament must be left untouched for a time. The obliquus internus is broad, thin, and irregularly quadrilateral, attached to the upper and posterior part of the crural arch to near the inguinal ring, to the

three anterior fourths of the interstice of the iliac crest, between the obliquus externus and transversus muscles, and to a thin and broad fascia, which some think to be the lumbar fascia, and others reckon a distinct aponeurosis, with fibres running obliquely outwards and upwards, situated behind the inferior bundle of the sacro-lumbalis muscle, and before the aponeurosis of the latissimus dorsi, from which it cannot easily be separated, continuous also above with that of the serratus posticus inferior, and attached to the last spinous processes of the loins, to the sacrum, and to the most remote part of the iliac crest. The fleshy fibres which succeed this aponeurosis are not numerous; they ascend almost vertically, and terminate by short aponeuroses, at the lower edge of the cartilage of the last rib. Those which have their origin from the crest of of the ileum, pass obliquely upwards and forwards, and their obliquity, as well as length, increases the more anteriorly they are examined, so that when close to the superior and anterior spinous process of the ileum, they are almost horizontal. The posterior fibres terminate by short aponeuroses, at the lower edge of the cartilages of the eleventh, tenth, and ninth ribs, where they are united with the intercostal muscles in their interval; and the others are distributed along a tendon, called by the French writers the middle layer of the abdominal aponeurosis. Lastly, the fleshy fibres which rise from the crural arch, descend inwards, and also terminate in the same tendon. About eight lines from the summit of the inguinal ring, the spermatic cord passes under them, and is accompanied through the ring by some of their fibres, under the name of *cremaster muscle*. This disposition is observed only in the male. The internal oblique is covered in its *outer surface* by the external oblique, and posteriorly by the latissimus dorsi. Its *inner surface* is applied chiefly upon the transversus abdominis. In the female generally, the internal oblique presents a distinct free margin posteriorly; in the male this margin is generally very short, hence has arisen the idea that the internal oblique, like the transversalis, runs to the spinal column, and has no free margin posteriorly: this notion is however an incorrect one. The broad tendon in which most of the fibres of this muscle terminate may now be traced. Near its commencement, it forms the *linea semilunaris,* which may be readily enough traced in some persons, just outside the edge of the rectus muscle. Here the tendon divides into *two laminæ*, to enclose the rectus, and to form its sheath.

352. SHEATH OF THE RECTI MUSCLES. To understand this mechanism properly, lay open the sheath of the rectus by an incision carried down its centre, over the surface of the rectus, from about the fifth or sixth rib nearly to the symphysis of the pubis, and reflect the fibrous sheath outwards and inwards, cleaning the rectus and pyramidalis, exposing at the same the lineæ transversæ. It will now be distinctly observed that the tendon of the obliquus internus divides at the linea semilunaris into two layers, an external and an internal, the external passing in front of the rectus to the linea alba, inseparably united with the tendon of the external oblique; the internal passing behind the rectus, but also to the linea alba, and inseparably united to the tendon of the transversalis abdominis. Inferiorly, these tendons run to the symphysis pubis, and are here called the conjoined tendons. They thus assist in forming a portion of the posterior wall of the inguinal canal, and it is here that they are not unfrequently strengthened by a small triangular fascia, called by some *triangular ligament*, which however is by no means a constant structure. Some consider the triangular ligament as being more particularly connected with the ligament of Gimbernat, and Poupart's ligament: I have not observed it to be so. Much individual variety prevails at this particular part of the conjoined tendons, and hence the multiplied descriptions of anatomists and surgeons; in some persons this portion of the conjoined tendons is strong, in others very weak, with partial deficiencies in it: these persons are much subject to direct hernia. The spermatic cord somewhat overlaps the conjoined tendons, just as it is about to pass through the external abdominal ring, and this, which is a plain enough fact, but not a practical one, has tended greatly to embarrass the student; the part of the conjoined tendons we have just alluded

to is situated immediately behind the external abdominal ring. The anterior lamina of the sheath is composed of two laminæ above, and three below. The posterior, which is entirely wanting below, has only two. This will be understood so soon as the muscle has been examined.

353. The RECTUS ABDOMINIS, long, flat, and broader above than below, extended vertically, like a fleshy band, on each side of the linea alba, from the pubes to the base of the thorax, and contained in the fibrous sheath, formed in the manner just described. The rectus muscle arises by two tendons which are attached to the symphysis of the pubes, and rarely to the bone itself. One of these, the internal, is slender, and interlaced with that of the opposite side in the median line; the other, which is external, broader and stronger, comes from the outer part of the upper edge of the symphysis. Both ascend converging, and soon unite to give rise to the fleshy fibres. These ascend vertically towards the thorax, but are interrupted from space to space, in their passage, by aponeurotic intersections, (*lineæ transversæ,*) varying from three to five. Their anterior part is more distinct than the posterior, and adheres intimately to the lamina of the abdominal aponeurosis which forms the anterior wall of the sheath; the muscular fibres which arise from an inferior intersection, do not all terminate in that which is placed immediately above, but that a great number of them pass behind it without being interrupted, and on to a more remote intersection. The rectus abdominis divides at the base of the thorax into three portions, the *inner* of which is attached to the costo-xiphoid ligament, and to the lower and fore part of the cartilage of the seventh rib, near the sternum; the *middle* is attached to the lower edge and anterior surface of the cartilage of the sixth rib, near its middle; and the *outer* terminates at the lower edge of the cartilage of the fifth, by distinct aponeurotic fibres. The *anterior surface* of this muscle is covered above by the aponeurosis of the pectoralis major, and in the rest of its extent, by the anterior lamina of the abdominal aponeurosis, which we have just shewn to be double above and triple below, excepting

at its lowest part, where the pyramidalis muscle is commonly met with. The *posterior surface* covers the cartilages of the last three sternal ribs, part of those of the first two a-sternal, the ensiform cartilage, the posterior lamina of the abdominal aponeurosis, the internal mammary and epigastric arteries, and inferiorly, the peritoneum, and according to some, the fascia transversalis. The rectus muscle bends the thorax upon the pelvis, or the pelvis upon the thorax. It compresses the abdomen from before backwards.

354. PYRAMIDALIS, elongated, rounded, triangular bundle, placed in the median line of the body, at the lower and fore part of the rectus, arising from the symphysis of the pubes, and from a little of the neighbouring part of the bone, by short aponeurotic fibres, which ascend converging toward each other, being only separated by the linea alba, in which they terminate by a slender and elongated tendon. The inner fibres are vertical, and shorter than the outer, which are oblique. Divide the rectus and verify the fact (349) that its fibrous sheath is deficient behind and below for about a hand-breadth above the pubes; the posterior layer however of the tendon of the internal oblique and the transversalis tendon, which together form the posterior part of the sheath of the rectus, do not generally stop together; the layer of the internal oblique becomes generally deficient first, and the tendon of the transversalis usually proceeds a good way farther down. Within the sheath may also be observed the epigastric vessels.

355. CREMASTER MUSCLE. The history of the *Cremaster* properly belongs to the description of the scrotum; as we require to return to it in that section of the work, we shall describe it very briefly here. The *Cremaster* was first correctly described by Mr. Jules Cloquet. It is thin and in a great measure a continuation of the fibres of the obliquus abdominis internus, which are attached to the anterior and superior iliac spine. However it also receives some fibres from the transversus muscle, and is in part attached to the inner surface of Poupart's ligament near the inguinal ring, and to the neighbouring region of the pubes. Arising from these different points, its fasciculi collect towards the ring,

form a small mass at the outer side of the sheath of the spermatic cord and pass outwards. They then separate and expand upon the cord; some fibres disappear entirely in the scrotum, but the greater number return in concentric circles to the pubis and to the other origins of the muscles as was first distinctly shewn by Mr. Jules Cloquet. This muscle supports the testicle, and impresses upon it slight motions from beneath upwards during the act of copulation. Detach the internal oblique cautiously, and at all points from the transversalis muscle which it covers, and proceed to clear this muscle.*

356. TRANSVERSE MUSCLE OF THE ABDOMEN arises superiorly from the inner surface of the cartilages of the sixth, seventh, eighth, ninth, and tenth ribs, by digitations which are interlaced with those of the diaphragm; the greater part of the lower edge of the eleventh and twelfth, by very distinct tendinous fibres; *inferiorly*, from the three anterior fourths of the inner lip of the crest of the ileum to the inside of the obliquus internus, and from the two outer thirds of the crural arch, by short aponeurotic fibres; mesially, its fleshy fibres arise from an aponeurosis which proceeds backwards, dividing into three laminæ; the *anterior* passes before the quadratus lumborum to be attached to the base of the transverse processes of the lumbar vertebræ; the *middle* lamina glides behind this muscle, before the common origin of the sacro-lumbalis and longissimus dorsi, to terminate at the summit of the same processes; the *third* is united with the aponeurosis of the obliquus internus, and inserted into the summits of the spinous processes of the loins. From these different points of attachment, the fleshy fibres proceed horizontally forwards and inwards, form a broad tendon which proceeds to the linea alba, forming a portion of the sheath of the recti in the manner already described. In use the transversalis is similar to the oblique muscles, but probably acts more

* Inferiorly, the internal oblique and transversalis seem inseparably mingled together; should this be the case, it is safer to leave a small portion of the internal oblique than to risk detaching the transversalis.

powerfully. The transversalis muscle covers the *fascia transversalis ;* beneath its inferior margin there passes the spermatic cord. The muscle must now be very cautiously dissected off, and this will expose the

357. FASCIA TRANSVERSALIS. This important fascia is placed on the peritoneum ; it extends upwards to the diaphragm, inwards to the linea alba behind the recti, and is more firmly attached to the crest of the ileum and to the greater part of Poupart's ligament ; it thus contributes mainly to form the posterior wall of the inguinal canal. It will be afterwards shewn when the abdomen has been opened, that the fascia transversalis is continued across the iliacus and psoas muscles, and thus becomes the *facia iliaca.* Moreover although it seems to terminate inferiorly by being inserted into Poupart's ligament, this termination is more apparent than real. The *advanced student* may satisfy himself of this fact by cutting away Poupart's ligament entirely, when he will find the fascia transversalis still running down behind it to take a firm hold of the fascia lata ; the fact is curious anatomically, but we do not think that it leads to any important practical conclusion. The use of the fascia transversalis must be to strengthen the lower parts of the abdomen. About midway between the anterior superior spine of the ileum and symphysis pubis, is an opening of a square shape, the *internal or deep abdominal ring*, through which passes the spermatic cord in the male and the round ligament of the uterus in the female. The edges of this opening are shut in by a layer of cellular substance which follows the cord, and which must be cut through before the deep ring can be properly understood or the spermatic cord traced through it. This layer of cellular substance is called the *infundibuliform fascia* and forms the *fascia propria* of oblique inguinal hernia when that disease is present. It is derived from two sources ; 1st, From the edges of the deep ring ; 2d, From the outside of the peritoneum, which membrane may be seen so soon as the infundibuliform fascia has been opened. Let the student now examine this opening in the fascia transversalis ; it presents three margins, an external, an internal, and a superior margin ; it is the *superior* only which can be

cut with safety in cases of strangulated inguinal hernia; for upon the inner margin or pillar he will observe the epigastric artery and vein or veins which forbid incisions in this direction. The outer margin might be also safely cut if the diagnosis was certain, but this can seldom or never be the case.

358. INGUINAL CANAL AND ITS CONTENTS. Its course is from above downwards and from within outwards; its limits are the internal and external abdominal rings; its boundaries are, anteriorly, the tendon of the external oblique; inferiorly, Poupart's ligament, and its junction with the fascia transversalis; posteriorly, the fascia transversalis and a small part of the conjoined tendons of the internal oblique and transversalis muscles; superiorly, the inferior margins of these same muscles, shut it in by their cellular attachment to the inner surface of the tendon of the external oblique. The obliquity of the canal and the want of coincidence between the abdominal rings contribute no doubt to render hernia less frequent than it would otherwise be. These rings being larger in man than in woman renders the inguinal hernia most frequent in him, whilst the contrary has been observed in respect to crural hernia. Of the normal contents of the inguinal canal, it will be sufficient at present merely to say that they consist, 1°. Of the genital branch of the genito-crural nerve, 2°. A small branch of the epigastric, 3°. The cremaster muscle, 4°. The spermatic cord properly so called; this will be more particularly examined afterwards. Of the *anormal* contents of the canal, the direct and indirect inguinal hernia chiefly interest the student, because nearly the whole considerations here bear on these surgical diseases. The *oblique* or *indirect* inguinal hernia is when the bowels, (whatever they may be,) pass through the deep abdominal ring, (spermatic opening in the fascia transversalis) pushing the peritoneum before them so as to form a sac or covering. They generally do not remain in this opening, but make their way downwards and inwards along the inguinal canal, to pass out not unfrequently by the external abdominal ring (spermatic opening in the tendon of the external oblique) and following the course of the cord may ulti-

mately pass quite down into the scrotum. At other times, the hernia which in this case is called a *direct* or *internal* inguinal hernia, protrudes through the conjoined tendons immediately behind the internal abdominal ring, thus placing the epigastric artery upon its iliac side, whereas in the indirect inguinal hernia that artery lay upon its pubic side. The danger of confounding these cases is sometimes very great, and hence has arisen the practice of directing the deep incision required to be made in operating for strangulated hernia, always upwards. The student ought here to be informed, in order to render the following remarks intelligible to him, that the object the surgeon has in view in cases of hernia, is to replace the bowels within the cavity of the abdomen which may be done by the taxis, that is mere manipulation without cutting; but if that fails, he must have recourse to the operation for strangulated hernia; that is he must generally cut into the hernial sac, and finding out the part by which its tightness prevents the return of the bowels, divide it, and thus be enabled to replace them within the cavity of the abdomen. The following remarks may serve to connect the anatomical facts with the pathology of the canal. In *Oblique Inguinal Hernia,* the hernial sac with its contents, pass first through the deep ring, next into the inguinal canal, and lastly, not unfrequently, through the external abdominal ring downwards into the scrotum. The *coverings* of this form of hernia will then be somewhat different according to the extent to which it may have passed outwards. It is always to be remembered that the cremaster muscle is external to the sac, and the epigastric artery lies upon the pubic side of the hernia as it leaves the abdomen by the deep abdominal ring. In the inguinal canal, the spermatic vessels are behind the sac and its contents; the inferior margins of the internal oblique and transversalis are superiorly close over the neck of the sac. When the *sac* of the hernia has passed the ring of the tendon of the external oblique, it is usually covered by the following parts; 1st, The integuments; 2d, The superficial fascia; 3d, The inter-columnar fascia; 4th, The cremaster; 5th, The fascia propria. The course of the epigastric artery and its vein or veins will be described in its proper place; the only part of the artery which can interest the student here, is where it lies on the inner pillar of the deep ring. On the other hand, the *direct* or ventro-inguinal hernia, called also by some *internal*, protrudes through the walls of the abdomen to the pubic side of the epigastric artery, through the conjoined tendons, and almost directly behind the external abdominal ring, so that it occupies but very little, if any, of the inguinal canal. It has been found difficult in practice to discriminate this kind of hernia from the indirect; the epigastric artery is placed on the iliac side of the neck of the sac; the cremaster does not usually cover it, and I have not observed any tendinous expansion of the conjoined tendons covering the sac, but it is not improbable that this may occasionally be the case. To avoid confusion, it has been judged preferable to delay the consideration of the *crural* hernia until the pelvis be examined.

359. CAVITY of the ABDOMEN. Carry an incision through the walls of this great cavity, commencing at the ensiform process of the sternum to about the umbilicus, and one on each side from this point to the anterior and superior spine of the ileum; reflect the flaps, and display the organs of digestion, which occupy the greater part of the cavity thus laid open. To facilitate description, anatomical writers for many hundred years have divided the cavity of the abdomen into regions, by ideal lines drawn across it, in the following directions. Two lines are drawn transversely between the extremities of the cartilages of the ninth ribs, and anterior spinous processes of the ileum; these divide the whole surface into three great regions, viz. the epigastric, umbilical, and the hypogastric. Let two vertical lines be now drawn from the cartilages of these ribs to the anterior spines of the ileum; this subdivides each into three regions; viz. superiorly the right and left hypochondria and the proper epigastrium; in the middle the umbilical, and laterally the lumbar regions; inferiorly in the middle the hypogastrium proper, and laterally the iliac regions. Many of these regions may be still farther subdivided, and this has been done to a very

great, and perhaps altogether unnecessary extent, by systematic writers on surgical anatomy. Previous to proceeding further with the inspection of the contents of the abdomen, replace the lower flap again in its natural position, and distending the urinary bladder, by blowing air into it through the urethra, dissect the remaining portions of muscles from off the outer surface of the two lower flaps; this will expose the external surface of a portion of the peritoneum (its fixed or cellular surface,) and upon it three cords, viz. two lateral and one mesial. The lateral cords are the remains of the obliterated umbilical arteries, the mesial one is the obliterated urachus; all these structures have a reference to the original fœtal condition of the individual. If the flap be now laid down again, it will be seen that, in some subjects particularly the cords just described, project inwards, although placed on the external surface of the peritoneum, and by their projections, and the weakness of the abdominal walls, they cause the formation in many subjects of pouches, which are of course two on each side. Of these pouches, one will be found to correspond to that weak point in the abdominal walls, (the internal or deep abdominal ring), and the other will correspond to the superior aperture of the crural canal, situated just below Poupart's ligament, and to the outside of Gimbernat's ligament. These pouches, by their extent, not unfrequently resemble hernial sacs. A third pouch may sometimes be observed corresponding to the situation of the direct or ventro-inguinal hernia.

360. When a penetrating opening, whether large or small, is made through the walls of the abdomen, and the finger or hand passed in between the walls and the viscera, it passes not only into the cavity of the abdomen, but into that of the peritoneum. It is in this space, which the student now sees fully laid open, that fluids collect in dropsies (ascites), &c. The peritoneum, a smooth shining serous membrane of great extent, not only invests the walls of the abdomen, but covers more or less most of the viscera which are now seen shining through it. With the hand the student may now examine the boundaries of the abdominal cavity, bound an-

teriorly and laterally by the abdominal muscles just described; superiorly by the diaphragm, inferiorly continuous with the pelvis; posteriorly large muscles, together with the spine, shut it in; these will be seen after the viscera have been removed. The viscera which are seen *in situ*, are portions of the liver, and its suspensory ligament, stomach, large omentum, small omentum, large intestines, small intestines, bladder if distended; the abdomen contains many more parts, but these cannot be seen at present.

361. PERITONEUM. Although some prefer examining the viscera first, this would require the student to have the command of another abdomen, which might not be convenient at the time. The peritoneum is a shut sac in the male, but two openings open into it in the female. It is thin and translucid, has a very complicated course, invests the inner surface of the walls of the abdomen, forms several more or less marked folds in that cavity, and is prolonged, under the form of an envelope, over most of the viscera which are contained in the abdomen, and which belong to the organs of digestion, of secretion, and generation. It is not unusual to call that part of the peritoneum lining the walls of the abdomen, its *parietal* portion, and that investing the viscera its *visceral* portion, but the distinction is not very practical, and of but little importance. In the male, the peritoneum represents, like all serous membranes, a sac, without aperture, whose internal surface, is to appearance smooth, but in reality covered with very fine villosities, moistened with serous fluid, and every where in contact with itself. In the female it is perforated with an aperture opposite the fimbriated extremity of each Fallopian tube, with the mucous membrane of which it seems to be continuous. Next trace with the hand the peritoneum as it invests the umbilical portion of the abdominal cavity and its viscera. It lines the posterior part of the linea alba, closes the posterior orifice of the umbilicus, and adheres around that aperture, to the abdominal aponeurosis. From thence, the peritoneum directs itself horizontally, to the right and left, behind the broad muscles of the abdomen; in the first direction, it meets the ascending colon: in the

other, the descending colon; and forms around these intestines two folds, named the *Lumbar Mesocola*, which serve to attach them to the posterior wall of the abdomen. At the same time, it passes before the kidneys, from which it is separated by a thick layer of cellular tissue; then, covering the ureters, the spermatic and renal vessels, the vena cava and the aorta, it advances on each side towards the vertebral column, before which it is reflected from behind forwards, lying upon itself, in order to form the *Mesentery*. The mesentery is thus a process of peritoneum supporting the small intestines, extending at its base from about opposite to the second lumbar vertebra obliquely downwards to the right iliac fossa. In the hypogastric region the peritoneum, tracing it *mesially*, descends from the umbilicus towards the pubes, and covers the urachus and the two umbilical arteries which raise it a little, so as to make it form three folds projecting backwards, confounded at the umbilical ring, and separated inferiorly. It is then aplied against the posterior surface of the recti muscles, and arrives at the upper edge of the ossa pubis, whence it is directed over the summit and posterior region of the bladder. There, it presents differences, according as it is examined, in the male or in the female. In the former, it invests the base of the vesiculæ seminales, and is reflected over the rectum, forming two similunar folds, separated by a cul-de-sac, and called the *Posterior Ligaments of the Bladder*. Opposite these folds and their separation, the peritoneum is applied superiorly upon the anterior surface of the rectum; but above, it also covers its lateral surfaces, and constitutes behind it the *Mesorectum*, of which the upper extremity is continuous with the *Iliac Mesocolon*. In the female, the peritoneum passes from the bladder over the vagina, before which it forms two semilunar folds and an intermediate cul-de-sac, similar to those which in the male, occur between the rectum and bladder, but less distinct. It then invests the anterior surface, the upper edge and posterior surface of the uterus, and a portion of the corresponding wall of the vagina, prolonging itself to the right and left to form the *Broad Ligaments*. From thence, it gains the rectum, and presents the same disposition as in the male. The peritoneum then ascends before the sacro-vertebral articulation, and unites with the lamina which forms the mesentery. *Laterally* the peritoneum is at first seen reflecting itself from the walls of the abdomen over each iliac fossa, covering part of the iliacus and psoæ muscles, embracing to the left the sigmoid flexure of the colon by means of the *Iliac Mesocolon*, and to the right the cœcum and its appendages by means of the *Mesocæcum*. A process of peritoneum which is apt to vary in its length, and thus gives to the cæcum very different positions in different subjects. From thence it ascends forwards behind Poupart's ligament, and forms two depressions on each side, called the *Inguinal Fossæ*, which are distinguished into *internal* and *external*. These fossæ are separated from each other by the fold of the membrane which the umbilical artery supports. At the bottom of its summit, which is directed downwards and inwards, the peritoneum is seen to dive a little into the internal orifice of the inguinal canal. Posteriorly the peritoneum, which has invested the iliac fossæ, ascends to be continued into the lumbar mesocola. The *Epigastric Portion of the Peritoneum* is of great extent, and very complex. 1°. *To the left* it invests a portion of the diaphragm, and sinks into the most retired region of the hypochondrium as far as the vertebral column, whence it is successively reflected over the posterior surface of the splenic vessels, the posterior half of the inner surface of the spleen, its outer surface, its whole circumference, and the anterior half of its inner surface. There it meets the splenic vessels a second time near the fissure of the spleen, passes over the anterior part, gains the cardiac extremity of the stomach, and is continued into the anterior lamina of the great omentum. These laminæ of the peritoneum of which we have just been speaking, and which are comprised between the spleen and the stomach, are called *gastro-splenic omenta* by many authors. 2°. *In the middle*, the peritoneum leaves the diaphragm before its œsophageal aperture, arrives upon the anterior surface of the stomach, passes before the gastro-epiploic vessels, descends to near the cavity of the pelvis, and is reflected from below upwards as far as the convex edge of the arch of the colon, thus contributing to the formation of the great omentum. It then invests the inferior surface of the arch of the colon, glides beneath the pancreas and duodenum, forming the inferior lamina of the transverse mesocolon, and is finally continued into one of the laminæ of the mesentery. 3°. *To the right*, the peritoneum covers a less extent of the inferior surface of the diaphragm. Arrived upon the posterior edge of the liver, it is reflected upon that organ, forming a fold which has been inappropriately named its *coronary ligament* (*ligamentum hepatis coronarium*). It covers its whole upper surface, at the middle of which it gives rise to another triangular fold which is its *suspensory ligament* (*ligamentum hepatis suspensorium*). This fold divides the upper surface of the liver into two unequal parts, corresponds on the other hand to the diaphragm, and is continued inferiorly into another fold, named the *Falx of the umbilical vein*. This fold in fact contains that vein in its substance, and descends anteriorly and to the left as far as the umbilicus. The right lamina of the so-called suspensory ligament of the liver is then reflected under the concave surface of the great lobe, unites with the rest of the peritoneum along its sharp edge, covers the gall-bladder, and at length forms altogether on the right, a small fold which gains the diaphragm, and is called the *right lateral* or *triangular ligament of the liver* (*ligamentum hepatis triangulare dextrum*.) This same lamina leaves the gall-bladder posteriorly, and slips before the duodenum to proceed over the colon. The left lamina is in like manner reflected under the inferior surface of the left lobe, unites upon its sharp edge with that which covers the upper surface of the liver, and bends, near its posterior edge, to form the *left lateral* or *triangular ligament of the liver* (*ligamentum hepatis triangulare sinistrum*) and the anterior lamina of the *hepato-gastric omentum*, and to expand over the anterior surface of the stomach. The *posterior cavity of the omentum* lies immediately under the neck of the gall-bladder, where a triangular aperture, the *foramen* or *hiatus of Winslow*, will be found, into which two fingers may easily be made to penetrate. Through this aperture there is seen to dive superiorly the lamina of the peritoneum which has formed the anterior lamina of the hepato-gastric omentum, which is thus applied upon itself, containing in its duplicature the cystic and hepatic ducts, and ductus communis choledocus, the vena portæ, the hepatic and pyloric arteries, and capsule of Glisson, and nearer to the cardia, the coronary artery of the stomach. This lamina then directs itself over the whole posterior surface of the stomach, descends behind the gastro-epiploic vessels, applies itself upon the portion of the peritoneum which has embraced the spleen and the anterior surface of the stomach, arrives along with it as far as the inferior edge of the great omentum, and afterwards ascends towards the convex edge of the arch of the colon. It then leaves this first lamina, covers the upper surface of the colon, forming the upper lamina of the *transverse mesocolon*, and passes above the pancreas and duodenum, the base of the crura of the diaphragm, the vena cava and lobulus Spigelii. At length it passes through the foramen of Winslow, and is continued over the concave surface of the right lobe of the liver. In following this course, the lamina of the peritoneum of which we have been speaking forms the walls of a large ovoidal cavity, the *posterior cavity of the omentum*. This cavity, which has no other issue than the foramen of Winslow, is formed anteriorly from above downwards by the hepato-gastric omentum, the posterior surface of the stomach, the two lamellæ of the anterior lamina of the great omentum. Posteriorly, and from beneath upwards, it is formed by the two lamellæ of the posterior lamina of the great omentum, the upper surface of the arch of the colon, the upper lamina of the transverse mesocolon, and its prolongation towards the lobulus Spigelii. To prove these facts, insert the nozzle of a bellows into the foramen of Winslow, and distend the great bag of the omentum ; this will generally succeed in a healthy abdomen where the omentum has not been handled ; or make an incision through the anterior lamina of the great omentum coming from the great curvature of the stomach and pushing the hand into the great bag of the omentum thus laid open, the student may thus satisfy himself of the existence of that layer of the peritoneum investing the posterior surface of the stomach, and likewise examine the course of the superior lamina of the transverse mesocolon. The *organization and general relations of the peritoneum.* The peritoneum has precisely the same structure as the other serous membranes which we have already examined. It is in general very thin, although not equally so in all its parts. Its thickness is greater in the loins and behind the anterior wall of the abdomen than any where else. Upon the liver, spleen, stomach, and intestines, and especially in the omenta, the thinness of this membrane is extreme. Nor is its adhesion to the organs which it invests uniform in all parts. It is very decided upon the liver, spleen, and intestines, with the exception of the duodenum; but is much less so upon the pancreas, bladder, uterus and vagina, as well as upon the diaphragm and the walls of the abdomen, which is especially remarkable in the lumbar regions and before the kidneys. In general, at the level of these different parts, in the excavation of the pelvis, the peritoneum has beneath it a great quantity of adipose cellular tissue. It also contains much of that substance in the different folds which it forms, as the mesentery, mesocolon, &c. The student may now examine more carefully the various processes which the peritoneum forms.

A. HEPATO-GASTRIC OMENTUM (*omentum minus*). Is a fold of the peritoneum, extending transversely from the right side of the cardia to the corresponding extremity of the transverse fissure of the liver, and from above downwards, from the inferior surface of the diaphragm to the pylorus and duodenum. It is under it that the foramen of Winslow occurs, and between its two laminæ that the biliary and hepatic vessels are lodged. It contains in general little fat.

B. The GREAT OMENTUM (*omentum majus*) is a very large fold, free and floating upon the convolutions of the intestine. It is regularly quadrilateral, and commonly longer on the left side than on the right. Its base is attached anteriorly to the great curvature of the stomach, and posteriorly to the arch of the colon. Its edges are continuous above, the one with the colic omentum, the other with the gastro-splenic omentum, and farther down with the neighbouring portions of the lumbar cola. It is formed of two laminæ, each composed of two lamellæ, four in all, the one superficial, the other deep. The two lamellæ of the anterior lamina leave between them and the great curvature of the stomach a triangular space, between which are situated the gastro-epiploic arteries and veins; also the long epiploic arteries and their veins, but they are afterwards confounded, proceed downwards, and then turning upwards, ascend together to form the posterior lamina. At the upper part of this latter, they separate again to embrace the arch of the colon, and form the transverse mesocolon. The one joins the mesentery, the other ascends towards the foramen of Winslow. There is found in the substance of the great omentum a large quantity of vessels (arter. epiploicæ and their accompanying veins), and fat, the latter being generally dispersed in flakes.

c. Colic Omentum. This is a fold of the peritoneum which exists only on the right side, and is placed behind the great omentum; it nearly fills the angle formed by the union of the right and transverse portions of the colon; sometimes it extends as far as the cœcum or towards the spleen; its two laminæ are separated by the colic arteries and veins.

d. The Gastro-splenic Omentum is formed by the peritoneum, which, from the edges of the fissure of the spleen, proceeds over the cardiac extremity of the stomach. It contains in its substance the splenic vessels and vasa breviora.

e. Besides the omenta, the peritoneum forms other folds, such as the mesentery, the mesocola, the mesorectum, the mesocœcum, the broad ligaments of the uterus, the suspensory ligaments of the liver, the adipose appendages of the large intestine, &c. It may be useful for the student to dissect most of these processes of the peritoneum, and thus, besides acquiring a knowledge of their general course, extent, and connections, ascertain in a practical way what is contained between their folds. Commence with the dissection of the *Mesentery*. The removal of one layer of this extensive process, and the fat which may be present, exposes the superior mesenteric artery and all its branches; the corresponding veins, the mesenteric or lacteal glands, and the lacteal vessels and superior mesenteric plexus of nerves; all these parts will be described more carefully afterwards. Next dissect the transverse *mesocolon.* By laying up the transverse arch of the colon over the edges of the thorax, it will be seen that the transverse mesocolon, together with that portion of the large intestine it incloses, forms a sort of partition across the abdomen; above which will be found the stomach, liver, and spleen, and below, the small intestines, &c. Dissect off the inferior layer of the transverse mesocolon, and expose the pancreas, which is situated across the spine and between its layers. The ascending layer of the transverse mesocolon may be seen either by raising up the stomach after the bag of the omentum has been opened into, or by tearing through the lesser omentum. The course of these layers has been already particularly described. Finally, upon the edges of the large intestines may be seen numerous small processes of their peritoneal tunic; these are called *appendices epiploicæ.* These appendices are probably analogous to the omenta whose uses are unknown. They generally contain a good deal of fat.

362. The farther dissection of the abdomen may be proceeded with in two ways: 1°. If the dissector be already acquainted with the viscera, he ought next to proceed with the dissection of the arteries and nerves of the abdomen; but, 2°. If this be not the case, and particularly if it be his first dissection of the abdomen, his attention should be exclusively devoted to the viscera. These organs are, 1°. The stomach, duodenum, jejunum, ileum, appendix vermiformis, cœcum, ascending or right colon, transverse arch and descending or left colon, sigmoid flexure of the colon, proper rectum and pouch of the rectum; these last are pelvic viscera: 2°. Liver, pancreas, spleen: 3°. Supra-renal capsules, kidneys and ureters: 4°. Diaphragm, psoas magnus, psoas parvus, quadratus lumborum, iliacus internus: 5°. The arteries, veins, and absorbent vessels within this cavity: lastly, The nerves of the walls and of the viscera, including the anatomy of crural hernia. As it is evident that a great multiplicity of important parts cannot be dissected upon one subject, we shall first consider the anatomy of those organs and muscles whose consideration must precede the others, and without a correct knowledge of which the student can never hope to become master of the anatomy of the arterial and nervous

system, nor of the surgical anatomy of these regions. Commence with the small intestines. Lay up the transverse arch of the colon over the edges of the thorax, and at the root of the mesentery will be found the termination of the duodenum and the commencement of the jejunum; remove the jejunum after having placed ligatures above and below the section of the gut, and cutting through the mesentery at about an inch from the intestine, detach the jejunum and ileum from the mesentery, leaving, however, about three or four inches of the lower end of the ileum in connexion with the colon. The following are the principal facts connected with this portion of the intestinal tube.

363. The SMALL INTESTINE (*Intestinum tenue*), in which the duodenum terminates, is the longest portion of the digestive canal. It forms a general great curve, of which the concavity is connected with the mesentery, while the convexity is free and floating, and it is moreover folded upon itself in different directions a great number of times, producing the *convolutions*. All these convolutions, of which the convexity is directed forwards, and whose concavity faces backwards towards the vertebral column, are placed close together, and constitute a considerable mass, occupying, in the abdomen, the umbilical and hypogastric regions, a portion of the lumbar and iliac regions, as well as of the excavation of the pelvis. This mass is circumscribed on all sides by the large intestines, that is to say, superiorly, by the transverse mesocolon and arch of the colon, which separate it from the stomach, the pancreas, the liver and the spleen; to the right, by the cœcum and ascending colon; to the left, by the descending colon and the sigmoid flexure. The small intestine commences under the superior mesenteric vessels, on the left side of the transverse mesocolon, and terminates in the right iliac region, opening into the large intestine. There results from this that its general direction is inclined from above downwards and from left to right. Its length is about four times the length of the body; anatomists have divided it into two portions, although they have failed to assign fixed and distinct limits to each of them. The upper is named *Jejunum*, on account of its being commonly found empty; the other is

called *Ileum.* The jejunum occupies the two upper fifths of the small intestine, and the ileum the rest of its extent. The division is arbitrary, and has no sufficient foundation. A projection called a *diverticulum*, composed of the same tunics as the intestine, and communicating with it, is occasionally found upon the small intestine; it has been supposed by Mr. Meckel to be the remains of the vesicula umbilicalis of the fœtus, and by its presence marks a distinction in the canal above and below it: I concur in this opinion. The small intestine has a smaller calibre than that of the other parts of the digestive canal; it is wider above than below. Its *outer surface* is smooth, excepting on its posterior edge, where it is destitute of peritoneum and lodged between the two laminæ of the mesentery; its *inner surface* has the same appearance as the duodenum. (367.) There are seen upon it numerous villosities, disposed in the form of more or less prominent fringes, and extremely large valvulæ conniventes. But the latter are more numerous the nearer to the duodenum the intestine is, and diminish progressively towards the cœcum. To display this *inner surface*, or mucous membrane, requires merely that a few inches of the intestine be laid open at each end, in order to contrast the appearance. The peritoneum covers the entire external surface of the small intestine, excepting at the posterior edge, where it is reflected to be prolonged backwards by two laminæ which constitute the mesentery, and which leave between them and the intestine, at the moment of their coming together, a triangular space exactly similar to that which prevails along the curvatures of the stomach; in this space, the intestine does not adhere to the peritoneum, a circumstance which is favourable to its dilatation. To display the anatomy of the peritoneal tunic of the intestine, it is only necessary to distend the gut with air. The *Muscular Membrane* or *Coat* is displayed by stripping off the peritoneal from a portion of the intestine previously distended with air; the superficial fibres are longitudinal, thin, not numerous, and collected especially along the convex edge of the intestine; they do not run along its whole extent, but are interrupted from space to space, and seem composed of shorter fibres whose extremities are interlaced with each other; the deep fibres form a more distinct layer; they are curved in the transverse direction of the intestine; but none of them pass entirely round it, they being interrupted like the longitudinal. The muscular membrane is connected with the peritoneum by a layer of cellular tissue, thin, and loose on the side next the mesentery. It is separated from the mucous membrane by another layer of denser and more compact cellular tissue, *nervous coat* of the older writers. The *nervous*, cellular, or vascular tunic may be examined either from within or from without. If from without, scrape off the peritoneal and muscular tunics; this shews the density and strength of the cellular tunic: if from within, evert a portion of the small intestine, turning it inside out, and enclosing it in ligatures, and distend it with air, that the cellular tunic may be entirely filled with it. If this portion of the intestine be now dried, and afterwards cut across, it will give a very good idea of the cellular tunic. The *Mucous Membrane* or *Coat* is whitish and thicker than in the stomach. The valvulæ conniventes are formed by its being folded upon itself. Its villosities are thin, flexible, and collected into pellets or fringes. On examining them with the microscope, it has been thought that each of them is terminated by an oval ampulla perforated with a small hole, which Lieberkuhn considers as the entrance of a lacteal vessel. The walls of this ampulla are lined with a net-work of arteries and veins; intervals which exist between these villosities are furnished with mucous follicles, designated by the name of glands of Brunn, which form slight prominences on the inside of the intestine; they are more numerous on the side next the mesentery than anywhere else; their form is round or oval. In addition to these mucous follicles, which Brunn considered as most abundant in the duodenum, other small glandular looking bodies are found upon the mucous surface in various parts of the small, and even the large intestine. They were perhaps first described by Peyer, and as they are collected in considerable numbers, and have a distinct oval shape, they have of late been known by the name of *Peyer's Patches.* They are in general easily found by holding up the intestine between the eye and the light. In many animals they are much more extended than in man, as in the kangaroo, &c. The arteries of the small intestine come from the convexity of the terminating branch of the superior mesenteric artery. Its veins join the vena portæ. Its lacteals, which are more numerous above than below, end in the glands of the mesentery. Its nerves arise from the superior mesenteric plexus.

364. LARGE INTESTINES, (*intestinum crassum*). Having thus examined the anatomy of the small intestines, proceed with the large. Remove them cautiously from the body, in the same way as the small, cutting through close to the intestine the various mesocola connecting them to the walls of the abdomen and to the stomach, &c.; throw a ligature around the top of the rectum, and leave it in the pelvis for future examination. The portion of intestine thus removed consists of, 1°. a small part of the ileum; 2°. the appendix vermiformis; 3°. the cœcum; 4°. the ascending colon; 5°. the transverse arch; 6°. the descending colon; 7°. the sigmoid flexure of the colon. The mode of examining the large intestine is generally similar to what has been recommended for the investigation of the small. The following are most of the anatomical facts:—The small intestine, after diminishing in calibre, enters the large intestine upon its left side; the peritoneal tunic binds down this gut in a remarkable way to the large intestine, and it is this chiefly which gives rise to a valve, (ileo-colic and ileo-cœcal valve), to be afterwards described. To satisfy himself of this, first let the dissector cut through the peritoneal tunic above and below the entrance of the small into the large intestine, and cautiously dissect through the close cellular substance connecting the termination of the small intestine to the cœcum and colon. If this dissection be continued far enough, the valve will afterwards be found nearly destroyed, thus proving the mechanism of its formation. Distend the large intestine with air, enclosing various parts with ligatures, and commence with the *appendix vermiformis.* This appendix is the smallest part of the large intestine, and is the commencement of it; it is present in man, and in only a very few animals. Even Morgagni mis-

took the *cæcum* of the dog for the *appendix vermiformis*, which that animal has not.

A. APPENDIX VERMIFORMIS, similar to the rest of the cœcum in its structure; its fleshy coat is thick, and formed of longitudinal fibres. Three bands of the intestine seem to come from it, of which we shall speak presently; it communicates with the cœcum by an orifice which allows air readily to enter, but not to escape so easily. The mucous membrane, at its orifice, forms a sort of valvule. The appendix is sometimes wanting.

B. The CŒCUM is placed between the end of the appendix vermiformis and the colon, in the right iliac fossa. Its volume is often triple that of the small intestine, and surpasses that of the colon or rectum. Its length is about three or four finger-breadths, and no other limits can be assigned it, to distinguish it from the colon, than the termination of the small intestine. Its *outer surface* presents very large bulgings, irregularly disposed, and interrupted in three places by longitudinal depressions formed by the union of the longitudinal muscular fibres. One of these depressions is anterior, the other two are posterior, but one is turned to the right and the other to the left. In its interior, the cœcum is lined by a mucous membrane, which we shall afterwards describe. It presents three longitudinal prominences, which correspond to the three external depressions mentioned above, and cellules occupying their intervals, separated by transverse folds, and forming externally prominences which we have also mentioned. Inferiorly and posteriorly, is seen the entrance of the appendix vermiformis, which is always free and open, and a little widened. To the left are the orifice of the small intestine and the *ileo-colic valve* or *valvule* of *Bauhin*. This valve, which prevents the return of the excrementitious matters from the cœcum into the small intestine, is elliptical, broad, soft, thick, without support, and directed transversely. In the direction of its great diameter it is divided by a slit which separates it into two lips united at their extremities, adhering to the intestine by their convex edge, and floating in its cavity by their concave edge. Of these two lips, the upper, which is narrower, corresponds above to the colon and below to the small intestine; while the lower, which is broader, faces the small intestine above, and the cœcum below. Their extremities unite and form a prominent line on each side, which terminates insensibly in the straight part of the cœcum. These rugæ were called by Morgagni the *Fræna of the Valvule of Bauhin.* The peritoneum wholly covers the inferior portion of the cœcum, and invests the greater part of it above, forming its *serous coat.* It passes upon the walls of the abdomen, without in general forming any fold. Sometimes, however, a more or less distinct fold is observed, to which the name of *meso-cœcum* is given. The *muscular membrane* or *coat,* composed of longitudinal and circular fibres; the longitudinal fibres are united into three distinct bands, and are shorter than the intestine itself, causing it to present the prominences of which we have already made mention. These fasciculi seem to arise from the appendix vermiformis, and on cutting them transversely, the cœcum is immediately seen to elongate, and the transverse folds and prominences which it presented entirely disappear. The layer of cellular tissue which connects this membrane with the following is thicker than in the small intestines, but in other respects presents nothing remarkable. The *mucous membrane* or *coat* presents villosities much less apparent than those of the small intestine, and no valvulæ conniventes; it contains a greater quantity of mucous follicles, but they are isolated from each other. The *ileo-colic* valve is formed by the mucous coat of the small intestine and the cellular coat which lines it, folded upon itself in such a manner as to project into the cœcum before being continued into the same membranes of that intestine and of the colon. There results from this that it is formed of four mucous laminæ, two for each of its lips, and that in their interval there occurs cellular tissue. But moreover, there is observed in the lower lip, a layer of strong muscular fibres of a whitish colour, which are continuous with those of the small intestine.

c. The Colon extends from the right iliac region to the left, between the cœcum and the rectum, with which it is continuous, and describing various turns which have caused it to be divided into four portions. 1°. The

Ascending Colon commences at the cœcum, and ascends in the right lumbar region vertically and a little backwards, to near the edge of the corresponding false ribs, lying upon the quadratus lumborum and kidney of the right side; *internally*, connected with the inferior lamina of the transverse mesocolon and the right lamina of the mesentery; *externally*, applied against the walls of the abdomen. Its volume does not much exceed that of the small intestine. Its mobility is not great, on account of its being connected with the kidney and quadratus lumborum by a great quantity of adipose cellular tissue. Sometimes, however, the peritoneum forms for it, posteriorly, a more or less loose fold, which is named the *right lumbar mesocolon.* 2°. The *Arch of the Colon*, or *Transverse Colon*, occupies the anterior and inferior region of the epigastrium, beneath the stomach, above the small intestine, behind the great omentum, and before the transverse mesocolon. Its *upper surface* is free and smooth, corresponding to the liver and the great curvature of the stomach, which advances more or less upon it. and at its left end is in relation with the spleen. Its *lower surface*, which is also smooth and polished, rests upon the mass of the small intestine. Its *anterior edge*, which is convex, gives attachment to the great omentum, and is in contact with the walls of the abdomen; the *posterior* is concave, and embraced by a fold of the peritoneum named the *transverse mesocolon.* 3°. The *Descending*, or *Left Lumbar Colon*, commences under the spleen; it is placed behind the small intestine, and before the left kidney and quadratus lumborum, with which it is connected by cellular tissue, or by a fold of the peritoneum named the *left lumbar mesocolon.* 4°. The *Sigmoid Flexure of the Colon* is very mobile, occupies the deeper part of the left iliac fossa, where it describes a double curve in the form of the letter S, whence its name. It commences at the end of the left lumbar region, and terminates at the upper strait of the pelvis, near the articulation of the last lumbar vertebra with the sacrum. It is surrounded in nearly its whole circumference by the peritoneum, which fixes it above and behind, by means of a loose fold, directed obliquely from left to right, named the *iliac mesocolon.* The colon thus describes in the abdomen a circle which measures nearly its whole circumference, and which contains the convolutions of the small intestine. In its whole extent, the colon, like the cœcum, presents interrupted bulgings, produced by three longitudinal bands; but these prominences, which are not so large as in the cœcum, are almost obliterated in the sigmoid flexure. It also presents a very great number of fatty appendages, owing to particular folds of the peritoneum, and so multiplied in its ascending and descending portions, that they seem to envelope it with a continuous layer; there are fewer upon the arch, and scarcely any upon the sigmoid flexure, where they are also much less voluminous. In its interior, the colon presents the same disposition as the cœcum. The peritoneum forms its *serous coat*, after having enveloped the intestine, fixing it to the neighbouring parts by different folds, which take their name from the portion to which they belong; the largest of these folds is the *transverse mesocolon*, which proceeds from the concave edge of the arch of the colon which it supports, and forms a horizontal and moveable partition, which separates the epigastric region from the umbilical, and the stomach, liver, and spleen from the small intestine. It is broader at the middle than at its two extremities, and has a nearly semicircular form. It is composed of two laminæ, an inferior and a superior: the former is continuous with the mesentery; the other is prolonged into the posterior cavity of the peritoneum, and covers a part of the duodénum. In the interval of these two laminæ are found the vessels and nerves destined for the arch of the colon, together with a great number of lymphatic glands. Between them and the concave edge of the intestine, there is observed an empty triangular space, similar to those which we have already described in the stomach and small intestine. These two laminæ, after uniting upon the colon, give rise to the posterior lamina of the great omentum. The *iliac mesocolon* varies much with respect to its extent, and is similar to the other folds of the same kind; it is broader at the middle than its extremities; it is continuous above with the descending mesocolon, or terminates in a point behind the colon, and inferiorly is united to the mesorectum; it also contains vessels, nerves, and some lymphatic glands. The *muscular* and *mucous membranes* are the same in the colon as in the cœcum. The arteries of the cœcum, of the ascending colon, and of the right half of the arch of the colon are furnished by the superior mesenteric artery. Those of the other parts of the colon come from the inferior mesenteric. The veins of these two intestines form the two meseraic veins, and open into the vena portæ. It is doubtful if any lacteals exist in the mesocola. Its nerves are furnished by the two mesenteric plexuses. The total length of the large intestine is about seven feet in a man of ordinary size. It forms about the fifth of that of the small intestine.

365. It being presumed that the student is desirous of afterwards examining the diaphragm and the deep muscles of the abdomen, his next step perhaps ought to be the removal of the stomach, duodenum, liver, spleen, and pancreas in a mass. In doing this for the first time, he will receive the aid of the demonstrator or more advanced student. If he be desirous of examining the arteries and nerves distributed to these organs, he must proceed with their dissection and examination previous to removing any of the viscera. Having now removed these viscera, and laid them apart in a position somewhat similar to what they occupied in the body, next distend the stomach and duodenum with air, and clean them cautiously; clean the pancreas and expose its duct by cutting into the centre of the gland; clean the vessels going to the spleen, and finally expose the ductus communis choledochus, ductus cysticus, and hepaticus, also the vena portæ and hepatic artery. These vessels he will find inclosed by the capsule of Glisson, and within the layers of the small omentum; a ligature had better be passed around the ductus communis choledochus, so as readily to find it again.

366. The Stomach, (*Ventriculus*), is a conical, elongated musculo-membraneous reservoir, curved from before backwards and from below upwards in the direction of its length, slightly depressed on two opposite sides, continuous on the one hand with the œsophagus, on the other with the duodenum, situated beneath the diaphragm, between the liver and the spleen, behind the left asternal ribs, occupying, at the upper part of

the abdomen, the epigastrium and a portion of the left hypochondrium. Its greatest diameter is transverse; the small diameter is vertical, gradually diminishing in proceeding from the œsophagus towards the duodenum. Its two orifices are considerably contracted, and are directed upwards and backwards. Its direction is nearly transverse, inclined slightly downwards, to the right and forwards, so that its right extremity is anterior and inferior to the left. When the viscus is filled with food, this obliquity is increased, and the stomach approaches the vertical direction. There are distinguished in the stomach, 1°, an external or outer surface; 2°, two curvatures; 3°, two extremities, each having an orifice, a larger to the left, and a smaller to the right; and lastly, 4°, an internal mucous surface. 1°. The *external surface* is more convex anteriorly than posteriorly, turned a little upwards in the state of repletion, corresponds, from right to left, to the left lobe of the liver, to the diaphragm and the false ribs, and in the state of distention only, to the anterior wall of the abdomen, over a great or less extent. It is always inclined downwards and forwards. *Posteriorly* flat, oblique, like the preceding, but of less extent than it, and directed downwards when the organ is full, is always entirely concealed in the posterior cavity of the omenta, and is in connexion with the transverse mesocolon, and sometimes even with the arch of the colon and the duodenum. These two surfaces are smooth and polished, continually moistened, traversed by a great number of blood vessels, and of a whitish colour. 2°. The *Great Curvature* is that margin where the two surfaces of the stomach meet externally downwards and forwards. The edge here produced is convex, and extends from the one orifice to the other; in the vicinity of the spleen, and to the left, its convexity is greater than elsewhere. It corresponds to the transverse mesocolon and to the arch of the colon. It is as it were lodged in a separation of the lamellæ of the anterior lamina of the great omentum, so that, in the empty state, the peritoneum is not exactly applied upon it. It is to this space that the right and left gastro-epiploic arteries, and a certain number of lymphatic glands correspond. To the right, the great curvature of the stomach forms a bend, which corresponds to an internal depression, named the *Small Cul-de-Sac*. To the left, it presents a considerable prominence, named the *Tuberosity* or *Great Cul-de-Sac of the Stomach*, which, placed beneath the œsophageal orifice, is prolonged into the hypochondrium, and diverges from the general direction of the viscus. It increases its length in a decided manner, and corresponds to the anterior half of the internal surface of the spleen, with which it is connected by a fold of the peritoneum, which lodges the vassa brevia. The *Small Curvature* is concave, and unites the two surfaces of the stomach above and behind. It corresponds to the aorta, the great fissure and lobulus Spigelii of the liver, and extends from the one orifice to the other, without presenting either dilatation or cul-de-sac, on which account its dimensions are smaller than that of the great curvature. But, like it also, it is not immediately invested by the peritoneum; for it sinks between the two laminæ of the hepato-gastric omentum, and is coasted by the coronary artery of the stomach. 3°. The *Cardia* (*Cardiac, Left* or *Œsophageal Extremity* and *Orifice*), separates the two curvatures on the left side, and is placed beneath the diaphragm, and above the large extremity of the stomach, at the union of the two right thirds and the left third of that viscus. It is in it that the œsophagus terminates. It is surrounded by a circle formed by the coronary artery and vein, and by the extremities of the œsophageal cords of the pneumogastric nerves. It is also in relation with a part of the left lobe and lobulus Spigelii of the liver, and with the corresponding anterior side of the vertebral column. The *Pylorus* (*Pyloric, Right* or *Intestinal Extremity* and *Orifice*), is situated in the epigastrium, lower and more anteriorly than the cardiac orifice; it terminates the stomach to the right, forming the summit of the cone represented by that viscus, and makes it communicate with the duodenum. Placed in the direction of the two curves at once, it commences by a funnel-shaped expansion, and terminates abruptly by a circular contraction; it generally ascends backwards and a little to the right, as far as the union of the two fissures of the liver. It corresponds above and before to the liver, below and behind, to the pancreas, posteriorly, directly to the right gastro-epiploic artery, and on the right side to the neck of the gall-bladder. It is often coloured by the transudation of the bile through the walls of that reservoir, and surrounded by a number of vascular twigs and nervous filaments. The *internal* (mucous) surface of the stomach is of a reddish white colour, having a marbled appearance; it is lined by mucous membrane, and numerous and irregular wrinkles are observed upon it in its empty condition. The walls of the stomach are formed by three superimposed membranes, a serous, a muscular, and a mucous. There also enter into their composition cellular tissue, vessels and nerves. These tunics are dissected much in the same way as was shewn in regard to the intestines. The *Serous Membrane* or *Coat* is formed by the peritoneum, and does not exist along the curvatures when the stomach is empty, as we have already said. There results from this disposition that the stomach, in the state of vacuity, is no longer covered by the same portions of peritoneum which were in connexion with it during its distention; for it is then prolonged between the laminæ of the omenta. The peritoneum is white, transparent, smooth, and lubricated externally by a serous fluid; united to the muscular membrane by a cellular tissue, loose on the edges of the stomach, but dense in the middle part of its two surfaces, where there is an intimate adhesion. The *Muscular Membrane* or *Coat* is thin, and differs essentially in this respect from the muscular coat of the pharynx and œsophagus. It is composed of fasciculi of soft whitish colours, never red, placed beside each other, and running in three different directions. 1°. Some of these fibres, which are more superficial, are *longitudinal:* Less numerous and less uniformly diffused than the others, they form the continuation of the external muscular layer of the œsophagus; the principal fasciculi form a bundle which runs along the small curvature as far as the pylorus; another bundle descends on the great cul-de-sac, and is prolonged in the direction of the great curvature; those which are expanded over the two surfaces of the stomach are shorter and irregularly disposed; some of these latter collect into two small bands, the one before, the other behind, which arrive at the pylorus after a course of about an inch. 2°. The fibres of the second kind, lying immediately under the former, are *circular*, and belong peculiarly to the stomach; they appear to have no connexion with those of the œsophagus; less numerous at the cardia than on the rest of the stomach, and especially at the middle, and running parallel to each other, they never entirely encircle the stomach. 3°. The fibres of the third kind are *oblique;* constitute two broad bands, one extending from the left side of the cardia over the two surfaces of the stomach, the other prolonged from the right side of the cardia over the great extremity, where it seems to replace the circular fibres, which occur there only in small number. A layer of dense and close filamentous cellular tissue unites the muscular to the mucous membrane; this, the older writers improperly named the *nervous coat.* The *Mucous Membrane* or *Coat* is soft, spongy, of a reddish white colour, having a marbled appearance, continually moistened with an abundant inodorous viscid fluid, it presents numerous and purely accidental irregular wrinkles when the stomach is empty. When examined with a lens, especially at some distance from the orifices, it is found to be perforated with a multitude of holes disposed pretty regularly in quincuncial order, not more than a fifth of a line in diameter, separated from one another by partitions, and thus constituting a kind of reticular warp, the tissue of which recurs between the folds of the mucous membrane of the duodenum, and around Peyer's glands or follicles. It does not at first sight appear to be a continuation of the inner membrane of the œsophagus, there being an apparent line of demarcation perceived between the two membranes, caused by the abrupt termination of the epithelium or epidermis of the mucous membrane of the œsophagus. The longitudinal folds which that of the œsophagus forms terminate at the cardia by so many mammellæ or tubercles; the mucous membrane of the stomach is thicker than that of the œsophagus, neither having villosities. Between the muscular and mucous coats of the stomach, and along the two curvatures only, are observed mucous follicles, of small size, opening on the inside of the viscus, by sunk and not very apparent orifices. They are commonly called *Brunner's glands,* from the name of an anatomist who first described them. At the place where the pylorus presents the least width, there occurs internally a circular rim, flattened and perpendicular to the walls of the orifice ; it has been improperly called the *valve of the pylorus ;* it is merely a replication of the muscular and mucous coats of the stomach, corresponding by one of its surfaces to the cavity of that viscus, and by the other to that of the duodenum, the small circumference of which is thin, free and floating, so as to circumscribe a narrow aperture by which the chyme passes into the intestines. But its great circumference is formed by a particular fibrous ring, of a solid texture and white colour, placed between the two forementioned membranes. This ring is the *pyloric muscles* of some authors. The arteries of the stomach are numerous and large, compared with the volume of the organ and the thickness of its walls. They come from the two gastro-epiploic, the pyloric, the coronory, and the splenic arteries. They creep at first in the cellular tissue between the peritoneal and muscular coats ; but their secondary divisions pass through the latter, and their ultimate ramifications form a very delicate net-work in the substance of the mucous membrane. These arteries are extremely flexuous, on account of the changes of volume to which the stomach is exposed. The veins of the stomach bear the same name, and follow the same course as the arteries. They pour their blood into the trunk of the vena portæ, or into one of its principal branches. Like the arteries, they anastomose with each other a great number of times. The lymphatic vessels of the stomach arise at its inner or outer surface, and present for the most part their principal trunks under the peritoneum; they may be referred to three orders; they go particularly to the glands placed along the two curvatures. The nerves of the stomach come particularly from the pneumo-gastric nerves, and the three divisions of the cœliac plexus.

367. The Duodenum, (*ventriculus succenturiatus*) immediately succeeds to the stomach. It is less voluminous than that organ, but has a greater diameter

than the rest of the digestive canal, and is susceptible of great dilatation. It occupies the deep middle part of the abdomen, where it is concealed by the transverse mesocolon or by the stomach. The direction of the duodenum is such that it may be divided into three portions. The *first*, which is about two inches long, commences at the valve of the pylorus, proceeds horizontally backwards and to the right, and ends near the neck of the gall-bladder, uniting angularly with the *second*, which has a variable length, and which descends vertically and a little to the left, as far as the third lumbar vertebra. The *third* portion is directly continuous with the second, with which it does not form an angle; it proceeds transversely to the left, before the vertebral column, and ends by being directed upwards and forwards, toward the upper extremity of the mesentery, above the superior mesenteric vessels, which cross its direction, and are embraced by a curve which it forms for them. The *first* portion is covered, in the greater part of its extent, by the peritoneum, and is in connexion with the hepato-gastric omentum. The *second* has no other connexion with the peritoneum than that of being covered by the upper lamina of the transverse mesocolon. The *third* is contained between the two laminæ of that fold. From this disposition, the duodenum forms a semicircle which circumscribes the pancreas, and has its concavity to the left, and its convexity to the right; it only appears to be kept in a fixed position in its two inferior thirds. The relations of the duodenum to the neighbouring organs are the following; *above*, it corresponds to the liver and part of the neck of the gall-bladder; *below*, it is limited by the inferior lamina of the transverse mesocolon; *anteriorly*, it is covered by the superior lamina of this fold inferiorly, and by the stomach and right extremity of the arch of the colon above; *posteriorly*, it is applied upon the anterior and right side of the vertebral column, the right kidney, the vena cava inferior, the aorta, and the right pillar of the diaphragm. By its whole inner side, it embraces the pancreas, from which it is separated below by the superior mesenteric vessels. Its outer side is immersed in the sub-peritoneal cellular tissue, between the right kidney and the ascending portion of the colon. The *inner surface* of the duodenum is mucous like that of the stomach. There is seen upon it a multitude of circular folds, which differ in their configuration, and are close to each other; these are the *valvulæ conniventes:* they are formed by the mucous membrane, and their existence is constant in all states of the duodenum, they project three or four lines in its cavity; some of them are oblique and cross each other, or run into those next them; their length is not the same in all; they never form entire circles, only representing arches which embrace the half, two-thirds, or three-fourths of the intestine, whose pointed extremities advance unequally beyond each other; their breadth varies as much as their length. The use assigned to them is that of retarding the progress of the alimentary substances for the purpose of favouring the absorption of the chyle. The reticular tissue which we pointed out at the inner surface of the stomach shows itself in the bottom of the grooves by which they are separated. There is also observed in the interior of the duodenum, at the point of union of the second and third curvatures, a small tubercle, at the summit of which are seen the united or isolated orifices of the choledochus and pancreatic ducts. At its lower part the duodenum is continuous with the small intestine, without any very distinct line of demarcation being observed. The duodenum is not, like the stomach, invested with a serous membrane, the peritoneum being only applied upon it in a small portion of its extent; it is to this partial deficiency of the peritoneal coat that the intestine owes the faculty of dilating to such a degree as almost to equal the stomach in size. The *muscular membrane* or *coat,* is thick; all its fibres are transverse or circular, and have a great similarity to those of the stomach. The *mucous membrane* or *coat* is reddish, soft, spongy, villous, and as if downy; it is of its reduplication that the valvulæ conniventes are formed; it possesses all the characters of the internal membrane of the stomach, and is truly continuous with it. Between it and the preceding coat, there is observed a quantity of flattened mucous follicles, the orifices of which are more visible than in the stomach. The arteries of the duodenum are very numerous, and come from the superior mesenteric, pyloric, pancreatic, and gastro-epiploic arteries. Its veins exactly correspond to the arteries. Its lacteals and lymphatics go to the glands situated above the pancreas. Its nerves come from the solar plexus.

368. The SPLEEN (*Lien*) whose uses, although entirely unknown, seem to have some connection with the secretion of the bile, is a parenchymatous, vascular viscus, of a soft and spongy texture, and of a dark red colour, inclining to black, rarely uniform, and almost always marbled. It is placed deeply in the left hypochondrium, beneath the diaphragm, above the descending colon, between the tuberosity of the stomach and the cartilages of the false ribs, before the corresponding supra-renal capsule and the upper part of the kidney of the same side. It is attached to the surrounding organs in a more or less loose manner by folds of the peritoneum, and by a great number of vessels. Its form is that of a segment of an ellipse, of which the greatest diameter is nearly vertical. Its volume varies, and cannot be given with precision, any more than its weight. Its specific gravity, however, is to that of water as 1160 to 1000. The *outer surface* of the spleen is convex and in contact with the diaphragm. It corresponds to the ninth, tenth, and eleventh ribs of the left side. The *inner* is divided into two parts by a longitudinal groove called the *fissure of the spleen.* This fissure never occupies the whole length of the organ, and is filled by vessels and fat. The posterior portion of the inner surface of the spleen is applied upon the left side of the vertebral column; the anterior, which is a little larger, corresponds to the great cul-de-sac of the stomach. The *circumference* has an irregular form. Thicker above and behind than below and before, it is smooth and rounded, but intersected from space to space by notches varying in depth and number. It corresponds above to the aponeurosis of the diaphragm, below to the left kidney and supra-renal capsule, behind to the pancreas, and before to the walls of the thorax, through the intervention of the diaphragm. The peritoneum invests its exterior, with the exception of the bottom of the fissure, on the edges of which it is reflected to

be continued into the laminæ of the membraneous folds which fix the spleen to the stomach and diaphragm. Thin, transparent, smooth at its outer surface, and adhering by the other, it is applied upon another envelope of a fibrous nature. The *fibrous envelope* adheres intimately to the preceding by its outer surface, and by its inner sends a great number of delicate prolongations into the parenchyma of the organ. At the bottom of the fissure, it is in contact with adipose cellular tissue, and furnishes other more distinct prolongations which accompany the vessels in the interior of the spleen, and whose number is consequently indeterminate. It is of a grayish white colour, pretty thick, strong, elastic, scantily supplied with vessels, and destitute of nerves. It is composed of the *elastic tissue*. The *blood-vessels*, in proportion to its size, are numerous and large. Its principal artery is furnished by the cœliac trunk, is remarkable for its size, the thickness of its walls, its numerous windings, and the manner in which it divides in the fissure. It receives also branches from the capsular, phrenic, first lumbar and spermatic arteries of the left side. Its veins are not larger than the arteries, and are especially remarkable for the thinness and extensibility of their walls. They have no internal valves, and form one of the principal roots of the vena portæ. Its *nerves* come from the solar plexus under the name of splenic plexus, and from the left pneumo-gastric nerve. The *lymphatics* are numerous, and unite with those of the liver. There occurs a rather thin layer of *cellular tissue* around the splenic arteries and veins, extending deeply into the substance of the spleen, but not between the secondary divisions of the vessels, the interstices of which are filled with serum. The spleen is in general soft, and as it were spongy; internally, its colour is deep. It always contains a very great quantity of blood, which seems to be identified with its tissue, and which is met with in three different states, viz. in the arteries and in the veins, as takes place in other organs; and in a sort of intimate combination with the other organic elements, and with a certain quantity of albumen. The latter is thick, slightly viscous, opaque, of a livid red colour like wine lees. It appears to be contained in cellules or areolæ destined for itself, of which the walls are formed by the prolongation of the internal surface of the fibrous envelope of the spleen.

369. PANCREAS. The dissection of the pancreas requires no particular directions, farther than to clean it carefully, and to expose the duct; it is deeply seated in the abdomen, lying across the vertebral column, between the three curvatures of the duodenum, behind the stomach, and to the right of the spleen; it is longer than broad, and flattened from before backwards, slightly concave posteriorly, and thus accommodated to the curvature of the vertebral column; its right extremity is larger than the left. Its *anterior surface* is inclined upwards, covered by the upper lamina of the transverse mescolon, the stomach, and the first portion of the duodenum. Its *posterior surface* presents superiorly a groove in which are lodged the splenic vessels; it corresponds to the superior mesenteric vessels, the aorta, the vena cava, and several nervous and lymphatic plexuses. Its *upper edge* is intersected by the course of the cœliac artery, and is directed backwards; the *lower* lies upon the third portion of the duodenum, and is separated from it by the superior mesenteric vessels. Its *left extremity* is thin, prolonged beneath the spleen, to near the corresponding supra-renal capsule. The *right extremity* or *head* is applied against the second portion of the duodenum, over which it commonly advances a little. There generally occurs beneath it a small mass, named the *small pancreas*. The pancreas resembles the salivary glands in its structure. It is of a grayish white colour, inclining to red; its parenchyma is firm and tenacious, appears composed of lobes and granular lobules, which are distinct and connected by a dense cellular tissue; it is from each of these granulations and lobules that the radicles of its excretory ducts arise, which are slender, and unite in the manner of veins. The duct itself is generally single; placed in the substance of the organ, near its lower edge, directed from left to right, and increasing in size from the numerous branches which it receives in its course, this canal proceeds in a serpentine manner towards the duodenum, disengages itself from the gland, becomes free behind the second

portion of the intestine, and is then of the size of a crow-quill. Near its extremity it receives an excretory duct which comes singly from the small pancreas, and shortly after opens at an acute angle, into the ductus communis choledochus, or adheres to it to enter the duodenum by itself. The walls of this duct are whitish. The arteries of the pancreas are numerous, but their size is small. They come from the cœliac, splenic, superior mesenteric, right gastro-epiploic, coronary, and left capsular arteries. Its veins pour their contents into the roots of the vena portæ, and in particular into the small mesaraic and splenic veins. Its nerves are supplied by the solar plexus; and its lymphatics go to be divided in glands to which it gives its name. The pancreas secretes a fluid which appears to have much resemblance to the saliva, and which mingles with the bile to be poured into the duodenum.

370. The Liver. To examine this organ advantageously, the vessels enveloped within the capsule of Glisson must be divided, first tracing the ductus communis choledochus to the duodenum, the vena portæ to the splenic and superior mesenteric veins, and the hepatic artery to the cœliac axis, of which it is a branch. Having thus detached the liver from the surrounding organs, proceed with its systematic anatomy. The liver is the largest gland in the body. It is a single, unsymmetrical organ, dense, easily torn, and of a reddish brown colour. It occupies the whole right hypochondrium, and a part of the epigastric region. Its general form is irregular. Its weight, in the adult, varies from two to five pounds, and its specific gravity is 15.203. Limited above by the diaphragm, it is protected anteriorly by the base of the thorax, beyond which it does not pass in the sound state, although it may be liable to undergo some slight changes of position, according to the state of the neighbouring organs, and the posture of the body. The *Upper Surface of the Liver* is convex; turned directly upwards at the left extremity; looks backwards medially, and inclined straight outwards; it is everywhere contiguous with the diaphragm. A fold of the peritoneum (*Suspensory Ligament of the Liver*) divides it from before backwards into two unequal portions, which are named

Great or *Right Lobe*, and the *Small* or *Left Lobe*. The *Inferior Surface of the Liver* is of less extent than the upper, irregularly concave, and inclined a little backwards, presenting from right to left the following parts: 1°. A broad and superficial depression, which belongs to the left lobe, and rests upon the upper surface of the stomach. 2°. The *Longitudinal fissure*, passing from before backwards, and separating the two lobes below, as the suspensory ligament does above. This groove is more or less deep, and in its lower half is frequently converted into a canal by a portion of the substance of the liver, which passes from one lobe to the other. In the fœtus, it lodges anteriorly the umbilical vein, and posteriorly the ductus venosus; and in the adult it is occupied by the fibrous cords which are formed by the remains of these obliterated vessels. 3°. The *Transverse fissure* is less deep and shorter than the preceding, (which it intersects at right angles), follows the direction of the great diameter of the liver; it occupies about the middle third of that organ, a little nearer its posterior than its anterior edge; it commences upon the right lobe by a narrow slit, then enlarges much as it proceeds towards the left side. It lodges the sinus of the vena portæ, the hepatic artery, the roots of the hepatic duct, nervous filaments and lymphatic vessels. All these parts are connected together by a dense, compact, and fibrous sheath (*Capsule of Glisson*). 4°. The *Groove of the Vena Cava Inferior*, situated behind, near the convex edge of the liver, very short, but deep, and often converted into a true canal. 5°. The *Lobulus Spigelii*, a mamillary eminence placed behind the transverse groove of the liver, in the posterior cavity of the peritoneum, beneath the gastro-hepatic omentum; its form is commonly that of a more or less obtuse triangular pyramid. A prolongation (*lobulus caudatus*) passes from its base to the right lobe of the liver. The lobulus Spigelii rests posteriorly upon the vertebral column, between the vena cava inferior and the œsophagus. 6°. The *Lobulus Quadratus*, broad, elevated, separates the anterior half of the longitudinal fissure from a superficial fossa of an oval form, which lodges the gall-bladder. 7°. Two superficial depressions, of which the anterior corresponds to the right extremity of the arch of the colon, while the posterior corresponds to the right kidney and supra-renal capsule. The *Circumference of the Liver* is irregularly quadrilateral, varying in thickness at the different parts of its extent, and everywhere, excepting at its posterior part, embraced by the peritoneum. *Anteriorly*, thin, convex, applied against the base of the thorax, and interrupted by two notches. Of these, one is narrow and deep, and is formed by the anterior extremity of the longitudinal fissure; the other is broader, but more superficial, and placed to the right of the first; it corresponds to the fundus of the gall-bladder. This part of the circumference of the liver is horizontal in the middle, but, to the right and left, is inclined downwards. *Posteriorly*, the circumference of the liver is shorter than before; but its thickness is considerable, especially to the right. It is rounded, and attached to the diaphragm, near its extremities, by two folds of the peritoneum, which are named the *Lateral* or *Triangular Ligaments* of the liver. A deep notch corresponding to the vertebral column marks this posterior margin. At the middle, it is united to the diaphragmatic aponeurosis, in an intimate manner, by a dense and close cellular tissue. It also presents the end of the longitudinal fissure, and that of the vena cava, together with the trunks of the hepatic veins. *To the right*, the circumference of the liver is thin at its fore part, thick behind, where it is in contact with the diaphragm. *To the left*, it presents a thin and convex edge, which is sometimes prolonged as far as the spleen. The *Serous* or *Peritoneal Envelope of the Liver* is a prolongation of the peritoneum, reflected from the lower surface of the diaphragm over the liver, which it does not surround in its whole extent. This envelope is transparent, smooth, polished, thin, and constantly bedewed with a serous fluid. Free on the side next the abdominal cavity, it adheres by its other surface to the second envelope, and does not cover the posterior part of the circumference of the organ, the two grooves of its inferior surface, that of the vena cava, and of the fossa destined to lodge the gall-bladder. It is equally wanting in the interval of the two laminæ of the suspensory ligament, as it is of itself that this alleged ligament is formed. The *Deep* or *Cellular Envelope of the Liver* is much more extended than the superficial, for it covers all the parts of the liver upon which the peritoneum is not applied, and is prolonged into the substance of that viscus, forming sheaths which accompany the branches and twigs of the vena portæ and hepatic artery, as well as the roots of the hepatic duct. They adhere to the parenchyma of the liver by numerous filaments, and do not present the least appearance of the muscular structure which Glisson attributed to them. In general thin, though dense, this envelope is much more apparent in the places of the surface of the liver where it exists alone, than in those where it is in connexion with the peritoneum, to which it adheres intimately. The *Blood-Vessels* and *Lymphatics of the Liver* are numerous. Some of them carry the blood to the liver: such are the hepatic artery, the vena portæ, and, in the fœtus, the umbilical vein. Others carry it off, after it has resided for some time in the organ: these are the hepatic veins. The lymphatics of the liver are extremely numerous. Its nerves are abundant; they come from the pneumo-gastric nerve, the phrenic nerve, and the hepatic plexus. The *Parenchyma* presents a reddish or yellowish tint superadded to the brown colour of its surface. Its general aspect is porous, from the great number of small vessels which have been divided in cutting it. There are moreover observed in it small yellow dots irregularly disseminated, which correspond to the radicles of the excretory ducts of the bile. The nature of the vessels which traverse the parenchyma of the liver in different directions, is indicated by the direction which they follow: thus, the branches of the vena portæ and hepatic artery, and the roots of the hepatic duct, proceed horizontally in the direction of the great diameter of the liver, while the trunks of the hepatic veins direct themselves in a converging manner towards its posterior edge. The orifices of the divided branches of the vena portæ are collapsed, and those of the hepatic veins remain circular: this depends upon the circumstance, that the former of these vessels is accompanied by a cellular sheath which prevents it from adhering to the parenchyma of the liver, while the others being destitute of that particular envelope, are intimately united to it. If the tissue of the liver be torn, it appears uneven and formed of roundish grains or solid polygons, in which end the extreme ramifications of the vena portæ and hepatic artery, and whence proceed the radicles of the biliary ducts, hepatic veins, and deep seated lymphatics. These granulations are about the size of a millet seed, of a soft and dark red colour, and appear to be united to each other by cellular tissue.

The *Excretory Apparatus of the Bile* is complicated. It consists of the hepatic duct, which issues from the liver, and after passing over a certain space, unites with the cystic duct, which ends in the gall-bladder, and of the ductus communis choledochus, which results from their junction, and terminates in the duodenum.

A. The Hepatic Duct arises by a number of slender radicles in the granulations of the liver. These radicles successively unite into larger branches which accompany the divisions of the vena portæ and hepatic artery. These branches are then united into two principal trunks, one for the left lobe, the other for the right, which issue by the transverse groove of the inferior surface of the liver, converge towards each other, closely connected with the corresponding branches of the vena portæ, and end at a right angle. At the point of union, some small branches of indeterminate number and variable size join them. The hepatic duct is about an inch and a half in length and a line and a half in diameter, descends obliquely inwards between the laminæ of the gastro-hepatic omentum, before the vena portæ, behind the right branch of the hepatic artery, to the left of the neck of the gall-bladder and cystic duct.

B. Gall-Bladder, a membraneous, pyriform or ovoidal reservoir, situated in a superficial depression of the under surface of the right lobe of the liver. It is placed obliquely, so that its large extremity is directed forward, to the right and downwards, while its summit looks backwards, upwards, and to the left. In the gall-bladder we distinguished a body, a fundus, and a summit or neck. 1°. The *body* adheres above, over a variable extent, to the substance of the liver, through the intervention of a layer of lamellar cellular tissue, and several ramifications of blood-vessels. Inferiorly, free and covered by the peritoneum; it lies, in this direction, upon the pylorus, the commencement of the duodenum, and the right extremity of the arch of the colon. 2°. The *fundus* is rounded, in general passing beyond the circumference of the liver. 3°. The *neck* or *summit* is curved upwards, and narrow. It is continued into the cystic duct. The internal surface of the gall-bladder is generally tinged with green, from the effect of the bile which it contains in its cavity. It is rough, reticulated, and plicate, presenting in its whole extent, rounded or polygonal areolæ of very variable breadth and depth, and more especially apparent towards its middle. In the vicinity of the neck of the gall-bladder, there are observed several valvular and prominent folds, which appear destined to diminish the velocity of the bile in that place. The gall-bladder has walls composed of three superimposed membranes, a serous, a cellular, and a mucous. The *Serous Membrane* belongs only to the free surface of the gall-bladder, and is formed by the peritoneum which is reflected from the lower surface of the liver, and which is continuous with the superior lamina of the gastro-hepatic omentum. The *Cellular Membrane* is compact. On the side next the liver, producing the adhesion of the gall-bladder; on the other surface, it unites the serous with the mucous membrane. The *Mucous Membrane* during life is supposed to be whitish, and it is only after death that it is tinged green by the transudation of the bile. Neither crypts nor follicles are perceived in it, there being only found in it some small grains, analogous to these organs, between the valvular folds of the neck. It is, however, covered with a great number of fungoid papillæ very close to each other. Its arteries are furnished by the cystic twig of the hepatic artery. Its veins go to the vena portæ. Its nerves come from the hepatic plexus, and its lymphatics join those of the liver.

C. The Ductus Cysticus, placed, like the hepatic duct, in the substance of the gastro-hepatic omentum, is smaller than it; they meet at an acute angle and unite.

D. The Ductus Communis Coledochus results from the union of the cystic and hepatic ducts; about three and a half inches long, and lodged between the laminæ of the gastro-hepatic omentum, before the vena portæ and below the hepatic artery, surrounded with cellular tissue, it descends behind the right extremity of the pancreas, and the second portion of the duodenum, inosculates with the pancreatic duct, or merely runs along side of it, enters obliquely between the fleshy and mucous coats of the intestine, and opens, an inch lower, in the duodenum, near its last curve; its mouth is placed upon a small mammillary eminence, and is furnished with a membraneous fold. The different excretory ducts of the bile are formed by two distinct membraneous laminæ, an outer and inner. The *outer* appears composed of white longitudinal fibres; the *inner* is mucous, very thin, and furnished with a small number of papillæ. It is continuous with the internal membranes of the gallbladder and duodenum.

371. The only organs now left within the cavity of the abdomen, independent of muscles, vessels and nerves, are the kidneys and ureters, and the supra-renal glands; but although these ought to be cleaned at this stage of the dissection, their being no occasion for their removal, they ought to be allowed to remain until the pelvis be examined. The student should proceed therefore with the dissection of the larger trunks of the veins and arteries, and with the deep muscles of the abdomen; lastly, by leaving the right or left iliac fossæ *undissected*, the student may afterwards more conveniently examine the anatomy of the parts concerned in crural hernia. After cleaning the great trunks of the arteries and veins and their branches, clean the following muscles, regardless of whatever may be situated upon or near them, that is, of whatever obstructs his view of them.

372. The DIAPHRAGM (*Septum Transversum, Midriff*,) is a single, broad, and membraneous muscle, situated obliquely between the thorax and abdomen, which it separates. Its figure is nearly circular, fleshy at its circumference, aponeurotic in the middle, and forms a kind of elliptical arch, mobile and flexible, but not symmetrical, a singular case in the system of muscles under the influence of the cerebral nerves.* The

* Physiologists usually divide the muscular system into voluntary, involuntary and mixed; to this last class belongs the diaphragm. The writer of this work for the last twelve years, has

central aponeurosis, called the *Cordiform Tendon*, is of considerable breadth; it is notched behind towards the vertebral column, and anteriorly is three lobed, on which account it has been compared to a trefoil leaf; of the three lobes of this aponeurosis, the middle is the largest, the right is a little less, and the left the smallest. The fibres of the aponeurosis are all of different lengths and directions. In their general disposition, they are radiated, proceeding from the posterior notch to the circumference of the lobes; they are interlaced with each other, and with more superficial and looser planes of fibres, which occur at the upper and under surfaces of the muscle, and describe nearly transverse curves, an arrangement which is especially evident on the right side; they are white and shining, with a pearly and satiny lustre, and are denser toward the upper surface of the aponeurosis than toward the lower. Between the right and middle lobes, near the vertebral column, is an aperture of a square form, with unequal sides; it gives passage to the vena cava inferior, to which it adheres pretty strongly. Its anterior side is the shortest, and not very distinct from the right, which is the longest. Each of its sides is formed by a particular layer of aponeurotic fibres, which are interlaced with the neighbouring layers at its extremities. Besides this aperture for the vena cava inferior, there frequently occurs a hole for the diaphragmatic vein, and one or two other holes for the venæ cavæ hepaticæ, which are all formed in the cordiform tendon. The fleshy fibres proceed from the whole circumference of this aponeurosis, to be directed forwards, laterally, and backwards. The anterior fibres are short, directed downwards and forwards, to the xiphoid cartilage, where they terminate by short aponeurotic fibres. Between these fibres and those which come from the cartilage of the seventh rib, there is a triangular interval with its base below, by which the cellular tissue of the thorax communicates with that

recommended that these terms be laid aside, and the following substituted; muscles usually acting *with our consciousness*; muscles acting *without our consciousness*; these terms the author has used in his Lectures for the last ten years, and they will be found to involve a good many of the modern physiological doctrines of muscular action and of sensation.

of the abdomen. The lateral fibres are the most numerous arising from the right and left lobes, and proceed toward the circumference of the base of the chest, to be attached to the inner surface of the last six ribs, by digitations which are interlaced with those of the transversalis abdominis. The first of these digitations is attached to the outer half of the posterior surface, and of the upper edge of the cartilage of the seventh rib ; the second, which is the longest of all, is inserted into the corresponding parts of the eighth rib ; the other four, which become gradually shorter, are moreover slightly attached to the bony portion of the four last ribs. Of these lateral fibres, the posterior terminate in an aponeurotic bundle, extended between the extremity of the last rib and the base of the transverse process of the first lumbar vertebra. It has been named the *Ligamentum arcuatum Diaphragmatis,* and is merely the upper edge of the anterior lamina of the aponeurosis of the transversalis abdominis, which slightly covers the quadratus lumborum and the last intercostal nerve, strengthened however by additional tendinous fibres. This *Ligamentum arcuatum externum* or *longum*, serves two purposes ; being stretched over the superior margin of the quadratus lumborum muscle, it permits that muscle to proceed upwards behind it to be attached to the last rib ; and it further gives attachment by its superior margin to the fleshy fibres of the great muscle of the diaphragm which are here very generally feeble and even altogether wanting. Lastly, in the two last intercostal spaces, the diaphragm is continued by common aponeurotic fibres, into the transversalis abdominis. The posterior fibres proceeding from the posterior notch of the aponeurosis, are directed in small numbers to an aponeurotic arch, extended from the base of the transverse process of the first lumbar vertebra to the body of the second, under which the upper part of the psoas muscle passes. This arch is the ligamentum arcuatum internum or breve stretched over the upper portion of the psoæ muscles. But the fleshy fibres generally unite into two bundles, named the *Pillars* or *Crura of the Diaphragm.* Of these crura the *right* is longer, broader, and thicker, and situated nearer the middle line of the vertebral column ; it is attached to the bodies of the four first lumbar vertebræ, by as many tendinous digitations. The *left*, which is narrower, shorter, more slender, and situated more to the side, is only attached to the bodies of the three first lumbar vertebræ. These two crura leave at first between them a considerable separation, which constitutes a narrow, oblong aperture, a little broader before, situated toward the middle of the vertebral column, all fleshy in its circumference, through which the œsophagus and pneumogastric nerves pass from the thorax to the abdomen. Immediately after, there is detached from each of them a fleshy bundle, which is interlaced with that of the opposite side; the anterior bundle, which descends from the left crus to the right, is the larger. These two bundles complete the lower part of the *œsophageal aperture*, and form the upper part of another opening of a parabolic form, situated between the two crura and vertebræ, which gives passage to the aorta, vena azygos, and thoracic duct. *This aperture*, which is situated more posteriorly and more to the left than the preceding, is further distinguished from it by having its margin aponeurotic and continuous with the tendons of the crura, and further by not being in the diaphragm but behind it. On its sides and behind, are spaces left between the fleshy fibres, for the passage of the splanchnic nerves. The *upper* or *thoracic surface* of the diaphragm is convex and inclined backwards. Its middle part is strongly connected with the pericardium, and corresponds to the mediastina. Its sides which are lined by the pleura, support the base of the lungs. Anteriorly, it covers the triangularis sterni; on the sides, the intercostales interni; and posteriorly, the aorta, psoas magnus and quadratus lumborum. Its *inferior* or *abdominal surface* is concave in its whole extent, and a little inclined forwards; but its concavity is not regular, being greater to the right than to the left, apparently from the presence of the liver; in the middle it is nearly plain. Posteriorly, the kidneys, the suprarenal capsules, the pancreas and the duodenum; on the right side, the liver; and on the left, the spleen and stomach are connected with it. In the rest of its extent, it is covered by the peritoneum, so that it is placed between two serous membranes, but not furnished with a special envelope. On these two surfaces there are vessels and nerves of considerable size, which belong particularly to the diaphragm. The *circumference* of the diaphragm corresponds, anteriorly, to the ensiform cartilage, and the triangularis sterni; on the sides, to the ribs and internal intercostal muscles; posteriorly, to the vertebral column, the aorta, the thoracic duct, and the psoas and quadratus lumborum muscles. The diaphragm separates the thorax from the abdomen, and serves to support the viscera which these great cavities contain. But it also performs motions, which, by varying the dimensions of these cavities, have the greatest influence upon many functions. When it contracts, the convexity which it forms in the thorax disappears; its fibres, from being curved, become straight; the aponeurotic centre acquires more obliquity; the thorax is thus enlarged, and the abdomen diminished; in ordinary circumstances, it is the only muscle that produces inspiration. If its contraction is carried farther, it draws the ribs toward the vertebral column, which diminishes the transverse diameters of the thorax. When it relaxes, it resumes its former dimensions, ascends in the thorax, forms there the same arch, compresses the lungs and thus contributes to expiration. During contraction, the lateral parts of the diaphragm descend much more than the middle part, which is retained by the pericardium and mediastinum. During the same action, the œsophagus is compressed, the aperture through which it passes being entirely fleshy; but this does not happen to the vena cava, vena azygos, aorta and thoracic duct, the circumference of their apertures being aponeurotic. The motions of the diaphragm also produce various remarkable phenomena, as *sighing*, *yawning*, *coughing*, *sneezing*, *laughing*, *sobbing*, and *hiccup*, which are all more or less connected with the motions of inspiration and expiration. It is also subservient to smell in the action of snuffing odoriferous effluvia, and contributes to the formation of the voice in crying, singing, &c. By constantly pressing upon the abdominal viscera, it subjects them by its motions of elevation and depression to a tossing which is favourable to their functions. It also contributes essentially, when it contracts strongly, to vomiting, the excretion of the feces and urine, and the expulsion of the fœtus. The psoæ, iliacus, and quadratus lumborum should be dissected only on one side at first, leaving those of the opposite side until after the examination of the parts in crural hernia.

373. The Psoas Parvus is not always present. It is situated externally to the psoas magnus, over which it is applied, arising by short aponeuroses, from the lower part of the body of the last dorsal vertebra, and the fibro-cartilage which separates it from the first lumbar vertebra, and it sometimes sends a small tendon to the transverse process of the twelfth vertebra of the back. The fleshy fibres cease opposite the fourth lumbar vertebra, and are replaced by a flat tendon, becoming broader as it descends, and which turns over the psoas magnus, passing to its inner part. This tendon terminates at the ileo-pectineal eminence, and the neighbouring part of the body of the pubes, sending to the iliac fascia a broad and thin membraneous prolongation, which covers the iliacus and psoas magnus; *anteriorly*, covered above by the diaphragm, afterwards by the renal vessels and nerves, and by the peritoneum, and below by the external iliac artery. The *posterior surface* is united to the psoas magnus by cellular tissue. Use, to bend the pelvis on the vertebral column, or the opposite.

374. Psoas Magnus, situated on the side of the vertebral column at its lower part, and along the upper strait of the pelvis, extending to the upper and fore part of the thigh; of an elongated form, thicker in the middle than at the extremities, rounded at its middle part, but at its upper thin and flat, and tendinous at the lower. It arises, by short aponeuroses, from the lateral and inferior part of the body of the last dorsal vertebra, from a small portion of the posterior extremity of the twelfth rib, from the side of the bodies of the first four lumbar vertebræ, from the fibro-cartilages which separate them, and from the base of the corresponding transverse processes. Between the latter insertion and the others, there is a space in which are lodged the branches of nerves, which concur to form the lumbo-abdominal plexus. The fleshy body forms at its upper part a flat and nearly vertical bundle, which becomes rounded as it descends, and afterwards directs itself towards the sides of the upper strait of the pelvis, where it gives rise, near the crural arch, to a strong tendon.

This tendon is placed at the inner side of the muscle before being totally separated from it, and is even concealed among its fleshy fibres, until close to the lumbar vertebræ. It receives, by its outer side, the fleshy fibres of the iliacus internus, (and hence these muscles really form a bicipital muscle, which ought long ago to have been described under a common name, as they are never distinct); it next passes under the crural arch, in the notch observed between the ileo-pectineal eminence and the anterior and inferior iliac spine, descends inwards and backwards, over the capsular ligament, and terminates by embracing the trochanter minor. The *external surface* of the psoas magnus, which is at the same time *anterior*, corresponds: that part of it which is above the crural arch, to the diaphragm, the kidney, the iliac fascia, and the psoas minor, when it exists. Below the arch this surface becomes entirely anterior, and is covered by the cellular tissue of the bend of the groin, then by the crural artery and the corresponding vein. Its *inner surface*, which is applied upon the sides of the bodies of the lumbar vertebræ, and upon those of the corresponding intervertebral fibro-cartilages, is yet separated from these parts by the lumbar nerves and vessels; it leaves between it and the fifth lumbar vertebra a triangular interval, filled with cellular tissue; then, becoming narrower, it is in contact with the external iliac vein and the tendon of the psoas parvus, and descends parallel to the pectineus, from which it is separated, at the lowest part, by the internal circumflex vessels. Its *posterior surface* is applied above upon the quadratus lumborum, from which it is separated by the lumbar nerves, and the anterior lamina of the aponeurosis of the transversus abdominis. Farther down, it is connected with the os innominatum, and the capsular ligament of the hip joint. A synovial bursa of great extent separates the branch of the pubes and the capsular ligament of the hip joint, from the tendon of the psoas magnus, which it embraces behind. This bursa frequently communicates with the hip joint, but not oftener in old than in young persons, as the second Dr. Monro imagined. The psoas magnus bends the thigh on the pelvis, directing the point of the foot a little outwards. It acts, especially in the standing posture, by retaining the body when it tends to fall backwards, and can even bend the pelvis and vertebral column on the inferior extremity. This flexion is direct when the muscles of both sides contract at the same time, but it is oblique if only one acts. This muscle performs a principal part in walking.

375. The Iliacus lies in the iliac fossa; broad and thin above, thick and narrow below, arising by aponeuroses, from about the upper three-fourths of the iliac fossa, the inner lip of the two anterior spinous processes of the ileum, the ileo-lumbar ligament, and the two anterior thirds of the inner lip of the iliac crest. Its fibres converge and descend; the inner, which are very short, vertically; the outer more and more obliquely; the latter are the longest: all successively inserted into the outer edge of the tendon of the psoas magnus, which they accompany to the small trochanter, passing with it under the crural arch. Its *anterior surface* is concave above, and convex below; covered, above the crural arch, by the iliac fascia, above which is the peritoneum, and by the cœcum to the right side, and the sigmoid flexure of the colon to the left side. The portion of this surface which is below the arch, corresponds externally to the sartorius; internally, to the pectineus and the crural vessels and nerves; anteriorly, to the cellular tissue of the fold of the groin, which separates it from the crural aponeurosis. Its *posterior surface* covers the iliac fossa, the upper extremity of the rectus muscle, and the hip joint. It bends the thigh upon the pelvis, or the latter upon the thigh, and acts powerfully in maintaining the body in the erect posture.

376. The Quadratus Lumborum, flat, thick, irregularly quadrilateral, situated in the loins, upon the sides of the vertebral column, and in the posterior wall of the abdomen. It is attached below, by aponeurotic fibres, and over an extent of about an inch, to the middle and posterior part of the iliac crest, also to the ileo-lumbar ligament, and by some transverse fibres, to the transverse process of the fourth and fifth lumbar vertebræ. The fleshy fibres which come from the os innominatum ascend to the last rib, and terminate in nearly the whole length of its inferior edge; those which arise

from the ligament proceed upwards and inwards, and terminate in four aponeurotic slips, continuous at their edges, and attached to the fore part of the base of the first four transverse processes of the loins. In addition to these tendinous slips attached to the transverse processes of the lumbar vertebræ, and which proceed from below upwards, there run very constantly a series of other tendinous slips from above downwards, proceeding as it were from the direction of the last rib downwards to the transverse processes of the second, third, and fourth of the lumbar vertebræ; these tendons lie anterior to the others first described; *anteriorly*, covered above by the diaphragm, and in the rest of its extent by the anterior lamina of the aponeurosis of the transversalis abdominis, and by the psoas magnus; it corresponds to the kidney and colon by the intervention of other parts. Its *posterior surface* is separated from the sacro-spinalis by the middle lamina of the aponeurosis of the transversalis abdominis. This muscle inclines the loins to one side; it lowers the last rib, and is subservient to expiration, being an antagonist of the scaleni muscles in this respect; it can also raise the haunch.

377. Crural Hernia. We have (303) given a description of the parts concerned in crural hernia from without. But to understand them properly, they require also to be dissected from within the pelvis. Strip off the peritoneum from the lower flap of the abdominal walls, and from the iliac fossa; this exposes the inside of the fascia transversalis and of the fascia iliaca; these fasciæ are thus seen to be one and the same, or mere *reflexions* of each other, the iliac portion is, however, almost always distinctly fibrous. If this fascia iliaca be now traced to the iliac vessels, it will be there found to dip down into the pelvis behind the vessels, and thus to become in some measure continuous with the pelvic fascia. The external iliac artery and vein are united to the fascia by a layer of cellular substance, this constitutes the *sheath* of the vessels, and accompanies them out of the pelvis into the thigh. At their passage below Poupart's ligament, the cellular sheath may be seen uniting firmly to the fascia transversalis, and this union, together with the circumstance that the fascia transversalis and fascia

iliaca are but one, prevents the possible occurrence of hernia at any point external to the passage of the vessels. But from this point inwards towards the pubes, the walls of the abdomen beneath Poupart's ligament are naturally weakened, particularly in the female, owing to the width of the pelvis; it is here, therefore, on the pelvic side of the common femoral vein, and to the iliac side of the semilunar edge of Gimbernat's ligament that crural hernia uniformly occurs. Writers on surgical anatomy, by adopting anatomical hypotheses in respect to the structure of the parts, have greatly embarassed the subject, and tended much to confuse the student. In the following description we shall endeavour to avoid this as much as possible, admitting, however, that the minute anatomical views of Hesselbach may be examined with advantage by the surgeon. We have already recommended the student to strip off the peritoneum from all these surfaces, and to reflect it towards the pelvis; he will next come to a layer of very loose cellular substance connecting this membrane to the fasciæ and to the sheath of the vessels. Having removed this, the fasciæ present themselves, and the sheath of the great vessels. Upon the inside the sheath, or towards the pubes, many have thought that the fascia transversalis is altogether wanting, but this seems to be an error; the fascia is much thinner immediately to the inside of the vessels, where, however, it passes over an opening down which the crural hernia uniformly passes. As the fascia transversalis passes over this opening, it is not unfrequently still farther strengthened by a layer of cellular substance, which together form the *septum crurale* of the French anatomists. The fascia now covers the inside of Gimbernat's ligament, and frequently forms upon this surface a crescent-shaped membrane doubling the ligament of Gimbernat, and having precisely its form; this doubling of Gimbernat's ligament by another structure, was particularly described by Hesselbach. If the student now push a portion of the peritoneum with his finger downwards, so as to imitate a hernia, he will find that the finger, pushing the peritoneum before it, has passed into a rounded aperture, (superior orifice of the crural canal,) and has pushed before it the *septum crurale*, which thus, unless it should give way, must become the fascia propria of every crural hernia. Sir A. Cooper speaks of the crural hernia descending in the sheath of the vessels; I cannot say that I ever examined a case of this kind. The boundaries of this opening are *superiorly* Poupart's ligament; *externally* the great vein enclosed by its sheath; *inferiorly* the *horizontal ramus of the pubes;* internally the semilunar edge of Gimbernat's ligament, and of its doubling already described, when such a structure happens to be present. It is here, *i. e.* in this ring, that I have always noticed the stricture in strangulated crural hernia to be placed, and it is obvious that some part or other of the ring must be cut by the surgeon in order to relieve the strangulation; now, the only parts which can be conveniently cut, are, 1°. Poupart's ligament, by cutting directly upwards. 2°. Gimbernat's ligament by cutting horizontally inwards. Timid surgeons whose knowledge of anatomy is unsound, usually cut Poupart's ligament; experienced surgeons divide or rather scratch through a portion of Gimbernat's ligament; the neck of the sac is of course cut in both cases. Let the student now continue to push his finger still further down towards the thigh, imitating the course of the femoral hernia, he will now find that it has passed underneath the cribriform fascia. In this situation it usually remains, or at least I have always seen it so, but it may, of course, in certain cases, enlarge and escape through some of the openings in the cribriform fascia, and thus become ultimately almost subcutaneous; I have never seen a case of this kind, the hernial sac appearing to me to be always invested by the cribriform fascia. In this situation the pressure on it being but feeble, the hernia, so soon as it escapes from below Poupart's ligament expands, and rising upwards, covers partially Poupart's ligament, so that at first it is occasionally a somewhat difficult matter to decide on its real nature. We may further remark, that on every occasion of dissecting these parts whether in the male or female, whether in the recent or old hernia, we have uniformly found a *septum* or partition of dense cellular substance between the sac and the femoral vein.

378. Arteries and Veins of the Abdomen and its Viscera. To do justice to these, the student will

require to devote an abdominal cavity to their exclusive examination. Neither can he even then but with some difficulty dissect them in any systematic way. 1°. Those arteries supplying the anterior walls of the abdomen are chiefly the internal mammary, the epigastric and the circumflex arteries of the ileum; the phrenic arteries supply the diaphragm, the lumbar arteries the posterior and lateral walls of the abdomen. 2°. On laying open the cavity of the abdomen, the arteries which fall most conveniently to be first examined are the superior mesenteric, the inferior mesenteric, then the cœliac axis and its branches, and, lastly, the phrenic, capsular, renal, lumbar, spermatic, aorta itself, and iliacs. We recommend to the student, however, to dissect these vessels, and also the nerves, in a sytematic manner, as being the only safe way of proceeding, and to enable him to do so, have permission from his fellow-students (in case the parts do not belong to him,) to cut down the walls of the thorax so low as to allow him easily to get at the lower portion of the thoracic aorta, trace this artery into the abdomen behind the diaphragm; cut away so much of this muscle as may be required, and cleaning the gullet, the commencement of the abdominal aorta, proceed to trace its branches exactly in the order in which they come off from it. In this way we shall examine them; all other methods, however convenient they may be with reference to a scarcity of subjects, cannot fail greatly to embarass the student.

379. The Abdominal Aorta is a continuation of the thoracic portion of the aorta; it receives the name at the moment of its passage behind the diaphragm, and retains it until its subdivision into the *common iliacs,* which usually happens about the lower part of the fourth lumbar vertebra. We shall first describe the branches of this great vessel, since the main trunk cannot well be seen until the removal of nearly all the viscera. Begin with,

380. The Inferior Phrenic Arteries. The *Right Phrenic Artery* generally comes off from the aorta by itself, sometimes along with the left, occasionally from the cœliac artery. It immediately ascends a little outwards, along the free edge of the right crus of that muscle, to which it gives several twigs, as well as to the *supra-renal*

capsules, the *pancreas*, and the *liver*. It then divides into two branches. The *anterior branch* gives off at its commencement a transverse twig, which unites before the œsophagus with a similar twig of the left phrenic artery. It then traverses the adhesion of the liver to the diaphragm, gains the neighbourhood of the vena cava inferior, sends several ramifications to the pericardium, through the diaphragm, and separates into a great number of secondary branches which lose themselves in that muscle, communicating with the corresponding superior phrenic. Others penetrate into the posterior part of the liver. One of them, which seems to be the continuation of the original trunk, turns over the central aponeurosis, and anastomoses with the left phrenic. *External branch.* Directed transversely outwards, above the liver, behind the right lobe of the aponeurosis of the diaphragm, it terminates in the digitations by which the diaphragm is attached to the ribs. It furnishes two or three twigs to the supra-renal capsule (*superior capsular arteries*), and, by those which are diffused in the muscle; it anastomoses with the other branch, and with the inferior intercostal and lumbar arteries. The *Left Phrenic Artery* has a distribution similar in most respects to the right. The next artery given off by the aorta, is,

381. The Cœliac Artery or Axis. It must be traced very carefully, and if possible none of the viscera removed until all its branches have been examined. The *Cœliac Artery* (*Art. cœlica*) is the shortest of the arteries which the abdominal aorta furnishes. It comes off at a right angle, between the crura of the diaphragm, opposite the union of the last vertebra of the back with the first of the loins. It is directed horizontally forwards and to the right, in the posterior separation of the two laminæ of the hepato-gastric omentum. It corresponds, *above*, to the left side of the small lobe of the liver; *below*, to the upper edge of the pancreas, on which it rests; *to the left*, to the cardia; *to the right*, to a pretty considerable space which separates it from the pylorus. This artery sometimes furnishes the capsular or the inferior phrenic. But it always separates after a course of about half an inch, into three branches of unequal size, which are, 1°, the *Coronary*

artery of the stomach, 2°, the *Hepatic artery*, and, 3°, the *Splenic artery*.

A. CORONARY ARTERY of the STOMACH (*Art. Coronaria ventriculi.*) The smallest of the three arising from the cœliac, directs itself upwards, forwards, and to the left, approaching the cardia, over the right side of which it bends downwards to follow the small curve of the stomach, to near the pylorus, where it anastomoses with the pyloric artery. In this second parts of its course, it occupies the interval which the two laminæ of the hepato-gastric omentum leave between them, when they are reflected over the stomach. The branches which it gives off may be distinguished into œsophageal and gastric. *Œsophageal Branches.* They vary in number, and are either vertical or transverse. Frequently there is only one of the former. Arising from the bend which the artery forms near the cardia, it ascends upon the œsophagus, which it follows to a considerable distance in the posterior mediastinum, and is distributed to its walls by a great number of flexuous twigs, which anastomose with the aortic œsophageal arteries. If there be two or a greater number, they follow precisely the same course. The transverse branches surround the cardia in a semicircular manner. Some of them subdivide on the widest part of the œsophagus; the others extend as far as the great cul-de-sac of the stomach, and there anastomose with the vasa brevia. *Gastric Branches.*—They come off along the small curvature of the stomach, and pass over the two surfaces of that viscus. Their number is irregular, and their size very variable. They separate into a great quantity of flexuous twigs, which ramify between the muscular and mucous coats of the stomach, and anastomose with each other, and with the gastro-epiploic arteries. The coronary artery often sends a considerable branch to the liver.

B. HEPATIC ARTERY (*Arteria hepatica*). Much larger than the preceding, it directs itself transversely to the right and forwards under the small lobe of the liver to near the pylorus, whence it slightly ascends towards the neck of the gall-bladder, and the transverse fissure of the liver. In this course it furnishes only two branches, the pyloric and right gastro-epiploic. *Pyloric Artery* (*Ar. pylorica.*) It arises from the anterior part of the hepatic, on the right side of the pylorus, whence it ascends, from right to left, along the small curvature of the stomach, to anastomose with the termination of the coronary artery of the stomach, after a course of greater or less length. It gives to the two surfaces of the stomach and to the pylorus twigs, which inosculate with those of the right gastro-epiploic artery. *Arter. gastrica duodenalis*, by some called the *gastro-epiploica dextra.* It arises to the right of the pylorus and beneath it, from the lower part of the hepatic. Its size is considerable. It descends at first vertically behind the stomach towards its great curvature, applied posteriorly upon the second portion of the duodenum, and covered to the left by the pancreas. In this course it gives off two or three small branches to the pylorus and pancreas, (arter. pylor. inferiores.) It soon divides into two principal branches, viz. the gastro-epiploica dextra and pancreatica duodenalis. The first of these, which is really the continuation of the main trunk, proceeds from right to left along the great curvature of the stomach, between the layers of the anterior lamina of the great omentum, as far as the middle part of that curvature, where it inosculates with the left gastro-epiploic artery. The branches of the pancreatico-duodenalis are distributed to the walls of the duodenum, and the posterior surface of the pancreas. In its *horizontal portion,* along the great curvature of the stomach, the gastro-epiploica dextra gives off, superiorly, numerous twigs, which ascend in a flexuous manner over the two surfaces of that viscus, and anastomose with those of the pyloric artery and coronary artery of the stomach. Inferiorly, it sends off some which descend vertically between the laminæ of the great omentum, and gain, by being reflected in the posterior lamina, the edge of the arch of the colon, where they inosculate with the colic arteries. When the hepatic artery has furnished these two arteries, it ascends, before the vena portæ, and on the left of the hepatic duct, to the right side of the lobulus Spigelii of the liver, and in the transverse fissure of the liver divides into two considerable branches, a right and a left. *Right Branch,* (*art. hepatica dextra*). Directed upwards and outwards, it crosses the direction of the hepatic duct, beyond which it furnishes the *cystic artery* (*art. cystica*), which gains the neck of the gall-bladder, and spreads out in the lower part of the walls of that reservoir, where it winds for some time between the serous and mucous membranes of which it is composed. The cystic artery, moreover, sends a very considerable twig between the liver and gall-bladder, to be distributed in the substance of both. After the origin of the cystic artery, the right branch of the hepatic artery dives into the transverse fissure of the liver, and loses itself by ramifying in its right lobe. *Left Branch* (*art. hepatica sinistra*). Proceeding obliquely upwards and inwards, it enters the transverse fissure and loses itself in the left lobe and in the lobulus Spigelii of the liver, accompanying the divisions of the vena portæ.

c. The Splenic Artery, in the adult, is larger than the hepatic, but smaller in the child. At its commencement, it passes from right to left in a tortuous manner along the upper part of the pancreas, which lodges it in a particular groove. It thus arrives at the fissure of the spleen, after furnishing several branches, which are the following. *Pancreatic Branches*, (*art. pancreaticæ mediæ et sinistræ*). They come off, in irregular number, from the lower part of the splenic artery, dive perpendicularly into the substance of the pancreas, and there subdivide, to be united with the twigs of pancreatic artery furnished by the right gastro-epiploic. *Left Gastro-epiploic Branch*, (*art. gastro-epiploica sinistra*), arises from the trunk of the splenic artery, or only from one of the branches by which it terminates. Its size is generally equal to that of the right gastro-epiploic; but it is frequently much larger, so as to appear to form the true continuation of the artery which gives rise to it, having its direction changed. It ascends at first a little to the left towards the great extremity of the stomach, is concealed for some time by it, and then descends along the great curvature. At its commencement, it sends some ramifications into the pancreas; but along the great curvature it sends upwards, over the two surfaces of the stomach, and downwards, into the great omentum, twigs of larger size, which are distributed precisely in the same manner as those of the right gastro-epiploic artery, with which it anastomoses toward the middle of the great curvature. At some distance from the fissure of the spleen, the artery divides into two or three branches, which subdivide into seven or eight twigs, which diverge from each other, before entering the inner surface of the spleen. They penetrate into that viscus by so many separate apertures which are observed along its fissure, presently subdivide to infinity, anastomosing with each other by arches, and seem in a great measure to constitute the proper tissue of the organ. *Vasa Brevia.*—These are large but short twigs, which come from the terminating branches of the splenic artery before their entrance into the spleen, and immediately pass to the large extremity of the stomach, near the cardia, expanding over the two surfaces of that organ, and anastomosing with the transverse œsophageal twigs of the coronary artery. In this manner, they serve to complete the arterial circle which surrounds the cardia. The student will now find it most convenient to proceed with the dissection of

382. The Superior Mesenteric Artery (*art. mesaraica superior*). It arises from the anterior and right side of the aorta, a short way below the cœliac, which it almost equals in size, but greatly exceeds in length. It immediately ascends a little to the left and forwards, behind the pancreas, and before the third portion of the duodenum, and passing behind the left part of the transverse mesocolon, goes to the upper extremity of the mesentery, between the two folds of which it enters, directing itself downwards and to the right, and describing an elongated curve, the convexity of which is turned to the left and forwards, and approaches so much nearer the intestine the lower it is examined. Towards the end of the ileum, the superior mesenteric artery, now become slender, anastomoses with the inferior branch of the ileo-colic artery. Near its origin, it gives off some small branches to the duodenum and pancreas, and communicates with twigs of the splenic and hepatic arteries. In the mesentery, it furnishes many large branches, distinguished into those arising from its *concavity*, and those from its *convexity*. 1°. Branches given off from its concavity (*Right colic arteries*). (*Art. Colica Media*), arise from the right and some-

what anterior part of the superior mesenteric artery, when the latter passes the transverse mesocolon. It proceeds from behind forwards, between its two laminæ, and runs horizontally to near the middle part of the arch of the colon; there, it divides into two branches, which separate from each other to right and left, forming a more or less open angle. The right branch runs along the right part of the arch of the colon, and anastomoses with a twig of the middle right colic artery. The left follows the corresponding part of the same intestine, and in the lumbar region inosculates with the ascending branch of the superior left colic artery. *Art. Colica Dextra.* It arises a little beneath the preceding, which sometimes furnishes it, and directs itself obliquely to the right, forwards and a little upwards in the mesocolon. On arriving near the upper part of the right lumbar colon, it divides, like the preceding into two branches, one of which bends to the left and inosculates with the right branch of the superior colic artery, while the other descends to unite with the ascending twig of the ileo-colic artery. *Art. Ileo-Colica* larger than the preceding, near which it is found at its commencement. Directed transversely to the right in the meso-colon, it divides, near the cœcum, into three branches. The first bends from beneath upwards, and communicates with the descending branch of the right colic artery. The second descends in the mesentery, and unites with the extremity of the superior mesenteric artery itself. The third is transverse, and arises from the angle of the other two; it gains the posterior part of the colon and cœcum, where these two intestines communicate. From thence it sends a small twig, into the peritoneal fold of the vermiform appendage. It then separates into two branches, of which one ascends behind the colon, while the other descends behind the cœcum. Its twigs belong to the walls of these intestines. In anastomosing with each other, as we have pointed out, the right colic arteries form distinct arches, whose convexity is turned towards the intestine. These arches give off no twigs by their concavity, but by their convexity they send off a very great number. These, for the most part, on leaving the arches, direct themselves parallel to each other as far as the colon; but several of them, following an oblique direction, meet and anastomose so as to constitute areolæ of various forms, whence arise other secondary twigs which go directly to the intestine. When they have all arrived there, they subdivide, upon its two surfaces, into slender twigs which dive beneath the serous coat, and form a very fine net-work in the other coats. Those which belong to the cœcum are much closer and more numerous than those of the colon. *Branches arising from the convexity of the superior mesenteric artery commonly from fifteen to twenty.* Their volume and length diminish from the upper towards the lower, which are mere twigs. They all direct themselves more or less obliquely downwards and to the left between the two laminæ of the mesentery, towards the small intestine, for which they are destined, as well as for the lower third of the duodenum. At the end of a rather short course, each of them divides into two twigs which separate from each other, and unite by arches with those of the neighbouring branches. From the convexity of these primary arches, there arise other smaller twigs, which presently divide in the same manner, and constitute secondary arches by new anastomoses similar to the first. These second arches in like manner give rise to other twigs which form third arches ; and from these again come off others of a fourth order, which themselves produce a fifth, quite close to the intestine. All these twigs thus constitute in the mesentery a kind of net-work, of which the very numerous areolæ vary in their form and size. These areolæ are themselves traversed by very delicate twigs which go from one branch to another, and which by the way give ramifications to the mesentery and its lymphatic glands. Near the edge of the small intestines, in the place where the two laminæ of the mesentery leave a triangular interval between them, the vascular net-work, which we have described, abruptly ceases, and furnishes a great number of small parallel twigs, which proceed directly over the two surfaces of the intestine, and pass into the cellular tissue between the mucous and muscular coats, where they ramify and subdivide to infinity, taking the appearance of small shrubs. When they have arrived at the convex edge of the intestine, those of one side anastomose with those of the opposite side, in such a manner as to represent rings. The capillary ramifications, which the mucous membrane receives from all these branches, form at its surface a net-work of the greatest delicacy, which spreads out in the valvulæ conniventes and in the villosities which it presents. By laying the mesentery, and with it the whole tract of the small intestines over to the right side, the course of the next artery may readily be traced.

383. The INFERIOR MESENTERIC ARTERY, somewhat smaller than the superior, arises much lower from the anterior and left part of the aorta, at the distance of an inch and a half from its termination. It descends at first a little to the left, behind the lamina of the peritoneum, which goes to form the corresponding lamina of the mesentery, then bending to the right, it enters into the substance of the iliac mesocolon, forming a much less extended curve than that of the superior mesenteric artery, and whose convexity also looks to the left. Arrived at the brim of the pelvis, it prolongs itself into the posterior separation of the mesorectum, and reaches near to the anus. The concavity of the curve formed by the inferior mesenteric artery produces no branch, but there issue a great number from its convexity. Of these the four principal branches have received the name of *Left Colic, Superior and Inferior Sigmoid arteries and Superior Hæmorrhoidal.*

A. LEFT COLIC ARTERY arises opposite the bifurcation of the aorta. Directed almost transversely to the left, it arrives near the lumbar colon of the same side, and there separates into two branches, one of which ascends as far as the arch of the colon, and anastomoses with the left branch of the middle colic (a branch of the superior mesenteric), while the other descends in the iliac mesocolon, and inosculates with

B. The SUPERIOR SIGMOID ARTERY often arises from the preceding, sometimes wanting. It directs itself towards the first curve of the sigmoid flexure of the colon, and there divides into two branches, one of which ascends to form an arch with the descending branch of the superior left colic artery, while the other unites with one of the branches of

C. The INFERIOR SIGMOID ARTERY passes towards the middle part of the sigmoid flexure and separates into two branches. The upper ascends to form an arch with the preceding. The lower descends to unite with one of the twigs furnished in the meso-rectum by the inferior mesenteric artery itself. These colic arteries, on arriving at the intestine, exhibit precisely the same arrangement as the colic branches of the superior mesenteric; that is to say, after forming arches to which succeed some areolæ, they send, over the two surfaces of the colon, twigs at first parallel, and afterwards divided a great number of times. After furnishing these arteries, the inferior mesenteric gives off some small, and in all respects very irregular arteries, and presently after divides into one or two branches.

D. The Superior Hæmorrhoidal Arteries descend along the posterior surface of the rectum, at first superficial, soon conceal themselves in the layer of longitudinal fleshy fibres of the intestine, progressively diminish in size, and end by minute twigs, after giving off laterally a great number which embrace from behind forwards the circumference of the rectum, and anastomose on its fore part with each other and with the middle and inferior hæmorrhoidal arteries; some twigs leave the rectum upon its sides, and go to communicate with the lateral sacral arteries. Their terminating branches approach to within a short distance of the anus; they can only be examined along with the anatomy of the rectum after a lateral section of the pelvis has been made. The student may now remove the viscera to which the branches of the cœliac, superior mesenteric, and inferior mesenteric arteries proceeded (with the exception of the rectum which must be left in its place for future examination); this will enable him to clean the main trunk, *i. e.* the aorta, and all the remaining branches it gives off. These are mostly lateral, and proceed either to certain viscera, or to the walls of the abdomen.

384. Capsular Arteries. These arteries are two in number, one on each side, and are called *middle*, to distinguish them from those which the phrenic above, and the renal below, send to the supra-renal capsules. Their size is inconsiderable, and they come off from the lateral parts of the aorta a little above the

renal arteries. Sometimes they come from the cœliac trunk. Directed transversely over the sides of the vertebral column, they gain the anterior edge of the capsules, and divide into several branches which spread out upon the two surfaces of these organs, and ramify in their substance. Before arriving at the supra-renal capsules, they frequently send several small twigs to the crura of the diaphragm, and to the mass of adipose cellular tissue which envelops the kidneys. The left, moreover, gives some twigs to the colon and spleen; the right to the duodenum and liver.

385. The RENAL *or* EMULGENT ARTERIES. Of large size, short, and generally two in number, one on each side, they come off below the capsular arteries and the superior mesenteric, forming with the aorta an angle approaching more or less to a right one. The left is commonly a little more anterior and higher than the right. Immersed in abundant adipose cellular tissue, directed transversely over the sides of the bodies of the vertebræ, covered by the renal vein and peritoneum on both sides, and, on the right only, by the vena cava inferior, they arrive, after a short course, at the fissure of the kidneys, where they divide each into two, three, or four large branches. Before arriving at the kidney, they give off only some slender twigs, which ascend towards the supra-renal capsules, or lose themselves, under the name of *Adipose Arteries*, in the surrounding fat. They also, however, frequently furnish the spermatic arteries. The three or four branches which terminate each renal artery separate from each other, and enter the kidney, between the pelvis, which is behind and below, and the roots of the renal vein, which are before. They divide into a considerable number of twigs which pass between the walls of the pelvis and parenchyma of the kidney, and subdivide around the calyces into a number of small twigs. These pass round each of the bundles of tubes which are to form one of the mammillæ of the kidney, and anastomose with each other so as to constitute a distinct arch, the convexity of which is turned towards the cortical substance, which receives a great number of ramifications from it. In some subjects there are three or four renal arteries on each side; but this arrangement is not of frequent occurrence.

386. The SPERMATIC ARTERIES. One on each side, slender and of great length, they come off from the anterior or lateral parts of the aorta, and sometimes from the renal arteries. They do not always both come off from the aorta at the same level, but pretty frequently one of them is higher than the other. In all cases forming with it an acute angle below, they descend almost vertically, and only a little outwards, over the sides of the vertebral column, before the psoæ muscles and ureters, whose direction they cross, and behind the peritoneum. The right passes, moreover, backwards, or before the vena cava inferior. Their course is extremely flexuous. They are presently after united to the spermatic veins, and distributed very differently in the male and in the female; after previously giving off, in either sex, very small twigs to the fat and lymphatic glands of the surrounding parts, as well as to the walls of the ureters and to the peritoneum. *In the Male,* the spermatic artery, placed beside the vas deferens, issues by the inguinal ring, and is distributed to the testicles, giving off by the way ramifications to the different parts which constitute the spermatic chord. At its termination, it divides into two bundles of twigs, one of which goes to the epididymis, the other to the testicle. The first penetrate by the head of the epididymis, are expanded in that body, and give some ramifications to the tunica albuginea and the substance of the testicle. The others penetrate into the testicle by its upper edge, and give to the tunica albuginea a great quantity of ramifications, which afterwards lose themselves upon the fibrous septa lying between the masses of the spermatic ducts. *In the Female,* after crossing the edge of the psoas muscle, the spermatic artery dives into the pelvis and goes to the ovary, hence called *ovarian artery.* Most of its twigs lose themselves in the tissue of that organ. The others are distributed in the Fallopian tube, the round ligament, and on the sides of the uterus, where they anastomose with the uterine arteries.

387. The LUMBAR ARTERIES are commonly four on each side. Five, however, are not unfrequently met with, and sometimes only three. Their size is always greater than that of the intercostal arteries. They come off as much from the posterior part as

from the sides of the aorta; and direct themselves more or less transversely outwards over the middle of the bodies of the first four lumbar vertebræ, being covered by the psoas magnus, or by the crura of the diaphragm. At the base of the transverse processes, they divide into a dorsal or posterior branch, and an anterior or lumbar branch, properly so called, after sometimes giving a few small twigs to the bodies of the vertebræ, the cellular tissue, and the lymphatic glands of the loins, the crura of the diaphragm, and psoæ muscles. The dorsal branches of the four lumbar arteries are very slender. They send at first into the vertebral canal a twig which is distributed to the spinal marrow and its envelopes, and then dive into the substance of the fleshy mass of the sacro-lumbalis, and longissimus dorsi muscles, where they lose themselves, sending some ramifications into the intertransversales and multifidus spinæ muscles, and into the integuments. They anastomose with each other. *First Lumbar Artery.* It directs itself outwards, under the lower edge of the twelfth rib, following exactly the attachment of the diaphragm. It then bends downwards, and descends almost vertically between the peritoneum and transversus abdominis muscle, in which latter it loses itself. *Second Lumbar Artery.* Its anterior branch, which is of small size, descends in the substance of the quadratus lumborum and ramifies there. *Third Lumbar Artery.* Its anterior branch, which is very large, dives between the quadratus lumborum and transversus abdominis muscles, bends towards the iliac crest, and divides, towards the posterior third of the latter, into two large twigs, which pass through the broad muscles of the abdomen near their origins, and descend backwards into the glutæi muscles, where they communicate with the twigs of the glutæal artery. *Fourth Lumbar Artery.* Its anterior branch, which is still larger than that of the preceding, directs itself transversely between the psoas magnus and quadratus lumborum, along the inferior attachment of the latter, gives large twigs to the iliacus muscle, passes above the iliac crest, and is equally dispersed in the glutæi muscles.

388. The continuation of the *abdominal aorta* may now be traced. It follows pretty nearly the course

of the vertebral column, from where it passes between the crura of the diaphragm to its ultimate division into the common iliacs, opposite to the inferior part of the fourth lumbar vertebra. The omenta, stomach, large and small intestines lie in front of it, also many of the great arteries we have just described. But notwithstanding, the aorta in thin persons is comparatively near the surface of the body where placed on the third and fourth lumbar vertebræ. The thoracic duct and vena azygos generally pass with it behind the diaphragm. A great portion of the abdominal aorta is covered by the mesentery, the vena cava abdominalis is situated to the right side, and both vessels are enclosed by a sheath of cellular substance, in which also are many lymphatic vessels, glands, and branches of the sympathetic nerves. Moreover, in its course downwards, it is crossed by the vena portarum between the first and second lumbar vertebræ, by the pancreas, by the duodenum and left emulgent vein. The *arteria sacri media* which some consider as a branch of the abdominal aorta, will be examined along with the arteries of the pelvis. (For the anatomy of the abdominal veins, and of the vena portæ, see the section treating of the veins.) The anatomy of the nerves of this region will be most conveniently dissected and examined along with those of the pelvis; we shall therefore delay their consideration for a little, and proceed with the anatomy of

389. The PELVIC VISCERA. The subject must be put as in the situation for the operation of lithotomy, and a thin block placed under the pelvis; a grooved staff introduced by the urethra into the bladder, and secured there, and the scrotum well raised up with hooks; this exposes the perinæum. The *Perinæum* is bounded in front by the scrotum, behind and at the sides by the coccyx and sacro-sciatic ligaments and tuberosities of the ischium; laterally, but more forward, by the rami of the pubis and of the ischium. The integuments are tense, thin, and stretched as it were across this space, and are, like the scrotum, of a darker colour than in other parts of the body; along the mesial plane extends a raphe, which may also be traced over the scrotum and lower surface of the penis. Dissect off the integuments of this region by two flaps, to be reflected outwards

towards the thighs and tuberosities of the ischion; this dissection exposes the *superficial perineal fascia.* This fascia is an exceedingly important part: anteriorly, it is continuous with the dartos, or at least with that layer of the scrotum which corresponds to the superficial fascia of the abdomen; laterally, it extends to the thighs, after being attached to the rami of the pubes and ischion; posteriorly, it proceeds to the verge of the anus, where it degenerates into loose cellular tissue, proceeding to the right and left of the termination of the gut. Divide the fascia into two by a vertical incision, and reflect its sections towards the tuberosities of the ischion. This exposes the fascia propria of the muscles, which the French anatomists have called the *middle perineal fascia;* but the name is not a good one, neither can there be any occasion for distinguishing it by a particular name; remove this fascia carefully from all it covers, likewise clean the surface of the sphincter of the anus. The parts thus exposed are, 1st, muscles; 2d, other parts. The muscles are the sphincter ani, the erectores penis, the acceleratores urinæ, the transversales perinæi. The other parts are, a portion of the urethra, the central point of the perinæum, the ischio-rectal space, and some branches of the common pudic arteries, veins, and nerves.

390. The Sphincter Ani is usually divided into two parts, an external sphincter and an internal. The *sphincter externus* is an oval membranous muscle surrounding the anus. It is attached to the tip of the coccyx by a sort of cellular tendon, from which two fleshy bundles arise, which, passing round the sides of the anus, unite again before it to form a fleshy point, which is partly confounded with the accelerator urinæ, and partly expanded in the cellular tissue, more especially into that part of it called the *central point* of the perinæum. The fibres of this muscle are concentric and semi-elliptical, and interlaced with each other in the median line, forming acute angles. Within this a thick fleshy bundle close to the mucous membrane surrounds the anus; these have no attachment to the coccygeal bones posteriorly: this is the *sphincter internus.* In the female its anterior portion is much more

rounded than in the male. The *inferior surface* of the externus is covered by the skin. The *upper* corresponds to the levator ani, from which it is almost every where separated by cellular tissue, but with which it is intimately confounded near the rectum. Anteriorly, it also unites in part with the accelerator urinæ and transversus perinæi. This muscle closes the anus, and wrinkles the surrounding skin. In the male, it draws the bulb of the urethra backwards.

391. The ERECTOR PENIS (*Ischio-Cavernosus*) is a small elongated flat muscle, broader in the middle than at its extremities, which surrounds the origin of the corpus cavernosum. Fixed to the inner side of the sciatic tuberosity, it ascends forwards and inwards, and degenerates into a white and strong aponeurosis, identified, beyond the level of the bulb of the urethra, with the fibrous membrane of the corpus cavernosum, over which it is applied by its outer surface, which moreover corresponds to the ramus of the ischium, while its inner surface is in connexion with the transversus perinæi and accelerator urinæ, from which it is separated by much adipose cellular tissue, together with vessels and nerves. It draws the root of the penis downwards and backwards.

392. The ACCELERATOR URINÆ or BULBO-CAVERNOSUS is long, flat, broader behind than before, and situated in the perinæum, beneath the bulb of the urethra and the root of the penis. A raphe extends inferiorly along the mesial line of the urethra as far back as the central point of the perinæum ; this raphe is tendinous, and there the muscles of the opposite sides meet, and are firmly attached. From this, which for the sake of the description we may call the origin of the muscle, the muscular fibres proceed outwards and upwards, to terminate by being inserted, 1st, into the fibrous membrane of the corpus cavernosum ; 2d, a few into the deep perinæal fascia ; 3d, into a tendon which is common to the muscle of the opposite side, and lies above the urethra. The *upper surface* of this muscle covers the bulb, and the commencement of the spongy portion of the urethra, as well as the corpus cavernosum. The *lower* is covered by the skin, the sphincter ani, and the erector penis, from which it is separated by

much cellular tissue. This muscle compresses the posterior part of the canal of the urethra, which it carries backwards and upwards. It accelerates the ejection of the urine and seminal fluid.

393. The TRANSVERSUS PERINÆI is a small, flat, thin, irregular muscle, varying much in form, more commonly triangular, sometimes composed of several separate bundles, and situated at the posterior part of the perinæum. It is often wanting in women. It arises, by short aponeuroses, from the inner part of the tuberosity and the ramus of the ischium, above the erector penis and root of the corpus cavernosum, directs itself inwards and a little forwards, and terminates at a tendinous line placed between it and its fellow, being also in part confounded with the accelerator urinæ and sphincter ani, and in the female with the constrictor vaginæ also. Sometimes all its fibres unite with the accelerator urinæ; they are always longer behind and below than before and above. The *anterior surface* of the transversus perinæi, which is inclined downwards, corresponds to the erector penis and accelerator urinæ, and a mass of cellular tissue, which fills up their interval. The *posterior surface* is covered by the levator ani, from which it is separated by much cellular tissue, and externally by the deep branch of the internal pudic artery. It concurs with the accelerator urinæ, to compress the urethra; and with the levator ani, it supports the lower part of the rectum and the bladder. Santorini described all these muscles with more care than modern anatomists; he also pointed out the frequent occurrence of a second transversus muscle (transvers. perinæi alter), arising like the former, but uniting itself to the accelerator muscle. The student may now examine this dissection, with a reference to the other parts spoken of; 1st, the triangular space bounded by the accelerator urinæ, erector penis, and transversus muscles. In the lower part or base of this space, on the left side, the surgeon most readily cuts into the urethra in lithotomy, feeling first for the groove in the staff. By a little dissection carried into the deepest part of the space, the student will readily find the sub-pubic triangular membrane through which the urethra runs.

2d, By dissecting through or behind the erector penis on either side, he may examine the position of the common pudic artery, and the coming off of certain of its branches, particularly the artery of the bulb. 3d, Divide the raphe, uniting the acceleratores muscles to each other, and by this means examine the bulb of the urethra, and its connection with the central point of the perinæum. 4th, Between the tuberosity of the ischium on each side, and the anus and rectum which occupy the mesial line of the pelvis, is the ischio-rectal space. This is not important surgically; but by clearing away the fat and cellular substance which here abound, the student will reach the inner side of the obturator internus muscle and the outer side of the levator ani, both being covered by a fascia, which will ultimately be traced to the pelvic fascia. He may even clean the outer surface of the levator ani, and take a view of the muscle from this side. Lastly, by detaching the left crus penis from the ramus of the pubes and ischion, also the erector penis, he may better expose the anterior surface of the sub-pubic triangular membrane, and see the urethra passing through it. By this incision, he also exposes the deep suspensory ligament of the penis, the dorsal and central arteries, and the vena dorsalis. It has been recommended to divide the central point in the perinæum, and thereby expose the inferior fundus of the bladder and the prostate gland, but this view could only benefit the very advanced student. We have very carefully described the sub-pubic triangular membrane, (note to 151), and the student would do well to revert to that description, and to the engravings of the ligaments. The points most worthy of his attention at present are, the passage of the urethra through the membrane, the layer which it detaches anteriorly along the surface of the urethra, towards the bulb, and the glands of Cowper, which may either be exposed now, by cutting through a portion of the membrane, or left to be dissected afterwards, when the lateral section of the pelvis has been made.

394. Lateral Section of the Pelvis. Divide the left pubis vertically with a saw, at the distance of about three-fourths of an inch from the symphysis, and detach the remains of the left os innominatum, by

opening the sacro-iliac articulation; leave all the soft parts, if possible, within the pelvis connected with the opposite side; and having distended the bladder and rectum, clean cautiously the whole of the surfaces, taking care to preserve every important part. When this is done, the student ought to review the position of all the parts displayed with the greatest attention. Commence with the peritonæum, tracing it from the walls of the abdomen upon the surface of the superior fundus of the bladder, a little of the sides, and the posterior surface where the bladder faces the rectum; observing, at the same time, that all the anterior surface, the neck, a great deal of the lateral regions, and all the inferior surface, are entirely without any peritoneal covering. Next trace this membrane, where it forms the deep cul-de-sac between the bladder and the rectum, marking the point of its reflexion from the one organ to the other, and the formation of the meso-rectum, by which about three inches of the lower part of the rectum is altogether without a peritoneal covering; likewise that the back part of the rectum is equally uncovered by it. Next examine the *pelvic fascia* of the left side. A better view of this fascia will be afterwards obtained in dissecting the right side of the pelvis; in the mean time may be noticed, the detached portion which lined the inside of the left obturator and levator ani muscles, and which being reflected from the walls of the pelvis upon the viscera, nearly upon a level with the upper surface of the prostate gland, transmits a lamina (*vesical fascia*) over the surface of the bladder, encloses the prostate, sends a partition between the prostate, bladder, and rectum, and finally encloses the rectum (*rectal fascia*). Dissect off a small portion of the vesical fascia, in order to examine its strength and attachments; lay open the rectal fascia by a longitudinal incision, and clean the *external* or longitudinal muscular tunic; clean the ureter and vas deferens, and trace the former to the bladder, the latter to the back of the prostate gland; dissect between the prostate, bladder, and rectum, and drawing the former upwards, expose the vesicula seminalis first of the left side, then the fundus of the bladder, and next the vas deferens and seminal vesicula of the right side. It is at the back of the prostate that the bladder may be punctured through the rectum. The position and size of the Prostate Gland must next be adverted to and its surgical anatomy. The way in which it surrounds the neck of the bladder and commencement of the urethra, the firmness it gives to these parts, the consequent danger and impropriety of cutting it through and through in lithotomy, the lamina it receives from the sub-pubic triangular membrane. The left levator ani muscle should also be attended to, and laid up and down, so as rightly to understand the indirect support it gives the prostate gland and bladder, and the more intimate union it has with the pouch of the rectum. In front of the prostate is the membranous part of the urethra and the glands of Cowper; these will be more particularly examined afterwards.

395. The Levatores Urethræ or *muscles of Mr. Wilson,* must be examined at this stage of the dissection. These muscles, viewed by Albinus as a portion of the levatores ani, are yet generally distinct. They arise narrow and tendinous on the inside the symphysis pubis, beneath the anterior ligaments of the bladder; running parallel with its fellow, they both descend, fleshy and increasing in breadth, until they reach the sides of the membranous portion of the canal of the urethra where they surround and embrace it, inferiorly connected with each other and the central point of the perinæum. They elevate, compress, and probably occasionally contract the urethra at its narrowest part, and it is also possible, that by spasm or otherwise, they may sometimes offer obstacles to the passage of the staff or catheter. Mr. Guthrie has given a more complicated view of these muscles; this distinguished surgeon being of opinion, that anatomists have only described *half a muscle*, forgetting the lateral connection it has on each side with the ramus of the pubis. The fibres shewn the author by Mr. Guthrie, appeared to resemble rather an elastic and vascular tissue than a muscular structure, but the *subject* may have been an unfavourable one, having been preserved in alcohol. Finally, the student may now review the position of the bulb of the urethra and its surgical anatomy, with great advantage. The most

advantageous time for examining the anatomy of the rectum is also at this stage of the dissection.

396. The RECTUM occupies the posterior part of the pelvis, and terminates the digestive canal. It succeeds the sigmoid flexure of the colon, and extends from the left side of the sacro-vertebral articulation to the summit of the coccyx, where it opens externally. It is a little inclined from left to right at its commencement; but afterwards follows the median line of the body nearly in a vertical direction, accommodating itself to the curve of the sacrum, and thus describing a curve, the general concavity of which is anterior. Frequently also it presents lateral reflections more or less distinct. It is cylindrical in the greater part of its extent; but, near its inferior extremity, particularly in the adult, commonly presents a more or less considerable expansion. Less voluminous than the cœcum aud colon, it is yet susceptible of very great dilatation, and does not present at its surface either bulgings or muscular bands; only in the state of vacuity, it is marked with some irregular transverse wrinkles, which arise from the falling in of its walls. The rectum being immoveably fixed in its place, its relations are not subject to variation, although they differ anteriorly in the different sexes. Thus in the male, it corresponds, inferiorly and anteriorly, to the fundus of the bladder, the prostate gland, and vesiculæ seminales, while in the female, it is covered by the vagina, with which it is connected by a very considerable vascular lace-work. To this union the name of *recto-vaginal septum* is given. But anteriorly and superiorly, the rectum is covered by the peritoneum in both sexes, and is in contact with the uterus in the female, and the body of the bladder in the male. Frequently, one or two convolutions of the small intestine glide between it and these organs. Posteriorly, and in both sexes, the rectum lies upon the sacrum and coccyx, from which it is separated by the hypogastric vessels and nerves, contained in a fold of the peritoneum, broad above, where it is continuous with the sigmoid colon, narrow below, and bearing the name of *meso-rectum*. At its lowest part, it is in contact with the levator ani muscle. On its sides, this intestine is only connected with the adipose cellular tissue which

occurs abundantly in the pelvis, and with the levatores ani. The *outer surface* of the rectum is smooth, polished, and white, being covered above by the peritoneum; the lower part, called pouch of the rectum, has no peritoneal covering, but is enveloped by a thick layer of cellular substance, which may be traced to the pelvic fascia. It presents in its whole extent vertical and parallel striæ, which are owing to the presence of longitudinal muscular fibres uniformly diffused over its whole circumference, so that it has a considerable resemblance to the œsophagus considered also with reference to its exterior. There are, moreover, observed upon it, the numerous anastomoses of the hæmorrhoidal vessels, and some fatty appendages towards the base of the sacrum. The *inner surface* of the rectum is commonly smooth in its upper half, but, in the lower, that is, in the pouch of the rectum, there are observed some parallel longitudinal wrinkles, which are thicker near the anus, and of variable length. These wrinkles, whose number varies from four to ten or twelve, and which are called the *columns of the rectum*, are formed by the mucous membrane and the layer of subjacent cellular tissue. Between these columns, there are almost always to be found two membranous semilunar folds, oblique or transverse, of which the floating edge is directed from below upwards towards the cavity of the intestine. These folds are called the shelf-like projections of the rectum; the larger of them lies about $2\frac{1}{2}$ to 3 inches from the anus; it forms a well-marked division between the upper or true *rectum* and the lower or *pouch*. These folds form a kind of lacunæ, the bottom of which is narrow and directed downwards. There are observed, moreover, on the inside of the rectum the orifices of mucous follicles which are directed from above downwards, and reddish villosities belonging to the mucous membrane. The follicles in question pour into the rectum a white and pretty thick mucus. The *upper extremity* of the rectum communicates with the end of the sigmoid flexure of the colon. The *lower*, which is very contracted, is terminated by the *anus*, which is situated at about an inch before the coccyx. On the edges of the anus, the inner membrane of the intestine is continuous with the skin, which, there. is very delicate, furnished with radiating plicæ, and covered with a greater or less quantity of hair which exists only in the adult male. This extremity is embraced by the sphincter ani, and by the two levatores ani. Next proceed, 1°. With the examination of the pelvic fascia of the *right side*. 2°. The ligaments and connections of the urinary bladder. 3°. The anatomy of the levator ani, ischio-coccygeus, and sacro-coccygeus muscles. 4°. The arteries and veins of the pelvis.

397. Examination of the Pelvic Fascia on the Right side. The peritoneum having been stripped off and the loose cellular substance removed, clean and afterwards divide the remains of the right umbilical artery and vesical arteries, draw the rectum and bladder forcibly towards the left side, and in a great measure out of the pelvis, but leaving them connected; this displays the pelvic fascia which may be now seen descending from the linea ileo-pectinea, and covering the obturator internus muscle and concave side of the levator ani; after descending to a level with the prostate, it is reflected upwards upon the sides, and front of the urinary bladder, becoming thus the vesical fascia. A sort of tendinous arch strengthening the fascia, extends from the back of the symphysis to the spine of the ischion. This may be considered as a principal origin of the levator ani; above and behind, this arch may be seen shining through the fascia, the muscular fibres of the obturator internus; in front and below it, may in like manner be seen the fibres of the levator ani; at the back of the cavity of the pelvis, where investing the rectum, the fascia degenerates into loose cellular tissue. At the tendinous arch we have just described, the pelvic fascia divides into two layers; one, the internal, descends on the inner or concave side of the levator ani; this we have just described; to see the other or external, look into the ischio-rectal space, where it will be found to have again subdivided into two layers, the innermost of which invests the convex surface of the levator ani, and the outermost proceeds to the tuberosity and ramus of the ischion to shut in the obturator muscle and common pudic artery.

398. The Ligaments of the Bladder should

be examined next, and its *different regions* named. When empty, the bladder (vesica urinaria) sinks down into the pelvis below the level of the symphysis pubis; when even moderately distended, it rises up into the hypogastric region. In this condition it is most advantageously studied. The folds of peritoneum by which that membrane assists in securing the bladder in its natural position, have very improperly been termed *false* ligaments; they are five in number, viz. one superior, two lateral and two posterior. The reflected portion of the peritoneum forming the *superior false ligament* proceeds from the recti muscles to the superior fundus of the bladder; the remains of the urachus and of the umbilical arteries are on its outer surface. The false *lateral ligaments* are merely those folds of peritoneum extending from the sides of the bladder to the iliac fossæ; it forms anteriorly a duplicature in which will be found the vas deferens in the male and the round ligament of the uterus in the female. The *posterior false* ligaments formed also by folds of peritoneum, extend from the back of the bladder to the sides of the rectum; they give rise to duplicatures or folds containing the obliterated umbilical artery and ureter. There are *four true ligaments* of the bladder, two anterior and two lateral; these are formed by the pelvic fascia, and are formed merely by the connexion of the fascia to the bladder at the point of its reflexion upon that organ from the walls of the pelvis. The anterior of these two ligaments pass backwards from the inferior margin of the pubes near the symphysis, and expand upon the neck of the bladder and prostate gland; the dorsal veins of the penis pass between them on their way to join the iliac veins. Surgical anatomists have made the most of the different regions of the bladder. They have been divided into, a *superior fundus*, an *inferior fundus*, resting on the rectum; a *body* and *cervix*. Besides these, there are the *superior region*, the *lateral regions*, the *anterior region*, the *posterior region*, lastly, the *inferior region*, all which present different relations which the student cannot examine too often so long as the bladder is *in situ*. The student may now proceed to examine the anatomy of the levator ani, ischio-coccygeus and sacro-coccygeus muscles.

Also the origins of the obturator internus and pyramidalis.

399. Levator Ani muscle. This muscle completes the lower wall of the abdomen, forming, at the lower part of the pelvis, a concave floor, sustaining the inferior part of the rectum and the bladder, around which it forms a cincture, also embracing the commencement of the urethra, and the vesiculæ seminales. Thin, membraneous, irregularly quadrilateral, broader above than below, arises by short aponeurotic fibres, from the inferior and posterior part of the symphysis pubis, from the ileum, from above the upper region of the obturator internus, from the sciatic spine, and from the pelvic fascia. These different origins, which are continuous with each other, are only a little interrupted, toward the obturator hole, for the passage of the obturator nerve and vessels. The middle and anterior fleshy fibres descend from without inwards and from before backwards; they unite behind and beneath the rectum, with those of the opposite side, and envelope that intestine in a radiating manner; some of the more anterior seem to be attached to the prostate gland, or confounded with the sphincter ani. The posterior descend inwards, and terminate below the sides of the coccyx, forming a tendinous line. The *outer surface* of this muscle corresponds to a lamina of the pelvic fascia, to the glutæus maximus and transversus perinæi, as well as to the fat which surrounds the anus. Its *inner surface* corresponds anteriorly to the bladder and prostate gland, and to the inner lamina of the pelvic fascia, and embraces the lower part of the rectum. Its *posterior edge* is continuous with the coccygeus muscle. In the female, this muscle adheres strongly to the vagina, before arriving at the rectum. It is weaker than in the male, and its fibres, especially the posterior, are less curved. This muscle raises and carries forward the rectum, which it compresses, at the same time that it resists the action of the diaphragm and abdominal muscles. It also favours the ejaculation of the spermatic fluid, and the expulsion of the urine. In the female, it contracts the vagina a little.

400. The Ischio-Coccygeus is of a triangular form, thin, and flat, and concurs, with the preceding, behind

and above which it is placed, to form the floor of the abdominal cavity. Attached to the inside of the sciatic spine, it descends enlarging to be attached to the whole edge of the coccyx, and the lower part of the lateral surface of the sacrum ; it is even prolonged a little upon the anterior surface of that bone. This muscle is a mixture of fleshy and aponeurotic fibres, which seem to be confounded in an intimate manner with those of the anterior sacro-sciatic ligament. It frequently receives, from the lower part of the sacrum, a small bundle (the *Curvator coccygis* or sacro-coccygeus of Soemmering) thin, slender, descending over the middle of the coccyx, and uniting with the two muscles at once. Its *posterior surface*, which inclines downwards, is covered by the two sacro-sciatic ligaments. The *anterior* corresponds to the rectum and the cellular tissue which surrounds it. It retains the coccyx, and prevents it from being turned backwards during the excretion of the feces. Its motions are not very decided. Previously to removing the viscera of the pelvis for a systematic examination of their structure, the student, if advanced in his studies, had better examine the arteries and veins of the pelvis.

DISSECTION OF THE ARTERIES AND VEINS OF THE PELVIS.

401. The Middle Sacral Artery (*Arteria sacri media*), arises from the posterior part of the abdominal aorta, a little above its bifurcation, before the fourth lumbar vertebra. Its size is about the same as that of the lumbar arteries ; but it is frequently much less. It descends vertically, and in a flexuous manner, over the sacro-vertebral articulation, and upon the anterior surface of the sacrum, placed, in the median line of the body, behind the rectum, the superior hemorrhoidal vessels, and the nerves of the hypogastric plexus. It is very slender when it arrives at the coccyx, and terminates towards the summit of that bone, anastomosing by two arches with the lateral sacral arteries, and sending small twigs into the fat which surrounds the rectum, and into the ischio-coccygeus muscle. The middle sacral artery furnishes a great number of lateral branches. The first frequently take the place of one of the inferior

lumbar arteries. They are generally very small and irregular, and communicate with the ileo-lumbar arteries. The others which are larger, come off to the right and left, at the middle of each false vertebra of the sacrum; they direct themselves transversely outwards, and unite, near the anterior sacral holes, with the branches of the lateral sacral arteries. Sometimes they pass through these holes, and are distributed upon the last spinal nerves. In their course they furnish many ramifications to the periosteum of the sacrum.

402. Common Iliac Arteries result from the bifurcation of the aorta, generally opposite the body of the fourth lumbar vertebra. Both arteries are of equal size, descend and separate at an acute angle, directing themselves forwards, as far as the sacro-iliac symphysis, where they divide each into two large arteries, the *Hypogastric* and *External Iliac*. The *right common iliac* artery passes before the end of the iliac vein, and covers the vena cava inferior. The left is accompanied internally and posteriorly by the left common iliac vein, and is only covered by the peritoneum. The ureters cross, anteriorly and at right angles, the direction of each of them. Externally, they are both applied upon the psoæ muscles. These arteries give off no branch, excepting a few slender twigs to the walls of the iliac veins, the peritoneum, the lumbar lymphatic glands, and the ureters.

403. Internal Iliac, (*Hypogastric Artery*), is smaller than the external iliac, dives almost vertically into the excavation of the pelvis, before the sacro-iliac articulation, and, directing itself forwards, forms a curve, of which the convexity is posterior. At the end of a short course, it separates into numerous branches, which arise separately, or by common trunks, and are distinguished into *posterior*, *anterior*, *internal* and *inferior*.

A. Ileo-lumbar Artery, (*first posterior branch of the hypogastric*), arises opposite the base of the sacrum. It ascends outwards and backwards, before the lumbo-sacral nerve, and behind the psoas muscle, which receives some ramifications from it; towards the anterior edge of the base of the sacrum, it divides into two branches, one ascending, the other transverse. The *ascending branch* ascends vertically between the psoas muscle, os ileum and last lumbar vertebra, and terminates by anastomosing with a branch of the fourth or fifth lumbar artery; it sends ramifications into the psoas, iliacus and quadratus lumborum muscles, and into the periosteum of the sacrum and the iliac bones: one of its twigs enters into the vertebral canal, under the fourth or fifth lumbar vertebra, and is distributed to the dura mater and nerves, there anastomosing with the artery of the opposite side, the lateral sacral and the last lumbar. The *transverse branch* directs itself outwards, between the psoas and iliacus muscles, and subdivides into two orders of twigs. Some of these spread out upon the anterior surface of the iliacus muscle, beneath the peritoneum, and anastomose anteriorly with the circumflex iliac: the other, or *deep* twigs, penetrate into the muscle, and are distributed in all directions to its fleshy fibres and to the periosteum of the iliac fossa. One of them, of considerable size, enters the iliac bone, by the hole which is observed at the middle of the iliac fossa.

B. SACRO-LATERAL ARTERY, (*second posterior branch of the hypogastric*). Directed inwards and downwards, it descends before the anterior sacral holes, and reaches the summit of the coccyx, where it anastomoses by an arch with the middle sacral artery. The *External* or *Posterior twigs* are large, usually four in number; introduce themselves into the sacral canal by the anterior sacral holes, and divide each into two secondary twigs; one passes over the anterior wall of the sacral canal; the other issues by the posterior sacral hole, and loses itself in the muscles of the vertebral grooves; those of one side generally communicate with those of the opposite side. The *Internal twigs* spread their ramifications in the sacral nerves and glands in the pyriformis muscles, and upon the periosteum of the sacrum, anastomosing with the lateral branches of the middle sacral artery.

C. GLUTÆAL ARTERY, (*third posterior branch of the hypogastric*), and usually its largest branch. Directed downwards, outwards and backwards, it issues from the pelvis by the upper part of the sciatic notch, above the pyriformis muscle, between the lumbo-sacral and the anterior branch of the first sacral nerve. It gains the posterior part of the pelvis, is covered by the glutæus maximus, and near the posterior edge of the glutæus minimus, divides into two branches, the one superficial, the other deep. Before issuing from the pelvis, this artery sends some small twigs to the rectum, pyriformis muscles and neighbouring cellular tissue. The *superficial branch* directs itself outwards, between the glutæus maximus and glutæus medius muscles, and separates into many twigs, anastomosing with the sciatic artery. The *deep branch* ascends from behind forwards, between the glutæus medius and glutæus minimus, gives first a nutritious twig to the os innominatum, and subdivides into three secondary branches. Of these, the *upper* chiefly supplies the glutæus medius and minimus; the *middle* or transverse branch goes mostly to the glutæus medius; the *lower* branch gives branches to the pyriformis and glutæus minimus, capsule of the hip-joint and rectus femoris, anastomosing with twigs of the femoral artery.

D. UMBILICAL ARTERY, (*first anterior branch of the hypogastric*). Directed forwards and inwards as far as the lateral and upper part of the bladder, it bends upwards to ascend behind the anterior wall of the abdomen, where it is contained in a fold of the peritoneum, and whence it directs itself towards the umbilicus, approaching the urachus and that of the opposite side. In the adult, this artery is all but obliterated. But in the fœtus, it is of large size, and appears to form the true continuation of the trunk of the hypogastric artery. On arriving at the umbilicus it issues by that aperture, forms part of the umbilical cord, and gains the placenta; it then furnishes all the other branches of the hypogastric, while after birth it gives only a few very slender twigs to the bladder and uterus.

E. VESICAL ARTERIES, (*second anterior branch of the hypogastric*), varying as to number and origin. The umbilical artery always furnishes three or four, which ramify in the walls of the bladder, and anastomose there with each other, and with the neighbouring branches. The middle hæmorrhoidal, internal pudic, and obturator arteries furnish others. The hypogastric produces one a little larger, which gains the fundus of the bladder, and sends it numerous twigs, as well as to the commencement of the urethra, and in the male, to the prostate gland, vesiculæ seminales and vas deferens. Its last ramifications reach as far as the rectum.

F. Obturator Artery, (*third anterior branch of the hypogastric*), sometimes a branch of the glutæal, and also of the epigastric; in the latter case, it descends vertically behind the iliac bone as far as the obturator hole. When normal, *i.e.* a branch of the hypogastric, it directs itself forwards and outwards, then turns horizontally into the excavation of the pelvis, over the obturator internus muscle, under the obturator nerve, along with which it issues from the pelvis through the empty space left by the obturator membrane. In this course it is slightly flexuous. Near its origin, it gives off a large twig which is distributed to the iliacus muscle. Also a number of small twigs to the obturator internus, to the neighbouring lymphatic glands, and to the bladder. Before entering into the obturator hole, it gives off a branch which directs itself behind the symphysis pubis, sends ramifications upon the periosteum, and anastomoses with a similar branch of the opposite obturator artery. At its exit from the pelvis, on the upper edge of the obturator externus muscle, the artery divides into two branches, a posterior and an anterior. The *Posterior branch* descends along the outer edge of the obturator hole, placed between the two obturator muscles, in which it sometimes directly loses itself. In general, however, it reaches as far as the sciatic tuberosity, bends outwards beneath the quadratus femoris muscle, and gains transversely the back part of the thigh, where it gives several twigs to the ileo-femoral articulation, and anastomoses with the descending branch of the sciatic artery. It loses itself in the surrounding muscles; but there is detached from it a very remarkable small twig, which penetrates into the cotyloid cavity by its inferior notch, and goes to be distributed to the reddish cellular tissue which fills the deepest part of that cavity. The *Anterior branch* descends between the long and short adductor muscles, giving off twigs to them, as well as to the neighbouring muscles, and to the integuments of the upper and inner region of the thigh and of the genital parts. It terminates by anastomosing with a twig of the internal circumflex artery. Near its commencement, it sends off a small twig which descends along the internal edge of the obturator hole, to anastomose with a twig of the posterior branch, so that this foramen is surrounded by a complete arterial circle.

G. Middle Hæmorrhoidal Artery (*first internal branch of the hypogastric*), of more constant occurrence in the female than in the male, varying in size and origin, and frequently coming off from the ischiatic or internal pudic. It descends obliquely over the anterior part of the rectum, behind the fundus of the bladder in the male, and behind the vagina in the female, separating into a number of twigs, which expand in different parts, and anastomose superiorly with the hæmorrhoidal twigs of the inferior mesenteric artery, and inferiorly with those of the internal pudic.

H. Uterine Artery, (*second internal branch of the hypogastric*), small in the unimpregnated state, but at the end of gestation larger than any other branch of the hypogastric artery. It directs itself at first upon the lateral and upper part of the vagina, between it and the bladder, giving off a number of twigs to both these organs. It then ascends, in the substance of the ligamentum latum, upon the sides of the uterus, and has an extremely flexuous course; divides into numerous twigs, which penetrate into the tissue of the organ, proceed transversely and in a flexuous manner over its two surfaces, and anastomose in the median line with those of the opposite side. It also sends to the Fallopian tube and round ligament some small twigs which inosculate with those of the spermatic arteries.

I. Vaginal Artery, (*third internal branch of the hypogastric*), exists only in the female; when absent it is replaced by twigs of the uterine, vesical and middle hæmorrhoidal arteries, which are distributed in the walls of the vagina. It descends forwards, furnishing a twig to the lateral region of the bladder, then continues its course over the side of the vagina, gives it numerous branches, and reaches as far as its orifice, whence it distributes ramifications to the external parts of generation.

K. Ischiatic Artery, (*first inferior branch of the hypogastric*), appears to be the true continuation of the trunk of the hypogastric. Directed downwards between the rectum and the walls of the pelvis, before the pyriformis muscle, it issues through the lower part of the sciatic notch, between the inferior edge of the pyriformis and the anterior sacro-sciatic ligament, having behind it the great sciatic nerve. In the pelvis, this artery furnishes twigs to the rectum, bladder, uterus, and levator ani muscle, and at times gives off the two pudic, the middle hæmorrhoidal, and the obturator arteries. At its leaving the pelvis, the ischiatic artery separates into several large branches; one directs itself obliquely downwards and inwards, following the origin of the glutæus maximus which covers it, gives off twigs to it, and loses itself in the ischio-coccygeus and levator ani muscles; another branch is distributed in the lower third of the glutæus maximus and in the cellular tissue which surrounds the sciatic tuberosity; a third accompanies the sciatic nerve as far as the inferior and posterior part of the thigh, and gives twigs to the neighbouring muscles. It anastomoses with the perforating and circumflex arteries.

L. Common or Internal Pudic Artery, (*second inferior branch of the hypogastric*), smaller than the ischiatic, of which it is often a branch. It descends before the sciatic plexus and pyriformis muscle, and issues from the pelvis by the lower part of the great sciatic notch, between the pyriformis muscle and the posterior edge of the levator ani, close to the anterior sacro-sciatic ligament, and separated from the ischiatic artery by a layer of fat. Immediately after, it proceeds downwards and inwards, passes between the two sacro-sciatic ligaments, bends over the anterior, which it embraces externally, places itself upon the internal surface of the ischium, between the obturator internus and levator ani muscles, runs horizontally forwards and inwards to near the common origin of the erector penis and transversus perinæi muscles, and there divides into two branches, which are differently distributed in the male and in the female, and of which one is superficial and the other deep. In the pelvis, this artery occasionally gives off the middle hæmorrhoidal, obturator, &c. But it always sends branches to the bladder, vesiculæ seminales, prostate gland, urethra, rectum, and (in the female) upper part of the vagina. After issuing from the pelvis, it gives off laterally numerous twigs, which may be distinguished into internal and external. The internal are spread out in the midst of fat which surrounds the rectum, and are distributed to the sphincter and levator ani muscles. The others descend towards the tuber ischii, towards the origins of the flexor muscles of the leg and in the integuments. The *superficial perineal branch* runs from behind forwards, between the skin and transversalis perinei muscle, in the adipose cellular tissue which fills the triangular space between the erector penis and accelerator urinæ muscles. At first nearer the ramus of the ischium than the raphe, it approaches the latter as it advances, and gives numerous twigs, (one of which is the *arteria transversalis perinæi*), to the anterior half of the sphincter ani muscle, and to the transversalis perinæi, erector penis and accelerator urinæ muscles, as well as to the integuments. Some of them ascend towards the rectum under the name of *inferior* or *external hæmorrhoidal arteries*, and anastomose with the middle hæmorrhoidal and the termination of the inferior mesenteric. Then the branch itself passes over the accelerator urinæ muscle, dives into the septum of the dartos, and is distributed to the scrotum, dartos, and skin of the penis. The *deep branch* traverses the transversus perinæi muscle, and then ascends above it, along the ascending ramus of the ischium. Concealed by the erector penis muscle, it arrives at the triangular cellular interval which separates the two roots of the corpus cavernosum, before the symphysis pubis, where it divides into two branches which are called the *dorsal artery of the penis*, and the *artery of the corpus cavernosum:* before this however it gives off the *branch of the bulb, (ramus magnus ad urethræ bulbum)* directing itself inwards and forwards, above the transversus perinæi muscle, so far as the bulb of the urethra, into which it dives, subdividing into several twigs. One of them penetrates into the corpus cavernosum, and there anastomoses with the cavernous artery. After giving off the artery of the bulb, the deep branch of the pudic sends small twigs into the obturator internus, erector penis, and transversus perinæi muscles, and into Cowper's glands. The *branch to the corpus cavernosum, (art. corporis cavernosi penis,)* penetrates into the corresponding side of the corpus cavernosum, and presently divides into several secondary twigs, which run along its whole length, and distribute in all directions a great number of ramifications in the midst of the spongy tissue. Some of them perforate the fibrous membrane, and introduce themselves into the walls of the urethra. The *branch to the dorsum of the penis, (art. dorsalis penis,)* passes through the sub-pubic triangular membrane, (note to sec. 151,) runs along the dorsum of the penis. Its course is flexuous, and it gives numerous small twigs to the fibrous membrane of the corpus cavernosum and to the skin. Near the glans, it subdivides and loses itself in the tissue of that part, the right and left arteries frequently anastomosing. In the female, the *superficial branch* of the internal pudic artery, after sending twigs to the transversus perinæi, sphincter ani and constrictor vaginæ muscles, terminates in the substance of the labium. The *deep branch, (art. clitoridis,)* ascends along the ischium and pubes, so far as the interval between the roots of the corpus cavernosum of the clitoris, throws a twig into the retiform plexus which surrounds the orifice of the vagina, and separates, before the symphysis of the pubes, into two secondary branches, one of which penetrates into the corpus cavernosum of the clitoris, *(Art. cavernosa clitoridis,)* while the other creeps upon the back of that organ, *(Art. dorsalis clitoridis.)*

404. External Iliac Artery arises from the bifurcation of the common iliac artery, and extends to the crural arch, where it changes its name to that of femoral artery. It descends obliquely outwards, along the inner and fore part of the psoas muscle, applied posteriorly and internally upon the external iliac vein, and covered by the peritoneum. It is generally straight, but sometimes forms several curves of greater or less extent. In its course, it gives off a few small twigs to the psoas muscle, the peritoneum, and the neighbouring lymphatic glands. Before passing the crural arch, it furnishes two considerable branches, viz., the *epigastric* and *circumflex iliac arteries.*

A. Epigastric Artery, *first branch;* arises from the lower and internal part of the external iliac artery, a little above the crural arch, and beneath the place where the peritoneum leaves the anterior wall of the abdomen to be reflected into the iliac fossa. It immediately directs itself inwards and forwards, crosses the direction of the spermatic cord, which conceals its origin, and ascends vertically to the inner side of it, and of the internal inguinal ring, between the peritoneum and fascia transversalis. It still follows a little the outer edge of the rectus muscle, and at the distance of about two inches above the pubes, passes upon its posterior surface, along which it proceeds as far as the umbilicus, where it terminates by several twigs. This epigastric first gives twigs to the peritoneum, the neighbouring cellular tissue, and the spermatic cord. One twig enters the inguinal ring, and is distributed to the cremaster muscle, the tunica vaginalis, and the skin of the scrotum, anastomosing with the spermatic artery, and in the female, to the ligamentum teres, mons veneris, and upper parts of the vulva. Beyond the spermatic cord, the epigastric artery gives off numerous lateral branches to the rectus muscle, and outwards to the broad muscles of the abdomen; furnishing twigs to the peritoneum, and anastomosing with the lumbar and last intercostal arteries. The terminating twigs communicate with those of the internal mammary artery.

B. Circumfex Iliac Artery, *second branch* of the external iliac, is immersed at its origin in cellular tissue, and concealed by the peritoneum; it ascends obliquely outwards, curving a little along the outer edge of the iliacus internus muscle, until above the anterior superior iliac spine; it then separates into two branches, after giving off *external twigs* to the transverse abdominal muscle, and *internal twigs* to the iliacus muscle, anastomosing with the ileo-lumbar artery. Of the two branches which terminate this artery, the *external* is small, and ascends between the transversus and obliquus internus abdominis muscles, in which it loses itself. The *internal*, is larger and transverse, runs along the iliac crest, and ascends obliquely backwards, between the transversus and obliquus internus abdominis muscles, in which it divides, as well as in the obliquus externus, anastomosing with the internal mammary artery, the lumbar and inferior intercostal arteries.

The student may now proceed to remove the whole of the pelvic viscera, including the supra-renal capsules, kidneys, and ureters, in order to examine these separately, and make himself master of their systematic anatomy.

405. The SUPRA-RENAL CAPSULES are two small bodies placed above the kidneys, of which they embrace the upper extremity. They are never wanting, but their uses are totally unknown. Hollow and oval in the adult, they are prismatic and granulated in the fœtus, in which their volume, proportionally of course, is much greater than in the adult, on which account it has been supposed that they must have some connexion with the exercise of nutrition in the first stages of life. These capsules are of a yellowish-brown colour, present a *posterior surface* corresponding to the diaphragm and upper part of the psoas; an *anterior surface* covered on the right side by the vena cava inferior, the duodenum, and the liver, and on the left side by the spleen and pancreas; and an *inferior surface*, concave, and applied upon the summit of the corresponding kidney. Each supra-renal capsule is really a small bag with thick parenchymatous walls, formed of small granulations, collected into lobules, and having but little consistence. In its interior there exists a triangular cavity, without any known orifice, furnished in its inferior part with an eminence in the form of a a ridge, and containing in the fœtus a considerable quantity of a reddish, viscous fluid, coagulable by alcohol. In children, this fluid is yellowish; in old people brown. These capsules receive a great number of arteries from the aorta, the inferior phrenic and renal arteries, which are larger in the child than in the adult. The veins of those of the right side pour their blood into the vena cava; those of the left side open into the renal vein. Their lymphatics enter into the formation of the emulgent and inferior diaphragmatic plexuses. Their nerves come from the renal plexuses.

406. The KIDNEYS (*Renes*), the secreting organs of the urine, are two glands situated in the lumbar regions, on the sides of the vertebral column, opposite the last two dorsal and the first two lumbar vertebræ, one to the right, the other to the left. They are enveloped

on all sides by a solid, thick mass of fat, the left is higher than the right. Their colour is a dark red, inclining to brown. Their form is that of a kidney-bean. Their volume is proportionally larger in children than in adults, in women than in men. The *anterior surface* of the kidneys is convex and sometimes completely covered by the peritoneum. At other times it is more or less in connexion, to the right side, with the vertical portion of the duodenum, the liver and the ascending colon, and to the left, with the spleen and the descending colon. Their *posterior surface* almost flat, applied upon a thick layer of fat which separates it from the diaphragm and the aponeurosis of the transversus abdominis muscle. Their *circumference* presents: 1°. superiorly, a thick and rounded extremity, embraced by the corresponding renal capsule: 2°, inferiorly, a thin and somewhat elongated extremity, which approaches more or less the iliac spine: 3°. externally, thick convex edge, inclined backwards: 4°. internally, a deep notch, (fissure of the kidneys) more distinct anteriorly than posteriorly. Each kidney receives from the aorta an artery of considerable diameter, and sends to the vena cava inferior corresponding veins. A nervous plexus and lymphatics accompany these vessels. The parenchyma of the kidney is firmer than that of the other glands; composed of two distinct substances, an *external* (*cortical*), an *internal*, (*tubular* or *mamillary*.) The *external* or *cortical substance* forms around the kidney an external layer, one or two lines thick, of a dark or reddish bay colour, and adhering to their capsular membrane. Internally, it furnishes several prolongations in the form of septa, between which are placed the conical bundles of the tubular substance, and which diminish in thickness towards the pelvis, from which they are separated by fat. This substance tears with great ease, and appears under the microscope composed of solid granulations, formed by the capillary extremities of the renal arteries and veins. The *internal* or *tubular substance* represents a number of conical, truncated bundles, enveloped on all sides, excepting towards their summits, by the cortical substance. The base of these cones is rounded and directed towards the circumference of the kidney ; their summit is directed towards the pelvis or fissure of the kidney. The colour of this substance is pale red, especially at the centre of each cone. Its tissue is dense, firm, and tenacious. It is formed of numerous delicate convergent canals, very close upon each other towards the summit of the cones, and directly continuous with the vessels of the cortical substance, from which they derive their origin. They are expanded at the surface of each cone, while towards its summit they open at the interior of the calyces by orifices extremely close upon each other. The summits of the cones represent so many mammillæ at the surface of which the urine thus oozes out. Some anatomists consider the mammillæ a third substance, (*mammillary substance.*) Their number, which is generally equal to that of the cones, varies from twelve to eighteen; but, in some subjects, two cones are seen ending in a single mammilla, or two mammillæ terminating in a single cone. They are separated from each other by adipose cellular tissue. They are often short and blunt, but they are also seen to prolong themselves into a more or less distinct prominence of a cylindrical or pointed form. The orifices of the canals of the tubular substance which are perceived at their surface, are less numerous than the canals themselves, on which account it is to be presumed that several of the latter unite before terminating. The *membranous envelope of the kidneys* is double, and covers their whole surface, dips into their fissure, where it is traversed by the divisions of the renal vessels, and reflected upon the free surface of the pelvis. It may be easily detached from the cortical substance, with which it is connected by numerous delicate filaments, and by some small blood-vessels. Though double, it is thin, transparent, and possessed of little extensibility, and appears to be of a cellulo-fibrous nature. The urine secreted in the cortical substance of the kidneys passes through the ducts of the tubular substance, and thus arrives in the *calyces*, the *pelvis*, and *ureter*. 1°. The *calyces* (*infundibula*) are small membranous ducts, embracing, on the one hand, the circumference of the mammillæ, and on the other, opening in the pelvis, and only at its extremities or towards the side of it which faces the convexity of the kidney. Their number varies from six to twelve, one of them frequently belonging to several mammillæ; their diameter is always proportional to the number of mammillæ which they embrace. 2°. The *pelvis* is a small membranous bag which occupies the posterior part of the fissure of the kidney, placed behind the renal artery and vein; elongated from above downwards, flattened from before backwards, presenting an irregularly oval form, contracted below. The orifices of the calyces are perceived in its deepest part. The *ureter* is a long membranous canal, of a cylindrical form and of about the size of a writing quill, extended obliquely between the pelvis, with which it is continuous, and the bottom of the bladder, into which it opens. It commences in the sinuosity of the kidney by a hollowed portion, which is named the *infundibulum.* From thence it descends obliquely inwards as far as the sacro-iliac articulations. Continuing to descend, it directs itself forwards, to the inferior posterior wall of the bladder, between the muscular and mucous membranes of which it passes, contracting a little. It proceeds thus between them for the space of about an inch, directing itself inwards and forwards, and terminates by a narrow oblique orifice, situated in the male about half an inch behind the prostate gland. The ureter corresponds from above downwards, and *posteriorly,* to the psoas magnus muscle, the common iliac vessels, whose direction it crosses, and the hypogastric vessels. *Anteriorly,* it is at first covered by the peritoneum and the spermatic artery; in the excavation of the pelvis, it is crossed in the male by the vas deferens. The ureter of the right side is placed externally of the vena cava inferior, to which it is parallel. The calyces, pelvis, and ureter appear to have the same organization; their walls are composed of two membranes. The *outer* thick, of an opaque white colour, covered externally of the pelvis and ureter by a prolongation of the fibrous capsule of the kidney. The *inner* mucous, thin, white, and semi-transparent, is prolonged from the calyces over the mammillæ, and, perhaps, even introduces itself into the uriniferous tubes.

407. Structure of the Urinary Bladder. We have already described its form, situation, and connex-

ions (398); it is only necessary here to speak of its structure. Its tunics are, 1st, A peritoneal or serous coat; this, as has been shewn, is only a partial tunic; a loose cellular membrane unites it to the *vesical fascia;* this forms the second tunic of the bladder, and is derived wholly from the pelvic fascia, as has been already explained. The 3d tunic is muscular. It is intermediate in colour and thickness to those of the stomach and œsophagus. It is extremely thin, except towards the fundus, between the vesiculæ seminales, and at the superior region, and is composed of small whitish fasciculi, flattened, following longitudinal transverse directions. Those which are situated in the median line ascend from the prostate gland and the neck of the bladder towards the urachus. The rest arise from the lateral parts of the neck, and cross each other at the superior region. Sometimes they unite into cylindrical columns, which cross each other, and are more or less prominent. The neck of the bladder is not surrounded by a particular muscle, as some anatomists aver. The fleshy fibres are here only brought closer together, and applied upon a layer of whitish, firm, elastic, extensile tissue, having a fibrous appearance, which is prolonged, becoming thinner, as far as the base of the trigonal space, and which contributes to form the prominence of the uvula vesicæ. 4°. Some anatomists consider the cellular membrane situated beneath the muscular tunic as a distinct tunic. It connects the muscular and mucous layers of the bladder together. 5°. The mucous tunic. To display this membrane, lay open the bladder anteriorly from the superior fundus to the neck, including this, however, in the incision, and the prostate which surrounds the cervix vesicæ and commencement of the urethra: the incision may be prolonged throughout the whole length of the urethra to the orificium urethræ externum; this exposes the structure of the urethra and penis. The mucous membrane of the bladder is thin, continuous with that which lines the ureters and urethra; it is frequently marbled with a slight red tint; its villosities are delicate, and not readily seen. In the natural state, no crypts or mucous follicles have been yet perceived in it; in certain pathological cases, however, their presence is very apparent. The arteries of the bladder arise from the hypogastric, umbilical, ischiatic, middle hæmorrhoidal, and internal pudic arteries. Its veins, which are numerous, join the hypogastric venous plexus. Its nerves come from the sciatic and hypogastric plexuses. Its lymphatic vessels ramify in the hypogastric glands. Thus the internal surfaces of the bladder is formed by a mucous membrane furnished with a great number of villosities, much less apparent than those of the intestines. It presents, in its empty state, numerous irregular rugæ which disappear when the bladder is full. In certain subjects only, there are observed elongated persistent prominences, crossing each other in different directions, and separated by cellules varying in breadth and depth. This disposition is owing to a greater development of the muscular fasiculi of the bladder; and when it exists, the bladder which presents it, is commonly called a *Columnar Bladder* (*Vessie à colonnes*). The name of *Trigonal Space of the Bladder* (*La trigone de la vessie*, Lieutaud,) is given to a smooth triangular surface on the inside of the bladder, in the middle of its fundus, and where the mucous membrane is destitute of rugæ. The two posterior angles of this triangle correspond to the mouth of the ureters, and the anterior to the origin of the urethra. Its sides are each about an inch long, and the muscular fibres are here frequently stronger.* Its base is directed backwards, and its summit forwards. The orifice of the urethra, which is also named the *Neck of the Bladder*, has the form of a crescent, the circumference of which is thick. A small tubercle (*Uvula vesicæ*), said to be formed by the projection of the mucous membrane, was described by Lieutaud. It has no existence in the healthy bladder.

408. Male Generative Organs. These must be examined in a systematic order, and we shall first describe

A. The Scrotum. The skin and its surface has been already described (secs. 347, 348): upon reflecting this, the *Dartos* are exposed; these are two cellulo-filamentous membranes, traversed by vessels of all kinds, destitute of fat, of a reddish tint, attached to the rami of the ossa pubis and ischii, whence they descend towards the

* These muscular bands were described by Morgagni and Sir C. Bell as distinct muscles.

raphe, to which they closely adhere. Above it they are reflected from beneath upwards, come into mutual contact, forming a septum (*Septum Scroti*), and terminate at the lower part of the urethra, thus separating the two testicles from each other. Their outer surface adheres to the cutaneous envelope of the scrotum in the greater part of its extent. The inner corresponds to the fibrous coat, and adheres to it by some prolongations. It also covers the extremities of the cremaster muscle. The dartos appear in general entirely cellular, exhibiting, however, occasionally an appearance of muscular fibres. These membranes are strengthened by a thin and flat fibrous band, which proceeds from the upper and outer part of each inguinal ring. MM. Chaussier, F. Lobstein, and Breschet, thought the dartos absent previous to the descent of the testicles. Some authors consider the dartos as distinct from the superficial fascia of the abdomen, and *not continuous with it*; there are no good grounds for maintaining this opinion. The cremaster muscle has been already described, (355). Divide the scrotum entirely, and examine

B. The TESTES. Their anatomy has been lately examined with great care by Sir A. Cooper. The result of his dissections, combined with what was known previously, is as follows:—The weight of a healthy testicle and epididymis is about an ounce. The *serous tunic* is a partial one; below it is the *tunica albuginea testis*, which, besides being complete, sends a process into the interior of the organ, the *mediastinum testis*. From this inverted portion arise numerous ligamentous cords; of these, some form purses, enclosing the lobes of the glandular structure, others proceed to the inner surface of the tunica albuginea. Sir A. Cooper thinks that the tunica albuginea may farther be subdivided into two layers; he proposes calling the innermost one *tunica vasculosa testis*. The *tubuli seminiferi* are disposed in numerous pyriform lobes, which are of two kinds, a larger and smaller. Each *tubulas* begins from one of the canals which form the *rete*, and when unravelled, is found to be composed of a long convoluted vessel; these tubuli compose the great mass of the testis. By the *rete* is meant a set of canals which receive the semen from the tubuli; these canals are situated within the *mediastinum* at the posterior edge of the testis, opposite to the epididymis. The *vasa efferentia* pass from the rete testis to the epididymis in which they terminate; they vary in number, but are usually 13 or 15; they arise singly from the rete, and terminate in the epididymis in such a way so as to leave the *epididymis* a *single tube.* The head and tail of this tube have been called the globus major and minor; the vasa efferentia assist in forming the globus major, and the globus minor, or tail of the epididymis, terminates in the *vas deferens.* The body of the epididymis is entirely composed of the convolutions of a single seminal tube. The *vas deferens* proceeding upwards, constitutes a portion of the spermatic cord.

c. The Spermatic Cord (*Funiculus Spermaticus*), composed of the spermatic artery and vein, of some other inconsiderable and irregular blood-vessels, of lymphatics, of nervous filaments from the spermatic plexus, and from the genito-crural branch of the lumbo-abdominal plexus, and of a duct for the semen called the vas deferens, enveloped by several membraneous layers, and a quantity of cellular tissue. From the upper edge of the testicle, which is suspended at its extremity, as far as the symphisis pubis, the spermatic cord, commonly shorter on the right side than on the left, and of variable size, ascends almost vertically. There, it receives numerous veins from the scrotum, and then directing itself outwards and upwards, enters the abdomen by the inguinal ring, crossing the epigastric artery; the organs of which it is composed, here separate from each other. The membraneous layers which surround the spermatic cord are the fibrous coat of the tunica communis and the cremaster muscle.

d. Vas Deferens (*Ductus Deferens*), arises from the tail of the epididymis, ascends, describing several flexuosities, behind the testicle, and enters the spermatic cord, behind and internally of the spermatic artery and vein, and the nerves which accompany them. After clearing the inguinal ring, it leaves the other vessels of the cord, descends backwards and inwards, parallel to that of the opposite side, upon the sides of the bladder, passes behind the umbilical artery, and before the lower part of the ureter. Arriving under the inferior and posterior region of the bladder, it approaches its fellow, is flattened in a remarkable manner, becomes more adherent, and changes its direction so as to proceed horizontally from behind forwards, and from without inwards, along the inner side of the vesiculæ seminales. At the base of the prostate gland, it receives a canal from the vesiculæ seminales, and is continued into the ejaculatory duct. The vas deferens, from being rather slender near its origin, and so long as it is contained in the spermatic cord, increases in size in passing through the inguinal ring, and becomes twice as large along the vesiculæ seminales. At its termination, it resumes its original size. With respect to its dimensions, no duct has so small an internal diameter; its cavity is scarcely capable of admitting a hair from the epididymis to within the abdomen; but near the vesiculæ seminales it sensibly increases. Its walls are thick; of a dull white colour. have an almost cartilaginous consistence, and are probably lined by a mucous membrane.

E. The VESICULÆ SEMINALES are two small membraneous bags which form a reservoir for the semen; placed under the bladder, before the insertion of the ureters, above the rectum, behind the prostate gland, externally of the vasa deferentia, and internally of the levatores ani muscles; they are of an irregular conical form, flattened from above downwards, tubercular and bulgedin their whole surface, immersed in a mass of adipose cellular tissue, traversed by a great number of arteries and veins, have no communication with each other, and are directed obliquely from without inwards, and a little from above downwards. Widely separated behind, and only disjoined by the vasa deferentia before, they circumscribe between them a triangular space, in which the bladder is in contact with the rectum. Their *posterior extremity* or *fundus* is a rounded cul-de-sac of considerable breadth; their *anterior extremity* or *neck* is elongated, narrow, and sometimes concealed by the base of the prostate. It terminates by a very short canal which opens into the vas deferens. The vesiculæ seminales have generally in the adult a length of two inches and a half, a breadth of six or seven lines towards their fundus, and a thickness of two or three lines. The interior of the vesiculæ seminales seems, at first sight, to form a cavity composed of numerous cellules, separated by partitions; but it in reality represents a flexuous canal, terminating above in a cul-de-sac, and into which there open laterally simple or compound appendages, to the number of six, eight, ten, fifteen, or even twenty. These appendages give rise to the prominences observed at the external surface. They are very close to each other, and connected together by a dense cellular tissue. They may be separated by careful dissection, especially if the parts have been previously macerated. The vesiculæ seminales are commonly filled with a thick, yellowish, opaque fluid, of a peculiar smell, and of an aspect very different from that of the semen which is ejaculated during life. The walls of the vesiculæ seminales are evidently formed of two membranes. The *external*, which is dense and whitish, appears to resemble the substance forming the vas deferens, only it is thinner. The *internal*, which belongs to the order of mucous membranes, is fine, almost white, a little wrinkled, and similar to that which lines the gall-bladder.

F. The PROSTATE GLAND, (*Prostata*), formed by an assemblage of mucous follicles, and surrounds the commencement of the urethra in the male. It has the form of a truncated cone, flattened from above downwards, and superficially notched at its base, which is directed backwards. Its axis is nearly horizontal, but inclined a little forwards and downwards. It is much thicker behind, and on the sides than before. Its *upper surface* is immediately covered by the anterior ligament of the bladder. The *lower surface*, smooth and plain, rests upon the rectum, to which it adheres by a dense cellular tissue. Each of its surfaces is traversed longitudinally by a superficial groove. Its *sides* are rounded and correspond to the levatores ani muscles. Its *base* embraces the neck of the bladder, and forms around it a prominence, especially on the sides. Its *summit* terminates upon the membraneous portion of the urethra by gradually becoming thinner. The prostate gland is traversed longitudinally, and nearer its upper than its under surface, by a canal, wider in the middle than its extremities, which lodges the commencement of the urethra, or surrounds at least the three upper fourths of the circumference of that canal. In its lower part, it is also traversed by the two ejaculatory ducts, which are lodged in a conical canal of which the summit is directed forwards. The prostate gland is of a grayish white colour. Its tissue, which is very dense and firm, is of a nature very difficult to be well described. It is filled internally with a great number of small follicles containing a viscid, ropy fluid of a whitish colour. From these follicles arise excretory ducts which collect to the number of ten or fifteen, and open in the urethra, on the sides and at the surface of the *verumontanum.* By compressing the prostate gland, the fluid which it contains may be made to distil from the orifices of these ducts. Surgical anatomists divide the prostate into three portions, viz. two lateral lobes, and a third or middle lobe. This latter is a process seen at the back, connecting the lateral lobes to each other.

G. Cowper's Glands (*Accessory Glands,*) are two small, granulated, oblong or rounded, glandular bodies, placed parallel to each other before the prostate, on the sides of the urethra, and above the acceleratores urinæ muscles. They are about the size of a pea, of a reddish colour, and of a tissue which is pretty firm and resembling that of the salivary glands. These glands, which are sometimes wanting, have each an excretory duct about six lines in length, which creeps obliquely inwards and forwards in the spongy tissue of the urethra, and opens before the *verumontanum.* A small gland of the same nature has sometimes been met with in the angle formed by the union of the roots of the corpus cavernosum.

H. Ejaculatory Ducts, (*Ductus Ejaculatorii*), are formed by the junction at an acute angle of the vasa deferentia with those which terminate the vesiculæ seminales. They are of a conical form, and about an inch in length. They proceed forwards, parallel to each other, in the substance of the prostate gland, unite with each other, contracting considerably, and open into the urethra by two small oblong orifices, situated upon the lateral and anterior parts of the verumontanum. Before their termination, they bend a little outwards. Their course and structure is readily shewn by passing bristles into them and then laying them open.

409. The Penis is formed by 1°, the *corpus cavernosum*, the principal seat of erection ; 2°, the *urethra*, destined for the transmission of the semen and urine ; 3°,

the *corpus spongiosum urethræ*, terminated by the *glans*; by *vessels*, *nerves*, and a *cutaneous envelope* which gives rise to the *prepuce*. The prepuce (a process of the common integuments of the penis,) does not require any particular description.

A. The CORPUS CAVERNOSUM forms about two-thirds of the volume of the penis. It extends from the anterior and internal part of the sciatic tuberosities as far as the substance of the glans. Many authors describe two corpora cavernosa in the penis, but there only exists one. There are distinguished in it two roots or crura, an anterior extremity, and two surfaces. The *Crura of the Corpus Cavernosum* are attached to the inner edge of the rami of the ossa ischii and pubis, and covered internally by the erectores penis muscles. About two inches in length they commence at the fore part of the sciatic tuberosities by a slender extremity, and unite before the lower part of the symphysis pubis. The triangular space which separates them from each other is filled by fat and by the urethra. The *anterior extremity* represents a truncated cone, united to the base of the glans, and perforated by several apertures for the passage of vessels. Its *upper surface* is marked with a longitudinal and shallow groove, in which run the dorsal arteries and veins of the penis. At its backmost part, it gives attachment to the *Suspensory Ligament of the Penis*. Its *inferior surface* presents a broad groove, deeper than that of the upper surface, which receives the upper part of the corpus spongiosum urethræ, to which it is attached by a filamentous cellular tissue. The corpus cavernosum is essentially composed of an elastic, fibrous, strong external membrane, and of an internal spongy tissue. The *Fibrous Membrane* is elastic, thick and strong, excepting upon its roots, in the groove which receives the urethra, and at the extremity which sustains the glans, in all which places it is traversed by a multitude of vascular ramifications. Its general colour is opaque white, excepting in the parts just mentioned, where it appears more or less livid. Its fibres are interlaced posteriorly with the periosteum of the ischium and pubes, and the aponeuroses of the muscles which are attached to their lower edge. The cavity of this fibrous membrane is divided into two lateral portions by an incomplete middle partition, (*Sep-*

tum pectiniforme), which commences before the symphysis pubis, but is not prolonged as far as the glans, presenting in its anterior third only a few flattened fasciculi, separated by intervals of greater or less breadth. The *Spongy Tissue* fills the whole cavity of the fibrous membrane, is a complicated lace-work of arterial and venous vessels, probably of nervous filaments, and of small fibrous laminæ, which by crossing each other, form a multitude of cellules, which all communicate together. An injection made by the cavernous artery penetrates into these cellules, but this is no proof of any direct communication with these cells during life. The filaments which enter into the composition of this tissue are distinctly continuous with the fibrous membrane. The arteries of the corpus cavernosum come from the deep branch of the internal pudic, and occupy the centre of its lateral portions; they have frequent anastomoses with each other, and communicate with the arteries of the glans and urethra. Lately, M. Muller has described a peculiar plexiform arrangement of certain of the arteries of the corpus cavernosum; to these vessels he has given the names of *arteriæ helicinæ*, and ascribes to them the phenomenon of the erection of the penis. We feel assured that no such vessels exist in the corpus spongiosum urethræ. Its veins follow the same course as the arteries; but their volume is much larger.

B. The URETHRA is the excretory duct of both the urine and semen. It is from nine to twelve inches long, extends from the neck of the bladder to the extremity of the penis, where its external orifice occurs, is bent several times in the direction of its length, and has a large capacity; its walls are partly spongy, partly membranous, and it receives in its course the ejaculatory ducts and those of the prostate gland, of Cowper's glands, and of a multitude of mucous follicles. The external diameter is not the same in its whole length. At first directed obliquely forwards and downwards, the urethra traverses the prostate gland. On emerging from that body, it passes before the inferior extremity of the rectum, under the symphysis pubis, ascends before the latter part, between the two crura of the corpus cavernosum, places itself in the groove of the lower surface of the latter organ, and terminates at the summit of the glans by a vertically elongated aperture. From the difference of disposition and structure which this canal presents in the different parts of its extent, it is divided into three portions, as follows:—viz. 1°. A *prostatic portion*, near the bladder, situated above the inferior extremity of the rectum, at about an inch from the anus and perinæum, and from fifteen to eighteen lines in length. It passes obliquely through the prostate gland, the tissue of which sustains its walls. It has the figure of a cone having its summit directed forwards, and is intimately attached to the intestine by cellular tissue and by the recto-vesical aponeurosis. 2°. A *membraneous portion*, contracted in calibre from eight to ten lines in length, connected with the rectum by dense cellular tissue below and behind; it approaches anteriorly the inferior region of the symphysis pubis, and the anterior fibres of the levatores ani muscles. It rests upon the vesiculæ seminales, and is connected with them by an aponeurotic lamina. In this place there occur between it, the bladder and the symphysis pubis, large veins and loose cellular tissue. 3°. A *spongy portion* (*corpus spongiosum urethræ*) which expands anteriorly to form the glans. It commences posteriorly before the inferior extremity of the rectum, (to which it is attached partly by means of the sphincter ani,) by the *bulb of the urethra*, placed immediately under the angle of union of the crura of the corpus cavernosum, above the two acceleratores urinæ muscles and the skin, between Cowper's glands, and insensibly loses itself anteriorly in the rest of the spongy tissue. This portion of the canal is afterwards in relation inferiorly with the septum of the dartos and skin. Its upper part is lodged in a groove of the corpus cavernosum. *Interiorly*, the urethra has not the same breadth in its whole course. From being pretty wide at its commencement, it contracts, and again dilates in the centre of the prostate. The membraneous portion which comes next is much narrower than any other part of the canal, which is wider from the bulb to the base of the glans. There, immediately before opening, a decided dilatation occurs, named the *fossa navicularis;*

its orifice again contracts. In the interior two median whitish lines may be observed, a superior and an inferior. In the membraneous and spongy portions, some longitudinal wrinkles are seen, which are effaced when the mucous membrane forming them is distended, and which do not extend into the fossa navicularis. The inferior median line ends posteriorly at an oblong rounded prominence, about an inch long, called the *verumontanum* (*caput Gallinaginis*). This prominence is formed by the mucous membrane, and contains in its most retired part a lacuna. Anteriorly, it becomes thin and ends in a point. The oblique orifices of the ejaculatory ducts are placed upon its sides, those of the prostate gland are seen at its surface, arranged in the form of a semi-circle, and anteriorly, those of Cowper's glands. All these orifices are destitute of valves. Sometimes only the summit of the ridge is drawn back upon itself, so as to cover with a kind of prepuce the aperture of the ejaculatory ducts. The urethra is lined by a *mucous membrane,* which is backed, in its first two portions, by a cellular membrane, and in the last, by a layer of a soft and spongy tissue. This membrane is continuous with that which covers the glans, with the inner coat of the bladder, and with the membranes which line the ejaculatory and prostatic ducts, &c. It does not adhere firmly to the subjacent parts, excepting towards the glans and in the prostate. Its colour varies according to the different parts where it is examined, being of a bright red near the external orifice, very pale and whitish in the rest of its extent. It is folded upon itself in the direction of its length, and furnished with small holes (sinuses of Morgagni), which are the orifices of the oblique ducts placed in its substance. These ducts appear to be lacunæ, for they are not seen to proceed from follicles, as is the case in many other mucous membranes; they begin opposite the bulb, and become more abundant as far as the fossa navicularis. The mucous membrane is delicate, so as not to be distinguishable from epidermis, and traversed by a number of minute blood-vessels. The *cellular membrane* seems to arise from the white tissue peculiar to the neck and triangular space of the bladder, and at first separates the mucous membrane from the tissue of the prostate gland. Opposite its membraneous portion, it becomes dense, and is strengthened by the fibres of the levatores ani, acceleratores urinæ, transversi perinæi and sphincter ani muscles. The *spongy tissue* surrounds the three anterior fourths of the length of the urethra. It commences by forming the bulb, then diminishes in thickness, and constitutes a uniform and cylindrical layer as far as the glans. Beneath the fossa navicularis, it becomes thin, and collects above and behind to form the glans by expanding. It is attached to the corpus cavernosum by a number of blood-vessels which it receives from that part, and by a lamina of its fibrous membrane. The cellules of this tissue are large in the glans, but small in the rest of its extent. Mr. Hunter proved it to be composed chiefly of dilated veins. The arteries of the urethra come mostly from the internal pudic; the largest branches penetrate into the bulb. Its veins follow the course of the arteries, and its lymphatic vessels go to the inguinal and hypogastric plexuses. Its nerves come from the pudic and inferior glutæal.

c. The GLANS (*Balanus*) of the penis is continuous with the corpus spongiosum urethræ, and forms the extremity of the penis. It is circumscribed by a prominent edge, the *corona glandis,* behind which the inner membrane of the prepuce forms a cul-de-sac by being reflected. Beneath the urethra, the corona glandis is interrupted by a small groove extending to the orifice of that canal, and filled by the frænum præputii. The glans is invested by the mucous membrane of the prepuce, which, over it, is thin, rather dry, destitute of mucous crypts, and covered by a very delicate epidermis. Its internal tissue is spongy, erectile, and of the same nature as that of the corpus spongiosum urethræ, only it appears firmer and denser.

410. FEMALE GENERATIVE ORGANS. As there are so many analagous parts in the dissection of the female pelvis to those of the male, we shall confine our description to the organs of generation, premising that the dissection of the female pelvis and its contained organs must be conducted much in the same way as that of the male: 1°. By examining the external organs and perinæum. 2°. By a lateral sec-

tion of the pelvis, removing the left os innominatum. The external female parts of generation are the vulva or pudendum, mons veneris, greater labia, fourchette, fossa navicularis, vestibule, clitoris and its prepuce, smaller labia or nymphæ, orificium urethræ, and orificium vaginæ, together with the very short female perinæum; these parts do not require any minute description here. The sphincter ani is dissected as in the male. The other muscles met with here are, the erector clitoridis and sphincter vaginæ.* A view of the pelvic viscera is obtained, by making the lateral section as directed in the male. Introduce a tube into the urethra, and lay it open as far as the bladder; the vagina and the rectum may also, after being carefully cleaned and examined externally, be laid open longitudinally. The female *urethra* is about an inch in length, and comparatively of a simple structure; it is slightly curved, and a slight membraneous fold at the orifice forms a kind of imperfect valve. At the entrance of the vagina is occasionally found the *hymen;* this varies in its shape; its presence is not a test of virginity, nor does its absence imply the embraces of the male. The carunculæ myrtiformes are small reddish tubercles, considered as the remains of the hymen.

A. The VAGINA is a cylindrical curved canal, varying in length and capacity, according to the stature of the person. It is thought that different races of women present considerable and constant differences in these respects. Composed of a mucous membrane internally, and a celluloso-fibrous tunic externally. Anteriorly and posteriorly, partially invested above by the peritoneum; anteriorly and inferiorly, it is in contact with the bladder and urethra; posteriorly and inferiorly, it rests upon the rectum. On the sides, it corresponds above to the broad ligaments of the uterus, and below to a mass of cellular tissue which separates it from the levatores ani muscles, and in which creep the uterine and vesical vessels, and the umbilical artery. The walls of the cavity of the vagina are in contact with each other in their ordinary state, and invested with a

* The erector clitoridis corresponds in its details to the erector penis. The sphincter vagina is almost always distinct; it does not surround the orifice of the vagina.

more or less thick layer of mucus. The anterior wall is intersected longitudinally and in the middle by a narrow and elongated ridge, more distinct on the side next the vulva than near the uterus: in the former direction it frequently forms a tubercle beneath the orifice of the urethra; on the posterior wall a similar but less apparent ridge is observed. These two walls present also, transverse wrinkles, effaced on the sides, more prominent and numerous in the vicinity of the vulva than near the uterus, where they follow various directions. All these rugæ are intersected at right angles by the two longitudinal ridges of which we have spoken, and are formed by the mucous membrane which lines the canal. The *upper extremity of the Vagina* is fixed around the upper part of the neck of the uterus, a little higher behind than before. The *lower extremity* forms in the vulva a fissure elongated from above downwards, and from before backwards. The mucous membrane is evidently continuous with that of the pudendum inferiorly, with that of the uterus superiorly. Its artery comes from the internal iliac, and its nerves from the sacral plexus.

B. The UTERUS. The *ligamenta lata uteri* are folds of peritoneum placed in the excavation of the pelvis, and form with the uterus and upper part of the vagina a transverse septum which divides that cavity into two parts, an anterior for the bladder, and a posterior for the rectum. They are continuous with the peritoneum which invests the two surfaces of the uterus, and externally are expanded upon the sides of the excavation of the pelvis. They are formed of two laminæ placed back to back, in the interval of which is contained cellular tissue rarely containing fat; also between these two laminæ are placed, on each side and superiorly, the Fallopian tubes, then beneath, interiorly the round ligament, and posteriorly the ovary. The tube occupies the free edge of the ligaments; the other two organs raise each of their surfaces angularly, and thus form two smaller folds which are named *little wings*. Besides these folds, the peritoneum forms others running towards the rectum; these are sometimes called the ligaments of Douglass. The *Round Ligaments* arise from the lateral, superior and anterior part of the uterus, beneath and before the insertion of the tubes. They direct themselves from thence towards the inguinal ring, pass through it, and terminate by expanding in the cellular tissue of the groins, Mons Veneris, and labia pudendi. Many tortuous vessels creep among these fibres. Fallopius asserts that these cords are enveloped by a kind of cremaster muscle. If the student wish now to examine the remaining organs, together with the uterus, systematically, they must be removed from the pelvis, but not until the pelvic fascia, levator ani muscles, and vessels and nerves of the pelvis have been dissected. The *Uterus* (*matrix*,) is a hollow, symmetrical organ, of the shape of a truncated cone, placed in the middle of the pelvis, between the bladder and rectum, above the vagina, and beneath the inferior convolutions of the small intestine, flattened from before backwards, and nearly an inch in thickness. About two inches broad in its highest region, it contracts towards the vagina, and terminates by a narrow elongated portion, the *neck*. The *body of the Uterus* is less than two inches in length, its two surfaces are convex, the anterior more so than the posterior, and invested by the peritoneum; the former is in contact with the bladder, and the latter with the rectum. Its lateral edges are convex, directed downwards, forwards and inwards; correspond to the interval of the two laminæ which compose the broad ligaments. Its upper edge, (*fundus*) is rounded, transverse, convex in the direction of its length, and covered by the peritoneum. By its union with the lateral edges, it produces two slightly projecting angles, in the middle part of which terminate the Fallopian tubes, above the insertion of the ligament of the ovarium which is behind, and of that of the round ligament which is before. The *neck of the uterus* is continuous at the exterior with the body, from ten to twelve lines in length, antero-posterior diameter from six to eight, transverse from eight to ten. Slightly inflated at its middle part, it is compressed from before backwards and of a cylindrical form. Its upper part is embraced by the vagina; the rest projects into that canal. This latter portion is more or less prominent, presents at its summit a transverse slit (*os tincæ*), bounded by two rounded lips (*labia*) placed close to each other, and distinguished into anterior and posterior: both are smooth and rounded in women who have not had children, wrinkled in those who have been repeatedly brought to bed. The *cavity of the uterus* is small in proportion to the volume of the organ, which necessarily supposes a great thickness of wall; it occupies the body and neck, and terminates inferiorly at the slit of the os tincæ. The portion of this cavity, which corresponds to the body, is triangular and flattened; its edges are curvilinear, and its upper angles present the extremely minute orifices of the Fallopian tubes. Each of its surfaces is longitudinally traversed by a superficial line. The cavity of the neck is continuous with that of the body; it is nearly cylindrical, slightly compressed from before backwards, and dilated before opening into the vagina. It presents, upon its anterior and posterior walls, the continuation of the prominent vertical lines of which we have just made mention, together with some scarcely perceptible transverse rugæ. The *Uterus* is composed of an external or serous membrane, an internal mucous membrane, an intermediate proper tissue, nerves, and vessels. The *serous membrane* is formed by the peritoneum. The *mucous membrane* is a prolongation of that of the vagina; many anatomists doubt its existence. It sends into the Fallopian tubes two prolongations which we shall subsequently examine. Its colour is white, very slightly tinged with red, especially manifest some days before and during menstruation. It is covered with a number of fine villosities, and presents the orifices of mucous crypts, which are more abundant towards the neck than elsewhere. Frequently also these crypts dilate in that place, and assume the form of small semi-transparent vesicles projecting into the interior of the uterus. The *proper tissue* occupies the interval which separates the peritoneum from the mucous membrane. Its thickness amounts to five or six lines. It is of a dense and close texture, and yields great resistance to the knife. It is elastic and of a grayish white colour. It adheres to the mucous membrane, and its intimate nature is unknown. It is traversed by a number of blood-vessels. The arteries of the uterus come from the spermatic and hypogastric; they are very flexuous, and anastomose frequently together. Its veins follow the same course, but are still more flexuous, and form cavities in its walls, which become very large during gestation, and are called *uterine sinuses*. Its nerves come from the sciatic and hypogastric plexuses. Its lymphatics are very numerous, and during gestation acquire enormous dimensions.

C. The FALLOPIAN TUBES (*Tubæ uterinæ*) are two canals floating in the abdomen and placed along the upper edge, and in the duplicature of the broad ligaments. They extend from the upper angles of the cavity of the uterus to near the sides of the upper strait of the pelvis. In the inner half of their length, they are straight and of very small diameter, afterwards acquire the size of a writing quill, and become flexuous, before terminating they contract again. Their free extremity is wide, floating, and fringed, hence called the fimbriated extremity of the tube (*Morsus Diaboli.*) Among the fimbriæ of this part, one is observed longer than the rest, attached to the corresponding extremity of the ovary. The surface of the fimbriated extremity of the tube is generally directed backwards. These tubes contain interiorly a canal commencing at the upper angle of the cavity of the uterus. Almost capillary in its first half, it afterwards dilates and opens at the surface of the fimbriated extremity by an orifice, (*ostium abdominale*), *the only place in the body where a serous membrane communicates with the exterior.* The Fallopian tubes are internally lined by a mucous membrane; soft, reddish, and slightly villous, and presenting several longitudinal plicæ. Externally, these organs are formed by a thin layer of a spongy and erectile tissue.

D. The OVARIES (*Ovaria*,) are two egg-shaped bodies, placed in the substance of the broad ligament. They are compressed from before backwards, of a pale red colour, wrinkled and rough at their surface. Their outer extremity gives attachment to one of the fimbriæ of the morsus diaboli; the inner is attached to the uterus by a small filamentous cord about an inch and a half long, entirely solid and called the *Ligament of the Ovary*. The ovary is enveloped by a dense, cellulo-filamentous membrane, the inner surface of which sends a number of prolongations into their parenchyma. The parenchyma is soft and spongy; when torn, seems composed of cellular and vascular lobules, of a grayish colour, gorged with fluid. In the midst of these lobules, are lodged from fifteen to twenty small vesicles (*vesiculæ* s. *ovula Graafiana*), transparent, of the size of a millet seed, and formed by a delicate pellicle, in which is contained a viscid fluid, of a reddish colour.

For the anatomy of the rectum, pelvic fascia, levator ani, blood-vessels, and nerves of the female pelvis, see the corresponding parts in the male.

411. Nerves of the Abdomen and Pelvis. This is an extremely troublesome dissection, and is seldom performed well in any dissecting room. The nerves supplying the walls of this cavity and its contents, are of three kinds. 1°. Cranial nerves. 2°. Spinal nerves. 3°. Sympathetic nerves. Presuming that the student is quite familiar with the anatomy of the abdominal and pelvic viscera, he will experience little difficulty in tracing the larger branches of these nerves. 1°. The nervi vagi, or rather the gastric portions of the nervi vagi having formed the œsophageal cords, as has been already described in the dissection of the thorax, enter the abdomen by the œsophageal orifice of the diaphragm. The right is larger than the left, and is attached to the posterior orifice of the gullet. It forms a complicated plexus, from which branches proceed to the stomach; likewise to the solar plexus, and to many of the secondary plexuses arising from it, viz. hepatic, splenic, cœliac, right gastro-epiploic; some expand upon the vena portæ, or go back to the pancreas, duodenum, and gall bladder. The *left* œsophageal cord passes anterior to the gullet; its branches go to the stomach, or communicate with those of the right side, or join the hepatic plexus. 2°. The sympathetic nerves within the abdomen must be next dissected. Commence by finding the main trunk itself passing on each side from the thorax into the abdomen, generally along with the psoas muscle, and behind the ligamentum arcuatum breve or internum; and at the same time look for the passage of each of the splanchnic nerves also through the diaphragm, they are generally covered by the supra-renal capsules. These form a key to the dissector, of all the sympathetic nerves within the abdomen and pelvis. We shall commence with the examination

of the splanchnic nerves. The great splanchnic nerves, two in number, must be traced to the semilunar ganglion, and solar plexus, in which they terminate. The smaller splanchnic, also two in number, have a similar termination. Having examined the semilunar ganglion and solar plexus, (for which, and all other parts of the sympathetic system of nerves, see the "Account of the Nervous System") trace from it generally along the course of the various blood vessels the plexuses to which it gives rise; these are the sub-diaphragmatic, cœliac, hepatic, splenic, superior mesenteric, inferior mesenteric, renal or emulgent, and spermatic plexuses. Let the student next return to the continued trunk of the sympathetic nerve, and to its ganglion. Having traced it from the thorax into the abdomen, where it is generally much curved, and very small, as it passes behind the diaphragm, it descends a short way, and then joins the first *lumbar ganglion*. These ganglia are commonly five on each side, near the inner edge of the psoas magnus, behind the vena cava on the right side, and the aorta on the left; they all communicate with each other by *rami communicantes*. From these ganglia proceed filaments, viz. *external* and *internal*. The external cross the lumbar arteries, before which they pass to join the anterior branches of the lumbo-spinal nerves. Some filaments go to the psoas magnus. The *internal filaments* from these ganglia are numerous and slender. They form the *aortic plexus*, which is continued into the hypogastric plexus. By tracing the sympathetic into the pelvis on either side, the sacral ganglia, and those communicating branches connecting them to each other, and to the last lumbar ganglia, are easily made out. There are three or four sacral ganglia on each side. They lie in front of the sacrum, immersed in fat and cellular substance. The first communicates with the inferior lumbar ganglia; the last is *impar*—the sympathetic nerves on each side running into it. It lies in front of the superior coccygeal vertebra. From these ganglia arise *external* filaments which anastomose with the sacro-spinal nerves, and internal filaments which join those of the opposite side upon the middle of the sacrum. The hypogastric plexus is remarkable for its complexity. It is formed by filaments of the vesical, uterine vaginal, and hæmorrhoidal plexuses. It sends its ramifications to the rectum, bladder, vesiculæ seminales, uterus, vagina and anus. M. Muller has shewn that branches may also be traced to the penis. The spinal nerves within the abdomen and pelvis are not difficult of dissection; their branches proceed chiefly to the muscles forming the walls of the abdomen and pelvis, and to the muscles of the lower extremities; likewise to the integuments of all these parts. Begin by examining the lumbar nerves, cutting away cautiously the psoas, taking care to remove the os innominatum, or a portion of it, on one side; this is generally the left. Clean these nerves, carefully preserving as many of the more superficial branches as may be. To do justice to this dissection, remove the bodies of the two last dorsal vertebræ, and those of all the lumbar vertebræ. Open the theca or dura mater of the medulla, and examine the roots of the lumbar nerves, as they come from the medulla, previous to their passing out of the canal by the foramina conjugalia.

412. Lumbar Nerves. Of these there are five pairs, reckoned numerically, from above downwards. The first leaves the vertebral canal by the foramina conjugalia formed between the first and second lumbar vertebræ, and the fifth by the same openings formed between the last lumbar and first sacral vertebræ. Their posterior branches chiefly supply the muscles of the back; their anterior form a plexus, *lumbar plexus*, from which arise the following nerves. 1°. Ilio scrotal. 2°. Middle branch. 3°. Inguino cutaneous. 4°. Genito-crural, or external spermatic. 5°. Anterior crural. 6°. Obturator. 7°. Lumbo-sacral.

413. The Sacral Nerves vary in number from four to six on each side. Their posterior branches are very small, and pass out of the canal by the posterior sacral foramina, the anterior by the anterior sacral foramina; the anterior branches, which are chiefly very large, together with the lumbo-sacral nerves, form the *sciatic* or *sacral plexus*. From this arise branches which may be divided into *anterior* and *posterior*. The *anterior* are the hæmorrhoidal, the vesical, uterine, and vaginal nerves. The posterior are the small sciatic and

its branches, the pudic, and the great sciatic. For the further account of this nerve, see the "Dissection of the Lower Extremity." This nerve terminates the sacral plexus, and escaping from the pelvis by the great sciatic notch, beneath the inferior margin of the pyramidalis, after passing in front of this muscle, to which it sends filaments, next places itself behind the gemelli and obturator internus, between the tuber-ischii and great trochanter. Its further dissection, together with that of the obturator and crural nerves, belongs to the anatomy of the lower extremity.

PART VIII

DISSECTION OF THE HEAD AND NECK.*

414. The dissection of the head and neck is that with which the student generally, and very properly, completes his anatomical studies. In his first dissection of this part, he should confine himself strictly to the anatomy of the muscles and larger organs, such as the parotid, thyroid gland, &c. During a second, and even a third examination of the same parts upon different subjects, he may then examine the anatomy of the arteries and nerves. These repeated examinations will make him also master of the surgical anatomy of these important regions. Let the dissection be commenced with the soft parts situated over the calvarium. The hair having been closely removed, make an incision through the integuments merely, from the external occipital protuberance to the extremity of the nose, along its dorsum.

* It is presumed, that the student, previous to commencing the dissection of the fore part of the head and neck, with which this section is chiefly occupied, has already dissected the muscles on the back of the neck. For a minute account of them, see the section, "muscles of the back."

A second incision, between the extremity of the first and the back part of the cartilage of the ear, a third incision from the vertex or top of the head to the root of the zygomatic arch, and a fourth, from the root of the nose along the superciliary ridges in a semicircular direction towards the external angular process of the frontal bone, and a short way above the eye-brow. The greatest care must be used in dissecting off these flaps of integument; the cellular substance connecting them to the subjacent muscles and tendons being extremely dense, close, and granular, similar in some respects to what is found over the palmar and plantar aponeuroses. Having removed the integuments carefully, the student will find them of great thickness and extremely vascular, it being in this part of the body more than in any other, that arteries of considerable magnitude approach the surface for the purpose of supplying the integuments; this is obviously caused by the peculiarities of the hairy scalp, and the necessity of an ample supply for the nourishment of the hair. The bulbs of the hair may be seen mostly in the subcutaneous cellular substance, and their presence, together with that of numerous sebaceous follicles, contribute, no doubt, to give to the hairy scalp its peculiarities both of structure and diseases. That the hairy scalp moves either by the action of its own muscles or by the hand, is dependent on the looseness of a cellular tissue between the epicranial aponeurosis and the pericranium; thus the epicranial muscles and aponeurosis move along with the hairy scalp. The student must now proceed to clean the following muscles,—

415. Occipito-frontalis; although this muscle is usually described as one, it is, in fact, composed of four; viz., two occipital and two frontal, with a common central aponeurosis—the epicranial aponeurosis; the whole might with propriety be called, the *musculus epicranius;* clean the muscles, as usual in the dissection of their fibres, and commence with the occipital portions. The occipitalis is situated at the posterior part of the cranium, behind the mastoid process, and above the upper curved line of the occipital bone, it is attached by short aponeurotic fibres to the outer part of that line, and to the neigh-

bouring region of the temporal bone, above the splenius and sterno-cleido mastoideus; it terminates above, after a short course, in the epicranial aponeurosis. The integuments, and some nervous filaments cover it, together with a thin layer of the epicranial aponeurosis, beneath it we find a similar layer of the same part; secondly, the pericranium; and lastly, the occipital and temporal bone. Its action is to stretch the aponeuroses and to alternate with the frontalis muscle. Next clean the *frontalis*. This muscle covers the forehead, it is thin, square-shaped, adheres strongly to the skin; superiorly it terminates in the epicranial aponeurosis, inferiorly the fibres unite with the pyramidalis nasi, orbicularis palpebrarum, and corrugator supercilii; thus it is the antagonist of these muscles. It moves the scalp freely, and by its action produces the transverse wrinkles of the forehead, it also is enclosed by a thin sheath or splitting of the epicranial aponeurosis. The integuments cover it anteriorly, its deep surface covers the supra-orbitar vessels and nerves. The *epicranial aponeurosis* is the broad tendinous expansion which connects these four muscles to each other, it adheres strongly to the scalp, but very loosely to the parts beneath it; anteriorly the frontal muscles are inserted into it; posteriorly, the occipital; laterally, the superior muscles of the ear; upon the temples it degenerates into common cellular membrane, and becoming thinner and thinner, is lost upon the face. The six arteries supplying the scalp, lie above it, together with the integuments; beneath it is a quantity of lax cellular substance containing no fat, and connecting it loosely to the pericranium and to the temporal aponeurosis; the fibres composing it are white and parallel posteriorly, but in other parts interwoven and indistinct; the intervals which occur between the bundles of its fibres contribute to render its dissection difficult; lastly, as we have seen, it furnishes thin sheathes for the muscles just described. The next muscles to be dissected are the extrinsic muscles of the ear, so named as they proceed from other parts towards the ear itself.

416. The SUPERIOR AURIS, or *attollens auriculam*, is situated on the temple, above the ear. Thin, membranous, and angular, attached by its summit to the fore and inner

part of the fibro-cartilage of the ear, on the convexity which is formed by the upper part of the concha, ascends from thence, in a radiating manner, to the epicranial aponeurosis, where it terminates. The *outer surface* is covered by the skin, the *inner* covers the aponeurosis, of the temporal muscle. Its action is to raise the ear.

417. ANTERIOR AURIS, (*prior auriculæ*), is of the same form as the preceding muscle, but less apparent, and is situated on the temple, before the ear. Its summit is attached to the fore part of the helix, and from this point its fibres proceed, to terminate on the outside of the epicranial aponeurosis, near the frontal muscle. *Its outer surface* is covered by the skin; the *inner* is applied upon the temporal muscle and artery. Its *upper edge* is confounded with the preceding muscle, while the *lower* is lost in the cellular tissue above the zygomatic arch. It carries the ear forwards and upwards. Next dissect

418. The POSTERIOR AURIS (*Musculi Retrahentes Auriculam*). This muscle consists of one or more small bundles of fleshy fibres, thin, flat, or fusiform, rather irregular, and situated behind the ear; attached by short aponeuroses to the mastoid process, whence they proceed horizontally forwards to terminate at the lower part of the convexity formed by the concha of the ear by aponeurotic fibres or small tendons. They are covered by the integuments, and are separated from the temporal bone by cellular tissue. This muscle, which has no connexion with the epicranial aponeurosis, carries the ear backwards. To dissect this muscle, the student will require to draw the external ear forward with hooks. The intrinsic muscles of the ear, viz. those which pass from one cartilage to another, will be described along with the organ of hearing, as being interesting only in a physiological point of view. The vessels and nerves, which supply this region of which we have just examined the muscles, are chiefly the temporal, posterior, auricular, and occipital arteries; the branches of these vessels proceed mostly to the hairy scalp; veins having the same names accompany them; the nerves are derived from the portio-dura (7th), ophthalmic division of the

5th, and the occipital branches of the cervico-spinal nerves.

419. Removal of the Brain and Dissection of the Face. If the student be desirous of examining the brain of the subject he is dissecting, he must at this stage of the dissection take off the skull-cap, and in the usual way remove the brain. He will, however, in doing so, destroy the temporal muscle and its aponeuroses, which should therefore, if possible, be rapidly cleaned and examined. Having removed the brain, it ought to be preserved in alcohol of sufficient strength, until such time as he can return to its examination with advantage, and he may now proceed with the dissection of the face. Commence the dissection by an incision round either orbit; a *second* around the mouth, which cavity must be filled with baked hair or some such substance, and neatly stitched up; a *third* incision is to be carried from the angle of the mouth to the temple, and a *fourth* to the angle of the jaw. Remove cautiously the flaps of integuments from these surfaces, and commence by the dissection of the *orbicularis palpebrarum.* The integuments over this muscle are very fine, and the substratum of cellular structure may be observed to be without fat; clean the fibres in a semicircular direction, commencing at the external canthus of the eye, and tracing its fibres inwards towards the internal canthus, where a tendon will be found attaching them to the nasal process of the superior maxillary bone; this tendon lies over the lachrymal sac, and must be cleaned with great care, inasmuch as it is a minute structure.

420. The Orbiculares Palpebrarum surrounds the base of the orbit, and occupies the greater part of the upper and lateral region of the face: broad, thin, and circular, slit transversely in the middle for the aperture of the eyelids. There are three distinct points of origin internally for its fleshy fibres: 1st, at the ascending process of the upper maxillary bone, and internal orbitar process of the frontal; 2dly, at the anterior edge of the lachrymal groove and the neighbouring part of the base of the orbit; 3dly, at the two sides and fore part of a small tendon (tendo palpebrarum), about half a line broad, and two lines long, stronger toward its point of attachment than the place

where it terminates; this tendon proceeds transversely outwards, from the anterior edge of the lachrymal groove, to the internal commissure of the eyelids, where it bifurcates to be continued with each of the fibro-cartilages, situated in their substance. Posteriorly, this tendon adheres intimately to a thin aponeurosis, which covers the lachrymal sac, and also gives rise to some fleshy fibres, and was formerly called the *reflected tendon of the orbicularis palpebrarum.* After originating in this manner, the upper and lower fibres of the muscle proceed, in opposite directions, to the upper and under parts of the base of the orbit, and following its curvature, unite at the outside of the external commissure of the palpebræ. The middle fibres, which are less distinct, much less curved, and always very pale, are distributed in the substance of both eyelids, and also unite below the outer commissure by a tendinous line, sometimes of considerable size. This tendinous line occurs very rarely; it is denied by Cruvillhier, but I have seen it twice distinctly. All these fibres describe concentric curves, whose centre corresponds to the aperture of the eyelids, where they are much shorter. Those which are nearest the circumference are almost circular; the others describe a sort of ellipse, and the more central do not even go so far as the commissures of the palpebræ. The *anterior surface* of this muscle is covered by the skin, to which it is intimately united above, while below it is separated by fat; and in the place which corresponds to the eyelids, is in connexion with a very delicate laminar cellular tissue. The *posterior surface* is applied superiorly upon the corrugator supercilii, to which it adheres; lower down, upon the ligamentum latum and fibro-cartilage of the upper eyelid; externally, upon the external orbitar process, and the aponeurosis of the temporal muscle; below, upon the cheek bone, the zygomatic muscles, the levator labii superioris, the levator labii superioris alæque nasi, from which it is separated by the facial vein, and upon the ligament and the fibro-cartilage of the lower eyelid; internally, upon the ascending process of the superior maxillary bone, and the lachrymal sac. Its *circumference* is confounded, above and below, with the pyramidalis nasi; then a little more outwards, with the anterior edge of the frontalis. At its lower part, it is free, and some irregular bundles of fibres are detached from it, which are lost in the cellular tissue of the cheek, and describe curves whose convexity is below; some of them unite with the zygomaticus minor. The orbicularis palpebrarum carries the eyelids toward each other, bringing them over the fore part of the eyeball, upon which it applies them, wrinkling them more or less. It also depresses the eyebrow at the same time that it raises the cheek, and renders it more prominent. It determines the course of the tears toward the inner angle of the eye. The cessation of its action allows the eyelids to open. It is the antagonist of the levator palpebræ superioris. Remove this muscle cautiously from without inwards, and from above downwards, and thus expose

421. The Corrugator Supercilii, short and thin, describes the same curve as the superciliary arch of the frontal bone, on which it lies. Internally, it is attached toward the nasal prominence of the same bone, by an extremity sometimes simple, but most commonly divided into two or three portions. It terminates in a pointed form, about the middle of the orbitar arch, where it is confounded with the frontalis and orbicularis palpebrarum. Its *anterior surface* is covered by these two muscles, and, a little inwards, by the pyramidalis nasi. The *posterior surface* covers the frontal bone, superciliary artery, and frontal branch of the ophthalmic nerve. It draws towards the nose the skin of the eyebrows, the hairs of which it raises so as to shade the eye. It acts especially in the depressing passions. At this stage of the dissection, a portion of the *tensor tarsi* may be exposed, but this muscle cannot be well seen until both eyelids have been cut through about the middle, and reflected towards the nose, and the mucous membrane covering the surface of the eyeball dissected from off the internal canthus of the eye; this, with the removal of a little cellular substance, will expose the

422. Tensor Tarsi. This muscle was not discovered by Horner, but by Rosenmuller. It arises broad, square, and fleshy from the os unguis, near

its junction with the orbitar plate of the ethmoid, and after a curved course, divides into two fasciculi, one to each eyelid. These fasciculi run along the inner edge of the tarsal cartilages, until they are lost by uniting with the fibres of the orbicularis muscle. *Use:* The muscle is supposed to draw the punta lachrymalia and eyelids into close contact with the eyeball, and to compress the lachrymal sac.

423. Pyramidalis Nasi, situated at the root of the nose, regarded by many anatomists as an appendage of the frontales muscles. At its upper part it covers the nasal bones. The two pyramidales muscles are united above, but separate lower down, terminating in a diverging manner in a membranous tissue rather cellular than fibrous, which occupies the sides of the nose, and also receives the fibres of the triangularis nasi. Externally, they are intimately united with the orbiculares palpebrarum. *Use:* it gives to the frontalis a fixed point, and contributes a little to the motions of the nose.

424. Triangularis Nasi (*Compressor* or *Dilator Nasi*) is thin, flat, and triangular, and is situated upon the sides of the nose. It arises internally of the fossa canina by a short and narrow aponeurosis, from which proceed in a divergent manner the fleshy fibres, which issuing from beneath the levator labii superiores alæque nasi, cover the back of the nose, describing a curve whose convexity is directed upwards. The superior fibres, which are longer, ascend, and the inferior, which are shorter, are horizontal; they gradually degenerate into a rather loose aponeurotic expansion, which covers the nose, adheres to it, and is continuous with the pyramidalis nasi and the muscle of the opposite side. One of its portions is attached to the fibro-cartilage of the wing of the nose. Its *anterior surface* is covered by the skin, and a little by the levator communis muscle; the *posterior* is applied upon the superior maxillary bone, and upon the lateral cartilage of the nose. Anatomists have attributed entirely opposite uses to this muscle. Its true action is to draw the wings of the nose outwards, and thus to dilate the nostrils. This muscle is exposed by detaching the inner part of the following.

425. Levator Labii Superioris Alæque Nasi, usually called the *Levator Communis;* this muscle is a thin triangular fleshy bundle, contracted at its upper part, and broader below. It is situated on the sides of the nose. It arises above from the outer surface of the ascending process of the superior maxillary bone, beneath the tendon of the obicularis palpebrarum, as well as from the anterior edge of the lachrymal groove and lower part of the base of the orbit, by short aponeuroses, succeeded by the fleshy fibres, which descending obliquely outwards in a diverging manner, are partly attached to the fibrous membrane, fibro-cartilage, and even skin of the wing of the nose, and partly lose themselves in the upper lip, passing before the orbicularis oris. Its *anterior surface* is placed beneath the skin, to which it adheres intimately below. At its upper part alone, it is concealed by a portion of the orbicularis palpebrarum and by the labial vein. The *posterior surface* covers the preceding muscle, the ascending process of the superior maxillary bone, the edge of the levator labii superioris, the depressor alæ nasi, a part of the orbicularis oris, and some branches of the infra-orbitar nerve. It raises the upper lip and the wing of the nose, which it also draws a little outwards. The next muscle,

426. The Levator Labii Superioris lies to the outer side of the last described, and some anatomists have viewed both as one muscle, but this is incorrect, since its fibres follow a somewhat different direction, and the following description, which is strictly anatomical, proves that it merits to be classed as a different muscle. This muscle is thin, flat, rather short, and of an irregularly quadrilateral form. Attached above the infra-orbitar foramen, over an extent of about an inch, to the malar and upper maxillary bones, by short aponeurotic fibres, frequently divided into two, and sometimes into three fasciculi. Thence it descends, contracting, downwards and inwards, to the corresponding lip, where it is confounded with the orbicularis oris, between the nose and the commissure. Its *anterior surface* is covered at its upper part by the orbicularis palpebrarum and labial vein, and below by the skin, to which it strongly adheres. The *posterior*

surface is in connexion wlth the levator anguli oris, from which it is separated by the infra-orbitar vessels and nerve, as well as by a great quantity of adipose tissue. It also covers the depressor labii superioris et alæ nasi. Its *inner edge* is often confounded with the levator labii superioris alæque nasi; and the *outer* frequently united to the zygomaticus minor. It raises the upper lip, carrying it a little outwards. Detach the levator labii superioris from the edge of the orbit, and reflect it toward the nose,—this will expose the

427. Levator Anguli Oris or (*Musculus Caninus*). This is a small elongated flat muscle, broader and thinner above than below, attached, beneath the infra-orbitar hole, by short aponeuroses, to the fossa canina, from which it descends obliquely outwards to the commissure of the lips, where it seems to be continuous with the triangularis, although some of its fibres are interlaced with those of the orbicularis oris, zygomaticus major, and buccinator muscles. Its *anterior surface* is covered above by the preceding muscle, and the infra-orbitar vessels and nerves, and below by the zygomaticus minor and skin. The *posterior surface* covers the fossa canina, the mucous membrane of the mouth, and buccinator. It raises the commissure of the lips and carries it inwards.

428. Zygomaticus Minor. This muscle does not occur in all subjects. It is situated internally of the zygomaticus major, and above it, is flat, elongated, and thin. It arises from the outer surface of the malar bone, or from the orbicularis palpebrarum, and descends obliquely inwards, terminating in the levator labii superioris, or in the orbicularis oris. Its *anterior surface* is covered by the skin and orbicularis palpebrarum. The *posterior* covers the malar bone, the levator anguli oris, and the labial vein. It runs parallel with the zygomaticus major. It raises the upper lip and draws it outwards.

429. Zygomaticus Major. Is elongated, slender, rounded, attached by aponeuroses, below the outer surface of the malar bone, near its posterior angle; becoming a little broader, it descends inwards and forwards, and terminates at the commissure of the lips, where it is continuous with the levator anguli oris, depress-

anguli oris, buccinator and orbicularis, sometimes bifurcating. Its *anterior surface* is concealed above by the orbicularis palpebrarum, and farther down by the skin, from which it is often separated by an enormous quantity of fat. The *posterior surface* covers the malar bone, the masseter and buccinator muscles, the labial vein, and a more or less considerable mass of adipose tissue. It raises the commissure of the lips, which it carries backwards and outwards. It acts principally in laughing.

430. The DEPRESSOR LABII SUPERIORIS et ALÆ NASI. This is a small fleshy bundle, somewhat irregular, placed beneath the wing of the nose and behind the upper lip. To expose it, the upper lip must be everted, and the mucous membrane dissected from off it, close to the frænum. It arises, by short aponeuroses, near the anterior nasal spine, from a small fossa, whence it ascends in part toward the posterior region of the wing of the nose, and is partly confounded with the levator labii superioris alæque nasi and the orbicularis oris. Internally, its fibres are vertical, externally oblique. They are covered by those of the levator labii superioris alæque nasi, and by the mucous membrane of the mouth, and are applied upon the superior maxillary bone. It depresses the wing of the nose.

431. The DEPRESSOR ANGULI ORIS, or (*Triangularis Labiorum,*) is thin, flat, and triangular, with the apex superiorly, and the base inferiorly; arising from the external maxillary line, between the masseter muscle and the mental hole, by short aponeurotic fibres, succeeded by fleshy fibres, some of which appear to come from the platysma myoides. These fibres ascend toward the commissure of the lips, those in the middle vertically, the anterior obliquely backwards, and the posterior from behind forwards. At the summit of the muscle, they are incorporated with the zygomaticus major and orbicularis oris, but more especially with the levator anguli oris. The *outer surface* adheres strongly to the skin. The *inner* covers the platysma myoides, buccinator and depressor labii inferioris, to which latter it is united. Close to its outer edge the fascial artery will be found running over the base of the jaw, and proceeding in the same direction as the muscle. It

lowers the commissure of the lips, and acts especially in grief.

432. The Depressor Labii Inferioris, or (*Quadratus Menti,*) is situated to the inside of the preceding muscle, and is thin and quadrilateral. It arises from the external oblique line of the inferior maxillary bone, and ascends in the lower lip, where it is confounded with the orbicularis oris. Its fibres, which are parallel, and seem to be continuous with those of the platysma myoides, are directed obliquely upwards and inwards, uniting in the most intimate manner, internally and above with those of the opposite side, and internally and below with those of the levator menti, while externally and below they are interlaced with those of the preceding muscle. In the substance of the muscle there is much fat deposited, which, together with the paleness of its fibres renders it difficult of dissection. Its *anterior surface* is covered by the depressor anguli oris and by the skin, to which it strongly adheres. The *posterior surface* is applied upon the lower jaw, the mental nerve and vessels, and the orbicularis oris and levator menti. This muscle depresses the lower lip.

434. The Levator Labii Inferioris, or (*Levator Menti,*) is situated between the two depressores labii inferioris; short, thick, and conical. It is attached by its summit to the fossa, tendinous on the side of the symphysis of the chin, under the alveoli of the incisors. Its fibres diverge from this point, and are inserted into the skin of the chin, to which they strongly adhere, and where they produce the small hollows that are generally observed on that part. It is covered *above* by the mucous membrane of the mouth: *internally* is separated from that of the opposite side by cellular tissue; *externally,* it is contiguous with the depressor labii inferioris and orbicularis oris; *below,* it lies upon the jaw, and is covered *anteriorly* by the integuments. It raises the chin, and pushes the under lip a little upwards. Its upper fibres also serve to invert the lip.

434. The Orbicularis Oris. This muscle forms the greater mass of the lips, and should perhaps be dissected immediately after the orbicularis palpebrarum; the terminations of the zygomatici, levatores labii,

levatores anguli oris, depressores labii inferioris, levatores menti and buccinators, which are interlaced in a very complicated manner, are incorporated with its proper fibres. It completely surrounds the mouth. Its fibres correspond to the free edge of the lips ; they are concentric, curved, and divided into two planes, one of which belongs to the upper, the other to the under lip. Viewed in connexion, they present an oval form, and intersect each other at their two commissures. Covered *anteriorly* by the skin, to which it firmly adheres. The *posterior surface* is lined by the mucous membrane of the mouth, to which it is more loosely attached ; it is also in connexion with the labial glands. Its *free circumference* is invested by the red membrane of the lips. Its *great circumference* is continuous on all sides with the muscles which we have just enumerated. Superiorly and in the middle, it is attached by some fibres to the lower part of the septum of the nose. *Use:* to bring the lips toward each other, and contract the aperture of the mouth, which it carries forward. It acts in suction, in playing upon musical instruments, &c. It also acts as an antagonist to all other muscles of the lips. Detach the zygomaticus major and minor from the bone,—remove cautiously the fat and cellular substance lying in the hollow of the cheek, between the angle of the mouth and ramus of the jaw. In this dissection, the dissector will meet with many branches of the seventh pair of nerves, some of which may be preserved, but more especially the duct of the parotid, which perforates the buccinator muscle at the distance of about three-fourths of an inch below the zygomatic arch. Having cleaned and preserved these parts for after more minute examination, and pulled backwards the anterior margin of the masseter, he will thus expose a sufficiency of the buccinator muscle to enable him to understand its general course.

435. The BUCCINATOR is flat, thin ; situated in the interval between the two alveolar borders. It is attached above to the posterior part of the upper alveolar border, from the last tooth to the second small grinder ; below, to the same part of the lower alveolar border ; in the middle, to an aponeurosis which descends from the summit

of the inner wing of the pterygoid process, to the root of the coronoid process, and which receives on the other side fibres from the constrictor pharyngis superior. This tendon is called the inter-maxillary ligament. From these origins the fleshy fibres proceed toward the commissure of the lips, following different directions: the upper descending, the lower ascending a little, and the middle fibres passing horizontally forwards. They meet at the commissure, where a marked interlacing takes place between the upper and lower, the former passing into the under lip, the latter into the upper, where they are confounded with the fibres of the orbicularis oris. Covered by an extremely thick layer of fat, without which the cheek would appear hollow, and which forms in the middle of the latter a sort of ball, appearing as if separated from the neighbouring parts. By this fat, its *external surface* is separated posteriorly from the coronoid process, and from the lower part of the temporal muscle; and in the middle, from the masseter. Anteriorly, it is covered by the zygomaticus major, platysma myoides, and triangularis muscles, by the skin, labial artery and vein. A whitish membrane, formed of a fibrous cellular tissue, also covers it in its whole extent, adhering intimately to it, and prevents the buccal glands from being immediately applied upon it posteriorly. The *inner surface* is lined by the mucous membrane of the mouth. Opposite the third molar tooth, it is obliquely traversed by the duct of the parotid gland. It draws the commissure of the lips backwards, and contributes to mastication, by keeping the food between the teeth. If the mouth is filled with air which distends the cheeks, it compresses it and drives it out, as in the action of blowing, sounding a trumpet, &c. Before proceeding with the dissection of the temporal, masseter, and pterygoid muscles, which are the great muscles of mastication, and can be exposed only by deep sections of the upper and lower jaw, the student ought to examine the anatomy and structure of

436. The Parotid Glands (right and left) are the largest of the salivary glands, of which we usually reckon six, placed around the lower jaw. To expose

the parotid fully, an incision must be carried downwards from before the ear, a short way upon the neck, and this, together with the previous incision through the integuments of the face, will enable the student to display the upper part of the latissimus colli or platysma-myoides; by cautiously reflecting this from without inwards, he will find a strong facia underneath: this is the upper part of that important texture named the cervical facia. He will find this facia continuous with another facia covering the parotid. This latter facia is not limited to the surface of the gland, but sends prolongations into the interior of the gland, whereby its lobules are partially separated from each other, and moreover adheres to the cartilaginous lobe of the ear, and to the zygomatic process of the temporal bone. The parotid is situated partly before and partly beneath the external ear, filling up the deep excavation on the sides of the face, between the posterior edge of the ramus of the lower jaw, the meatus auditorius externus, and the mastoid process of the temporal bone. It extends vertically from the zygomatic arch to below the angle of the jaw. Its *outer surface* is broad, flat, oval, slightly convex, and having no precise limits, extends more or less upon the face. It is covered by some fibres of the platysma-myoides, the skin, with a few nervous filaments. Its circumference is prolonged anteriorly over the masseter muscle, and superiorly over the articulation of the jaw. At the under part of this circumference, from which Steno's duct takes its rise, the branches of the facial nerve are seen emerging. The *anterior surface* corresponds above to the articulation of the lower jaw, externally to the posterior edge of the same bone, and internally to the pterygoideus internus muscle. It is moulded upon these different parts, and penetrates into their intervals. Its *posterior surface* is connected by dense cellular tissue with the meatus auditorius externus, the mastoid process, the anterior edge of the sterno-cleido-mastoideus, the posterior belly of the digastric muscle, the styloid process, and the muscles which arise from it. All these relations of the gland may be sufficiently exposed by a careful dissection of the edges of the gland. The internal carotid artery, and internal jugular vein, touch its deepest surface. The external carotid artery, at its termination, and especially the superficial temporal artery, are also in connexion with this surface of the parotid gland. They are even generally enveloped by its parenchyma, especially the latter, which traverses it from below upwards; while the facial nerve, which is also placed in the gland during part of its course, passes transversely through it; but in order to see these two facts, the gland must be divided perpendicularly with the knife, to such a depth as to expose the facial nerve, the external carotid artery, and its accompanying vein, these lie at a great depth in the gland, and near its posterior surface. The parotid gland furnishes, by each of the granulations of which it is composed, a very slender excretory duct, which unites with those in its vicinity, in the manner of veins, to form somewhat larger twigs, then branches, and lastly, a considerable trunk named the *Parotid Duct* or *Steno's Duct*, (*ductus Stenonianus.*) This duct emerges from the fore and outer part of the gland, a little above the middle of the height of the masseter muscle, over which it proceeds horizontally, from behind forwards, to turn over its anterior edge, and sink into the adipose cellular tissue of the cheek, and beneath the zygomatic muscles. Having arrived upon the buccinator muscle, it passes through an aperture formed in the midst of its fibres, and terminates in the mouth, opposite the second molar tooth of the upper jaw, at the distance of about three lines from the meeting of the cheek with the corresponding gums. The duct does not pass through the buccinator obliquely, but perforates it perpendicularly, and forms an angle as it passes through the mucous membrane of the mouth, proceeding a little forwards. Its orifice is besides very contracted, and furnished with a small fold of the mucous membrane, so that it is not easily perceived from the inside of the mouth. It very frequently receives, about the middle of its length, another duct from a glandular body placed in its vicinity, (*socia parotidis*) which appears to be an accessory gland to the parotid. This body is in fact placed before the masseter muscle, either above or beneath the duct, sometimes even in its course. Its surface is commonly smoother than that of the gland itself. Its duct seems uniformly to join that of Steno, although the contrary has been asserted by some. The parotid duct is but loosely connected with the neighbouring parts. It is accompanied by several branches of the facial nerve, and by some arteries which furnish ramifications to its walls. Placed immediately under the skin, it is only separated from it internally by some fibres of the platysma-myoides, and by the zygomaticus major, which crosses its direction obliquely. It is about a line in diameter, but its cavity is very narrow. Its walls are composed of two distinct membraneous layers. The *outer* is firm, strong and thick, of a whitish colour, and fibro-cartilaginous appearance; it acquires still greater density towards the end of the duct, which, without increasing in capacity, becomes conical; and near the buccinator muscle it gives rise superficially to a thin aponeurosis which covers the fleshy fibres of that muscle, while it also gives attachment to some of its fibres as it passes into the aperture of which we have spoken above, and by which these fibres are actually interrupted and not merely separated. The other membraneous layer of the duct is *internal;* it is mucous, very delicate, and appears to be continuous with the membrane which lines the cheeks, differing from it only in whiteness. To expose this, the duct had better be opened about the middle with a pair of scissors, and a probe or bristle passed through the interior of the duct into the mouth. There are always found, in the substance of the parotid gland, a great number of branches of the facial nerve, the transverse artery of the face, the posterior auricular artery, and the vein which forms a communication between the internal and external jugular vein. It thus receives the greater part of its vessels and nerves; but a branch of the inferior maxillary nerve and one of the ascending branches of the cervical plexus furnish it with a few additional nerves. Its lymphatic vessels are numerous, and pass into the glands situated at its surface or behind the angle of the jaw. Its parenchyma differs in nothing from that of the other salivary glands. To observe the deep-seated connexion of the gland and its position to the deep arteries, styloid process, &c., the gland must be extensively cut into and even partially raised up. As this necessitates the section of many nerves and vessels, the student must view them at this stage of the dissection.

437. The PORTIO DURA or motor division of the seventh pair of Willis, and its connexion with the fifth pair and with the cervical nerves form the principal nerves to be considered here. Immediately on leaving the foramen stylo-mastoideum, the facial nerve or portio dura gives off the *posterior auricular* branch, which is applied to the mastoid process and lodged in the groove between that process and the vaginal; it next gives off the *styloid branch* to the stylo-hyoid muscle; a *posterior mastoid branch* to the posterior belly of the digastric muscle. The porto dura next divides into two great divisions, the *temporo-facial* and *cervico-facial*. The first or superior of these proceeds from behind forward in the substance of the gland, crosses the neck of the condyle of the lower jaw receiving branches from the *auriculo-temporal* branch of the fifth or trifacial. *This branch* which comes from the inferior maxillary branch of the fifth, lies very deep close to the mastoid process and behind the neck of the bone. The *Temporo-facial* division of the portio dura next subdivides into temporal, orbitar, sub-orbitar, and buccal branches which may be seen piercing the gland in various directions. The greater number of these nerves supply the muscles of the regions to which they proceed. The second or inferior division of the *facial* nerve, called the *cervico-facial*, follows the original direction of the nerve, proceeding, like the former from behind forwards in the substance of the gland as far as the angle of the jaw, where it subdivides into *buccal*, *mental* and *cervical* branches. These latter anastomose with the *nervus superficialis* or *ascendens colli*, a branch of the cervical plexus which may be seen crossing the mastoid muscle obliquely, and after penetrating the gland, unites with the facial. The older anatomists described a *plexus* or *pes anserina* formed by the portio dura whilst in the gland. The portio dura in its course forms not one but several plexuses.

438. The EXTERNAL CAROTID ARTERY enters the gland at its inferior margin and close to its deep surface; in its ascent it is crossed by the portio dura. By

dividing the substance of the gland, the artery may be traced through it, becoming more and more superficial, until becoming the temporal it ascends over the superior border or apex of the gland, pierces the fascia, and passes over the root of the zygoma, in front of the external ear. In this course it gives off the *posterior auricular*, running between the mastoid process and auditory canal; the *transversalis faciei* which arises, however, most frequently form the *temporal branch* of the carotid. This branch follows the course of Steno's duct, being generally above it Lastly, the external carotid, whilst still embedded in the gland, divides into its terminal branches, viz. the internal maxillary and temporal. The internal maxillary passes inwards and forwards behind the ramus of the jaw, and a short way below the condyle. The anterior border of the gland must be drawn forcibly away from the parotid margin of the jaw, in order to expose a small portion of this artery. Lastly, the *temporal* artery follows the original direction of the external carotid, becomes subcutaneous soon after passing over the root of the zygoma. The *veins* corresponding to these arteries, follow their course, and are similarly named. The temporal and internal maxillary veins unite to form a single trunk in the substance of the gland, which, descending, leaves it inferiorly, and near the angle of the jaw subdivides into two branches, (on the surface of the digastric muscle,) one proceeding to join the external jugular vein, the other, the internal jugular. The latter branch is usually the larger, but not constantly. To examine the deeper connexions of the carotid, and thus be satisfied of the danger, if not impossibility of removing the whole of the gland, when schirrous, or affected with any disease requiring its extirpation, divide Steno's duct, and forcibly raise up the gland. It may now be perceived that it partially envelopes the styloid process, touching the internal carotid artery and jugular vein, the glenoid cavity of the temporal bone, ligaments of the lower jaw, and internal pterygoid muscles. Its intimate union with the external surface and anterior margin of the sterno-mastoid, has been already noticed. The student must next clean the masseter muscle.

439. MASSETER lies upon the outer surface of the

lower jaw, arising from the two anterior and outer thirds of the inferior edge of the zygomatic arch, from the posterior part of that edge, from the inner surface of the arch, and from the internal aponeurosis of the temporal muscle. These origins take place in a distinct manner; the *first*, by a very strong, broad, and thick aponeurosis, which covers the outer surface of the muscle to beyond its middle part, and is divided into several digitations which are interposed between its fleshy fibres; the *second*, by small aponeurotic bundles, which are much shorter; the *third*, by small fibrous planes of still less extent. The fleshy fibres which come from these three points follow different directions; the first, which constitutes the principal part of the muscle, pass obliquely downwards and backwards, to be inserted at the outside of the angle of the lower jaw, by small aponeurotic laminæ; the second descend vertically, and are attached a little higher; the third proceed obliquely downwards and forwards to terminate on the outside of the coronoid process by other aponeuroses. The *external surface* of this muscle is covered posteriorly by the parotid gland; below, by the platysma myoides; in the middle by Steno's duct, the facial nerve, and the transverse facial artery; anteriorly and above, by the orbicularis palpebrarum and zygomaticus major. All the other parts of this surface are in contact with the skin. The *internal surface* covers the ramus of the jaw, the tendon of the temporal muscle, and the buccinator, from which it is separated by a great quantity of fat. The masseter raises the lower jaw, and acts much during mastication. The part of the lower jaw situated a short way below the condyle, is quite smooth, and has no attachment of any muscular fibres to it. Next clean the

440. Temporal Aponeurosis. This *aponeurosis* is attached to the whole of the curved line formed by the external, frontal, temporal, and parietal crests, to the posterior and superior edge of the malar bone, and to the upper edge of the zygomatic arch. Thin, membranous, and of a violet tint, above where the muscular fibres may be seen shining through it, becoming thick and strong inferiorly, where previous to its attachment to the zygomatic arch, it separates into two very dense laminæ,

between which will be found the middle temporal arteries, and in most young persons, a collection of fat. This aponeurosis secures the temporal muscle in its place, and furnishes an extensive origin for its fibres.

441. The Temporal Muscle may now be exposed fully by removing the temporal aponeurosis and dividing with a saw the zygomatic arch at two points, the first a little in front of the inferior maxillary articulation, so as to avoid cutting through the external lateral ligament; the *second* through the malar bone: by forcing up the part thus separated with a chisel, we remove the masseter along with the divided portion, exposing the temporal muscle and several branches of the inferior maxillary nerve. These branches may be examined and preserved, or divided in such a way as to be afterwards recognized in the progress of the dissection. The *Temporal Muscle* is broad, triangular, thin above, narrow and thick below, filling the whole of the temporal fossa. The fleshy fibres take their origin from the inner surface of the aponeurosis and from the bones forming the temporal fossa, *i. e.* the parietal, frontal, temporal and sphenoid, as low down as a crest which separates the temporal from the zygomatic fossa. The fibres proceed obliquely to a tendon occupying the centre of the muscle which gradually becoming more and more tendinous, is at last inserted into the coronoid process of the inferior maxilla; it embraces this process nearly in its whole extent, excepting externally, into which a portion of the masseter is inserted. The *external surface* of the temporal muscle is covered by the epicranial aponeurosis, the superior and anterior auricular muscles, orbicularis palpebrarum and masseter, the superficial temporal vessels and nerves, and the zygomatic arch. The *internal surface* is applied upon all the bones which form the temporal fossa, the internal maxillary artery, the pterygoideus externus and buccinator muscles, from which it is separated by much fat. The *upper edge* of this muscle is curved; the *anterior* extends from the external orbitar process of the frontal bone, to the anterior edge of the coronoid process of the lower jaw. The *posterior edge*, which is at first attached to the horizontal root of the zygomatic process, is reflected from above downwards over the base of that process,

to proceed to the posterior edge of the coronoid process. This muscle strongly raises the lower jaw, lowers the upper a little, and presses the teeth against each other. The posterior portion draws the jaw backwards, when it has been carried forward by the action of the external pterygoid muscles.

The student may next proceed to the dissection of the pterygoid muscles. Saw through the coronoid process of the lower jaw obliquely at its base; cut the external lateral ligament, and opening the inferior maxillary articulation, depress it cautiously. The masseter muscle may be entirely removed from the outer surface of the ramus after examining the masseteric branch of the fifth pair of nerves, and a portion of the broad surface of the ramus of the jaw also removed with the saw or a pair of bone nippers; this, with a little cleaning, will expose the pterygoid muscles as far as they can be seen at this stage of the dissection.

442. The PTERYGOIDEUS EXTERNUS is short, situated in the zygomatic fossa. It has two origins, one from the outer surface of the pterygoid process and from the palatine tuberosity, the other from the lower part of the zygomato-temporal aspect of the sphenoid bone, immediately beneath the upper edge of the spheno-maxillary fissure. These attachments are formed by aponeuroses; the internal maxillary artery often passes between them, in an interval filled with cellular tissue. From thence the muscle is directed outwards and backwards, becoming gradually thinner, and is inserted into a small fossa at the anterior surface of the neck of the condyle of the jaw, and into the fore part of the circumference of the inter-articular fibro-cartilage. Its *outer surface* is in contact with the temporal muscle, and most commonly with the internal maxillary artery. The *inner surface* corresponds to the pterygoideus internus, the inferior maxillary nerve, the internal lateral ligament of the temporo-maxillary articulation, the middle meningeal artery, and sometimes the internal maxillary artery. The *upper surface* touches the upper part of the zygomatic fossa, and the deep temporal and masseteric nerves. The outer pterygoid muscle draws forward the condyle of the jaw and the fibro-cartilage of the articulation, moving the chin in the opposite di-

rection. When the two act together, the jaw is drawn directly forwards.

443. The PTERYGOIDEUS INTERNUS is a strong and thick muscle, situated internally of, and a little behind, the ramus of the inferior maxillary bone. It arises from the whole pterygoid fossa, and particularly from the inner surface of the outer wing of the pterygoid process, by distinct aponeurotic fibres. It descends backwards and outwards, after receiving fibres from the middle groove of the upper surface of the palatine tuberosity, and some others from the outside of the summit of the outer wing of the pterygoid process. It terminates on the inside of the angle of the jaw by aponeuroses, attached to the more or less prominent ridges that are observed in this place. Its *inner surface* covers, at its upper part, the circumflexus palati and constrictor pharyngis superior, and inferiorly the sub-maxillary gland. The *outer surface* lies internally upon the branch of the lower jaw, much in the same manner as the masseter does externally. It is separated from that bone above by an interval, in which are found the lingual and dentar nerves, the inferior dentar artery, and internal lateral ligament of the temporo-maxillary articulation. When the two muscles act simultaneously, the jaw is raised and carried a little forwards; if only one acts, it carries it a little obliquely toward the opposite side. When the lower jaw is fixed, they depress the upper. During the dissection of these muscles, the student must preserve as far as he can the internal maxillary artery and various branches of the inferior maxillary nerve; in the small triangular space between these muscles, this artery and vein will be found, likewise the dentar and lingual branches of the inferior maxillary.

444. VESSELS AND NERVES OF THE FACE. During the dissection of the muscles and other soft parts just described, the student will meet with the following arteries or at least with portions of them; viz. the fascial or external maxillary, the temporal and the internal or deep maxillary arteries. The student should trace the fascial artery from a little below the jaw to where it crosses the ramus immediately in front of the masseteric muscle, and from this point proceeding in rather a tortuous manner towards the commissure of the lips, and

ultimately to the root of the nose and internal canthus of the eye where it anastomosis with some branches of the ophthalmic which artery is a branch of the internal carotid. But unless the injection of the arteries has been a minute and successful one, this and other anastomoses cannot be seen. In the living person the facial artery may be felt as it crosses the ramus of the jaw, and may easily be compressed at this point during operations on the lips or mouth; the main trunk runs close to the mucous membrane of the mouth, but on its outer side, and may also be compressed at the angle of the mouth between the fingers of the surgeon. We shall afterwards consider that part of the facial artery which lies in the neck in connexion with the submaxillary gland and with the external carotid artery from which it comes. The branches sent off from the fascial, and which will have been met with in the course of this dissection, are the *Labialis Inferior*, the *Coronaria Inferior*, *ar. massetericæ*, *coronaria superior*, *nasi lateralis*, and *angularis*. These arteries are accompanied by corresponding veins. The *Fascial Vein* itself in which they terminate, does not strictly accompany its corresponding artery, but is situated external to it at the distance generally of half an inch; on the ramus of the jaw, however, they closely approximate. The vein ultimately joins the external and internal jugulars. (449.) The external carotid artery as it passes through and behind the carotid will be afterwards described; likewise its termination in two branches, the temporal and internal maxillary arteries. The course of the arteria transversalis faciei may readily be traced. Should the student be disposed to follow the branches of these arteries at this stage of the dissection, he will find that the temporal gives off the following; viz. *anteriores auris*, some very small branches to the fore part of the ear; *capsulares* to the joint of the inferior maxilla with the temporal bone; *temporalis media* penetrating the temporal *aponeurosis* to ramify between its laminæ and upon the muscle; *temporalis posterior* to supply a portion of the scalp; *temporalis anterior* also supplying the scalp and forehead. This is the branch usually selected for arteriotomy. The internal maxillary artery in point of size, may be considered as the terminating branch of the external carotid. Its course is behind the neck of the inferior maxillary bone, between that bone and the internal lateral ligament, afterwards in a tortuous manner between the pterygoid muscles until it reaches the bottom of the spheno-maxillary fossa. All the branches of this artery cannot be traced at this stage of the dissection, but the more important may be noticed; and a knowledge of the bones, which during this and most dissections should be placed before the student, will enable him to judge accurately enough of the course of those he cannot at present follow. The branches come off nearly in the following order: *Ar. meningea media, Ar. dentalis, Ar. pterygoideæ,* and *temporalis profundæ, Ar. massetericæ, Ar. buccales, Ar. maxillares superior, Ar. infra orbitales, Ar. palatina descendens, Ar. nasalis.* Veins accompany these arteries which lie mostly in osseous canals. If the cranium has been previously opened, the middle artery of the dura mater may be seen between the bone and dura mater, and lying in those grooves which mark the cerebral surface of the cranial bones, particularly those of the parietal. When the dura mater is stripped from off the bone, the artery in most cases comes along with it, being in fact firmly imbedded upon its outer surface, the artery in some parts, however, runs along short osseous canals in the bone, and will of course be torn across in the separation of the dura mater from the bone, hence the danger in fractures in this situation. It is this artery which seems to nourish the cranium. The vein occasionally accompanies the artery, but more generally is situated between the tables of the skull, in the diploæ, hence the name veins of the diploæ. The nerves met with in the dissection of the face, are branches of the seventh and fifth pair of cerebral nerves, those of the seventh pair or *portio dura,* have already been carefully described in speaking of the parotid, they proceed chiefly to the muscles of the face. The fifth pair of nerves shews itself on the face chiefly at three points. A branch of its first great division, the ophthalmic leaves the orbit by the *supra orbitar notch*, it proceeds to be distributed mostly to the upper eyelid and forehead. Another branch of the same division of the fifth pair leaves the orbit below the trochlea or pulley for the superior oblique muscle of the eye, this comes from the nasal branch of the ophthalmic. Below the levator labii superioris, there passes out by the *infra orbital foramen*, the terminating branches of the second division of the fifth pair, which is also well named the superior maxillary, this spreads to the integuments of the upper lip and adjoining parts; the branches of this division of the fifth, form a remarkable plexus with the portio dura of the seventh pair. Lastly, by the *foramen menti* there passes the terminating branch of the inferior maxillary nerve, a third great division of the fifth pair; this mental nerve sends its branches chiefly to the integuments of the lower lip. In dissecting the pterygoid muscles, the student will have observed many important branches belonging to the inferior maxillary nerve, the gustatory, inferior dentar, buccal, &c., but it will be better for him to postpone the examination of these until he has nearly completed the dissection of the neck.

445. Dissection of the Neck. The subject having been placed on its back, a single flat block is to be put beneath the shoulders. The face turned to the side opposite to which the dissection is to be made, and thus secured with hooks, make an incision from the symphysis of the chin to the membrane of the sternum, through the integuments only; a second incision along the line of the clavicle, as far as the shoulder; and a third if the face has not been dissected, from the symphysis of the chin to the back part of the mastoid process of the temporal bone, reflect the square flap of the integuments thus insulated with great caution, commencing the dissection at the angle near the manubrium of the sternum, and in doing so dissect the platysma-myoides. This dissection will expose the platysma-myoides fully, and that portion of the cervical facia which covers the front of the neck above the manubrium of the sternum, and a small portion of the sterno-mastoid muscle; below the mastoid process will also be seen a small portion of the cervical facia covering the upper part of the sterno-mastoid muscle. At this stage of the dissection, the student must make himself fully master of the position of all those parts which project, or may be felt in the middle plane of the neck between the sternum and chin; *first*, there is the incis-

sura or upper margin of the manubrium; above this, a deep hollow, in which is situated the trachea; but this organ is only to be felt in thin subjects: proceeding upwards laterally, the swellings of the thyroid body, if large; and mesially, may be felt the projecting edge of the cricoid cartilage, the *crico-thyroid* ligament, the salient angle of the thyroid cartilage, the thyro-hyoid ligament, and lastly, the body of the hyoid bone; between this bone and the symphysis of the chin, there is a most important dissection, but no hard parts, the whole being filled up with numerous muscles. Having thus made himself master of the position of these organs, let the student again turn his attention to

446. The PLATYSMA-MYOIDES MUSCLE. This muscle has the appearance of a thin fleshy membrane extended over the lateral parts of the neck. It is of a square form, broader above and below than in the middle. Its fibres originate in the cellular tissue and thin aponeurosis which covers the upper part of the deltoides and pectoralis major, and sometimes even so far down as the fourth rib. At first spread out, they approximate and ascend obliquely inwards, the plane they form on the sides of the neck assuming some degree of thickness. The two muscles thus converge; at the middle of the base of the jaw, they expand a second time. Their more anterior fibres are the longest and largest, intermingle beneath the symphysis of the chin, and terminate in the skin of that part. The middle fibres are fixed to the external oblique line of the lower jaw, and to the base of that bone. Several of them pass across those of the depressor anguli oris to be continued into the quadratus menti, or ascend to the commissure of the lips. The posterior are in part incorporated with the depressor anguli oris, and in part lost in the cellular tissue of the cheek. The latter sometimes ascend to the orbicularis palpebrarum, or direct themselves toward the ear, covering the trapezius a little; but the last of them, which are much shorter than the rest, do not reach so far as the jaw-bone. They are also frequently strengthened by a thin muscular plane, (*Musculus risorius* of Santorini), which, arising before the parotid gland, or aponeurosis of the masseter muscle, proceeds horizontally toward the angle of the mouth. The *external surface*

of the platysma-myoides is covered by the skin, from which it is separated by a dense cellular tissue, containing in general little fat. It depresses and carries outwards the commissures of the lips; lowers the skin of the cheek and that of the neck, which it wrinkles transversely, and raises it into long projecting folds; assists in lowering the under jaw; and may also raise the skin which covers the upper part of the chest. Divide the latissimus colli about the middle, and reflect it towards its origin and insertion. This will expose the

447. CERVICAL FASCIA. This fascia, to which surgical writers since the time of Mr. Allen Burns, have devoted so great attention, is a firm layer of very condensed cellular substance, enveloping the muscles, vessels, nerves, and glands of the neck. It is usual to divide it into two, a superficial and a deep fascia, but this only serves to confuse the student, and is not a correct description of it. It is double merely where it encloses the muscles, and forms sheaths for the vessels and nerves, following in its arrangement that of the aponeurosis of the extremities. Having cleaned its surface generally, and examined the course of the external jugular vein and nervus superficialis colli which lay imbedded in it, crossing the course of the sterno-mastoid muscle, proceed with the dissection of the fascia. Make an incision from the middle of the hyoid bone to the sternum; a second from over the mastoid also to the sternum, along the line of the sterno-mastoid muscle about the middle; raise up the flaps so made cautiously, and clean the surface of the muscles. This will shew the student that the fascia in question is single, excepting where arriving at the edges of a muscle, such, for example, as the sterno-mastoid, it divides into two, so as to enclose it. Thus the fascia furnishes sheaths for the muscles. Next make an incision from the symphysis of the chin to the part where the cornua of the lingual bones unite with the middle portion; and a second from this point to the surface of the mastoid process; by reflecting the fascia along the line of these incisions, may now be seen how it furnishes a sheath for the anterior and posterior bellies of the digastric muscle: lastly, an incision carried downwards and inwards along the anterior margin of the sterno-mastoid muscle, will next display the share

that the cervical fascia has in the formation of the sheath of the vessels. In the course of this dissection the parts chiefly to be avoided are the veins which cross the posterior belly of the digastric muscle, and the nervus descendens noni which occasionally lies in or imbedded in the sheath of the great vessels of the neck. Lastly, the student should make an incision below the base of the jaw, from near the angle to the symphysis, and reflecting the portion of the fascia which he thus divides, he will thereby expose the sub-maxillary gland, and be able also to examine it *in situ:* it should not at this stage of the dissection be much disturbed from its position, since all that is required at present is merely to be convinced that it lies enclosed in a sheath of the cervical facia like so many other soft parts in the neck. We have now only to speak of the extent of the fascia towards other regions, and of the anatomy of the few parts requiring to be cut through to enable the student to proceed with his dissection of the muscles. Superiorly, it expands over the parotid, adhering to the cartilaginous tube of the ear and lower jaw; *posteriorly* and latterly in the direction of the trapezius, it degenerates into common cellular membrane; *inferiorly*, it adheres to the inter-clavicular ligament posterior edge of the manubrium of the sternum and clavicles; behind the sternum it passes towards the chest; *finally*, it is known to be connected with the styloid process of the temporal bone, the stylo-maxillary ligament and hyoid. Between the sterno-mastoid and anterior margin of the trapezius, it shuts in very carefully the space above the clavicle, and here covers many important parts. Proceed with the dissection of

448. The STERNO-CLEIDO-MASTOIDEUS MUSCLE is long, flat, about two inches broad, narrower in the middle than at its extremities, bifurcated below, and situated obliquely upon the anterior and lateral parts of the neck. The two branches of its bifurcation are separated from each other by an interval filled with cellular tissue. The inner or anterior, which is thicker and narrower than the other, arises from the fore part of the manubrium of the sternum, by a tendon which ascends very high upon the fleshy fibres. The outer, which is sometimes divided into several portions,

arises by very distinct aponeurotic fibres, from the inner and upper part of the clavicle, over an extent which varies in different subjects. These two portions of the muscle follow different directions: the first ascends obliquely backwards and outwards, and covers the second, which is nearly vertical. After thus crossing each other they remain for some time distinct, but are at length incorporated, so as to form a single bundle, terminated by a broad and thin aponeurosis posteriorly, where it is attached to the outside of the upper curved line of the occipital bone, narrow and thicker anteriorly, where it is inserted into the mastoid process. At the union of its two portions, or a little above it, the sterno-mastoideus is traversed obliquely by the spinal accessory nerve. A few of its fibres arise from the inside of the sheath this muscle receives from the cervical fascia. Its *outer surface* is covered in its whole extent by the cervical fascia and platysma-myoides, excepting at its upper part, where it lies under the skin and parotid gland. Between it and the platysma-myoides are observed the external jugular vein, and some nervous filaments of the superficial cervical plexus and nervus superficialis colli. Its *inner surface* is applied throughout upon the deep part of the sheath it derives from the cervical fascia, beneath which are placed inferiorly the sterno-clavicular articulation, the sterno-thyroideus, sterno-hyoideus, and omo-hyoideus muscles, the internal jugular vein, the trunk of the carotid artery, the pneumo-gastric nerve, the cervical plexus, and the sympathetic nerve. Above, it corresponds to the scalenus, levator anguli scapulæ, splenius, and digastricus muscles, and to the spinal accessory nerve. Its *anterior* or *tracheal edge* is very close below to the muscle of the opposite side, but widely separated above. Its upper and lower parts are pretty thick, but in the middle it is thin. The *posterior edge* is thin, and a little concave; the anterior edge is convex. This muscle carries the head forwards, inclines it to its own side, and makes it perform a rotatory motion which turns the face to the opposite side. When the two muscles act together, the head is bent directly forwards.

449. External Jugular Vein. At this stage

of the dissection, the student may examine particulary the course of the *external jugular vein*, and *nervus superficialis colli*. The *vein* commences generally by a deep branch, which it receives from the common trunk of the temporal and internal maxillary veins, and at first lies imbedded in the parotid; it also usually receives another branch from the facial vein, and frequently numerous superficial veins join it from the fore part of the neck,—thus formed, it crosses the sterno-mastoid, descending outwards beneath the platysma-myoides until just over the clavicle, where it penetrates deeply to join the subclavius or some of its branches. The *nervus superficialis colli* is a pretty strong nervous filament crossing the sterno-mastoid from without inwards, and from below upwards, it proceeds from the cervical plexus to join the fascial in the parotid. Previous to dividing the sterno-mastoid, let the anterior margin of the trapezius muscle be cleaned, next cut the sterno-mastoid about an inch above its sterno-clavicular attachment, and reflecting it carefully, clean the *omo-hyoideus* (scapulo-hyoideus) muscle.

450. The OMO-HYOIDEUS (*Scapulo Hyoideus*), is a long, slender, flattened, and narrow muscle, situated obliquely on the sides and fore part of the neck. It arises below, by aponeurotic fibres, longer before than behind, from the upper edge of the scapula, behind the coracoid notch, and often from the ligament which converts the latter into a hole. It ascends forwards and inwards, becoming narrower, passes behind the clavicle, some times attaching itself to its posterior edge, crosses the direction of the sterno-mastoideus, and is here converted into a thin and narrow tendon, of variable length, and form more distinct before than behind. It then becomes fleshy again, increases its breadth, and ascends nearly parallel to the sterno-hyoideus, to terminate by very short aponeuroses on the sides of the lower edge of the body of the hyoid bone. It is thus a digastric muscle. Its *outer surface* is covered by the trapezius, platysma-myoides, sterno-mastoideus, and the clavicle. The *inner* corresponds to the two scaleni, the anterior branches of the inferior cervical nerves, the trunk of the carotid artery, the internal jugular vein, the supe-

rior thyroid vessels, and the sterno-hyoideus and sterno-thyroideus muscles. This muscle lowers the hyoid bone, carrying it a little backwards and to a side. When it acts along with its fellow, it lowers the bone directly and carries it backwards. It is much used by some persons whilst speaking. The inferior extremity of this muscle cannot be exposed until the clavicle has been removed, and the anterior part of the trapezius cut through.

451. The STERNO-HYOIDEUS is placed at the fore part of the neck, arises behind the clavicular extremity of the sternum, from the posterior sterno-clavicular ligament, and also sometimes from the cartilage of the first rib. Its origin, therefore cannot be seen at this stage of the dissection. It ascends obliquely inwards, contracting a little, and approaching that of the opposite side, as far as the middle of the larynx. It then directs itself a little outwards, and terminates at the lower edge of the body of the hyoid bone, internally of the preceding muscle to which it adheres very closely. It commonly presents, at a variable height, an aponeurotic intersection more visible before than behind, somewhat tortuous, and often only existing on the inside. The *anterior surface* of this muscle is covered by the clavicle, the sterno-mastoideus, platysma-myoides, and omo-hyoideus muscles, and by the skin. The *posterior* is applied upon the sterno-thyroideus, crico-thyroideus and thyro-hyoideus muscles, the thyro-hyoid membrane, the thyroid body, and the superior thyroid vessels. A small synovial bursa exists between it and the crico-thyroid membrane. It depresses the hyoid bone, and consequently the larynx, and thus furnishes a fixed point to the depressor muscles of the jaw. Cut this muscle through about the middle, and reflecting its portions towards their attachments, clean the

452. STERNO-THYROIDEUS. This muscle arises from the upper part of the internal surface of the sternum, opposite the cartilage of the second rib, whence it ascends, directing itself a little outwards, and contracting, to the thyroid cartilage, on the oblique ridge of which it terminates by short aponeuroses. It also sometimes presents, at its lower part, an oblique or transverse aponeurotic intersection. Its *anterior sur-*

face is covered by the sterno-hyoideus, sterno-mastoideus, and omo-hyoideus muscles. The *posterior* covers the subclavian and internal jugular veins, the trunk of the carotid artery, the trachea, the thyroid body and its vessels, the crico-thyroideus muscle, and a part of the constrictor pharyngis inferior. It acts upon the thyroid cartilage in the same manner as the preceding muscle upon the hyoid bone. Cut through the *sterno-thyroideus,* reflect its portions, and thus expose the

453. Thyro-hyoideus. It is of a quadrilateral form, short and thin, situated at the middle and fore part of the neck upon the larynx. It is often continuous with the preceding by its lower edge, which is attached to the oblique ridge of the thyroid cartilage, and consequently inclined downwards and inwards. It ascends from thence parallel to the muscle of the opposite side, and terminates at the lower edge of the body of the hyoid bone, and at the anterior half of the outer edge of its great horn. Its *anterior surface* is covered by the sterno-hyoideus, omo-myoideus, and platysma-myoides. The *posterior* lies upon the thyroid cartilage and the thyro-hyoid membrane. Its use is to bring the larynx and hyoid bone toward each other.

454. Crico-thyroideus. This small muscle is generally examined along with the intrinsic muscles of the larnyx, but practically it ought to be examined at this stage of the dissection, and we shall afterwards again refer to it when describing the larynx. The muscle is short and triangular, arising from the fore part of the cricoid cartilage, and ascending obliquely, is inserted broad into the lower border of the thyroid cartilage; by thus diverging from the muscle of the opposite side, it leaves a triangular space between them, in which will be found the *crico-thyroid ligament.* Its use is to approximate the two cartilages of the larynx to which it is attached.

455. Levator Glandulæ Thyroideæ. This muscle, which, properly speaking, belongs to the thyroid body, arises from the condensed cellular tissue investing that body; it is of a pyramidal shape, and ascending, is inserted into the body of the hyoid bone, often narrow, or even not to be distinctly made out; it is never strictly mesial in its course, and is remarkable

in being an azygos muscle. In its ascent it lies upon the thyroid cartilage. Next clean

456. The DIGASTRIC MUSCLE or *Biventer Maxillæ.* Thick and fleshy at its extremities, slender and tendinous at the middle, where it is bent upon itself. It arises posteriorly, by aponeurotic fibres, from the mastoidal groove of the temporal bone, and descends obliquely inwards and forwards, at first broader and thicker, but becoming gradually thinner, and changing into a strong rounded tendon, about two inches long, which passes through the lower part of the stylo-hyoideus, but sometimes merely behind it. At the hyoid bone it is received into a kind of aponeurotic ring, which is attached to its upper edge, and furnished internally with a small synovial bursa, a line or two in breadth and of variable length. Then a broad and thin aponeurosis is detached from the lower edge of the tendon, which here changes its direction, and is bent upon itself. It descends before the mylo-hyoideus, contracts firm adhesions to it, and is also attached to the body of the hyoid bone. The muscle then ascends forwards and inwards toward the base of the jaw, becomes a second time fleshy and thick, approaches that of the opposite side, and is inserted into a fossa situated upon the sides of the symphysis of the chin, by aponeurotic fibres, which are sometimes interlaced with those of the other muscle. Its *external surface* is covered posteriorly by the trachelo-mastoideus, splenius and sterno-mastoideus; in the middle, by the maxillary gland, which is lodged in the angle formed by the tendon; anteriorly, by the platysma-myoides. Its *inner surface* lies upon the stylo-hyoideus, stylo-glossus, any stylo-pharyngeus muscles, the external and internal carotid, the labial and lingual arteries, the internal jugular vein, the hypo-glossal nerve, the hypo-glossus and mylo-hyoideus muscles. This muscle depresses the under jaw, or raises the os hyoides and carries it forward. Its posterior portion appears to assist in raising the upper jaw, by acting upon the skull.

457. STYLO-HYOIDEUS, long and slender, placed at the upper and lateral part of the neck. An aponeurosis, prolonged upon the fleshy fibres, attaches it to the styloid process, near its base, and is separated from

the latter by a small synovial bursa. It descends thence inwards and forwards, following the direction of the posterior belly of the digastricus; it becomes broader, and then generally bifurcates, in a more or less distinct manner, to give passage to the tendon of that muscle. Uniting its two portions again, it is inserted at the lower part, and on the sides of the body of the hyoid bone, by short aponeurotic fibres. Its *outer surface* is covered by the digastric muscle. The *inner* is in relation with the external carotid, the labial and lingual arteries, the internal jugular vein, the stylo-glossus, stylo-pharyngeus, and hyo-glossus muscles, and the hypo-glossal nerve. It raises the hyoid bone, and consequently the larynx, carrying it at the same time backwards and to a side. When the two muscles act together, the hyoid bone is raised directly and carried backwards. The stylo-hyoid ligament runs in the direction of this muscle, and is sometimes ligamentous, sometimes osseous, or cartilaginous, or even muscular. Detach the anterior belly of the digastric from the symphysis of the chin, and clean the

458. Mylo-Hyoideus, broad, thin, flat, and of a triangular form; arises, by short aponeuroses, from the internal oblique line of the inferior maxillary bone, between the last molar tooth and the mental process. Its anterior fibres, which are short, proceed obliquely downwards and inwards, and are incorporated with those of the opposite muscle, along a tendinous raphe, which descends from the symphysis of the chin to the hyoid bone, and degenerates below into a thin aponeurosis united to that of the digastric muscle. The other fibres, which become longer the farther back they are situated, are less and less oblique, so as ultimately to become nearly vertical; they terminate by aponeuroses, at the lower and fore part of the body of the hyoid bone. The *outer surface* of the mylo-hyoideus, which inclines downwards and forwards, is covered by the digastricus and platysma-myoides, and by the sub-maxillary gland. The *inner* covers the genio-hyoideus, genio-glossus, and hyo-glossus muscles, the sub-lingual gland, the duct of the sub-maxillary gland, the prolongation of it, and the lingual nerve. It raises the hyoid bone and carries it forward,

or depresses the lower law. Detach the mylo-hyoideus, by cutting through its attachment to the lower jaw, and also separate it from its fellow of the opposite side, by an incision carried from the symphysis of the chin to the hyoid bone. In doing so, the student must be cautious not to detach the sub-maxillary gland from its connections, and he must be careful to leave the duct of that gland, together with the gustatory nerve, which he will find above the mylo-hyoideus muscle. Next clean the

459. Genio-Hyoideus, thin, short, flat, narrower above than below. It arises from a small tendon inserted into the lower genial process, and descends backwards to be attached to the middle of the anterior surface of the body of the os hyoides. Its *anterior surface*, which is inclined downwards, is covered by the mylo-hyoideus; the *posterior* is applied upon the genio-glossus and hyo-glossus. Its *inner edge* is contiguous to that of the opposite side, and often incorporated with it. The action of this muscle is to raise the hyoid bone, carrying it forward, or to depress the jaw. Detach the genio-hyoid from the symphysis of the chin, and reflect it towards its hyoid attachment. The student must now, with a saw, divide the inferior maxilla at two points, *first*, in front of the masseter muscle; *secondly*, at the distance of scarcely half an inch from the symphysis; take away the insulated portion of the jaw, leaving all the soft parts, by stripping the bone from off its periosteum. Lastly, draw the apex of the tongue out of the mouth, fix it thus prolonged with hooks, and proceed to examine the stylo-glossus muscle.

460. Stylo-Glossus. To display this muscle, perhaps it is best to detach the stylo-hyoideus and digastricus from the hyoid bones, and reflect them; but they must not be cut away, but preserved in order to be replaced, when examining the course of the great arteries. The external carotid artery separates the stylo-hyoideus from the stylo-glossus and stylo-pharyngeus. The stylo-glossus is narrow above, broad and thin below, and arises chiefly from the stylo-maxillary ligament, which seems peculiarly intended for it. It is in fact attached to nearly the whole anterior edge

of that ligament and lower half of the styloid process, near its apex, by a thin aponeurosis. It then expands, and descends forwards and inwards, to be partly lost upon the edge of the tongue, and partly continued into the lingualis, hyo-glossus and genio-glossus muscles, after being divided into two and sometimes into three bundles. Its *outer surface* is covered by the digastric muscle, the lingual nerve, the sub-maxillary gland, and the mucous membrane of the mouth. The *inner* covers posteriorly the constrictor pharyngis superior, hyo-glossus and lingualis. The stylo-glossus carries the tongue upwards, backwards, and to a side, when it acts alone; but when it contracts at the same time with the other, the tongue is carried directly upwards and backwards. By using great caution, the student may at this stage of the dissection, and without cutting away any important parts, dissect the

461. STYLO-PHARYNGEUS, narrow above, broad and flat below, and of an elongated form. It is situated on the side and back part of the pharynx. It arises by short aponeurotic fibres, from the inner part of the styloid process of the temporal bone, near its base, and descends inwards and backwards towards the pharynx, passes under the constrictor medius, and between it and the superior expands, confounds the greater part of its fibres with those of the other muscles of this region, and sends some to the thyroid cartilage and hyoid bone. Its *outer surface* is covered by the stylo-hyoideus, constrictor pharyngis medius, and external carotid artery. The *inner* is in connexion with the internal carotid artery, the internal jugular vein, the membrane of the pharynx, and the constrictor superior and palato-pharyngæus muscles. This muscle shortens the pharynx by raising its lower part. It also raises the larynx. Next examine the *hyo-glossus,* taking care, during the course of the whole of this dissection, to cut away no important artery, nerve, or vein which may occur, more especially if this be the second time that the student is examining the head and neck; but if it be his first dissection of these parts, he ought not to pay much attention to the smaller vessels and nerves.

462. The HYO-GLOSSUS is thin, broad, and square-shaped. It arises from three different points of the os

hyoides. The first (*cerato-glossus*) is attached by short aponeurotic fibres to the upper surface of the great horn of the hyoid bone. It ascends a little obliquely from behind forwards, contracting in its progress, toward the lower and lateral part of the tongue, where it is continuous with a portion of the fibres of the stylo-glossus, after having passed between its two bundles, and finally terminates in the dermis of the mucous membrane. The second portion (*basio-glossus*) which is not so broad but thicker, covers the preceding portion a little at its upper part, and is separated from it below by the lingual artery; it arises from the upper part of the anterior surface of the body of the hyoid bone, and ascends a little obliquely backwards and outwards. Lastly, the third portion (*chondro-glossus*) originates from the small horn of the same bone, as well as the cartilage placed between the body and the large horn, and ascends upon the sides of the root of the tongue, where it is confounded, like the basio-glossus, with the lingualis and genio-glossus, without our being able to trace it to the tegumentary membrane. The *outer surface* of this muscle is covered above by the stylo-glossus, with which it is connected; a little farther down, by the mylo-hyoideus, the great hypo-glossal nerve and sub-maxillary gland; and still farther down, by the genio-hyoideus, stylo-hyoideus and digastricus. The *inner surface* is in connexion with the constrictor pharyngis medius and genio-glossus muscles, the lingual artery, and the glosso-pharyngeal nerve. Thus the muscle separates the lingual artery from the hypo-glossal nerve. The hyo-glossus lowers the base of the tongue, or raises the hyoid bone when the tongue is fixed. When it acts on one side only, it inclines the tongue towards the same side.

463. Genio-Hyo-Glossus. The tongue must be elongated, drawn well out of the mouth, and fixed with hooks, and the sublingual gland and mucous membrane of the mouth detached from their connexion with the inside of the symphysis of the jaw and lower surface of the apex of the tongue; by this means only can the whole of this very difficult muscle be exposed. The *genio-glossus* is a triangular radiated muscle, transversely flattened, and situated between the tongue and lower maxillary

bone. It arises from the upper tubercle of the genial process, by a small but very strong short tendon, which is more prolonged externally than internally, and from which proceed the fleshy fibres, diverging and following different directions, but almost always perpendicularly to the axis of the tongue. The upper fibres, which are the shortest, are at first horizontal, but on arriving at the lower part of the tongue, curve upwards and forwards to reach its point. The middle fibres, which are less curved, are confounded on the side with the lingualis muscle. The inferior are much longer, and descend obliquely backwards to lose themselves at the base of the tongue, or even to be attached in part to the summit of the small horn of the os hyoides, or continued into the constrictor pharyngis medius. There results from this arrangement that the muscle represents a triangle whose base is attached to the tongue, where its fibres are interlaced with those of the lingualis, stylo-glossus, constrictor pharyngis superior, constrictor medius, and hyo-glossus. At the place where the two genio-glossi touch each other behind, there is observed a small bundle of fibres, which ascends towards the middle ligament of the epiglottis, to be inserted at the dorsal surface of that organ. The *external surface* of the genio-glossus is covered by the sublingual gland, and the stylo-glossus, hyo-glossus, lingualis, and mylo-hyoideus muscles. Its *inner surface* is in contact with that of the opposite side, and even incorporated with it below and behind. Its *lower edge* corresponds to the genio-hyoideus; the *upper*, to the mucous membrane of the mouth. The contraction of the inferior fibres of this muscle carries the tongue and hyoid bone forwards, after having previously raised the latter. The superior fibres pull it backwards, and restore it to its natural position; while the middle fibres hollow its dorsal surface into a groove.

464. The Profound Lingual, or Lingualis Muscle is a small irregular bundle, entirely composed of fleshy fibres, lying under the sides of the tongue, between the hyo-glossus and stylo-glossus, which are on the outside, and the genio-glossus, which is within. It is elongated, thicker posteriorly than anteriorly, and incorporated in its lateral parts with the muscles just

mentioned. Its posterior extremity loses itself in the base of the tongue; the anterior is prolonged as far as the tip of that organ. Its *inferior surface* is lined anteriorly by the mucous membrane of the mouth. The *upper*, confounded with the fleshy and complicated texture of the tongue. It shortens the tongue, and depresses its point.

465. GLANDULAR BODIES met with during this dissection. 1°. A very considerable number of lymphatic glands lie scattered over this dissection; a chain of these glands will be found beneath the tracheal margin of the sterno-mastoid muscle; another chain of glands run beneath the posterior margin of the same muscle; a number of insulated glands between the sterno-mastoid and trapezius, a little above the clavicle, and a few deeper, close to the great blood-vessels; some may also be observed behind the sterno-thyroideus muscle, and at the sides of the trachea and gullet: one or two lie upon, or are imbedded in the parotid and sub-maxillary glands; likewise, over the edge of the base of the jaw, and just below and within the symphysis of the chin. All these glands are small in healthy persons, but become enlarged in constitutional disease. The lymphatic vessels which pass through them are usually descending from above downwards. The student may now detach the superior attachment of the omo-hyoideus muscle to the body of the hyoid, clean more fully the thyroid body than he has hitherto done, thus obtaining a view of it on both sides.

466. The THYROID BODY (*Glandula Thyroidea*), is an organ respecting the uses of which we are totally ignorant, and which anatomists usually describe after the larynx, on account of its situation; for it covers the lower and anterior parts of that organ, as well as the first rings of the trachea. This body exhibits great differences in its size in different individuals, and at different ages in the same individual, without our being able to assign any reasons for them; but, in general, it is larger in the child than in the adult, and in the female than in the male. It is more constant in its form; is composed of two oval lobes, flattened from before backwards, thicker below than above, and having a more or less oblique direction in different individuals.

These two lobes are sometimes united in a great part of their extent; but in general are separated, and only connected with each other by a transverse cord, more or less broad and thick, named the *Isthmus or Middle Lobe of the Thyroid Gland;* from this middle lobe there ascends not unfrequently a narrow portion, called the *Pyramidal Lobe*, this ascends upwards on the surface of the thyroid cartilage, following the course of the muscle named the *Levator Glandulæ Thyroidei.* (455.) This lobe is rarely wanting, and varies in almost every subject, nor does it ever ascend as high as the larynx. The *anterior surface* of the thyroid body, is covered in the middle by the sterno-thyroidei muscles, and on the sides by the latissimi colli, omo-hyoidei, and sterno-cleido-mastoidei. Its *posterior surface*, which is concave, is connected by a filamentous cellular tissue with the larynx and the first rings of the trachea. It also covers the crico-thyroidei, thyro-hyoidei, and constrictores pharyngis inferiores. Its *posterior* and *lateral edges* rest upon the trunks of the carotid arteries, the internal jugular veins, the pneumo-gastric and recurrent nerves, the communicating cords of the cervical ganglia, and that of the left side only, on the œsophagus. The superior thyroid arteries run along its *upper edge*, which is deeply notched in the middle. The *lower edge*, which is convex, is in like manner accompanied by arteries, and gives rise to large veins. The *upper extremities* of its lateral lobes are lodged between the thyroid cartilage and the trunks of the carotid arteries; the *lower*, between these arteries and the trachea. The thyroid body is not contained in any membrane. The cellular tissue by which it is immediately surrounded seems alone to supply it with an envelope, which is somewhat dense and never contains fat. The proper tissue of the thyroid body is soft and spongy. Its arteries come from the external carotid and subclavian arteries; frequently the arch of the aorta sends a separate branch to it. Its veins are numerous, and accompany the arteries, or issue from its lower edge. Its nerves come from the pneumo-gastric nerves and sympathetic. Its lymphatics lose themselves in the jugular glands. It is this body or gland, which, becoming enlarged, forms the bronchocele, one of the symptoms of goître. The number of large vessels proceeding to it, whilst they seem to warrant a conclusion in regard to its physiological use in the system, contribute to render its extirpation in disease a hazardous operation. Bronchocele is more frequent in Britain than has been supposed, and abounds particularly in Newark and Wolverhampton in England, and in some parts of Roxburghshire in Scotland.

467. The SUB-MAXILLARY GLAND is situated at the inner side of the ramus and body of the inferior maxillary bone, and partly in the sub-maxillary fossa, in the triangular space which the two bellies of the digastric muscle leave between them. Irregularly ovoidal and flattened on three surfaces, frequently bifurcated at its fore part, it is prolonged externally as far as the angle of the jaw, sometimes touching in this direction with the parotid gland. *Internally,* the superficial portion of its anterior extremity advances towards the digastric muscle, and the deep portion, which is engaged behind the mylo-hyoideus muscle, touches the sublingual gland. In the same direction, it is separated from its fellow by the anterior bellies of the digastric muscles and the genio-hyoidei. *Anteriorly,* it is covered by the inferior maxillary bone, and *posteriorly,* is in connexion with the lingual nerve, the stylo-glossus and hyo-glossus muscles, and the facial artery, which it embraces. *Inferiorly,* it rests upon the platysma-myoides and the integuments. *Superiorly,* it is prolonged more or less between the pterygoideus internus and mylo-hyoideus. It is moreover surrounded by a pretty considerable, although variable number of lymphatic glands. The excretory duct of the sub-maxillary gland is named *Wharton's Duct.* It is smaller than Steno's duct, and has much thinner walls, which are transparent and more elastic. Arising in the same manner by very slender radicles in the lobules of the gland, it issues from its deepest portion, passes between the mylo-hyoideus and hyo-glossus muscles, and proceeds nearly horizontally from without inwards, and a little forwards, between the genio-glossus and the sub-lingual gland, from which it often receives several excretory ducts. When it has arrived upon the side of the frænum linguæ, it places itself beneath the mucous mem-

brane of the mouth, and terminates in this place by a very narrow orifice, situated in the middle of a slightly prominent tubercle. It is accompanied, in its whole extent, by the lingual nerve, and lined in its interior by a prolongation of the mucous membrane of the mouth: perhaps it is entirely formed by the latter. To display the course of the duct properly, open it with the scissors near its origin in the gland, introducing a strong bristle into its interior, and passing it towards the mouth,—this will generally succeed in displaying its whole course. The arteries of the sub-maxillary gland are numerous, but of small size. They are furnished by the trunk of the facial and the branches of the lingual arteries. Its veins correspond exactly to the arteries. Its nerves come from the lingual nerve, the mylo-hyoid branch of the inferior dentar nerve, and the sub-maxillary ganglion.

468. The SUBLINGUAL GLAND is placed in the substance of the inferior wall of the mouth, under the fore part of the tongue, and seems in general to be merely a sort of appendage to the sub-maxillary gland. Its position is nearly horizontal, and its direction parallel to that of the opposite side. It is smaller than the sub-maxillary gland, of an oblong form, with its greatest diameter from behind forwards, transversely flattened, and nearly of the shape of an almond. It rests upon the mylo-hyoideus muscle, which separates it from the preceding gland, and is covered by the mucous membrane of the mouth, beneath which it forms a prominence. It is, moreover, in connexion *internally*, with the genio-glossus muscle; *anteriorly*, with the body of the jaw; *posteriorly*, with the deepest extremity of the sub-maxillary gland, with which it often appears confounded between the hyo-glossus and mylo-hyoideus muscles. This gland has several excretory ducts, whose disposition is liable to much variation. They are always very slender. Six or eight proceed from its upper part to open upon the sides of the frænum linguæ, while five or six others issue from its lateral parts, and perforate singly the mucous membrane of the floor of the mouth. Two, three, or even a greater number, are also seen to end in the sub-maxillary duct; these latter are short, and frequently unite into a single

trunk before terminating. All these ducts appear to have the same structure as that of the sub-maxillary gland, and like it are thin and transparent. The arteries of the sublingual glands come from the facial and sub-lingual; their nerves are furnished by the lingual and hypoglossal.

469. SCALENI MUSCLES. Although it be usual and proper for systematic writers to consider these muscles along with the deep muscles of the neck, practically they ought first to be dissected and examined at this stage of the dissection, otherwise it is impossible for the student to understand the relative anatomy of the subclavian artery, vein, and axillary plexus, all which parts he will find, and must dissect in the lower part of the neck.* There are usually, but not always three scaleni, often but two, and sometimes as many as four. We shall speak of them as three, viz. anticus, medius, posticus.

470. SCALENUS ANTICUS. In cleaning this muscle, great care must be taken not to cut away the phrenic nerve which lies upon it, also the subclavian vein, ascending superficial artery, and sometimes two or three more vessels which cross it. Simple and broader below, narrow and divided into several portions above, situated upon the lateral and inferior part of the neck. It is attached by a tendon which expands over the fleshy fibres, to the outer surface and upper edge of the first rib, toward the middle of its length, and ascends a little obliquely inwards and backwards, dividing immediately into four fleshy tongues connected by their neighbouring edges, and giving rise to as many small tendons, the upper of which are most distinct. Each of them is inserted, by means of these tendons, into the anterior tubercle of one of the transverse processes of the neck, from the third to the sixth inclusive. The *anterior side* of this muscle is covered below by the subclavian vein; higher up, by the trans-

* The only reason I can assign for the compilers of certain manuals of anatomy not describing the scaleni in this place, as ought to be, is, that their authors have copied verbatim, not merely the description of M. Cloquet, but even the *systematic* arrangements of that excellent writer, forgetting that in a manual the student looks for a *practical* and not a *systematic arrangement.*

verse and ascending cervical arteries, the phrenic nerve, and the omo-hyoideus and sterno-mastoideus muscles. Its *posterior side* forms with the next muscle a triangular space, broad below, contracted above, in which are lodged, inferiorly, the subclavian artery, and superiorly, the branches of the cervical nerves, which form the brachial plexus. Its *inner side* is separated from the longus colli by the vertebral artery and veins. This muscle bends the cervical portion of the spine laterally and forwards. It also assists in inspiration, by raising the first rib.

471. Scalenus Medius, longer and larger than the preceding, but of the same form, and placed farther back, the scalenus posticus arises below from the outer surface of the first rib, from a rough impression which is observed behind the passage of the subclavian artery, and occasionally from the upper edge of the second rib. These two origins take place by aponeurotic fibres, which are prolonged to a great distance among the fleshy fibres. The second origin is sometimes wanting, and is always smaller than the first. The muscle which is here separated into two distinct bundles, soon unites, although it is sometimes separated in its whole length, ascends a little obliquely inwards and forwards, and terminates by six small tendons, of which the superior are the longest, on the posterior tubercles of the last six transverse processes of the neck. It is observed, in some cases, that a small bundle proceeds from the portion attached to the axis to ascend to the transverse process of the atlas. The *anterior side* of the scalenus posticus corresponds to the preceding muscle, from which it is separated below by the subclavian artery, and above by the anterior branches of the cervical nerves. The *posterior side*, which is very narrow, is in connexion with the sacro-lumbalis, transversalis coli, splenius, and levator anguli scapulæ. The *inner* covers the first external intercostal muscle at its lower part, and at the upper, the summits of the last six transverse processes of the neck, and between them the posterior intertransversalis muscles. Lastly, the *outer* side, which is broad below, and narrow above, is covered by the serratus magnus below; in the middle, by the transverse cervical artery, the skin, a great

number of lymphatic glands, and nervous filaments of the cervical plexus; at its upper part, by the sterno-mastoideus muscle. This muscle has the same uses as the scalenus anticus, but draws the vertebral column a little backwards. There is usually behind this muscle, a much smaller one, the

472. Scalenus Posticus; arises, when present, from the upper edge of the second rib, behind the preceding muscle, and ascending upwards and inwards, is inserted into the posterior tubercles of the transverse processes of two or three of the lower cervical vertebræ. In use it is similar to the other scaleni.

473. Vessels and Nerves of the Neck. We shall suppose that the student has made himself well acquainted with the preceding history of the muscles, by devoting one side of the head and neck to their almost exclusive consideration, and that having re-dissected and carefully cleaned all the muscles, preserving the arteries and nerves, in a second dissection, he is now prepared to consider the anatomy of these important parts. The nerves should perhaps be examined first. They are derived chiefly from three sources, viz. cranial, spinal, and sympathetic. To the first belong those branches of the fifth he will meet with during the dissection of the neck; likewise of the eighth and ninth. Of the spinal nerves, he will meet with the anterior branches of all the cervico-spinal and of the first pair of dorso-spinal nerves. Lastly, the cervical portion of the great sympathetic system of nerves. *Of the fifth pair of cranial nerves:* The dissection of the numerous and important branches of this nerve met with during the dissection of the face and neck, will be best examined at a later period of the dissection. The only one we shall notice here is the nervus lingualis or gustatorius. This large branch comes from the inferior maxillary division of the fifth pair, and receives its usual name of gustatorius from its supposed function of bestowing the sense of taste on the mucous surface and papillæ of the tongue, to which it is mainly distributed—a function, however, which has been lately disputed. The nerve will be probably first met with on cutting through the mylo-hyoideus muscle, running parallel to the stylo-glossus muscle, accompanying the

duct of the submaxillary gland, and ultimately running between the sublingual gland and the mucous membrane of the mouth. If the nerve be traced cautiously backwards, a branch will be found joining its inferior margin, and coming from the fissure of Glasser in the temporal bone. This nerve is the *corda tympani.* It is supposed to continue downwards along the inferior margin of the gustatorius, (from which, however, it cannot be properly distinguished) and to leave it after a short course, together with some other filaments from the anterior part of the nerve, then proceed to a small ganglion close to the submaxillary gland, (*the submaxillary ganglion,*) and from this several branches proceed to the gland itself. Whilst dissecting the pterygoid muscle, the student will have met with many other branches of the inferior maxillary division of the fifth pair of nerves, but the consideration of these should be deferred until the dissection be farther advanced. The eighth pair of Willis (glosso-pharyngeal, nervus vagus and spinal accessory of most anatomists) leave the cranium by the foramen lacerum posterius, along with the jugular vein which is behind it. Its minute anatomy, whilst passing through the cranium, will be described afterwards. The anterior division of the nerve, or the glosso-pharyngeal, is generally first met with upon or close to the stylo-pharyngeus muscle. It may be traced to the tongue and pharynx. The second division, viz. nervus vagus, descends along the neck in the sheath of the vessels, between and behind the common carotid artery, and internal jugular vein. The artery is to the tracheal side of the nerve. The nerve should be traced as high as its connection with the superior cervical ganglion of the sympathetic, and downwards until it passes into the thorax. Its course through the thorax, and into the abdomen, have been already carefully described. As these nerves are passing from the neck into the thorax, they are situated between the subclavian artery and vein, the vein being in front of them. On their inner side is the common carotid, and externally the internal jugular vein, but more apart from each other than higher up. In its course through the neck, the nervus vagus gives off the following branches proceeding from above downwards, *com-*

municating branches to the lingual and superior cervical ganglion, also some to join the hypo-glossal; pharyngeal branch which had better be examined afterwards; superior laryngeal branch, arising very high, and sloping much downwards in its course to the larynx, passing behind the great vessels, and readily met with previous to its entering the larynx, between the middle and inferior constrictor muscles of the pharynx. Lastly, the nervus vagus gives off, whilst in the neck, some cardiac branches to join the cardiac plexus of the sympathetic. A branch of the nervus vagus is met with in the neck, which arises from it much lower down, and whilst the main trunk may be considered as in the thorax; this is the inferior laryngeal nerve or recurrent. These nerves (one on each side) the recurrent, so remarkable for their course, and for the numerous experiments made on them, arise differently on the two sides. The recurrent on the right side comes off from the nervus vagus whilst crossing in front of the subclavian artery, it passes backwards behind the artery, and reaches the sides of the gullet and trachea, lying embedded in much cellular substance; it may be traced readily to the lower and back parts of the larynx. That on the left side comes off much lower down, whilst the artery is passing in front of the aorta, around which, to the left of the ligamentum arteriosum, the nerve passes. From this point upwards, it follows a course similar in most respects to that of the right side, but considerably longer. The third division of the eighth, on leaving the nervus vagus at the base of the cranium, passes behind the internal jugular vein to reach the deep surface of the upper part of the sterno-mastoid muscle; it perforates this muscle after supplying it with branches, and is ultimately distributed to the trapezius muscle. A large portion, however, of this nerve, enters into the composition of the superior laryngeal nerve. The hypoglossal nerves leave the cranium by the anterior condyloid foramina, and are united to the outer side of the pneumo-gastric by cellular tissue, and sometimes by a nervous filament; descend forwards, becoming superficial, placed upon the two branches of the carotid artery, the pneumo-gastric nerve, and the superior cervical ganglion, and covered by the stylo-hyoideus and digastricus muscles, the occipital artery, and the internal jugular vein. There, it communicates, by *one or two filaments*, with the nervous arch which the *first and second cervical nerves* form around the transverse process of the atlas. It then appears between the branches of the internal jugular vein, and immediately under the sterno-cleido-mastoideus muscle. At the angle of the jaw, it changes its direction, bends under the middle tendon of the digastric muscle, sends a branch along the neck, and ascends itself forward towards the tongue, where it terminates. The *descending cervical branch* (*descendens noni.*) This nerve is really a plexus of nerves; arises where the hypoglossal nerve forms a bend around the digastric muscle, sometimes receiving a filament from the pneumo-gastric. It descends vertically along the anterior side of the internal jugular vein as far as the middle of the neck, where it bends backwards and upwards to anastomose with the internal descending branch of the cervical plexus, under the sterno-cleido-mastoideus muscle, and over the common carotid artery and internal jugular vein. This anastomosis forms a reversed arch, from the convexity of which proceed several filaments, constituting a small plexus. This branch furnishes no twig until previous to communicating with the cervical plexus, it gives off two anteriorly, which soon unite, to proceed under the omo-hyoideus muscle. There they separate again; one of them loses itself upon the inner surface of that muscle; the other traverses it, gains the sterno-hyoideus, and divides in its substance as far as its inferior attachment, sending some filaments to the sterno-thyroideus muscle. The small plexus which terminates this branch gives of several sets of twigs. The *internal* glide under the omo-hyoideus muscle, and enter the sterno-thyroideus. The *external* descend under the omo-hyoideus, and are lost in its scapular extremity. The *inferior* proceed along the common carotid artery, furnish filaments to it, and communicate with the fourth and fifth cervical nerves. The *lingual branch* is the continuation of the hypoglossal; it enters between the mylo-hyoideus and hyo-glossus muscles, increases in volume by the separation of its fibres, gives off a large twig to the thyro-hyoideus muscle, receives one from the superior cervical ganglion, and sends filaments to the constrictor pharyngis superior, stylo-pharyngeus, genio-hyoideus, mylo-hyoideus and genio-glossus. In the two last muscles there is observed a union between one of the filaments of the hypo-glossal nerve and the mylo-hyoid filaments of the inferior dentar nerve. Several filaments ascend upon the outer surface of the hyo-glossus muscle, form there a plexus, and communicate with filaments of the lingual branch of the inferior maxillary nerve. At the anterior edge of the hyo-glossus muscle, this branch dives, along with the lingual artery, between the genio-glossus and lingualis muscles, and directs itself inwards, forwards, and upwards. It then terminates, at about an inch from the point of the tongue, by filaments, which lose themselves in its fleshy fibres.

474. The *Cervical* portion of the sympathetic system of nerves may be traced by commencing with the *Superior Cervical Ganglion*, erroneously considered by some as the commencement of the whole system. See "Sympathetic System of Nerves."

475. We shall next notice, but more briefly, the divisions of the *Cervico-spinal* and *Dorsal-spinal nerves* found in the neck; the previous dissection of the muscles, and the section of the clavicle and sub-clavius muscle, (probably made by this time,) will have sufficiently exposed all these nerves. There are eight pairs of cervico-spinal and one pair of dorsal nerves, the anterior branches of which will have been met with in this dissection. The first pair is also called sub-occipital; it leaves the canal by the notch behind the condyles of the occipital bone, over the posterior arch of the atlas; the remaining cervical nerves leave the canal by the *foramina inter-vertebralia*. Each of the anterior branches of the second, third, and fourth pairs of cervical nerves, after receiving a filament from the superior cervical ganglion, bifurcates and unites with the following and the preceding by two twigs, forming an arch from the convexity of which proceed others which again unite more externally. It is of those anastomoses, that the *Cervical Plexus* is formed. It lies upon the scalenus posticus muscle, on the outside of the pneumo-gastric nerve, carotid artery, and jugular vein, under the pos-

terior edge of the sterno-cleido-mastoideus, it communicates above with the first cervical nerve, below with the brachial plexus, and internally with the superior and middle cervical ganglia. It sends filaments to the spinal accessory nerve, furnishes some to the muscles, and gives off various branches distinguished into *internal* and *external descending, ascending* and *superficial cervical.*

476. The *Phrenic* or *Internal Respiratory nerve;* is formed by filaments from the third, fourth, and even sometimes fifth pair of cervical nerves, it descends at first between the rectus capitis anticus major and the scalenus, then crosses the anterior surface of the scalenus in a slanting manner, towards its inner edge, and thus penetrates into the thorax between the subclavian vein and artery, crosses the internal mammary artery, and enters for a short way the anterior mediastinum; its further course through the thorax to the diaphragm has been already described. The anterior branches of the four inferior pairs of cervical nerves unite with that of the first dorsal, to form the *axillary* or *brachial plexus;* this extends downwards following the course of the subclavian artery to the axilla, giving off the branches which supply most of the muscles of the shoulder and arm; the plexus is situated at first between the scalenus anticus and medius, then below the subclavian muscle, and above the first rib. The posterior branches of these eight pairs of cervico-spinal nerves supply the muscles and integuments of the back of the neck and head.

477. The arteries met with in the dissection of the face and neck, are the carotids and subclavian of each side, and their branches. The right common carotid, together with the right subclavian, arise from the arteria innominata. If the manubrium of the sternum and proximal end of the clavicle be removed, the whole of the arteria innominata may readily be exposed. It arises from the top of the arch of the aorta, ascends obliquely to the right side over the trachea, and divides opposite the articulation of the clavicle and sternum into two great arteries, the right subclavian and right common carotid; a small artery occasionally arises from it, the middle thyroid artery.

478. The COMMON CAROTID ARTERIES resemble each other in their course and termination, but there is an important difference in respect to their origin,—the right arising, as we have seen, from the brachio-cephalic,—the left springing directly from the arch of the aorta,—the right comes thus to be shorter than the left, —somewhat larger also, and placed more anteriorly, they diverge in their course upwards and backwards, as high as the superior edge of the thyroid cartilage, or even the os hyoides, opposite to which each divides into two branches, the internal and external carotids. At first the left carotid lies altogether within the thorax, this may be called its thoracic portion, it is here covered by the sternum and left vena innominata, but in the neck, both carotids have the following course. In the lower part of the neck, *anteriorly*, the left carotid is covered in its lower part by the left vena innominata, the thymus gland and the clavicle. In the lower part of the neck both carotids are covered by the sterno-mastoidei, sterno-hyoidei, sterno-thyroidei and platysma-myoides muscles, but higher up in the neck, after having ascended behind the omo-hyoidei, they are directly covered by the platysma-myoidei only. *Posteriorly*, the common carotids are applied upon the vertebral column, upon the inferior thyroid arteries, longi colli and recti capitis antici majores muscles. *Internally*, they correspond to the trachea, the thyroid body, the larynx and pharynx. That of the left side is moreover in relation with the œsophagus. *Externally*, they correspond to the internal jugular veins, the pneumo-gastric nerves, and the communicating cords of the superior and middle cervical ganglia. The common carotid arteries preserve the same calibre, give off no branch, excepting some very slender ramifications to the neighbouring muscles. The sheath of each carotid is an important point of surgical anatomy; it is composed of dense cellular substance.

479. The INTERNAL CAROTID ARTERY separates from the external behind the digastricus muscle, enters the space between the ramus of the inferior maxilla and the pharynx, and ascends inwards, becoming deeper as it approaches the skull, into which it enters by the carotid canal. It is accompanied externally by the in-

ternal jugular vein, internally by the pneumo-gastric nerve, the superior cervical ganglion, and the twig by which it communicates with the middle cervical ganglion. It forms at first a curve whose convexity rests upon the vertebral column; near the skull it presents another having its convexity directed downwards. Its ultimate course will be afterwards traced.

480. The EXTERNAL CAROTID ARTERY is equal in size to the internal carotid, excepting in children, in whom the internal is larger. The external carotid extends from the upper part of the larynx to the neck of the condyle of the lower jaw. Placed near the internal carotid at its commencement, and even situated internal and anterior, it ascends parallel to it until under the digastric muscle, where it crosses its direction and gains the angle of the jaw. It then proceeds between the ear and the posterior edge of the lower jaw, concealed by the parotid gland, and divides into two branches, *Temporal* and *Internal Maxillary Arteries.* Inferiorly, the external carotid is covered by the platysma-myoides and the skin; but it sinks under the hypoglossal nerve and the digastricus and stylo-hyoideus muscles, and lastly under the parotid gland. Internally, it is in relation below with the internal carotid artery, at the middle with the stylo-pharyngeus and stylo-glossus muscles, and above with the styloid process of the temporal bone. Its branches are distinguished into, 1°, *anterior*, viz. the *Superior Thyroid*, *Lingual*, and *Facial Arteries*; 2°, *posterior*, viz. the *Occipital* and *Auricular Arteries*; 3°, *inner*, *Inferior Pharyngeal Artery*; and, 4°, *terminating*, *Temporal* and the *Internal Maxillary Arteries.* Lately, an additional branch or two has been added to these, viz. the ar. sterno-mastoidea and the ar. transver. faciei.

481. SUPERIOR THYROID ARTERY arises from the fore part of the external carotid near its origin, or even opposite to it, descends inwards and forwards towards the side of the larynx, changes its direction, and proceeds towards the summit of the corresponding lobe of the thyroid body. In this course it is covered from without inwards, by the platysma-myoides, omo-hyoideus, and sterno-thyroideus muscles, to which it gives twigs. Its branches are the laryngeal, crico-thyroid and proper thyroid.

482. The Lingual Artery arises from the external carotid, sometimes by a common trunk with the facial artery. It first ascends, directing itself inwards and forwards; enters between the hyo-glossus muscle, near its inferior attachment, and the constrictor pharyngis medius; bends upwards, and ascends between the hyo-glossus and genio-glossus muscles, and between the latter and the sublingual gland, above the great horn of the hyoid bone, as far as the root of the tongue. There, it becomes horizontal, and, under the name of *Ranine Artery*, advances, accompanied by the lingual nerve, between the genio-glossus and lingualis muscles, to the point of the tongue, where it anastomoses with that of the other side by an arch. Its branches are the dorsal artery of the tongue, and sometimes a *sublingual.*

483. The Facial Artery arises from the fore part of the external carotid, above the lingual artery, and behind the digastricus muscle, directs itself transversely inwards and forwards, and gains the inner part of the angle of the lower jaw, covered in this course by the hypoglossal nerve, the digastricus and stylo-hyoideus muscles and the sub-maxillary gland. It then turns between that gland and the base of the jaw, changes its direction, ascends obliquely towards the commissure of the lips, between the triangularis and masseter muscles, covered by the skin and the platysma-myoides. Near the free edge of the upper lip, it enters under the union of the levator anguli oris and triangularis muscles, and ascends upon the side of the nose, as far as the inner angle of the eye, where it terminates either by anastomosing with the nasal twig of the ophthalmic artery or with the infra-orbitar, or by spreading out its twigs in the neighbouring parts. In the second part of its course, it is separated from the skin by fat, and corresponds successively and posteriorly to the inferior maxillary bone, the buccinator muscle, the orbicularis oris, levator labii superioris and levator labii superioris alæque nasi. Its branches in the neck are, the inferior palatine and submental.

484. The Occipital Artery arises from the posterior part of the external carotid, under the parotid gland, and opposite the lingual artery. It ascends at first obliquely backwards, beneath the sterno-cleido-

mastoideus muscle, along the posterior belly of the digastricus muscle and the hypo-glossal nerve. It then passes horizontally between the transverse process of the atlas and the mastoid process, after crossing the direction of the internal jugular vein and pneumo-gastric nerve, above which it is situated. It then bends back upon the occipital bone, covered by the splenius muscle, under the inner edge of which it emerges to become subcutaneous, and ascends in a tortuous manner upon the back part of the head where it terminates. It gives off many muscular and cutaneous branches in its course.

485. The POSTERIOR AURICULAR ARTERY is one of the smallest branches of the external carotid artery, arises above the digastricus muscle, and extends to the inner surface of the auricle. It ascends at first backwards, covered by the parotid, between the mastoid process and auditory canal; reaching the auricle, it bifurcates: one of its branches, placed before the other, expands over the inner surface of the auricle, between the skin and the cartilage; the other passes over the mastoid process, and divides into twigs, supplying the temporalis and retrahens auriculam muscles, the epicranial aponeurosis, &c.

486. The INFERIOR PHARYNGEAL ARTERY, smaller than the posterior auricular, more deeply situated than the other branches of the external carotid, from which it arises at the same level as the facial. It ascends at first vertically along the lateral and posterior part of the pharynx, between the external and internal carotids, covered below by the stylo-pharyngeus muscle, and above by the constrictor superior. During his previous dissection of the parotid gland, the student will have traced the two remaining branches of the external carotid artery, but it may be advantageous to resume shortly their description here.

487. The TEMPORAL ARTERY. Not so large as the internal maxillary, from which it separates opposite the neck of the condyle of the jaw, ascends at first obliquely outwards between the ramus of the jaw, the auditory canal, and the parotid gland which covers it as far as the zygomatic arch. But above the latter it glides in a tortuous manner under the anterior and superior

muscles of the ear, and becomes subcutaneous. Arrived at the middle of the temporal region, it divides into two branches, an anterior and a posterior. It is from this artery that the transverse artery of the face generally arises.

488. The INTERNAL MAXILLARY ARTERY is remarkable for its complex course, and for the important branches which it gives off to the deep parts of the face. Immediately after its origin, it passes behind the neck of the condyle of the jaw, bending inwards and downwards, advances inwards, between the dentar and lingual nerves, reaches the interval between the pterygoidei muscles, where it changes its direction, proceeding to the maxillary tuberosity. It then bends, becomes vertical, glides between the two fixed insertions of the pterygoideus externus muscle, and ascends in the bottom of the zygomatic fossa between it and the temporalis muscle. Finally, arriving near the floor of the orbit, it again takes a horizontal and transverse direction, enters the spheno-maxillary fossa, and divides into several branches. Its branches, which the student, however, cannot trace at this stage of the dissection, are the Middle Meningeal, Inferior Dentar, Deep Temporal, Buccal, Alveolar, Infra-Orbitar, Videan, Pterygo-Palatine, Superior Palatine, Spheno-Palatine.

489. SUB-CLAVIAN ARTERIES. The right, generally larger than the left, arises from the arteria innominata. The left arises from the aorta at the end of its arch: Both extend as far as the upper part of the first rib, in the interval of the scaleni muscles; but the right is obviously shorter than the left. They differ in their position, direction, and relations to the neighbouring organs. The right subclavian is more superficial than the left, which appears to depend especially upon the direction of the arch of the aorta. The right directs itself obliquely outwards and upwards as far as the interval of the scaleni muscles; the left ascends vertically to near them, and suddenly turns outwards to pass into their interval. Thus the *anterior side* of the right subclavian is covered, from within outwards, by the clavicle, the sterno-hyoidei and sterno-thyroidei muscles, the corresponding subclavian vein, and the right pneumo-gastric and phrenic nerves, which cross

its direction. Its *posterior side* is separated from the vertebral column and longus colli muscle by a considerable interval. Its *outer side* approaches the top of the lung, and the *inner* leaves a triangular space between it and the right common carotid artery. The *anterior side* of the left subclavian is covered at first by the pleura and vena innominata, then by the pneumogastric nerve, which, instead of crossing its directions, runs parallel to it. Lastly, the first rib, the clavicle, and the sterno-thyroideus muscle are applied upon it in a distant manner. Its *posterior side* rests upon the vertebral column and longus colli muscle. Its *outer side* lies upon the pleura; the *inner* corresponds to the common carotid artery. The subclavian arteries traverse a considerable space without furnishing any branch; but in the vicinity of the first rib, before passing between the scaleni muscles, they give off a pretty large number, of which the vertebral and inferior thyroid come off from its upper side; the internal mammary and superior intercostal from its lower, and the transverse cervical, supra-scapular and deep cervical from the outer. Of these branches

490. The Vertebral Artery is the largest: it is especially intended for the upper part of the medulla spinalis, cerebellum, and cerebrum. On both sides it lies at first behind the inferior thyroid artery, upon the vertebral column, and between the longus colli and scalenus anticus muscles; it soon afterwards enters the foramen at the root of the transverse process of the sixth, often of the fifth, or even fourth cervical vertebra: its vein accompanies it, and a branch of the sympathetic system of nerves. If the student proposes tracing these vessels, he must, with a pair of delicate but strong bone nippers, lay open the osseous canal, through which they pass as high as the occipital bone. The artery, after a remarkable turn behind the occipital condyle, passes through the membrana annuli posterior; and thus entering the foramen magnum of the occipital bone, it joins the opposite vessels, and forms the bazilar artery within the cranium. Whilst passing up the neck through its osseous canal, it is placed before the roots of the cervical nerves.

491. The Inferior Thyroid Artery usually

comes from a short axis, from which arise other branches, more especially the transversalis colli and transversalis humeri, or superior and posterior scapular. It ascends at first vertically upon the scalenus anticus, and, on arriving before the fifth vertebra, suddenly bends inwards, passes transversely behind the common carotid artery, and goes in a tortuous manner to the thyroid body. From this vessel usually comes

492. The Ascending Cervical Artery, ascends upon the scalenus anticus and longus colli muscles, arrives at the rectus capitis anticus major, furnishing ramifications to the splenius muscle and lymphatic glands; it anastomoses with the vertebral, posterior cervical, and occipital arteries.

493. The Internal Mammary Artery arises from the subclavian at the same level as the inferior thyroid; descends inwards before the scalenus anticus muscle, and externally of the phrenic nerve; enters the thorax, along the posterior surface of the sterno-costal cartilages and internal intercostal muscles, whose direction it crosses; gradually approaching the sternum, places itself between the triangularis sterni and the walls of the thorax, and, towards the xiphoid cartilage, divides into two branches, which are prolonged into the walls of the abdomen. To dissect this artery, remove the cartilage of the ribs and intercostal muscles, or divide the sternum vertically with a saw, and force the two sections asunder.

494. Superior Intercostal Arteries. It will be difficult to get a view of these; but if the thorax has been extensively opened previously, they may be traced from the subclavian into the thorax, and behind the pleura, and over the necks of the first, second, and sometimes the third ribs, thus supplying the three intercostal spaces. The left artery gives off more branches than the right.

495. The Transverse Cervical Artery frequently arises from the thyroid axis. Directing itself transversely outwards, it winds along the scaleni muscles above the nerves which form the brachial plexus, in the triangular space between the sterno-cleido-mastoideus, trapezius, and clavicle, where it is covered by the first of these muscles. It then curves and descends

obliquely backwards, under the trapezius and levator anguli scapulæ muscles, changes its direction again, and descends vertically under the rhomboideus muscle, along the posterior edge of the scapula, where it gets the name of *posterior scapular* (*art. scapularis posterior*), to terminate by subdividing near its inferior angle.

496. The SUPERFICIAL CERVICAL ARTERY is usually a branch of this. It proceeds in a tortuous way to the splenius and trapezius muscles, supplying in its course the lymphatic glands, which lie here in great abundance, and the integuments.

497. The SUPRA-SCAPULAR ARTERY, called by some the *transversalis humeri*, is less voluminous than the preceding, and often a branch of the inferior thyroid; proceeds in a tortuous manner from within outwards, behind the clavicle, covered by the sterno-cleido-mastoideus, platysma-myoides and trapezius muscles, and arrives at the upper edge of the scapula, following exactly the course of the supra-scapular nerve. On arriving near the supra-spinatus muscle, it passes above the coracoid ligament, dives between the supra-spinatus muscle and the bone, directs itself outwards under the clavicle and acromion, winds over the edge of the spine of the scapula, and enters the fossa infra-spinata.

498. The DEEP CERVICAL ARTERY arises from the posterior and deep part of the subclavian, externally of the inferior thyroid, behind the scalenus anticus muscle. It ascends obliquely outwards, passes between the two last transverse processes of the neck, after giving small twigs to the scaleni, longus colli and rectus capitis anticus major muscles, directs itself backwards, upwards and inwards; between the complexus and semi-spinalis colli muscles, becomes vertical, and ends by anastomosing, towards the head, with the vertebral and occipital arteries, sending ramifications into the muscles and integuments. If the student has dissected the muscles on the back of the neck previously, as he ought to have done, he will have met with branches of this artery, lying upon or imbedded in the semi-spinalis colli and adjoining muscles.

499. The VEINS met with in the dissection of the neck are, the terminating trunks of the veins from the face, the external jugular, which has been already de-

scribed (449), and the Internal Jugular. This great vein commences in the jugular fossa, and is the continuation of the lateral sinuses, &c. It follows the course of the internal carotid artery, and afterwards of the common carotid artery, inclosed in the same sheath and upon its outer side; in the inferior part of the neck it joins the subclavian vein, and thus forms the vena innominata of the right and left sides. These follow a different course, but ultimately unite within the thorax to form the vena cava superior, which terminates in the right auricle of the heart.

500. SURGICAL REGIONS OF THE NECK. *Triangular spaces.* These are, of course, quite ideal, and must mislead the surgeon who proposes substituting their outline for the correct anatomy of the neck. Indeed, this mechanical mode of subdividing any part of the body into artificial regions, ought to be discouraged as much as possible, more especially by the teacher and student of anatomy; it establishes, or tends to establish, false and fanciful associations, instead of practical and useful ones. But as there are examinating boards unhappily so constituted, as to require some knowledge of these triangular spaces on the part of the student, we shall here briefly trace their outline. The anterior margins of the sterno-mastoid muscles, the base and symphyses of the inferior maxilla, and the upper edge of the sternum, form together a large triangular space, whose apex is downwards and base upwards. The mesial line will divide this into two equal halves, and thus are formed the anterior lateral triangles of the neck. The posterior margins of the mastoid muscles, together with the trapezius, the clavicle inferiorly, and mastoid process superiorly, constitute two other triangular spaces; these are called *posterior lateral.* Now, each of these triangular regions has been divided into two others by the *omo-hyoideus* muscle, crossing the neck obliquely below the mastoid muscle, from the body of the os hyoides to the cervical region of the scapula. Thus, these four triangular spaces on each side are named—*anterior superior*, *anterior inferior*, *posterior superior*, *posterior inferior*. The anterior superior triangular space, is bounded by the anterior margin of the sterno-mastoid, superior belly of the omo-hyoideus muscles; the apex is inferior where

these muscles decussate, it has no well-defined basis towards the jaw. It is here that the great vesselsand nerves are so superficial, and where the surgeon prefers, when it is optional with him, to tie the common carotid artery in the apex of this triangle. The *anterior inferior triangle* requires to be made by the dissector; the lower and middle portions of the sterno-mastoid muscle must be drawn forcibly outwards, and the parts beneath cautiously dissected. This will display the anterior and inferior triangle, bounded superiorly by the superior belly of the omo-hyoid, messially by the middle plane of the neck, posteriorly by the sterno-mastoid. If the dissection is delicately conducted, the first structure which will be seen are branches of the decendens noni nerve, a portion of the common carotid artery, jugular vein, and nervus vagus; but these are, as we have remarked, all covered by the sterno-mastoid, sterno-hyoid and sterno-thyroid muscles. The *posterior superior triangle* is bounded by the posterior belly of the omo-hyoid, mastoid and trapezius muscles; it abounds with cellular substance and lymphatic glands, a great part of the cervical plexus of nerves. The *posterior inferior* triangle, seldom exists naturally because the inferior belly of the *omo-hyoideus* muscle is very commonly attached to the upper margin of the clavicle, or runs parallel to it, and the fascia of the neck connecting them together, completely shuts up this space from the view of the student at first. On cutting through the fascia, and dissecting or cleaning the inferior belly of the omo-hyoideus; this may be slightly drawn upwards, and a triangular space formed, whose boundaries may be described (though by no means in an accurate way), to be the *omo*-hyoideus muscle, sterno-mastoid, and clavicle, or rather first rib. It is a very important region of the body, as in it is found that portion of the subclavian artery, which the surgeon prefers tying in the operation for axillary aneurism. The subclavian vein will be found internal to the artery. The nerves which form the brachial plexus, lie above the artery in the upper part of the space.

501. MOUTH, PHARYNX, and LARYNX. To obtain a view of these parts, divide the trachea, œsophagus,

and great vessels and nerves, about an inch above the sternum, raise them up, cutting through the loose cellular substance, connecting them to the anterior part of the cervical vertebræ, draw them well forward, and introducing a saw close to the vertebræ, divide the *basis cranii* on each side, between the styloid and mastoid processes, but always behind the styloid. These two sections should meet each other in the bazilar portion of the occipital bone in front of the foramen magnum. We thus leave the superior part of the spine, its connection with the occipital bone, and consequently all its important ligaments, for after dissection. Under particular circumstances, the student may wish to preserve the head entire, in which case, making up his mind to sacrifice the ligaments, he cuts through all connection between the occiput and spine, and thus gets a view of the pharynx, &c., similar to the first, but we think not so manageable. The pharynx and mouth, must now be fully distended with baked hair, place the preparation in its anterior aspect, and proceed to examine the posterior aspect, or that part which lies immediately on the bodies of the cervical vertebræ.

502. The PHARYNX is a muscular and membranous bag, placed in the median line of the body, and somewhat funnel shaped; it extends from the base of the cranium, in front of the vertebral column, to about the fourth or fifth cervical vertebra. Limited *above* by the basilar process of the occipital bone, continuous *below* with the œsophagus, *anteriorly* with the nasal fossæ, mouth, and cavity of the larynx, corresponding to the velum palati in their interval; *posteriorly*, it rests upon the vertebral column, longi colli and recti capitis antici muscles. On *its sides*, it is in contact with the common and internal carotid arteries, internal jugular veins, pneumo-gastric nerves, and, at its uppermost part, with a small portion of the internal pterygoid muscles. *Superiorly*, the pharynx is attached in a solid manner to the basilar process by the cephalo-pharyngeal aponeurosis, to which are attached some of the fibres of the superior constrictors of the pharynx. Stronger and denser at the middle than on the sides, it there constitutes of itself the fixed part of the organ. *Inferiorly*, the termination of the pharynx in the œsophagus is indicated by a sudden contraction at the ex-

terior, and rendered very remarkable by a change in the direction of the muscular fibres. In a general way, therefore, the pharynx may be described as a bag, placed between the mouth, and larynx, which are in front, and the cervical region of the spine, which is behind, and into which bag pass the air, whether breathed by the nose or mouth; and the food, solid or liquid, which passes directly from the mouth into the pharynx over the surface of the tongue, by an aperture which the student may examine at this stage of his dissection, simply by opening the mouth. The aperture by which the mouth communicates with the pharynx, is called the *isthmus faucium.* Depress the tongue, and look through the isthmus faucium into the pharynx, and observe the superior aperture of the pharynx, which also leads into the larynx. Thus the air which ultimately passes into the lungs by the larynx and trachea, can reach the tube only through the pharynx. Next proceed with the dissection of the constrictor muscles of the pharynx, by removing carefully, and in the direction of the fibres, the pharyngeal aponeuroses which cover them, preserving at the same time, whatever lateral parts may still remain.

503. The Constrictor Pharyngis Inferior arises below, from the outer part of the cricoid cartilage, partly from the trachea, small horn and the oblique ridge of the thyroid cartilage, behind the crico-thyroideus and sterno-thyroideus; its fibres proceed backwards, inwards, and upwards; and in the median line, they are incorporated with those of the opposite muscle by a kind of raphé. Its *outer surface* is covered externally by the sterno-thyroideus, the thyroid body and trunk of the carotid artery; posteriorly, it corresponds to the rectus capitis anticus major and longus colli muscles and with the anterior vertebral ligament. The inner surface is covered by the constrictor medius above; by the palato-pharyngæus and stylo-pharyngæus muscles, and the mucous membrane of the pharynx, in the middle; and by the thyroid and cricoid cartilages below. The *upper edge* is oblique, forms an acute angle with that of the opposite side, and ascends more or less high, sometimes to near the occipital bone.

Upon this edge, and between it and the constrictor medius, will be found the superior laryngeal nerve. The *lower edge* is transverse; connected with the commencement of the œsophagus, and allows the inferior laryngeal branch of the pneumo-gastric nerve to pass under it anteriorly.

504. Constrictor Pharyngis Medius arises from the retiring angle formed by the union of the large and small horns of the hyoid bone, and from the whole extent of these two bony appendages, as well as from the stylo-hyoid ligament. The inferior fibres pass downwards and backwards; the middle transversely, the superior ascend obliquely; they are all interlaced with those of the opposite side, forming at the posterior part of the pharynx a raphe, whose inferior extremity is concealed by the preceding muscle, while the upper is attached to the basilar process. Covered, in its *outer surface*, by the hyo-glossus and lingual artery externally, and by the constrictor inferior behind and below; in the rest of its extent, united to the muscles of the anterior part of the cervical vertebræ, and to the anterior vertebral ligament. The *inner surface* is covered by the mucous membrane of the pharynx, the stylo-pharygeus, palato-pharyngeus, and constrictor superior. The stylo-pharyngeus muscle and glosso-pharyngeal nerve are situated between this muscle and the following.

505. Constrictor Pharyngis Superior arises externally from the lower half of the edge of the internal wing of the pterygoid process; from an aponeurosis extending from the pterygoid process to the posterior part of the inferior alveolar arch; from the extremity of the myloid line; from the sides of the base of the tongue, between the stylo-glossus and hyo-glossus muscles. The fleshy fibres of the first origin descend backwards and presently ascend towards the base of the cranium, so as to form a sort of arch. They are attached to a thin yet firm aponeurosis (the *cephalo-pharyngeal*), which is attached to the basilar process, but only by its extremities, so as to leave an empty space between the bone and its middle part. Here therefore the mucous membrane of the pharynx may be seen not covered by any muscular fibres; this space is called the sinuses of Morgagni. The other fibres proceed in

a transverse direction, to be interlaced with those of the opposite muscle in the middle of the posterior part of the pharynx. The *outer surface* is covered posteriorly by the constrictor medius, and laterally is in connexion with the stylo-glossus, stylo-pharyngæus, internal carotid artery, internal jugular vein, pneumo-gastric, hypo-glossal, spinal accessory nerves, and several filaments of the superior cervical ganglion of the sympathetic. These different parts are contained in a triangular space, filled with cellular tissue, which occurs between the constrictor pharyngis superior and pterygoideus internus. Its *inner surface* covers the palato-pharyngæus and levator pallati mollis, and is lined by the mucous membrane of the pharynx. From the description of these muscles, it will be seen that they all three cover each other, in such a manner that the lower only remains visible in its whole extent, and they also all unite in the middle of the pharynx with those of the opposite side by a sort of raphe, and thus some of them require to be divided before the others are fully seen. They contract that portion of the digestive canal when it is filled with alimentary substances. The constrictor *medius* raises the os hyoides and larynx, carrying them backwards, and the *inferior* raises the larynx. It is at this stage of the dissection that the student can best follow the anatomy of the stylo-pharyngeus which for special reasons was formerly described.

506. Next open the bag of the pharynx by an incision made along the mesial line, extending from the bazilar process of the occipital bone to the commencement of the œsophagus, and it may also be convenient to cut the pharynx laterally for a short way in the situation of the sinus of Morgagni, at least on one side. Looking into the pharynx which has been thus laid open, the following apertures may now be observed: the posterior apertures of the nostrils and anterior openings of the Eustachian tubes: suspended beneath those is the velum pendulum palati, and mesially the uvula; beneath is the isthmus faucium or opening from the mouth, bounded by the base of the tongue inferiorly, the *velum* and uvula above, and laterally the pillars of the fauces with the tonsils. Connected with the base of the tongue is the epiglottis, immediately beneath which is the su-

perior aperture of the larynx; lastly inferiorly the student will find the opening leading directly to the gullet; thus there are seven openings leading to or from the pharynx. The boundaries of the other apertures may be easily understood. All the surfaces here mentioned are covered by a continuous mucous membrane lining not only the interior of the pharynx, but passing along the various tubes already mentioned to the nostrils, *ears*, larynx, trachea and lungs, and by the gullet towards the stomach. The student must carefully observe the form of these different openings. The nostrils being bounded by hard parts which do not vary, those of the Eustachian tubes looking forward and composed of an extremely thick and dense fibro-cartilage; this will be examined afterwards in relation to the cavity of the tympanum to which the tube leads. The opening into the larynx is protected by the epiglottis which follows the movements of the tongue, and it is bounded laterally and posteriorly by the aryteno-epiglottic folds, arytenoid muscles and cartilages; these however cannot be seen until the mucous membrane is removed which must not be done at this stage of the dissection.

507. The PALATE is the upper wall of the mouth, limited anteriorly by the adhering edge of the upper lip, posteriorly by the base of the velum palati, and laterally by the cheeks; a white line, slightly depressed, traverses it mesially. At the anterior extremity of this line, between the two middle incisors of the upper jaw, is a small tubercle which corresponds to the inferior orifice of the anterior palatine canal. The *Bony Portion of the Palate* is formed by the upper alveolar arch, the inferior surface of the palatine processes of the superior maxillary bones, and the horizontal portions of the palate bones. On the vault of the palate, the mucous membrane is denser, thicker, and less red than in the other parts of the mouth. At its anterior part, it presents transverse rugosities, varying in number and extent, elsewhere it is smooth and presents the orifices of mucous follicles situated between it and the bony arch of the palate, which become more numerous near *the velum.* The gums are formed of a firm and compact reddish tissue, covering the two sides of each alveolar

arch, and filling the intervals which remain between the teeth, the necks of which they closely surround. They appear composed of two layers, a pulpy and a fibrous, covered by the mucous membrane, united to the periosteum. The mucous membrane which enters into their constitution, is prolonged into the alveoli, and from the bottom of these cavities, sends into the cavity of each of the teeth a bulbous prolongation which exactly fills it, and which has been named the *pulp* or *nucleus* of the tooth. The arteries of the palate and gums come from the palatine, alveolar, infra-orbitar, facial and buccal branches, and for the lower gums in particular, from the submental and mental. The veins correspond to the arteries. The nerves are furnished by the palatine, facial, infra-orbitar, superior and inferior dentar nerves, and by the naso-palatine ganglion.

508. The VELUM PALATI is a soft, broad, thick, mobile partition, appended to the extremity of the vault of the palate, and separating the mouth from the pharynx. Its form is nearly quadrilateral. Its two surfaces, the *anterior* and *posterior*, are smooth. Its *upper edge* is very thick and fixed to the vault of the palate; the *lower edge* is free and floating above the base of the tongue. It presents at its middle part an appendage or prolongation named the *Uvula.* The uvula is cone-shaped, forming the inferior edge of the velum palati into a double arch, terminated on each side by two pillars which are continuous with the tongue and the pharynx. These pillars are placed the one before the other, and separated by a triangular space in which are lodged the tonsils; they are united above but diverge below. The anterior is oblique, and contains in its substance the constrictor isthmi faucium muscle. The posterior is nearly vertical, and formed by a portion of the palato-pharyngeus muscle internally. The *Mucous Layer of the Velum Palati* contains the muscular layer, and is continued anteriorly into the membrane of the mouth, and posteriorly into those of the nasal fossæ, so that the palatine and pituitary membranes unite upon the free edge of the velum palati. The anterior lamina of this layer is less red than the posterior, and covers many mucous follicles, extending over the fore part of the muscles, and are so close as to

be in contact with each other; they form of themselves nearly the whole thickness of the uvula; they are rounded and compressed. Beneath the velum pendulum palati is the aperture of the mouth, the form and limits of which we have already described, its size is in no case equal to that of the anterior aperture: it varies, however, but only from above downwards, for on the sides it is limited by the pterygoid processes, which of course are perfectly fixed.

509. The Circumflexus Palati (*Peristaphylinus Externus*), is found in the substance of the velum, arises, by aponeurotic fibres, from the scaphoid fossa of the pterygoid process, the cartilage of the Eustachian tube, and the parts in the neighbourhood of the great wing of the sphenoid bone, it descends vertically along the posterior edge of the inner plate of the pterygoid process, and turns under the hook by which it terminates, it then proceeds horizontally inwards, is expanded in the velum palati, before the levator palati mollis, unites with its fellow, and terminates at the transverse ridge, which is observed upon the inferior surface of the horizontal portion of the palate bone. There it sends off a prolongation to a dense and compact membrane, which keeps the velum palati firm at its upper part. The fleshy portion of this muscle is covered, *externally*, by the pterygoideus internus. Its *inner surface* is applied against the levator palati mollis and constrictor pharyngis superior, and against the inner wing of the pterygoid process. Its aponeurotic portion is covered anteriorly by the mucous membrane of the velum palati. Posteriorly, it is connected with the palato-pharyngeus. It stretches the velum horizontally.

510. The Levator Palati Mollis (*Peristaphylinus Internus*), is situated on the sides of the posterior apertures of the nasal fossæ; arises from the under surface of the petrous process, before the external orifice of the carotid canal, and from the neighbouring part of the Eustachian tube. From thence it descends obliquely backwards and inwards, becomes broader, and terminates at the middle part of the velum palati, uniting with that of the opposite side, the levator uvulæ, and a little with the palato-pharyngeus and the aponeurosis of the circumflexus palati. Its *outer surface*

corresponds above to the circumflexus palati, and below to the palato-pharyngeus and constrictor pharyngis superior. The *inner* is lined above by the mucous membrane of the pharynx, and below by that of the velum palati. It raises the velum palati so as to apply it against the posterior apertures of the nasal fossæ.

511. The LEVATOR UVULÆ, (*Azygos Uvulæ*), occupies the substance of the uvula, sometimes distinct on both sides. It arises from the aponeurosis common to the two circumflex muscles, and descends vertically to the tip of the uvula. It is connected anteriorly with the levator palati mollis, and covered behind by the posterior membrane of the velum palati. It raises and shortens the uvula.

512. The PALATO-PHARYNGÆUS, placed vertically in the lateral wall of the pharynx and in the velum palati. From its origins being very distinct from each other, it has been divided into three portions, which Winslow described as so many separate muscles. In a general way it may he said to arise from the posterior edge of the palatine vault, intermingling inferiorly with stylo-pharyngeus and middle constrictors. It assists in forming the posterior pillar of the fauces. When the two muscles act together, they lower the velum palati, while at the same time they raise and shorten the pharynx. It is in deglutition that they principally act. By opening the mouth widely, and depressing forcibly the lower jaw and tongue, the student will bring into view the anterior pillars of the fauces, and so be enabled to dissect

513. The CONSTRICTOR ISTHMI FAUCIUM, situated in the anterior pillar of the velum palati, between the membrane of the palate and constrictor pharyngis superior, before the tonsil. Its lower extremity loses itself in the base of the tongue. The upper, which is narrower, is incorporated, in the velum palati, with the palato-pharyngeus and circumflexus palati muscles. This muscle lowers the velum palati, and raises the base of the tongue.

514. The MOUTH (*Os*) is a nearly oval cavity, placed horizontally, comprised between the two jaws, bounded laterally by the cheeks, anteriorly by the lips, posteriorly by the velum palati and the pharynx,

above by the arch of the palate, and below by the tongue. The mucous membrane may be traced on the free edge of the under lip, of which it lines the posterior surface, to be afterwards reflected upon the body of the maxillary bone; there it forms opposite the symphysis of the chin, a fold, more developed below than above, named the *Frænum of the under lip*, which is lost insensibly upon the lip. The membrane then sends into each alveolus a prolongation which strengthens the insertion of the roots of the teeth, and is continuous with a membraneous lamina which lines these cavities. From thence it proceeds over the posterior surface of the body of the inferior maxillary bone, forms opposite the symphysis, the *Frænum of the tongue*, covers that organ, gains the epiglottis, and is continued into the mucous membrane of the larynx and pharynx. *Superiorly* it commences on the free edge of the upper lip, forms between it and the superior maxillary bones a *frænum*, gains the upper alveolar arch, sends prolongations into the corresponding alveoli, passes to the vault of the palate, of which it closes the anterior and the two posterior foramina, receives the nerves and vessels which pass through them, and is reflected over the fore part of the velum palati, on the free edge of which it is continuous with the pituitary membrane. On either side, this membrane, proceeding from the commissure of the lips, lines the cheeks, proceeds over the branches of the inferior maxillary bone, forming a vertical fold opposite their anterior edge. At the backmost part, it turns over the constrictor isthmi faucium, and palato-pharyngeus muscles, to form the pillars of the velum palati, between which it covers the tonsils. Beyond this, it is continuous with the membrane of the pharynx. The mucous membrane of the mouth varies in structure, and is covered by a distinct epithelium. At this stage of the dissection, the student may examine the structure of the lips. At the back of the mouth he will observe the velum pendulum palati; descending from which, are the two anterior pillars of the fauces on each side. To examine these minutely, cut through the cheek on one side, also both pillars of the fauces, and the tonsil of the same side. The side remaining entire, and thus fully brought into view, will give him an exact notion of the relative position of the fauces, and of the tonsils lying between them.

515. The TONSILS (*Amygdalæ*) are bodies lodged between the pillars of the velum palati. They represent an ovoid, of which the *large extremity*, directed upwards, corresponds to the point at which the pillars meet, while the *small extremity*, which looks downwards, rests upon the base of the tongue. Their *external surface* adheres to the constrictor pharyngis superior muscle; the *internal*, convex and free, projects, and constitutes the sides of the isthmus of the fauces; their *anterior edge* touches the constrictor isthmi facium muscle; the *posterior* touches the palato-pharyngeus. They are divided into several lobes, and have a grayish colour, and appear formed by a pulpy tissue resembling that of those follicles. They are filled internally by cellules open on their inner surface, whose orifices are large; the mucous membrane of the mouth lines their wall. In their bottom, excretory ducts are observed to open from a mass of follicles, forming the substance of the tonsil externally. The arteries of the tonsils come from the lingual, inferior palatine, and internal maxillary arteries. Their nerves from the lingual and glosso-pharyngeal.

516. The TONGUE is very moveable, and extends from the hyoid bone to behind the incisive teeth; it is used in sucking, mastication, deglutition, speaking, &c.; it has two surfaces, two edges, and two extremities. The upper surface is entirely free, flat, covered by the mucous membrane of the mouth, with a groove running along the middle, and dividing it into two equal lateral portions; towards the back part upon this surface, there is a depression called the foramen cœcum; from this point two lines formed of papillæ proceed forward, diverging from each other; all this surface of the tongue is rough with nervous papillæ; the fore part of the tongue is called the apex, the central part the body, the posterior part the base. The apex is free inferiorly; the body and base are fixed by numerous and powerful muscles to the inferior maxilla and hyoid bone; the edges are also free. The mucous membrane covering the upper surface of the tongue passes from it

uninterruptedly upon the epiglottis; three folds may be observed here, one mesial, and two lateral; these are called the ligaments of the epiglottis. The tongue is very thick at the level of the foramen cœcum, but it becomes thinner as it approaches the hyoid bone; its apex inferiorly is fixed to the inferior maxilla by the *frenum linguæ*, a fold of mucous membrane. The *Fleshy* or *Muscular Portion* forms the greater part of the organ, and is composed of fibres of the stylo-glossi, hyo-glossi and genio-glossi muscles; their fleshy fibres interlace in an inextricable manner, and form at the upper region of the tongue a layer in which it is impossible to discern them, and in which there is interspersed a multitude of small globules filled with an almost fluid fat, placed very close upon each other, which gives them a flattened form, and so much the less red the nearer they approach to the back of the organ. On the sides of the tongue may be distinguished an inferior longitudinal muscular plane, formed by the linguales and stylo-glossi muscles, and another plane lying above the latter, with transverse fibres, formed by the genio-glossi, and surrounded by the proper tissue of the tongue. These interlaced fibres have been described lately by Gerdy and others as distinct muscles, under the names of superficial lingual, vertical lingual, and transverse lingual. At the centre of this fleshy tissue, and in the direction of the median line, there occurs a *fibro-cartilaginous lamina* or *septum*, of a whitish colour, stronger behind than before, having its *upper edge* concealed in the substance of the organ, at a considerable distance from the mucous membrane, and the *lower* free in the interval of the genio-glossi muscles. This septum is continued posteriorly as far as the body of the hyoid bone, and by its two lateral surfaces gives attachment to muscular fibres. To exhibit this elastic septum, the tongue may be cut across about the middle, or the septum exposed at the base, or vertically. The *Papillæ* on the upper surface of the tongue are of three kinds,—*lenticular*, from nine to fifteen in number, arranged in the form of a triangle without the base; *fungiform*, placed near the edges at the point of the tongue; lastly, *conical*, these are most numerous, and are spread generally over the surface. The *Nerves* of the tongue are furnished by the inferior maxillary, glosso-pharyngeal, and hypo-glossal. The filaments of the latter belong especially to its muscles or mucous follicles; the first is distributed to the mucous membrane, and to the conical papillæ. The arteries come from the lingual (branches of the external carotid arteries), and palatine and tonsilar twigs of the labial. Its veins are the superficial lingual, ranine, lingual, and submental; they open into those of the pharynx and larynx. Its lymphatic vessels go to the gland on the edge of the hyo-glossi muscles.

517. The LARYNX cannot be understood merely by a dissection of that larynx which appertains to the head and neck, that the student has just dissected. He must apply to his anatomical teacher for the following preparations,—the os hyoides,—a dried larynx, with the upper part of the trachea,—separate specimens (recently prepared, and preserved in weak alcohol) of the individual cartilages entering into the composition of the larynx; with these, and a careful dissection of the larynx belonging to the head and neck he has just dissected, he will readily make himself master of this organ, which no existing manual of practical anatomy, aided by the dissection of a single larynx, would ever enable him to accomplish. Having put these preparations before him, and cautiously cleaned the larynx, attached to which he must leave the tongue and hyoid bone, let him commence by re-examining the anatomy of the hyoid bones. The *Larynx* communicates superiorly with the pharynx, inferiorly with the trachea; the pharynx separates it from the vertebral column. It gives passage to the air in the act of respiration, and is the organ of the voice.

518. The CARTILAGES of the LARYNX are nine in number. 1°. The *Thyroid Cartilage*, composed of two broad laminæ, having thus something of the form of a shield, hence also called scutiform: these laminæ give rise to a projecting angle anteriorly, readily felt under the integuments; posteriorly, the thyroid cartilage is quite open, being defective here; the sterno-thyroid, sterno-hyoid, and inferior constrictor of the pharynx are attached to it. In the hollow of the retiring angle are

attached the ligaments of the glottis, and the thyro-arytenoid muscles. The crico-arytenoid muscles are inserted into it inferiorly, and on its outer side. The upper edge gives attachment to the thyro-hyoid ligament, and, together with the posterior margin, forms the ascending *cornu ;* there is also an inferior cornu on each side, overtopping the cricoid cartilage ; the crico-thyroid ligament attaches its inferior edge to the cricoid cartilage. 2°. The *Cricoid Cartilage* has somewhat the form of a ring, and forms a complete circle ; its connexions above have been already stated ; inferiorly, it is connected to the upper ring of the trachea, by the fibrous membrane of the trachea ; internally, it is lined by the mucous membrane of the larynx. The base of the arytenoid cartilages rest upon it, and it gives attachment to the crico-thyroidei, crico-arytenoidei postici and laterales. 3°. and 4°. The *Arytenoid Cartilages,* two in number, rest upon the cricoid cartilage, and are of a pyramidal shape, the apex being placed upwards ; posteriorly, they give attachment to, and are connected to each other by the arytenoid muscles ; anteriorly, they give attachment to the ligaments of the glottis, or true vocal cords ; moreover, the crico-arytenoidei muscles are attached to them. The summit is surmounted by a small cartilage, (5°. and 6°. *Cornicula Laryngis*) and from their summits proceed the folds of mucous membrane, called aryteno-epiglottic folds. All these cartilages have a homogenous texture, and are apt to become osseous in aged persons. 7°. The *Epiglottis* is a fibro-cartilage, placed at the base of the tongue, with which it is connected by folds of a mucous membrane, *frenula epiglottidis.* Its tissue is elastic, the base superiorly, apex inferiorly. The gland of the epiglottis lies in front of it. In general, its position is vertical, but it changes and becomes horizontal during deglutition ; it serves therefore to cover and protect the superior aperture of the larynx, during the deglutition of solid and liquid aliment. It has two surfaces, a *lingual* and a *laryngeal.* 8°. and 9°. The *Cuneiform Cartilages* are two small cartilages, of a triangular form, with the base superiorly and apex inferiorly, situated in the aryteno-epiglottidean folds: their use is to support these folds. They are always present, but are easier felt than demonstrated.

519. The LIGAMENTS OF THE LARYNX are, 1°. The thyro-hyoid and the fibro-cartilaginous ligament of the great horn. 2°. The crico-thyroid membrane. It is this ligament which is opened in laryngotomy: there are also ligaments which attach the small horns of the thyroid cartilage to the cricoid, and a synovial bursa to facilitate motion; and others which attach the arytenoid cartilages to the cricoid. 3°. The thyro-arytenoid ligaments which can only be seen upon the deeply dissected larynx are called the inferior or true vocal cords; also, the inferior ligaments of the glottis.

520. The MUSCLES of the LARYNX are easily dissected, requiring no particular directions. Clean first, the crico-thyroid, next the crico-arytenoidei postici by removing the mucous membrane of the pharynx; also the arytenoideii; cut through vertically one of the wings of the thyroid cartilage, but in such a way as to avoid injuring the salient angle; this will expose the crico-arytenoideus lateralis and thyro-arytenoideus of one side. The crico-thyroidei have been already described. Each arises from the side and fore part of the cricoid-cartilage and ascending obliquely upwards and outwards is inserted into the lower and outer surface of the thyroid cartilage, leaving between it and its fellow an interval occupied by the crico-thyroid membrane. *Use* to approximate these cartilages to each other; these muscles are farther remarkable in being supplied by branches of the superior laryngeal nerves. The *Crico-Arytenodei Postici* are also two in number; they are of a triangular shape and arising extensively from the cricoid cartilage, are inserted into the base of the arytenoid cartilage. The *Crico-Arytenoideus Laterales;* each arises from the side of the upper circumference of the cricoid cartilage, and is inserted into the outer and fore part of the base of the arytenoid cartilage. The *Arytenoideus* is a single and very remarkable muscle, inasmuch as it crosses the middle plane of the body. It is formed of several planes of fibres having different directions, hence the names of oblique and transverse given to different portions of it. They connect the

arytenoid cartilages to each other. Finally, this muscle is invested anteriorly and posteriorly by a mucous membrane.

521. The GLANDS of the LARYNX are, 1°. The periglottis, situated anteriorly to the epiglottis; and 2°. The arytenoid glands, lodged in the aryteno-epiglottic folds; all these glands are extremely small.

522. The MUCOUS MEMBRANE of the Larynx may be studied, 1st, upon the entire larynx; 2d, upon the larynx divided posteriorly by cutting through the cricoid cartilage and the arytenoid muscles and mucous membrane. This membrane is obviously continuous superiorly with that of the mouth, and inferiorly with that of the trachea and lungs. After forming the glosso-epiglottic folds, it invests a portion of the epiglottis and penetrates into the larynx, forming superiorly between the epiglottis and summits of the arytenoid cartilages, the aryteno-epiglottic folds. These folds, together with the epiglottis in front, and the arytenoid cartilages and muscles behind, constitute the *superior aperture* of the *larynx*. A short way beneath this, and within the larynx are the false vocal cords, or superior ligaments of the glottis, formed merely of mucous folds, and covering a part of the thyro-arytenoidei muscle. A little lower down, within the larynx, are two other folds; these are the true vocal cords, or inferior ligaments of the glottis, and are formed of the thyro-arytenoid ligaments covered by the mucous membrane. The space between these ligaments is called the glottis, or *Rima of the Glottis,* and is the narrowest part of all the air tubes. It is of a triangular shape, and liable to vary, and may sometimes no doubt be completely closed at the will of the individual. On each side of the larynx, bounded above by the false vocal cords, and below by the true ones, is a depression or cavity; these are the ventricles or sinuses of the larynx.* The mucous mem-

* An attempt has been lately made to establish a distinction between the terms *glottis* and *rima* of the glottis; the *superior aperture of the larynx* they call the glottis. But there can arise nothing good from such a distinction, and the superior aperture of the larynx should simply be allowed to retain its name. The same persons seem to think that the rima of the glottis and the

brane lining the larynx is soft, spongy, continually moistened, and of a rose colour. The arteries of the larynx are furnished by the superior and inferior thyroid; the nerves are the superior and inferior laryngeal nerves on each side, branches of the pneumo-gastric. The dissection, if followed as directed (501), enables the student to dissect the deep muscles of the neck. Three on each side have been already described, viz. the Scaleni (470); the remaining are the Longi Colli, Recti Capitis Antici Majores, Recti Minores, Recti Laterales.

523. Longus Colli Muscle flat, narrow, elongated, lying on the anterior and lateral part of the bodies of the vertebræ, from the atlas to the third dorsal, formed of two fasciculi superimposed upon each other: *one* superior, directed obliquely outwards, extended from the anterior tubercle of the atlas, where it takes its origin by aponeurotic fibres, to the transverse processes of the third, fourth, and fifth cervical vertebræ; the *other inferior*, descends vertically from the body of the axis and third vertebra, anterior tubercle of the fourth to the bodies of the last four cervical vertebræ and three first dorsal, attached by aponeurotic fibres, also inserted into the fibro-cartilages and base of the transverse processes. Its *anterior surface* covered by the rectus capitis anticus major, pharynx, carotid artery, pneumogastric nerve, communicating cords of the cervical ganglia and the œsophagus; its *outer edge* is separated from the scalenus anticus by a triangular interval, which lodges the vertebral artery and vein. Its *upper extremity* is confounded with that of the muscle of the opposite side. *Use* to bend the cervical vertebræ on each other, and on the dorsal vertebræ.

524. Rectus Capitis Anticus Major lies upon the anterior and lateral part of the cervical vertebræ. Four thin, flat tendons, fixed by a pointed extremity to the anterior tubercles of the sixth, fifth, fourth and third transverse processes of the neck, and so much the larger the higher they are, give origin to the fleshy fibres of this muscle, which are united into so many imbricated bundles, behind which they are more or less prolonged.

inferior aperture of the larynx are synonymous; it is rather difficult to imagine how a practical anatomist could have confounded them with each other.

It proceeds from below upwards and from without inwards, becoming broader in its progress, and attached to the basilar surface near the occipital foramen. Its *anterior surface* corresponds to the carotid artery, internal jugular vein, pneumo-gastric nerve, superior cervical ganglion, and pharynx. *Use* to bend the head upon the neck, directly, if it acts in conjunction with that of the opposite side, and laterally, if it acts by itself. Detach and reflect the upper part of this muscle from the bone. This will display

525. The RECTUS CAPITIS ANTICUS MINOR, situated behind the preceding muscle, has nearly the same form, but is shorter and narrower; arises below, from the fore part of the lateral mass and of the transverse process of the atlas, by aponeurotic fibres; it ascends to the anterior margin of the occipital hole, and the cartilaginous substance which unites the petrous with the basilar process; terminates behind the rectus anticus major, by thin aponeuroses. It is concealed by that muscle, and covers the atlanto-occipital articulation. *Use* to bend the head upon the neck.

526. RECTUS CAPITIS LATERALIS, thin, flat and of an elongated square form; attached inferiorly, by a small tendon, to the upper and anterior part of the transverse process of the atlas, ascends vertically to the occipital bone, to terminate at an impression behind the jugular fossa. Its *anterior surface* is covered by the internal jugular vein, the *posterior* corresponds to the vertebral artery. It inclines the head laterally and forwards. The student ought now to turn this part of the *subject* and proceed at once to the dissection of the articulations of all the cervical vertebræ with each other, and particularly of the two first with the occipital bone. The anatomy of these articulations together with the modes of dissecting them, he will find under their proper head.

527. MUSCLES AND NERVES OF THE ORBIT. To understand the anatomy of the orbit it is essential for the student to dissect two orbits. In the first he must dissect the muscles only. In the second the nerves. If the horizontal section of the cranium for the removal of the brain has already been made, and the section carried close to the superciliary ridges, the student will

only have to remove the thin lamina of bone forming the ceiling of the orbit. A vertical section of the superciliary ridge must also be made, and the saw must not be carried within at least a quarter of an inch of the internal angular process of the frontal bone, a similar section must be made towards the external angular process, but the lower this is cut the better, the chissel or a pair of good bone nippers will now remove all the osseous textures which obscure the superior part of the orbit and its appendages. In removing these portions of bone, the periosteum must be carefully stripped off and left on the subject.

528. The Levator Palpebræ Superiores. Dissect off the periosteum, &c. and the frontal branch of the ophthalmic nerve will be observed lying on the muscle. Attached to the meningeal sheath of the optic nerve, and by a small tendón to the lower surface of the small wing near the optic foramen, from which it is separated by the rectus superior; it is directed horizontally forwards, curves downwards, expands and losing its red colour, descends as far as the fibro-cartilage of the upper eyelid, to which it is attached by a thin aponeurosis. Divide this muscle through about the middle, reflect these and dissect the

529. Rectus Occuli Superior (*Atollens*) attached, posteriorly, near the optic foramen, to the process of Ingrassias and fibrous sheath of the optic nerve, mingling there a little with the rectus internus; it proceeds horizontally forwards to the upper part of the eye-ball, becomes aponeurotic and is connected to the sclerotic membrane. This aponeurosis, as well as that which terminates toward the eye the other three recti, is separated from the eye-ball by a small indistinct synovial capsule, the walls of which are soft, and as it were downy. Its *upper surface* is covered by the levator palpebræ superioris, from which it is separated by some nervous filaments, and by the membrana conjunctiva; the *inferior surface* rests, posteriorly, on the optic nerve, the ophthalmic artery, and the nasal branch of the ophthalmic nerve, and, anteriorly, upon the eye itself. It raises the eye. Upon the nasal side of the orbit will be found the

530. Obliquus Superior arises by short aponeuroses, near the optic foramen, proceeds horizontally to

the internal orbitar process, passing beneath the internal orbitar foramina, forms a rounded tendon, surrounded by a soft and loose sheath; it is engaged in a cartilaginous ring, whose extremities are attached to the bone in a moveable manner by short fibrous ligaments. In the interior of this pulley is a synovial capsule which is reflected over the tendon, and accompanies it for some way, forming around it a distinct and close sheath; it then proceeds backwards and downwards between the rectus superior and ball of the eye, forms a radiated aponeurosis which descends over the outer and posterior part of the eye-ball, confounding a portion of its fibres with the sclerotic membrane near the entrance of the optic nerve. *Use* to carry the ball of the eye forwards and inwards, giving it a rotatory motion, which directs the pupil downwards and inwards. Divide this muscle in its fleshy belly, and beneath it will be found the

531. RECTUS INTERNUS (*Adductor Oculi*) occupies the internal region of the orbit, arises near the margin of the optic hole, and proceeds horizontally forwards to the inner side of the eye. Its *internal surface* corresponds to the orbit; the *external* to the optic nerve. It carries the eye inwards. Detach the lower eyelid from the inferior margin of the orbit also in the direction of the external canthus of the eye, and draw the eye-ball upwards and inwards, and thus expose the

532. RECTUS EXTERNUS (*Abductor Oculi*) from the outer part of the circumference of the optic hole, by short aponeuroses. Between these two origins pass the third pair of nerves, sixth pair, and nasal branch of the ophthalmic. The muscle then proceeds horizontally outwards and forwards, to the outer part of the eye. It corresponds by its *external surface* to the periosteum of the orbit, and to the lachrymal gland; by its *internal surface* to the optic nerve and sixth pair, as well as to the lenticular ganglion. It draws the eye outwards. Divide this muscle, and expose

533. The RECTUS INFERIOR (*depressor oculi*) arises posteriorly from a tendon common to it with the internal and external recti, and proceeds horizontally towards the ball of the eye, on which it terminates in the same manner as the rectus superior. Its *inferior surface* is separated from the floor of the orbit by adipose tissue,

and covered anteriorly by the conjunctiva. The *upper surface* is in connection with the optic nerve, a branch of the third pair of nerves, and the eye. It is the antagonist of the rectus superior, drawing the eye downwards.

534. The OBLIQUUS INFERIOR OCULI is attached to the inner and fore part of the orbitar surface of the superior maxillary bone, outside of the lachrymal groove, directed backwards and outwards, curving upwards upon the convexity of the eye, between it and the rectus externus; forms an aponeurosis which terminates in the sclerotic membrane, at the distance of two lines from the entrance of the optic nerve. Its *inferior surface* rests upon the floor of the orbit; the *upper* corresponds to the eye-ball and rectus inferior. It carries the eyeball inwards and forewards, and directs the pupil upwards and outwards. When it acts along with the preceding muscle, the eye is carried forwards and inwards, which counterbalances the effort made by the united recti muscles. The student will of course during the dissection of the muscles, have seen many filaments of nerves, and particularly the optic, but it is so essential to have a clear comprehension of the muscles, that, with the exception of the optic, they should all be neglected until returning to the other orbit, or assisting his fellow student who ought to have been looking on during the examination of the muscles.

535. NERVES of the ORBIT, these are the *second, third, fourth,* and *sixth pairs of Cerebral Nerves,* together with the *Ophthalmic* or *first division of the Trifacial* or *fifth pair.*

536. The OPTIC or *Second pair of Cerebral Nerves* may be examined on the same orbit in which the muscles were dissected. They traverse the foramina optica, together with the ophthalmic artery which lies beneath them. On entering the osseous orbit, the arachnoid prolongation which had accompanied them from the brain is reflected. A sheath which they receive from the *dura mater* accompanies them within the orbit. As the nerve leaves the short osseous canal it is received into a fibrous ring formed by the attachments of the muscles of the eye, it

here changes its direction a little, and proceeding nearly straight forward, penetrates the sclerotic coat of the eye-ball towards the inferior and inner side of the axis of the eye. The nerve is circularly contracted at the moment of penetrating the tunica sclerotica. A great quantity of fat in nearly all subjects surrounds the nerve in its course from the foramina optica to the eye-ball separating it from most of the other nerves. The ciliary artery and nerves lie upon it,—also the ophthalmic ganglion upon its outer side. A fibrous sheath furnished by the dura mater accompanies it to the sclerotic,—thus the optic nerves have two sheaths, their own neurilema and the one just mentioned. A vertical incision of the eye-ball must be made, upon the fresh eye of any animal, and the dissector will thus be enabled, by removing the sclerotic and choroid tunics of the fresh eye, to trace the optic nerve directly to the *retina,* in which it terminates. The optic are nerves of special sensation, viz. that of vision, and Dr. Arnold thinks that the optic communicates with the superior maxillary by two fine filaments. The dissector will now proceed to take his view of the other nerves distributed to the eye, and its appendages on the opposite and entire orbit. The section of the bones has been already described, and the dissection of these complex and curious nerves must be commenced within the cranium, previous to their coming in contact with the cavernous sinus. If they have been cut sufficiently long, on removing the brain, they will readily be found in their respective situations. The *third* close to the optic; the *fourth* on the upper edge of the prolongation of the dura mater to the posterior clinoid processes; the *fifth* entering a foramen in the dura mater below that edge a little in front of the meatus auditorus internus; and the *sixth pair* still more in front, and a little lower down. The *fourth,* which is an extremely fine nerve, and the *fifth* must first be examined, tracing the *frontal* and *lachrymal branches of the fifth,* next follow the *nasal branch of the fifth,* next examine the *third,* and finish the examination with the *ophthalmic ganglion and ciliary nerves.*

537. Fourth Pair. *Pathetic* or *Trochleator,* this nerve, remarkable for its fineness, arises at the sides

of the valvule of Vieussens, and after winding round the crura cerebri, penetrates into a sheath formed by the dura mater in the anterior prolongation of the tentorium cerebelli externally to the third; it next places itself upon the ophthalmic branch of the fifth, with which it communicates by *several filaments,* and by *one more especially* which seems to join the *lachrymal* branch of the fifth, it next penetrates into the orbit by the widest part of the *foramen lacerum,* and quitting the course of the ophthalmic, proceeds inwards to the *superior oblique*, to which muscle it is entirely distributed. Whilst within the cranium, and inclosed in the sheath of the dura mater, the fourth sends a *filament to the tentorium of the cerebellum :* this filament has a retrograde course. The dissector must follow the fifth pair from the point where it enters the foramen in the dura mater, over the depression in the fore part of the petrous portion of the temporal bone to the Casserean ganglion.

538. The FIFTH PAIR, *Trifacial* or *Trigemini,* is composed of from eighty to a hundred filaments, and close inspection shews that these filaments are arranged in two distinct bundles,—a motor and a sentient; these were first described by Paletta and Wrisberg; passing along together, they reach the anterior part of the pars petrosa of the temporal bone, and are lodged here in a particular depression near its summit; a fold of the dura mater passes over the depression, forming a bridge underneath which the nerve passes; the nerve continues to increase in size, and its *sentient* portion soon expands into a ganglion, the ganglion of Gasser. All the filaments of this nerve do not pass through the ganglion; like the spinal nerves, the motor portion or roots pass beyond it to unite afterwards with one of its subdivisions, the *inferior maxillary* nerve. To observe this, cut through the little bridge of the dura mater which passes over the nerve, and clean its upper surface carefully; next raise it up from within outwards, and the *motor roots* discovered by Paletta will be found at first upon its inner side, and afterwards passing below it. These correspond to the *anterior roots* of the spinal nerves. The ganglion of Gasser adheres very intimately to the dura mater. From its convexity proceed

three plexiform fasciculi, which, on being traced, prove to be the three great divisions of the nerve, viz. the *ophthalmic of Willis*, the *superior maxillary*, and the *inferior maxillary;* to this last proceeds the *non*-ganglionic roots of this pair of nerves.

539. OPHTHALMIC NERVE, or *First Division of the Trifacial.* Trace this upwards, forwards, and outwards inclosed in the outer wall of the cavernous sinus. It there divides into three branches, viz. an external or lachrymal, a middle or frontal, and an internal or nassal; these enter the orbit by the sphenoidal fissure. 1°. The *Lachrymal Nerve* is the smallest of the three divisions of the ophthalmic; it is difficult to trace this nerve at its origin; having entered the orbit, it proceeds along the upper surface of the rectus externus, traverses the lachrymal gland to which it furnishes twigs, pierces the ligamentum latum palpebræ superioris, and is distributed ultimately to the upper eyelid and skin of the temporal region. The lachrymal nerve is generally formed by two filaments, one from the fourth pair, and the other from the ophthalmic division of the fifth. This will be best seen in tracing the fourth pair, which the student should do at the same time that he traces the ophthalmic, thus taking care that the dissection of these nerves proceeds together. 2°. The *Frontal Nerve* is, properly speaking, the continuation of the ophthalmic, it enters the orbit along with the fourth pair, and proceeding horizontally forwards between the periosteum of the orbit, and the levator palpebræ superioris divides into two branches, an *internal* and an *external frontal.* The external frontal is likewise called supra-orbitar; it leaves the orbit by the supra-orbitar foramen, and divides into ascending or frontal branches, and descending or palpebral branches. The frontal branches may be followed in the skin of the forehead, as high as the lambdoidal suture. The internal frontal, which varies in size, leaves the orbit between the supra-orbitar notch and the pully of the trochleator muscle, hence called supra-trochlear, and divides into ascending or frontal branches, and descending or naso-palpebral. It is presumed that all, or the greater number of the terminating filaments of these nerves proceed to the integuments. 3°. The *Nasal*

Nerve is the internal branch of the ophthalmic. It penetrates into the orbit between the two divisions of the third pair, crosses obliquely over the optic under the rectus superior and superior oblique muscle, reaches the inner wall of the orbit, and subdivides into two branches, the *sub-trochlear* and *proper nasal.* The sub-trochlear branch follows the original direction of the nerve, leaves the orbit beneath the pully of the trochlear muscle, (hence its name,) and here subdivides into three sets of branches, viz. palpebral, nasal, and frontal. The proper nasal branch follows a very singular course. It leaves the main trunk nearly at right angles, and penetrates the anterior of the internal orbitar foramina, and this leads it to the upper surface of the cribriform plate of the ethmoid bone, and consequently within the cranium. Its passage through this osseous canal to reach the interior of the cranium, may very readily be displayed by cautiously laying it open with a chisel or strong knife; but the course of the nerve through the nose can only be traced upon a vertical section of the head. It next passes forward to the fissure in the anterior part of this plate, and descending through this fissure, penetrates into the nasal fossæ, and there subdivides into two branches, viz. *nerve of the septum and nasolobar branch.* The first is distributed to the septum; the second proceeds to the integuments of the lobe of the nose, and to the surface of the turbinated bones. The nasal branch is the nerve experimented on by M. Magendie, and seems in some way or other intimately connected with the sense of smell. By the branch which it sends to the lenticular ganglion, it must also be in some way connected with that of vision. This branch will be more particularly described along with the ganglion.

540. The THIRD PAIR of CEREBRAL NERVES commences in the crura cerebri, and is found afterwards to the outside and somewhat below the posterior clinoid processes. It is here received in a sheath of the dura mater, which it perforates, and is said by some (Cruvillhier) to pass through the cavernous sinus. This is incorrect; the only nerve fairly passing through the sinus being the sixth; it divides previous to passing into the orbit, into two branches, a superior and an in-

ferior. Just as it is about to enter the sphenoidal fissure, it is said to receive from the cavernous plexus of the sympathetic, some very fine filaments, and one from the first branch of the fifth pair.* At this point the sixth pair lies below the third, and the fourth and frontal branch of the fifth pair, above it. The nasal branch of the fifth passes between its two divisions. The *superior branch* of the third is much smaller than the *inferior;* it passes immediately below the superior rectus muscle, and divides into a number of branches, supplying that muscle; some filaments proceed to the levator palpebræ superioris. The *inferior branch* of the third pair looks like the continuation of the main trunk. It proceeds forwards and downwards between the optic nerve and the sixth pair, and almost immediately subdivides into three branches, of which one proceeds to the rectus internus, one to the rectus inferior, and the third to the inferior oblique. From this branch, going to the inferior oblique muscle, there proceeds a short and strong filament to the *lenticular ganglion.*† We have thus seen that the third pair of cerebral nerves supplies all the muscles within the orbit, excepting the trochleator and rectus internus. Its supplying the obliquus inferior, is remarkable, as proving that the muscle cannot be an involuntary one, and yet it furnishes the necessary filaments to the levator palpebræ superioris muscle, acting throughout the whole day, altogether without our consciousness, and therefore in this sense *involuntary.*

541. Sixth Pair of Cerebral Nerves, or *Abducens Oculi,* supplying the rectus externus muscle, which directs the globe of the eye and its axis outwards, arises from the fissure which separates the rachidian bulb from the pons Verollii; each nerve at its commencement seems composed of two roots; the nerve after penetrating the dura mater at the sides of the basilar groove by one or two apertures, penetrates the cavernous sinus. Whilst in the sinus it

* I have never seen these filaments, neither do I believe that the third pair passes through the cavernous sinus, in the strict sense of the term.

† This filament is generally, but not always stronger than that which the ganglion receives from the nasal.

crosses the internal carotid artery (also inclosed in the sinus;) communicating also with two branches of the sympathetic system of nerves, thus connecting it to the superior cervical ganglion ;* it next leaves the sinus and penetrates into the orbit, through the foramen lacerum, gains the ocular surface of the rectus externus muscle, and is distributed wholly to it. The uses of the nerve are obvious, but physiologists have hitherto offered no explanation of the singular want of sympathy there is between the nerves and muscles of the two orbits, as proved by the simultaneous direction of the axis of both eyes towards one object. The student will find it more convenient to trace the branches of the sympathetic which communicate with the sixth pair of cranial nerves at a later period of his dissection.

542. Ophthalmic or Lenticular Ganglion. This ganglion may be reached in several ways. 1°. By tracing the branch it receives from the nasal branch of the ophthalmic; this is the most difficult method. 2°. By following the branch, it receives from the inferior division of the third, more especially from the branch the third furnishes to the inferior oblique muscle. 3°. By dissecting cautiously in the fat situated between the rectus externus muscle, and optic nerve. The ganglion so found, is also called *lenticular ;* it is a small greyish body of an irregular shape; by its two posterior angles, it receives the filaments from the nasal branch of the ophthalmic and from the third; and from its anterior margin it sends off the ciliary nerves. Finally, the ganglion receives, directly or indirectly, a very fine filament, which is scarcely ever attended to, from the cavernous plexus; but this more generally joins the nasal. The ciliary nerves compose two fasciculi, the superior composed generally of four filaments, the inferior of five or six; they run along the surface of the optic nerve, are flexuous, do not anastomose with each other, and finally reaching the tunica sclerotica, they pierce it to reach the space between it and the choroid tunic; passing along this, they

* In the horse, and more rarely in man, I have seen a branch of the sympathetic as it reached the sixth, suddenly separate, and passing around it, proceed to the first division of the fifth.

proceed to the iris, and also to the annulus albus. To follow them to their termination, let the student remove the sclerotic and cornea. The nasal branch of the ophthalmic usually sends off a ciliary branch or two distinct from the others.

543. Lachrymal Gland and its Ducts, Tunica Conjunctiva, Palpebræ, Puncta Lachrymalia and Ducts, Lachrymalic Sac and Nasal Duct. All these parts may be readily made out on one or other of the orbits just dissected, with the exception, perhaps, of the eyelids, which will have been detached from the margins of the orbits during the previous dissection.

544. The Eyelids (*Palpebræ*,) are two in number, a superior and an inferior; these are horizontal. There is, however, a third or imperfect eyelid, (the vertical eyelid or *membrana nictitans*), connected with the tunica conjunctiva; this will be described afterwards. In the eyelids, we have to consider their form and organization: their dissection consists merely in reflecting the layers of which they are composed, successively. The *upper eyelid* is possessed of great mobility, descends below the transverse diameter of the eye; chiefly closing the eye. Both eyelids are convex before, and present a number of transverse wrinkles, particularly distinct in old age. The two eyelids are united at the extremities of the transverse diameter of the orbit, forming two angles (*canthi*), the inner of which is more open than the outer; this difference arises from the fibres of the orbicularis palpebrarum being inserted internally upon a tendon which does not exist at the outer angle. The free edges of both eyelids are in contact with each other, and supported by a fibro-cartilage. That of the upper eyelid is directed downwards, while the other looks upwards; they are cut obliquely from before backwards, and are so disposed as to form, on being brought together, a narrow and triangular canal, of which the ball of the eye constitutes the posterior wall. This canal is broader internally, especially opposite the puncta lachrymalia, than externally; it serves to conduct the tears towards these orifices during sleep. The free edges of the eyelids are concave and rounded over an extent of two or three lines on the side next

the nose, where they correspond to the caruncula lachrymalis. When they begin to be cut obliquely, there is observed a small tubercle in which is placed the orifice of the lachrymal ducts. There also, they change their direction, become nearly straight when the eye is open, and present on the side next the eye, as far as the outer angle, a row of small holes which are the excretory orifices of the Meibomian glands, before which, near the skin, is a series of hairs named *ciliæ*. The *ciliæ*, or *eye-lashes*, are hard and solid hairs, arranged in two or three rows. The *skin of the eyelids* is peculiar in its extreme delicacy and transparency; it is applied upon a layer of loose cellular tissue, never charged with fat, but capable of being filled with serosity with extreme facility. The *muscular layer of the eyelids;* is formed by a portion of the orbicularis palpebrarum. The *fibrous membrane of the eyelids* exists behind the muscular layer, from which it is separated by cellular tissue, and occupies only the external part of each eyelid. It is usually called the ligamentum latum palpebræ superioris, and was long ago shewn by Winslow to be derived from the periosteum of the frontal bone and orbit. The portion which belongs to the upper eyelid is placed between the orbicularis muscle and the expanded aponeurosis of the levator palpebræ; that of the lower eyelid is immediately applied upon the tunica conjunctiva. These two portions have their fibres mutually interlaced, from the angle of union of the tarsal cartilages to the outer angle of the orbit, and proceed from thence to the corresponding part of the circumference of that cavity, as well as to the edge of the cartilages, diminishing progressively in strength and thickness, so as to be substituted internally by a lamellar tissue loaded with fat. Apertures are observed in several places of it for the passage of nerves and vessels. Moreover, the upper eyelid presents a second fibrous layer crossing the direction of the above, which is constituted by the aponeurosis of its levator muscle which attaches itself to the corresponding fibro-cartilage. The *Tarsal Fibro-Cartilages* are two small laminæ placed in the substance of the free edge of each eyelid, on the same level as the fibrous layer. Each of them commences at the bifurcated extremity of the tendon of the orbicularis muscle, and terminates externally, by uniting with its fellow opposite the crossing of the two fibrous layers. They are broader in the middle than at the extremities, and differ in their form as well as size. The *upper* is larger, about six lines broad, very contracted at the two ends; the *lower* is two lines in breadth, and presents nearly the same dimensions in its whole extent. Their *anterior surface* is convex, and is in connection with the orbicularis muscle; the *posterior* is concave, lined by the tunica conjunctiva, and marked with several vertical grooves, which lodge the Meibomian glands. Their *adherent edge* gives attachment to the fibrous layer of each eyelid; but in the upper eyelid it is strongly curved, and affords insertions to the levator muscle, while in the lower it appears rectilinear. Their *free* or *ciliary edge* is broad and thick, rounded, and slantingly cut. These two fibro-cartilages are rather thin, flexible, elastic, and of a slightly yellowish tint, but present nothing peculiar in their structure. The *Tensor Tarsi muscle* connected with these tarsal cartilages, has been already described. (422). The *Meibomian Glands* or *Ciliary Follicles*, are small round follicles, lodged in particular grooves, between the tarsal cartilages and the tunica conjunctiva. They are disposed one above another, in such a manner as to represent two vertical and parallel lines of a yellowish colour, more numerous and more distinct in the upper eyelid, where there are thirty or forty, than in the lower, where they are only about twenty; they communicate with each other, and those nearest the free edge of each eyelid open externally by minute orifices disposed in one or two rows on the side next the eye, behind the ciliæ; there issues from them a sebaceous humour, which, on pressing the tarsal cartilages, may be squeezed out under the form of extremely minute cylinders.

545. The LACHRYMAL GLANDS occupy the outer orifice of each orbit, and correspond to the lachrymal fossa within the external angular process of the frontal bone. Their size varies. Above them is the periosteum of the orbit, and here they are convex; by their concave side they rest on and adapt themselves to the surface of the eye-ball. The *lachrymal gland* is composed of a

number of lobules connected by cellular tissue, and separated from each other by vessels and nerves which creep in their intervals. These lobules are formed of rounded granulations, of a reddish white colour, in which the last ramifications of arteries terminate, and in which the radicles of the veins commence, but whose more intimate structure is still entirely unknown. It is presumed that from each of them issues a small excretory canal, which by uniting with others in its vicinity, gives rise to trunks somewhat more distinct. Anatomists who have seen and injected them, state that they are six or seven in number, and open, internally of the upper eyelid, at some distance from the outer part of the corresponding tarsal cartilage; their orifices are seen upon the conjunctiva, where their series forms a curved line, the convexity of which is directed upwards and outwards. The capsule of the gland is fibro-cellular, and it sends partitions into its substance. The orifices of these ducts are very evident in the lower animals, as in the dog.

546. The Tunica Conjunctiva (*Membrana adnata*), belongs to the order of mucous membranes; thin, transparent, and lines the posterior surface of the eyelids, and the fore part of the ball of the eye, but according to Ribes, limited at the circumference of the cornea. On the free edge of the upper eyelid, it is continuous with the skin, where the ciliæ arise; it then covers the edge of the fibro-cartilage, and is perforated externally by the orifices of the ciliary follicles. Internally, it introduces itself by the superior punctum lachrymale into the lachrymal duct, proceeds behind the fibro-cartilage and the aponeurosis of the levator palpebræ muscle, is reflected over the sclerotica, to gain the posterior surface of the lower eyelid, and terminates upon its free edge, where it is continuous with the skin, and dives into the inferior lachrymal punctum. On leaving the eyelids to be reflected over the eye, it forms a semicircular fold, which corresponds to the fat of the orbit. On the internal part of the ball of the eye, the tunica conjunctiva forms another rather indistinct fold, named the *membrana nictitans,* or vertical eyelid, because in man it seems to be the rudiment of an organ of the same name, which is highly developed in certain ani-

mals. It is rendered apparent by turning the eye towards the nose. Mr. Meckel supposes that there is a small cartilage in it, even in the human structure. The *inner surface* of the tunica conjunctiva is attached to the eyelids and ball of the eye by dense cellular tissue. The *outer surface* is smooth, constantly moist; when the eyelids are closed, it corresponds to itself in all points; when open, it is in part exposed to the contact of the air; it contains a number of capillary blood-vessels, especially on the eyelids. Its arteries are derived from the ophthalmic artery; it receives minute filaments from the lachrymal nerve and external nasal.

547. The Caruncula Lachrymalis is a small reddish tubercle, of a pyramidal form, situated in the inner angle of the eyelids, at the fore part of the ball of the eye, behind and within the puncta lachrymalia. It is a mass of small mucous crypts, invested by the conjunctiva, which forms anteriorly and externally of them a semilunar fold (*membrana nictitans*). Each of the orifices of these crypts is furnished with hairs of excessive delicacy, and visible only by the microscope. They receive filaments of the nasal nerve, and some vascular ramifications. *Use*, to retain the tears in the inner angle of the eye, and furnish a peculiar sebaceous fluid.

548. Puncta Lachrymalia and Ducts. The Puncta are small apertures, occupying the centre of a small tubercle, slightly inclined backwards, and situated at the distance of about a line and a half from the internal commissure of each eyelid, at the place where their edge changes its direction. A small mucous rim surrounds their circumference. They are placed opposite each other; that of the *lower* eyelid is directed upwards, outwards, and backwards; that of the *upper*, downwards, and also outwards and backwards, so that when the eyelids are closed, they only touch each other on the side next the skin. These puncta are the external orifices of the lachrymal ducts which carry the tears into the lachrymal sac, through the eyelids, and whose diameter is longer than the circumference of the puncta lachrymalia themselves, which makes these canals appear slightly contracted at their

origin. The lachrymal ducts are distinguished into superior and inferior, according to the eyelid to which they belong. The *superior lachrymal duct,* which is longer than the inferior, ascends at first vertically, then bends nearly at a right angle, and proceeds inwards and downwards along the inner part of the free edge of the eyelid, immediately beneath the conjunctiva. The *inferior lachrymal duct* also at first descends nearly vertically, then directs itself inwards, ascending a little to place itself beside the superior. Opposite the commissure of the eyelids, both proceed alongside of each other, behind the tendon of the orbicularis palpebrarum, as far as the lachrymal sac, into the middle part of the outer side of which they open separately. These ducts are formed of a delicate prolongation of the conjunctiva, which is thus continuous with the mucous membrane of the lachrymal sac; are wider generally than the puncta. The passing of bristles along these ducts into the lachrymal sac should be frequently practised by the student.

549. The LACHRYMAL SAC is a membraneous bag, lodged at the inner angle of the orbit, in the channel formed by the lachrymal bone and the ascending processes of the upper maxillary bone. Its form is ovoid; its *outer side* is covered anteriorly by the skin, the orbicularis palpebrarum, and its tendon, which divides it transversely into two portions, the *lower* narrower and more elongated than the *upper*. *Posteriorly*, it corresponds to the caruncula lachrymalis and conjunctiva, and furnishes some insertions to the inferior oblique muscle of the eye. Its *inner side* fills the lachrymal groove, to which it is closely attached. Its *upper extremity* is dilated and rounded, forms a prominence above the tendon of the orbicularis palpebrarum. The *inferior extremity* is continuous with the nasal canal. *In its interior*, the sac is lined by a mucous membrane, continuous with that of the eye and nasal fossæ. It is always covered with mucus. *At the exterior*, the lachrymal sac is formed by a fibrous aponeurotic membrane, which some consider as the *reflected tendon* of the orbicularis palpebrarum. This membrane is white, dense, and strong, fixed on all sides to the bony edge of the lachrymal groove. An-

teriorly, it is united to the tendon of the orbicularis palpebrarum and to some of its fleshy fibres, to which it gives insertion.

550. NASAL DUCT. Lay open the sac from the tendo-oculi downwards; and pushing a blunt probe into it in the same direction, will thus shew the course of this duct. By looking into the inferior meatus of the nose, the student will observe the extremity of this probe, indicating the course of the tears. The osseous part of this canal has already been described (80). It is lined by a prolongation of the mucous membrane of the lachrymal sac, which adheres feebly to the periosteum, and opens, by a contracted orifice, under the inferior turbinated bone, which is furnished with a circular fold formed by the pituitary membrane. The inferior orifice of the nasal duct may be reached from the anterior nostrils, by a firm instrument, such as a portion of brass wire, having the curve of a common aneurism needle. It is not usual to expose the mucous membrane of the duct, or indeed any part of its course, but this may be done either by chiselling off the corresponding nasal bone, and a portion of the upper maxillary, or from within the nose, by removing the anterior extremities of the inferior and middle turbinated bones.

551. TRIFACIAL NERVE. The fifth pair of cranial nerves. Of the three great divisions into which this important nerve has been divided, the *first* has already been described (538–9); the *second* and *third* divisions have also been repeatedly alluded to, and their minute anatomy may be completed on the same head and neck on which the student has been examining the muscles and other parts; but if the student's object be solely that of the anatomy of the trifacial nerve, it were better that he commence his dissection on a fresh part; and as the dissection is tedious and difficult, the head and neck must be separated from the trunk. A vertical section carried a little to the mesial line, so as to leave the vomer entire on one side, will enable him not only to display, but examine minutely, the trifacial in all its subdivisions, and this may be preserved in weak alcohol for any length of time, for after reference. In the dissecting room, it is necessary how-

its inferior wall, subdivides into two branches; a *lachrymal branch* enters the lachrymal gland by its lower surface, and anastomosing with the lachrymal branch of the ophthalmic nerve, (a branch of the *first* great division of the trifacial nerve,) sends some filaments to the upper eyelid near the external angle. The *temporo-malar branch* proceeding forwards, penetrates the malar foramen, and subdivides it into a malar filament which passes through the bone to be distributed to the integuments of the cheek, and a temporal filament which traverses the orbitar portion of the same malar bone and plunges into the thickest part of the anterior surface of the temporal muscle, where it anastomoses with the anterior deep temporal nerve, a branch of the inferior maxillary. After having furnished the orbitar nerve, and whilst it is still in the spheno-palatine fossa, the superior maxillary nerve gives off from its inferior margin a large branch; occasionally two and sometimes even more, from which proceed immediately a great number of diverging nerves, viz. the three *palatine nerves,* the *spheno-palatine* and the *vidian:* At the point of divergence, or where these nerves are leaving each other, there will very generally be found the speno-palatine ganglion, or ganglion of Meckel, which, although not always present, it is usual to describe the following nerves as coming from the ganglion. They very generally arise directly from the superior maxillary nerve itself. 1°. The *anterior, middle,* and *posterior palatine,* easily traced, proceeding from trunk to branches. The *anterior* or *great palatine* penetrates directly into the posterior palatine canal, which it passes through, and terminates upon the vault of the palate. In its course it furnishes an inferior nasal twig to the middle meatus of the nose, and to the middle and inferior turbinated bones,—some filaments which pass through the inner wall of the maxillary sinus, and proceed to the last molar teeth. A strong branch to the velum palati,—its terminating branches are plunged deep in the midst of the glandular structure of the palate; these nerves, no doubt, proceed ultimately to the mucous membrane of this part. The *middle* and *posterior palatine* enter osseous canals, peculiar to each, and proceed to the nasal surface of the velum palati. The next branches to be followed are the *posterior nasal* or *spheno-palatine.*

These must be examined upon a vertical section of the head and face, such as we have already directed to be made, and they can be seen only upon such; they are very small, and penetrate by the spheno-palatine foramen into the nasal fossæ; they were described by Scarpa with extreme care; they will be found chiefly between the periosteum and mucous membrane, and to trace them fully and properly, the preparation must have been placed for some time in nitric acid diluted with spirits,—they proceed to the septum, and to the outer wall of the nasal fossa, and have hence been divided into internal and external branches. These nerves were supposed by M. H. Clocquet to proceed forward, and to terminate in a ganglion in the anterior palatine canal, but this anatomy has not been satisfactorily made out. The *Vidian* or *Pterygoid* nerve proceeding backwards from the ganglion of Meckel, almost immediately enters the canal of Vidius, and traversing it, reaches the foramen lacerum medium and cartilaginous substance which fills up this foramen. By reverting now to the inside or cerebral aspect of the basis cranii, and cautiously raising up the Casserian ganglion, and that part of the fifth pair lying between the ganglion and the brain, and opening with a chisel or strong knife, the vidian canal through its whole length, it will be seen that the vidian nerve divides into two branches,—a superior or cranial, and an inferior or carotid. The inferior descends along the carotid canal and cannot be very easily followed at this stage of the dissection, it proceeds to join the superior cervical ganglion. The superior branch of the vidian may now be traced across the foramen lacerum medium, gradually gaining its upper surface, until it reaches the *Hiatus Fallopii*, it joins the *portio dura* of the seventh pair in the canal of Fallopius, and anastomoses with it, a fact which we have maintained and taught since 1821. According to some, therefore, this branch of the vidian stops here, but others think that it proceeds alongside the portio dura for a short way, so that the two nerves lie together in the canal of Fallopius; it is then supposed to leave the *portio dura* by an opening leading into the cavity of the tympanum across which it passes, and here receives the name of the corda tympani, thus formed by the upper branch of the vidian. The corda tympani leaves the tympanum by the fissure of Glasser, and shortly afterwards placing itself upon the lower margin of the nervus gustatorium, proceeds to the sub-maxillary ganglion, as has been already described (473). The disputed point in the course of this nerve, viz. where it is supposed to follow the portio dura in the Fallopian canal, cannot be well seen at this stage of the dissection, but the cavity of the tympanum should be displayed by taking off the plate of bone forming the upper wall; where the vertical and petrous portions of the bone meet each other. In the cavity of the tympanum, will be found the corda tympani, and the further progress of the nerve is very readily traced by a reference to the nervus gustatorius (473), upon the lower margin of which it will be found, and may be followed upwards to the fissure of Glasser, and downwards to the sub-maxillary ganglion. A reference to the dissection of the ear and of the portio dura, will explain to the student how he may examine that part of the nerve, which is supposed by M. Chaussier and others to lie in the Fallopian canal, but of the anatomy of which we have never felt satisfied. The *Posterior Alveolo-dentar* nerves, two or three in number, detach themselves from the superior maxillary nerve, sometimes by a separate trunk, sometimes together, just as the trunk itself is about to enter the infra-orbitar canal. They descend over the maxillary tuberosity, furnish some branches to the buccinator, and next enter osseous canals, hollowed out of the superior maxillary bone. The inferior branch is the larger, and like the upper is contained in an osseous canal below the tuberosity, and both supply the pulps of the small and large molar teeth. The *Anterior Alveolo-dentar* is sent off from the infra-orbitar whilst in the canal, and descending in a canal peculiar to itself, supplies the pulps of the incisive, canine, and first molar teeth. The *Terminating branches* of the inferior maxillary nerve have been already described; they escape by the *foramen infra orbitale* upon the face, and spreading out in all directions, supply the integuments. These branches may be divided into palpebral, nasal, and labial branches. Finally, by uniting with the portio dura, they give rise to the sub-orbitar plexus.

553. The INFERIOR MAXILLARY NERVE is the *Third*

great division of the Trifacial. It may be dissected either from the outer side, or from the inner side; the preferable way is to do both. Upon its *outer side* the following dissection will display the *deep temporal, masseteric, buccal, internal pterygoid,* and *auriculo-temporal branches:* cut through the zygomatic arch, reflect the masseter muscle cautiously as far as the sigmoid notch, saw through the coronoid process at its base, reflect from below upwards the temporal muscle, and cautiously divide the pterygoid muscle, as the buccal nerve passes through it. By dissecting from the inner side of a vertical section of the head and face, the student will most readily trace the *corda tympani*, the *otic ganglion*, and the origins of the other branches of the inferior maxillary nerve, viz. the lingual, dentar, and even the branch to the internal pterygoid muscle. Commence the dissection by examining that portion of it which lies within the cranium. It is the largest division which comes from the Casserian ganglion, and it is to it that the motor branches of the fifth, discovered by Wrisberg and Palletta, attach themselves. These motor branches do not pass through the ganglion, but join the inferior maxillary intimately after it has passed through it. The nerve thus formed is evidently composed of two divisions, distinct physiologically, but not anatomically, viz. a motor and a sentient part. Both pass together through the *foramen ovale* of the sphenoid bone. By cutting away the base of the cranium upon the inner or mesial side of the bone, the *otic ganglion* placed across the trunk of the nerve will be exposed, and in the course of the preceding dissection, the seven branches of this complex nerve, or rather division of the trifacial. We shall first describe the branches, and next the ganglion, which is less certain. The branches may be arranged in this way:

1°. *External.*	Anterior and profound temporal,	1
	Masseteric	1
	Buccal	1
2°. *Posterior.*	Auriculo-temporal	1
3°. *Internal.*	Internal Pterygoid	1
4°. *Inferior.*	Lingual	1
	Dentar	1
		7

1°. The *Profound Temporal* will be found between the upper wall of the zygomatic fossa, and the external pterygoid muscle. Having reached the crest of the sphenoid which separates the temporal from the pterygoid fossa, it forms a sort of plexus with the buccal and messeteric branches. The filaments from this proceed to the deepest layers of the temporal muscle. The *Masseteric Branch* arises at the same point as the preceding, but is larger, proceeds directly backwards and outwards to reach the sigmoid notch of the inferior maxillary, and enters the deeper layers of the masseter muscle. The *Bucco-Labial Branch* is large; it traverses, by two or three branches, the external pterygoid muscle, which reunite on passing through the muscle. It next descends between the coronoid process and maxillary tuberosity, gives filaments to the external pterygoid, gains the level of the posterior part of the buccinator muscle, and spreads out in a great number of branches to this muscle. Many anatomists think that these branches may be traced chiefly to the mucous membrane of the mouth. 2°. *Auriculo Temporal Nerve*, (posterior branch of the inferior maxillary nerve) may be exposed by removing the condyle and neck of the lower jaw, behind which it is placed, only dividing with a saw the neck of the bone, and forcibly raising up the condyle. This branch is very large at its origin, is deeply situated, anastomoses freely with the portio dura in the substance of the parotid, and finally is distributed to the integuments of the external ear. 3°. *Internal Pterygoid* nerve (internal branch of the inferior maxillary nerve) distributed to the internal pterygoid muscle. This nerve will be seen best in examining the *otic ganglion* on which it always has appeared to us to be placed. 4°. *Lingual* or *Gustatory* and *Dentar*, are the terminating branches of the inferior maxillary nerve. The lingual or gustatory is situated at first between the external pterygoid muscle and the pharynx, next between the two pterygoids; afterwards between the internal pterygoid and the ramus of the lower jaw; it next proceeds from behind forwards, along the upper margin of the submaxillary gland, between the gland and the mucous membrane of the mouth, above the mylo-hyoideus muscle, then under the sublingual gland, which it crosses to reach the corresponding edge of the tongue, into the thickest part of which it penetrates. Whilst passing between the pterygoid muscles, it receives the branch called the *Corda Tympani*, which forms with it an acute angle. We consider the corda tympani as merely a branch of the facial, but as we have already said, many esteem it to be the cranial or superior branch of the vidian. Upon the inferior margin of this nerve on a level with the sub-maxillary gland will be found the *otic ganglion.* This ganglion is connected by several filaments with the lingual, and sends off several to the glands and other parts; but the main trunk of the nerve itself also sends off several branches to the gland. In the tongue, the lingual branch of the fifth, which we have thus traced, communicates with the hypo-glossal, or ninth pair of nerves, and may finally be traced to the nervous papillæ of the tongue. *Use.*—It had always been esteemed the gustatory until lately, when this function has been called in question by Panizza. The *Inferior Dentar Nerve;* larger than the lingual, descends with it, at first between the two pterygoid muscles, then between the internal pterygoid and the ramus of the lower jaw; here it is applied close to the bone between it and the internal lateral ligament of the joint; it next enters the posterior opening of the inferior dentar canal which it traverses along with the inferior dentar artery, protected by a fibrous canal; it furnishes as it goes along filaments to the large and small molar teeth, and reaching the *foramen menti,* passes out by it to the integuments of the lower lip, having previously sent forward a branch along the continuation of the canal which runs below the incisive teeth. The pulps of these teeth are supplied from this branch. The inferior dentar, just before it enters the dentar canal, sends a branch to the mylo-hyoid muscle.

555. The Otic Ganglion. We have already explained how this ganglion should be exposed. M. Arnold has given the following description of it. "Situated immediately beneath the foramen ovale, and upon the internal side of the inferior maxillary nerve at the spot where the *smaller portion* of the trifacial, (motor faciculus of Palletta) unites itself to the other

filaments. Externally the ganglion is covered by the cartilaginous part of the Eustachian tube, and by the origin of the circumflex muscle of the palate; behind it unites the middle meningeal artery. Its external surface rests against the inner side of the third branch of the fifth." The connexions and anatomy, as stated by Arnold, are, a branch to the glosso-pharyngeal; a branch or branches from the inferior maxillary; a connexion with the sympathetic. Branches proceed from it to the internal muscle of the malleus, and to the circumflex muscle of the palate.

PART IX.

OF THE NERVOUS SYSTEM.

556. BEFORE proceeding with the dissection of this important system, the following brief *general considerations* may be useful to the student. The entire nervous system may be divided into two great divisions. 1°. A central portion, the brain, and spinal marrow. 2°. The nerves, or peripheral portion. The first division or central portion, is further subdivided into the *cerebrum*, *cerebellum*, *medulla oblongata*, and *medulla spinalis*; but all these are intimately united with each other, and form anatomically but one organ, even admitting that its various parts may have different functions. Thus, many commence the study of these organs with that of the spinal marrow, and from that proceed to the brain. The nervous centres, are protected by, 1°. an osseous envelope, the *cranium* and *spinal column*. 2°. A fibrous sheath, the *dura mater*. 3°. A serous membrane, the *arachnoid*. 4°. A proper or vascular tunic, the *pia mater*.

557. MEDULLA SPINALIS AND ITS MEMBRANES. As soon after the dissection of the muscles of the back as possible, the student should place the subject on its face, and lay open with chisel, saw, and mallet, the spinal canal, taking care not to injure the parts within. This is best done by placing an elevated block below the middle of the chest and upper part of the abdomen, so as to cause it to arch much backwards; and applying a

saw, obliquely inwards to the laminæ of five or six of the dorsal vertebræ, remove these laminæ together with their spinous processes. As soon as this is done, the student may proceed to lay open the entire canal, from the extremity of the sacrum quite to the head, and even removing the posterior part of the occipital bone. This section will expose the spinal marrow enclosed by its membranes.

558. The SPINAL PORTION OF THE DURA MATER is a long, fibrous, cylindrical prolongation of that portion of the dura mater which is within the cranium, extending from the foramen magnum of the occipital bone, to the termination of the canal of the sacrum. The *capacity* of the spinal portion of the dura mater is much larger than what is required by the organ it contains. This may be shewn by injecting a fluid into it, which, by distension, shews a considerable enlargement in the cervical region, and another in the lumbar region. It terminates inferiorly by subdividing into several sheaths enclosing the sacral nerves. The reason assigned by Cotunni for the great capacity of the spinal portion of the dura mater is that it contains a "serous liquid."* This is called the liquor of Cotunni, respecting the nature of which many interesting experiments have been made of late years by M. Magendie. The *external surface* of the spinal portion of the dura mater posteriorly scarcely adheres to the osseous and ligamentous surfaces; a net-work of veins surrounds it, preventing contact with the inside of the laminæ vertebrarum and the yellow ligaments; the void spaces are filled with a fluid reddish fat, intermingled with small veins, and infiltrated with serosity. This fat resembles the marrow of the long bones. On each side the dura mater furnishes short sheaths for the spinal nerves passing with them through the foramina conjugalia, and then mingling with the surrounding cellular substance and periosteum. Anteriorly, the dura mater adheres more firmly to the posterior common ligament of the vertebræ by fibrous prolongations; this can only be seen towards the close of the dissection when the student proposes removing the spinal *marrow and its membrane from out its osseous case.* Lay open the dura mater by an incision from the upper quite to its lower part. The *internal surface* is smooth and humid, which is owing to the layer of the arachnoid membrane investing closely its inner surface; they cannot be separated to any extent by dissection. On each side may be seen the double orifices of the fibrous canals giving passage to the anterior and posterior roots of the spinal nerves. The edges of these openings are quite smooth as the arachnoid passes in a short way along with the nerves. *Inferiorly* the dura mater extends quite to the extremity of the sacral canal, and consequently much beyond the extent of the spinal marrow. *Superiorly* it is intimately united to the bone around the edge of the foramen magnum, and is there continued into the interior of the

* Quidquid autem spatii est inter vaginam duræ matris et medullam spinalem, id omne plenum etiam semper est; non medulla quidem ipsa in viventibus turgidiori, non nube vaporosa, sed aqua, &c. p. 11.

cranium, where it becomes the cerebral dura mater. The vessels of the spinal dura mater come from the adjoining ones; no nerves have yet been traced to it; it is insensible under the knife in living animals, but is said by M. Cruveillhier to be sensible when torn.

559. SPINAL ARACHNOID. This, like the spinal dura mater, is a continuation of that within the cranium. It is composed of two portions, a *parietal* portion and a *visceral*. The parietal layer invests intimately the inner surface of the dura mater. It is continuous with the visceral portion by the sheaths which the latter furnishes to the spinal nerves. The visceral layer is an extremely delicate serous sheath, much more capacious than the spinal marrow it envelopes. It is also prolonged around the cauda equina, and furnishes to each pair of nerves a funnel-shaped sac terminating on a level with the foramina conjugalia, and is there reflected upon the dura mater, and thus the visceral and parietal layers of the arachnoid are continuous. Between the spinal marrow and its visceral layer, there exists a considerable interval, or at least a large space may be formed by blowing air between them, or by the injection of a liquid. In this respect the spinal arachnoid differs much from the cerebral; it is in this sub-arachnoid space that the liquor Cotunnii is found. The visceral layer, however, has certain connexions with the proper membrane of the spinal marrow by means of long filaments of a seemingly fibrous nature. This mode of connexion takes place also at some points of the cerebral arachnoid, but not uniformly so. It may also be observed occasionally that the two layers of the spinal arachnoid adhere by a number of points to each other; these are not found in the cerebral arachnoid. The sub-arachnoid liquid fills the space between the visceral layer of the arachnoid and the pia mater; it is found as well within the cranium as within the spinal canal. The existence of this liquid was known to Haller, but most clearly demonstrated by Cotunni; many interesting experiments have been made on it by M. Magendie. By opening the dura mater in the lumbar region, from four to five ounces of a clear limpid fluid may sometimesbe collected. There can be little doubt that the cerebral sub-arachnoid liquid communicates with the spinal liquid, but a question has arisen, Does the liquid of the ventricles of the brain communicate with the spinal sub-arachnoid liquid at the bottom of the fourth ventricle or elsewhere? I have always entertained the opinion that there exists no communication between them. Tiedemann also, we believe, denies this communication. The *uses* of the arachnoid membrane resemble those of other serous membranes; it lubricates the surface of the brain and spinal marrow. The *uses* of the sub-arachnoid liquid are not well known; when evacuated in the living animal by opening the spinal canal, it appears for a time as if stupified and as if intoxicated. But it soon recovers from this state.

560. SPINAL PIA MATER. This is a continuation of the cerebral *pia mater*, but it differs from it in some respects. It has been named by some the *neurilema* of the spinal marrow. It is

easily examined, but it is difficult of demonstration, in consequence of its firm adhesion to the spinal marrow, and the softness of the organ to which it adheres. The spinal marrow ought to be quite fresh, but this the student cannot expect if he has already taken time to dissect the muscles of the back. In new-born children also, the membrane we now speak of is pretty easily demonstrated. The proper or investing membrane of the medulla spinalis is usually considered a fibrous membrane of some resistance supporting the medulla, as the neurilema does the nerves. The external surface is surrounded by a vascular net-work, remarkable for its flexuosities; it penetrates into the thickness of the membrane. In other respects the membrane is of a dull yellowish colour, and even a few black points may occasionally be seen upon it. By its outer surface it adheres by a few fibrous points to the visceral layer of the arachnoid; its connexion with the medulla is cellular and vascular. In the line of the anterior median fissure it forms a duplicature which penetrates to a considerable depth: a single prolongation of extreme tenuity passes into the posterior median fissure. The terminating *cord* or *filament* of the spinal marrow is generally considered merely as a prolongation of the proper membrane. It is strong and habitually tense, and seems intended to keep the spinal marrow in its proper position. Next examine the *Ligamentum Dentatum*. This is so named both from its functions and from its toothed appearance. It is a delicate fibrous lamina extending throughout the whole length of the medulla spinalis, adhering by its base to the proper membrane of that organ, and sending out from its free margin tooth-shaped processes which adhere by their summits to the inner side of the dura matral covering of the spinal marrow. The first of these may be seen at the sides of the foramen magnum occipitis, between the vertebral artery and the hypo-glossal nerve; the last, which is the twentieth or twenty-first, is the termination of the ligament and corresponds to the termination of the medulla. It separates the spinal nerves from each other, and retains the medulla in its place.

561. The MEDULLA SPINALIS (*spinal marrow, μυελος ῥαχυτες*) is a white symmetrical cylinder of nervous matter, situated in the spinal canal, and occupying its superior portion chiefly; it is continuous with the central portion of the nervous system, situated within the cranium. The limits are superiorly, the *bulb*, which in this country is usually called the *medulla oblongata*; inferiorly, it descends as low as the middle or inferior margin of the first lumbar vertebra, or middle of the second. Its dimensions vary in the adult from fifteen to eighteen inches; its absolute bulk has been supposed by some to be in the direct ratio of the vital activity of the animal; this idea, however, is extremely vague. In respect to the discussions regarding the comparative importance of the spinal marrow and brain, and the relation they hold to each other, these may be cut short by the remark, that neither organ produces the other, and thus in respect to their

growth they are strictly independent. Proportionally to the weight of the body, man is supposed to have the largest spinal marrow. It differs also in volume in different parts of its course, being somewhat larger in the cervical region, on a level with the third cervical vertebra, and as far as the second dorsal; it here contracts considerably, and thus continues as far as the eleventh dorsal, where it once more enlarges, but again suddenly contracting, forms a cone, which terminates by a fine cord concealed amongst the nerves constituting the *cauda equina;* this cord is semi-transparent, seems elastic, fibrous, and firm: a vein constantly accompanies it. The cord may be followed as far as the first coccygeal bone.* Viewed *anteriorly*, may be observed the *anterior median fissure; posteriorly*, a similar one, but scarcely so distinct, although some assert it to be deeper than the anterior. On each side these fissures are seen the roots of the anterior and posterior spinal nerves. By pulling out a few of these roots of the nerves, Chaussier endeavoured to shew lateral fissures; there are no *lateral fissures.* The immediate investing membrane of the spinal marrow has been already described; it differs somewhat in structure from the cerebral pia mater, in having a fibrous appearance. The investing membrane must now be carefully stripped off, (the roots of the nerves coming with it,) which can only be done in very fresh subjects. Next examine the *anterior commissure;* this is at the bottom of the *anterior median fissure*, and is cribriform; the perforations are caused by the passage of numerous blood-vessels proceeding into the interior of the medulla. The commissure is generally considered merely a medullary lamina. When anatomists say that there are two medullæ, they can only use the language in the same sense as they would speak of the brain. The *posterior median fissure* is deeper than the anterior; it is extremely narrow, and in the bottom of it may be seen the cineritious substance of the medulla spinalis. The following cords have been admitted as composing the spinal marrow: two posterior median excessively narrow, traced on either side of the posterior median fissure; two posterior lateral, compressed between these and the roots of the posterior nerves; two anterior lateral, comprising all the remaining part of the medulla, as far as the anterior fissure. Are there any strictly lateral cords or fasciculi situated between the anterior and posterior roots of the spinal nerves? This is very doubtful. *Interior structure.*—It results from a careful inspection of the structure of the medulla spinalis that it is composed of two large lateral cylinders of the white nervous matter enclosing the grey or cineritious. The mark)(represents tolerably well the arrangement of the interior when cut across. Little is known further than this of the precise structure of the spinal marrow; many consider it as fibrous

* M. Cruveillhier says, "On le suit jusqu'à la base de sacrum, ou on le voit se confondre, avec le dura mere," 566. But the above remark is decidedly erroneous.

and laminated, each fibre and each lamina being independent of each other, and extending throughout the whole length, but their descriptions are far from being distinct. Previous to the fourth month in utero, there is a cavity in the centre of the medulla spinalis, *but this usually disappears before birth.*

562. The Brain and its Membranes. When the student has made up his mind to dissect the brain and its membranes, he ought to proceed as early as possible, to open the head by a vertical incision carried from the root of the nose, over the vertex, to the external occipital protuberance, through the soft parts, quite down to the bones. Reflect these flaps, and next divide all the soft parts quite to the bone circularly around the skull cap, a little above the zygomatic arch. Saw the skull cap cautiously, and remove it. This will expose the outer surface of the dura mater. The skull cap may also be removed in fragments, by repeated blows of a sharp-pointed hammer, without injury to the dura mater or brain, as was first shewn by Bichat.

563. Cranial Dura Mater is a dense fibrous sac enclosing the brain, which it further supports by processes or partitions, and serving as an internal periosteum to the cranium. The external surface comes of course first into view. It exactly invests the interior of the cranium, to which it adheres more or less strongly, both by means of numerous blood vessels, and likewise by numerous small fibrous prolongations. Upon this outer surface of the dura mater may be seen the branches of the middle meningeal artery, and some of the branches of its veins, adhering internally to the membrane. These are the vessels which nourish the skull. The adhesion of the dura mater to the skull differs in different regions, and in different subjects. It adheres very strongly to the upper margin of the *pars petrosa*, around the great occipital foramen, and to the base of the skull generally; also in the line of the sutures. In different subjects also, and in respect to age; in extreme old age, and in extreme youth, the union is most intimate. At the base of the skull, we shall afterwards find when the brain has been removed, that it sends some remarkable prolongations through it; one particularly into the orbit. Open the dura mater with the scissors, beginning just above the edge of the divided bone, and carry the incision forwards and backwards as far as convenient. Make a similar incision through the dura mater on the opposite side, and lay up the flaps so formed. These incisions will expose the inner surface of the dura mater, and the external surface of the brain: but anatomically speaking, these incisions open into the cavity of the arachnoid membrane, and into the seat of the water in the disease called hydrocephalus externus. The inner surface of the dura mater, where it faces the brain, is smooth and polished. This is owing to its being invested with a layer of the arachnoid. This inner surface ought to be free of all adhesions, excepting at those points where the cerebral veins proceed to open into the sinuses of the dura mater. It closely touches the visceral or cerebral layer of

the arachnoid, there being no space between these but what is sufficient to contain the lubricating serosity common to the arachnoid with all serous membranes. From the internal surface of the dura mater proceed three processes or partitions which partially divide the brain into subdivisions, and the interior of the cranium into compartments. These prolongations are the *falx cerebri, tentorium cerebelli,* and *falx cerebelli.* The first two can readily be seen at this stage of the dissection, but not the falx cerebelli. The processes can be very well examined upon a preparation, which will enable the student, in this his first dissection of the brain, to avoid disturbing that organ, so as to endanger its after dissection. They may however be examined in this way. Cut through the cerebral veins entering the superior longitudinal sinus on each side, and gently draw outwards the hemispheres of the brain, so as to widen the interhemispherical fissure; by looking down into this fissure, the whole extent of the falx cerebri may be seen. Again, by raising up the posterior lobes of the cerebrum on each side, the tentorium cerebelli may be seen, but not very well examined. Indeed, to examine these processes of the dura mater, the brain would require to be dissected *in situ,* or sacrificed altogether; and this would not be advisable, because the mechanical arrangement of all the processes can be well seen on a dried preparation. The falx cerebri, however examined, is a median fibrous lamina, having the shape of a scythe, tense, stretched between the crista galli and the tentorium cerebelli. The point is forwards, dips into the foramen cæcum of Morgagni, envelopes the crista galli of the ethmoid; its base is behind, and falls perpendicularly upon the tentorium cerebelli. Where these two processes meet is the straight sinus. In the upper or convex margin will be found the superior longitudinal sinus. This should be laid open and examined at the present stage of the dissection, because it will in part be afterwards destroyed. Its inferior edge looking towards the corpus callosum, contains the inferior longitudinal sinus. The course of these sinuses will be more fully explained afterwards. The uses of the falx cerebri are not well known. It is sometimes slightly cribriform, and one or two instances are recorded of its total absence. The *tentorium cerebelli* is an incomplete horizontal septum, separating the posterior lobes of the brain from the cerebellum. It is in a state of continual tension. The *external circumference* corresponds behind to the posterior half of the lateral grooves of the occipital bone, for lodging the lateral sinuses which are formed or lodged within this portion of the dura mater. Anteriorly it adheres to the upper margin of the pars petrosa; and here the superior petrosal sinuses exist. The *internal circumference* intercepts a small space, filled by the pons Verolii or tuber annulare. The extremities or points of these margins or circumferences cross each other like the letter X. The extremity of the external edge or base is fixed to the posterior clinoid process, thus forming towards the summit of the petrous portion of the temporal bone, a bridge under which passes the trifacial nerve. The point or extremity of the inner margin or circumference of the tentorium cerebelli proceeds to be attached to the anterior clinoid process. These prolongations of the tentorium will be better seen after the brain has been removed; they complete the sides of the sella turcica or pituitary fossa, and inclose within their thickness the cavernous sinuses. The *Falx Cerebelli* cannot be seen at this stage of the dissection. It is a small vertical median scythe-shaped process of the dura mater, extending from the internal occipital protuberance to the edge of the foramen magnum occipitis; it slightly separates the hemispheres of the cerebellum from each other. Its base is fixed to the lower surface of the middle of the tentorium, the summit is bifurcated at the sides of the occipital foramen. Its posterior edge corresponds to the internal occipital crest; its anterior to the median fissure of the cerebellum. The occipital sinuses are formed in it. In *structure* the dura mater is remarkably strong. It has been usually divided into two layers, a fibrous and serous. The serous is internal, the fibrous external. The internal or serous is merely the reflected lamina of the cerebral arachnoid; the fibrous or external may be further subdivided into two layers, a periosteal or vascular layer, and a fibrous properly so called. The separation between these layers is best seen where the sinuses are formed in the thickness of the dura mater. The *Glands of Paccioni*, which are seen at this stage of the dissection, are certain small bodies of a whitish or yellowish colour, sometimes isolated, sometimes collected together in the form of a bunch of grapes, which receive vessels, but are destitute of nerves, of whose intimate texture and uses we are entirely ignorant, and which are not met with in children or in all subjects. The superior longitudinal sinus contains a remarkable quantity of them, particularly at its middle and posterior parts. They were formerly designated by the name of *Glands of Pacchioni*, although they are very different from glandular organs. These granulations generally occupy in this sinus the circumference of the orifices of the veins, where they form a more or less distinct prominence between the internal bridles. Very few of them are isolated, almost all being agglomerated into small masses, and intimately connected with each other. They are covered by the internal membrane of the sinus. In the torcular Herophili very few of them are observed. But there are some at the mouths of the veins, in the occipital portion of the lateral sinuses. In the straight sinuses some are occasionally found at the orifices of the venæ Galeni. All the other sinuses are destitute of them. In the external pia mater graniform bodies resembling those of the sinuses are also met with. They are especially observed along and to the outside of the superior longitudinal sinus, around the cerebral veins. Here they are enveloped by the arachnoid membrane, and their size is so much larger the nearer they are to the sinus. Some of them are engaged in the separations of the fibres of the dura mater which give passage to the veins, and are in some measure continuous with the granulations of the sinus itself. At the base of the brain and around the other sinuses no similar disposition is observed. The internal pia mater also presents some of these granulations. They are observed in the choroid plexus, where they are of a reddish gray colour, and rather soft. There are also some beneath the velum interposition, at the fore part of the pineal gland, where they are disposed in two rows which unite so as to form a triangle. Lastly, they are equally met with in the choroid plexus of the fourth ventricle. We have already spoken of the arteries and veins of the dura mater; its nerves have been much disputed, as it is quite insensible during life, and in a healthy state. M. Cruvillhier says that its nerves are derived from the fifth pair. The dura mater extends into the spinal canal; the description of that part of it will be found at 558. The student may now proceed to remove the brain from its case. Cut through the anterior part of the falx cerebri, and draw it upwards; next divide the veins of Galen which enter the straight sinus at the fore part of the tentorium cerebelli; then cut through the tentorium on each side, and commence raising the brain from before backwards, cutting through in succession all the nerves and blood vessels proceeding to or from it. Having reached the back part, with a long and sharp scalpel cut the spinal marrow across as low down as possible. The entire mass may now be removed from the cavity, and laid in pure water for an hour, and immediately afterwards let it be immersed in spirits, or in a solution of corrosive sublimate. By this means it may be preserved until the student has examined all the parts left on the base of the cranium, and which he will now find fully exposed by the removal of that organ. The whole interior of the base of the cranium will be seen covered with the dura mater, smooth and shining owing to the presence of the arachnoid layer investing it. This surface the student should now examine with the greatest care. The following is the description given of it by M. Clocquet:—At the base of the cranium, the external surface of the dura mater is very complex in its disposition, on account of the great number of holes and inequalities which are observed in that region. It sinks into the foramen cœcum, where it contracts pretty intimate adhesions by several prolongations. It embraces the summit of the crista-galli of the ethmoid bone, whence it descends on each side into the ethmoid grooves: there, at each hole of the cribriform plate, it furnishes for each branch of the olfactory nerves a small fibrous canal, which terminates on the outer layer of the pituitary membrane. More laterally, similar canals penetrate into the internal orbitar canals to accompany the nerves and vessels which they contain, and are continued into the periosteum of the orbit. Lastly, altogether on the sides, the dura mater adheres but little to the orbitar arches, even at the place of the sphenoidal suture. More posteriorly, it adheres in a decided manner to the groove at the fore part of the sella turcica, and penetrates into the optic foramina, forming an envelope for the optic nerves. This cylindrical envelope separates when it arrives at the posterior insertion of the recti muscles of the eye; its outer lamina, which is rather thin, expands into the periosteum of the orbit; the inner, which is whiter, denser, thicker, and immediately applied on the nerve, accompanies it to the ball of the eye, and is continued into the sclerotic membrane. Behind the optic hole, the dura mater presents a circular aperture which embraces the internal carotid artery as it issues from the cavernous sinous; some fibres arising from the circumference of this aperture, seem to throw themselves into the walls of the artery. At its anterior part, there occurs the orifice of a small canal, formed inferiorly between the two laminæ of the envelope of the optic nerve. It transmits the ophthalmic artery into the orbit. The dura mater then lines the sella turcica, where it is covered by the pituitary body, which separates it from the arachnoid membrane at this place; it then passes over the sides of the body of the sphenoid bone, where it divides into two laminæ, to form the cavernous sinuses. The inner of these laminæ is thin, and immediately covers the cavernous groove; the outer, which is free, forms the opposite wall of the sinus. On the free edge of the processes of Ingrassias, the dura mater forms a small fold which enters into the fissura Sylvii; then, descending from thence vertically, it closes the sphenoidal fissure, and sends through it a prolongation, thicker on the inner side, which proceeds into the orbit, and is continuous with the periosteum of that cavity. This prolongation presents several apertures for the passage of vessels and nerves which enter the orbit. The membrane then extends into the middle lateral fossæ of the base of the cranium, to which it adheres but feebly; but, on approaching the sides of the body of the sphenoid bone, it furnishes first an envelope to the superior and inferior maxillary nerves in the bony canals by which they pass out of the cranium; it also gives one to the middle meningeal artery, and concurs to form the cavernous sinus and various canals. One of the latter is for the third pair; it commences a little before the posterior clinoid process; it is fibrous in its whole circumference, and invested by the arachnoid coat at the commencement of its course, but the latter afterwards leaves it to be reflected over the nerve, and there is no longer perceived a complete fibrous canal, but the lamina of the dura mater alone, which forms the outer wall of the cavernous sinus, is seen externally: internally, the nerve is separated from the sinus itself only by a thin and apparently cellular membrane. Another canal belongs to the nerve of the fourth pair; it is a little higher than the preceding, and much narrower, and, like it, is fibrous and lined by the arachnoid membrane in the first part of its course; afterwards, it is in like manner only formed by a single lamina of the dura mater applied externally upon the nerve, which is separated from the rest of the sinus by a thin and transparent membrane.

Lastly, a little farther back and opposite the upper edge of the petrous process, the dura mater forms a canal for the nerve of the fifth pair, consisting of two laminæ; the upper of these laminæ is attached to the posterior clinoid process, and is continued over the upper edge of the petrous process; the other is placed between the nerve and the cavernous sinus, and becomes so thin as to be converted into a cellular lamella, which is prolonged internally of the ophthalmic branch. As it advances, the nerves of the third pair, fourth pair, and ophthalmic branch of the fifth, are each engaged in a new portion of entirely fibrous canal, which is afforded them by the prolongation of the dura mater passing from the sphenoidal fissure into the orbit. On the middle of the upper surface of the petrous process, the dura mater covers the superior filament of the vidian nerve, and may easily be detached from it. It then adheres pretty strongly to the upper edge of the petrous process and to the quadrilateral plate of the sphenoid bone. It descends from thence into the basilar groove, and is intimately attached to the occipital bone over the whole circumference of the foramen magnum. A little laterally, it presents for the nerve of the sixth pair, a hole which is not succeeded by a canal, and which consequently transmits it into the cavernous sinus. The arachnoid membrane descends in it as far as that sinus, which it closes, and is then reflected upon the nerve. Farther on, and upon the posterior surface of the petrous process, the dura mater penetrates into the meatus auditorius internus, seems to enter the aqueduct of Fallopius, but cannot be followed into the foramina which are traversed by the filaments of the portio mollis of the seventh pair. Farther down, at the foramen lacerum posterius, it envelopes the glosso-pharyngeal, pneumo-gastric and spinal accessory nerves, and is continued into the periosteum of the outer part of the base of the skull. A thinner lamina surrounds the internal jugular vein. It also sends into the anterior condyloid foramen a fibrous canal, which is in like manner continuous with the periosteum. Next examine the sinuses. These may very generally be made out by the dark blood they contain, and should all be laid open. The following description will point out their position, course, and connexions. The *Sinuses* are of variable dimensions, and disposed in a symmetrical and regular manner, have walls formed externally by the dura mater, and lined internally by a smooth and polished membrane, of a serous aspect, such as is met with in the interior of all the veins. Being constantly stretched in all points of their extent, they can neither change place, nor even contract upon themselves. Their cavity presents, at intervals, bridles passing irregularly from one wall to the other, which are generally formed by fibrous bundles of the dura mater. It is into the sinuses that all the veins of this membrane, and all those of the brain, empty themselves. *Torcular Herophili.* This is a smooth and polished cavity, of irregular form, placed at the union of the three great folds of the dura mater, on the fore part of the internal occipital protuberance. It is lined by the internal membrane of the veins, and presents six apertures; a superior, of a triangular form, belonging to the superior longitudinal sinus; two inferior, of variable form and breadth, corresponding to the occipital sinuses; an anterior, rounded, belonging to the straight sinus; lastly, two lateral, broader, but generally of different sizes, transversely oval, furnished with a thick rim in their contour, and leading into the lateral sinuses. The two last, and sometimes the two inferior, transmit to the outside of the cavity the blood which is poured into them by the others. *Superior Longitmdinal Sinus* (*Sinus Falciformis Superior*). This is a long triangular canal, convex above, presenting its acute angle below, occupying the whole upper edge of the falx cerebri, narrow before, broader behind, commencing by a sort of cul-de-sac at the fore part of the crista-galli of the ethmoid bone, and corresponding to the frontal ridge, the sagittal suture, and the vertical groove of the occipital bone. In its interior, it is smooth and polished in its whole extent, and presents a considerable number of those bridles (*chordæ Willisii*), of which we made mention above, which are invested, like it, by the internal membrane of the veins. This sinus communicates above with the frontal veins by a certain number of little veins which pass through the sagittal suture; it also receives, in the same direction, veins which come from the diploe of the bones of the upper part of the skull; it also communicates, by means of a small branch which passes through the parietal hole, with the veins on the outside of the head; lastly, it receives some trunks from those of the dura mater, and all those which are expanded over the convex and plain surfaces of the two cerebral hemispheres. They almost all open into its interior obliquely forwards. In general, the mouths of the veins are covered in a great measure by membranous folds in the form of valvules, whose free and concave edge is turned forwards. All these folds are formed by the internal membrane of the veins applied upon itself, and are in general much less visible in the anterior region of the sinus than in the posterior. It is also probable that, by its anterior extremity, the superior longitudinal sinus often communicates with a vein of the nose which passes through the foramen cœcum. *Inferior Longitudinal Sinus* (*Sinus Falciformis Inferior*). Much narrower than the preceding, occupying the lower edge of the cerebral falx, from its anterior third to the tentorium cerebelli, it seems to result from the union of several small veins of the falx itself, and generally terminates by two branches in the straight sinus. Of these branches, one is directly continuous with it above the aperture of the venæ Galeni; the other ascends in the substance of the falx for some time, curves backwards and downwards, and penetrates obliquely into the straight sinus towards the middle of its length. The latter only is furnished with a valvular fold. *Straight Sinus* (*Sinus quartus*, s. *perpendicularis*). Triangular in its whole extent, broad behind, contracted before, passing a little obliquely downwards and backwards, it prevails all along the base of the falx, above the tentorium cerebelli, from the termination of the inferior longitudinal sinus to the torcular Herophili. In its interior, it presents the same appearance as the superior longitudinal sinus: that is to say, upon its walls a great quantity of fibrous bundles, closer to each other before than behind, form remarkable prominences beneath the delicate membrane which covers them. It receives the inferior longitudinal sinus, as we have already said: the veins of the cerebral ventricles or the venæ Galeni empty themselves into its anterior and inferior part, presenting a valvular fold. Towards the middle of its length, and inferiorly, the straight sinus still receives the blood of the superior veins of the cerebellum, through a rounded separation of the fibres of the dura mater. *Occipital Sinuses* (*Sinus occipitalis posterior dexter et sinister*). These sinuses commence on the sides of the foramen magnum, not far from the termination of the lateral sinuses, with which they sometimes communicate, and ascend, becoming broader, and drawing nearer each other, in the substance of the falx cerebelli, where they pretty frequently unite altogether: they open, each by itself, into the lower part of the torcular Herophili. They receive the veins of the falx cerebelli, of the dura mater which lines the inferior occipital fossæ, and those of the posterior part of the cerebellum. *Lateral sinuses* (*sinuses transversi*). They carry the blood from the torcular Herophili to the foramen lacerum posterius, into the sinus of the jugular vein. Their course is marked by a groove which exists on each side of the interior of the cranium. A difference of capacity is almost always observed between them, the sinus of the right side being generally larger. From the torcular Herophili to the upper edge of the petrous process, they have a triangular form; in the rest of their course, their section is elliptical. Their interior, which is everywhere smooth and polished, presents none of the bridles of which we have made mention in speaking of the other sinuses. They receive some veins from the cerebellum, the posterior extremity of the cerebral hemispheres, the tentorium cerebelli, and the cavity of the tympanum. They also present in the second part of their course the orifices of the superior and inferior petrous sinuses, which carry the blood from all the other sinuses of the base of the skull By the mastoid and posterior condyloid foramina, they communicate moreover with the occipital veins on the outside of the cranium. *Coronary sinus* (*sinus circularis.*) It surrounds in a more or less regular manner the sella turcica and pituitary body, passing behind the channel of the optic nerves and before or above the quadrilateral lamina of the sphenoid bone. It is very narrow in its whole course; it receives the small veins of these different parts and those of the neighbouring portion of the dura mater, and opens to the right and left into the cavernous sinuses. *Cavernous sinuses* (*sinus cavernosi.*) These sinuses are much more complicated than all the rest. They commence beneath the anterior clinoid processes, behind the inner third of the sphenoidal fissure, proceed from thence horizontally backwards upon the sides of the sella turcica, whence they descend into the place which separates the summit of the petrous process from the quadrilateral plate of the sphenoid bone. There they terminate by emptying themselves into the superior and inferior petrous sinuses. Their breadth is considerable, and they are lodged in the lateral grooves of the body of the sphenoid bone, between two lamina of the dura mater. Of these two laminæ, by an arrangement already partly described, the inner immediately lines the bony surface, and is prolonged into the sphenoidal fissure; while the other, which is much thicker, forms the outer wall of the sinus, which contains in its substance the nerves of the third and fourth pairs and the ophthalmic branch of the fifth, and closes the two outer thirds of the sphenoidal fissure, becoming confounded above with the extremities of the tentorium cerebelli, which close the sinus in that direction. Altogether internally, the latter lamina is united with the first. The cavity of the cavernous sinuses generally presents a great number of soft reddish filaments, interlaced and as it were reticulated. The intimate nature of this kind of cellular structure is very difficult to be determined. It appears to be formed by nervous filaments of the superior cervical and cavernous ganglions, the fibres of the dura mater, and the folds of the internal membrane of the veins. There are moreover met with, in the interior of these same sinuses, the internal carotid artery and the nerve of the sixth pair, placed against their inner wall, and immersed in the blood, from which they are only separated by the delicate internal membrane of the veins which envelopes them. The cavernous sinuses receive a great number of meningeal veins, the ophthalmic veins, whose roots originate in the interior of the eye and orbit, several emissary veins which traverse the sphenoid bone, and the two coronary sinuses. Beneath the pituitary body the two cavernous sinuses have a very distinct communication, (*sinus transversalis, sellæ equinæ*, Haller.) *Superior petrous sinuses,* (*sinus petrosi superiores.*) They seem to arise from the termination of the preceding sinuses, towards the summit of the petrous process, whose upper edge they follow, lodged in a pretty distinct groove, and in a part of the great circumference of the tentorium cerebelli. They pass above the nerve of the fifth pair, where they leave for a moment the groove of the temporal bone. They are less broad but longer than the inferior; they open into the lateral sinuses, towards the point where the latter experience a curvature. They are triangular in their interior, and present but a very few transverse bridles. *Inferior petrous sinuses* (*sinus petrosi inferiores.*) They arise from the cavernous sinuses at the same point as the preceding, with which they communicate at their commencement, descend behind and to the outside between the inferior edge of the petrous and basilar processes, and terminate in the lateral sinuses opposite the sinus of the internal jugular vein. They are broader at their extremities than at their middle part, and present the same structure as the superior petrous sinuses. Their inner wall, that which is immediately applied upon the bones, appears to be formed only of the internal membrane of the veins, no lamina of the dura mater being perceived upon it. The two petrous sinuses receive veins of no great importance, all of which come from the dura mater. Some of them traverse the bones and communicate with the outside of the skull. *Transverse sinus* (*sinus occipitalis anterior.*) Placed transversely at the upper part of the basilar process, it forms a communication between the union of the two petrous sinuses and cavernous sinus of the one side with that of the other. It varies in breadth, but is always of large size, and is lodged between two laminæ of the dura mater, in a superficial depression of the bone. In its interior, it presents a very distinct cavernous tissue. It receives several veins from the labyrinth. It is by no means rare to see two or three other transverse sinuses placed between the latter and the occipital hole. Should the student be disposed to trace the nerves, of which he will have carefully examined the position in connexion with the dura mater, he may turn to the systematic description of the cerebral nerves, but we recommend him to proceed with the dissection of the brain and its remaining membranes.

564. Of the CEREBRAL ARACHNOID. The layer of this membrane investing the inner surface of the dura mater has been already described: the visceral layer invests the brain. On the convexity of the cerebrum it invests the convolutions without penetrating into the anfractuosities by which they are separated, and gives to each vein, going to the longitudinal sinus, a sheath which is reflected over the dura mater. Descending on each side in the great longitudinal fissure, it lines the corpus callosum, passing over the arteries which cover it, and furnishes the veins of the inferior longitudinal sinus with envelopes which are afterwards continued on the falx cerebri. Posteriorly, the arachnoid membrane is prolonged over the posterior lobes, envelopes some of the veins of the lateral sinuses, is reflected over the upper surface of the cerebellum, surrounds the veins of the straight sinus, and part of those of the lateral sinuses, then covers the circumference and inferior surface of the cerebellum, between the two hemispheres of which it is isolated by its two surfaces over a greater or less extent. Anteriorly, the arachnoid membrane descends over the anterior lobes, and passes immediately from the one to the other inferiorly, near the commissure of the optic nerves, without penetrating into the fissure which separates them. It equally covers the inferior surface of the olfactory nerves, for which it forms a small sheath near their extremity. It also furnishes one to each of the optic nerves; but this sheath is conical, accompanies them to a great distance, and is only reflected upon their fibrous envelope in the orbit. It descends farther around the infundibulum, and is expanded over the pituitary body which separates it from the dura mater. It embraces the internal carotid arteries at their

exit from the cavernous sinuses; it then passes under the cerebral protuberance, being separated from the pia mater in all the space that exists between that protuberance and the commissure of the optic nerves, which is also separated from it, but by a less marked interval, opposite the protuberance and the grooves which limit the anterior prolongations laterally. It also gives sheaths to the third, fourth, fifth, sixth, and seventh pairs of nerves. Lastly, it directs itself over the lateral parts of the cerebellum, the posterior prolongations, the pneumogastric, spinal accessory, hypoglossal, and first cervical nerves, the vertebral arteries, and the spinal marrow itself, with which it is only connected by a small number of cellular filaments, easily torn, and which in general scarcely exist, so that it may be very easily detached by insufflation. On the sides of the spinal marrow, the arachnoid membrane furnishes envelopes to each nerve, and to each serra of the ligamentum dentatum, which are reflected upon the dura mater when the nerve penetrates it, and when the ligamentum dentatum is inserted into it. It also furnishes an envelope to the vessels which creep upon its anterior and posterior surfaces. These are more carefully described at 559. Lastly, on arriving at the lower extremity of the spinal marrow, it terminates by a sort of narrow and very long canal, of a cylindrical form, which descends vertically in the middle of the bundles of the lumbar nerves, to the extremity of the sacral canal, where it is reflected upon the dura mater. It is by means of this canal, and of all the envelopes of the nerves and vessels, that it may be conceived how the arachnoid membrane covers in its whole extent the inner surface of the dura mater, and gives it the smooth and polished appearance which it presents. It is pretty difficult to separate these two membranes from each other by the scalpel, excepting in the fœtus or in very young children. I have always maintained that the arachnoid membrane, although it penetrates a short way towards the interior of the third ventricle, beneath the corpus callosum and fornix, does not line the interior of any of the ventricles. The membrane is here reflected around the veins of Galen; it is the pia mater which proceeds inwards, into the interior of the ventricles of the brain. Beneath the membrane just described, and closely investing the brain, is situated the *pia mater*. In the interval between them is the sub-arachnoid space, filled with cellular tissue, and here is contained the liquid of Cotunii. This liquid has been described more particularly in section 559.

565. The Pia Mater, (*Meninx Interior*), may be divided into two parts, an external and internal; it covers the brain on all sides, is prolonged into its internal cavities, and dips down into the anfractuosities and depressions which are observed at its surface. We also observe that, properly speaking, it is not a true membrane analogous to the organs known under that name. It is a cellular, loose, transparent web, without consistence, in which there ramify and cross each other in a thousand different directions a multitude of blood-vessels, more or less delicate, and more or less

tortuous, and is only attached to the surface of the brain by the ramuscules of these vessels which penetrate into the substance of the latter organ. *External Pia Mater.* Above, the pia mater covers on each side the convex surface of the two hemispheres of the brain, sinks into their anfractuosities, is reflected in the great longitudinal fissure, prolongs itself over the upper surface of the corpus callosum, and descends upon its anterior extremity; opposite the posterior extremity, it also bends downwards, but enters into the third ventricle. Inferiorly, the pia mater covers on each side the anterior, middle, and posterior lobes of the brain, sinks into the fissura Sylvii, is reflected over the commissure of the optic nerves, after covering the membrane which closes the third ventricle anteriorly, passes over the layer of gray substance which forms its floor, envelopes the infundibulum, invests the inferior surface of the cerebral protuberance, is engaged in the groove which separates it from the spinal marrow, on which it presently ceases in an insensible manner, to be carried over the lower surface of the cerebellum, and from thence over the upper, as far as the posterior cerebral fissure, by which it enters into the third ventricle. It sinks between the lobes of the cerebellum, and is engaged in all the anfractuosities which separate its concentric laminæ. By its *outer surface* the pia mater is in contact with and adheres to the arachnoid membrane, upon all the cerebral prominences, but is entirely isolated from it opposite the depressions into which it alone penetrates. They are then even frequently separated by a pretty large vacant interval, as may be easily seen in the fissura Sylvii, in the spaces which exist between the lobes of the cerebellum, between the brain and the cerebral protuberance, &c. These spaces are filled by the liquor of Cotunnius. Its *inner surface* corresponds everywhere to the cerebral substance. The internal pia mater will be best understood, and can only be seen when the ventricles have been laid open during the dissection of the brain, to which we next proceed. As it is to be presumed that the student has attended one or two demonstrations of the brain previous to his attempting its dissection for himself, we may commence the anatomy of this organ by examining its blood-vessels, its arteries and veins. Place the brain upon its vertex, and display the arteries which are chiefly found on its base; this requires a little careful dissection, so as not to remove the roots of the nerves. The brain is supplied by four great arteries, viz. the internal carotid and vertebral. The former are branches of the common carotids, the latter of the subclavian. To trace these arteries in the first part of their course, a recent dissection or dried preparation must be referred to.

566. The Internal Carotid Artery, (it being sufficient to describe one of them), separates from the external behind the digastricus muscle, enters the space between the ramus of the inferior maxilla and the pharynx, and ascends inwards, becoming deeper as it approaches the skull, into which it enters by the carotid canal. It is accompanied externally by the internal jugular

vein, internally by the pneumo-gastric nerve, the superior cervical ganglion and the twig by which it communicates with the middle cervical ganglion. It forms at first a curve whose convexity rests upon the vertebral column; near the skull it presents another having its convexity directed downwards. Its ultimate course will be afterwards traced. In passing through the carotid canal, it accommodates itself to the different directions which it follows, so that from being at first vertical, it afterwards directs itself a little obliquely forwards and upwards. This portion of the internal carotid artery is surrounded by the ascending filaments of the superior cervical ganglion, and the lamina of the dura mater which lines the canal. Before emerging, it gives off a small branch, which penetrates by a particular aperture into the cavity of the tympanum, to be distributed to its mucous membrane and to the promontory, on which it anastomoses with a twig of the middle meningeal artery. Frequently also it furnishes another which enters from behind forwards into the Vidian canal, and there anastomoses with the artery of the same name. On emerging from the canal, the internal carotid artery directs itself upwards and a little forwards, enters into the cavernous sinus of the dura mater, and follows anteriorly its lower wall, on the sides of the body of the sphenoid bone, to above the anterior clinoid process, being enveloped by the inner membrane of the sinus, and accompanied by the sixth nerve and cavernous ganglion. In this course, the artery forms two curves which pretty exactly resemble those of a Roman S. The convexity of the first is turned backwards and upwards, and that of the second forwards and downwards. While contained in the cavernous sinus, the internal carotid artery sends two or three twigs to the dura mater, the pituitary body, the membrane of the sphenoidal sinuses, and the trunks of the third, fourth, fifth, and sixth pairs of nerves. Arrived under the anterior clinoid process, it curves vertically upwards, then directs itself a little backwards, is embraced by the dura mater and arachnoid membrane, and enters into the cranium a little externally and posteriorly of the optic nerve. It is afterwards enveloped with a sheath which is furnished to it by the arachnoid membrane, ascends obliquely backwards and outwards, and separates into several branches opposite the fissura Sylvii, where it terminates. But before this, whilst ascending along the anterior clinoid process, the internal carotid artery furnishes a very remarkable branch—the ophthalmic artery. After giving rise to the ophthalmic artery, the internal carotid produces in the interior of the cranium several branches distinguished into posterior and anterior. The first are *the communicating* and *choroidal arteries*; the others, *the anterior* and *middle cerebral arteries*.

567. The Communicating Artery of Willis. It directs itself obliquely backwards and a little inwards, passes over the side of the infundibulum and mammillary eminences, above the arachnoid membrane, and internally of the thickened edge of the middle lobe of the brain, and goes to open into the posterior cerebral

artery, which is furnished by the basilar. Its size, which is in general rather moderate, frequently varies however, and is not always the same on both sides. In its course, it sends very slender ramifications to the optic thalami and nerves, the mammillary eminences, the *tuber cinereum,* the infundibulum, the choroid plexus, and the crura of the brain. Frequently the twig which belongs to the optic thalamus is much larger than the others.

568. The ARTERY OF THE CHOROID PLEXUS. Always less than the preceding, it arises above it, and proceeds obliquely backwards and outwards, towards the crus of the brain, close to which it enters into the corresponding lateral ventricle by its inferior fissure, to lose itself by subdividing in the choroid plexus. But before this, it gives a great number of twigs to the thalamus of the optic nerve.

569. The ANTERIOR CEREBRAL ARTERY directs itself obliquely forwards and inwards, between the optic nerve and the posterior region of the anterior lobe of the brain, as far as the great fissure which separates the hemispheres of that organ from each other. There, after furnishing small twigs to the pia mater, and olfactory nerves, it comes very near the corresponding artery of the other side, and unites with it by a very short, but pretty large transverse branch, which is named the *anterior communicating artery.* Sometimes this branch is substituted by three or four parallel twigs; but in all cases, it sends one or more small twigs to be distributed to the fornix, the anterior commissure, and the septum of the ventricles. After thus communicating with each other, the two anterior cerebral arteries change their direction, proceed forwards and dive, parallel to each other, between the two anterior lobes of the brain, turning over the corresponding extremity of the corpus callosum. They then proceed from before backwards over its upper surface, at the posterior part of which they terminate by subdividing, so as to embrace that body entirely in an arch which exactly represents its form. It is to this arch that the name of *artery of the corpus callosum* is commonly given. In this second part of its course, the anterior cerebral artery sends from its concave side a great number of small twigs to the corpus callosum, while, by that which is convex, it furnishes somewhat larger twigs to the plain surface of the cerebral hemispheres. These twigs are lodged and subdivide in the anfractuosities which this surface presents, and are prolonged as far as the convex part of the same hemispheres, where they communicate with those of the middle and posterior cerebral arteries.

570. The MIDDLE CEREBRAL ARTERY is much larger than the anterior, it seems to be truly the terminating branch of the internal carotid. Directed outwards and backwards, it gives at first a great number of twigs to the lower part of the brain, to the pia mater which covers its crura, and to the choroid plexus; it then enters into the fissura Sylvii, and divides into two large branches, the one to the anterior lobe, the other to the middle lobe of the brain. These branches bend backwards, following

deeply the fissure, and end towards the posterior part of the brain, where they subdivide into a great number of twigs. In their course, they also furnish sòme, and all enter together into the cerebral anfractuosities, forming many windings, and ramifying in the pia mater, to such a degree as to convert that membrane into an extremely fine and close vascular net-work, from which issue the arteries which are distributed to the substance of the brain. It is only in some particular places, which we have already made known, that this organ receives trunks of any size, as in the optic thalami, near the medullary roots of the olfactory nerves, &c.

571. The Vertebral Arteries are the largest branches of the subclavian. Of these also it will be sufficient to describe the course of one. On both sides, immediately after its commencement, the vertebral artery proceeds directly upwards, behind the inferior thyroid artery, upon the vertebral column, between the longus colli and scalenus anticus muscles. At the end of a more or less short course, it enters the hole with which the base of the transverse process of the sixth cervical vertebra is perforated, and sometimes that of the fifth, without having given rise to any branch; in other rarer cases, it enters these holes only at the fourth or third vertebra. It then ascends in the canal which results from the aggregate of all those holes, with which the transverse processes of the cervical vertebræ are perforated, and which is completed by the intertransversales muscles. In this part of its extent, it passes before the trunks of the cervical nerves. It thus arrives at the axis, having only described very slight flexuosities; but it then leaves the canal, directs itself backwards under the trachelo-mastoideus, and forms, between the two first vertebræ, a vertical curve, the convexity of which is directed backwards, upwards, and inwards. It then proceeds upwards and outwards as far as the transverse process of the atlas, of which it perforates the base directly upwards, under the obliquus capitis inferior muscle; after which it passes backwards and inwards, and describes, between that vertebra and the occipital bone, in the triangular space of the recti postici and obliqui capitis muscles, a second transverse curve, whose convexity, also directed backwards, is covered by the complexus and rectus capitis posticus major muscles, while its concavity embraces the side of the posterior occipito-atlantal ligament. Lastly, the two vertebral arteries pass through the apertures of the two extremities of the same ligament, and through the dura mater, and enter the cranium by the occipital foramen, on the sides of the spinal marrow. They then converge and ascend in a tortuous manner inwards and forwards, between the corpora pyramidalia and olivaria and the basilar groove, on which they unite angularly, to give rise to the basilar artery. *In the canal of the transverse processes*, the vertebral artery sends off several branches in all directions, of which the external, anterior, and posterior emerge between these processes, go to the intertransversales, scaleni, rectus capitis anticus major, trachelo-mastoideus, and splenius muscles,

and communicate with the neighbouring arteries, while the internal penetrate into the vertebral canal, by the inter-vertebral foramina, to expand upon the spinal marrow and dura mater, anastomosing with those of the opposite side. *In its vertical curve,* the vertebral artery sends internally and inferiorly of the obliquus capitis inferior a small branch, which bifurcates as it descends. One of its twigs is distributed to the semi-spinalis colli and multifidus spinæ and the other, (*Art. meningea posterior,*) ascends under the posterior arch of the atlas, to be distributed to the dura mater. Moreover, there also separate from it some twigs for the obliquus capitis inferior and trachelo-mastoideus. *In its transverse curve* it sends a considerable number of twigs to the recti postici and obliqui capitis muscles. One of them, larger than the others, is transverse, directs itself inwards, and presently divides into two branches, one of which, anastomosing with that of the opposite side, constitutes a kind of arch between the complexi and recti capitis postici majores muscles, while the other, descending obliquely, is distributed to the latter and to the rectus posticus minor. *Posterior spinal artery,* (*art. spinalis posterior.*) It arises from the vertebral artery, near the corpora pyramydalia, and sometimes from the inferior cerebellar artery. It directs itself downwards and a little obliquely inwards, passes behind the spinal marrow, and continues to descend parallel to that of the opposite side, as far as the second lumbar vertebra. It is extremely slender. All its twigs are transverse, and anastomose with those of the opposite side, or lose themselves upon the proper membrane of the spinal marrow, sending only some absolutely capillary ramifications to the pulpy substance of the latter. *Anterior spinal artery* (*art. spinalis anterior.*) It is a little larger than the preceding, and arises internally, near the termination of the vertebral artery. It even sometimes comes from the inferior cerebellar or basilar artery. It descends in a tortuous manner upon the anterior surface of the upper extremity of the spinal marrow, gives some ramifications to it, and unites angularly with that of the opposite side opposite the occipital foramen. There results from this union a very flexuous common trunk, which descends as far as the lower extremity of the spinal marrow, giving off, to the right and left, twigs similar to those of the posterior spinal arteries, and which is afterwards prolonged, without dividing, in the midst of the nervous filaments forming the cauda equina, as far as the articulation of the sacrum with the coccyx, where it terminates by anastomosing with the twigs of the lateral sacral arteries. *Inferior cerebellar artery* (*art. inferior cerebelli.*) It arises externally from the end of the vertebral or even from the basilar trunk. Its size is very variable, although almost always pretty considerable. It directs itself transversely outwards, crossing the corpus pyramidale, passes between the origins of the corresponding pneumo-gastric and spinal accessory nerves, and advances in a serpentine manner upon the inferior surface of the cerebellum. Its first twigs, which are very small, are distributed to the superior extremity of the spinal marrow, the origins of the pneumo-gastric and hypo-glossal nerves, and the walls of the fourth ventricle. But the last, which are much larger, creep under the hemisphere of the cerebellum, as far as its circumference, where they communicate with those of the superior cerebellar artery. There are only some which penetrate into the anfractuosities; the rest subdivide at the surface, and form a very fine net-work in the pia mater.

572. The BASILAR ARTERY (*arteria basilaris*), results from the union of the two vertebral arteries. Larger than either of them individually, it has yet a smaller calibre than that of the two together. It commences posteriorly towards the groove which separates the cerebral protuberance from the medulla oblongata, ascends, describing some flexuosities, in the groove which runs along the middle part of the protuberance, and ends anteriorly in the interval which separates the crura of the brain. It therefore corresponds above to a groove of the protuberance, and rests below upon the basilar groove. In its short course, the basilar artery gives off on each side a great number of small irregular and flexuous twigs, which are distributed to the protuberance, the cerebellum, the corpora olivaria and pyramidalia, and the acoustic, facial and trifacial nerves. But there also separate from it two somewhat more remarkable branches, which are the superior cerebellar. *Superior cerebellar artery* (*art. cerebelli superior.*) Arising from the basilar artery, near its termination, it directs itself outwards and backwards under the protuberance and crus of the brain, around which it turns to ascend upon the upper surface of the cerebellum, opposite the tubercula quadrigemina, and after sending a great number of twigs over the protuberance, the crura cerebri and cerebelli, the tubercula quadrigemina, and into the pineal gland, the choroid plexus and the valvule of Vieussens, it divides into a great number of branches, some of which ascend in a very flexuous manner upon the posterior lobe of the cerebrum, whilst others descend upon the upper surface of the cerebellum, where they are distributed like those of the inferior cerebellar artery. The basilar artery terminates by separating into two branches, which are the posterior cerebral arteries.

573. The POSTERIOR CEREBRAL ARTERY (*Art. cerebri profunda*), is much larger than the superior cerebellar, from which it is separated at its commencement by the nerve of third pair. It proceeds at first forwards and outwards, then presently directs itself backwards, turning over the corresponding crus of the brain, whence it gains the lower part of the posterior lobe of that organ. Immediately after its commencement, it furnishes several small twigs to the mammillary tubercles, and to the crura of the brain; it sends a large one into the third ventricle for the thalamus of the optic nerve, the tuber cinereum, and the anterior pillars of the fornix. Precisely in the place where it is in contact with the nerve of the third pair, it receives the communicating artery of Willis, which comes from the internal carotid. Afterwards there

still proceed from it a considerable number of twigs for the cerebral protuberance, the crus of the brain, the choroid plexus, the thalamus of the optic nerve, the cornu Ammonis, the corpus striatum, the pineal gland and the tubercula quadrigemina. The branches which this artery sends over the brain dive into the anfractuosities of its posterior lobe, and subdivide in the pia mater like those of the other cerebral arteries, with which their ramifications anastomose. The posterior cerebral arteries, the communicating arteries of Willis, the anterior cerebral, and the anterior communicating artery, form a sort of polygon, in the area of which are situated the mammillary eminences, the tuber cinereum, the pituitary body, and the infundibulum. It is also to be observed that the principal trunks of the arteries of the brain occupy the base of that organ, and are placed between it and the bony surfaces, so that the motions of the arterial circulation are communicated to the brain, as was first distinctly proved by Duverney. This impulse is transmitted to it in a uniform manner, on account of the extensive anastomoses of these different trunks. The principal branches of these same trunks are lodged in the fissures and anfractuosities. The twigs subdivide to infinity in the pia mater, and it is in reality only the capillary extremities of the vessels that penetrate into the pulp of the organ.

It would further appear from some experiments made recently by Sir A. Cooper, that in some animals much distress is occasioned by compressing the vertebral arteries, although the carotids be left pervious to the passage of the blood, and *vice versa ;* it would also appear, that when both vertebral and both carotids have been tied so as to cut off altogether the supply of blood to the brain and spinal bulb, the animal dies immediately. This result was to be anticipated by previous physiological facts proving the influence of the bulb and restiform bodies over respiration. When the animal dies immediately in consequence of the ligature of both vertebral arteries, it is simply due to the fact that the arterial circle of Willis is not always complete as an arterial anastomosis ; even in man I have often found the communicating arteries of Willis mere threads not admitting of any blood or injection. When this happens, the animal must die when either the vertebral or carotids have been tied. There is nothing peculiar, or singular, or even unexpected in this ; it simply confirms the long established fact, that on the integrity of the bulb depends the function of respiration, and that if the supply of blood to the bulb be suddenly cut off by the ligature of the great arteries, its functions will cease, and with it the phenomena of life in the higher animals, in whom vitality is so directly dependent on the functions of respiration.

574. Origin of the Cranial Nerves. The student may now remove the vessels and membranes at the base of the brain, and examine the coming out of the roots of the cranial nerves or their *apparent origins.* These examined from before backwards, are 1st, The olfactory, whose apparent origin will be found about the

commencement of the fissure of Sylvius; 2°. Of the optic, the student may observe a considerable part of the tractus opticus, the chiasma or commissure, and the divided extremities of the nerves themselves; the 3d pair seem to come from the inner side and back part of the crura cerebri; the 4th may be traced upwards towards the deep parts of the brain; it comes from the valvule of Vieussens, a part which cannot be seen at present; the 5th comes out from the sides of the pons Varolii; the 6th, from the fore part of the medulla oblongata; the 7th, (portio mollis and portio dura,) seems to arise from the top of the corpora restiformia and floor of the 4th ventricle; the filaments or roots of the 8th, (glosso pharyngeal, nervus vagus and spinal accessory), may be seen coming from the medulla oblongata between the corpora restiformia and olivaria, and the division called spinal accessory from the sides of the spinal marrow; and the 9th or hypo-glossal, from between the pyramidalia and olivaria. The filaments by which these nerves communicate with the brain, will be examined afterwards.

575. Of the Brain viewed from above. *The Brain* may now be examined either from above downwards or from below upwards; the first method will best suit the student during his first examinations of this organ. Place the brain upon its base as situated in the body, and remove as much as possible the membranes from its convexity. This displays the *Convolutions.* In the mixed races of Europe, these convolutions are not symmetrical, but they probably are so in the Bosjeman race (yellow-skinned African race) and even in the negro. It is possible that the same remark may apply to many *pure races* of men whether white or black, but it certainly does not apply to the now existing European family of men which is an extraordinary *mixed race.* A transverse section of the upper surface of the brain made so as to take off about an inch of its substance, displays the two forms of matter composing it, viz. the cortical, grey or cineritious, and the white or medullary. The grey is probably the seat of the intelligence, the white or medullary of motion; we have publicly maintained these opinions for at least twelve years. The grey matter is very vascular and not fibrous; the medullary or white substance is distinctly fibrous. A section a little above the level of the corpus callosum, displays the *great hemispherical medullary centre;* a section on a level with the corpus callosum shews the *centrum ovale* of Vieussens. The *corpus callosum* is a powerful transverse commissure connecting the hemispheres of the cerebrum to each other. In length it is about three and a half inches in the adult brain, which it is presumed the student first examines; this body presents a *superior* surface, an *inferior*, and two *extremities.* Upon the superior surface are observed the *raphe,* and the arteries of the corpus callosum which in the progress of the dissection may have been removed. The inferior surface of the corpus callosum contributes to form the ceiling of the ventricles at the sides, but in the median line it is situated immediately

above the *septum lucidum* and the *fornix*. These will be examined afterwards. Next lay open the lateral ventricles by cautiously scraping through the sides of the corpus callosum, and having penetrated into them on each side, lay them open with the handle of a scalpel throughout their whole length. The *lateral ventricles* thus displayed are two in number, a right and a left; they communicate with each other below the fornix *and through the third ventricle*, but there is one point where the lateral ventricles communicate with each other beneath the fornix more directly than at any other part; this is towards the fore part of the ventricles near the point where the corpora striata join the thalami nervorum opticorum; here the communication is very direct, and as the fornix is narrow, it led the second Dr. Munro into the opinion, most certainly erroneous, that the *lateral ventricles* of the brain communicate *directly* with each other, whereas they only communicate *through* the third. Next attend to the objects seen in each of the lateral ventricles; 1°. The anterior horn (cornua anteriora); 2°. The corpus striatum; 3°. The tænia semicircularis and lamina cornea; 4°. The thalamus nervi optici; 5°. The posterior horn, digital or ancyroid cavity; 6°. The hippocampus minor; 7°. The choroid plexus. Next make an incision through the lateral mass of the hemisphere following the fornix down towards the base of the brain; this will display 8°. The inferior horn of the ventricle; 9°. The cornu ammonis; and 10°. The fimbria corpus fimbriatum or tænia hippocampi. He may now return to examine more at leisure some of the parts thus named. Between the corpora striata is the septum lucidum, forming here a partition between the ventricles and upon the base of the ventricle may be seen the commencement of the veins of Galen. The hippocampus minor varies much in appearance and size; it is sometimes double and occasionally absent. The choroid plexuses which are seen so soon as the lateral ventricles have been sufficiently laid open, cannot be well understood until the corpus callosum and fornix have been cut through and raised up; we shall therefore return to their anatomy afterwards. These bodies are vascular, and have a granular appearance, but their uses are unknown. They are intimately connected with each other by the tela choroidea or velum inter positum running below the fornix, and as they are continuous with the pia mater covering the external surface of the brain, they have been called the internal pia mater. Next return to the median parts which lie between and over the ventricles; cut through the corpus callosum cautiously, and raise its anterior part from the septum lucidum; this usually tears off the upper part of the septum lucidum, and exposes its ventricle, also named the fifth ventricle. The upper margin of the septum lucidum communicates with the corpus callosum, the posterior with the fornix and its anterior pillars. It is formed of two lamellæ and a ventricle between them; the walls of this ventricle are smooth and glassy, looking like the other ventricles, but it does not communicate with them. The removal of the corpus callosum exposes the *Fornix*. This body is continuous above with the corpus callosum; it is of a triangular shape, and has four pillars, two anterior and two posterior. Below it is placed the velum interpositum or tela choroidea. Cut through the fornix about the middle, and reflect the divided portions anteriorly and posteriorly. This shews the inferior surface of the fornix, called *lyra*, psalterium; also the anterior and posterior pillars. The anterior pillars of the fornix may be traced downwards to the *corpora candicantia* in the base of the brain; the anterior commissure of the brain runs in front of these pillars. The *posterior pillars* of the fornix proceed backwards and downwards, to terminate by chiefly forming the medullary layer investing the cornu Ammonis and the corpus fimbriatum. Immediately below the fornix will be found the tela choroidea, a vascular membrane uniting the choroid plexuses to each other. If a probe be pushed backwards below the fornix, it will be found to pass to the exterior surface of the brain by an extended fissure, (the great cerebral fissure); it is by this fissure that the pia mater enters so as to form the velum and the choroid plexuses. This fissure extends quite down to the base of the brain between the posterior pillars of the fornix and the thalami nervorum opticorum. Next cut through the back part of the fornix and corpus callosum mesially, and separating the parts from each other, trace the velum interpositum and veins of Galen, through the fissure to the exterior of the brain. The *velum* or *tela* is of a triangular shape, it lies in the third ventricle; its edges are continuous with the choroid plexuses, its anterior extremity is bifid, and terminates below the narrowest part of the fornix. Posteriorly it is continuous with the external pia mater and incloses partially within it the *conarium* or pineal gland. Raise up the velum after dissecting the pineal gland, and removing a good part of the membrane, expose the greater part of the third ventricle more fully. This ventricle is placed upon the middle plane of the brain; it is a very narrow oblong cavity, or rather fissure. In it we observe, 1st, the commissura mollis, connecting the two sides of the thalami nervorum opticorum together. This commissure varies very much in shape, strength, &c., but I have only observed it to be once absent in many hundred brains examined with more or less care; the openings in front and behind the commissura mollis, used to be called the anus and vulva. Anteriorly this ventricle leads towards the infundibulum, and tuber cinereum which here contributes to form the floor of the ventricle; at the sides are the thalami nervorum opticorum; behind, the pineal gland, its peduncles, the corpora quadrigemina, posterior commissure of the brain, and beneath it the aquæduct of Sylvius, this passage leads from the third to the fourth ventricle. It is, as it were, hollowed out of the substance of the isthmus, above which it is placed. We have already mentioned the pineal gland, its situation and pedicles; in it are usually found a few gritty particles or concretions (acervulus.) The part which next requires examination, is the VALVULE of

VIEUSSENS and FOURTH VENTRICLE. To examine these with advantage, push back cautiously the median part of the cerebellum as far as possible, this will display the valvule of Vieussens which assists in forming the ceiling of the fourth ventricle; cut through the median part of the cerebellum, and by this will be exposed the posterior opening of the aquæduct of Sylvius, and the cavity of the fourth ventricle. Connected with it may be seen the calamus scriptorius; the posterior median fissure of the medulla oblongata; the origins of the portio mollis, the crura cerebelli *a* medulla (corpora restiformia); the crura cerebelli *a* tuberculis. The valvule of Vieussens connected these crura to each other, and extended from the posterior tubercles to the median part of the cerebellum. From its appearance it seems to belong to the peculiar formation of the cerebellum, that is, its structure is more analogous to it than to the cerebrum. Finally, in the fourth ventricle are small choroid plexuses, and the ventricle is shut up at the back by the arachnoid membrane, so that there is no communication between its cavity and the arachnoid cavity of the spinal column.

576. The BRAIN VIEWED FROM BELOW. The brain may now be turned upon its upper surface, and the parts seen at its base examined carefully. The *Rachidian Bulb*, usually called in this country, the *medulla oblongata*, terminates superiorly the spinal marrow, with which it is strictly continuous. It lies in the basilar fossa of the occipital bone, and unites the medulla spinalis to the cerebrum and cerebellum. Its limits are well defined anteriorly, but posteriorly they are perfectly artificial; it is usual to fix its posterior limits where the decussation of its fibres takes place; anteriorly the transverse fibres of the isthmus sufficiently point it out. It is thought that the position of the bulb varies a little during flexion and extension of the head. On the anterior surface of the bulb, are, 1°, the median fissure and *decussation of the fibres*, and to the right and left of this decussation and fissure are the *anterior pyramids*. Outside these pyramids are the *corpora olivaria*. These are shorter than the pyramids; thus they do not reach the isthmus anteriorily, whilst posteriorly a series of fibres, (*arch-formed* fibres) limit them. Those of the arch-formed fibres which proceed along with the corpora restiformia to the cerebellum have been considered by Mr. Solly as proving the passage of motor fibres from the anterior columns of the spinal cord to the cerebellum. The filaments of the hypo-glossal nerves come out between the olivaria and pyramidalia; a deep fissure separates them from the corpora restiformia. When cut into, the corpora olivaria display an appearance called corpus rhomboideum. The posterior surface of the bulb has been already examined when speaking of the fourth ventricle. It is formed by the *corpora restiformia*, which are also called *inferior peduncles* of the *cerebellum*. But many divide the corpora restiformia into two parts on each side: to the cords which run up on each side of the posterior median fissure, they give the name of posterior pyramid, or posterior median columns; and to the large lateral portions proceeding chiefly to the cere-

bellum the name of corpora restiformia is reserved. The lateral surfaces of the bulb are chiefly remarkable for the *arch-formed* fibres, so well described by Santorini and Rolando; I have seen them in one or two brains remarkably large and distinct, but they are also extremely irregular in number, &c. They seem as it were to arise from near to the anterior median fissure, and ascending divide into two bundles, one of which proceeds to join the anterior pyramids; the other joins the corpora restiformia, and probably in this way reach the cerebellum. Whatever be the physiological views in respect to the structure of the bulb, the following anatomical facts merit attention, at least until they be refuted by more careful examination. The anterior *pyramids* are not formed out of the anterior columns of the medulla spinalis; the posterior fasciculi of the medulla separate into two divisions on a level with the bulb. The medullary fibres of the spinal marrow having reached the bulb divide into two bundles. The one *anterior;* this passing into, or becomes the anterior pyramid, and proceeds ultimately to the cerebrum; the other posterior, restiform body, proceeds almost entirely to the cerebellum; the fibres composing the anterior or cerebral fasciculi come chiefly from the deepest part of the medulla; those composing the cerebellar fasciculi come chiefly from the anterior fibres of the medulla. A fasciculus innominatus has been lately described as commencing in the bulb; it is so situated as to form the anterior wall of the fourth ventricle close to the median fissure, and it terminates in the *thalamus* and restiform body. The existence of *olivary* fasciculi has always appeared to us extremely doubtful. Next examine the *Pons, Isthmus,* or annular protuberance. Its limits are well defined; in volume its development follows that of the lateral lobes of the cerebellum. As the pons is usually, or at least at first examined from below upwards, or commencing by its inferior surface, we shall follow this method here. The inferior surface of the pons is composed of firm transverse medullary fibres which go chiefly to form the crura cerebelli, whilst from the anterior part of the pons proceed the crura cerebri. These crura cerebri follow in their development the ratio of the cerebral hemispheres. Their course is oblique and diverging, leaving a triangular space between them, filled by the substantia perforata, the mamillary eminences, and the tuber cinereum. We have already examined the superior peduncles of the cerebellum, the valvule of Vieussens, the aquæduct of Sylvius, and tubercula quadrigemina; but as these parts in some measure belong to the system of the pons, the student should again, at this stage of the dissection, examine their relations with it, and with each other. The *tubercles* are situated on the superior surface of the crura cerebri; from the anterior proceed fibres to the tractus opticus: the *corpora* geniculata (externum et internum), may now be best seen upon the posterior and inferior surface of the thalamus nervi optici.

577. The Pons or *Protuberance* when dissected, exhibits the

following parts:—1°. The superficial layer of transverse fibres proceeding across to the hemispheres of the cerebellum. 2°. Above these, but not in any very regular order, a series of *antero-posterior* fibres, which are the continuation of the anterior pyramids of the bulb, and which, traversing the pons from behind forwards, proceed into the crura cerebri. In the centre also of the isthmus may be traced the fasciculus of the origin of the fifth pair of nerves. It is usual to divide the layers composing the pons into three stages or planes, which may readily be made out either by vertrical or transverse sections of the pons and bulb.

578. The CEREBELLUM into which the dissector will by this time have traced the passage of its crura on each side, may now be considered more minutely. In respect to volume, it is larger in man than in any other animal; its ratio to the cerebrum is as one to seven. On its superior surface is the *vermis superior*, which is merely the superior surface of the median lobe of the cerebellum. There is also to be remarked the hemispherical fissure, the hemispheres themselves, and inferiorly the *inferior vermis*. Externally, the cerebellum has a very different appearance from the cerebrum; it presents fissures and laminæ, and about the middle of each hemisphere is the *sulcus horizontalis*, which penetrates very deeply into the interior of the organ. The laminæ composing the cerebellum are situated upon each other like the leaves of a book; but within these are lamellæ which go from one lamina to another. Besides these parts, some anatomists, as Meckel, speak of lobes or lobules, to be seen upon the surface of the cerebellum, and of a *lobule* of the *pneumo-gastric* nerve, (flocculus), situated behind the pneumo-gastric nerve, but under the facial and auditory nerves. The *Fourth Ventricle*, sometimes called the ventricle of the cerebellum, has been already examined. This ventricle is shut in behind by the arachnoid, so as to cut off all communication between the cavity of the ventricle and the general *arachnoid* cavity (serous cavity) of the head and spinal column. M. Magendie thinks, however, that the fluid contained in the fourth ventricle may find its way into the sub-arachnoid space of the spinal cord, by two openings which he states to exist between the inferior cerebellar arteries, and upon or near to the median line. There is nothing improbable in the existence of such openings, but they have uniformly appeared to be artificial, that is, made by the dissector. It is said, however, that if a fluid be forcibly injected into the lateral and third ventricles of the brain, it will make its way by the aqueduct of Sylvius and fourth ventricle into the sub-arachnoid cellular tissue and space of the spinal arachnoid. The pia mater forms in the fourth ventricle two small choroid plexuses. The precise structure of the connexion between the inferior vermis of the cerebellum, and the restiform bodies, has not been as yet clearly made out by anatomists; some authors speak of a fibrous lamella shutting in the fourth ventricle completely behind; I have only as yet observed the arachnoid and pia mater, although at the sides there are appearances indicative of such a lamina, but its limits and connex-

ions have never been clearly made out. The cerebellum when cut into, shows the cortical and medullary substance peculiarly arranged, so as to form the *arbor vitæ;* the interior of each hemisphere likewise contains a large *corpus rhomboideum.*

579. In conclusion, the dissector may re-examine with more care the division of the encephalic mass strictly called *cerebrum,* although most of its parts have been already seen. The great size of this portion of the encephalon is undoubtedly a remarkable feature in the human organization, and although it be not true that the intellect in its most extended sense is in the direct ratio of the cerebral mass, yet below a certain standard as to bulk there is no intellect. The cerebral hemispheres, then, are remarkably large in man, and in all the races of men equally so; thus, if the different races *differ* in the degree of intelligence possessed by each, it is not owing to any inferiority as to volume of *brain,* but must be dependent on some other specific qualities of texture. The male brain is heavier than the female; it is also larger; it varies from a little less than two pounds to nearly four pounds; the average is under three pounds. We have already examined the upper surface of the cerebrum, a few points upon its inferior surface still merit attention. Each hemisphere of the cerebrum inferiorly is divided into three lobes, an anterior, middle, and posterior; there is often a great want of symmetry between the hemispheres, and an obliquity in the great superior median fissure, but this does not necessarily imply an *obliquity* in judgment. The base of the brain must be examined very carefully after being cleared of its vessels and membranes. We have already spoken of most of the parts seen here; they are placed in the following order; the enumeration applies only to the base: 1°. Lower surface of the anterior lobes and great median fissure. 2°. Fissures of Sylvius. 3°. Behind these the inferior angles of the great cerebral fissure. In the middle, the commissure of the optic nerves, the infundibulum and tuber cinereum, the corpora candicantia, the inter peduncular space or substantia perforata, the crura cerebri, annular protuberance, &c. A horizontal section of the commissure of the optic nerves shews a distinct decussation of its fibres. The tuber cinereum, infundibulum and pituitary body seem to belong to the same system of parts; their uses are entirely unknown. A tolerably accurate idea of the structure of the brain may be obtained by following the anterior pyramids from the bulb through the protuberance, crura cerebri, thalami nervorum opticorum, corpora striata, and finally expanding into the cerebral hemispheres and their convolutions. The fasciculus innominatus of the bulb may be traced above the cerebral protuberance into the optic thalami. From all the external parts of the thalami, fibres proceed in a radiating manner into the convolutions (corona radiata of Reil); most of the white fibres of the corpora striata proceed from the thalami. A difference of opinion exists as to the mode of connexion between the radiating fibres from the thalami and corpora striata and those

forming the corpus callosum, some supposing that they are continuous; they have generally appeared to me to be interrupted by grey matter. The brain of the young child is extremely soft, and previous to birth, the distinction of its texture into grey and medullary is scarcely apparent. According to some, the brain attains its full weight and size so early as the fourth year. The texture of the brain of the negro has always appeared to me different from that of the European.

PART X.

OF THE NERVES.

580. The greater number of the more important nerves have, throughout the various preceding sections, been described so much in detail, and the mode of displaying them so fully explained, that all now required here is a systematic summary of their origin, course, and distribution. The nerves form two great divisions, viz. *cranio-spinal* and *sympathetic.* The cranio-spinal are further subdivided into *cranial* and *spinal;* the cranial may be still farther subdivided into *nerves of special sensation, nerves of motion*, and *common moto-sentient nerves.* The spinal nerves have double roots, viz. a motor and a sentient; of the cranial, some have double roots, others single; these will be more particularly specified afterwards. Some nerves are associated in a particular manner with respiration, and are therefore called *respiratory.* The spinal nerves pass through the *foramina conjugalia* in pairs; the cranial, by various openings, through the base of the cranium. There are thirty-one pairs of spinal nerves, viz. eight cervical, twelve dorsal, five lumbar, six sacral. We shall examine them with reference to, 1st, their common characters; 2d, the regional; 3d, individual. 1°. They arise from, or terminate in the spinal marrow, by a double linear series of filaments or roots; these are *anterior* and *posterior*, or ganglionar. Beyond the ganglions the anterior and posterior roots unite inseparably; the trunk resulting from this union combines both roots, and from this trunk there usually proceed three sets of branches, viz. posterior spinal, anterior spinal, and branches to join the ganglions of the great sympathetic. These characters are common to all the spinal nerves; the first cervical pair, called sometimes suboccipital, seldom offers any exception.

581. Spinal Nerves. The peculiarities of these nerves, with

reference to regions are, 1st, in the *cervical* pairs the volume of the posterior roots is to the anterior as three to one; they increase generally from the first pair to the fifth, and maintain that increase to the eighth; the first pair has the posterior roots fewer in number than the anterior (Ash.), and is said to be frequently without a ganglion, but in no instance have we remarked this. The *dorsal* pairs of spinal nerves; with the exception of the first, they are nearly equal in volume; the roots are slender. The lumbar and dorsal nerves are characterized by the great number of filaments of origin, the extreme closeness of their origins. It has even been said that the anterior as well as the posterior roots pass into the ganglion; lastly, the great length of their course within the spinal canal. The *real central extremity*, or origin of the filaments from the spinal marrow is not known.

582. I. Posterior Branches of the Spinal Nerves. These branches are met with upon the posterior region of the trunk; they are very easily dissected; and as they proceed to the integuments, and to muscles already known to the student, they do not require any tedious description. 1°. Posterior branches of the cervical nerves. These are met with chiefly between the complexus and semi-spinalis colli, but many of their cutaneous branches are met with previous to this. The posterior branch of the first, leaving the column by the space between the occipital bone and atlas, close to the vertebral artery, and under the rectus capitis posticus major, ultimately supplies with branches the rectus major and minor, obliquus inferior and superior, and by a ramus anastomoticus, assists in forming a sort of plexus, recently called the *posterior cervical plexus*. It sends no branch to the great complexus. *Posterior branch* of the second cervical pair. The largest of all the posterior branches of the cervical nerves passes under the margin of the inferior oblique, and proceeds upwards to the occipital region and the scalp. It traverses the great complexus and trapezius, and follows the course in part of the occipital artery. It supplies branches to the great oblique, complexus major and splenius, the trapezius, and finally, to the hairy scalp of the occipital region; the occipital muscle is said not to receive any branches from this nerve, but to be supplied by the facial. *Posterior branch* of the third cervical pair leaves the canal between the transverse process of the second and of the third cervical vertebra, and proceeds transversely inwards between the complexus and semi-spinalis colli. Near the inner margin of the complexus, it divides into two cutaneous branches, one ascending, the other horizontal. The first, second, and third pairs of cervical nerves likewise form occasionally a plexus, situated under the complexus, close to its external attachments; some have proposed calling this the *posterior* cervical plexus; it is not very remarkable, nor of constant occurrence. The *posterior branches* of the fourth, fifth, sixth, seventh, and eighth cervical pairs are much smaller than the preceding, and decrease from the fourth to the seventh; they

send branches chiefly to the semi-spinalis colli and dorsi, and to the integuments.

583. POSTERIOR BRANCHES OF THE DORSO-SPINAL NERVES. Those of the first pair are almost identical with those of the last cervical: the posterior branches of the second, third, fourth, fifth, sixth, seventh, and eighth dorsal nerves greatly resemble each other. They all leave their respective *foramina conjugalia* external to the semi-spinalis muscles, and there divide into two branches, one external or muscular to the sacro-lumbalis and longissimus dorsi, the other musculo-cutaneous, which, after reaching the integuments close to the spinous processes, ascend towards the region of the shoulder. With respect to the posterior branches of the ninth, tenth, eleventh, and twelfth dorso-spinal nerves, they precisely resemble those of the loins; they have no musculo-cutaneous branch, like the preceding; they supply the abdominal walls. The *posterior branches* of the lumbar nerves diminish gradually from above downwards, the last being very small; they supply the adjoining soft parts. The *posterior branches* of the sacral nerves are extremely small; they decrease also in size, and supply the semi-spinalis lumborum and adjoining integuments.

584. II. ANTERIOR BRANCHES OF THE SPINAL NERVES. These are the true continuations of the nerves, and supply, 1st, the lateral and anterior parts of the trunk; 2d, the pectoral and pelvian extremities. Besides, these nerves form two great *plexuses*, viz. the cervico-brachial, and the lumbo-sacral. These have, of late years, been subdivided into four plexuses, viz. *Cervical*, *Brachial*, *Lumbar*, *Sacral*; this arrangement is artificial, but convenient for description.

585. CERVICAL PLEXUS. The *Anterior branch* of the first cervical pair, joins that of the second cervical pair, which subdivides into two branches, an *ascending*, to join the preceding one, and a *descending*, which joins the anterior branch of the third cervical pair. This is much larger than the preceding, and chiefly forms the *cervical plexus*. It will readily be found behind the upper part of the sterno-mastoid muscle, corresponding to the foramen conjugale, between the second cervical vertebra and the third. It divides into an ascending and descending branch. Its ascending branch bifurcates on the posterior margin of the sterno-mastoid muscle, and anastomosing by one or two filaments with the second cervical pair, forms the *mastoid nerve*, and the *superficial cervical* and *auricular nerve*. We shall speak of these nerves more particularly, after having described the *plexus* fully. The *anterior branch* of the fourth cervical pair, besides furnishing the phrenic, anastomoses, but not directly, with the third cervical pair; and thus these four, by anastomosing, constitute the *cervical plexus* (475).* This plexus is situated on the anterior and lateral parts of the four first cervical vertebræ, under the posterior margin of the sterno-cleido-mastoid muscle, external to the in-

* Generally the fourth pair unites by a small branch with the fifth.

ternal jugular vein, and between the rectus capitis anticus major and the cervical insertions of the splenius and levator anguli scapulæ. A deep layer of the cervical fascia invests it closely. The branches arising from it are :

1°. *Anterior.*	The superficial cervical.
2°. *Ascending.*	The great mastoid. The small mastoid. The auricular.
3°. *Descending.*	Superficial. Supra-clavicular. Supra-acromial.
4°. *Profound.*	The inner descending branch. The phrenic. Branches to the trapezius. Do. to the rhomboid. Do. to the levator ang.

586. The method of dissecting all these nerves having been already described (475), it is only necessary here to speak of their ultimate distribution. The *Superficial Cervical* (*superfic. colli*) crosses the external surface of the sterno-mastoid, beneath the latissimus colli and external jugular vein ; it supplies the integuments of the chin and of the space immediately beneath the lower jaw, and sends an anastomosing branch or two to the facial. It is therefore chiefly a *cutaneous nerve.* The *great mastoid*, the *small mastoid*, and the *auricular branches* of the cervical plexus are essentially cutaneous nerves ; their names will suggest their course. The *supra-clavicular* and *supra-acromial* are also essentially cutaneous ; they supply the integuments of the shoulder and upper part of the thorax ; they are situated superiorly beneath the cervical fascia, and between the omo-hyoideus and scaleni, but inferiorly they cross the clavicles to become cutaneous. The deep or inner descending branch is usually not much attended to, and is yet a very remarkable branch ; there are often two : they form, with the descendens noni, a *plexus*, from whose convexity arise filaments, supplying the sterno-hyoidei, omo-hyoidei, and sterno-thyroidei muscles. This plexus lies anterior to the deep jugular vein. The phrenic branch or nerve has been already very carefully described ; in its course it anastomoses with the sympathetic, and with the fifth and sixth cervical pairs, occasionally gives off a cutaneous branch above the clavicle, and ultimately is wholly distributed to the diaphragm. Finally, the profound muscular branches from the cervical plexus supply the trapezius, levator anguli scapulæ and rhomboidei ; they anastomose with the spinal accessory of Willis.

587. Brachial Plexus. The *anterior branches of the fifth, sixth, seventh, and eighth pairs of the Cervical Nerves* are of large size, are situated between the scaleni, and together with the anterior branch of the first pair of dorsal nerves, they form the brachial plexus (217). The plexus is formed in this way; the fifth and

sixth pairs unite together, the seventh proceeds by itself, the eighth and first dorsal unite together. The situation and the connection of this plexus are as follows; at its origin it is placed between the scalenus anticus and medius, and above the subclavian artery, a strong layer of cervical fascia insulates it completely from the surrounding parts; lower down there lie in front of it the clavicle and subclavius muscle, behind it the first rib and the upper part of the serratus magnus; still lower it is situated in the hollow of the axilla, resting on the tendon of the subscapularis muscle, which separates it from the shoulder joint. The branches furnished by the brachial plexus are easier of dissection, provided it be done after the clavicle and subclavius muscle have been cut through. They may be divided mechanically into three sorts.

I. Those which the plexus furnishes above the clavicle.

1. Branch to the subclavius. This branch anastomoses with the phrenic.
2. Branch to the levator anguli scapulæ.
3. Branch to the rhomboid.
4. The posterior external thoracic to the serratus magnus, (the external respiratory nerve of Bell.)
5. The supra-scapular to the supra and infra-spinati muscles.
6. The superior subscapular branch.

II. Branches which the plexus furnishes on a line with the clavicle.

1. Great pectoral nerve. } External anterior thoracic
2. Small pectoral nerve. } nerves.

III. Those which the plexus furnishes in the axilla.

1. The axillary or circumflex.
2. The subscapular branches, comprising
   Branch to the latissimus dorsi,
   Branch to the teres major,
   Inferior subscapular nerve.

Of all these branches, one only proceeds from the front of the plexus, all the rest come from behind.

IV. The terminating branches of the brachial plexus are five in number, viz.

1. Internal cutaneous and its accessory.
2. Musculo-cutaneous.
3. Median.
4. Musculo-spiral, or radial.
5. Ulnar.

Of these nerves the only one whose ultimate distribution has not been alluded to, is the circumflex or axillary. This supplies the deltoides and teres minor, and is a remarkable nerve in every respect.

588. The Terminating Branches of the Brachial Plexus, better known as the nerves of the superior extremities. Those acquainted with the anatomy of the muscles (229, 262), can experience no difficulty in tracing these branches to their ultimate

distribution: 1°. *The Internal Cutaneous*, following somewhat the course of the basilic vein, divides about the middle of the arm into two branches, a cubital, and an epitrochlear or posterior. The cubital, which is also anterior, proceeds in the course of the median basilic vein, to supply the integuments on the anterior parts of the fore-arm. The epitrochlear branch supplies the integuments along the back of the forearm. The *accessary branch* of this internal cutaneous is a fine nerve, difficult of dissection. It comes from the back of the brachial plexus, and from the trunk resulting from the union of the eighth cervical pair and first dorsal; and descending through the axilla, upon the sides of the thorax, divides into two branches, an external and an internal. The external may be followed across the united tendons of the teres major and latissimus dorsi, vertically to the integuments on the inner side of the arm. The internal, on the other hand, anastomoses with the second intercostal branch, and then follows a course pretty similar to the external. 2°. The *Musculo-Cutaneous*, also called the perforating nerve of Casser, from its traversing the coraco-brachialis muscle, supplies, in its course along the arm, nerves to the coraco-brachialis muscle, to the biceps, to the brachialis flexor, to the articulations of the elbow and wrists, and finally, numerous cutaneous branches. 3°. The *Median* furnishes no branch in its course along the arm. In the fore-arm it gives no nerve to the skin, but supplies all the muscles of the anterior region, excepting the flexor carpi ulnaris, and the inner half of the flexor profundus. In the hand it supplies all the cutaneous nerves to the palm of the hand, the digital branches of the thumb, fore-finger, middle finger, and radial side of the ring finger; finally, branches to the short muscles of the thumb, and to the two external lumbricales. 4°. The *ulnar nerve*. This nerve should be examined in three different sections, a brachial, an antibrachial, and palmar. It furnishes no branch to the arm, but in the fore-arm, a cutaneous branch; and moreover supplies the flexor carpi ulnaris and inner half of the flexor profundus. In the hand it furnishes a dorsal cutaneous branch, whence proceed nerves to the little finger, ring-finger, and inner half of the middle finger; also a palmar cutaneous branch, which gives branches to the little finger, and ulnar side of the ring finger. Lastly, a muscular branch which supplies the three muscles of the hypothenar eminence, all the interosseal muscles, and the two internal lumbricales. 5°. The *Musculo-Spiral* nerve. This nerve whose course is so remarkable, furnishes in the arm two cutaneous branches. It also supplies the triceps and anconeus; in the fore-arm, muscular branches to both layers of muscles situated in this posterior region; in the hand it furnishes the dorsal cutaneous branches of the thumb and index finger.

589. Anterior Branches of the Dorso-Spinal Nerves. The cutaneous branches of these nerves are difficult of dissection, but all the larger branches are easily found during the examination of the interior of the thorax. They are twelve in number, and are destined to supply the walls of the thorax and of the ab-

domen; but they do not alone supply these parts, since they also receive branches from the brachial and lumbar plexus. These nerves may further be subdivided into muscular and cutaneous branches. The anterior cutaneous perforating branches are extremely small; they pass through at the sides of the sternum and linea alba. There are also middle perforating cutaneous and posterior perforating cutaneous. The anterior branches of the dorso-spinal nerves here spoken of greatly resemble each other in their anatomy; separated from the posterior branches by the superior costo-transverse ligament, they reach the middle part of each intercostal space; here they are situated between the pleura, and an aponeurosis extending from the termination of the internal intercostal muscles to the spine. They next pass forwards between the intercostal muscles themselves, situated always inferior to the corresponding arteries. But about midway between the vertebral column and sternum, they all divide into two branches, one cutaneous or perforating, the other proper intercostal. This latter follows the original course of the nerve. The first pair of dorsal nerves differ from the others in this, that by far the greater part of it proceeds upwards in front of the neck of the first rib, to join the brachial plexus. Its proper intercostal branch is very small. The second intercostal is remarkable for the great size of its perforating or cutaneous branch, which crosses the axilla to supply the integuments of the arm. It anastomoses with the accessary of the internal cutaneous, and receives generally the name of the superior intercosto-humeral nerve. The third is also remarkable for the size of its cutaneous or perforating branch, which also proceeds to the integuments of the arm, and is called the inferior intercosto-humeral. It escapes from the thorax between the third and fourth ribs. Of the inferior intercostals it may be said that they are as much abdominal as thoracic. They supply the integuments of the abdomen, and send branches to the recti and obliqui muscles; branches also to the transversalis. It has never yet been shown rationally, how these nerves and the muscles they supply, sympathise with the organs of respiration.

590. LUMBAR PLEXUS. The dissection of the *anterior branches of the Lumbar Nerves* has been already described (411, &c.) in speaking of the abdominal cavity and its viscera. Those who understand the anatomy of the psoas magnus, and parvus, quadratus lumborum, and iliacus, will experience no difficulty in understanding the anatomy of these nerves, nor in tracing their ultimate distribution. They are five in number, and so named first, second, third, fourth, and fifth. The first is the smallest, the fifth the largest. The lumbar plexus results from the union of these with each other: It is situated at the sides of the bodies of the lumbar vertebræ, and beneath the origins of the psoas magnus. Three large nerves proceed from this plexus, viz. the *Crural*, the *Obturator*, and the *Lumbo-Sacral.* Four other smaller nerves also proceed from the same plexus, viz. the ilio-scrotal, the middle musculo-cutaneous, the inferior musculo-cu-

taneous, and the genito-crural. These nerves are easily traced between the peritoneum and psoas, quadratus lumborum, and iliacus. The name of *musculo-cutaneous* given to them by Bichat has been objected to, but not on good grounds, since this is really their destination. Of the three great nerves which proceed from the lumbar plexus, the *Lumbo-Sacral* is not properly a nerve, but rather an intermediate nervous communication between the lumbar plexus and the sacral plexus. It is formed by the anterior branch of the fifth pair of lumbar nerves, and a division from the fourth. The *Obturator Nerve,* after passing across the pelvis, but close to its walls, leaves this cavity by an opening in the obturator membrane, and thus passing into the thigh, sends branches to the obturator externus, to the three adductors, and to the gracilis. There generally arises from this nerve, a branch which anastomoses with the nervus saphenus internus. When present, it will be found below the pectineus. It is said by some occasionally to pass over the horizontal ramus of the pubis; and this variety in its course may be a reason why it is not often observed. The *Crural Nerve,* and all its branches, have already been described in the dissection of the lower extremity; but it may be useful to sum up here the principal points in its distribution. Within the pelvis it lies embedded in the psoas, sending branches to that muscle and the iliacus. It next proceeds under Poupart's ligament, at the distance of about half an inch on the iliac side of the femoral artery, embedded in a groove between the psoas and iliacus, and here suddenly divides into a great number of diverging branches. These branches, which the student ought to trace with care, are, *first,* the musculo-cutaneous branch; this supplies the sartorius. *Secondly,* a small branch to the sheath of the femoral vessel. *Thirdly,* a branch to the rectus. *Fourthly,* branches to the vastus externus. *Fifthly,* branches to the vastus internus and cruræus. *Sixthly,* the long saphenus internus, which also runs a considerable way in the sheath of the vessels.

591. Sacral Plexus. The *anterior branches of the sacral nerves* compose this plexus, and we have already described the mode of dissection, and the distribution of these nerves, in our account of the pelvis and pelvic extremity. A systematic summary, therefore, may suffice to complete their history. They are six in number, and communicate, as they leave the anterior sacral foramina, with the sacral ganglia of the sympathetic nerves. The first pair, which is very large, descends in front of the pyramidalis muscle, uniting at an acute angle with the lumbo-sacral nerve. The second pair is as large as the first, and contributes with it to form the sacral plexus. The third pair is separated from the second at a considerable interval; it is much smaller than it; it also joins the plexus. The fourth pair is more complicated, though much smaller than the third. *First,* it assists in forming the sacral plexus. *Secondly,* it sends several branches to the hypogastric plexus. *Thirdly,* communicates by a branch with the fifth pair. *Fourthly,* sends branches to the ischio-

coccygeus muscle. *Fifthly*, a cutaneous branch which traverses the long sacro-sciatic ligament, and the origins of the gluteus maximus muscle. The fifth and sixth pairs, according to some, have nothing to do with the sacral plexus, nevertheless, the fifth pair sends a branch upwards to join the fourth, and a descending branch to join the sixth; this last, which is extremely small, sends filaments through the sacro-sciatic ligament to the gluteus maximus. The sacral plexus thus formed, rests on the internal surface of the pyramidalis muscle, behind the hypogastric vessels. The branches which arise from the plexus are as follows: 1°. *Visceral Branches* to the rectum, bladder, and in the female, the vagina, rectum, and bladder; these nerves come from the lower part of the sacral plexus, and several proceed to the hypogastric plexus. 2°. A branch to the levator ani. 3°. A branch to the obturator internus. 4°. The deep pudic nerve, following the course of the internal pudic artery. These branches are mostly anterior. The posterior branches from the sacral plexus are, 1°. The *Nervus Gluteus Superior*, which leaves the pelvis by the upper part of the great sciatic notch, and supplies the gluteus medius, minimus, and tensor fasciæ latæ. 2°. The *Nervus Gluteus Inferior*, or *Small Sciatic Nerve* of Bichat, which leaves the pelvis by the sciatic notch, beneath the pyramidalis along with the great sciatic; the muscular branches of this nerve go the gluteus maximus; the cutaneous branches are large and very remarkable, particularly one which goes to the scrotum in the male, and the greater labia in the female. 3°. The nerve of the pyramidalis muscle. 4°. The nerve of the gemellus superior. 5°. The nerve of the quadratus femoris, which also supplies the gemellus inferior. 6°. The *Great Sciatic Nerve*, whose course has been very carefully described in the dissection of the lower extremity. We shall here, therefore, merely enumerate its branches. It supplies all the muscles of the posterior region of the thigh. Its fibular division supplies the muscles of the external region of the leg, the muscles of its anterior region, the integuments; also of the external region of the leg, and of the dorsal region of the foot. By its tibial division it supplies branches to all the muscles of the posterior region of the leg, the integuments of the inner and outer side of the heel, and of the external dorsal region of the foot. Moreover, by the internal plantar nerve, which is a branch of the posterior tibial, it supplies branches to the flexor brevis communis, to the two first interosseal, and to the two first lumbricales, to the integuments of the internal plantar region, and the digital branches of the first, second, third, and one side of the fourth toe. The external plantar, which is also a branch of the tibial, furnishes filaments to the muscles of the external plantar region, to the flexor accessary, to three interosseal, and two external lumbricales, to the abductor pollicis, and transversus pedis, to the integuments of the external plantar region, and finally, the digital branches to the fifth toe, and to one side of the fourth.

592. Of the Cranial Nerves. The cranial nerves pass through the foramina at the basis of the cranium. Willis reckon-

ed nine pairs, reckoning them in their numerical order, proceeding from before backwards, commencing with the olfactory, and terminating with the hypoglossal. This method is generally adopted, but all the nerves have other names, which we shall notice in speaking of the individual pairs of nerves. The modification introduced by Soemmering was not a good one. The analogy between the greater number of the cranial nerves, and the spinal nerves, is admitted to be very great.

593. First Pair, or Olfactory. These nerves, if they really be so, come from or communicate with the anterior lobes of the brain, at the base of the fissure of Sylvius, and in front of the *substantia perforata ;* one of its roots has been supposed to come from the middle lobe. After passing under the inferior surface of the anterior lobes of the brain, these nerves approach each other, and form on the cribriform plate of the ethmoid *a bulb*, from which the true olfactory filaments descend to the pituitary membrane of the nose.

594. Second Pair, or Optic Nerves. These commence in the *corpus geniculatum externum*, and therefore from the thalami optici : they afterwards decussate, and form the *chiasma ;* diverging from this, they enter the orbits by the foramina optica, to form ultimately the retina of each eye-ball.

595. Third Pair, or Oculo-motorii Communes. These nerves arise by five filaments from nervous cords intermediate to the *crura cerebri*, and from a little fossa between the pons and the tubercula mamillaria. Their course to and in the orbit has been particularly described. It sends branches to all the muscles of the eye-ball, excepting the trochleator and rectus externus. It also sends a remarkably strong branch to the lenticular ganglion.

596. Fourth Pair, or Pathetic. These nerves come from the sides of the valvule of Vieussens, and after sending a branch to the lachrymal nerve, supply the trochleator muscles.

597. Fifth Pair, or Trifacial, is a double nerve having a motor root, and a sentient or ganglionic root. The larger or sentient root, composed of nearly 100 filaments, arises from the external side of the olivary body, or in other words may be traced through the protuberance into the medulla oblongata. The origin of its motor root has not been well made out. Within the cranium, the fifth has a ganglion upon its sentient or larger root, (ganglion of Casser), the anterior root passing over the ganglion, but not uniting with it ; the nerve then subdivides into its three great divisions, viz. the ophthalmic, superior maxillary, and inferior maxillary. 1°. The *Ophthalmic* gives off the following branches, lachrymal, frontal, nasal ; connected with the nasal is the lenticular ganglion. 2°. The *Superior Maxillary* sends off an orbitar branch ; the nerves which are connected with the ganglion of Meckel, viz. the palatine, spheno-palatino and vidian ; the posterior and anterior alveolo-dentar ; finally, a few filaments encircling the internal maxillary artery. The superior maxillary nerve terminates by becoming the infra-orbital. All the branches of the ophthalmic and

superior maxillary are supposed to be sentient nerves. 3°. The *Inferior Maxillary* combines both motor and sentient filaments, because the motor roots, discovered by Palletta, join with it inseparably, and contribute to form it: the branches of the combined nerve are, three external branches, viz. the profound temporal, the messeteric, and buccal; *one posterior*, the internal pterygoid; *two inferior*, the lingual and *the inferior dentar*; finally, the *otic ganglion* is placed on the trunk of this nerve.

598. Sixth Pair, or External Motor, arises from the furrow separating the pons from the medulla oblongata; it is distributed ultimately to the rectus oculi externus.

599. Seventh Pair, (Portio Dura and Portio Mollis), is evidently formed of two distinct nerves. *The Facial* or *Portio Dura* is evidently a nerve of motion. It comes from the anterior and inferior part of the restiform bodies, and, according to some, from the fasiculi innominati which lie between the corpora restiformia close to the posterior median fissure of the medulla oblongata. The nerve passes into the meatus internus, and through its cribriform plate into the canal of Fallopius: it here receives the vidian, and whilst in the canal, gives off the corda tympani. Whilst in the meatus internus, it receives some branches from the auditory nerve, or portio mollis of the seventh. Having left the canal by the foramen stylo-mastoideum, it gives off the following branches: posterior auricular and styloid, next its terminating branches, or temporo-facial branch, and cervico-facial branch. These spread out upon the face, having passed through the parotid gland. The facial nerve supplies branches to all the cutaneous muscles of the cranium and face, or muscles of expression; also some cutaneous branches; lastly, forms numerous anastomoses with the branches of the fifth pair. *The Auditory Nerve*, or *Portio Mollis*, is distributed in an especial manner to the labyrinth of the ear. (The exact anatomy of these roots which lay between the auditory and facial, and which seem to come from the glosso-pharyngeal, or nervus vagus, have never been very accurately determined.)

600. Eighth Pair or Pneumo-Gastric, comprises three divisions: The Glosso-Pharyngeal; Nervus Vagus; and Spinal Accessory. In one sense they are all distinct nerves. 1°. The *Glosso-Pharyngeal*; and, 2°. The *Pneumo-Gastric* or *Vagus* have a common central origin from the *corpora restiforma*. 3°. The central origin of the *Spinal Accessory* is from the lateral parts of the cervical region of the medulla, between the posterior and anterior roots of the spinal nerves, and behind the ligamentum dentatum. In leaving the cranium by the foramen lacerum posterius, the glosso-pharyngeal is most anterior, and has a separate sheath; the pneumo-gastric and spinal accessory pass together.

The *Glosso-Pharyngeal* has on it a ganglion (of Andersch) as it passes through the foramen lacerum, always more distinct on the lower animals than in man;* the ganglion occupies a small

* For this and other reasons which need not be mentioned here, we have uni-

depression in the pars petrosa of the temporal bone, (receptaculum gangli petrosi). After this, the nerve descends into the neck, between the stylo-glossus and stylo-pharyngeus, and proceeds to the mucous membrane of the tongue. In its passage it furnishes, 1°. The branch of Jacobson, connecting the glosso-pharyngeal with the superior cervical ganglion, the spheno-palatine and the otic. 2°. An anastomosing branch with the facial. 3°. A communicating branch to the spinal and nervus vagus. 4°. A muscular branch to the digastric and stylo-pharyngeus muscles. 5°. Carotid filaments. 6°. Pharyngeal branches to the superior and middle constrictors. 7°. Tonsillar branches 8°. Lingual branches. These all proceed to the mucous membrane only.

The *Pneumo-gastric*, or *Nervus Vagus*, in passing through the foramen lacerum, forms a ganglion,* (ganglion of the pneumo-gastric :) the spinal accessory unites with the nervus vagus beyond the ganglion. From the ganglion proceeds an anastomosing branch to the facial ;† this branch lies in the jugular fossa. The pneumo-gastric next receives an anastomosing branch from the spinal accessory ; it is connected also with the hypo-glossal, with the glosso-pharyngeal, and with the sympathetic. In the neck, the pneumo-gastric is situated in front of the vertebral column, between the deep carotid and internal jugular, and in the sheath of these vessels. In its course it furnishes, 1°. The nervus pharyngeus forming the *pharyngeal plexus*. 2°. The *superior laryngeal nerve ;* this nerve is distributed to the mucous membrane of the larynx, and to the crico-thyroideus muscle ; it seems also to send a filament to the arytenoid muscle. 3°. The cardiac branches of the pneumo-gastric vary in number : they leave the trunk of the pneumo-gastric at different heights, and join the proper cardiac nerves of the sympathetic. In the thorax the pneumo-gastric gives off the inferior laryngeal or recurrent ;—a cardiac branch ;—tracheal or pulmonary branches ;—and œsophageal branches ; also the anterior and posterior pulmonary plexus. The recurrent or inferior laryngeal nerves winds around the arch of the aorta on the left side, and around the sub-clavian artery on the right side, and proceed upwards to the larynx. They are distributed, 1°, to the gullet, trachea, and to the inferior constrictor of the pharynx : 2°, to all the muscles of the larynx, excepting the crico-thyroid and the extrinsic muscles. The *anterior pulmonary branches* in front of, and crossing the bronchial and pulmonary arteries and veins, are usually called the anterior pulmonary

formly maintained the opinion that the glosso-pharyngeal nerve is in man merely a *rudimentary nerve*, and that its functions must be sought for in the lower animals ; in fishes, for example, it obviously is the *nerve of the gills ;* in them, therefore, the pneumo-gastric division is probably merely *gastric*.

* When the author of this work shewed the ganglion of the pneumo-gastric to Dr. Spurzheim in Paris in 1821, its existence was not generally admitted. Vieussens alludes to it.

† This branch is remarkably large in the horse, and explains perfectly why the facial nerve should sympathize with the lungs, and sets aside in some measure the hypothesis of Sir Charles Bell regarding the respiratory nerves of the face.

plexus. A more numerous set of filaments proceeding behind the bronchial tubes, assist in forming the posterior pulmonary plexus. The greater number of the branches from these plexuses follow the bronchial tubes into the lungs. The nervus vagus next gives off numerous œsophageal branches, and then proceeds into the abdomen by the œsophageal orifice of the diaphragm. The right is posterior, the left anterior to the gullet. These nerves supply numerous filaments to the stomach, but it is a great error in physiologists to suppose that they are limited to this; on the contrary, the right constitutes one of the great origins of the solar plexus; the left sends numerous branches to the liver.

The *Spinal Accessory* arises, as mentioned, from the spinal marrow, and proceeds into the cranium by the foramen magnum of the occipital bone; it afterwards leaves the cranium by the *foramen lacerum posterius*, and unites intimately with the pneumogastric. The nerve is ultimately distributed to the sterno-mastoid, the trapezius, and to the pharynx, and in our opinion forms a great part of the superior laryngeal nerve. It has been also called the *superior respiratory nerve of the trunk.*

601. The NINTH PAIR, or HYPO-GLOSSAL, arises from the furrow between the anterior pyramids of the olivary bodies of the medulla oblongata; it seems certain that the filaments of origin do not come from the pyramids. The hypo-glossal leaves the cranium by one or two divisions passing through the foramina condyloidea anteriora; they descend vertically in the neck between the internal carotid artery and internal jugular vein; its farther course in the neck has been already described. It anastomoses with the nervus vagus, the superior cervical ganglion, and with the first and second pairs of cervical nerves, afterwards with the ramus gustatorius of the fifth. It sends off, 1°, the ramus descendens, which forms a real plexus by means of its anastomoses with the first, second, and third pairs of cervical nerves; 2°, a small muscular branch; 3°, branches to the hyo-glossus and stylo-glossus. From the plexus formed by the descendens noni, branches proceed to the omo-hyoideus, thyro-hyoideus, and sterno-hyoideus. The ninth pair ultimately terminates in the intrinsic muscles of the tongue.

602. The GREAT SYMPATHETIC. A very extended view of this system of nerves is not necessary here, inasmuch as each portion of it must already have fallen under the student's attention repeatedly whilst dissecting the head and neck, the thorax and the abdomen. But it would undoubtedly be highly advantageous for the more advanced student to dissect this system of nerves upon a young subject, giving to it for the time his exclusive attention; under these circumstances the following summary may be found useful to the dissector, who by this time cannot require any particular directions for tracing the nerves. The great sympathetic, called also *System of the Ganglions, System of the Nerves of Organic or Nutritive Life, Vegetative System of Nerves,* extends on each side the vertebral column, from the first cervical vertebra to the last

sacral or even coccygeal; it extends also forwards quite to the orbits.* It is composed of two extended cords (on each side), interrupted frequently by ganglions placed upon them. These cords then, are formed of ganglions, and of their communicating branches. From these ganglions arise filaments which unite with most of the anterior branches of the spinal nerves, and more especially with the motor roots of the nerves, but according to some with both sets of roots, and they send numerous branches to most of the thoracic and abdominal viscera.

Cervical Portion of the Great Sympathetic. The *Superior Cervical Ganglion* situated in front of the second and third cervical vertebræ, and upon the rectus anticus muscle: from this ganglion a branch passes upwards into the carotid canal; this branch divides into two just as it enters the canal, and by their interlacing, forms a *plexus* in the cavernous sinus, whence proceed branches to the sixth cranial pair always, and sometimes to the fifth. The same branch sends a filament to the vidian, and thus reaches the ganglion of Meckel, for both branches of the vidian come from the ganglion of Meckel. This branch is called the inferior branch of the vidian. The cavernous plexus is situated to the inside the carotid artery as that vessel is about to enter the cavernous sinus. From this plexus arise filaments which may be traced to the third pair, to the lenticular ganglion, to the fifth pair, and finally those which accompany the carotid artery. From the superior cervical ganglion, pass its anterior branches communicating with the glosso-pharyngeal and pneumo-gastric nerves, and with the hypo-glossal. By its external branches this ganglion communicates with the first, second, and third pairs of cervical nerves. By its inferior branch descending in the neck behind the great vessels and inferior thyroid artery, it communicates with

The *Middle Cervical Ganglion*. Its internal branches are divided into those following the branches of the external carotid artery and visceral branches, viz. the pharyngeal branches, the laryngeal and the *cardiac*. The middle cervical ganglion is frequently wanting, in which case the ramus communicans goes on the inferior cervical ganglion. Haller called the middle cervical ganglion *Thyroid*, in consequence of its being generally placed in close union with the inferior thyroid artery. When this ganglion exists, it communicates of course with the one above, and the other below it: externally with the third, fourth, and fifth cervical pairs of nerves. Internally it gives of the *middle* or *great cardiac* nerve of Scarpa.

The *Inferior Cervical Ganglion* is very constant, and belongs as much to the thorax as to the neck, it being placed in front of the transverse process of the seventh cervical vertebra, and the head of the first rib, and behind the origin of the vertebral

* M. Cruveillhier does not admit a *cephalic* portion, but this idea is unphilosophical, and very probably incorrect.

artery. Besides the rami communicantes it gives off a branch following the vertebral artery; it communicates with the sixth, seventh, and eighth cervical pairs, and sometimes with the first dorsal. Other branches pass in front of and behind the subclavian artery, forming a nervous ring or loop; these join first the thoracic ganglion; finally, it usually gives off the *inferior cardiac nerve.*

CARDIAC NERVES AND PLEXUS. Before proceeding to the dissection of the thoracic portion of the sympathetic system, the dissector may follow the vertebral and the cardiac nerves. Trace the *Vertebral Nerve* through the canal for the vertebral artery which it follows. M. Cruveillhier thinks that this filament connects the inferior cervical ganglion with the third, fourth, and fifth pairs of cervical nerves. The *Cardiac Nerves, right* and *left*, arise from the cervical ganglions; they are joined by some delicate filaments from the pneumogastric. If traced into the thorax they will be found placed upon the origins of the pulmonary artery and aorta, there forming the *cardiac plexus*, from which proceed the coronary plexus, following the course of the coronary arteries, and after leaving these distributed to the muscular tissue of the heart. These nerves present remarkable varieties. The right superior cardiac nerve is usually placed behind the common carotid artery, and descends, crossing the inferior thyroid, next penetrates into the thorax behind, but sometimes in front of the subclavian artery; follows the course of the brachio-cephalic artery, and thus reaches the posterior surface of the arch of the aorta. Here they anastomose with the left cardiac nerves, and then join the cardiac plexus. The *middle cardiac nerve* of the right side arises from the middle cervical ganglion when present, and when absent from the cord of the sympathetic itself, often the largest of the cardiac nerves; it proceeds to join the cardiac plexus. The *inferior right cardiac nerve* comes from the inferior cervical ganglion, accompanies the middle cardiac, and descending with it in front of the trachea, terminates in the cardiac plexus. The left cardiac nerves differ a little in their arrangement from the right cardiac, but not in any essential points. In the cardiac plexus, which some divide into an anterior and posterior, there is generally found a ganglion or two; they are placed chiefly between the aorta and the right branch of the pulmonary artery.

603. The THORACIC PORTION of the GREAT SYMPATHETIC consists of twelve ganglia and their filaments of communication. The cord thus formed on each side of the thorax, external to the pleura, crosses in its course the heads of the ribs, communicating above with the last cervical ganglion, and below with the first lumbar. The intercostal arteries and veins pass behind the cord, and the azygos vein runs parallel with it. The branches proceeding from this portion of the great sympathetic are *external* and *internal.* The external are generally two for each ganglion, which it receives from or sends to the dorso-spinal (intercostal) nerves; the *internal* branches of the second, third, fourth, and fifth of the

thoracic ganglions proceed either to the walls of the aorta or to the pulmonary plexus; the *internal* branches of the sixth, seventh, eighth, ninth, tenth, eleventh, and twelfth unite to form the *splanchnic* nerves, these are usually two on each side, a large and small. The larger is formed by branches from the sixth, seventh, eighth, and ninth, but sometimes also from the fourth and fifth thoracic ganglia; these unite to form a considerable trunk, which after descending in a sloping manner over the sides of the vertebræ, the vena azygos and thoracic duct, get into the lower part of the posterior mediastinum, and pass through the diaphragm generally by an opening peculiar to themselves, and getting into the abdomen, join the semilunar ganglion. The smaller splanchnic follows pretty nearly the same course, but generally joins the renal plexus. The semilunar ganglion and solar plexus, although placed in the abdomen belong in an especial manner to the thoracic portion of the great symphatic. The ganglia composing the plexus are placed in the middle plane of the body around and upon the cœliac artery and above the pancreas. Both the great splanchnics proceed into its larger portion, usually called semilunar ganglion. Its form is so irregular as to defy description. From the solar plexus proceed as from a centre, *plexuses* following the course of the following arteries; Diaphragmatic, Cœliac, dividing into coronary, hepatic and splenic; Superior Mesenteric, Inferior Mesenteric.

604. LUMBAR PORTION of the GREAT SYMPATHETIC. The lumbar ganglia are four or five on each side, placed upon the sides of the bodies of the lumbar vertebræ, and to the inner side of the psoas. They of course all communicate with each other, and with the last dorsal and first sacral ganglion. They have also *external* and *internal* branches. The *external* hold the same relation to the lumbo-spinal nerves, as the external branches of the thoracic ganglia do to the dorso-spinal nerves. The *internal* branches assist in forming the inferior mesenteric plexus, and moreover constitute the aortic plexus, also the hypogastric plexus. There are two *hypogastric plexuses* a right and left. They occupy the lateral and inferior part of the rectum and bladder in man; and of the rectum, vagina and bladder in woman. These plexuses (hypogastric) receive filaments from several other sources, and in an especial manner from the anterior branches of the sacro-spinal nerves; and from these are given off the following secondary plexuses following the course of the arteries, viz. hæmorrhoidal, vesical, vaginal, uterine, testicular and ovarian.

605. The SACRAL or PELVIC PORTION of the GREAT SYMPATHETIC. This consists of a series of ganglia and their connecting filaments, placed in front of the sacral vertebræ, and behind the rectum, generally four in number on each side; the system usually terminates by an anastomoses between the right and left sympathetic cords on the anterior surface of the first coccygeal vertebra; at the point of union there is usually placed a small ganglion, the *ganglion* impar. The sacral ganglia in respect to their branches, resemble the other portions of the system.

PART XI.

OF THE ORGANS OF SENSE.

606. THE ORGANS OF SENSE (*instrumenta sensuum*) are five in number, viz. Skin, *Touch*; Tongue, *Taste*; Nose, *Smell*; Eyes, *Sight*; Ears, *Hearing*. They are the instruments which put man in relation with the external world, and make him acquainted with the properties of matter. They are, in short, the means by which we acquire all our knowledge, and without them there would be no intellect.

606. SENSE OF TOUCH. THE SKIN, or common external INTEGUMENTS of the body, is an extremely complicated membrane, of great extent, continuous with the mucous membranes, or internal integuments as they are sometimes called, at the mouth, anus, genito-urinary organs, &c. Its correct analysis was first made by Malpighi. The older anatomists used to commence their descriptions of the human structure with it. The skin is both a sensible and a protecting membrane. It is an organ of perspiration, of secretion of some peculiar fluids, and moreover, as some think, of inhalation. Thus, performing so many distinct functions, it cannot but be very complex in structure. The integuments present two surfaces, a free or external, and a fixed, adherent, or internal. Upon the *free surface* may be observed, 1°. folds and furrows. 2°. A colour varying according to the races of men. 3°. Horny appendages, as nails and hair. 4°. Small openings, by which escape the various products of secretion, and particularly the products of the sebaceous crypts and the inhaled fluids, also for the passage of the hairs. By detaching the skin we expose its *fixed surface*. Beneath it, in some places, there are cutaneous muscular fibres, such as the palmaris brevis, latissimus colli, &c. but there is not properly any muscular layer belonging to the integuments in man, as in so many animals, in some of whom it forms nearly the whole of their muscular system. But there is beneath the skin a considerable layer of adipose tissue (*panniculus adiposus*) remarkable in children of both sexes, and in women. This cellular and adipose layer has been called in most parts of the body the *superficial fascia*. The adipose tissue is not present however in all parts, being wanting under the skin of the eyelids, the penis, &c. This superficial fascia may be considered as an integral part of the skin, since it can scarcely be entirely separated from it. In it are lodged in various regions, large superficial cutaneous veins and nerves. It connects the true skin external to it, with all the parts which lie deeper, so that upon its integrity the life of the skin in a great measure depends. It is by its adhering surface, therefore, that the skin receives its blood vessels and nerves.

These are extremely numerous. The cutaneous bursæ are found in this structure.

608. *Structure of the Skin.* A section of the integuments made with a sharp knife, and then inspected with a good glass, will shew more or less clearly the following parts, some of which however rest for the proofs of their existence, not so much on *intuitive evidence*, as on experiment and analogical reasoning. 1°. The *Dermis*, (*cutis vera*, *true skin*, or *chorion*.) 2°. The papillæ, covering its surface. 3°. and 4°. The Rete Mucosum of Malpighi, admitted to be composed of two parts, viz. the pigmentum and mucous layer. 5°. The Epidermis, cuticle or scarf skin. As accessory parts there are the nails and hair, sebaceous follicles, vessels, and nerves. The *Dermis* is the strongest and fundamental part of the integuments. It is extremely dense in some parts of the body, and thin in others. It also varies in individuals and the sexes. It becomes extremely thin in old age. The texture is difficult to describe, being composed of fibres intimately interlaced, and may be reduced to gelatine by boiling. Its elasticity seems to depend more upon the peculiar arrangement of its fibres, than upon its intimate nature. The papillæ seen upon its external surface may be examined in the palm of the hand, or sole of the foot, either before or after removing the epidermis and rete mucosum. This is done by maceration and slight putrefaction. The dermis thus deprived of its epidermic parts, should then be examined under water, and with a good glass. Little is known of the intimate structure of the papillæ, but they are admitted by all to be eminently vascular, and to be well provided with nerves. The colour of the dermis is white in the whole human race.

Of the Lymphatic Net Work of the Dermis. An extremely fine net work of lymphatic vessels was proved by Mascagni to occupy the surface of the dermis, nearest to the epidermis, and a deeper one nearer to its adherent surface. This network of lymphatic vessels may be injected by puncturing the skin with a lancet very obliquely, so as to raise the epidermis, and then inserting the tube containing some quicksilver, the metal will occasionally penetrate these vessels, and ultimately inject in this way even the deep lymphatics of the body. These injections have tolerably well established the following circumstances. 1°. The lymphatic net-work is more superficial than the other vessels, and is quite independent of them. 2°. Its vessels present dilatations here and there, and they have no valves. 3°. They do not open externally.

Epidermic Parts. The parts external to the dermis were divided by Malpighi into two, viz. the rete mucosum and scarf skin, or epidermis. They were afterwards subdivided into four or more layers, by Gaultier and others. More lately they have been all reunited under one, by the name of "*epidermic parts*," and this perhaps is upon the whole the best arrangement. In the meantime it may be useful, were it only for the sake of description, to speak of them as composed of, 1°. A pigmentum. 2°.

The mucus of Malpighi. 3°. The epidermis. It is on the skin of the negro that we see the pigment easiest. The student therefore must examine this part in the anatomical museum of his teacher. The pigment which is found in all persons, excepting Albinos, is composed of small dark molcules, which some have thought scaly. They are insoluble in water, and are absolutely inorganic. The glandular structure supposed to secrete the pigment, has as yet only been seen in the integuments of the whale.

Of the Mucous Tissue of Malpighi. This is situated between the dermis and epidermis, and the pigment is deposited in it. Malpighi called it *Reticulum*, but it is doubtful if it be a network; it resembles concrete mucus, and is probably inorganic; it must have a number of openings through it for the passage of filaments going to or coming from the epidermis which lies upon it. Many anatomists consider the reticulum of Malpighi as a part not demonstrable anatomically, and as being merely the inner layer of the epidermis. There can be no ser ous objection offered to this view, which accords best with the structure of the integuments of the whale; but it is to be observed, that it is by no means difficult to shew a distinct layer in the negro skin, between what is usually called the epidermis and the dermis. This layer is very dark, and must therefore be what Malpighi understood by "pigment and reticulum." Some have supposed that this layer is the usual seat of the morbid growth called "corns." This, however, seems to be a mistake.

The *Epidermis* is not organized. It is a product of secretion, a kind of concrete mucus or horny substance, very hygrometric, easily restored when lost in the living body. Its texture has often been said to be scaly, but this is very doubtful. In the whale, and as some think in man himself, it seems composed of tubes or *sheaths*, united to each other, and each covering one of the nervous papillæ of the dermis; the organs which form it are not understood: being totally insensible, it resists the absortion of any gases or fluids through it, unless mechanically introduced beneath it. The nature of the filaments passing from the subjacent parts to it, and which may readily be seen by merely raising it up, is equally unknown. Its utility in preserving the body soft and pliable may be well observed in practical rooms for anatomy, those parts of the subject uniformly drying up, and becoming speedily unfit for dissection wherever the epidermis has been rubbed off and lost. In respect to colour, it is slightly tinged in the negro; its inner surface is marked with a number of hollows, which received the nervous papillæ of the dermis. The epidermis is in fact moulded upon these, and furnishes to each of them a sort of short tube: this, of course, is best seen on the extremities of the fingers and toes, where these papillæ are most highly developed. The epidermis attains to a great degree of thickness, where it is most exposed to pressure, as in the palms of the hands and soles of the feet. The extent to which it may be traced inwards upon the mucous membranes towards the interior of the body has never yet been fully determined. It is generally supposed to proceed as far as the cardiac orifice of the stomach; it passes into the meatus auditorius externus, and is reflected over the integument covering the membrana tympani; this is easily proved by maceration. It may be traced a short way into the rectum.

The *Nails and Hair.* The consideration of the structure of the nails and hair appertains more to the "anatomy of tissue," or "general anatomy," to which the student is therefore referred for more extended details.* The *Nails* are hard, flexible, elastic, and semi-transparent, of a horny nature. They occupy the dorsum of the last phalanges of the fingers and toes, and serve, perhaps, to protect the elastic cushion or pulp, placed upon the palmar aspect of the same phalanges. The integument covering this elastic cushion is the proper instrument of *touch*. Each nail presents a root, a body, and a free part. The root is entirely concealed. Make a vertical, and longitudinal section of the great toe to see this, and to study the structure and connexion of the nail generally. This shews that the root is the thinnest part of the nail, and is slightly toothed or notched. A very thick *dermis* separates the nail from the rest of the phalanx, which being very white, especially near the root, forms what is called the *lunula;* this dermis is very vascular. By maceration of a finger in water, it will be found that the nail and epidermis separate together from the outer parts; their intimate union and relations can be well studied upon a preparation of this kind. The nails are formed much after the same mode as the teeth: they are totally insensible, and have neither vessels nor nerves. The *Hairs* are also a kind of epidermic production, quite insensible and inorganic. They present remarkable differences in the human races. Their examination can only be made with the aid of the microscope. The following parts may be thus made out: 1°. The *bulb* or *follicle* implanted generally below the dermis in the subcutaneous cellular tissue. This is the formative organ of the hair. This bulb contains a pouch (membrana bursalis) and a papilla; from the surface of the papilla, and exactly moulded upon it, grows the horny sheath or stalk, *i. e.* the hair. The hairs are formed thus by successive cones pushing up the preceding ones, in the same manner probably as feathers. The stalk or hair itself is merely a product of the organization; examined microscopically the external or horny layer is considered as colourless, and filled with a coloured marrow or medulla. It appears not to be canaliculated.

609. Sense of Taste. The Tongue in structure strongly resembles the common integuments. The sense of taste is supposed to reside in the nervous papillæ of the organ. The *special nerve* of this sense has not been altogether demonstrated. The papillary membrane adheres closely to the muscular surface, and is constantly moist. In this membrane exist, as Malpighi first shewed, all the

* Beclard, Meckel, Muller, Grainger, &c.

elements of the skin. 1°. A chorion. 2°. The papillæ, which receive numerous nerves and blood-vessels. 3°. A lymphatic net work. 4°. According to Malpighi, a *reticulum* or rete mucosum; its presence is denied by some anatomists. To this may be added, in the tongues of certain animals, a pigment. 5°. An epidermis. Albinus called this the *periglottis*. Most of these parts may be made out by examining sections of the tongue with a good lens. The nerves of the tongue are very numerous, and yet it is not an acutely sensible part. On each side it receives the ninth or hypoglossal, the glosso-pharyngeal, and the lingual branch of the inferior maxillary. The functions of these nerves have not been fully ascertained; it appears tolerably certain, however, that the hypoglossal is the nerve of motion.

610. SENSE OF SMELL. The Nose, the instrument of this sense may be divided into two parts; 1°. An external apparatus, properly called *Nose*, and presenting a *base*, *dorsum*, *lobe*, and *root*. 2°. The nasal fossæ and pituitary membrane. The frame-work of the nose is osseous, cartilaginous, and fibrous. The osseous parts have been already carefully described; the cartilaginous part when cleared of the integuments, consists of. 1°. The lateral cartilages and cartilage of the septum. 2°. Cartilages of the nostrils; usually reckoned five in all. The more accurate Santorini reckoned them as nine. The *fibrous* part is a fibrous plate, filling up the intervals between these cartilages. The skin covering these cartilages is remarkable for the number of sebaceous follicles it presents. The pituitary membrane may be readily displayed by a vertical section of the cranium and face, made on either side of the crista galli and vertical plate of the ethmoid. The membrane thus displayed is a fibro-mucous membrane, investing the nasal fossæ throughout their whole extent, and prolonged into the various sinuses in communication with the nasal fossæ. These sinuses are in fact appendages of the fossæ. When thus covered by the pituitary membrane, the nasal fossæ present a very different appearance from what they did in the skeleton, in consequence of so many foramina being either closed up or concealed. It may be advantageous, however, to re-examine the meatuses (three in number) of each nostril, and to observe the peculiar appearance of the entrance of the various sinuses and canals into these passages. Connected with the superior meatus are the openings of the posterior ethmoidal cells and sphenoidal sinus: into the middle meatus enter the orifice of the maxillary sinus and of the infundibulum, but to see these, and particularly the orifice of the sinus, either the middle turbinated bone must be forcibly raised up or cut through, or the outer wall of the antrum must be taken off with the chisel and mallet or saw. The orifice of the sinus, is large in the skeleton, but, when the soft parts are present, a mere slit. Lastly, into the inferior meatus there enter the nasal duct anteriorly, whilst posteriorly, but at a short distance, will be found the pharyngeal orifices of the Eustachian tubes which lead into

the cavity of the tympanum. The pituitary membrane is eminently vascular; a layer of lymphatic vessels is said almost to form its free surface, beneath which is a net-work of veins; these do not communicate with each other. The nerves it receives are of two kinds, viz. the branches of the olfactory, or first pair, and the nasal branch of the ophthalmic. Other branches of the fifth pair also proceed to it. The pituitary membrane is continuous with the integuments at the anterior nares, and with the mucous membrane of the pharynx, and velum palati posteriorly. It further presents at many of the orifices of the canals and sinuses, slight folds, which further contribute to narrow these apertures. The application of leeches to the pituitary membranes is one of the most powerful means for relieving deep inflammation of the nose, &c.; its veins are so numerous as to give it even the appearance of an erectile tissue.

611. SENSE OF SIGHT. The student seldom think of examining the human eye whilst in a fresh condition, resting content with dissecting those of sheep and oxen. This, however, is a great error, inasmuch as the eyes of these animals differ in a great many respects from the human. It is, in like manner, a serious error in studying the eye to endeavour to "get it up," (this is the phrase) from diagrams. No correct ideas whatever can be acquired in this way of any structure, human or comparative, and the *terms* or names of parts learned after this fashion are uniformly found to escape the memory in a few weeks. The student should if possible dissect the human eye, to which the following anatomical remarks almost exclusively apply. Remove the globe of the eye from the orbit, and carefully dissect from it the muscles, vessels, &c.; leave the optic nerve attached to it; by this dissection the student will have exposed the following tunics, viz. the tunica sclerotica and the cornea; the tunica conjunctiva oculi has been already described in speaking of the lachrymal passages. (546.)

The *Ball of the Eye* has not the same direction as that of the orbit, its axis being that of the other eye. Viewed in profile, it appears composed of two distinct portions of a sphere of different diameters united to each other; the anterior segment has the smallest diameter. The eye-ball is moved by six muscles already described; it is further covered anteriorly by the tunica conjunctiva which probably passes over its whole anterior surface.

The *Sclerotica* is a fibrous membrane of great strength, thinner anteriorly than posteriorly; the tendons of the recti muscles serve to add to its strength. To examine the inner surface of the tunica sclerotica, the membrane must be cut through cautiously with a sharp knife, and an opening having been made into it, introduce a pair of probe-pointed scissors underneath, and cut through the sclerotic all round the eye-ball, next reflect the posterior segment towards the optic nerve. This dissection exposes the greater part of the choroid, the ciliary nerves and vessels, and their passage through the sclerotic. The inner surface of the sclerotica is lined by the choroid to which it is feebly connected throughout the greater part of its extent by sheaths of cellular tissue enclosing the ciliary nerves and vessels. Behind, the sclerotica is perforated by a rounded opening for the passage of the optic nerve, the central artery of the retina and its vein. Anteriorly, the transparent cornea is strongly attached to the sclerotica. The mode of attachment differs in different animals; in man it is a simple bevelling at the expense of the inner part of the sclerotic and outer part of the cornea. The sclerotic adheres very intimately and strongly to the choroid by means of the ciliary ligament or annulus albus which will be presently described. Before examining the choroid, ciliary nerves, &c. proceed with the examination and dissection of the *cornea.* Dissect off the cornea by pushing the probe-pointed scissors under it into the anterior chamber of the aqueous humour and in front of the iris; in doing so the aqueous humour escapes, but this does not interfere with the view of any of the parts. Cut the cornea across, and take it off in two portions, tearing through at the same time the adhesion of the annulus albus to the sclerotica; or by gently detaching the annulus albus from the inside the sclerotica, the cornea may be removed entire, leaving for examination the following parts, viz. the choroid and its vessels, and the ciliary nerves; the annulus albus and the iris.

The *Cornea* is perfectly transparent, nearly circular, anteriorly convex, posteriorly concave, thicker than the sclerotica, but composed of six laminæ of great strength, having a serous fluid interposed. Its anterior layer is probably formed by the tunica conjunctiva; its posterior by the membrane of the aqueous humour. When the cornea is punctured, this humour escapes. It is thought to contain neither blood-vessels nor nerves.

The *Choroid* is a dark brown membrane, soft, cellular, and extremely vascular; it is situated betwixt the sclerotica and the retina, and anteriorly is continuous with the iris, which seems to be a modification of the choroid. Posteriorly, the optic nerve usually perforates it by a number of openings; anteriorly the annulus albus is strongly fixed to it and to the iris, and thus connects the one directly, and the other indirectly to the sclerotica; internally the membrane forms upon it the ciliary processes, and being continued forwards, constitutes the layer of the iris called the uvea. The dark substance called the pigmentum nigrum forms a coating for the choroid externally and internally; this pigment seems also enclosed by a distinct but extremely delicate membrane, at least in some parts. The arteries of the choroid are mostly external; the veins called *vasa vorticosa,* are mostly internal; the division into two layers by Ruysch is perfectly artificial.

The *Ligamentum Ciliare, Annulus Albus,* or *ciliary ligament* is a white or grayish ring situated between the sclerotica, the iris, and the choroid, which it connects together. Its texture is analogous to the iris; most of the ciliary nerves pass through it, but some filaments remain in it. Its uses are in some measure unknown, although it obviously serves the purpose of a ligament, which may be one of its uses. The true ciliary processes of the choroid correspond to its inner side, but are not in contact with it.

The *Iris* is a moveable curtain floating in the aqueous humour; the rounded opening in its centre is the pupil. It thus separates partially the *anterior* chamber of the aqueous humour from the *posterior*. The pupil varies almost every instant during the waking state, becoming smaller when the eye is exposed to a strong light, and larger as the light becomes obscure; from this has been *inferred* the muscularity of the iris. Anteriorly the iris is invested by the membrane of the aqueous humour; its second layer is the true nervous and fibrous layer, which is also coloured; the third layer is the uvea, and the fourth the membrane of the pigmentum nigrum. The ciliary nerves are distributed chiefly to the iris; it is also very vascular. In the fœtus the pupil is shut up by a membrane (membrana pupillaris), discovered by Wachendor, and described with the greatest exactness by Dr. William Hunter: this membrane is double and vascular; it disappears generally about the seventh month of the fœtus.

Ciliary Processes. By removing a portion of the choroid and the iris, and immersing it in clear water, the *ciliary processes* may be next examined. They are vascular spear-shaped eminences of the choroid, placed anteriorly and upon the inner side of the choroid; externally they adhere firmly to the choroid, and seem to be but processes of it; internally each of them is united seemingly by a dove-tail, but at all events most intimately, with a similar number of *colourless ciliary processes*, forming appendages on the outer surface of the hyaloid membrane; these *colourless ciliary processes of the hyaloid* are also called the Zonule of Zinn, who first spoke of them, but did not understand their mechanism.* Besides this dove-tailing, or intimate union of the two sets of ciliary processes, the coloured and colourless, or the *choroidian* and *hyaloidian*, numerous blood-vessels pass from the one to the other. This is the reason why in the fresh eye these membranes adhere very intimately together, whereas, when the organ has been kept for a few days, they separate from each other with the greatest ease, because the *vascular* connexion has been loosened by putrefaction. This mechanism, which was first pointed out in the memoirs just referred to, has been altogether misunderstood even by the latest writers. Taken collectively, the choroidian ciliary processes are called the *ciliary body*. Anteriorly their extreme points float a little in the posterior chamber of the aqueous humour behind the iris. These bodies are extremely vascular, and full of pigment, which also stains the Zonule of Zinn, when the choroidian ciliary processes have been forcibly torn from it.

The *Retina.* To expose the retina, remove the choroid, the iris and ciliary processes, and immerse the eye in a tumbler full of clear

* See an account of this structure in the Trans. Royal Soc. of Edinb. vol. x. p. 1, by Dr. Knox.

water: (the inverted glass globe is not a convenient way of examining the structure of this interesting membrane.) The retina is a soft pulpy membrane, translucent, but of a slight greyish colour; many think that it is quite transparent during life. It extends from the termination of the optic nerve quite to the edge of the zonule of Zinn, and perhaps even further; it is composed of two layers, the inner called *vasculosa*, the outer *pulposa*. In compliment to Dr. Jacob of the royal college of surgeons of Dublin, a third layer, still more external, has been added, viz. *serosa*. It seems composed of a delicate filamentous tissue, not demonstrable unless the preparation is under water, but may in every instance be floated off the pulpy layer of the retina, by immersing the structures in clear water.

Central Spot. At about two lines to the outside of the junction of the optic nerve with the retina is a dark spot with a yellow margin, first discovered by Soemmering. Here the pulpy layer of the retina is deficient, and much interest has naturally attached to the discovery, inasmuch as this spot (foramen centrale retinæ), is actually in the axis of the eye-ball and of vision. It was supposed to be peculiar to man and apes, but this was disproved, and its presence in the eyes of the chameleon and certain lizards is undoubted.* After all, the structure may merely be a rudimentary structure, of a nature analogous to the divided retina in the eyes of fishes; for the eyes of birds and some fishes and reptiles have instead of a *mere foramen*, as in man and the chameleon, a *divided retina*, and occasionally also a *marsupium*. These peculiarities then in the human retina, discovered by Soemmering, may after all be merely rudimentary.

The *Aqueous Humour* cannot be exhibited like the other humours of the eye, as a distinct structure, but its history may be well enough understood by the following description. This humour is limpid and transparent, filling the two chambers from the cornea to the anterior surface of the membrane of the lens; the iris floats in it. It amounts to five or six grains. When left to itself it putrifies, thus showing the presence of some animal particles in it. The membrane of the aqueous humour has been already spoken of; the fluid is reproduced very readily when it has been evacuated by accident or by the surgeon. The remaining structures may now be removed from the interior of the eye-ball and examined. They consist of the following parts, 1. The lens or crystalline humour and its capsule, and the liquor Morgagni. 2. The vitreous humour and its capsule the tunica hyaloidea; the Zonule of Zinn; the Canal of Petit.

The *Vitreous Humour* or *Body*, is soft, transparent and tremulous; it resembles melted glass, and ought to be called *vitrine*; it is a semi-solid body. Anteriorly the lens and its capsule are lodged in a depression of the vitreous humour. The membrane investing it throughout is the *membrana hyaloidea*; this membrane is intimate-

* See Transactions of Wern. Soc., vol. v. part 1.

ly united to the capsule of the lens, thus connecting these humours together; anteriorly and externally its union with the choroid is equally intimate by means of the zonule of Zinn, which we have already explained to be a series of colourless ciliary processes, analogous to the choroidian ones, and with which they have a most intimate vascular union. The anterior concave surface of the vitreous humour is shut in by a layer of the hyaloid membrane, which however, does not adhere *at this point* to the capsule of the lens. The *canal* of Petit is formed by a splitting of the hyaloid membrane anteriorly for a short way into two laminæ. The outer is called the zonule of Zinn, or hyaloidian ciliary processes. The two layers unite after a very short course, and the membrane then unites to the equatorial margin of the lens. The *canal* which is irregularly swollen may be demonstrated by opening its outer layer with sharp scissors, and blowing air into it; when thus distended it resembles the colon in miniature. It is not unfrequently partially or entirely obliterated during life. In young persons a branch of the central artery of the retina runs through the centre of the vitreous humour, to be distributed upon the posterior surface of the capsule of the lens; but this vessel is afterwards obliterated.

The *Crystalline Lens* is a transparent solid body inclosed in a transparent capsule. To this capsule the hyaloid membrane adheres around the equatorial margin, and even perhaps passes over it. The lens has no connexion whatever with its capsule, so that on this being punctured the lens very readily escapes. In the adult the lens shews a central nucleus of much density, but its external layers are soft and viscous; it seems composed of concentric layers of a structure, but little understood, notwithstanding the ingenious researches of Dr. Brewster. It is this body, which becoming opaque, constitutes the cataract. The liquor Morgagni, interposed between the capsule of the lens, and the lens itself, is thought by some to be a *post mortem* appearance. In the event of the student not having an opportunity of dissecting the recent human eye, he must of necessity avail himself of that of the sheep, ox, or horse. All these differ in many respects from the human, but the principal points of difference undoubtedly are, the presence of the suspensory muscles, and of the coloured part of the choroid, called the *tapetum*. It is this peculiar coloration which causes the glaring of the eyes of the lower animals, and which of course does not take place in the human species.

612. SENSE OF HEARING. The *External Ear* (*Auricle*, *Pinna Auriculæ*), presents the following prominences and depressions. 1. The helix. 2. The grooves of the helix. 3. The anti-helix. 4. The fossa navicularis. 5. The tragus. 6. The anti-tragus. 7. The concha. 8. The lobe of the ear; all these parts are readily found out, and require no particular description here. The structure of the auricle is as follows:—The skin of this region is remarkably delicate; its sebaceous follicles

are numerous. A *cartilage* constitutes the basis of the external ear, and by its configuration forms the prominences and depressions just spoken of. No part of the cartilage enters the lobe. There are fissures in the cartilage minutely described by Santorini. The *ligaments* of the auricule are, a superior, an anterior, and a posterior; these are somewhat intermingled with the muscles of the ear. The *intrinsic* muscles of the ear which are very readily found in some persons, but not in others, do not require here any minute description; they are quite rudimentary, and are named, musc. tragicus; anti-tragicus; helicis major; helicis minor; transversus auriculæ. The *auditory canal* extends from the bottom of the concha to the cavity of the tympanum. It is formed by a prolongation of the cartilage of the concha, by a kind of fibrous membrane, and by a bony portion belonging to the temporal bone; it is lined internally by the integuments. In its cartilaginous portion there are fissures, incisuræ of Santorini, filled however with a fibrous cellular tissue. The *fibrous* portion of the canal completes it above and behind. The integuments proceed quite to the bottom of the passage, and cover the external surface of the membrana tympani. The *ceruminous glands* are met with under the skin at the upper and back parts of the canal. The *cerumen* secreted by these glands is a yellowish, thick, oily, and bitter fluid.

The Cavity of the Tympanum, or Middle Ear, merits from the anatomical student a very careful examination. The cavity of the tympanum may be laid open from without and from below, by removing the auditory canal and membrana tympani; or from above, by removing with a strong scalpel or chissel, its upper wall, which is merely the anterior part of the base of the pars petrosa; a fissure or kind of suture seen upon the cerebral aspect of the bone, between the squamous and petrous parts of the bone, points out where the removal of the bone should be effected. The outer surface of the mastoid process must be removed with the saw or chissel and mallet; this will expose the mastoid cells. At this stage of the dissection the superior branch of the vidian may be traced into the portio dura. All this is best done if the bone covered by all its soft parts has been immersed for some time in an acid and spirituous liquor. Moreover, the cavity of the tympanum must be examined first upon a dried preparation, from which all the soft parts have been removed by maceration, or a preparation of this kind, as well as the recent dissection, must be placed before the student to enable him to understand the following description of the tympanum, its contents and appendages. The Tympanum, examined first on the macerated and cleaned bone, and afterwards with all its soft parts, is a very irregularly shaped cavity, placed between the bottom of the external auditory canal and the labyrinth, behind the Eustachian tube and in front of the mastoid cells. Its outer wall is formed by the membrana tympani, a complicated membrane, seemingly fibrous, and in young persons vascular. Upon the inner wall may be observed, 1°. The fenestra ovalis leading to the vestibule; this is closed by the base of the stapes. 2°. The promontory below the fenestra ovalis, marking the position of one of the scalæ of the cochlea. 3°. The fenestra rotunda; this leads from the tympanum to the inner scala of the cochlea. In the inferior wall of the tympanum may be seen the glenoid fissure, through which pass the long process of the malleus and the corda tympani; the anterior muscle of the malleus and some blood-vessels enter here. In the posterior wall there is a canal which leads to the mastoid cells, also an eminence called the pyramid, in which there is a small opening. The pyramid marks a cavity which contains a small muscle, the stapedius, whose tendon passes through the small opening spoken of. Below the pyramid is another opening, which leads into the canal of Fallopius; by this foramen the corda tympani passes into the tympanum. In the anterior wall there is the processus cochleariformis, above which is the canal for the tensor tympani muscle, and below is the Eustachian tube. By this tube, which is partly osseous, partly cartilaginous, air passes from the upper and fore part of the pharynx into the cavity of the tympanum. The cavity of the tympanum contains a chain of small bones, *Ossicula Auditus,* extending across it from the membrana tympani to the deepest margin of the fenestra ovalis, or rather to the membranous vestibule. These are called, malleus, incus, os lenticulare, and stapes. The malleus is placed vertically on the inner and upper part of the membrana tympani; it has a *head, neck, handle,* and long process, described by Raw. The incus has a body, a superior branch and an inferior branch. The lenticular bone is articulated between the *long* branch of the incus and the head of the stapes. This bone, the stapes much resembles a stirrup-iron; its base is placed deep in the fenestra ovalis. Certain muscles move these bones, which, according to some, are four in number, but others admit only one, viz. the tensor tympani. It arises from the petrous portion of the temporal bone, before the inferior orifice of the carotid canal, and in part from the Eustachian tube. It enters the tympanum by the canal already described, and is inserted into the process of the handle of the malleus. The other muscles which some have doubted, are, the laxator tympani, which arises from the spine of the sphenoid, and entering the fissure of Glasser, is inserted into the summit of the process of Raw. The stapedius has been already spoken of; it is very probably not muscular, but composed of the yellow elastic tissue; at least it is so in the lower animals. A fibro-mucous membrane invests the cavity of the tympanum, liable to inflammation, ulceration, &c.; the cavity has been found filled with pus in children not more than eight or ten days old.

INTERNAL EAR OR LABYRINTH. This dissection must be made on subjects of different ages; the fœtal age is the most favourable, and several specimens are required, as different sections must be made. To display the *vestibule,* (the central portion of the labyrinth) open its upper wall, which corresponds to the superior surface of the pars petrosa, on a level with the fenestra ovalis; this opening leads directly into the vestibule. At the same time remove the superior wall of the meatus auditorius internus, in which will be found the portio mollis and portio dura. This will direct the student to the cochlea, also to the vestibule and to the first part of the Fallopian canal (canal for the portio dura.) The semicircular canals are easiest dissected in the temporal bone of the fœtus; the spongy osseous tissue surrounding them must be removed with the chissel or a strong scalpel. Of the three parts composing the labyrinth, the vestibule is towards the centre, the cochlea anteriorly, and the semi-circular canals above and posteriorly.

The *Vestibule.* If a probe be passed into the fenestra ovalis of the tympanum, it will pass directly into the vestibule, hence this opening has been called the tympanic opening of the vestibule. This cavity is, as it were, the centre of the internal ear. Intermediate to the semicircular canals which are external to it and somewhat behind, and to the cochlea which is internal and before. The openings leading into it are of two kinds, large and small, the large are, 1. The fenestra ovalis. 2. The five orifices of the semicircular canals. 3. The opening leading to the vestibular scala of the cochlea. 4. Some admit an opening leading towards the upper part of the fenestra rotunda. The small openings are, 1. That which leads to the aqueduct of the vestibule. 2. Vascular openings. 3. Those by which the portio mollis enters. The osseous cavity we have just described, is invested by the membranous labyrinth; this appears to have been discovered by Comparetti and Scarpa; it is full of a liquid, to which M. De Blainville has given the name of the auditory vitrine. The membranous labyrinth is not so extensive as the osseous one. 1. It does not seem to pass into the cochlea; and 2. It is evidently less than the osseous vestibule itself, the space thus left between the osseous vestibule and the membranous vestibule is filled by the liquor Cotunii. Finally, the membranous labyrinth is thus composed of two parts. 1. A vestibular portion. 2d. The membranous semicircular tubes.

The *Osseous Semicircular Canals*, are three in number, but opening into the vestibule by only five orifices, since two of them run together to form the utriculus communis. Of these canals, two are vertical and one horizontal. The superior vertical occupies the most elevated part of the labyrinth; in the fœtus it may be seen almost without preparation. By one extremity it unites to the other vertical, to form the utriculus communis. The inferior vertical canal forms almost a complete circle. The horizontal canal is the smallest. In the interior of these canals, are found the membranous semicircular canals. The portio mollis also penetrates into these canals. In addition to the membranous labyrinth thus contained within the labyrinth and semicircular canals, there are evident traces of another membrane, which serves as a periosteum to these cavities. The osseous cochlea is a part difficult to describe, although its dissection, generally speaking, be one of not much difficulty. Its base rests upon the meatus auditorius internus. We distinguish in the cochlea, 1. A compact plate forming the walls. 2. The lamina spiralis, which is a spiral septum dividing the general cavity into two others, called scalæ. This lamina spiralis proceeds from the base of the cochlea, and the neighbourhood of the fenestra rotunda to the summit winding around a central portion or axis. The lamina spiralis is composed of two parts, an osseous and a membranous ; it terminates in a process termed *hamulus* or *rostrum.* The axis or collumella, is the centre (nucleus modiolus columella) around which the lamina spiralis turns. Its surface is full of holes for the passage of the auditory nerve. The scalæ of the cochlea are distinguished into two, a vestibular and a tympanic. The first communicates directly with the vestibule, the second with the tympanum, by means of the fenestra rotunda, but when the soft parts are present, this orifice is closed by a membrane. The aqueduct of the cochlea has been already described along with the temporal bone. It seems to us to have precisely the same uses as ascribed to it by Cotunio. We venture therefore to think modern French anatomists slightly in error in the view they take with respect to these aqueducts.

The *Auditory Nerve, or portio mollis of the seventh pair*, passes from the meatus auditorius internus, to the cribriform plate, where it divides into two portions, an anterior and posterior ; the anterior proceeds to the cochlea, passing up into its interior by the axis or columella, the posterior proceeds to the membranous vestibule and semicircular canals.

PART XII.

ANATOMY OF THE ARTERIAL SYSTEM.

613. During the preceding practical sections of this work, most of the arteries of the body of the smallest importance to the surgeon have been carefully described ; but it may still be useful to insert here a systematic outline of the arterial system. A summary of this kind may be useful to the student as a reference, to aid his memory respecting names and details, which should

however, in as far as is possible, be associated with interesting practical, or physiological results. There are two great arteries in the body, viz. the pulmonary artery, and the aorta.

614. The PULMONARY ARTERY springs from the right ventricle of the heart, and conveys to the lungs the whole of the dark or venous blood. It is remarkable in this respect. Likewise it has no accompanying vein. In the adult it has *two* branches, a right and left. These proceed to the lungs. In the fœtus it has a third branch, the ascending or vertical, which proceeds to the aorta; this is obliterated at birth.

615. The AORTA springs from the left ventricle, and terminates upon or a little below the fourth lumbar vertebra, by dividing into two great trunks, viz. the common iliacs. In this course the aorta has been divided for convenience, and as giving greater precision to the description, into three divisions, viz. The *Arch;* The *Descending Thoracic;* and, The *Abdominal Aorta.*

Arch of the Aorta. There arise from this portion five vessels: the *coronary arteries,* right and left. These supply the substance of the heart itself with blood. The *brachio-cephalic.* The *left common carotid.* The *left subclavian.* These vessels and their branches supply with blood the head and neck, and thoracic extremities.

616. BRACHIO-CEPHALIC, or ARTERIA INNOMINATA, after a very short course, divides, into the *right subclavian* and *right common carotid.*

617. The COMMON CAROTID divides opposite the hyoid bones, into the *external carotid,* and the *internal carotid.*

618. The EXTERNAL CAROTID gives off nine principal branches.

(1.) The *Superior Thyroid,* whose branches are, Ramus thyoideus. Ramus superficialis. Ramus laryngeus. Ramus thyroideus.

(2.) The *Arteria Lingualis.* Its branches are, Ramus hyoideus. Dorsalis linguæ. Sublingualis. Ranina.

(3.) The *Facial, or External Maxillary Artery* whose branches are, 1. The inferior palatine. 2. Tonsillar. 3. Glandular branches. 4. Submental. 5. Inferior labial. 6. Inferior coronary. 7. Masseteric branches. 8. Superior coronary. 9. Lateral nasal. 10. Angular. Few of these branches are of any consequence in a surgical point of view.

(4.) *Arteria Muscularis, or Sterno-Mastoid.* This is not a very constant branch of the external carotid, more usually arising from some other branch.

(5.) *Occipital Artery.* Although a large and important vessel it gives off few branches, which have received names. It supplies many of the deep muscles on the upper and back part of the neck, and chiefly the hairy scalp. Lastly, a branch to the ear (the posterior auris.)

(6.) The *Ascending Pharyngeal.*

(7.) The *Transversalis Faciei*, which just as often comes from the temporal.

(8.) The *Internal Maxillary*, whose branches are very numerous. Middle meningeal. Inferior dentalis. Pterygoid branches. Deep temporal. Masseteric. Buccal. Superior dental. Infra orbital. Descending palatine.

(9.) The *Superficial Temporal* may be considered as the terminating branch of the external carotid. Its branches are, the *anteriores auris*. Capsulares. Temporalis media. Posterior temporal. Anterior temporal.

619. The INTERNAL CAROTID is the largest division of the common carotid in the young person, but the smallest in the adult. It is chiefly distributed to the brain. Its course is into the cranium through the carotid canal of the temporal bone. It gives off a few small branches in the canal, and in the cavernous sinus; but it also supplies five important branches.

(1.) The *Arteria Ophthalmica*. This artery enters the orbit by the optic foramen, and sends off the following branches: Lachrymalis. Centralis retinæ. Supra orbitalis. Ciliares. Musculares. Ethmoidalis. Palpebralis, superior and inferior. Nasalis. Frontalis.

(2.) *Arteria communicans Willisii.* This artery arises from the internal carotid in the interior of the cranium, and communicates with the posterior cerebral artery, which is a branch of the basilar.

(3.) The *Ar. Cereb. Anterior*. This artery after furnishing numerous small twigs, approaches the corresponding artery of the other side, when a short transverse branch,

(4.) The *Anterior Communicating Artery*, is given off. This arrangement is so uniform, that it may be considered the normal distribution, and constitutes the *Arterial circle* of *Willis*, by which a free circulation is maintained at the base of the brain, although the main trunks in the neck should have been obliterated. The anterior cerebral arteries terminate in the arteries of the corpus callosum.

(5.) The *Ar. Cerebri Media*. This is a very large branch, following the course of the fissure of Sylvius, and imbedded in it.

620. The SUBCLAVIAN ARTERIES differ from each other in length, and in some other particulars. The branches arising from each are much the same. The right subclavian is a branch of the brachio-cephalic and the left springs from the aorta. They in fact terminte at the bend of the elbow, but for the sake of description, have been divided into the following portions. The *subclavian*, properly, so called. The *axillary*. The *humeral* or *brachial*. The *subclavian portion* of this great artery gives off three important branches.

(1.) *Arter. Vertebralis*. This artery is in every way a remarkable one, it gives off, Ar. Medullæ Spinalis, anterior and posterior. Ar. cerebelli inferior, or posterior, and ultimately uniting with the opposite vertebral forms, the Basilar Artery. The basilar is an azygous branch, and gives rise to the Arter. cerebri posteriores, which anastomose with the arteria communicans Willisii.

(2.) *Mammaria Interna.* Its branches are, Art intercostales anteriores. Art. mediastini. Comes nervi phrenici. Musculo phrenica. Abdominales.

(3) *Axis Thyroideus.* Its branches are, Inferior thyroid. Cervicalis ascendens. Supra scapularis, or transversalis humeri. Posterior scapular, or transversalis colli. Cervicalis superficialis Art. cervicalis profunda. Art. intercostalis superior. As soon as the subclavian artery has passed from under the subclavian muscle, it receives the name of

621. The *Axillary*, whose branches are, Thoracica acromialis. Thoracica suprema. Thor. alaris. Thoracica longa. Subscapularis. Internal or posterior circumflex. Anterior or external circumflex. The main trunk again changes its name as soon as it has passed the lower margin of the teres major muscle, and is then called the

622. *Brachial* or *Humeral.* From its external side arise only nameless muscular branches; from the internal side come off in succession, the art profunda superior. Profunda inferior. Anastomotica magna. At the bend of the elbow the humeral artery subdivides into two large branches, the *radial* and *ulnar.*

623. The *Ulnar* gives off eight branches, The Anterior and Posterior Recurrents. The interosseal. The anterior and posterior carpal arteries. Ramus communicans. Superficial palmar arch, from which arise, the digital arteries.

624. The *Radial Artery* is smaller than the ulnar. Besides numerous mascular branches, it gives off eight principal ones. Radialis recurrens. Superficialis volæ. Anterior and posterior carpal arteries. Dorsal arteries of the thumb. Arteria magna pollicis. Radialis indicis. Palmaris profunda.

625. (B. 618.) The *Thoracic Aorta* is the second division of the great trunk of the aorta, (615) and the following branches arise from it:

626. Art. Bronchiales.

627. Œsophageæ.

628. Intercostales.

629. The *Abdominal Aorta* is the third and last portion of the aorta (615.) There arise from it—

630. THE RIGHT AND LEFT PHRENIC OR SUBDIAPHRAGMATIC.

631. THE CŒLIAC AXIS, from which arise, Art. gastrica, or coronaria ventriculi. Arteria hepatica. This branch gives off the pylorica superior, the gastrica-duodenalis or epiploica dextra, and the right and left proper hepatic branches. Arteria splenica; from this come the *pancreaticæ parvæ* and *magna;* the vasa brevia, the arteriæ splenicæ, and the gastro-epiploica sinistra.

632. THE ARTERIA MESENTERICA SUPERIOR. The branches of this artery are, first, The large but nameless branches supplying the jejunum and ileum with blood. Secondly, The arteria ileo-colica. The colica dextra. The colica media, which ought to be called the right superior colic.

633. THE INFERIOR MESENTERIC ARTERY gives off, the colica

sinistra. Art. sigmoidea superior. Art. sigmoidea inferior. Arteria hæmorrhoidalis. From the sides of the aorta are given off—

634. ARTERIÆ CAPSULARES.

635. RENALES.

636. SPERMATICÆ.

637. LUMBALES.

638. ARTERIA SACRI MEDIA. This, though a small branch, is properly the terminating branch of the aorta.

639. THE ARTERIÆ ILIACÆ COMMUNES. These arteries result from the bifurcation of the aorta, and in their course supply only a few twigs.

640. The *Arteria Iliaca Externa* results from the bifurcation of the common iliac, and extends to the crural arch, where, assuming the name of femoral, it chiefly supplies the lower extremity, and might with more propriety have been called the crural. As soon as it passes below Poupart's ligament, it is called the common femoral artery. Before passing under the crural arch, it furnishes two important branches, The epigastric; The arter. circumflex ossis ilii.

641. The *Common Femoral Artery*, after a course of an inch or two at the most, subdivides into the superficial femoral and the deep femoral. In its course it gives off, the epigastrica superficialis, circumflex ilii superficialis, pudica externa.

642. The *Superficial Femoral Artery*, by its direction, seems to be the continuation of the common trunk; it descends along the thigh into the popliteal space, and after traversing it, divides at the inferior margin of the popliteus muscle into two branches, viz. the posterior tibial and anterior tibial. Some anatomists, however, are of opinion, that the anterior tibial artery is merely a branch of the popliteal, and that the proper division of the artery is into posterior, tibial, and fibular. The superficial femoral supplies several muscular branches which have not received any name, and the *anastomotica magna;* it then becomes

643. The *Popliteal Artery*, and under this name it gives off, the internal superior articular artery. The external superior articular. The middle articular. Arter. surales. The internal inferior articular. External inferior articular. Besides these, it supplies a number of muscular twigs. The artery then divides into the anterior tibial and the posterior tibial.

644. The *Arteria Profunda Femoris* gives off, Arteria circumflexa externa. Circumflexa interna. Perforans prima. Perforans secunda. Perforans tertia.

645. The *Posterior Tibial Artery*. The largest division of the popliteal gives off a few mascular branches, but soon after subdivides into two arteries, viz. the fibular or peronæal, and the proper posterior tibial.

646. The *Fibular* ought to be called the *common fibular*, since it soon after subdivides into an anterior and posterior fibular. They give off many muscular branches.

647. The *Posterior Tibial*, besides sending numerous muscular branches to the deep flexors of the toes, subdivides into the internal plantar and external plantar; this latter is a large artery, which, besides giving off the digital branches, anastomosis freely with the anterior tibial.

648. The *Anterior Tibial Artery* passes through an opening in the upper part of the interosseal ligament, and thus gains the anterior surface of the interosseous ligament. In its course it sends off, The recurrens. Many muscular branches. Internal malleolar. External malleolar. Arteria tarsi. Arteria metatarsi. Ramus communicans. Arteria pollicis.

649. The *Internal Iliac*, or *Hypogastric Artery*, results from the bifurcation of the common iliacs. Its branches are numerous, important, and difficult of dissection. They are, The ilio-lumbalis. Sacri-lateralis. Hæmorrhoidalis media. Arteriæ vesicales. Umbilicalis (obliterated after birth.) Uterina. Vaginalis. Obturatrix. Gluteal. Ischiadica. Arter. pudica interna. The branches which the internal pudic gives off are, the external hæmorroidal; artery of the perinæum; transversalis perinæi; arter. corporis bulbosi; arter. corporis cavernosi penis; arteria dorsalis penis.

650. It was first clearly announced by Scarpa, though well understood long before his time by practical men, that the anastomoses of arteries throughout the human body are generally adequate to the supply of blood to most parts, even after the ligature of the largest trunks; the abdominal aorta itself was tied by Sir Astley Cooper. A ligature has also been applied upon the brachio-cephalic, and although not hitherto successful, these operations may at some future time be the means of saving or prolonging life.

PART XIII.

SYSTEMATIC ANATOMY OF THE VEINS.

651. The Veins, (with exceptions to be afterwards particularly noted,) are vessels carrying dark or venous blood; their form is cylindrical, and their parieties or walls are formed of two tunics. The outer is loose, extensile, composed of longitudinal fibres, and often surrounded with a sheath of cellular membrane, to which it adheres more or less intimately. The inner coat is thin and smooth, forming, by being folded as it were inwards, a vast number of semicircular valves; this tissue is also prolonged into the right cavities of the heart and sinuses of the dura mater. The coats of the veins have, of course, their arteries and veins; but with the exception of the vena portæ, few nervous filaments have been traced to them. When a bandage is applied to the arm, as in phlebotomy, the course of the blood in the

superficial veins is obstructed. The vessels dilate, more particularly at certain parts, the contracted parts indicate the situation of the valves, which in these circumstances, are allowing the vessels to get filled with blood, coming towards the heart, but preventing, or at all events retarding in successive stages, the reflux back. They perform this function very accurately, as no force short of rupturing the vessel could push any fluid along most of the veins from *trunk* to *branch*. We shall now proceed to endeavour to group the veins, which by their union, ultimately form the *inferior cava*.

652. Internal Vena Saphena, commences on the inner edge of the great toe, extending over the dorsum of the foot, in the form of a transverse arch, receiving many twigs from the toes, a considerable sized vessel results from this source, which ascends over the malleolus internus and ankle-joint, it follows nearly a vertical course up the inner part of the leg, and passes behind the inner condyle of the femur. It then ascends almost vertically on the inner side of the thigh. In this course it is entirely subcutaneous, embedded in the superficial fascia, and is constantly augmented by the addition of branches, when within about two inches of the crural arch, it receives several abdominal subcutaneous veins, particularly the superficial epigastric circumflex iliac and pudic, and, passing through the saphenic opening in the fascia lata, joins the femoral vein.

653. The External Vena Saphena commences on the outer side of the foot, receives many twigs from the dorsum of the foot, and behind, but close to the malleolus externus is found as a single trunk, which, having communicated by means of a large branch with the internal saphena, ascends first obliquely, afterwards vertically on the back of the leg, and reaching the hollow of the ham, dips deep into the popliteal space, and terminates in the popliteal vein.

654. The Popliteal Vein accompanies an artery with which the student will be familiar; it is situated first at the outer, and afterwards at the posterior part of the artery, and is formed by the union of three deep veins in addition to the external saphena. These deep veins accompany the anterior tibial, posterior tibial, and peroneal arteries. The popliteal thus formed, ascends obliquely at the inner part of the thigh close to the artery, changes its name as the artery does, is increased by branches corresponding to those of the artery, and reaches the crural arch, through which it passes, placed on the inner side of the artery. As soon as the femoral vein has passed under the crural arch, it assumes the name of *External Iliac*, and its branches and course are precisely similar to those of the common iliac artery; in the male subject it receives a considerable vein from the envelopes of the testicle, which enters by the inguinal ring, and thus reaches the great vein. The *Internal Iliac*, or *Hypogastric Vein*, is placed in the excavation of the pelvis, rather behind the artery, and is formed of branches exactly corresponding to the divisions of that impor-

tant artery; it receives, in addition, however, some important veins, (vesical veins,) these are very numerous and of large size, and exhibit differences in the male and female. In the male they commence upon the glans penis, forming two large trunks;—the dorsal veins of the penis; these run along the dorsum of the penis, wind around the organ towards the external aspect of the corpora cavernosa, they here subdivide and form a plexus with other veins from the scrotum, dartos, and tunica vaginalis, they again seem to unite into two trunks, pass towards the roots of the corpora cavernosa, pass under the arch of the pubes, and ultimately reach the sides of the bladder. They here again unite and subdivide, repeatedly forming an extensive plexus with veins from the prostate and walls of the bladder, and again collecting into few trunks communicate with the internal iliac vein, previously receiving some veins from the rectum and vesicalæ seminales. In the female, the *vesical veins* commence by the *dorsal veins* of the clitoris, which are at first minute and numerous, they unite around the vulva, communicate with the internal and external pudic veins, and also branches from the constrictor vaginæ muscle, ultimately forming on the sides of the vagina and bladder a very remarkable plexus, from which proceed trunks which communicate with the internal iliac.

655. The Sacro-Lateral Veins, anastomose with the vertebral sinuses, form a net-work around the anterior sacral foramina, and then join the internal iliac.

656. The External and Internal Iliac Veins unite on their respective sides of the body, opposite the sacro-iliac symphyses, and thus gives rise to the *common* iliac veins; these veins ascend obliquely inwards towards the inter-articular cartilage between the fourth and fifth lumbar vertebræ, where they unite and form one great trunk,

657. The Vena Cava Inferior. The course of the vena cava inferior through the abdomen, until it enters the right auricle of the heart, has been already particularly described. In this course it receives, the middle sacral vein, the lumbar vein, the right spermatic vein, the renal, capsular, hepatic or inferior phrenic veins.

We have now traced the veins directly communicating with, and forming, in fact, the *inferior* cava. There are still, however, some important points connected with the venous circulation within the abdomen, to which we shall return with advantage, having first traced the composition of the *vena cava superior*.

658. Cephalic Vein, commencing by a great number of minute branches on the back of the hand, and muscles of the thumb; many unite upon the thumb into one trunk which takes the name of the cephalic vein of the thumb; this trunk, and the other branches from the back of the hand, ascend, and gradually reach the anterior and external part of the fore-arm, where they form the *superficial radial vein*. On arriving at the bend of the arm, the trunk is of considerable size, and receiving the *median cephalic*

vein, assumes the name of the *cephalic vein*, ascends along the external edge of the biceps to the inter-muscular space between the great pectoral muscle and deltoid, when, passing under the clavicle, it joins the axillary vein.

659. BASILIC VEIN, is generally larger than the cephalic, it is formed by two branches, viz. the *posterior ulnar* and *anterior ulnar*. The posterior ulnar commences on the inner part of the back of the hand from a great number of minute branches, forming generally a pretty large trunk on the inner part of the hand, called the *vena salvatella*. This vein ascends upon the inner part of the fore-arm, and assumes the name of the posterior ulnar; it passes behind the inner condyle and unites with the anterior ulnar vein. The *anterior ulnar* vein ascends on the anterior aspect of the arm, receiving many branches anterior to the inner condyle, a considerable trunk results, and receiving its half of the median vein by a branch called the *median basilic*, it ascends along the inner part of the arm, dips deep sooner or later, and communicates with the axillary vein.

660. The MEDIAN VEIN is formed by a collection of numerous branches from the anterior aspect of the fore-arm, forming frequent anastomoses with the deep veins, and near the bend of the elbow terminates, one part going to the cephalic, the other to the basilic, under the names of median cephalic and median basilic.

661. VEINS OF THE PECTORAL EXTREMITIES. The arteries supplying the arm and hand with blood, have all their accompanying veins, generally two in number, one on each side of the artery, which unite until they are diminished in number to two, which embrace the brachial artery, anastomosing with each other repeatedly, and receiving branches from all the collateral veins, corresponding to the branches of the humeral artery; the basilic also joining them, *one* large vein results, viz.,

662. The AXILLARY VEIN, situated anterior to the axillary artery in the axilla, and extending from the tendon of the great pectoral muscle to the inferior extremity of the scalenus anticus, receiving in this course the circumflex, sub-scapular, long thoracic, superior thoracic, and acromial veins. Whilst passing under the clavicle, the vein changes its name to subclavian, which thus extends from the inferior margin of the scalenus anticus muscle for a short way along the lower part of the neck, when receiving the internal jugular vein it receives the name of

663. VENA INNOMINATA. The right vena innominata is short, covered by the sterno-cleido mastoid muscle, the sterno-clavicular articulation, and a small portion of the sternum. It is applied externally and posteriorly against the right lamina of the mediastinum, the pneumo-gastric nerve, the right subclavian artery, and scalenus anticus muscle. The left vena innominata is longer and larger than the right, its direction is nearly horizontal, it is covered by the same parts, and in addition, by nearly the whole breadth of the sternum, and the muscles which are attached to it;

it covers in its course the scalenus anticus muscle, the left subclavian artery, the left lamina of the mediastinum, the pneumo-gastric nerve, the arch of the aorta, and the arteria innominata, it receives analogous veins to the right, and in addition the *left internal mammary* and *left inferior thyroid.* The two venæ innominatæ also receive the vertebral and superior intercostal veins.

664. External Jugular Vein. The student in his dissection of the neck, meets with two great veins on each side, viz. the external and internal jugular veins, and in the mesial line the thyroid venous plexus. These veins are subject to numerous varieties, two external jugulars, being often found on each side of the neck, in which case the thyroid plexus will be small. We subjoin the more ordinary arrangement. Immediately below the parotid gland, a large and superficial vein is found, which has received the name of the external jugular; it results from the union of most of the veins accompanying the branches of the temporal, internal maxillary, and posterior auricular arteries. The external jugular vein descends nearly vertically along the lateral and anterior part of the neck, under the platysma-myoides muscle, it reaches the outer edge of the sterno-cleido mastoid, and communicates with the subclavian a little externally of the internal jugular vein, during this course it receives some branches of considerable size, and particularly important to the surgeon; these are called the cervical, cutaneous, and trachelo-scapular veins.

665. The Internal Jugular Vein commences by a dilatation, situated in a fossa pointed out in the temporal bone, and named the jugular fossa, and descends along the outer side of the common carotid artery, and pneumo-gastric nerve, joins the subclavian vein, when both thus united into one trunk, receives the name of the vena innominata, presenting on the right side the same direction as the vena cava superior, whilst on the left it forms a right angle with the subclavian, and which disposition is caused by the position of the heart in the chest.

666. The Veins which give rise to the Internal Jugular Vein. The sinuses of the dura mater described particularly in speaking of that membrane (563), collects the blood from the brain, eye, part of the nasal fossæ, &c. by means of the following veins. The superior cerebral veins, veins of the corpus striatum, vein of the choroid plexus, venæ Galeni, superior cerebellar veins, inferior cerebellar veins, lateral and inferior veins of the cerebrum and ophthalmic vein, the blood thus collected is poured into the sinuses of the dura mater and these terminate at the foramina lacera posteriora in the internal jugular veins. The bones of the cranium have a very peculiar venous circulation. The veins of the diploe are situated in the substance of the diploe of the bones of the skull, and lodged in particular canals. They commence by numerous roots near the point where ossification originally commenced; these roots unite and form branches which all tend towards the base of the

skull, a few branches enter the frontal vein, others enter the lateral sinuses and deep temporal and occipital veins, they also communicate outside and inside the cranium by multitudes of *emissary* twigs. The veins accompany the facial, lingual, pharyngeal, superior thyroid and occipital artery, all in a great measure communicate directly with the internal jugular vein, and it might perhaps be sufficient to state this ; they present considerable differences, however, and we prefer being minute, particularly in a part of the body where so much anxiety is felt by the student for precise and accurate description.

667. The Facial Vein commences on the top of the head and forehead by a great number of branches which unite to form on the middle region of the forehead the *vena preparata ;* this vein descends to the root and sides of the nose, and here gets the name of angular vein and anastomosis with the ophthalmic. It is now called the facial vein, and collecting all the branches corresponding to the facial arteries, it crosses the base of the jaw, and generally reaches the internal jugular vein after being joined by the ranine, submental and palatine veins. It often sends a branch to assist in forming the external jugular vein also. The internal jugular also receives the lingual, pharyngeal, superior thyroid and occipital veins.

668. Vena Cava Superior. The Right and Left Venæ Innominatæ unite opposite the cartilage of the first rib *on the right side* a little above the arch of the aorta, and the single trunk resulting from their union receives the name of the *vena cava superior,* it descends forwards and slightly towards the left as far as the base of the pericardium, the fibrous layer of which it penetrates, descending vertically to the right of the aorta, and opens into the right auricle of the heart, behind its free appendage. Before penetrating the fibrous pericardium, the vena cava superior receives the vena azygos, right internal mammary and inferior thyroid veins, several thymic, mediastinal, pericardiac and superior phrenic veins, but all from the right side.

669. Of the Veins of the Spinal Marrow and the Vertebral Venous Sinuses. There are two great sinuses extending throughout the whole length of the vertebral canal behind the bodies of the vertebræ, before the dura mater and on the sides of the posterior common ligament of the vertebræ. They communicate with each other by transverse sinuses placed upon the middle of the body of each vertebra ; also with the intercostal and lumbar veins. The veins of the spinal marrow open into the inferior cerebellar veins.

670. The Coronary Veins of the Heart commence in the texture of the organ by roots which may best be traced from its apex. The great right coronary vein, the small right, and the left coronary veins all collect into one trunk which terminates in the right auricle of the heart. These veins have valves, but they are imperfect.

671. The Vena Portæ derives its origin from the veins of

all the organs contained within the cavity of the abdomen, excepting the kidneys, the bladder and uterus. But these veins unite to form two principal trunks, the splenic, and superior mesenteric veins, and these two by their union, form the vena portæ. Of the two trunks thus forming the portal vessel, we may first allude to the splenic vein; this collects all the veins corresponding to the branches of the splenic artery, and besides in its progress receives the duodenal and pancreatic veins, the coronary of the stomach and the small mesaraic or mesenteric vein which joins the splenic nearly at a right angle. The superior mesenteric vein, the other great trunk which forms the portal vein, collects the veins corresponding very nearly to the course of its arteries, and are in consequence named accordingly; these need not be particularly enumerated. The trunk of the vena portæ thus formed, is placed at its commencement and in its course, behind the second portion of the duodenum, covered by the hepatic artery, cystic and hepatic ducts, and enveloped by the capsule of Glisson, and between the laminæ of the small omentum. It next reaches the transverse groove of the liver, and divides into two branches; these separate nearly at a right angle, and thus form a horizontal canal called *sinus* of the *porta*. They follow the division of the hepatic artery, and penetrating into the substance of the liver, subdivide after the manner of an artery; the blood is a second time collected by the hepatic veins and poured into the inferior cava, and is thus said to undergo a second circulation; a late chemical analysis has shewn that the blood circulating in the vena portæ is not precisely like venous blood.

672. Pulmonary Veins. The vessels bringing the blood from the lungs toward the left side of the heart commence in the lungs in a manner not yet clearly made out; they all terminate in four large trunks which penetrate the left auricle of the heart. These have, for want of a better term, been called veins. The course of the circulating fluid in them is indeed from branch to trunk, but the blood is pure arterial blood. On the other hand, the pulmonary artery has been so named apparently from the blood circulating in it from trunk to branch like an artery, whilst the blood is in reality dark coloured, and has perhaps peculiar properties.

PART XIV.

OF THE LYMPHATIC SYSTEM.

673. The Lymphatic System (Absorbent System), is composed of vessels and lymphatic conglobate glands. Lymphatic Ves-

sels are long, extremely delicate, pellucid tubes, presenting when full at short intervals dilatations which give them a knotted appearance, which appearance is owing to the presence of valves placed in the interior of the tube, whose arrangement and function is altogether very similar to those of veins. The course of the fluid which circulates in these vessels is from branch to trunk, and thus the anatomist has to inject them like the veins, from a branch. The disposition and nature of the extreme roots of these vessels are in a great measure, in consequence of this, completely unknown. The material used for injecting them is quicksilver, and in a favourable subject, an extensive net-work of tubes may thus be displayed on the upper part of the thigh for instance. It is by this means indeed that anatomists have made out a great deal of the anatomy of these vessels, viz. that they are extremely numerous, and (with the exception of the brain, spinal chord, their membranous envelopes, the eye or the ear), found in every part of the human body, and more especially in the vicinity of the arterial and venous trunks. These vessels are arranged in the body in two distinct planes, a *superficial* and a *deep seated*. The *Superficial* are found in the periphery of the body, as a net-work placed in the sub-cutaneous cellular tissue, and distributed in a very uniform manner. The *Deep-Seated* unite into bundles around the blood-vessels, whose direction they exactly follow, these two planes communicating frequently by numerous twigs, and uniting to form plexuses. Another curious fact is their frequent unions and divisions, so that a great number of twigs, after being collected into a single trunk, again separate into twigs, and again unite. The lymphatics of both the inferior extremities, the abdomen, left side of the thorax, left superior extremity, left side of the head and neck, terminate in one principal trunk, situated on the front of the two superior lumbar, and nearly all the dorsal vertebræ, and termed the *Thoracic Duct;* whilst the lymphatics from the right side of the head and neck, right upper extremity, and right side of the thorax, form a short trunk situated on the right side of the upper dorsal vertebræ. We shall trace particularly the vessels which terminate in these two trunks, but we must first call the student's attention to the lymphatic conglobate glands, which we have stated to form an integral and undoubtedly a most important part of the *system*. These glands vary in diameter from the twentieth part of an inch to an inch, their colour commonly reddish, changing to gray, and even a blackish tint; they are enveloped by a compact glistening membrane, and are furnished with numerous blood-vessels. When carefully anatomized, these glands appear chiefly formed by an intimate interlacement of the lymphatic vessels. These glands are collected together in greater or less quantity, or even isolated; they are not numerous along the limbs, but are in great abundance in the abdomen and thorax; they are invariably situated in a celluloso-adipose tissue, and the situations where they are collected in greatest abundance, are between the layers of the mesentery (mesenteric glands), upwards of a hundred, around the vena portæ, and along the splenic artery (hepatic, pancreatic, splenic), between the laminæ of the mesocolon (mesocolic), along the two curvatures of the stomach (gastro-epiploic), from six to ten, along the sides of the lumbar vertebræ (lumbar), in the chest, on the diaphragm, pericardium, and anterior mediastinum (mediastinal), between the two layers of intercostal muscles, and in the posterior mediastinum, and at the roots of the lungs (bronchial glands). In the pelvis we find the *hypogastric, sacral,* and *external iliac glands,* collected near the respective arteries. In the head and neck we have *cranial, facial,* and *cervical;* the cervical are arranged into superficial and deep, and are very important; the superficial are found chiefly beneath the platysma-myoides, in the course of the external jugular vein and its branches; the deep-seated, (glandulæ concatenatæ) are found near the internal jugular vein and common carotid artery, forming a sort of chain from the mastoid process to the superior orifice of the thorax, and prolonged backwards between the pharynx and vertebral column. In the superior extremity we find them following closely the brachial artery from the bend of the elbow to the axilla (axillary), where they are of great size and in considerable numbers; they lie chiefly around the axillary vessels and their branches. In the inferior extremities a gland is very uniformly found on the lower extremity of the interosseous ligament (anterior tibial). In the popliteal space (popliteal), they are pretty numerous, but of small size; whilst in the inguinal region (inguinal glands), they are of large size, numerous, and have been divided into superficial and deep layers. The superficial, varying from six to twelve in number, are found surrounding the internal saphena vein, imbedded as it were in that important structure, named by surgeons the cribriform facia. The deep inguinal glands, varying from two to four or five in number, embrace chiefly the femoral artery. These glands are placed on the lymphatic vessels in such a manner as completely to break their continuity—some anatomists, as we have said, viewing them as being formed by a microscopic division and interlacement of the vessels. Having thus lost, as it were, in the glands, the vessels proceeding from the organs, and which have received the name of the *vasa inferentia,* or *afferentia, entrant,* (the free margin of the valves in which vessels are turned towards the glands;) whilst from the opposite side of the gland, other vessels are seen as it were to arise, the free margin of whose valves, still looking onwards towards the termination of the system and consequently from the glands, have received the name of the *vasa efferentia, egredient lymphatics.*

674. The Lymphatic Vessels of the Inferior Extremities are divided into superficial and deep. The superficial follow chiefly the course of the saphenæ veins; the deep, those of the great blood vessels. The lymphatics of the hips join the superficial inguinal glands; likewise those of the loins, the lower half of the walls of the abdomen, the lymphatics of the

perinæum, scrotum, and penis. In the female, the lymphatics of the labia pudendi and clitoris have the same termination. The deep obturator, ischiatic, genital, &c. lymphatic vessels, arise near and accompany the respective arteries, all terminating either in the hypogastric or lumbar glands. The lymphatics of the uterus are of large size at the period of gestation, becoming small and perfectly microscopic in the unimpregnated state. They arise from the surface and in the substance of the organ, uniting with these coming from the vagina, to terminate in the hypogastric glands. Others course along the broad ligament, and unite with those of the ovarium. They are very numerous, form frequent plexuses, ascend along the spermatic vessels, and communicate with the lumbar glands. The lymphatics from the bladder, kidneys, and supra-renal capsules, all communicate with the hypogastric, lumbar, or splenic glands, and follow very closely the course of the respective arteries distributed to these organs. The lymphatic vessels of the abdominal and pelvic walls are very numerous. They very generally accompany the arteries, and form the *external iliac lymphatic plexus*, the *hypogastric lymphatic plexus* placed on the sides of the sacrum, the *lumbar lymphatic plexus*. The lymphatic vessels of the intestines and stomach, particularly of the intestines, are of great importance. They are of two kinds; *lymphatics merely*, which probably chiefly originate in the serous tunic and *lacteals*. *The Lacteals* absorb the chyle from the mucous surface of the small intestines; situated between the laminæ of the mesentery, they anastomose a great many times, and at last gain the mesenteric and meso-colic glands; btween the intestine and the glands they are called the *vasa afferentia*; the vessels which leave the glands, and proceed to join the thoracic duct, are called *vasa efferentia*. The lymphatics of the stomach, great omentum, spleen, pancreas, and liver, all ultimately join the thoracic duct directly or indirectly.

675. The Thoracic Duct (*ductus thoracicus sinister*) commences on the body of the third lumbar vertebra, by the successive union of five or six large trunks, resulting from the assemblage of nearly all the lymphatic vessels and plexuses we have enumerated. At its commencement the duct generally presents a dilatation (receptaculum chyli) which gradually gets behind the aorta at the anterior and left part of the second lumbar vertebra. The duct contracting, ascends into the chest between the crura of the diaphragm, with the aorta on its left side, and the vena azygos on its right, it ascends and continues to contract as far as the sixth dorsal vertebra, after which it dilates gradually, and ascends behind the arch of the aorta to the left subclavian artery, on the inner side of which it is placed on the longus colli muscle. It then reaches the seventh cervical vertebra, bends inwards and downwards, passes behind the left inferior thyroid artery, and internal jugular vein, and communicates with the posterior part of the left subclavian vein. Two valves are found at this point of junction, whose functions seem to be to prevent the blood circu-

lating in the vein passing also into the duct. This duct is sometimes straight, sometimes flexuous, whilst in some subjects it has been observed composed of several branches uniting and again separating. The duct, as it courses along the thorax, receives *intercostal lymphatics*, and many branches from the liver, pleuræ, diaphragm, posterior mediastina, &c.

676. The *lymphatics* of the lungs are superficial and deep seated. They ultimately pass through the bronchial glands, from which vessels proceed to the right or imperfect thoracic duct, but the greater number proceed to the thoracic duct, properly so called.

677. The lymphatics of the *pectoral extremities* resemble in their general course and disposition, those of the *pelvic extremities*, being superficial and deep, &c. A considerable number of lymphatic glands are collected in the axilla. These become frequently the subject of surgical operations. The epicranial lymphatics, those of the face, and the superficial anterior lymphatics of the neck, chiefly descend to open in the left side into the highest part of the thoracic duct, and on the right side into the great lymphatic vessel of that side.

GLOSSARY.

A. The Greek *a*, used as a prefix in compound words, has a privative or negative force as *a-sternal*, having no sternal attachment.

Abdomen, *inis*. n. (*Abdo*, to hide.)

Abducentes nervi. (*Abdūco*, to lead away.) Sixth pair of nerves.

Absorbents. (*Absorbeo*, to suck up.)

Acetabulum, *i*. n. (*Acetum*, vinegar; from the *acetabulum* or ancient saucer in which vinegar was held.)

Achillis, Tendo. (From the story of *Achilles*' heel.)

Acinus, *i*. m. (The stone of grapes.) Small granulations composing the substance of the liver and some other glandular bodies.

Acoustic. (Ακουω, to hear.) Belonging to the ear, or to sound.

Acromion. (Ακρον, the top or extremity, and ωμος, the shoulder.

Adductor, *oris*. m. (*Adduco*, to lead to.)

Adipose. (*Adeps*, fat.) Of the nature of fat: fatty.

Afferens, *tis*. *part*. (*Affero*, to bring.)

Ala, *æ*. f. (A wing.)

Alveolar. (*Alveus*, a trough.)

Amnios, *ii*. n. (Αμνος, a lamb.)

Amphiarthrosis, *is*. f. (Αμφι, both, and αρθρον, an articulation.) A movement of bones, partaking of *Diarthrosis* and *Synarthrosis*, as in the tarsal and carpal bones, and the *vertebræ*.

Anastomosis, *is*. f. (Ανα, by, στομα, a mouth.)

Anatomy. (Ανα, through, among, and τεμνω, to cut.) It is now understood to be a science, whose object is the examination of the organs or *instruments* of life. All organized bodies are the subjects of it. As living beings are divided into two great sections, Vegetables and Animals; so there are two kinds of Anatomy, viz. *Vegetable Anatomy*, and *Animal Anatomy*.

Anatomy, Animal, is divided into Human Anatomy, and Comparative Anatomy; according as it treats of the organization of the human body, or that of other animals.

Anatomy, Human, is divided into Descriptive Anatomy, and General Anatomy.

Anatomy, Descriptive, is divided into the *Particular Anatomy of Organs*. Treating of the shape, and mutual relation of the numerous organs of which the body consists; and the *Anatomy of Regions* or *Surgical Anatomy*, a very useful kind of Anatomy, with which, however, the mere student had better have as little to do as may be, as it can only be understood when he is master of the elementary Descriptive Anatomy.

Anatomy, General. (The second division into which Human Anatomy has been divided,) treats of the structure and properties of the different tissues which are common to several organs; together with the minute examination of all the organs and humours.

Anchylosis, *is.* f. (Αγκυλαι, plur. of Αγκυλη, a contraction of the nerves or sinews; being often caused by the contraction of the flexor muscles.) The morbid consolidation of the articulating extremities of two or more bones which previously formed a natural joint; a stiff-joint.

Ancon, *onis.* f. (Αγκων, the elbow.) The triangular surface of the olecranon process of the ulna; being the part on which we rest when said to lean on the elbow.

Antihelix, *icis.* m. (Αντὶ, against, and *helix;* because opposed to it.)

Antitragus, *i.* m. (Αντὶ, against, and *tragus;* because opposed to it.)

Anus, *i.* m. (A circle.)

Aorta, *æ.* f. (Αηρ, the air, and τηρεω, to keep; because, being found empty in the dead subject, the ancients supposed it contained only air.)

Aponeurosis, *is.* f. (Απο, by, and νευρον, a nerve; because formerly supposed to be the expansion of a nerve.)

Apophysis, *is.* f. (Αποφύω, to grow from.)

Arachnoid Membrane. (Αραχνη, a spider's web, and ειδος, resemblance.)

Arcuatus, *a*, *um.* (*Arcuo,* to bend like a bow.)

Areola, *æ.* f. (Dim. *Area,* a vacant space.)

Artery. (Αἠρ, the air, and τηρεω, to keep; because, being found empty after death, the antients supposed they contained air.)

Arthrodia, *æ.* f. (Αρθρόω, to fasten by joints.) An articulation admitting of motion on all sides.

Arthrosis, *is.* f. (Αρθρόω, to fasten by joints.)

Articular. (*Articulus,* a joint.)

Articulus, *i.* m. (Dim. *Artus,* a joint.)

Arytænoideus, *a, um.* (Αρυταινα, a funnel, and ειδος resemblance.)
Astragalus, *i.* m. (Αστραγαλος, a die shaped like the anklebone.)
Atlas, *antis.* m. (*Atlas,* said to bear the world on his shoulders; because it immediately sustains the head, which is like a globe.)
Atrophy. (A, priv. and τρεφω, to nourish.)
Auditory. (*Audio,* to hear.)
Auris, *is.* f. (*Aura,* the air; because it is the conductor of sound.)
Axilla, *æ.* f. (Supposed to be corrupted from *ago,* to act.)
Axis, *is.* m. (*Ago,* to Act.) The second vertebra of the neck. Vertebra Dentata.
Azygos. (A, priv. and ζυγὸς, a yoke.)

Basilaris, *is, e.* (Βασιλεὺς, a king.) Applied to certain bones, arteries, veins, processes, &c., from the importance of their situation, or being near the brain.
Basis, *is.* f. (Βαίνω, to rest upon.)
Biceps, *cipitis,* adj. (*Bis,* two, and *caput,* the head.)
Bicornis, *is, e.* (*Bis,* two, and *cornu,* a horn.)
Bicuspis, *idis.* f. (*Bis,* twice, and *cuspis,* the point of a spear.)
Bifidus, *a, um.* (*Bis,* twice, and *findo,* to cleave.)
Bifurcus, *a, um.* (*Bis,* twice, and *furca,* a fork.)
Brachium, *ii.* n. (Βραχών.) The arm.
Bronchia, *orum.* n. pl. (Βρόγχὸς, the windpipe.)
Buccinator, *oris.* m. (Βυγανάω, to sound a trumpet; because it chiefly is used in doing so.)

Cæcum, *i.* m. (*Cæcus,* blind; from its being open only towards one part.)
Calcaneum, *i.* n. (*Calx,* the heel.)
Canthus, *i.* m. (Κανθὸς.) The angle, or corner formed by the junction of the eyelids; the internal being the greater and the external the lesser canthus.
Capillary. (*Capillus,* hair.)
Capsula, *æ.* f. (Dim. *Capsa,* a box.) A capsule.
Capsular. (*Capsula.*) Belonging to, or of the nature of a capsule. *Capsularis, is, e.*
Cardia, *æ.* f. (Καρδιά.) The heart.
Carpus, *i.* m. (Καρπος.) The Wrist.
Cartilage. (*Caro,* flesh.) A pearly white, glistening, elastic, uniform substance, adhering to articular surfaces of

bones, either moveable, or of a mixed character. *Cartilago, inis*, f.

Cephale. (Κεφαλη.) The head.

Cephalic Vein. (Because the head was supposed to be directly relieved by its being opened.)

Cerebellum, *i.* n. (Dim. *Cerebrum.*) The little brain.

Cerebrum, *i.* n. (Κάρα, the head.) The brain, situated within the cranium.

Cervical. (*Cervix*, the neck.)

Cervix, *icis.* f. (As if *cerebri via ;* because the spinal marrow descends through it.)

Cholæus, or Cholœus, *a, um.* (Χολη, bile.) Belonging to bile ; biliary.

Chole, *es.* f. (Χολη.) *Path.* The bile : chole.

Choledochus, *a, um.* (Χολη, bile, and δέχομαι, to receive.) Receiving bile or gall.

Chondrology. (Χονδρος, a cartilage, and λογος, a discourse.) A dissertation or discourse on cartilages. *Chondrologia, æ.* f.

Chondrus, *i.* m. (A cartilage.)

Chorion. (Χωρεω, to contain.) The second, or most external membrane involving the fœtus.

Chyle. (Χυλὸς, juice extracted by decoction.) The milk-like liquor, separated by digestion from the chyme, from which the blood is formed ; it occupies the lacteals (hence their name) and thoracic duct. *Chylus, i.* m.

Chyme. (Χυμος, juice.) The pulpy mass formed by the food when it has undergone its first great change in the process of digestion, and passed from the stomach into the duodenum. *Chymus, i.* m.

Ciliary. (*Cilium*, the eyelid, or eyelash.)

Clavicula, *æ.* f. (Dim. *Clavis*, a key ; from its supposed likeness.) The collar bone ; the clavicle.

Cleido. (Κλεις, the clavicle.)

Clinoid. (Κλίνη, a bed, and ειδος, resemblance.) Resembling a bed. *Clinoides, is.* f. ; also used adj.

Clitoris, *idis.* f. (Κλειω, to shut up ; because it is shut up by the *labia pudendi.*)

Coccyx, *cygis.* f. (Κοκκυξ, the cuckoo, whose bill it is supposed to resemble.)

Cochlea, *æ.* f. (Κοχλιας, a winding staircase.)

Cœliac. (Κοιλια, the belly.)

Colicus, *a, um.* (*Colon.*) Belonging to the colon : colic.

Colon, *i.* n. (Κοῖλος, hollow ; because generally empty in the dead subject.)

Commissurā, *æ.* f. (*Committo*, to join together.)

Condyle. (Κόνδυλος, a tubercle.) A round eminence of a bone in a joint. *Condylus, i.* m.

Conglobate. (*Conglobo*, to gather into a ball.) Applied to a gland formed of contorted lymphatic vessels, having neither cavity nor excretory duct. *Conglobatus, a, um.*

Conglomerate. (*Conglomero*, to heap upon one.) Applied to a gland formed of small glomerate glands, whose excretory ducts unite into one. *Conglomeratus, a, um.*

Coracoid. (Κοραξ, a raven, and ειδος, resemblance.) Shaped like a crow's beak. *Coracoideus, a, um.*

Cornea, *æ*. f. (*Cornu*, horn; from its consistence.)

Coronoid. (Κορώνη, a crow, and ειδος, resemblance.) Applied to processes of bones that are curved, or in any way like a crow's beak. *Coronoideus, a, um.*

Cotyloid. (Κοτύλη, a small drinking cup, ειδος, likeness.) Resembling an ancient drinking cup. *Cotyloides, is.* f., also used adj.

Cremaster, *eris.* m. (Κρεμάω, to suspend.)

Cricoid. (Κρίκος, a ring, and ειδος, resemblance.)

Crista, *æ*. f. (As if *carista*, from καρα, the head.) A crest; anything like the comb of a cock. *Crista Galli.*

Crucial. (*Crux*, a cross.) Like a cross. *Crucialis, is, e.*

Crural. (*Crus*, the leg.) Belonging to the leg, or lower extremity. *Cruralis, is, e.*

Cubital. (*Cubitus*, the fore-arm.) Belonging to the fore-arm. *Cubitalis, is. e.*

Cubitus, *i.* m. (*Cubo*, to lie down; because the ancients leaned on that part, when lying along at their meals.) The fore-arm, extending between the elbow and wrist; the *ulna*, or *os cubiti.*

Cuboid. (Κυβος, a cube, or solid square body, and ειδος, resemblance.) Like a cube. *Cuboides, is.* f.; also used adj.

Cuneiform. (*Cuneus*, a wedge, and *forma*, resemblance.)

Cuspidatus, *a, um.* (*Cuspis*, a point.)

Cutis, *is.* f. The skin. Cutis vera. Dermis.

Cystis, *is.* f. (Κυστις, a bag.) A bladder. The membranous bag in which any morbid substance is contained: a cyst.

Dartos, *i.* m. (Δερας, a skin.)

Deferens, *tis.* part. (*Defero*, to convey.) Bringing: conveying.

Deltoid. (Δελτα, and ειδος, resemblance.) Shaped like the Greek letter Δ. Applied to a triangular muscle on the shoulder.

Dens, *tis.* m. (As if *edens*, from *edo*, to eat.) A tooth.

Dermis. (Δερμα.) The skin. See *Cutis.*

Diaphanosus, *a, um.* (Δια, through, and *αινω*, to shine.) Transparent: diaphanous.

Diaphragm. (Δια, and φρασσω, to shut in.)

Diarthrosis, *is.* f. (Δια, through, and *αρθρον*, a joint.) A moveable articulation of bones.

Diastole, *es.* f. (Διαστελλω, to dilate.) The dilatation of the heart, by which, with its alternate contraction (*systole*) the circulation is carried on.

Digastricus, *a, um.* (Δις, twice, and γαστηρ, a belly.)

Dislocation. (Δις, out of, and *locus*, a place.)

Dorsal. (*Dorsum*, the back.)

Duodenum, *i.* n. (*Duodeni*, twelve.)

Enarthrosis, *is.* f. (Εν, in, and *αρθρον*, a joint.) The ball-and-socket joint; a variety of the class *Diarthrosis.*

Encanthis, *is.* f. (Εν, in, and *κανθος*, the angle of the eye.)

Encephalon. (Εν, in, and *κεφαλη*, the head.)

Ensiformis, *is, e.* (*Ensis*, a sword, and *forma*, likeness.)

Entero. (Εντερον, an intestine.)

Epicranial. (Επι, upon, and *κρανιον*, the cranium.)

Epicranium, *ii.* n. (Επι, upon, and *κρανιον*, the cranium.)

Epidermis, *idis.* f. (Επι, upon, and δερμα, the skin.)

Epididymis, *is.* m. (Επι, upon, and διδυμος, a testicle.)

Epigastric. (Επι, upon, and γαστηρ, the stomach.)

Epiglottis, *idis*, or *is.* f. (Επι, upon, and γλωττις, the aperture of the windpipe.)

Epiphysis, *is.* f. (Επι, upon, and φυω, to grow.)

Epiploic. (Επιπλοον, the omentum.) Belonging to the epiploon, or omentum, *Epiploicus, a, um.*

Epiploon, *i.* n. (Επιπλυω, to sail upon; because it, as it were, floats on the intestines.)

Ethmoid, or Æthmoid. (Εθμος, a sieve, and ειδος, resemblance.)

Falciformis, *is, e.* (*Falx*, a scythe, and *forma*, resemblance.) Resembling a scythe: falciform.

Fauces. (Pl. of *faux, cis.* f. the gorge, or mouth.) The cavity at the back of the mouth from which the pharynx and larynx proceed: the jaws.

Fenestra, *æ.* f. A window.

Fibula, *æ.* f. (As if *figilula*, from *figo*, to fasten; because said to fasten the tibia and muscles.)

Fœtus, *us*. m. (*Fœto,* to bring forth.)

Fontanelle. (Dim. *Fons,* a fountain; because the pulsation of the brain is seen like the bubbling motion of the sand in a spring of water. The quadrangular space which exists for two or three years after birth, between the frontal, and the two parietal bones, at the junction of the latter with each other; termed anterior fontanelle, or *fons pulsatilis,* in distinction from a posterior one, triangular-shaped, between the occipital and parietal bones. *Fontanella, æ.* f.

Fornix, *icis*. f. (An arch or vault.)

Frænum, *i*. n. (A bridle.)

Frontal. (*Frons,* the forehead.)

Ganglion, *ii*. n. (Γαγγλιον, a knot.) An enlargement in the course of a nerve, resembling a knot.

Gastric. (Γαστηρ, the stomach.) Belonging to the stomach. *Gastricus, a, um.*

Generation. (Γεινομαι, to beget.)

Genio. (Γενειον, the chin.)

Genu. n. indecl. in the singular number. The knee.

Ginglymus. *i*. m. (Γιγγλυμος, a hinge.) The hinge-like joint; a variety of the class *Diarthrosis.*

Glenoid. (Γληνη, a cavity, and ειδος, resemblance.) Having a cavity for articulation with another bone. *Glenoides, is.* f.: also used adj.

Globate. (*Globus,* a ball.) Applied to glands formed of lymphatic vessels connected together by cellular membrane and passing out again, having no excretory duct. *Globatus, a, um.*

Glomerate. (*Glomero,* to wind round.) Applied to glands formed of a clue, as it were, of sanguineous vessels, having an excretory duct but no cavity.

Glosso. (Γλωσσα, the tongue.)

Glottis, *idis*. f. (Γλωττις, the aperture of the windpipe.)

Gluteal. (Γλουτος, the buttock.)

Gomphosis, *is*. f. (Γομφοω, to drive in a nail.) A variety of the class *Synarthrosis,* in which one bone is fixed in another like a nail in wood, as the teeth in their sockets.

Guttural. (*Guttur,* the throat.) Belonging to the throat. *Gutturalis, is, e*

Gyri. (Pl. of *gyrus,* a circuit.)

Halo, *onis*. m. (Ἁλως, a circle.) The brownish circle around the female nipple.

Harmonia, *æ*. f. (Ἀρω, to adapt.) Harmony; a variety of the class *Synarthrosis,* denoting such bones as are simply joined together, as the nasal and other bones of the face.

Hemisphere. (Ἡμισυς, half, and σφαίρα, a globe.)

Hippocampus, *i.* m. (Ἱππόκαμπος, a sea insect, with a head like that of a horse.) The sea-horse.

Humerus, *i.* m. (Ωμος, the shoulder.) The arm: the shoulder: also the long bone of the arm, *os humeri*, or *os brachii*. BRACHIUM.

Hyaloid. (Ὑαλος, glass, and ειδος, resemblance.) Resembling glass: transparent. *Hyaloides, is.* f.; also used adj.

Hyoides, *is.* f. (Υ, and ειδος, resemblance.) Like the Greek letter υ: hyloid.

Ileum, *i.* n. (Ειλεω, to turn about: from its convolutions.)

Ilia. (Pl. of *ile, is.* n., the flank.)

Impar, *aris.* adj. (*In*, not, and *par*, equal.) Odd not even.

Incus, *udis.* f. (A smith's anvil.)

Inguinal. (*Inguen*, the groin.) Belonging to the groin. *Inguinalis, is, e.*

Innominatus, *a, um.* (*In*, not, and *nomen*, a name.) Without a name: unnamed.

Internodium, *ii.* n. *et us, ii.* m. (*Inter*, between, and *nodus*, a knot, or joint.

Iris, *idis.* f. (A rainbow; from the variety of its colours.)

Ischium, *ii.* n. (Ισχις, the loin; from its proximity to the loin.)

Jejunum, *i.* n. (*Jejunus*, empty.)

Lachryma, *æ.* f. (Λακρυμα.)

Lacteal. (*Lac*, milk.) Milky: belonging to milk. *Lacteus, a, um.*

Lacuna, *æ.* f. (*Lacus*, a channel.)

Lambdoidal. (Λ, and ειδος, resemblance.)

Lamina, *æ.* f. (Ελαω, to beat out.) A plate of metal.

Larynx, *gis.* f. (Λαρυγς.) The windpipe.

Ligamentum, *i.* n. (*Ligo*, to bind.)

Linea, *æ.* f. (*Linum*, a thread.) A line.

Lip. (*Labium, ii.* n.)

Lumbricalis, *is, e.* (*Lumbricus*, the earth-worm.) Resembling or belonging to the earth-worm.

Lunaris, *is, e.* (*Luna*, the moon.)

Luxatio, *onis.* f. (*Luxo*, to dislocate.)

Lymphatic. (*Lympha*, lymph.)

Malleolus, *i.* m. (Dim. *Malleus*, a mallet, which it has been supposed to resemble.)

Malleus, *i.* m. (A hammer; from its fancied resemblance.)
Mamilla, *æ.* f. (Dim. *Mamma,* the breast.)
Mamma, *æ.* f. (Μαμμα, the instinctive cry of an infant for the breast.)
Mandibula, *æ.* f. (*Mando,* to chew.)
Manubrium, *ii. n.* (A hilt, or handle.)
Manus, *us.* f. (The hand.)
Masseter, *eris.* m. (Μασσάω, to chew; because it is employed in chewing.)
Mastoid. (Μαστος, the breast, and ειδος, resemblance.)
Matrix, *icis.* f. (Ματηρ.) The womb, or uterus.
Maxilla, *æ.* f. (Μασσάω, to chew.) The upper, or lower jaw.
Meatus, *us.* m. An opening leading into a canal, or duct.
Mediastinum, *i.* n. (*Mediostans,* standing in the middle.)
Medulla, *æ.* f. (The marrow.)
Meningeal. (*Meninx,* a membrane of the brain.)
Meninx, *gis.* f. (Μανὸς, thin.)
Mesentery. (Μεσος, the middle, and εντερος, the intestine.)
Mesocæcum, *i.* n. (Μεσος, the middle, and *cæcum,* the blind-gut.)
Mesocephalon, *i.* m. (Μεσος, the middle, and κεφαλη, the head; because situated below the centre of the brain.)
Mesocolon, *i.* m. (Μεσος, the middle, and κωλον, the colon.)
Metacarpus, *i.* m. (Μετα, after, and καρπος, the wrist.)
Metatarsus, *i.* m. (Μετα, after, and ταρσος, the tarsus.)
Mitral. (*Mitra,* a mitre.) Resembling a mitre. *Mitralis, is, e.*
Molar. (*Mola,* a mill; because the molar teeth grind the food.)
Mouth. (*Os, oris.* n.)
Multifidus, *a, um.* (*Multus,* many, *findo,* to divide.) Divided into many parts.
Mylo. (Μυλη, a mill; in allusion to the *grinder* teeth.)
Myology. (Μυς, a muscle, and λογος, a discourse.) The doctrine of the muscles. *Myologia, æ.* f.
Myotomy. (Μυς, a muscle, and τεμνω, to cut.) Dissection of the muscles. *Myotomia, æ.* f.
Myrtiformis, *is, e.* (*Myrtum,* a myrtle-berry, and *forma,* resemblance.)

Nates, *is.* f. (*Nato,* to totter; because they shake by the motion of walking.)

Navicularis, *is, e.* (*Naviculo*, a little boat.) Boat-shaped: navicular.
Neurilemma, *atis.* n. (Νευρον, a nerve; and λεμμα, a covering.)
Nucha, *æ.* f. (The nape, or back part of the neck.)
Nucleus, *i.* m. (*Nux*, a nut.)

Obturator, *oris.* m. (*Obturo*, to stop up.) A stopper up of any hole, or cavity.
Occiput, *itis.* n. (The back part of the head.)
Odontoid. (Οδους, a tooth, and ειδος, resemblance.) Resembling a tooth in shape. *Odontoides, is.* f. also used adj.
Œsophagæus, *a, um.* (Οισοφαγος, the gullet.)
Œsophagus, *i.* m. (Οιω, to carry, and φαγω, to eat; because it conveys what is eaten to the stomach.)
Olfactory. (*Olfactus.*) Belonging to the organ, or sense of smell. *Olfactorius, a, um.*
Omentum, *i.* n. (*Omen*, a token; because the soothsayers drew omens, or tokens of good or bad, from its inspection.
Omo. (Ομος, the shoulder.)
Optic. (Οπτομαι, to see.) Relating to the eye. *Opticus, a, um.*
Orbicularis, *is, e.* (*Orbiculus*, the wheel of a pulley.) Round: circular: orbicular.
Orbit. (*Orbis*, a circle: from its form.) The bony cavity in which the eyeball, &c. are situated. *Orbitum, i.* n.
Os, *oris.* n. (Οσσα, the voice.) The mouth. Applied to the openings of parts.
Ossification. (*Os*, a bone, and *facio*, to make.) The formation of bone. *Ossificatio, onis.* f.
Osteogeny. (Οστέον, a bone, γενεια, generation.) The growth of bones. *Osteogenia, æ.* f.
Osteography. (Οστέον, a bone, and γραφω, to describe.) The description of the bones. *Osteographia, æ.* f.
Osteology. (Οστεον, a bone, and λογος, a discourse.) The doctrine of the bones. *Osteologia, æ.* f.

Palatum, *i.* n. (*Palo*, to set with pales; in reference to the teeth, which are set around it.)
Palma, *æ.* f. (Πάλλω, to wield.) The palm of the hand.
Palpebræ. (Pl. of *palpebra, æ.* f. from *palpito*, to throb; from their continual motion.) The eyelids, upper and lower.
Pancreas, *atis.* n. (Παν, all, and κρέας, flesh; from its flesh-like substance.)
Parenchyma, *atis.* n. (Παρεγχοω, to strain through.)
Parietal. (*Paries*, a wall.) Resembling, or belonging to a wall. *Parietalis, is, e.*

Patella, *æ.* f. (Dim. *Patina*, a pan; from its shape.) The knee-pan. ROTULA.

Pecten, *inis.* m. and n. (A comb: from its supposed resemblance to an ancient comb.) The *Os pubis*, which is a distinct bone in the fœtal pelvis.

Pectoral. (*Pectus*, the breast.) Belonging to the chest. *Pectoralis, is, e.*

Pelvis, *is.* f. (Πελλὶς, a bowl; from its shape.)

Penis, *is.* m. (*Pendeo*, to hang down.)

Pericardium, *ii.* n. (Περὶ, about, and καρδια, the heart.)

Pericranium, *ii.* n. (Περὶ, about, and κρανιον, the cranium.)

Perinæum, *i.* n. (Περινέω, to flow around; because it is generally moist.)

Periosteum, *i.* n. (Περὶ, about, and οστέον, a bone.)

Peritonæum, *i.* n. (Περιτείνω, to stretch all over.)

Perone. (Περονη, from πειρω, to traverse; because it passes through or traverses the leg.)

Phalanges. (Pl. of *Phalanx, gis.* f. a battalion of foot.)

Pharynx, *gis.* f. (Φερω, to conduct; because it leads the food into the œsophagus.)

Phrenic. (Φρένες, the diaphragm; being the plural of φρὴν, the mind, which the ancients supposed to exist in the diaphragm and parts immediately above it.) Belonging to the diaphragm. *Phrenicus, a, um.*

Pia Mater. (The *kind mother;* because it distributes the vessels to the substance of the brain.)

Pisiformis, *is, e.* (*Pisum*, a pea, and *forma*, resemblance.) Resembling a pea: pisiform.

Pituitary. (*Pituita*, phlegm.) Belonging to phlegm. *Pituitarius, a, um.*

Placenta, *æ.* f. (Πλακους, a cake; from its resemblance.)

Platysma-Myoides. (Πλατὺς, broad, μυς, a muscle, and ειδος, resemblance.)

Pleura, *æ.* f. (Πλευρα, the side.)

Plexus, *us*, m. (*Plecto*, to twist, or knit.) A network.

Popliteal. (*Poples*, the ham.)

Præpuce. (*Præputa*, to lop off before; because it is cut off in circumcision.)

Process. (*Procedo*, to go forth.)

Prostate. (Προ, before, and ἱστημι, to stand; because situated before the urinary bladder.)

Psoæ. (Ψοαι, the loins.) The loins: also applied to two pairs of muscles of the loins.

Pterygoid. (Πτέρυξ a wing, and ειδος, resemblance.) Resembling a wing. *Pterygoideus, a, um.* ALÆFORMIS.

Pudendum, *i.* n. (*Pudor*, modesty.)
Pudic, or Pudical. (*Pudor*, modesty.) Belonging to the *pudenda*. *Pudicus, a, um.*
Pulmo, *onis.* m. (Πλεύμων, for πνεύμων, the lungs.) The lung.
Pulse. (*Pello*, to beat down.) The beating of the heart felt along the arteries. *Pulsus, us,* m.
Pupil. (*Pupa*, a babe, from the miniature reflection of the person who looks on it.)
Pylorus, *i.* m. (Πυλη, an entrance, and ουρος, a guard; guarding, as it were, the entrance of the bowels.)

Rachis, *eos.* f. (Ῥάχις.) The spine.
Radius, *ii.* m. (A bone of the fore-arm, named from its supposed resemblance to the spoke of a wheel.)
Raphe, *es.* f. (Ραφὴ, a seam, or suture.)
Rectum, *i.* n. (Because it was supposed to be straight.)
Renal. (*Ren.*) Belonging to the kidney. *Renalis, is, e.*
Rete, *is.* n. (A net.) An interlacement of fibres, nerves, or vessels, like network.
Retina, *æ.* f. (*Rete*, a net, or web.)

Sacrum, *i.* n. (*Sacer*, sacred; because it was formerly offered in sacrifices.)
Sagittal. (*Sagitta*, an arrow.) Shaped like an arrow. *Sagittalis, is, e.*
Saphena, *æ.* f. (Σαφὴς, manifest.)
Sartorius. (*Sartor*, a tailor; because it is called into action in crossing the legs as tailors do.)
Scalenus, *a, um.* (Σκαλὴνος, irregular.)
Scalpel. (*Scalpo*, to carve.) A common, straight, surgical knife: a dissecting knife. *Scalpellum, i.* n.
Scaphoid. (Σκάφη, a little boat, and εἶδος, resemblance.)
Scapula, *æ.* f. (The shoulder-blade.)
Sceletos, *i.* m. (Σκελλω, to dry.) A skeleton.
Schindylesis, *is.* f. (Σχινδυλέω, to split into small pieces.) A variety of the class *Synarthrosis*, in which one bone is received into a slit in another, as the vomer into the sphenoid bone.
Schneiderian Membrane. (*Schneider*, a German anatomist, who first discovered it.)
Sciatic. (*Ischiaticus.*) Belonging to the ischium. *Sciaticus, a, um.*
Sclerotic. (Σκληρόω, to harden.) Hard: tough. *Scleroticus, a, um.*

Scrotum, *i.* n. (As if *scorteum*, a leather coat.)

Scutiform. (*Scutum*, a shield, and *forma*, likeness.) Like a shield. *Scutiformis, is, e.* THYROID.

Sella, *æ.* f. (As if *sedda*, from *sedeo*, to sit.) A saddle.

Sella Turcica. (A Turkish saddle; from its fancied resemblance.)

Semen, *inis.* m. (*Semino*, to sow.)

Septum, *i.* n. (*Sepio*, to hem in.) A partition.

Serous. (*Serum*, whey.) Belonging to serum. *Serosus, a, um.*

Serum, *i.* n. (*Serus*, late; because some time elapses before it becomes apparent.) The greenish yellow fluid which separates from the blood when cold and at rest: serosity: also, the whey of milk.

Sesamoid. (Σήσαμον, a grain of Indian corn, and εἶδος, resemblance.) Resembling a grain of Indian corn. *Sesamoideus, a, um.*

Sigmoid. (Σ, and εἶδος, likeness.) Resembling the Greek letter Σ. *Sigmoides, is.* f.; also used adj.

Sinciput, *itis.* n. (The fore part of the head.)

Sine Pari. (Without a fellow.) AZYGOS.

Sinus, *us.* m. A cavity, or depression.

Soleus, *i.* m. (*Solea*, a sole-fish; from its resemblance in shape.)

Spina, *æ.* f. (Dim. *Spica*, as if *spiculina.*) The backbone or spine, from the thorn-like processes of the vertebræ; the vertebral column.

Splanchnic. (Σπλάγχνον, an entrail, or viscus.) Belonging to the entrails, or viscera. *Splanchnicus, a, um.*

Spleen. (Σπλὴν. A purple, or livid-coloured, imperfect oval viscus in the left hypochondrium, whose function is not yet ascertained. *Splen, enis.* f.

Splenius, *ii.* m. (Σπλὴν, the spleen; because like its shape.) A muscle of the neck.

Squamous Suture. That between the parietal bone and the squamous portion of the temporal bone; because the latter overlaps the former like a scale.

Stapes, *edis.* m. (*Stat pes;* from its resemblance to a stirrup, in which the *foot stands.*)

Staphyline. (Σταφυλὴ, a grape.) Like a grape. *Staphylinus, a, um.*

Sternum, *i.* n. (Στέρνον.) The oblong, flat bone at the fore-part of the thorax, consisting in the young subject of several pieces united by cartilages, in the adult of three, of only two, and in the old subject often of one entire bone: the breast-bone. OS PECTORIS.

Stomach. (Στόμα, the mouth, and χεύω, to pour; the food passing into it from the mouth and œsophagus.)

Styliformis, *is, e.* (*Stylus*, a bodkin, and *forma*, resemblance.) Resembling a style, or bodkin: styliform.

Styloid. (Στύλος, a pillar, εἶδος, likeness) Like a stake, or pillar: styliform. *Styloideus, a, um.*

Stylus, *i*: m. (A pin to write with on wax tablets.)

Supination. (*Supinus*, held up.) The act of turning the palm of the hand upwards. *Supinatio, onis.* f.

Sutura, *æ.* f. (*Suo*, to sew together.) A seam, or suture. The union of flat bones by their margins, as those of the cranium.

Symmetry. (Σὺν, together, and μέτρον, a measure.) The due and exact proportion of one thing to another, in respect of the whole, *Symmetria, æ.* f.

Sympathy. (Συμπαθέω, to suffer with.)

Symphysis, *is.* f. (Σὺν, together, and φύω, to produce.) A natural union of bones, by means of an intervening substance; a variety of the class *Synarthrosis.*

Synarthrosis, *is.* f. (Σὺν, together, αρθρον, a joint.) An immoveable joint; a class of articulations having three varieties, *Sutura, Gomphosis, Symphysis.*

Synchondrosis, *is.* f. (Σὺν, together, and χόνδρος, a cartilage.) A union of bones by means of an intervening cartilage; a species of *symphysis*, as of the pubes.

Syneurosis, *is.* f. (Σὺν, together, and νεῦρον, a nerve; the term nerve formerly including ligaments, membranes, and tendons.) Union of bones by means of an intervening membrane; a species of *symphysis.*

Syssarcosis, *is.* f. (Σὺν together, and σὰρξ, flesh.) Union of bones by means of a kind of connecting muscle, as the *os hyoides* to the sternum.

Systole, *es.* f. (Συστέλλω, to draw together.)

Tarsus, *i.* m. (Ταρσὸς.)

Temple. (*Tempus, oris.* n.)

Tendo, *inis*, or *onis.* m. (*Tendo*, to stretch out.) The smooth, white, shining extremity of a muscle: a tendon.

Tentorium, *ii.* n. (*Tendo*, to stretch.)

Testis, *is.* m. (A witness; being evidence of manhood.)

Thalamus, *i.* m. (Θάλαμος.) A bed.

Theca, *æ.* f. (A sheath, or case.)

Thorax, *acis.* f. (Θώραξ, a coat of mail; because it incases the viscera of the chest.)

Thyroid. (Θυρεὸς, a shield, and εἶδος, resemblance.) Resembling a shield. *Thyroideus, a, um.* SCUTIFORM.

Tibia, *æ.* f. (A pipe; from its resemblance in shape.

Torcular, *aris.* n. (A wine-press; from *torqueo*, to rack, or torture; because the grapes are, as it were, tortured in it.)

Trachea, *æ.* f. (Τραχὺς, rough; from the inequalities of its cartilages.)

Tragus, *i.* m. (Τράγος, a goat; from the short hairs that grow on it, in advanced life.)

Trapezium, *ii.* n. (Τραπέζιον, a four-sided geometrical figure; from its shape.)

Trapezoides, os. (Τραπέζιον, the trapezium, and εἶδος, resemblance.)

Tricuspid. (*Tres*, three, and *cuspis*, a point.) Three-pointed. *Tricuspis, idis.* adj *Tricuspidatis, a, um.*

Trigemini. (Pl. of *trigeminus, a, um*, three-fold.)

Trigonus, *a, um.* (Τρεῖς, three, and γωνία, a corner.) Three-cornered: trigonial.

Trochanter, *ri.* m. (Τρέχω, to run; from the use of the muscles attached to it.)

Trochlea, *æ.* f. (Τρέχω, to run.) A pulley.

Turbinated. (Coped: made like a top, broad above and small below.) *Turbinatus, a, um.*

Tympanum, *i.* n. (Τύμπανον, a drum.)

Ulna, *æ.* f. (Ωλένη, the ulna, or cubit.)

Unciform. (*Uncus*, a hook, and *forma*, resemblance.) Resembling a hook. *Unciformis, is, e.*

Unguis, *is.* m. (Ονυξ, a claw, or talon.)

Urachus, *i.* m. (Οὖρον, urine, and εχω, to contain.)

Ureter, *eris.* m. (Οὖρον, urine.)

Urine. (Ὀρούω, to rush forward.)

Uterus, *i.* m. (Ὑστέρα.)

Uvea, *æ.* f. (*Uva*, a grape; from its colour.) The posterior surface of the *iris*, which is covered by a dark-coloured pigment.

Ventricle. (Dim. *Venter*, a cavity of the body.)

Vermiformis, *is, e.* (*Vermis*, a worm, and *forma*, likeness.) Worm-like: vermiform.

Vertebra, *æ.* f. (*Verto*, to turn.)

Villous. (*Villus.*) Like the pile of velvet.

Viscus, *eris.* n. (Any organ, or part having an appropriate use; as the viscera of the abdomen, or of the thorax.

Vitreous. (*Vitrum*, glass; from its clearness.) Resembling glass. *Vitreus, a, um.*

Vomer, *eris.* m. (A ploughshare; from its close resemblance.)

Vulva, *æ.* f. (As if *valva*, a door.)

Wrist. (*Sax.*) *Carpus, i.* m.

Xiphoid. (Ξὶφος, a sword, εἶδος, resemblance.) Sword-shaped. *Xiphoides, is.* f.; also used adj. ENSIFORMIS.

Zygoma, *atis.* n. (Ζυγὸς, a yoke.)

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