MANUAL OF ANATOMY

MANUAL OF ANATOMY.

BY

JAMES COCHRAN, M. A., M. D.

A NEW AND REVISED EDITION.

PHILADELPHIA:
PUBLISHED BY JOHN BUCHANAN,
227 *North Twelfth Street.*
1868.

W. B. Selheimer, Printer,
501 *Chestnut St., Philada.*

QUESTIONS ON ANATOMY.

Define anatomy.

The science of the mechanical structure of organized bodies of man, animals and plants.

Define phytotomy.

The anatomy of plants.

Define androtomy.

The anatomy of man.

Define zootomy.

The anatomy of the other species of the animal kingdom.

Define comparative anatomy.

The comparative study of each organ, so as to investigate the modifications of its structure in different animals or different classes of animals.

Define descriptive anatomy.

The treatment of the several parts and organs of the body in respect to their form, structure and systematic connection or relation with each other.

Define physiological anatomy.

That department of anatomy which investigates structure with a special view to function.

Define pathological anatomy.

The anatomy of the diseased human body.

Define physiological or transcendental anatomy.

It treats of the model upon which the animal frame or organs are formed.

Define surgical anatomy.

Is the relative study of the bones, muscles, nerves and vessels, so as to have a thorough knowledge of the part requiring to be operated upon.

Define topographical anatomy.

Regional, or the treatment of anatomy made in accordance with natural divisions, dividing the body into several regions, as the head, the trunk and the extremities.

Define artificial anatomy.

Is the art of modeling and representing, in wax or other substance, the different organs or parts of the human body, in either the sound or diseased condition.

Define general anatomy.

A description of the elementary tissues of which the systems and organs of the body are composed, and investigates their laws of formation and combination.

Define histology.

Is the science which classifies and describes the structural elements which exist in the solids and fluids of organized bodies.

Define zoology.

The natural history of animals.

What is a skeleton?

A dried body; the aggregate of the hard parts of the body or the bones. (From σκελλω, I dry.)

Name the number of bones in the human skeleton.

Two hundred and four—In this enumeration the sternum, sacrum and coccyx are reckoned as each constituting only one bone; the patellæ with other sesamoid bones, the wormian bones, as also the teeth, are excluded in the above reckoning.

Why do anatomists differ in the number?

Because some of them include the teeth, the sesamoid bones, &c., in their calculation of the number of bones composing the human skeleton.

Properly speaking, are teeth bones?

No; they differ both in their mode of growth, and in their chemical constituents, from bone.

What purpose do sesamoid bones serve?

They increase the power of muscles, by removing them further from the axis of the bone on which they are intended to act.

What is the usual division of the skeleton?

It is divided into cranial, thoracic, abdominal and pelvic, together with the upper and lower extremities.

What number of bones are there in the cranium, giving the name of each?

Eight—occipital, frontal, sphenoid, ethmoid, two parietal, and two temporal.

Give the same with respect to the face.

Fourteen—two superior maxillary, two nasal, two lachrymal, two malar, two palate, two inferior turbinated, vomer and inferior maxillary.

Also, the same with respect to the trunk.

Fifty-three—twenty-six vertebræ, two os innominata, twenty-four ribs, and one sternum.

What are the number and names of the bones in the upper extremity?

Thirty-two, in either extremity—scapula, clavicle, humerus, radius and ulna, one of each; eight carpal, thus: scaphoid, semilunar, cuneiform, pisiform, trapezium, trapezoid, os magnum and unciform, five metatarsal and fourteen phalanges.

The same respecting the lower extremity.

Twenty-nine, in either extremity—the femur, tibia, fibula, seven tarsal, viz.: the os calcis, astragalus, cuboid, scaphoid, and three cuneiform; five metatarsal and fourteen phalanges.

What is the composition of bone with the relative proportions of its various constituents?

It is composed of animal and earthy matter.

Animal basis,	33	per cent.
Earthy matter as follows:		
Phosphate of lime,	57	"
Carbonate of lime,	8	"
Fluoride of calcium,	1	"
Phosphate of magnesia,	1	"
	100	

To what may the animal matter of bone be reduced?

Reducible into gelatin by long boiling.

Under what circumstances is the proportion of earthy matter diminished?

In rickets and in children.

Is the usual proportion of earthy matter found in bone ever increased?

Yes, by old age.

How is the earthy matter obtained free from the animal?

By strong heat in an open fire the animal matter of bone is consumed, but the earthy is left intact.

What are the uses of bones?

They are the passive agents in locomotion, form numerous points of attachment to muscles, they protect the organs of special sensation, and they form cavities inclosing and protecting the various viscera of the body.

How are bones classified?

Into four groups, viz.: long, short, flat, and irregular.

What are the characteristics of long bones?

A lengthened cylinder or shaft, and two extremities.

What advantages are secured from large extremities?

They add strength to the articulation, and increase the surface for muscular attachment.

What bones have a medullary canal?

The clavicle, humerus, radius, ulna, femur, tibia, fibula, metacarpal and metatarsal bones, and the phalanges.

What purpose does the medullary canal serve?

It increases the strength and lightness of the bone, and furnishes a cavity for the protection of the medullary substance.

What use does the medullary substance serve?

It is a source of nourishment to the bone, and of nutriment to the body in disease.

Do the hollow bones in birds contain medulla?

No.

What do they contain?

Warm air.

Give a short description of the minute structure of bones.

By making a thin transverse section, we observe Haversian canals for blood-vessels, laminæ surrounding these canals; peel off laminæ, and it is found to be composed of fibrous tissue, and between the laminæ are lacunæ—spots like black insects—which ramify together, and also communicate with the vessels.

Give the names of some of the short bones.

The carpal and tarsal bones belong to that class.

Give the names and uses of flat bones.

The flat bones are the occipital, parietal, frontal, nasal, lachrymal, vomer, scapulæ, ossa innominata, sternum and ribs. Their principal uses are, that they afford extensive protection, and furnish extensive surfaces for muscular attachment.

What is peculiar in the structure of the cranial bones?

In containing two layers of compact tissue, with intervening cancellous structure, or diploe.

Name the irregular or mixed bones.

The vertebræ, sacrum, coccyx, temporal, sphenoid, ethmoid, superior and inferior maxillary, palate, inferior turbinated, and hyoid.

What are foramina?

Openings, or any structures pierced through and through.

What is understood by a sinus?

Any cavity, the interior of which is more expanded than the entrance.

What is meant by a fossa?

A cavity whose entrance is always larger than the base.

What is the form of a cotyloid cavity?

It is hemispherical.

What part of bones receives the name of head?

The superior articulating extremity.

To what part is the term neck applied?

To the constriction below the head.

What is a condyle?

An articular eminence—round in one direction, flat in another.

What are tubercles and tuberosities?

The latter term is applied to non-articular, *broad* rough, uneven elevations, and the latter to *smaller* elevations.

What are spinous processes?

A process of bone which projects backward from the two laminæ of each of the vertebræ, and forms a series of levers for the attachment of muscles.

What is meant by crest or crista?

A name given to several bony projections; and, when applied to the ilium, it denotes its superior margin.

BONES PARTICULARIZED.

By what are all higher animals characterized?

The possession of a spinal cord and vertebral column.

What is the position of the vertebral column in man?

It is vertical.

What is its general use?

It encloses and protects the spinal cord, supports the skull and trunk, transmitting their weight to the base on which it rests, affords attachment for muscles, and is the centre of all the movements of the body.

What is the meaning of the term vertebra?

The integral pieces of the column are so named from their mobility, (*vertere*, to turn.)

What are the essential parts of a vertebra?

A ring, body, articulating surfaces, spinous and transverse processes, and notches.

Name the modifications that are met with in the cervical vertebra.

The atlas has neither a body nor spinous process; the second cervical has a process, (the odontoid,)

forming the pivot on which the head rests; the seventh cervical has a larger spinous process than any of the other cervical.

What is meant by false vertebræ, and what their names?

Such as lose by their union into a single mass that character of mobility from which the term vertebræ is derived; sacrum and coccyx.

How early does the ossification of a vertebræ begin?

About the seventh week from the time of conception.

How many parts of each vertebræ at birth?

Three primary pieces.

At what period is the bone completed?

About the thirtieth year.

What is the form and structure of its body?

Rounded before, and marked in the middle by a transverse groove, which gives it a constricted appearance, slightly hollowed posteriorly, where it contributes to the formation of the vertebral canal, and in most cases is flat on the superior and inferior surfaces, by which, through the medium of fibro-cartilage, it is connected with the contiguous bones. Its outer surface has numerous foramina for the passage of blood-vessels, chiefly veins. Its structure is the most solid of any part of a vertebræ.

How many classes of vertebræ, and what their names?

Four—Cervical, dorsal, lumbar and false vertebræ, which comprise the sacrum and coccyx.

What foramen in the vertebræ?

The vertebral.

What is the spinal canal, and how formed?

That hollow in the middle line, at the posterior part of the trunk, formed by the vertebræ piled one

over the other, so that the rings are placed in apposition.

What openings in the canal, and how formed?

The intervertebral, formed by the juxtaposition of the intervertebral notches.

What is the purpose of these lateral openings?

They transmit the spinal nerves.

What occupies the spinal canal?

The spinal cord.

What features characterize the cervical vertebræ?

The smallness of their bodies and processes, the triangular form of the vertebral foramen, the oblique direction of their articular processes, and by the groove and foramen in the transverse processes.

What are the distinguishing marks of the dorsal?

They are larger than the cervical, but smaller than the lumbar vertebræ; the foramen is smaller than that of either the cervical or lumbar, and nearly circular in form; the lateral notches, and hence, also, the intervertebral foramina are larger than those of the cervical vertebræ; they are thicker behind than in front; they present oval depressions for the reception of the heads of the corresponding ribs; articulating processes nearly vertical in their direction; the transverse processes are long, thick and inclined backward; presents an articulation for the tubercle of the rib; and the spinous processes are long, triangular, directed downward, and terminate in a tubercle.

What peculiarities do the lumbar present?

The foramina are large and triangular, the notches very deep, the body is large, broader from side to side than from before backward, nearly equal in depth in front and behind, and less convex anteriorly than that of the dorsal vertebræ; the articulating processes are thick, strong and disposed vertically;

each of the superior articulating processes presents a tubercle which projects backward; the transverse processes are long, slender, horizontal, and do not project backwards like those of the dorsal vertebræ; the spinous processes are thick, broad, quadrilateral, horizontal in direction, and terminate in a thick rough border; and the laminæ are deeper and thicker, but shorter than those of the dorsal vertebræ.

How many pieces have the sacrum and coccyx?

The sacrum has five, and the coccyx four.

How are the vertebræ connected?

By the apposition of the articulating processes, the intervertebral substance, anterior and posterior common ligaments, and by numerous other ligaments.

How many articulating processes to each vertebra, and how are these united?

There are four—two superior and two inferior; the smooth surfaces of the upper pair look backward—those of the lower forward; they are coated with cartilage, and their margins rough for the attachment of ligaments.

Describe the first cervical vertebra.

The first vertebra, or *atlas*, is an irregular ring of bone, and has nothing analogous to the bodies or spines of the other vertebræ. In the fresh state, the ring is divided into two parts by a transverse ligament—the anterior being occupied by the odontoid process of the axis, the posterior by the spinal cord. It presents in front a small arch of bone, the anterior surface of which is marked by a tubercle, the posterior by a smooth depression, adapted to the odontoid process of the axis. At the middle of the posterior segment is a tubercle—the analogue of the spinous processes. On the upper border, on either side, is a smooth groove, placed behind the superior

articular process, which marks the tortuous course pursued by the vertebral artery before entering the cranium. The groove is analogous to the notches in the other vertebræ, for it transmits the first spinal nerve, as well as the vertebral artery. The large horizontal surfaces—the superior pair—receive the condyles of the occipital bone. The transverse processes terminate in a rounded point, in which is situated the foramen, which transmits the vertebral artery.

What are the peculiarities of the second cervical vertebra?

It is somewhat triangular in its form, and furnishes the pivot on which the head rests. The odontoid process has two smooth surfaces—one for its articulation with the atlas, the other with the transverse ligament. The superior articulating processes are nearly horizontal—are close to the body, so as to communicate to it the weight of the head. The spinous process is very large, and the transverse processes are neither grooved nor bifurcated.

The same as respects the seventh.

The spinous process is long, and terminates in a tubercle; hence the term "prominent." This process is thick, but not bifurcated, and has the ligamentum nuchæ attached to it. Transverse process large, and the vertebral foramen usually smaller, and sometimes wanting.

How many and what curves in the vertebral column?

Four—the cervical convex in front, the dorsal concave, the lumbar convex, and the pelvic concave, posteriorly.

What causes the frequent lateral curvature?

Muscular action. In left-handed individuals the lateral curvature is directed to the left side.

What is the form of the vertebral column?

Pyramidal, or, more strictly, composed of two pyramids—the upper one being formed by the true vertebræ, the lower one by the sacrum and coccyx.

BONES OF THE THORAX.

What is the shape of the thorax?

Conical—narrow above, broad below, flattened before and behind, and somewhat cordiform on a transverse section.

What bones enter into its formation?

The sternum, ribs, and dorsal vertebræ.

How many ribs, and how are they classified?

There are twenty-four, or twelve on each side, divided into *true*, *false*, and *floating*, but the last named are generally included with the false.

What parts of each rib are named?

Each rib has two extremities, a posterior or vertebral, and an anterior or sternal, with an intervening body or shaft, a head, neck, angle and tubercle.

Name each of the parts common to all.

Two surfaces, two borders and two extremities.

State what parts, and with what they articulate.

The head, which articulates with the bodies of the dorsal vertebræ; the tubercle with the transverse process of a single vertebræ, and the anterior extremity is attached to the costal cartilage.

What are the peculiarities of the first rib?

It is shorter and broader than any of the others; its direction is nearly horizontal—one surface looking upward, another downward; external border convex and rounded, the internal is thin and forms the margin of the superior aperture of the thorax; the head is small, and has only *one* articular facet; no

angle, and the shaft is *not* twisted upon itself, and the *anterior extremity* is larger and thicker than in any other rib.

Which rib is the longest, and what is its direction?
The seventh; oblique.

What are the peculiarities of the eleventh and twelfth?
They have no groove, angle or tubercle, loose at their anterior extremity; hence called *floating* ribs, and have each a single articular facet.

Do the ribs ever vary in number?
Occasionally are increased in number by the development of a cervical or lumbar rib, or may be diminished to eleven.

What purpose does the groove at the lower edge of the rib serve?
To lodge the intercostal vessels and nerve.

What covers the inner surface of the ribs?
The infra-costales and triangularis sterni muscles.

What is the structure of the ribs?
Composed of cancellous tissue, inclosed in a thin, compact layer.

What part of a cervical vertebra corresponds to a rib?
The anterior root of the transverse process.

Which true rib has the shortest cartilage?
The first.

Which one has the longest cartilage?
The seventh.

Describe the costal cartilages and their use.
They are of a medium consistence between bone and ligament, of a white elastic structure, serve to prolong the ribs forward to the front of the chest, and add considerable to the elasticity of this cavity.

How are these cartilages attached, including those of the false ribs?

The outer extremity is continuous with the osseous tissue of the rib to which it belongs; the inner rounded extremities are received into shallow concavities on the lateral margins of the sternum. The cartilages of the first three false ribs, becoming slender toward its extremity, is attached to and blended with the lower border of that which is next above it; the last two are pointed and unattached.

STERNUM.

What is the sternum, and how placed?

The breast bone, and situated in the median line of the front of the chest.

Describe its form, structure and use.

That of an ancient sword; cancellated in texture, covered by a thin layer of compact tissue; assists in forming the anterior wall of the thorax, affords attachment to ribs to the aponeurosis of the abdominal muscles, and to ten other muscles.

Name the principal pieces of which it is composed.

Manubrium, gladiolus and xiphoid or ensiform appendix.

How many centres of ossification?

Six; one for the manubrium, four for the gladiolus, and one for the ensiform appendix.

What defect sometimes occurs from the mode of growth?

Some of the pieces are often formed from two centres placed laterally, the irregular union of which may give rise to a sternal foramen or a vertical fissure.

Give the names of the ten muscles that are attached to the sternum.

Pectoralis major, sterno-cleido mastoid, sterno-hyoid, sterno-thyroid, triangularis sterni, aponeurosis of the external oblique, internal oblique, transversalis, rectus and diaphragm.

BONES OF THE PELVIS.

What bones form the pelvis?

Sacrum, coccyx, ilium, ischium and pubis.

How many vertebræ are represented in the sacrum?

Usually five.

What is its shape, position and structure?

Triangular; situated at lower extremity of vertebral column, and upper, back part of the pelvic cavity, and light in structure, consisting of loose spongy tissue, which is covered by a thin layer of compact tissue.

What bones articulate with it?

The last lumbar, coccyx, and the two ossa innominata.

Describe its surfaces, borders and openings.

Its *anterior* surface is concave from above downward; there are four transverse ridges in the middle, indicating the division of the bone into five pieces, and at either end of these ridges the anterior sacral foramina are placed. External to these foramina is the *lateral mass* which is traversed by four broad shallow grooves, which lodge the anterior sacral nerves as they pass outward.

The posterior surface is convex and narrower than the anterior, and the middle line contains three or four tubercles—the spinous processes of the sacral vertebræ; on either side, and external to the spinous processes, are the *laminæ*, and external to these are a number of indistinct tubercles, known as the *articular processes*, or the fourth and fifth, as *sacral cornua;* external to these are the posterior *sacral foramina;* and still more external are the *transverse processes.*

There are two lateral surfaces—superior and inferior; the superior large and irregular, in the fresh state

covered with cartilage, and articulated with the ilium, but posteriorly is concave and rough, for the attachment of strong ligaments. The anterior cartilaginous part is known as "the auricular surface." The inferior part is thin, and gives attachment to the sacro-sciatic ligaments.

The base, or superior extremity, presents, toward the middle, an oval surface cut off obliquely, which articulates with the oblique body of the last lumbar vertebra. On either side is a smooth convex surface, which is continuous with the iliac fossa. Its apex is directed downward and forward, presenting an oval convex surface, which articulates with the coccyx.

At what angle does it join the lumbar vertebræ?

An obtuse angle.

What kind of union with the os innominata?

Mixed or amphiarthrodial.

How many vertebræ are represented in the coccyx?

Three.

Describe its shape, position and articulation.

Resembles a cuckoo's beak suspended at the point of the sacrum, of which it is a movable appendage, continuing its line of curvature forward.

Describe the position and articulation of the os innominata.

The pair occupy the lateral and anterior parts of the pelvis, and articulates with its fellow of the opposite side, the sacrum and femur.

How many and what primary points of development?

By eight centres; three primary—one for the ilium, one for the ischium, and one for the pubes.

What epiphysis to complete the bone?

That which supplies the inner margin of the pubis.

Into what parts is this bone divided?

Ilium, ischium and pubis.

What is the position of the ilium?

It is directed upward from the upper and back part of the acetabulum.

Describe the shape and thickness of the crest of the ilium.

It is convex in its general outline, and bent inward anteriorly, outward posteriorly. The surface of the crest is broad, and it terminates at either end in the anterior and posterior superior spinous processes. It is very thick behind, but thinner at the centre than at the extremities.

What processes are upon this bone?

The anterior, superior and inferior, and the posterior, superior and inferior spinous processes.

What are the names of its surfaces?

External (dorsum) and internal.

Describe the shape and divisions of the internal surface.

It is divided into three parts, one anterior, concave and smooth, (iliac fossa;) another posterior, partly rough and partly smooth; the third is smooth, and enters into the formation of the true pelvis.

Describe the lines upon the dorsum ilii, with their position.

These are the superior and inferior curved lines—the former commencing at the anterior superior spinous process, arches downward to the margin of the sacro-sciatic notch, the latter (shorter and not so well defined as the superior) commencing at the anterior inferior spinous process; it inclines backward to the sacro-sciatic notch.

What is the position of the ischium?

It forms the back and lower part of the os innominatum.

How is it divided?

Into two parts—the body and ramus.

Give a general description of these parts.

It presents three surfaces—external, internal and posterior. The external forms a portion of the acetabulum; the internal, smooth and concave, forms the lateral boundary of the true pelvic cavity, and the posterior, which is quadrilateral in form, broad and smooth above, narrow below, becoming continuous with the tuberosity. Near the centre is a pointed triangular eminence—the spine of the ischium. Above the spine there is a large notch, (great sacro-sciatic,) converted into a foramen by the lesser sacro-sciatic ligament. Below the spine is a smaller notch, (lesser sacro-sciatic,) converted into a foramen by the sacro-sciatic ligaments.

The *tuberosity* is situated at the junction of the posterior and inferior borders.

The *ramus* is the thin, flattened part of the ischium, ascending upward and inward to join the ramus of the pubes.

Describe the position of the pubis.

It forms the anterior and inner part of the os innominatum.

Into what parts is the bone divided?

Into a body and ramus.

What are the shape, position and general characteristics of each part?

The body has an outer and inner extremity; the former is thick, and presents three surfaces—one (concave) forming part of the acetabulum; another (superior) connects it with the ilium; the third (inferior) is joined with the ischium. The latter is flat and compressed, and irregularly quadrilateral in shape.

The *ramus* inclines outward and downward, becoming thinner and narrower as it descends and joins the ramus of the ischium.

What and where is the symphysis?

The inner margin of the body is joined to the corresponding part of the opposite bone by an intervening cartilage; the junction is termed symphysis pubis. It occupies the median line.

Describe the angle, crest and spine of the pubis?

The angle is formed by the point of junction of the crest with the symphysis; leading outward from the symphysis there is a horizontal margin, nearly an inch in length, named the crista, or crest. The crest terminates externally by a nodule of bone—the tuberosity or spine.

Describe the arch and its variations.

The arch is three and a half to three and three-quarters of an inch broad at the base, but only one and a quarter to one and a half inches at its apex. It is larger in the female than in the male.

Where is the acetabulum, and how is it formed?

It is situated at the junction of the three pieces of os innominata. The ischium forms rather more than two-fifths, the ilium rather less than two-fifths, the remainder being made up of the os pubis.

Where is the margin strongest, and where deficient?

Strongest toward the superior and external part, but toward the obturator foramen it is deficient.

Describe the thyroid foramen and its use?

A large aperture, situated between the ischium and pubis; it is bounded by a thin uneven margin, affording attachment to thyroid membrane. At its upper and outer part there is a deep groove, which is converted into a foramen by the thyroid membrane, and transmits the obturator vessels and nerve.

How does it differ in the sexes?

In the male it is large and somewhat oval; in the female smaller and more triangular.

What muscles are attached to the crest of the ilium?

The tensor vaginæ femoris, the external oblique, and latissimus dorsi to the outer lip; the transversalis, quadratus lumborum, and erector spinæ to the internal lip; and the internal oblique to the interspace between the lips.

Which to the outer surface?

The three gluteii, reflected tendon of the rectus portion of the pyriformis.

Which to the inner surface?

The iliacus.

Which to the anterior border?

The sartorius and straight tendon of the rectus.

What muscles are attached to the outer and inner surfaces of the ischium?

The obturator externus to its outer surface, and obturator internus and levator ani to its internal surface.

What muscles are attached to the spine?

The gemellus superior, levator ani and coccygeus.

Which to the tuberosity?

The biceps, semi-tendinosus, semi-membranosus, quadratus femoris, adductor magnus, gemellus inferior, transversus perinæ, and erector penis.

Which muscles are attached to the pubis?

The external and internal oblique, transversalis, rectus, pyramidalis, psoas parvus, pectineus, adductor longus and brevis, gracilis, external and internal obturators, levator ani, compressor urethræ, and sometimes a few fibres of the accelerator urinæ.

What is meant by true and false pelvis?

The *true* pelvis is that part of the pelvic cavity situated below the ilio-pectineal line. The *false* embraces all the more expanded portion, situated above the ilio-pectineal line.

What are the form and principal diameters of the inlet of the pelvis?

Somewhat heart-shaped, obtusely pointed in front. It has three principal diameters—antero-posterior, transverse and oblique.

What parts bound the outlet of the pelvis?

Antero-posteriorly, from the lower part of the symphysis pubis to the tip of the coccyx; and, transversely, from the posterior part of one ischiatic tuberosity to that of the other.

What are the distinguishing features of the male and female pelvis?

The bones are thicker and stronger, and their eminences are better marked in the male than in the female. The cavity of the male pelvis is deeper and narrower, and the obturator foramen is larger. In the female the iliac fossæ are broad, and the spines of the ilia widely separated; the inlet and outlet are larger; the cavity is more capacious; the promontory is less projecting; sacrum wider and less curved, and the coccyx more movable. The arch of the pubis is wider; the tuberosities of the ischia and the acetabula are wider apart.

With what does the pelvis articulate?

The last lumbar and the two femurs.

BONES OF THE LOWER EXTREMITY.

How many bones in the lower extremity?

Twenty-nine, (beside the sesamoid bones.)

How is the lower extremity divided?

Into thigh, leg and foot.

Which is the largest bone in the body?

The femur.

How soon does ossification begin in the femur?

About the fifth week of fœtal life, being the first of all the long bones to show traces of ossification.

When and where does the first epiphysis appear?

In the last month of fœtal life, and in the lower end of the bone.

How many epiphysis, and where situated?

Five; one for the shaft, one for each trochanter, and one for each extremity.

At what age is the bone consolidated?

Not before the twentieth year.

What are the parts named on this bone?

The head, neck, greater and lesser trochanter, the shaft, linea aspera, external and internal condyles and tuberosities.

What is the form and structure of the shaft?

Slightly compressed, but nearly cylindrical toward the centre; it is expanded superiorly and inferiorly. The cylinder is of great thickness and density in middle third of shaft; but above and below is thinner, owing to a separation of the layers of the bone into cancelli.

Describe the linea aspera and its position.

A prominent longitudinal ridge, presenting on the middle third of the bone an external and internal lip, with rough intermediate space. Near the centre of the shaft it divides into three lines; the most external one becomes very rough, and continues nearly vertically upward to base of great trochanter.

What eminences at the upper part of the bone?

The head, greater and lesser tuberosities.

Describe the position and shape of each.

The head is directed upward, inward, and a little forward; it forms rather more than a hemisphere.

The greater trochanter is prolonged from the external surface of the body of the bone, convex and rough on its external surface; the internal is smaller, and presents at its base a pit—digital fossa; the superior border is flat and straight, and the posterior thick and rounded. The lesser trochanter is a conical rounded eminence, which projects from the posterior and inner side of the bone.

What circumstances give rise to a variation in the size and direction of the neck?

It varies in length and obliquity according to the period of life; before puberty, it is directed obliquely; in the adult male it forms an obtuse angle with the shaft; whereas, in the female, it forms nearly a right angle. In old or emaciated subjects it diminishes considerably in length, and becomes horizontal in direction.

What are the form, eminences and depressions on the lower end of the bone?

It is cuboid, broader and thicker than the superior; has two eminences—internal and external condyles—the *internal* presenting at its inner side a tuberosity for the internal lateral ligament, and the *external* having a similar projection on its outer side, and the inter-condyloid fossa or depression.

With what bones does the femur articulate?

The os innominatum, tibia and patella.

Name the muscles attached to the great trochanter.

The gluteus medius and minimus, pyriformis, obturator internus and externus, the two gemelli, and the quadratus femoris.

Which to the lesser trochanter?

The tendon of the psoas and iliacus.

Which are inserted into the trochanteric fossa?

The external rotators.

What muscles are attached to the different parts of the linea aspera?

The vastus internus and vastus externus to the inner and outer lips respectively, the adductor magnus to the whole length of the linea aspera, being connected with the outer lip above, and the inner lip below. Between the vastus externus and the adductor magnus, are gluteus maximus above, and the short head of the biceps below. Between the vastus internus and adductor magnus, the iliacus and pectineus above, and adductor brevis and longus are attached.

How many muscles are connected with the femur?

Twenty-four.

Name each in order from above downward.

The three gluteii, the common tendon of the psoas and iliacus, the pyriformis, the two gemelli, the obturator, whose tendon receives the attachment of the gemelli; the quadratus femoris, sartorius, gracilis, pectineus, adductors longus, brevis and magnus, two vasti, crureus, semi-membranosus and popliteus; the rectus femoris, biceps, and semi-membranosus—these three last named have no *direct* attachment to the bone.

THE PATELLA.

What and where is the patella?

It is a small, flat and triangular bone; resembling a sesamoid bone in being developed in the tendon of the quadriceps extensor. It is placed in front of the knee-joint.

With what does it articulate?

The two condyles of the femur.

What muscles are attached to it?

The rectus, crureus, vastus externus and vastus internus, which constitute the quadriceps extensor cruris.

BONES OF THE LEG.

Describe the position of the tibia and fibula.

The tibia is situated at the inner side and front of the leg; the fibula is situated at the outer side.

How many ossifying centres for each?

Each has three centres.

Name the parts upon the tibia?

Two tuberosities, a spinous process, a shaft, three faces and articulating surfaces for fibula and astragalus.

Describe the head and its articulations.

Large and expanded into two tuberosities, with smooth concave surfaces, which articulate with the condyles of the femur.

What projection between the condyles?

A pyramidal eminence.

Where are the tuberosities and tubercle?

The tuberosities are placed one on either side of the head; the tubercle is situated in front, a little below the head.

Where is the facet for the head of the fibula?

On the external tuberosity of the tibia.

Describe the diaphysis of the tibia.

Ossification commences in the centre of the shaft about the sixth week. The lower epiphysis joins the shaft about the twentieth, and the upper one about the twenty-fifth.

What oblique line on its posterior surface?

A line extending from its upper third upward and outward to the external tuberosity.

Describe the lower extremity of the tibia.

Smaller than the upper, quadrilateral in form, presenting a smooth surface for articulation with astragalus; the external surface has a triangular rough depression, the lower part sometimes smooth, covered with cartilage, and articulates with the fibula.

Which bones do the tibia articulate with?

The femur, fibula and astragalus.

Describe the malleoli, and their formation.

There are two—the inner, belonging to the tibia, and the outer, to the fibula. That of the tibia is formed by osseous matter developing itself in the cartilage of the lower extremity; and that of the fibula is formed by the ossification of the lower epiphysis.

How are the two bones united?

Somewhat in the form of a clasp.

Which of the two bones is the longest?

The tibia.

What muscles are attached to the tibia?

The tibialis anticus, extensor longus digitorum, the sartorius, gracilis, semi-membranosus and semi-tendinosus, the popliteus, soleus, tibialis posticus, and flexor longus digitorum.

What muscles are attached to the fibula?

Extensor communis digitorum, extensor proprius pollicis, peroneus longus, peroneus brevis, and peroneus tertius, and to its head biceps flexor cruris.

BONES OF THE FOOT.

How many bones of the foot?

Twenty-six.

How are these bones divided?

Into three—the tarsus, metatarsus and toes.

Name the tarsal bones, and the position of each.

The os calcis, astragalus, cuboid, scaphoid and three cuneiform. The os calcis is situated at the posterior and inferior part of the tarsus, and projects backward to form the heel; the astragalus is situated at the superior part of the tarsus; the cuboid at the external side of the tarsus; the scaphoid is placed at the inner border of the foot; and the three cuneiform bones, which, with the cuboid, form the most anterior row of the tarsus.

With what does the astragalus articulate?

The tibia, fibula, os calcis and scaphoid.

What is the shape of its upper and lateral surfaces?

The upper somewhat triangular and rough. The lateral is smooth, with articular surfaces for the malleoli of the tibia and fibula.

Describe the position and articulation of its head?

It is placed near the middle and upper part of the tarsus. Its anterior surface is convex, which is received into the hollow in the scaphoid.

What is the form and position of the os calcis?

Irregularly cuboidal, and situated at the back and lower part of the foot.

What parts are usually described?

A superior, inferior, internal, external, anterior and posterior surface.

Describe the articulating surfaces with their position.

That for the cuboid is situated on the anterior sur-

face, and somewhat triangular in form; that for the anterior articular surface of the astragalus is concave above.

Describe the inner and outer sides of the bone.

The *inner surface* presents a deep concavity, directed obliquely forward and downward, and furnishes an eminence of bone, the *lesser process;* the *outer* is broad, flat, and has a tubercle near its centre.

What bones does it articulate with?

The astragalus and cuboid.

What bone is above and what in front?

The astragalus above and the cuboid in front.

How many points of development?

Two.

What is the form and position of the cuboid?

Its form is indicated by its name; and is situated at the inner side of the foot, between the scaphoid behind, and base of the first metatarsal in front.

What bones does it articulate with?

The os calcis, external cuneiform, and fourth and fifth metatarsal, and sometimes with the scaphoid.

Name its surfaces.

Three articular and three non-articular.

Describe the form and position of the scaphoid.

It is so named from its excavated form, and is placed at the inner border of the foot, between the astragalus and cuneiform bones.

Describe its surfaces and articulations.

It presents a concave surface, which looks backward, and a convex one, which is turned forward behind a concavity for the head of the astragalus, in front; three distinct surfaces for the three cuneiform bones, and in some instances an articular surface for the cuboid bone.

How many and where are the cuneiform bones?

Three; and with the cuboid form the most anterior row of the tarsus, being placed between the scaphoid behind, three innermost metatarsal bones in front, and the cuboid externally.

What is the position of the pointed extremity in each?

Upward and outward.

Which is the largest and which the smallest?

The internal is the largest, the middle the smallest.

Where do we commence to number them?

At the inner side of the foot.

Describe the position and articulation of each.

The *internal* cuneiform is situated at the inner side of the foot; its base turned down into the sole of the foot; and, along with the third, is somewhat in apposition with the base of the second metatarsal bone, which is inserted between them.

It articulates with the scaphoid, middle cuneiform, and first and second metatarsal bones.

The *middle* cuneiform is situated between the other two bones of the same name; its base at the dorsal surface of the foot.

It articulates with the scaphoid, internal and external cuneiform, and second metatarsal bone.

The *external* cuneiform is situated in the centre of the front row of the tarsus.

It articulates with the scaphoid, middle cuneiform, cuboid, and second, third and fourth metatarsal bones.

How many ossifying centres for each tarsal bone?

Excepting the os calcis, each is developed by a single centre.

How many and where are the metatarsal bones?

Five; placed between the tarsus and the toes.

What are the form and articulation of each?

Long bones in miniature, somewhat concave on the plantar and convex on the dorsal aspect. The shaft is prismoid in form, gradually tapers from the tarsal to phalangeal extremity.

Which is the longest and which the largest?

The second is the longest, the first the largest.

What is the shape of each extremity of the bone?

The *base*, or posterior extremity, is wedge-shaped; the *head*, or anterior extremity, presents a terminal rounded articular surface.

What is the character of the tarso-metatarsal articulation?

It is an arthrodial or gliding joint.

How many phalanges, and their general shape?

Fourteen—Short; their bodies are compressed laterally, convex above, and concave below.

How many and where are the sesamoid bones?

In the extremities, never in the trunk. Their number vary; in the superior extremity, two are always found in the articulation of the metacarpal bone of the thumb with its first phalanx. In the lower extremity, there are generally two behind the femoral condyles, and constantly beneath the first joint of the great toe, as also in the tendons of the tibialis posticus and peroneus longus. They are placed in the direction of flexion; they increase the power of muscles by removing them farther from the axis of the bone on which they are intended to act, (the patella being the only exception.)

Name the bones from heel to toe on the inside of the foot.

Os calcis, astragalus, scaphoid, internal cuneiform, first metatarsal and two phalanges.

Name the bones from heel to toe on the outside.

Os calcis, cuboid, fifth metatarsal and three phalanges.

What are the general characters of the foot?

It is placed horizontally beneath the leg; the heel, which projects behind the leg, is narrow and thick; the anterior part broad, thinner and expanded toward the toes. The dorsum is convex in two directions, longitudinally, and from side to side; but in the latter direction the arch of the foot is much higher at the inner than at the outer side, also longer and more massive, and it is here that the weight of the body is received from the leg. The plantar surface presents corresponding cavities. From such a construction, when resting on a plane surface, the heel, the digital ends of the metatarsal bones, the toes, and outer part of the sole of the foot, are in contact with the surface.

BONES OF THE UPPER EXTREMITY.

How are the bones of the upper extremity divided?

Into those of the shoulder, arm, forearm and the hand.

Name the bones of the shoulder.

Scapula and clavicle.

Which one articulates with the trunk?

The clavicle.

What is the shape and position of the clavicle?

It is similar in shape to an italic *f*, and nearly horizontal in position.

How do the ends differ, and what do they join?

While the sternal end is thick and somewhat triangular, the scapular extremity is flat and broad; the one end articulating with the sternum, the other with the acromion process of the scapula.

What is the form of the upper surface?

Rough and flattened.

Describe the lower surface and attachments.

Flattened, but prismatic toward scapular end, presenting a tuberosity for the conoid ligament; extending backward from that point is an oblique line for the trapezoid ligament; in the centre, a longitudinal depression for the attachment of the subclavius muscle; and still more anterior is an impression for the rhomboid ligament.

What muscles are attached to the clavicle?

The sterno-cleido-mastoideus, trapezius, pectoralis major, deltoid and subclavius.

How early does ossification begin in the bone?

Before any other bone—about the thirtieth day or so after conception.

Is the clavicle present in all animals?

No.

Name some of its modifications in animals.

In the cat it exists in the rudimentary form of a small bone, neither connected with the sternum nor scapula; in birds, the clavicles are large.

SCAPULA.

What is its form and position?

It is irregular, triangular and flat; placed upon the upper and back part of the thorax, occupying the space from the second to the seventh rib.

Name and describe the three angles?

The *superior* is formed by the junction of the superior and internal borders; it is rounded, thin and smooth: the *inferior*, formed by the union of the

vertebral and axillary borders; it is thick and rough; and the *anterior*, which is the thickest, and forms the *head* of the scapula.

Describe and name the three borders.

The *superior*, the shortest and thinnest, is concave, and terminates at the superior angle interiorly, and at the coracoid process exteriorly; it is divided by the supra-scapular notch. The *external* or *axillary border*, the thickest, commences above at the lower margin of the glenoid cavity, and inclines obliquely downward and backward to the inferior angle. The *internal* or *vertebral border*, (also called the base,) is the longest, extending from the superior to the inferior angle; the portion above the spine is somewhat bent outward, forming an obtuse angle with the lower part.

Describe the three fossa.

The *supra-spinous fossa*, the smallest, is concave, smooth and broader at the vertebral than at the humeral extremity. The *infra-spinous fossa* is convex in the middle, but grooved inferiorly. The surface, on its outer fourth, is separated from the axillary border by an elevated ridge running from the glenoid cavity downward and backward to inferior angle; this ridge gives attachment to the aponeurosis, which separates the infra-spinatus from the two teres muscles. The *subscapular fossa*, or anterior surface, looks toward the ribs, is triangular, slightly concave, intersected by prominent lines directed from within outward and upward, and, therefore, crossing the direction of the ribs.

What is the posterior surface called?

The dorsum of the scapula.

Describe the spine of the scapula.

A prominent ridge of bone, commencing at the posterior border, with a smooth triangular surface,

which becomes elevated as it proceeds forward, until it terminates in the acromion process; it divides the supra from the infra-spinatus fossa.

Describe the position and form of the acromion process.

It is a large, somewhat triangular process, flattened from behind forward, and curves forward and upward, so as to overhang the glenoid cavity.

With what does this bone articulate?

The clavicle and humerus.

What is the position and form of the glenoid cavity?

It is a shallow, oval depression; its longest diameter is perpendicular, and is situated at the upper part of the external border of the scapula.

What is the shape and position of the coracoid process?

It is a thick curved process of bone, situated at the upper part of the neck of the scapula; at first directed upward, then becomes smaller, it passes forward and outward.

Where is the neck of the scapula?

It is situated between the glenoid fossa and the coracoid process.

What muscles are attached to the spine of the scapula?

The trapezius and the deltoid; also some muscular fibres of the supra and infra-spinatus muscles.

What muscles are attached to its base?

The levator anguli scapulæ, rhomboidens minor and rhomboidens major, and the serratus magnus to its anterior lip.

What muscle to its superior border?

Omo-hyoid.

What to its axillary border?

Long head of the triceps, teres minor, and teres major.

What muscles are attached to the coracoid process?

Pectoralis minor, short head of the biceps and the coraco-brachialis.

What the number and names of all the muscles attached to the bone?

Sixteen—the subscapularis, supra-spinatus, infra-spinatus, trapezius, deltoid, omo-hyoid, serratus magnus, levator anguli scapulæ, rhomboidei minor and major, triceps, teres minor, teres major, biceps, coraco-brachialis, pectoralis minor, and sometimes a few fibres of the latissimus dorsi to the inferior angle—making the number seventeen.

HUMERUS.

What is the form of the humerus?

Long, and irregularly cylindrical at the upper two-thirds, but triangular and somewhat prismatic at the lower third.

What parts are named in the upper third?

Head, anatomical and surgical necks, greater and lesser tuberosities, the bicipital groove, and the anterior and posterior bicipital ridges.

Describe the head and tuberosities.

The head is smooth and hemispherical in form, and upward, inward and backward in its direction.

The greater tuberosity is convex, rough, with an upper rounded surface, presenting three facets for the insertion of muscles, and situated on the outer side of the head and lesser tuberosity.

The lesser tuberosity is situated in front of the head, directed inward and forward, and has a facet for the insertion of the subscapularis muscle.

What separates the two tuberosities?

The bicipital groove.

What is meant by anatomical and surgical neck?

The depressed groove or constriction which bounds the circumference of its articular surface, is what is understood by *anatomical neck;* but there is another constriction situated below the tuberosities, which is named the *surgical neck*, from its frequently being the seat of fracture.

What and where are the parts named on the lower end of the bone, including its articulating surfaces?

The external and internal condyles, being the terminations of the external and internal borders. Anteriorly it presents articulating surfaces: one (the outer) is the *radial head* of the humerus which articulates with the cup-shaped depression on the head of the radius. Above the *radial head* is a well-marked depression called the *radial depression.* The inner portion of the articular surface is known as the trochlea, which articulates with the greater sigmoid cavity of the ulna. Immediately above the trochlea is a superficial depression for the coronoid process of the ulna. Above the trochlea, posteriorly, there is a large fossa, which lodges the olecranon during the extension of the forearm.

Which condyle is the most prominent?

The internal.

With what does the humerus articulate?

The glenoid cavity of the scapula, the radius and ulna.

What class of muscles are attached to either condyle?

Flexors to the internal, and extensors to the external condyle.

What muscles are attached near the middle of the bone?

The deltoid, coraco-brachialis and a portion of the origin of the brachialis anticus; also the internal and external heads of the triceps.

What muscles inserted within two inches of the head?

The supra-spinatus, infra-spinatus and subscapularis.

What ones within four inches of upper end, with the place of attachment?

The pectoralis major, which is inserted into the lower and anterior part of the bicipital ridge; the latissimus dorsi into the bottom of the bicipital groove, and the teres major into the posterior bicipital ridge.

What epiphyses has the humerus, and where situated?

One for the shaft, one for the head, one for the greater tuberosity, one for the radial portion of the articular surface, one for the trochlear portion, and one for each condyle.

What is the structure of this bone?

Cancellous at the extremities, covered with a thin compact layer; the shaft is composed of a cylinder of compact tissue, and hollowed out by a large medullary canal, which extends its whole length.

THE BONES OF THE FOREARM.

What are the bones of the forearm?

The ulna and radius.

Which contributes most to the elbow joint?

The ulna.

Which most to the wrist joint?

The radius.

What parts at the upper end of the ulna?

The olecranon and coronoid processes, and the greater and lesser sigmoid cavities.

Describe the olecranon and coronoid processes.

The olecranon is a large thick eminence, nearly on a line with the shaft of the bone. Its anterior surface is smooth and concave for articulation with the trochlear surface of the humerus; its posterior surface is smooth, subcutaneous; its upper is quadrilateral, marked behind by a rough impression.

The coronoid is a rough triangular eminence of bone, situated at the upper and front part of the ulna, and forms the lower part of the great sigmoid cavity.

Describe the greater and lesser sigmoid notches.

The greater sigmoid cavity is a semilunar depression, situated between the olecranon and coronoid processes, for articulation with the trochlear surface of the humerus.

The lesser sigmoid cavity is an oblong, narrow articular depression, situated on the outer side of the coronoid process for articulation with the head of the radius.

How are its articulating surfaces placed?

The greater sigmoid is slightly concave transversely, but the external portion is nearly plane from side to side; the lesser sigmoid is concave from before backward.

What is the form of the shaft of the bone?

Long, rather irregular, being larger at the upper than at the lower extremity, and presents three surfaces, an anterior, external and internal.

Describe the parts at the lower end.

It presents an outer and inner eminence; the former and larger is a rounded articular eminence, the head of the ulna; the latter, more projecting and

narrower, is a non-articular eminence, termed the styloid process. The head has an articular facet, a part of which plays on the surface of the triangular fibro-cartilage, which separates this bone from the wrist joint; the remaining portion directed outward, and received into the sigmoid cavity of the radius. The styloid process terminates in a rounded summit for the attachment of the internal lateral ligament of the wrist.

What is the situation of the ulna?

It is placed at the inner side of the forearm parallel with the radius.

With what bones does it articulate?

The humerus and radius, and mediately with the os cuneiform.

How many centres of ossification, and where?

Three; one for the shaft, one for the inferior extremity, and one for the olecranon.

What is the form and size of the body of the radius?

Its upper end is small, its lower large, and presents a prismatic form, slightly curved longitudinally.

Describe the parts named at the upper end.

A cylindrical head, depressed on its upper surface into a shallow cup, which articulates with the lesser head of the humerus; around the circumference of the head is an articular surface for rotating with the lesser sigmoid cavity of the ulna; below the head is the neck with a rough eminence—bicipital tuberosity.

Give a general description of its lower extremity.

Large, quadrilateral and presents two articular surfaces, one at the extremity for articulation with the carpus, and one at the inner side for articulation with the ulna; the former articulating with the scaphoid and semilunar. The external surface is prolonged into a conical projection—the styloid pro-

cess. The lower extremity also furnishes numerous grooves, through which pass the tendons of various muscles.

With what bones does the radius join?

The humerus, ulna, scaphoid and semilunar.

How many epiphyses upon the radius, and when do they unite?

Two; the upper epiphysis becomes joined to the shaft at puberty, and the lower unites about the twentieth year.

To what class of joints do the superior and inferior radio-ulnar articulations belong?

They are both lateral ginglymoid joints.

BONES OF THE HAND.

How are the bones of the hand divided?

Into three sets; the carpus or wrist, the metacarpus or palm, and the phalanges or fingers.

How many in each division?

Eight, five and fourteen, respectively.

How are the carpal bones arranged?

In two rows.

Name and describe the bones in each row?

The first row, reckoning from the radial side, are the scaphoid, semilunar, cuneiform and pisiform. The scaphoid is the largest of the first row, is convex on one side, concave on the other. The semilunar is concave or crescentric on its inferior surface, convex superiorly, and triangular in form. The cuneiform is pyramidal in shape, and presents an oval-shaped facet on its inner and palmar surface. The pisiform is the smallest carpal bone, and only has one facet.

Those of the *second row* are the trapezium, trapezoid, *os magnum* and the unciform.

The trapezium is placed between the metacarpal bone of the thumb and the scaphoid, and is very irregular in form; its dorsal surface presents an angular appearance, and its palmar surface has a groove and tubercle.

The *trapezoid* is small in size, and wedge-like in form; its broad end is situated in the dorsal, and its narrow end in the palmar surface of the hand.

The *os magnum* occupies the centre of the wrist, and is the largest of the carpal bones; its form is oblong, round superiorly, cubic inferiorly, and presents four surfaces, a superior, inferior, external and internal.

The *unciform* is the hook-shaped bone, and is distinguished from the rest by the curved process upon its palmar surface.

What is the form of the upper surface of the first row?

Convex.

How many points of development for each?

One.

Which metacarpal bone is the longest?

The second, or that of the index finger.

Which largest and which the smallest?

The first is the largest, and the fifth is the smallest.

What is the general shape of each?

The *bodies* are triangular in shape, each presenting three surfaces, and as many borders; two of the surfaces are placed laterally, and one backward.

Their *carpal extremities*, or bases, are cuboidal in form, and broader behind than in front.

Their *digital extremities*, or heads, have an oblong

surface, which is broader and extends farther forward in front than behind.

How do the carpal ends differ in shape?

Because the form and number of each articulating surface differ, one bone from another.

How many phalanges, and how arranged?

Fourteen, and arranged into three rows.

What are the peculiarities of each row?

The metacarpal extremity in the first row has a concave articular surface; the corresponding extremity in the other two rows presents a double concavity.

The second row has only four bones, the thumb having only two pieces corresponding with those of the first and last phalanx; the second row is somewhat smaller than the first.

The third row is distinguished by their small size, and by the relatively large size of the first bone of the row.

COMPARISON OF THE TWO EXTREMITIES.

What bone of forearm corresponds to the tibia?

The radius.

What tarsal bone corresponds to the scaphoid?

The scaphoid.

Which tarsal represents the cuneiform and pisiform?

The calcaneum.

What tarsal bones correspond to each of the second row of carpal?

The internal, middle and external cuneiform, and the cuboid.

What is the typical number of carpal bones?

Seven.

Which ones are double or compound?
The cuneiform and pisiform.

Which carpal articulates with two metacarpal?
The trapezium and unciform.

Which tarsal articulates with two metatarsal?
The cuboid and internal cuneiform.

BONES OF THE HEAD.

How many bones in the head and face?
Twenty-two.

How are they divided?
Into two sets; the bones of the cranium and those of the face.

What are the names of the cranial bones?
Occipital, frontal, sphenoid, ethmoid, two parietal, two temporal.

Give the number and names of the facial bones.
Fourteen; nasal, superior maxillary, lachrymal, malar, palate, inferior turbinated, two of each, and the vomer, and inferior maxillary.

What bones are common to both head and face?
Frontal, ethmoid, sphenoid and two temporal.

What is the structure of the cranial bones?
The compact (bony) tissue forms two plates or tables, termed external and internal tables, with an intervening spongy texture, named *diplœ*.

What are their principal uses?
To inclose and protect the brain, and the organs of special sensation.

What bone articulates with the atlas?
The occipital.

Where is the occipital bone situated?
At the back and base of the cranium.

What is its general form?
Somewhat trapezoid in figure.

With what bones does it articulate?
The two parietal, the two temporal, the sphenoid, and the atlas.

How many angles, and where situated?
Four; the superior is received into the retiring angle formed by the posterior border of the parietal bones; the inferior is represented by the extremity of the basilar process; and the lateral angles correspond with the line at which the posterior-inferior angle of the parietal bone joins with the mastoid part of the temporal.

What is the most prominent part of the bone?
The external occipital protuberance.

What lines running from it, and which way?
The superior curved lines pass from it nearly transversely, and the crest inferiorly or vertically; also from the crest at about its middle, and somewhat below the superior curved lines, the inferior curved lines arise, and are directed outward in a similar manner to the superior curved lines.

What openings in the bone, and where?
The foramen magnum, in front of the basilar process; the anterior condyloid foramen, on the outer side of each condyle. Behind each condyle there is the posterior condyloid foramen.

What is the form and size of the foramen magnum?
A large oval aperture, with its long diameter extending from before backward.

What parts pass through this opening?

The spinal cord and membranes, the vertebral arteries, and spinal accessory nerves.

What parts pass through the condyloid foramina?

The hypoglossal nerve passes through the anterior; a vein to the lateral sinus through the posterior one.

What part of the bone in front of the foramen magnum?

The basilar process.

Describe the basilar process.

It is a strong quadilateral plate of bone, wider behind than in front; its under surface is rough, presenting a tubercular ridge—the pharyngeal spine. Its inner surface presents a groove for medulla oblongata.

What bone in front of the basilar process?

The petrous portion of the temporal.

What ridges and grooves on the inner surface?

Two crucial ridges, vertical and transverse; a groove for the superior longitudinal sinus, for the occipital sinuses, and for the lateral sinuses.

What fossæ on the inner surface?

Four; for falx cerebri, falx cerebelli, fossa for cerebrum and cerebellum, one for each.

What fossa or notch at the edge of the bone?

The jugular fossa.

What elevation by the sides of the foramen magnum?

The condyles.

Describe their shape and articulation.

They are convex and oblong, and directed downward and outward; they articulate with the atlas.

Between what bones are its angles received?
The parietal, sphenoid and mastoid process of the temporal.

How many centres of development?
Four.

How many parts at birth?
Four.

PARIETAL BONE.

Where are the parietal bones situated?
The two bones by their union form the principal part of the roof of the skull.

What is the form of this bone?
It is of an irregular quadrilateral form, convex externally, concave internally.

What parts on the outer surface are named?
The parietal eminence, the temporal ridge, below which is a smooth surface, forming a part of the temporal fossa, the parietal foramen.

Which angle is the longest?
The anterior inferior angle.

What is the position of each angle?
The anterior superior angle corresponds with that portion of the skull which, in the fœtus, is membranous, and known as the anterior fontanelle. The anterior inferior is situated between the great wing of the sphenoid and frontal. The posterior superior angle corresponds with the junction of the sagittal and lambdoidal sutures; and the posterior inferior angle articulates with the mastoid portion of the temporal bone.

Describe each part named on the inner surface.

It is marked by branching lines, corresponding with the course of the middle meningeal artery, and by depressions for the convolutions of the brain. Near its middle is a depression—"parietal fossa"—corresponding with the eminence on the outside; along the upper margin is the longitudinal sinus, and near the same are the Pacchionian depressions.

With what bones is it connected?

The opposite parietal, the occipital, frontal, temporal and sphenoid.

Name and describe each of the sutures.

The lambdoidal suture is situated between the occipital and parietal bones, and begins on a line with the posterior inferior angle of the parietal bone, and inclines upward and forward to the point at which the two parietal bones are joined by the saggittal suture; frequently interrupted by accessory osseous deposits.

The saggittal suture is directed backward from the middle of the coronal to that of the lambdoidal suture, and connects the two parietal bones.

The coronal suture connects the frontal with the two parietal bones. On either side it commences about an inch behind the external orbital process of the frontal bone, where the anterior inferior angle of the parietal articulates with the great wing of the sphenoid bone. From this point it mounts obliquely up toward the vertex, having an inclination backward.

There are three at the side of the skull; the spheno-parietal, squamo-parietal and masto-parietal.

The spheno-parietal is but short, and is formed by the tip of the great wing of the sphenoid, which overlaps the anterior inferior angle of the parietal.

The squamo-parietal is arched, and is formed by

the squamous portion overlapping the lower border of the parietal.

The masto-parietal is formed by the posterior inferior angle of the parietal and superior border of the mastoid. The sutures of the base of the skull are, the basilar in the centre, and, on either side, the petro-occipital, masto-occipital, the petro-sphenoidal, and the squamo-sphenoidal.

FRONTAL BONE.

Where is it situated?

At the interior part of the skull and upper part of the face.

How many points of development?

Two.

How is the bone divided?

Into a vertical or frontal portion, and a horizontal or orbito-nasal portion.

What parts named on the frontal portion, and where placed?

A median line; the remains of frontal suture, on either side of which is the frontal eminence, and inferior to this is the superciliary ridge, with the nasal eminence intervening between; also the temporal ridge above the external angular process.

What processes at its lower border?

Nasal spine, internal angular process, supraorbital notch and external angular process.

Describe the inner surface of the frontal portion.

The frontal crest for superior longitudinal sinus; the foramen cæcum; its surface is deeply concave, with eminences and depressions for the convolutions

of the brain, and presenting numerous furrows for the anterior meningeal arteries; also irregular depressions for the Pacchionian bodies.

Where is the orbital portion situated?

Between the external and internal angular processes.

Describe the orbital plates, and name what separates the orbits.

The superior is convex, presenting the upper surfaces of the orbital plates, which are separated from each other by the ethmoidal notch; their inferior surface is smooth and concave.

How many and what bones join the frontal?

Twelve—these are two parietal, sphenoid, ethmoid, two nasal, two superior maxillary, two lachrymal and two malar.

ETHMOID BONE.

Where is the ethmoid situated?

At the fore part of the base of the skull, and is inserted between the orbital plates of the frontal bone, situated behind the nasal and superior maxillary bones, before the sphenoid and above the vomer.

What is its shape and general structure?

Of a cuboid figure, but viewed as consisting of three parts—a horizontal, a perpendicular plate, and lateral masses of cells; the lateral masses consist of a number of thin-walled cellular cavities in which are numerous cells, more or less capacious.

What is the appearance of its upper plate?

Sieve-like.

What projects downward from it?

The perpendicular plate.

What projects upward?
The crista galli.

What part of the orbit does the ethmoid form?
Central, or that between the two orbits.

What bones surround the orbital surface?
The frontal, malar, superior maxillary and lachrymal.

What part of the nasal fossa does it form?
The inner and middle portion of the roof, and the middle of the inner wall.

With what bones is it united?
Sphenoid, the two turbinated, the frontal, the two nasal, two superior maxillary, the two lachrymal, the two palate and vomer.

What bone posterior to the ethmoid?
The sphenoid.

SPHENOID.

Where is the sphenoid bone situated?
Transversely at the base of the skull.

What are its principal divisions?
Into body, four surfaces, four wings, and two pterygoid processes.

What is the central part called?
The body.

What is the form of the body.
Quadrilateral.

Describe the parts upon its superior surface.
The ethmoidal spine, the optic groove, the olivary process, sella turcica, the middle and posterior clinoid processes, and on either side the cavernous groove.

What occupies the pituitary fossa?
The pituitary body.

What bounds that fossa in front and behind?
The middle clinoid processes in front, and a square-shaped plate of bone, whose superior angles terminate in a tubercle (the posterior clinoid processes) behind.

What projects downward from the body?
The pterygoid processes.

How many wings on each side, and to what united?
Two—the greater wing which is united to the frontal and malar bones; and the lesser wing, which articulates with the orbital plate of the orbital and the cribriform lamella of the ethmoid bone.

What separates the two wings?
The body.

Name and describe the anterior one?
The greater wing is situated anteriorly, and is curved upward, outward and backward; it is prolonged behind into the spinous process of the sphenoid; each wing presents three surfaces, a circumference, and several foramina.

What does it join in front?
The frontal bone.

What process and foramen at its inner part?
Anterior clinoid process and foramen lacerum.

Name the three surfaces?
The superior or cerebral, the external and the anterior or orbital.

What do these surfaces help to form?
The superior or cerebral surface forms part of the middle fossa of the skull; the external enters into the formation of the temporal fossa, and the zygomatic

fossa; the anterior or orbital surface forms a part of the outer wall of the orbit, and of the sphenoidal fissure.

What is the shape of the cerebral surface?

It is large, elongated from behind forward and deeply concave.

What is the form of the temporal and orbital surfaces?

The temporal is elongated from above downward, and slightly hollowed; the orbital is square, smooth, and inclined obliquely forward.

What part of the orbit is formed by it?

The posterior part of the outer wall and a small part of the inner wall posteriorly.

What foramina at the base of the great wing?

From below upward foramen ovale, foramen vesalii, foramen rotundum and foramen lacerum, which extends along its superior border.

What processes project downward?

The spinous process, the external and internal pterygoid plates and the hamular process.

What is their position?

The spinous process is situated at the lower border of the greater wing, beneath the foramen spinosum. The external and internal pterygoid processes descend perpendicularly from the point where the greater wing diverges from the body; they are separated behind by an intervening notch—the pterygoid fossa. The hamular process is a hook-like prolongation of the internal pterygoid process.

Which process is the broadest?

The external pterygoid.

Which the longest?

The internal pterygoid.

What foramen at their base?
The vidian canal.

What passes through this foramen?
The vidian nerve.

What muscle winds around the hamular process?
Tensor palati.

What nerves leave the cranium through this bone?
The optic nerve—the third, fourth, the three branches of the ophthalmic division of the fifth, the sixth nerve, superior maxillary, inferior maxillary, petrosal nerve, and the vidian nerve.

Name each foramen, and what passes through it.
Foramen opticum, for the passage of the optic nerve and ophthalmic artery; the foramen lacerum transmits the third, the three branches of the ophthalmic division of the fifth, the sixth nerve, and the ophthalmic vein; the foramen rotundum transmits the superior maxillary nerve; the foramen vesalii transmits a small vein; the foramen ovale transmits the inferior maxillary nerve, the small meningeal artery, and the small petrosal nerve, and the foramen spinosum transmits the middle meningeal artery.

With how many bones is the sphenoid connected?
It articulates with *all* the bones of the cranium, and the two malar, two palate, and vomer of the face.

With what ones posteriorly and anteriorly?
Posteriorly—the occipital, parietal, palate bones and vomer.
Anteriorly, with the frontal, ethmoid and malar.

TEMPORAL BONE.

What position does the temporal bone occupy?

It is placed at the side and base of the skull.

With what other bones does it unite?

The parietal, malar, inferior maxillary, sphenoid and occipital.

What are its primary divisions?

The zygoma, the squamous part, the tympanic bone, the petrous and mastoid part and the styloid process.

What position does the squamous portion occupy?

It forms part of the temporal fossa, and is bounded above by an arched border, and below by a horizontal process called "zygoma."

Describe the upper border and the suture.

It is long, thin, sharp, and beveled to overlap the lower border of the parietal bone, forming the squamous suture.

Where is the mastoid part situated?

At the posterior part of the bone.

What fossa and groove on its inner side?

Digastric fossa and occipital groove.

What large foramen in mastoid, and what passes through it?

The mastoid foramen, a vein and small artery.

Where is the petrous portion of the bone placed?

It is situated in the base of the skull forward and inward.

What is the form of this portion?

That of a triangular pyramid.

What opening at the base, and the size?

The meatus auditorius rather more than an inch in length, and its calibre is least at the middle.

What process surrounds it?

A curved plate of bone, the auditory process.

What is attached to the auditory process?

The cartilage of the external ear.

What openings at the apex of the petrous portion?

The orifice of the carotid canal also forms part of the foramen lacerum medium.

What opening on the upper surface?

The hiatus fallopii.

Describe the openings on the posterior surface.

Near its centre is a large orifice, the meatus auditorius internus; about three lines further back is the aqueductus vestibuli; and intermediate between these two openings is a depression for a small process of dura mater, and transmits a small vein into the cancellous tissue of the bone.

What process projects down, and its length?

The styloid process; it varies in length, from an inch to an inch and a half.

What openings on the inferior surface?

The carotid canal, the aqueductus cochleæ, the jugular fossa, with a similar depression on the margin of the occipital, forms the foramen lacerum posterius, Jacobson's canal, canal for Arnold's nerve, the stylo-mastoid foramen and the auricular fissure, for the exit of the auricular branch of the pneumogastric nerve.

What cavity within the bone?

The eustachian tube.

Name the parts that pass each opening.

A vein to the lateral sinus and a small artery pass through the mastoid foramen; the petrosal branch of the vidian nerve through the hiatus fallopii, and a smaller branch for a smaller petrosal nerve; the

internal carotid artery and the carotid plexus through the carotid canal, a vein through the aqueductus cochleæ; Jacobson's nerve through a small foramen; Arnold's nerve, also a small foramen; the facial nerve and stylo-mastoid artery through stylo-mastoid foramen; the tensor tympani muscle and the eustachian tube through two canals.

What muscles are attached to this bone?

The temporal masseter, occipito-frontalis, sterno-mastoid, splenius capitis, trachelo-mastoid, digastricus, retraheus aurem, stylo-pharyngeus, stylo-hyoideus, stylo-glossus, levator palati, tensor tympani, and stapedius.

PROMISCUOUS QUESTIONS.

What bones form the base of the skull within?

Frontal, ethmoid, sphenoid, temporal, parietal.

What ones its lateral boundaries?

Frontal, malar temporal, sphenoid parietal, the two maxillary bones, and a small part of the palate.

How is the base of the skull divided within?

Into three fossæ—anterior, middle and posterior.

What bones form the anterior cerebral fossa?

Ethmoid, sphenoid and frontal.

What ones form the middle and posterior fossa?

The middle is formed by sphenoid, temporal, parietal and frontal; the posterior by occipital, temporal and parietal.

What is received into these different fossæ?

The anterior fossa lodges the anterior lobe of the cerebrum; middle fossa, the middle lobe; and the posterior fossa gives lodgment to the lateral lobes of the cerebellum.

Name the foramina at the base of the skull from before backward.

Four at the bottom of anterior palatine fossa, accessory palatine foramina, incisive foramina, (in young subjects,) posterior palatine foramen, the foramen rotundum, foramen ovale, foramen spinosum, stylo-mastoid foramen, foramen lacerum medium, vidian canal, the orifice of the canal for the eustachian tube and tensor tympani muscle, orifices of the carotid canal and the aqueductus cochleæ, jugular fossa, divided by a ridge of bone into anterior and posterior, small foramen for tympanic nerve, another near the root of styloid process for Arnold's nerve, foramen magnum, anterior condyloid foramen, and posterior condyloid foramen.

Which of these transmit nerves?

The palatine foramina, incisive foramina, sphenoidal fissure, orifices for olfactory nerves, optic foramen, foramen rotundum, foramen ovale, carotid canal, anterior portion of jugular canal, vidian canal, stylo-mastoid, tympanic foramen, anterior condyloid foramen, foramen magnum.

How many cranial nerves?

There are twelve pairs—but as the facial and auditory are now generally spoken of as forming one pair, (the seventh,) and the glosso-pharyngeal, pneumogastric and spinal accessory also reckoned as one pair, (the eighth)—they are nine in number on either side.

Which ones pass out without dividing?

The second, sixth, portio dura of the seventh, eighth and ninth pairs.

Which divide within the cranium?

The first, third, fourth, fifth and portio mollis of the seventh pair.

Name each nerve and its place of exit.

Olfactory, the ethmoidal foramina; optic nerve, optic foramen; motor oculi, the sphenoidal fissure; the pathetic, the sphenoidal fissure; the trifacial—including the ophthalmic, superior maxillary and inferior maxillary—the ophthalmic branch, the sphenoidal fissure; the superior maxillary branch, foramen rotundum; and the inferior maxillary branch, foramen ovale; the abduceus, the sphenoidal fissure; the facial or portio dura, and auditory or portio mollis, the auditory foramen; the glosso-pharyngeal, pneumogastric and spinal accessory, the jugular foramen; and the hypoglossal, or ninth nerve, anterior condyloid foramen.

What blood-vessels enter the cranium?

The internal carotid and vertebral arteries.

At what foramina do they enter?

The carotid and foramen magnum, respectively.

Where does the venous blood leave the cranium?

At the jugular foramen.

What vessels to carry it within the cranium?

The various sinuses of the dura mater.

What trace of them on the skull?

Several grooves.

Name the principal sinuses.

Lateral, superior longitudinal, and cavernous.

How are the bones of the head connected?

By sutures.

What purposes do the sutures serve?

They facilitate the development of the brain; they allow a certain reduction of the diameters of the head, and they ward off shock.

Name and describe the principal ones.

The sagittal suture is formed by the junction of the two parietals, and is directed from the middle of the frontal bone to the superior angle of the occipital. Occasionally, when the two halves of the frontal bone are not united, it is extended forward to the front of the nose; or a wormian bone sometimes exists. The coronal suture extends across the vertex of the skull, connecting the frontal with the parietal bones. It extends from one extremity of the great wing of the sphenoid to that of the other extremity.

The lambdoid suture connects the occipital with the parietal bones. It extends from the mastoid process to the end of the sagittal suture, on either side. Besides the above, which are of most importance, there are also six others—three at the side and three at the base of the skull.

Which table of the bones form the sutures?

The external table.

What is between the tables of these bones?

Diploe, or cancellous tissue.

What cavity in the frontal bones?

The anterior fossa.

What is its nature and object?

It presents eminences and depressions for the convolutions of the brain, and grooves for the lodgment of the anterior meningeal arteries. It incloses and protects the anterior lobe of the cerebrum.

Do bones grow at the edges?

No.

What are the ossa triquetra and their use?

Supernumerary or wormian bones; they supply the deficiency that sometimes arises in the ossification of the tabular bones of the skull.

Are sutures usually found in skulls?
They are.

What, then, is the real purpose of a suture?
It serves as a bond of union between the edges of bones in apposition.

FACIAL BONES.

Where are the nasal bones situated?
Between the frontal and ascending processes of the superior maxillary.

What is their general conformation?
They are small, irregularly quadrilateral, thick and narrow in their upper part, but gradually become wider and thinner lower down.

What bones and cartilage do they join?
The superior border articulates with the frontal bone; the external with the ascending process of the maxillary, and the internal with its fellow of the opposite side, supported by the nasal spine of the frontal bone, and the perpendicular plate of the ethmoid. The inferior border with the nasal cartilage.

Where are the malar bones situated?
They form the most prominent point of the side of the face, and the greater part of the outer border of the orbit.

What is its form?
Quadrangular.

How many and what surfaces and angles are named?
Three surfaces—anterior, posterior and superior. Four angles—anterior, posterior, superior and inferior.

How many processes?

Four—the frontal, orbital, maxillary and zygomatic.

With what do the processes unite?

The frontal articulates with the external angular process of the frontal bone; the orbital with the frontal and sphenoid bones, also with the orbital surface of the superior maxillary; the maxillary process articulates with the superior maxillary; and the zygomatic process, long, narrow and serrated, articulates with the corresponding process of the temporal bones.

With how many and what bones does it unite?

Four—the frontal, sphenoid, temporal and superior maxillary.

What muscles are attached to it?

The two zygomatic, masseter, part of the levator labii superioris, and sometimes the temporal.

Where are the lachrymal bones situated?

At the inner and anterior part of the orbit.

What is the size, form and use of these bones?

In size somewhat resembling a finger nail, and irregularly quadrilateral; with the excavation in the nasal process of the superior maxillary, they each form a groove for the lachrymal canal.

What bones above, behind, below and in front of it?

The frontal, ethmoid, the superior maxillary, and the nasal process of the superior maxillary in front.

What muscle arises from it?

The tensor tarsi.

Where is the groove, and how large?

It is situated in the outer wall of the nasal fossa, and is about an inch in length.

What bone aids to complete the bone?
The inferior turbinated.

What is lodged within the groove?
The lachrymal duct.

What position does the superior maxillary occupy?
It occupies the anterior and middle part of the face.

What is the form and structure of this bone?
Somewhat quadrilateral, but rather irregular in form; it presents three cavities with broken cellular cavities.

What surfaces are named upon it?
An external convex surface, a superior smooth, an internal, and one which projects horizontally inward, forming the floor of the orbit.

What processes, and where are they placed?
The *malar* process, which is on the external surface, a little above the molar teeth, and consists of a rough projection; the *nasal* process, which is a thick, triangular plate of bone, projecting upward, inward and backward, and forms part of the lateral boundary of the nose; the *alveolar* process; this is the thickest and most spongy part of the bone, and excavated into eight cavities for the reception of the teeth; and the *palate* process, which is a horizontal plate, projecting inward, and forms the roof of the mouth and the floor of the nares.

What foramina, and what pass through them?
The infra-orbital foramen, which transmits the infra-orbital nerve and artery; the posterior dental canals transmit the posterior dental vessels and nerves; the anterior palatine canal, for the anterior palatine vessels; the posterior palatine canal transmits the posterior palatine nerve and a small artery; the anterior dental canal transmits the anterior dental vessels and nerves; several foramina in the inferior

meatus, for the passage of nutrient vessels; the lachrymal canal, for the nasal duct.

What part of the orbit does this bone form?
The floor and inner side.

What part of the nasal cavity does it form?
The lateral boundaries.

What part of the hard palate does it form?
The anterior and lateral portions.

How are the two maxillary bones united?
By sutura harmonia.

With what other bones do they unite?
The frontal, ethmoid nasal, palate, malar, lachrymal, the vomer and the inferior turbinated.

What foramen in the anterior part of hard palate?
Anterior palatine.

What projection above incisive fossæ?
Nasal spine.

What cavity within this bone?
The antrum of Highmore.

What is its general shape?
Triangular shape.

Where is the opening into the antrum?
Near the upper part of the cavity.

Where is the palate bone situated?
At the back part of the nasal fossæ.

What parts are named, and where are they placed?
A horizontal and vertical plate; the former forms the back part of the roof of the mouth and of the floor of the nares; the latter articulates with the inferior turbinated, and is divided by a vertical groove, which is completed into the posterior palatine canal by the maxillary bone.

What part of the palate is formed by this bone?
The posterior.

What part of the orbit does it form?
The floor and inferior external angle.

What foramen, and what passes through it?
The spheno-palatine foramen, which transmits the spheno-palatine vessels and nerves.

How many turbinated bones, and where placed?
Two; one on each side of the outer wall of the nasal fossæ.

What is their form and structure?
They present the appearance of the lateral half of an elongated bivalve shell, and are sponge-like in structure.

Describe the form and position of the vomer.
It is flat, irregularly quadrilateral like a plough-share, and placed vertically between the nasal fossæ.

With what bones and cartilage does it join?
Sphenoid, ethmoid, the two superior maxillary and the two palate bones; also, the cartilage of the septum.

What is understood by nares?
Two elliptical apertures, situate beneath the nose.

What form the boundaries of the posterior nares?
It is bounded above by the body of the sphenoid, below by the palate plates of the ossa palati, and on the sides by the pterygoid processes.

What forms the septum of the anterior nares?
The perpendicular plate of the ethmoid, the vomer and nasal cartilage.

What is understood by meati of the nose?
Longitudinal passages.

What bounds the lower meatus?

The inferior turbinated bone and the floor of the nasal fossa.

What is the direction of this passage?

It extends along the entire length of the outer wall of the nose.

What structures bound the middle meatus?

In front is the orifice of the infundibulum, and at the centre of the outer wall is the orifice of the antrum.

What is the extent of the superior meatus?

The smallest of the three, and occupies the posterior third of the outer wall.

What openings into the upper meatus?

The spheno-palatine, and the ethmoidal cells.

What openings into the middle and lower one?

The *middle* presents two—the orifice of the infundibulum and the orifice of the antrum; the *lower* presents the lower orifice of the lachrymal canal.

What membrane lines the nasal fossæ?

Schneiderian membrane.

With what does the inferior maxillary articulate?

With the glenoid fossæ of the two temporal bones.

How is it divided at birth, and when united?

At birth it consists of two equal lateral parts, which unite in the first year after.

Describe the form of the body and ramus?

The body, its external surface is convex, the internal, concave. The branches or rami project upward from the posterior extremity of the body of the bone, forming nearly a right angle in the adult.

How does the form change with age?

At birth the body is a mere shell, containing the sockets of the various teeth only partitioned from one another; the angle is obtuse.

In infancy the angle becomes less *obtuse*. In the adult the ramus is almost vertical in direction.

In old age the bone diminishes in size, the alveolar process becomes absorbed, and the rami are oblique in direction.

What process and notch upon the ramus?

Coronoid and condyloid processes, and the sigmoid notch.

What and where are the openings in this bone?

The mental foramen below the root of the second bicuspid tooth; inferior dental canal for inferior dental vessels and nerve, and the various alveoli for the teeth.

What traverses the dental canal?

The inferior dental vessels and nerve.

What muscles are attached to inferior maxillary?

Levator menti, depressor labii inferioris, depressor anguli oris, platysma myoides, buccinator, masseter, genio-hyoglossus, genio-hyoidens, mylo-hyoidens, digastricus, superior constrictor, temporal, internal pterygoid and external pterygoid.

Name the point of attachment for each one.

Levator menti arises from a slight pit under the alveolar border and near the symphysis; depressor labii inferioris, situated nearer to the symphysis than the preceding muscle, and partly concealed by it; the depressor anguli oris arises from the oblique line; the platysma myoides has one of its attachments on the oblique line, becoming blended with the last-named muscle more or less intimately; the buccinator arises from the outer surface of the alveolar processes of

the upper and lower jaws, corresponding to the last three molar teeth; the masseter arises from the malar process of the superior maxillary from the lower border of the zygomatic arch, and is inserted into the angle and lower part of the ramus of the inferior maxillary. The masseter has a deep portion which is inserted into the upper half of the ramus and outer surface of the coronoid process; the genio-hyoglossus arises from the superior genial tubercle on the inner side of the symphysis of the chin; the genio-hyoidens arises from the inferior genial tubercle; the mylo-hyoidens arises from the mylo-hyoidridge, extending from the symphysis in front to the last molar tooth behind; digastricus, its anterior belly is inserted into a depression on the inner side, close to the symphysis; superior constrictor has an attachment to the alveolar process above the posterior extremity of the mylo-hyoid ridge; the temporal is inserted into the inner surface, apex and anterior border of the coronoid process of the jaw; the internal pterygoid is inserted into the lower and back part of the inner side of the ramus and angle, as high as the dental foramen; the external pterygoid is inserted into a depression in front of the neck of the condyle of the lower jaw.

Where is the os hyoides situated?

At the base of the tongue, between the chin and thyroid cartilage.

How is it divided, and where united?

It is divided into a body, two cornua and two cornicula, and are united at the junction of the body with the cornua.

What muscles are attached to it?

Sterno-hyoid, thyro-hyoid, omo-hyoid, stylo-hyoid, mylo-hyoid, genio-hyoid, genio-hyoglossus, hyoglossus, middle constrictor of the pharynx, lingualis, and the aponeurosis of the digastricus.

To what is it attached by ligaments?
Thyro-hyoid membrane and the epiglottis.

GENERAL QUESTIONS.

What is the general structure of facial bones?
More or less cancellated.

How many points of development for each?
The nasal, lachrymal, malar, palate, inferior turbinated, and the vomer, have only *one* for each bone respectively; the superior maxillary has four, and the inferior maxillary has five, including the centres for the condyle coronoid process, &c.

What is the shape of the orbital cavity?
That of a quadrilateral pyramid, whose base is directed forward and outward, and apex backward and inward.

What bones contribute to form it?
In either orbit—the frontal, ethmoid, sphenoid, os unguis, malar, maxillary, and palate bones—the three first named being common to both orbits.

Name the position of each.
The frontal is situated in the front part of the roof; the sphenoid (its lesser wing) in the back part of the roof; the body of the sphenoid forms a small part of the inner wall, and its orbital plate of the outer wall; the ethmoid (its os planum) forms part of the inner wall; the os unguis forms part of the inner wall; the malar forms, to a small extent, the floor and the whole of the outer wall in front; the maxillary forms a small portion of the inner wall and the greater portion of the floor; and the palate forms the posterior portion of the floor.

What bones form the upper, lower, inner and outer boundary?

The frontal forms the upper; the superior maxillary and a small portion of the malar form the lower; the inner is formed to a small extent by the frontal, but chiefly by the lachrymal; and the outer boundary is formed slightly by the frontal, but mostly by the malar bones.

What opening in the orbital cavity, and what passes through each?

The optic foramen, which transmits the optic nerve and ophthalmic artery; foramen lacerum anterius, which transmits the third and fourth ophthalmic divisions of the fifth and sixth nerves, and opthalmic vein; spheno-maxillary fissure, which transmits the infra-orbital vessels and nerve, and ascending branches from the spheno-palatine ganglion; the supra-orbital foramen, for the passage of the supra-orbital nerve, artery, and veins; the infra-orbital canal transmits the infra-orbital nerve and artery; the anterior and posterior ethmoidal foramina—the former transmits the anterior ethmoidal artery and nasal nerve, the latter the posterior ethmoidal artery and vein; the malar foramina transmits small nerves and vessels, and the lachrymal canal.

What bones form the hard palate?

The two palate and the two superior maxillary.

What process in the centre passing backward?

A linear ridge or raphe.

What openings in it, and where located?

The anterior palatine canal, which contains four openings—two placed laterally, and two in the middle, one before the other.

What pass through the openings?

The naso-palatine vessels and nerves.

What bones form the vertex of the skull?

The frontal, two parietal and occipital.

What bones form the temporal region?

The temporal, frontal, malar, sphenoid and parietal.

What openings on the facial surface of the skull?

There are two large cavities, the nasal and the orbital; and the following foramina: supra-orbital, infra-orbital, malar foramina, and mental foramen.

What is understood by facial angle?

The parts included with two given lines; these being drawn from the most prominent part of the forehead to the alveolar edge of the upper jaw opposite the incisor teeth; and the other from the meatus auditorius externus to the same point of the jaw.

What is the average capacity of the cranium of the most prominent races?

The Caucasian, European, . .	87	cubic inches.
Magnolian, Northern Asiatic, .	83	"
Malay, ...	81	"
American Indian, . . .	80	"
Ethiopian, ...	78	"

What is the capacity at birth?

Twenty to twenty-five cubic inches.

What is meant by synarthrosis?

Immovable articulations.

What is understood by suture?

An immovable articulation in which the bones unite by means of serrated edges.

What is the form of union called schindylesis?

That of a slit or fissure, formed by a ridge in one bone received into a groove in another.

What kind of union is gomphosis?

An articulation formed by the insertion of a conical process into a socket.

Describe and give an example of amphi-arthrosis.

An articulation where the bones are connected by an intermediate substance; the union at the pubic symphysis affords an example.

What is meant by diarthrosis?

Movable articulations.

Name the four principal varieties.

1. Arthrodial or gliding joint.
2. Enarthrosis or ball-and-socket joint.
3. Ginglymus or hinge joint.
4. Diarthrosis rotatorius, articulation by a pivot turning within a ring.

Describe and illustrate arthrodia.

Articulation by plane surfaces, with a limited motion, as in the case of the carpal and tarsal bones, which merely slide for a little way upon each other.

What is the enarthrosis?

Popularly known as the ball-and-socket joint.

What is the ginglymus, and where shown?

Hinge joint; where motion is limited to forward and backward.

What tissues form the ordinary joints?

Bone, cartilage, fibrous tissue or ligaments, and synovial membrane.

What are the physical properties of cartilage?

It is of a pearly-white or bluish-white color, highly elastic, flexible, smooth and cohesive.

By what means is articular cartilage nourished?

By means of the vessels of the synovial membrane, and those of the adjacent bones.

What is its structure and ordinary use?

Intermediate between bone and cartilage, and composed of albumen, water and phosphate of lime; by its smoothness it affords ease and freedom of movement between the bones, and by its elastic property it wards off shock.

Are vessels and nerves found in this cartilage?

No.

How extensively does it cover bones?

It extends over the articular surfaces only.

Is it equally thick in all parts of the joint?

Unless on the articular surfaces of the short bones, it is thick at the centre, and becomes gradually thinner toward the circumference.

What connects the bones, and how is it done?

In the movable joints, the bones forming the articulation are expanded for greater convenience of mutual connection, and the articulating surfaces are covered by an elastic structure—cartilage—held together by strong bands or capsules—ligaments—and lined by a synovial membrane.

What are the structure and properties of ligaments?

They are composed of white fibrous tissue, and are pliant and flexible, but strong, tough and inextensible.

What can be said of their vascularity and sensibility?

They contain but very few blood-vessels, and, as respects nerves, they have not been satisfactorily demonstrated by anatomical investigation.

How are the ligaments attached?

To the articular surfaces of bone, which often presents a rough surface, eminence or tubercle for their attachment.

What kind of membrane inside the ligaments, and what is its use?

Synovial; it secretes synovia.

MUSCLES.

What muscle covers the top of the head?

The occipito frontalis.

What muscles on the face above the eye?

The frontal portion of the occipito-frontalis, superior portion of the orbicularis palpebrarum, and the corrugator supercilii.

What muscles between the eye and mouth?

The inferior border of the orbicularis palpebrarum, levator labii superioris, levator anguli oris, zygomaticus major and minor, pyramidalis nasi, levator labii, superioris alæque nasi, dilator naris anterior and posterior, compressor naris, compressor narium minor, depressor alæ nasi, and superior border of the orbicularis oris.

What muscles on the face below the mouth?

Platysma myoides, inferior border of orbicularis oris, levator menti, quadratus menti, and triangularis menti.

Name the muscles of expression of the face.

The occipito-frontalis, corrugator supercilii, pyramidalis nasi and triangularis nasi, the zygomaticii, depressor anguli oris, platysma myoides, and the risorius.

Give the origin, insertion and action of each.

The occipito-frontalis.—The occipital part arises from the external two-thirds of the superior curved line of the occipital bone, and from the mastoid portion of the temporal. The frontal attachment—the

middle fibres become continuous with the pyramidalis nasi; the middle with the orbicularis and corrugator supercilii, and the external with the fibres of the orbicularis; the two inner margins are blended together above the root of the nose. It draws up the eyebrows, and throws the skin of the forehead into transverse wrinkles, forming a predominant expression in the emotions of delight.

The corrugator supercilii, arising from the inner extremity of the superciliary ridge of the frontal bone, and ends at the middle of the orbital arch by becoming blended with the orbicularis and the occipito-frontalis. It produces the vertical wrinkles of the eyebrow, and is the principal agent in the expression of grief.

Pyramidalis nasi extends from the root of the nose to half way down, where it unites with the compressor nasi.

The compressor nasi, (*triangularis nasi.*)—It arises from the canine fossa in the superior maxillary, and becomes blended with the corresponding muscle, the pyramidalis nasi and fibro-cartilage of the nose. These two elevate the skin of the nose, and are engaged in the expression of surprise.

The zigomaticii.—The minor arises from the anterior inferior part of the malar bone, and blends with the outer margin of the levator labii superioris; the major arises from the malar bone, near the zygomatic suture, and is continued into the orbicularis and depressor anguli oris. The action of the zygomaticii is observed in laughing.

Depressor anguli oris arises from the oblique line of the inferior maxillary. It becomes blended with the orbicular and great zygomatic muscles. It is concerned in the expression of sorrowful emotion.

Platysma myoides.—As this muscle is embraced with those of the neck, we only name it here as be-

longing to the muscles of expression; it is a chief agent in the expression of melancholy. And the risorius, which arises in the fascia over the masseter, and is inserted into the angle of the mouth, produces the smile of derision.

What are the muscles of mastication?

The masseter, the temporal, buccinator, and the two pterygoid.

Describe each of them separately.

The *masseter* is a short, thick muscle, arranged so as to form two bundles, the *external* portion, the largest, *arises* by a tendinous aponeurosis from the malar process of the superior maxillary, and from the lower border of the zygomatic arch, and is *inserted* into the angle and lower half of the ramus of the jaw; the internal portion *arises* from the lower border of the zygomatic process of the temporal bone, and is inserted into the upper half of the ramus of the jaw.

The *temporal* arises from the whole of the temporal fossa, and from the curved line on the frontal and parietal bones above, to the pterygoid ridge on the great wing of the sphenoid below. Its fibres terminate in an aponeurosis, which converges into a thick and flat tendon to be *inserted* into the apex and inner surface of the coronoid process of the jaw.

The *buccinator* is a broad, thin muscle, quadrilateral in figure, occupying the interval between the jaws. It *arises* from the outer surface of the alveolar processes of the upper and lower jaws to the extent of the molar teeth; and behind, from the anterior border of the pterygo-maxillary ligament. It is *inserted* into the angle of the mouth and the muscular structure of the lips. The duct of the parotid gland passes through this muscle. Its chief use in mastication is to keep the food between the teeth.

The *internal pterygoid* is oblong-square in form,

and arises from the pterygoid fossa being attached to the inner surface of the external pterygoid plate, and to the grooved surface of the tuberosity of the palate bone, and is inserted into the inner side of the ramus and angle of the jaws.

The *external pterygoid* extends horizontally backward and outward from the zygomatic fossa to the condyle of the lower jaw. It arises from two heads, one from the external pterygoid plate, the other from the great wing of the sphenoid, and is inserted into the neck of the jaw, and into its inter-articular fibro-cartilage.

The external pterygoids are the direct agents in trituration of the food, and these, with the internal pterygoids, masseter and temporal, raise the lower jaw against the upper.

What muscles are connected with the external ear?

Attollens aurem, attrahens aurem, and retrahens aurem.

MUSCLES IN THE NECK.

Describe the obliquely ascending group.

The *platysma myoides* is a flat, thin plane of muscular fibres, placed directly beneath the skin of the neck. It arises in the cellular tissue over the pectoralis major and deltoid muscles; then ascending over the clavicle and side of the neck, it gradually narrows and approaches the muscles of the opposite side, terminating thus: the anterior fibres cross those of the opposite platysma, near the symphysis of the jaw, and become blended with the skin of the chin; the middle are attached along the base of the jaw; the posterior are prolonged upon the side of the cheek, as far as the angle of the mouth, where they

terminate partly in the subcutaneous tissue of the cheek, and partly in adjacent muscles.

The *sterno-cleido mastoid* is extended diagonally across the side of the neck. It arises by a flat tendon from the upper part of the sternum, and by fleshy fibres, from the sternal third of the clavicle; the clavicle origin is usually separated from the sternal by a flat, triangular cellular interval. The two portions become inseparably blended, below the middle of the neck, into a thick, rounded muscle, which is finally *inserted* into the mastoid process, and about the outer half of the superior curved line of the occipital bone. The sterno-mastoid divides the neck, on either side, into two great triangles, anterior and posterior.

Describe the boundaries of these two triangles.

Anterior, its base is formed by the jaw, its sides by the mesial line and anterior border of the sterno-mastoid. Posterior—has the clavicle for the base, and the posterior border of the sterno-mastoid, and the free border of the trapezius for its sides.

The *omo-hyoid* arises from the notch in the scapula and the ligament over it, and is *inserted* into the body of the hyoid bone, near the great cornu. This muscle is digastric, having two bellies, and it forms an obtuse angle beneath the sterno-mastoid.

How does this muscle affect the two primary triangles?

It subdivides them into four smaller ones.

Describe each of the group ascending directly.

The sterno-hyoid.—The most superficial of the muscles of the neck arises from the back part of the sternum and sterno-clavicular ligament, and is inserted into the lower border of the body of the hyoid bone. Opposite the two or three upper rings of the trachea it is in contact with its fellow of the opposite side, as also behind the sternum.

Sterno-thyroid.—Broader and shorter than the preceding; arises lower down than that muscle, from the thoracic surface of the first bone of the sternum, to be inserted into the oblique line on the side of the ala of the thyroid cartilage.

Thyro-hyoid.—Appears like a continuation of the preceding muscle, as it arises from the oblique line on the side of the thyroid cartilage, and, passing up, is inserted into the lower border of the great cornu, and the body of the os hyoid.

What muscles in the obliquely descending group?

Digastric, stylo-hyoid, stylo-glossus, and stylo-pharyngeus.

Describe the next, or supra-hyoid group.

Mylo-hyoid is a flat, triangular muscle, placed immediately beneath the anterior belly of the digastric. It arises from the mylo-hyoid ridge of the lower jaw, and is inserted into the body of the os hyoides. It joins its fellow on the opposite side in the raphe or mesial line. The two muscles support the mucous membrane of the mouth and tongue, and constitute a muscular floor for that cavity.

Genio-hyoid.—Concealed by the preceding; arises from the inside of the symphysis of the chin, (its inferior submental tubercle,) and is inserted into the front of the body of the os hyoides.

Genio-hyo-glossus.—A flat, triangular plane of fleshy fibres; arises by a tendon from the tubercle behind the symphysis of the jaw, and inserted into the hyoid bone and the tongue from base to tip.

Hyo-glossus arises from the body and great cornu of the hyoid bone, and is inserted into the posterior two-thirds of the side of the tongue.

What muscles are connected with the tongue?

The genio-hyo-glossus, hyo-glossus, lingualis, stylo-glossus, and palato-glossus.

What muscles in the palatine group?

Levator palati mollis, tensor palati, azygos uvulæ, palato-glossus, and palato-pharyngeus.

Describe the five muscles connected with the pharynx.

Constrictor inferior.—The largest and thickest of the three constrictors; arises from the external surface of the cricoid cartilage, and the oblique ridge on the side of the great ala of the thyroid. The fibres curve backward and inward, and are inserted into the posterior median line of the pharynx. The fibres converge to those of the corresponding muscle of the opposite side.

Constrictor medius.—A flattened, fan-shaped muscle; arises from the greater and lesser cornu of the hyoid bone. The fibres proceed backward, diverging from one another, and are blended with those of the corresponding muscle along the middle line. The lower fibres incline downward, and are concealed by the inferior muscle; the middle run transversely; the upper ones overlap the superior constrictor.

Constrictor superior.—Thinner and paler than the others, and qurdrilateral in shape—*arises* from the hamular process of the sphenoid; from the pterygo-maxillary ligament; from the mylo-hyoid ridge of the lower jaw, and from the side of the tongue. The fibres pass inward to be *inserted* into the mesial line.

Stylo-pharyngeus.—A long slender muscle—*arises* near the base of the styloid process, and is *inserted* into the posterior edge of the thyroid cartilage. It is situated between the superior and middle constrictor.

Palato-pharyngeus.—This muscle has its origin in the soft palate, being connected with the fibrous structure of the palate; but, descending behind the tonsil, it distributes some fibres in the pharynx, and,

joining the stylo-pharyngeus, is attached with it to the thyroid cartilage.

What muscles are connected with cervical vertebræ in front?

The rectus capitis anticus, major and minor, and the longus colli.

Describe the scaleni muscles.

They lie deeply at the side of the neck, behind and beneath the sterno-mastoid muscle.

The anterior scalenus arises by a flat, narrow tendon on the inner border and upper surface of the first rib, and is *inserted* into the anterior tubercles of four cervical vertebræ—the third to sixth.

The middle scalenus.—Larger and longer than the preceding—*arises* from the upper surface of the first rib, and is *inserted* into the posterior tubercles of the last six cervical vertebræ.

The posterior scalenus arises from the second rib, between tubercle and angle; it divides into two or three small tendons, which are inserted into the transverse processes of as many of the lowest cervical vertebræ on their posterior tubercles.

What muscles cause the rotation of the head?

The splenii, rectus capitis anticus, major, minor and lateralis, the complexus, and the splenius.

Describe the action of each of the above muscles.

The splenii of the two sides, acting together, draw the head directly backward; acting separately, they draw the head to one side or the other, and slightly rotate it, turning the face to the same side. The recti muscles restore the head to its natural position when drawn backward by the posterior muscles; they serve to flex the head, and rotate it so as to turn the face to one side or the other; the principal action of

the complexus is to keep the head erect, and that of the splenius is to draw the head toward its own side.

How many muscles connect the shoulder to the body?
Seven.

What is the name and the action of each?

Pectoralis minor; it draws the scapula downward and forward.

Subclavius; it depresses the shoulder, drawing the clavicle downward and forward.

Serratus magnus; it draws the scapula forward, and is the most important external inspiratory muscle.

Trapezius; if the head is fixed, the upper part of the trapezius elevates the point of the shoulder, as in supporting weights; when the middle and lower fibres are called into action, partial rotation of the scapula upon the side of the chest is effected; if the shoulders be fixed, the two, acting simultaneously, will draw the head backward, or, if but one, the head is inclined to the corresponding side.

Levator-anguli scapulæ; it raises the posterior angle of the scapula; as, for example, in shrugging the shoulders.

Rhomboideus minor and major; they draw the scapula upward and backward; they are the antagonists of the serratus magnus.

How many connect the arm with the shoulder?
Seven.

What is the name and action of each?

Deltoid; it raises the arm; but the elevation is limited to an angle of sixty degrees.

Supra-spinatus; it assists the deltoid in raising the arm.

Infra-spinatus and *teres minor;* these two rotate the humerus outward.

Teres major; it draws the humerus backward, and

assists the latissimus dorsi in drawing the humerus downward when previously raised, and rotating it inward.

Subscapularis; it rotates the humerus inward, when the arm is raised, it draws the humerus downward.

Coraco brachialis; It assists in elevating the humerus toward the scapula, and draws it forward and inward.

How many muscles connect the arm to the body?
Two.

What is the name and action of each?
Pectoralis major; the principal action is to draw the humerus toward the chest; when the arm is made the fixed point, it assists in raising the trunk, as in climbing.

Latissimus dorsi; it draws the humerus backward and downward and rotates it inward; it depresses the shoulder; also, assists in raising the body, as in climbing.

What muscles connect forearm to shoulder?
The biceps and triceps.

What muscles connect forearm to arm?
Brachialis anticus and anconeus.

How many muscles on the forearm?
Nineteen.

What are the principal actions performed by them?
Flexion, extension, pronation and supination.

How many pronators, and their names?
Two—they are the pronator radii teres, and pronator quadratus.

How many supinators, and their names?
Two—the supinator radii longus and brevis.

Where are the pronators situated?

The pronator radii teres arising from the internal condyle, it passes obliquely across the forearm to the middle of the outer margin of the radius; the pronator quadratus is placed transversely across the front of the radius and ulna, near their carpal extremities.

Where are the supinators situated?

The supinator longus is situated superficially on the outer side of the forearm, extending from the upper portion of the external condyle to the extensors of the thumb or oblique extensors.

Extensors of the hand are inserted into the base of the metacarpal bones.

Extensors of the digits are inserted into the phalanges, and *extensors of thumb* inserted into the phalanges.

How many muscles in the hand?

Nineteen.

How many and what on the radial side?

Four—abductor pollicis, opponeus pollicis, flexor brevis pollicis and adductor pollicis.

How many and what on ulnar side?

Four—palmaris brevis, abductor minimi digiti, flexor brevis minimi digiti and adductor minimi digiti.

How many and what in the middle?

Eleven—four lumbricales, three anterior interosii, and four dorsal interosii.

Describe the position of the supinator brevis.

The supinator brevis is covered by the *longus*, surrounds the upper part of the radius, encircles its neck, and partly inserted into its oblique line.

How are the flexors divided?

Into those of the hand and those of the digits.

How many in each group?
Three.

Where are the different groups inserted?
Into the base of the metacarpal bone of the index and little fingers; but the palmaris longus is inserted into the annular ligament and palmar fascia; those of the digits are inserted into the phalanges.

How many extensors, and how classed?
Nine—and are arranged into three groups.

What are they, and where inserted?
Extensors of the hand, extensors of digits.

How many muscles attached (either by origin or insertion) to the humerus?
Twenty-four.

How many are inserted into the humerus?
Nine.

Give the name of each from above downward.
Supra-spinatus, infra-spinatus, teres minor, subscapularis, latissimus dorsi, pectoralis major, teres major, deltoid and coraco brachialis.

MUSCLES OF THE ABDOMEN.

How many abdominal muscles?
Six.

Describe the three in the lateral group.
The *external oblique* is attached to the eight or nine lower ribs by as many serrations. The upper five of these interdigitate with the serratus magnus, and the three lower with the latissimus dorsi. The fleshy fibres from the last ribs pass down in nearly a vertical direction to be *inserted* into the external margin of the crista ilii; all the rest incline downward and for-

ward, and terminate in tendinous fibres, which form a broad aponeurosis, which covers the fore part of the abdomen, and terminates by uniting with that of the opposite muscle along the median line, from the ensiform cartilage to the symphysis pubis.

The internal oblique arises from the outer half of the crural arch, and the anterior two-thirds of the crest of the ilium; the fibres ascend obliquely to be inserted into the abdominal aponeurosis, partly into the cartilages of the three or four lower ribs.

The transversalis arises from the outer half of the crural arch, from the anterior two-thirds of the crest of the ilium, from a fascia attached to the transverse processes of the lumbar vertebræ, and from the inner surfaces of the six or seven lower costal cartilages; the fibres proceed horizontally forward, and terminate in the abdominal aponeurosis.

What ones comprise the central group?

The rectus, pyrimidalis and quadratus lumborum.

Give the origin, insertion and action of each.

The rectus is situated along the front of the belly, and inclosed in a sheath formed by the aponeurosis of the lateral muscles of the abdomen. It arises from the symphysis and upper part of the pubes, and is inserted into the fifth, sixth and seventh costal cartilages.

The front of the sheath comprises the aponeurosis of the external oblique, and half the thickness of that of the internal oblique.

The *pyramidalis* lies near the pubes, close to the linea alba. It arises from the upper part of the pubes in front of the rectus, and terminates in the linea alba, about midway between the pubes and the umbilicus.

The quadratus lumborum consists of two portions. One portion arises by aponeurotic fibres from the iliolumbar ligament and adjacent parts of the crest of

the ilium, for about two inches, and is inserted into the lower border of the first rib, and, by four small tendons, into the apices of the transverse processes of the third, fourth and fifth lumbar vertebræ; the other portion is placed in front of the preceding—arises from the upper borders of the transverse processes of the third, fourth and fifth lumbar vertebræ, and is inserted into the lower margin of the last rib.

What structure internal to the transversalis muscle?

The fascia transversalis.

MUSCLES OF THE BACK.

What muscles comprised in the first layer?

Trapezius and latissimus dorsi.

Give the name of those in the second layer?

Levator anguli scapulæ, rhomboideus minor and major.

What muscles in the third layer?

Serratus posticus superior, serratus posticus inferior, splenius capitus, and splenius colli.

Give the origin, insertion and action of each.

Serratus posticus superior: it is flat, and very thin —*arises* from the ligamentum nuchæ, the spinous process of the last cervical, from those of two or three upper dorsal vertebræ, by a thin aponeurosis, which inclines downward and outward, and, becoming muscular, is *inserted* by four fleshy digitations into the bodies of the second, third, fourth, and sometimes the fifth ribs, rather beyond their angles.

Serratus posticus inferior: broader than the preceding—arises from the spinous processes of the last two dorsal, and two or three upper lumbar vertebræ,

and is *inserted* by four broad digitations into the bodies of the last four ribs.

Splenius capitis: *arises* from the spinous processes of the first two dorsal, and of the seventh cervical vertebræ; also from the ligamentum nuchæ, opposite sixth, fifth and fourth; its fibres proceed upward and outward, to be *inserted* into the lower end of the mastoid process, and the rough surface on the occipital beneath the superior curved line.

And the splenius colli arises from the spinous processes of four dorsal vertebræ—the third to the sixth, inclusive, and is inserted by separate points into the transverse processes of the first three cervical vertebræ, near the origin of the levator anguli scapulæ.

The serrati are respiratory muscles—the superior being a muscle of inspiration; the inferior a muscle of expiration. The splenii muscles of the two sides, acting together, draw the head directly backward, but, acting separately, they draw the head to one side or the other, and slightly rotate it, turning the face to the same side; they also assist in supporting the head in the erect posture.

THE THIGH.

How many and what muscles flex the thigh?

Three; the psoas parvus, psoas magnus and iliacus.

How many and what muscles extend the thigh?

Three; gluteus maximus, medius and minimus.

How many external rotators of the thigh, with their names?

Six; pyriformis, gemellus superior, obturator internus, gemellus inferior, obturator externus and quadratus femoris.

What muscles pass from trunk to femur?

Iliacus, psoas parvus, psoas magnus, pectineus, adductor longus, adductor brevis, adductor magnus, gluteus maximus, medius and minimus, pyriformis, two gemelli, obturator internus and externus, and quadratus femoris.

What superficial muscles on the thigh?

Tensor vaginæ femoris, sartorius and gracilis.

What are the adductors of the thigh?

Pectineus, adductor longus, adductor brevis, and adductor magnus.

What muscles extend the leg?

Rectus femoris, vastus externus, vastus internus and crureus.

What muscles flex the leg?

Semi-membranosus, semi-tendinosus, biceps and popliteus.

How many muscles on the leg?

Thirteen.

How many and what in superficial group behind?

Three; gastrocnemius, soleus and plantaris.

How many and what in posterior tibial group?

Four; popliteus, flexor longus digitorum, tibialis posticus, and flexor longus pollicis. The last has a fibular origin.

What ones in anterior tibial group?

Tibialis anticus, extensor proprius pollicis, extensor longus digitorum, (the peroneus tertius on the same plane but fibular side.)

What muscles in fibular group?

Peroneus longus, and peroneus brevis.

How many muscles on the foot?

Seventeen.

What three in superficial plantar group?
Abductor pollicis, flexor brevis digitorum, and abductor minimi digiti.

What five in middle plantar group?
The flexor accessorius, and the four lumbricales.

What four in deep plantar group?
Flexor brevis pollicis, adductor pollicis, flexor brevis minimi digiti and transversus pedis.

How many plantar interrossei?
Three.

How many dorsal interossei?
Four.

What superficial dorsal muscle?
Extensor brevis digitorum.

What muscles extend the foot?
Peroneus longus, peroneus brevis, and tibialis posticus.

What the flexors of the foot?
Tibialis anticus and peroneus tertius.

THE HEART.

What position does the heart occupy?
It is situated obliquely in the chest, between the lungs.

Where are the base and apex situated?
The base extends from about the fourth to the eighth dorsal vertebræ. The apex in the dead body corresponds with the cartilage of the sixth rib, but in the living it occupies the space between the cartilages of the fifth and sixth ribs.

What structures in front and behind it?

The bronchi, œsophagus, and descending aorta behind; small portion of the lungs, sternum and ribs in front.

What parts lie on each side of it?

The right and left lung.

What main structures above and below the heart?

The great blood-vessels above, and the diaphragm below.

What membrane invests the heart?

The pericardium.

What does it inclose besides the heart?

The commencement of the large vessels.

What are the properties and purpose of this membrane?

It is a fibro-serous membrane. Its inner surface is smooth and glistening, and secretes a thin fluid, which facilitates the movements of the heart within its inclosing sac. The use of the pericardium is, obviously, to suspend the heart in its place, to separate it from other parts, and to facilitate its movements.

How is the heart placed within the pericardium?

The heart is inclosed in the sac of the pericardium. The serous layer is reflected over it; the fibrous layer is not reflected over the heart.

What portion of the heart lies most to the right?

The base.

What part lies mostly in front?

The apex.

Where is the left auricle situated?

It occupies the left and posterior part of the base of the heart, and overlaps the root of the pulmonary artery.

What is the average length of the heart?
Five inches, or five and a half.

How wide?
Three inches and a half.

What is its usual thickness?
Two and a half inches.

How many valves pertain to the heart?
Six.

Where is the coronary valve situated?
In the right auricle.

Where and for what purpose is the eustachian valve?
Between the anterior margin of the inferior cava and the auriculo-ventricular orifice. Its use during fœtal life is to direct the current of blood from the inferior vena cava toward the foramen ovale.

What valve between the right auricle and ventricle?
Tricuspid.

Describe its structure and action.
It is formed by a fold of the "endocardium" of the heart, strengthened by fibrous tissue. During the contraction of the ventricle, the tricuspid valve is applied over the opening leading from the auricle, and prevents the blood from rushing back into that cavity.

Where is the mitral valve placed?
At the circumference of the left auriculo-ventricular orifice.

What other valve does it resemble?
The tricuspid.

How large are the openings closed by these valves?
The auriculo-ventricular openings are of sufficient size to admit the passage of three fingers.

Where are the semi-lunar valves placed?

Those of the right side are attached to the orifice of the pulmonary artery, and those of the left surround the orifice of the aorta.

What is the circumference of the orifice which they close?

That of the pulmonary artery is about three inches, and that of the aorta about two and three-quarter inches.

What difference is observed in their structure?

Those of the left are larger, thicker and stronger than those of the right.

What is the lining membrane of the heart?

A fibro-serous membrane.

What other tissue forms the valves?

Fibrous.

What is the structure of the ventricles?

Chiefly muscular.

How are the muscular fibres arranged?

In rings.

What is the comparative thickness of the walls?

The left ventricle is about double the thickness of the right.

What difference in the walls of the auricles?

The right auricle measures about one line; whereas, the left measures a line and a half in thickness.

DISTRIBUTION OF ARTERIES.

What branches arise first from the aorta?

Coronary.

Where are they distributed?

To the heart.

Describe their origin and position on the heart.

They arise near the commencement of the aorta, immediately above the semi-lunar valves; they encircle the heart near its base—one for the right and another for the left side of the heart.

Describe the shape and position of the arch of the aorta.

It describes a curve, having its convexity turned upward, forward, and to the right side; it extends from upper part of left ventricle to the lower border of the body of the third dorsal vertebra.

What branches arise from the arch of the aorta?

The two coronary, the innominata, left carotid, and left subclavian.

Describe the direction, length and branches of the innominata.

It ascends obliquely toward the right, until it reaches opposite the sterno-clavicular articulation of that side, where it divides into the right subclavian and right carotid arteries; in length it varies from an inch to an inch and a half. Occasionally it also supplies a thyroid and thymic branch.

Describe the primitive carotid on each side.

They are nearly similar in their course and position whilst in the neck, but differ in their mode of origin, and, therefore, in their length and position at their commencement. The right arises from the innominata, behind the right sterno-clavicular articulation; the left from the highest part of the arch of the aorta; consequently the left is the longer of the two.

Where and into what does the primitive carotid divide?

On a level with the upper border of the thyroid cartilage, it divides into the external and internal carotid arteries.

Why are they called external and internal?

Evidently because one remains outside and the other passes within the cranium.

What three branches form the external carotid anteriorly?

The superior thyroid, lingual and facial.

What is the first branch from the external?

The superior thyroid.

What is its direction and branches?

It passes beneath the omo-hyoid, sterno-hyoid, and sterno-thyroid muscles, to the upper and front surface of the thyroid body branches: 1, the hyoid; 2, the superior laryngeal; 3, sterno-mastoid; 4, crico-thyroid.

What is the second branch and its direction?

The lingual artery; curving upward it runs forward beneath the hyo-glossus muscle, ascends to the under surface of the tongue, terminating at its apex under the name of "ranine."

What branches are parts of the lingual artery?

1, the hyoid; 2, the dorsalis; 3, the sublingual. It is divided into an oblique, horizontal, ascending, and terminal part.

To what parts are the branches distributed?

The muscles attached to the hyoid bone, the mucous membrane of the dorsum of the tongue, the tonsil, soft palate, epiglottis, mylo-hyoid, sublingual gland, and the mucous membrane of the mouth and gums.

What the third branch from the carotid?

The facial artery.

What branches from it below the inferior maxillary?

1, The ascending palatine; 2, the tonsillar; 3, the glandular; and, 4, the submental.

To what part is each one distributed?

The soft palate, tonsils, submaxillary gland, mylo-hyoideus, and digastric muscles, and the sublingual absorbent glands.

What branches from the facial on the face?

Muscular, inferior labial, inferior and superior coronary, lateralis nasi, and angular.

With what does the inferior labial anastomose?

The inferior coronary, submental branches of the facial, and with the mental branch of the inferior dental artery.

What arteries surround the mouth?

Submental, inferior labial, and inferior and superior coronary.

With what does the angular branch anastomose?

Infra-orbital and nasal branch of the ophthalmic artery.

What arteries form the carotid, posteriorly?

The occipital and posterior auricular.

What branches form the occipital artery?

The muscular, auricular, inferior meningeal, and arteria princeps cervicis.

Where is it principally distributed?

To the digastric, stylo-hyoid, splenius, and a large branch to the sterno-mastoid.

What artery from the carotid near the occipital?

The posterior auricular.

Where is the posterior auricular distributed?

It supplies the back of the scalp and the cartilage of the ear.

Into what does the carotid divide?

The temporal and the internal maxillary.

What direction does the temporal take?
It continues upward in the direction of the parent vessel.

What branches from the temporal artery?
Branches to the parotid gland, transverse, middle temporal, anterior auricular, and the anterior and posterior temporal.

With what does its branches anastomose?
With the supra-orbital, frontal, posterior auricular, occipital, and the corresponding artery on the opposite side.

What direction does the internal maxillary take?
It passes inward to the inner side of the neck of the condyle of the lower jaw.

What are its principal branches?
Maxillary, pterygoid and spheno-maxillary.

THE INTERNAL CAROTID.

Where is the internal carotid distributed?
To the brain and to the eye.

Through what foramen does it enter the cranium?
The carotid.

What is its first considerable branch?
The ophthalmic.

Through what foramen does it enter the orbit?
The optic foramen.

Name the branches of the ophthalmic artery.
The lachrymal, supra-orbital, arteria centralis retinæ, ciliary, ethmoidal, nasal and muscular.

Which one anastomoses with the facial?
The nasal.

What is the second branch of the internal carotid?
Anterior cerebral.

Where is the anterior cerebral distributed?
To the olfactory and optic nerves, under surface of the anterior lobes of the brain, the third ventricle, the corpus callosum, and the inner surface of the hemispheres.

Where is the middle cerebral distributed?
Along the fissure of Sylvius.

What branch from the carotid running backward?
The anterior cerebral.

THE SUBCLAVIAN AND ITS BRANCHES.

Where do the subclavian arteries arise?
From the arteria innominata on the right side, and from the arch of the aorta on the left.

Describe the three parts of each subclavian artery.
The *first* part extends from the origin of the vessel to the inner border of the anterior scalenus muscle; the *second* is the portion placed beneath that muscle, and the *third* reaching from the outer border of that muscle to the outer border of the first rib.

The right and left differ in their origin, and likewise in their length, direction and connections. The right subclavian arises from the innominata, the left comes direct from the arch of the aorta, and is longer, deeper in the chest, and more vertical than the right.

What is the first branch of the subclavian?
The vertebral.

Describe the course of the vertebral to the brain.

Entering the foramen in the transverse process of the sixth cervical vertebra it ascends through the foramina in the transverse processes of the succeeding vertebræ; and after passing through the foramen of the atlas, the vessel curves backward and enters the skull through the foramen magnum.

What branches as it enters the foramen magnum?

Posterior meningeal.

What large branch before they unite?

The posterior spinal.

How is the basilar artery formed, and where?

By the union of the vertebral at the lower border of the pons varolii.

What branches form the basilar artery?

Transverse, anterior, and superior cerebella, and posterior cerebral.

What union between it and the carotid?

It joins the posterior communicating artery to unite with the circle of Willis.

How is the circle of Willis formed?

By branches of the internal carotid and vertebral arteries.

What purpose does it serve in the circulation?

It secures the equalization of the circulation of the blood.

What arteries supply the pia mater and brain?

The internal carotid and vertebral.

What arteries supply the dura mater?

The meningeal.

What is the second branch from the subclavian?

The internal mammary.

Describe the thyroid axis, and where situated?

A long, thick trunk, which divides a line or two from its origin into three branches. It arises from the fore part of the subclavian artery, near the inner side of the anterior scalenus muscle.

Name its branches.

Inferior or ascending thyroid, transverse cervical and supra-scapular.

What the direction and distribution of each?

The inferior thyroid passes upward behind the sheath of the common carotid artery and sympathetic nerve. It is distributed to the larynx, trachea and œsophagus.

The transverse cervical is distributed to the scalenus anticus, rectus capitis, anticus major, trapezius, and the spinal cord; it passes transversely outward across the upper part of the subclavian triangle.

The supra-scapular passes obliquely from within outward, across the root of the neck; it supplies the supra-spinatus, infra-spinatus, teres minor, sterno-mastoid, and the shoulder-joint.

What branches from the subclavian going down?

The internal mammary and superior intercostal.

What is the general direction of the internal mammary?

It runs perpendicularly, about half an inch from the sternum, between the cartilages of the ribs and the triangularis sterni, and passes behind the rectus abdominis.

Name its principal branches and anastomoses.

Anterior intercostal, perforating branches, and musculo-phrenic. It anastomoses with the epigastric.

Where is the superior intercostal situated?

Behind the scalenus anticus, and passes over the necks of the first and second ribs.

What other branch from the subclavian?
The vertebral.

What six branches from the axillary artery?
Superior, acromial, long and short thoracic, subscapular and circumflex.

Where does the acromial thoracic go for distribution?
It passes over the coracoid process, and supplies the deltoid muscle.

Name the distribution of the superior or short thoracic.
The pectoral muscles.

Where is the long thoracic distributed?
Serratus magnus, the pectoral muscles and mammary gland.

Describe the subscapular and its branches.
It arises opposite the lower border of the subscapularis, and passes backward and downward to the inferior angle of the scapula. Its branches are the subscapular, infra-spinous and median.

What is the origin and distribution of the circumflex?
It arises from the axillary, close to the lower border of the axilla. Its branches wind round the neck of the humerus, and are distributed to the deltoid muscle and shoulder-joint.

THE BRACHIAL ARTERY AND ITS BRANCHES.

Name the five principal branches from the brachial.
The superior profunda, the nutrient, inferior profunda, anastomotica magna and muscular branches.

What becomes of the superior profunda?
It winds round the posterior part of the humerus,

accompanied by the musculo-spiral nerve. After having supplied branches to several muscles of the arm, it descends on the outer side of the arm as far as the elbow, where it anastomoses with the recurrent branch of the radial artery.

Name the origin and distribution of the inferior profunda.

It arises from the brachial, near the insertion of the coraco-brachialis. It gives branches to the triceps and brachialis anticus.

Where is the anastomotica situated?

It arises from the brachial, about two inches above the elbow, and runs tortuously inward across the brachialis anticus.

With what arteries do these branches anastomose?

The inferior profunda, and the anterior and posterior ulnar recurrent arteries.

Where does the brachial artery usually divide?

A little below the middle of the elbow-joint, or opposite the neck of the radius.

When is it said to have a high bifurcation?

When it bifurcates at any point above the elbow-joint.

What is the course of the radial from its origin?

It commences at the bifurcation of the brachial, and runs down the radial side of the forearm to the wrist, where it winds backward round the outer side of the carpus, beneath the extensor tendons of the thumb, and enters the space between the first and second metacarpal bones to form the deep palmar arch.

What does the radial recurrent join?

The superior profunda.

What branches from radial on the forearm?
Radial recurrent, muscular, superficialis volæ and anterior carpal.

What branch just above the wrist?
The anterior carpal.

What becomes of the superficialis volæ?
It passes between the muscles of the thumb, and anastomoses with the termination of the ulnar artery to form the superficial palmar arch.

What position does the radial occupy at the wrist?
It winds round the outer side of the carpus, from the styloid process to the first interosseous space; it lies upon the external lateral ligament, and is covered by the extensor tendons of the thumb.

What other branches to thumb and fingers?
The princeps pollicis, radialis indicis, perforantes, interosseæ, dorsalis, pollicis and indicis.

What finally becomes of the radial artery?
It inosculates with the deep branch of the ulnar artery, forming the deep palmar arch.

Where is the deep palmar arch situated?
Upon the interosseous muscles and the metacarpal bones.

What branches from it to the fingers?
The palmar interossei.

With what other arteries do they join?
Recurrent, and superior perforating.

What branches from the ulnar turn upward?
Anterior and posterior ulnar recurrent.

With what others do they anastomose?
With the inferior profunda, anastomotica magna and interosseous recurrent.

What branches from the ulnar in the forearm?

Anterior ulnar recurrent, posterior ulnar recurrent, and anterior and posterior interosseous.

Where is the interosseous artery distributed?

The *anterior* gives off branches to the muscles on either side of the forearm, and the *posterior* supplies muscles on the back of the forearm.

Where does the ulnar enter the hand?

Reaching the outer side of the pisiform bone, it passes over the cutaneous surface of the anterior annular ligament of the wrist into the palm of the hand.

How is the palmar arch formed?

By the ulnar curving across to inosculate with the superficialis volæ.

Between what parts of the hand is it situated?

It rests on the annular ligament of the wrist, on the short muscles of the little finger, and on the tendons of the superficial flexor of the fingers, and is covered by the palmar brevis, palmar fascia, and the integument.

What branches from it to the fingers?

The digital branches.

How are these branches situated in the hand?

At first superficial to the tendons, then between them.

OF THE THORACIC AORTA AND ITS BRANCHES.

What position does the thoracic aorta occupy?

At its commencement it is situated on the left side of the spine, but approaches the median line as it descends; it extends from the lower border of the

third dorsal vertebræ, on the left side, to the aortic opening in the diaphragm in front of the last dorsal vertebra.

What branches from the aorta to the lungs?
The bronchial.

How many œsophageal arteries?
Four or five.

How many intercostal arteries?
Generally ten on each side.

What is their position and distribution?
They arise from the posterior part of the aorta, pass outward, across the bodies of the vertebræ, to the intercostal spaces, where each divides into two branches—an anterior or proper intercostal, and a posterior or dorsal branch. The *anterior* supplies the intercostal muscles and anastomose with branches of the internal mammary and thoracic branches of the axillary artery; the *posterior* branch passes backward to the inner side of the anterior costo-transverse ligament, and divides into a spinal branch, which supplies the vertebræ, the spinal cords and its membranes, and a muscular branch, which is distributed to the muscles and integuments of the back.

With what do the intercostals anastomose?
With branches of the internal mammary.

THE ABDOMINAL AORTA.

What position does the abdominal aorta occupy?
It extends from the front of the body of the last dorsal vertebræ, and, descending a little to the left side of the vertebral column, terminates on the left side of the body of the fourth lumbar vertebræ.

What is the first branch from it?
The phrenic.

To what part is that distributed?
The diaphragm.

What is the second branch from the abdominal aorta?
The cœliac axis.

What are the branches of the cœliac axis?
The gastric, hepatic and splenic.

Where is the gastric branch distributed?
Cardiac orifice of the stomach, the œsophagus, it passes along the lesser curvature of the stomach to the pylorus.

What is the position of the hepatic artery?
It passes upward to the right side, between the layers of the lesser omentum, in front of the foramen of Winslow, to the transverse fissure of the liver.

What is the direction and distribution of the splenic?
It passes horizontally to the left side behind the upper border of the pancreas; as it arrives near the spleen it divides into branches, some of which enter the hilus of that organ, and others are distributed to the great end of the stomach.

What artery next below the cœlic axis?
The superior mesenteric.

Where is it distributed?
To all the small intestines, excepting a part of the duodenum, the cæcum, ascending and transverse colon.

Name the principal branches of the superior mesenteric.

Inferior pancreatico-duodenal, vasa intestini tennis, ileo-colic, colica dextra, colica media.

What arteries next to the mesenteric?
Supra-renal and renal.

Where are the supra-renal distributed?
To the supra-renal capsules.

Where do the renal arteries arise?
Arise from the aorta, nearly at right angles, and immediately below the mesenteric.

What arteries next to the renal?
The spermatic.

Where are these distributed in each sex?
To the testicles in the male, and the ovaries in the female.

How is the length of the spermatic explained?
It is short in the fœtus, as the testes are placed immediately beneath the kidneys, but the arteries become longer as the testes descend into the scrotum. It is also shorter in females, as it keeps within the pelvis.

What artery next below the spermatic?
The superior mesenteric supplies the left side of the colon and the greater part of the rectum.

How many lumbar arteries?
Five.

Where are the lumbar arteries distributed?
Dorsal branches to the muscles of the back, and send branches into the spinal canal, and abdominal branches to the quadratus and psoas.

Where does the aorta divide, and into what?
About the body of the fourth lumbar vertebra it divides into the two common iliacs.

What artery is properly a continuation of the aorta?
The two common iliacs.

ILIAC ARTERIES AND THEIR BRANCHES.

Where do the iliac arteries divide?

Opposite the intervertebral substance, between the last lumbar vertebra and the sacrum.

What course does the internal iliac take?

It passes downward to the upper margin of the great sacro-sciatic foramen.

What are its principal branches?

Superior, middle and inferior vesical, middle hemorrhoidal, uterine, vaginal, obturator, internal pudic, sciatic, gluteal, ilio-lumbar, and lateral sacral.

What large one in fœtal life?

The superior vesical.

Where is the ilio-lumbar artery distributed?

To the psoas, quadratus, iliacus internus, the gluteal and abdominal muscles; also the spinal cord.

Describe the distribution of the lateral sacral.

The *superior* passes inward and unites with branches from the middle sacral, enters the first or second sacral foramen to the contents of the sacral canal, and passing through the corresponding posterior sacral foramen, supplies the skin and muscles on the dorsum of the sacrum.

The *inferior branch* passes in front of the pyriformis and sacral nerves to the inner side of the anterior sacral foramina, descends on the front of the sacrum and anastomosis with the median and lateral sacral arteries.

Where is the middle hemorrhoidal distributed?

To the rectum.

What becomes of the obturator artery?

Escaping from the pelvis by the obturator foramen, it divides into an external and internal branch, which are deeply situated beneath the obturator externus muscle; they anastomose at the lower part of the obturator foramen with each other, and with branches of the internal circumflex artery.

Where does the gluteal artery leave the pelvis?

Above the upper border of the pyriformis muscle.

To what parts is it distributed?

The glutei muscles, the integument covering the posterior surface of the sacrum, and to the hip-joint.

Describe the course of the ischiatic.

It is distributed to the muscles on the back of the pelvis, passing down to the lower part of the great sacro-sciatic foramen, behind the internal pudic; resting on the sacral plexus of nerves and the pyriformis muscle, it escapes from the pelvis between the pyriformis and coccygeus.

Where are the uterine, vaginal and vesicle distributed?

The uterine ascends in a tortuous course on the side of the uterus, between the layers of the broad ligament, and supplies branches to its substance. The vaginal—corresponding to the inferior vesicle in the male—supplies the mucous membrane of the vagina, the neck of the bladder and contiguous part of the rectum. The *superior* vesicle is that part of the fœtal hypogastric artery which remains pervious after birth. The *middle* supplies the base of the bladder and under surface of the vesiculæ seminales, and the *inferior* is distributed to the base of the bladder, prostate gland and vesiculæ seminales.

What arteries supply the rectum?

The superior, middle and inferior hemorrhoidal.

What is the course of the pudic?

It is distributed to the external generative organs.

What parts are supplied by its branches?

The sphincter, levator ani, and the transverse muscles, and the integument of the penis, and, in the female, the bulb of the vagina and the clitoris.

What branches arise from the external iliac?

The epigastric and circumflex iliac.

Where is the internal circumflex ilii distributed?

To the pectineus, psoas, the adductors, and the quadratus femoris muscles, and supplies branches to the hip-joint.

What becomes of the internal epigastric?

It terminates in the rectus muscle by minute inosculations with the internal mammary.

What irregularity in the origin of the obturator?

Instead of arising from the *internal*, sometimes it arises from the *external* iliac, or by a short trunk in common with the epigastric.

What course does the obturator artery take?

Passing along the side of the pelvis to the upper part of the obturator foramen, through which it passes to the muscles of the thigh.

Where does the external iliac leave the pelvis?

At the crural arch.

THE FEMORAL AND ITS BRANCHES.

Name the superficial arteries from the femoral.

The superficial epigastric, superficial circumflex iliac, and the superficial external pudic.

To what part is each one distributed?

The superficial epigastric ramifies over the lower part of the abdomen; the superficial circumflex ilii ramifies toward the spine of the ilium; and the superficial external pudic crosses the spermatic cord, and is distributed to the skin of the penis and the scrotum.

Where does the profunda femoris arise?

Usually from the outer and back part of the femoral artery, between an inch and two inches below Poupart's ligament.

Describe its general direction and distribution.

At first it inclines outward, but soon runs downward and backward behind the femoral artery. It is distributed to the ham-string muscles.

What branches arise from the profunda?

The external and internal circumflex, and three perforating.

What becomes of the circumflex arteries?

They inosculate with the obturator, ischiatic and terminal branches of the gluteal.

How many perforating branches, and where distributed?

Three; distributed to the ham-string muscles.

Where is the femoral artery situated?

Commencing at a point midway between the spine of the ilium and the symphysis pubis, it descends almost perpendicularly along the front and inner side of the thigh.

What and where is the last branch from it?

The anastomotica magna; and arises from the femoral artery just before it passes through the tendinous opening in the adductor magnus.

Where is the anastomotica distributed?

To the integument, vastus internus, and the knee-joint.

What position does the popliteal artery occupy?

It descends nearly perpendicularly behind the knee-joint, between the origins of the gastrocnemius, and lies on the popliteus, to the lower border of that muscle.

What branches from the popliteal artery?

Five articular, two sural, and one cutaneous.

Where are they distributed?

To the flexor muscles of the thigh, the gastrocnemius, the vasti, the knee-joint, and integument of the calf.

Into what arteries does the popiteal divide?

Anterior and posterior tibial.

What is the course of the anterior tibial?

In the upper half of its course it lies upon the interosseous membrane; afterward along the front of the tibia; it runs beneath the annular ligament over the front of the ankle.

What branches arise from it in the leg?

The recurrent tibial and muscular.

What position does the dorsalis pedis occupy in the foot?

It passes forward from the bend of the ankle along the tibial side of the foot to the back part of the first interosseous space.

What branches from the popliteal artery?

Recurrent tibial, muscular, and external and internal malleolar.

What becomes of the dorsalis pedis?

It divides into dorsalis hallucis and communicating.

What is the direction of the posterior tibial?
It extends obliquely downward from the lower border of the popliteus muscle, along the tibial side of the leg.

What are its branches above the foot?
Peroneal, muscular, nutritious, and communicating.

Where is the peroneal artery distributed?
To the soleus, tibialis posticus, flexor longus pollicis, peronei muscles, and a nutrient branch to the fibula.

Where is the posterior tibial artery situated at the foot?
Between the inner ankle and the heel.

What name does its branches take in the foot?
The internal and external plantar.

What arrangement have they in the foot?
The internal inosculates with its digital branches, and the external inosculates with the communicating branch from the dorsalis pedis, to form the plantar arch.

Where is the anastomosis between anterior and posterior tibial?
At the inner ankle.

What anastomosis of arteries occur around the knee?
The superior articular.

In ligature of the femoral, what branches supply it?
Chiefly the articular branches of the popliteal.

In ligature of the third part of the subclavian, what artery chiefly supplies the collateral circulation?
The posterior scapular.

THE VEINS.

Through what channel is the blood returned to the heart?
Through the veins.

What is the first division of the veins of the body?
The superficial.

Do the superficial veins have arteries accompanying them?
No.

How deep are the superficial veins usually situated?
They are placed between the layers of superficial fascia.

Where are the deep veins usually situated?
They are inclosed in the same sheath with the arteries?

How many usually accompany the smaller arteries?
Two, or one on each side of the artery.

What names do these deep veins usually bear?
Venæ comites.

How many veins accompany the large arteries?
One only.

Where do the superficial and deep veins communicate?
Under the deep fascia.

VEINS OF THE HEAD AND NECK.

What veins on the anterior part of the head and face?
The facial, frontal and angular.

How are the frontal veins connected and located?
They are connected by a venous plexus, which

communicates with the anterior branches of the temporal vein, and occupy the anterior part of the skull.

Describe the course and termination of the facial vein.

It commences at the inner angle of the orbit, and passes obliquely downward and outward beneath the great zygomatic muscle, along the anterior border of the masseter, crosses the body of the lower jaw, and beneath the platysma and cervical fascia to unite with the temporo-maxillary vein.

What veins on the side of the head?

External and internal jugular, and the temporal.

What veins unite to form the external jugular?

The temporo-maxillary and the posterior auricular.

Where do the external jugular veins terminate?

In the subclavian.

What other superficial veins on the neck?

The thyroid, supra-scapular and posterior scapular.

What provision for venous blood within the cranium?

Sinuses.

How are these sinuses formed?

Their outer coat formed by the dura mater; their inner, by a continuation of the serous membrane of the veins.

What ones are named, and where situated?

The superior and inferior longitudinal, straight and lateral sinuses, and occipital sinuses. The superior longitudinal sinus runs from the inner surface of the frontal to the crucial ridge of the occipital bone. The inferior longitudinal sinus is contained in the posterior part of the free margin of the falx cerebri. The straight sinus is placed at the junction of the falx cerebri with the tentorium. The lateral sinuses commence at the torcular herophili, passing horizon-

tally outward to the petrous portion of temporal bone, curve downward and inward on each side to the jugular foramen. And the occipital, they are situated in the attached margin of the falx cerebelli.

Where are the internal jugular veins situated?

Commencing at the jugular foramen, it passes down the side of the neck in a vertical direction; at first it is on the outer side of the internal carotid, and afterward on the outer side of the common carotid.

What forms the vena innominata?

The internal jugular and the subclavian.

VEINS OF THE UPPER EXTREMITY.

What are the principal superficial veins on the forearm?

The anterior ulnar, posterior ulnar, basilic, radial, cephalic, median, median basilic and median cephalic.

Describe the position of each.

The anterior ulnar commences on the anterior surface of the wrist and ulnar side of the hand, and ascends along the inner side of the forearm to the bend of the elbow, where it joins with the posterior ulnar vein to form the basilic. The posterior ulnar ascends on the posterior surface of the ulnar side of the forearm.

The basilic is formed by the coalescence of the anterior and posterior ulnar; ascending along the inner side of the elbow, it receives the median basilic vein; it ascends near the brachial artery, and terminates in one of the venæ comites, or in the axillary vein.

The radial vein commences from the dorsal surface of the thumb, index finger and radial side of the

hand, by branches which communicate with the vena salvatella; it receives branches from both its surfaces. It receives the median cephalic at the bend of the elbow, when it becomes the cephalic.

The cephalic vein ascends up the arm, and terminates in the axillary near the clavicle.

The median vein collects the blood from the superficial structures in palm of the hand and middle line of forearm, communicating with anterior ulnar and radial veins. At bend of elbow it receives a branch of communication from the deep veins, accompanying the brachial artery, and divides into two branches, the median cephalic and median basilic.

The median cephalic passes outward in the groove between the supinator longus and biceps, and joins with the cephalic vein.

The median basilic passes obliquely inward, and joins with the basilic.

What vein was usually opened in venesection?

The median basilic.

Why was it preferred to the median cephalic?

Because it is larger, and more easily compressible, on account of the strong fascia beneath.

What are the deep veins of the forearm?

Venæ comites of the radial and ulnar arteries.

What becomes of the brachial vein?

At the lower margin of the axilla it unites with the basilic to form the axillary vein.

What position does it occupy in the axilla?

It is covered in front by the pectoral muscles and costo-coracoid membrane, and lies on the thoracic side of the axillary artery.

What name does this vein next take?

The subclavian.

What large vein unites with the subclavian?
The internal jugular.

What vein is formed by the left subclavian and internal jugular?
The left vena innominata.

What position does this vein occupy?
It passes obliquely from right to left across the upper and front part of the chest.

What vein is formed by the right subclavian and interior jugular?
The right innominata.

How long are the venæ innominatæ, and where placed?
The right is about an inch and a half; the left about three inches. That on the right side passes nearly directly downward, joins the left vena innominata to form the superior vena cava; that on the left passes obliquely from right to left across the upper part of the chest to unite with its fellow.

What vein is formed by the transverse and innominata?
The superior vena cava.

How long is the superior vena cava?
From two and a half to three inches.

Where is it situated?
Commencing below the cartilage of the first rib on the right side, it enters the pericardium about an inch and a half above the heart, and ends in the upper part of the right auricle.

What vein joins the descending vena cava?
The vena azygos.

What veins unite to form the vena azygos?
A number of intercostal, œsophageal, mediastinal, and vertebral veins; also the smaller azygos.

VEINS OF THE LOWER EXTREMITY.

What veins below the knee are named?
The internal and external saphenous.

Describe the commencement and course of the internal saphenous, and where it terminates.
Taking rise from the plexus of the veins, which covers the dorsum and inner side of the foot, it passes upward in front of the inner ankle and corresponding border of the tibia; also along the inner and fore part of the thigh, and terminates in the femoral vein.

Where does the externæl saphenous vein commence and end?
At the dorsum and outer side of the foot, and terminates in the popliteal.

What vein in front of the inner malleolus?
The internal malleolar.

What veins accompany the arteries?
The deep veins.

What superficial vein above the knee?
The internal saphenous.

Where does this vein terminate?
In the femoral vein.

Where is it situated at the knee?
It passes backward behind the inner condyle of the femur.

What large vein behind the knee?
The popliteal.

What are its relations to the artery?
The vein closely accompanies the artery; is situated superficially with regard to it; lies external to it,

until near its termination, when it crosses to its inner side.

What vein accompanies the femoral artery?
The femoral vein.

Which of the vessels is more superficial?
At the groin the vein and artery are on the same plane, but as they descend the artery is more superficial.

What veins join the femoral artery at its upper part?
The profunda femoris and internal saphenous.

With what vein does it become continuous?
The external iliac.

VEINS OF THE ABDOMEN.

What do the iliacs form by uniting?
The inferior vena cava.

What veins return the blood from the pelvis?
The hemorrhoidal and vesico-prostatic plexusis in the male, and the uterine and vaginal plexusis in the female.

What veins open into the vena cava?
The lumbar, right spermatic, renal, supra-renal, phrenic and hepatic.

Where is the ascending vena cava situated, and where does it terminate?
Along the front of the spine, on the right side of the aorta, passes under the liver, perforates the tendinous centre of the diaphragm, enters the peri-

cardium, and terminates in the lower and back part of the right auricle.

What veins unite to form the portal vein?

The inferior and superior mesenteric, splenic and gastric.

Where is this vein situated?

In the substance of the liver.

Describe each vein aiding to form it.

The inferior mesenteric returns the blood from the rectum, sigmoid flexure and descending colon, and terminates in the splenic.

The superior mesenteric returns the blood from small intestines, cæcum and colon; it unites behind the upper border of the pancreas with the splenic vein.

The splenic arises by five or six large branches, which return the blood from the spleen; these, uniting, pass from left to right behind the upper border of the pancreas, and terminate by uniting at a right angle with the superior mesenteric.

The gastric is of small course; accompanies the gastric artery along the lesser curvature of the stomach to terminate in the vena cava.

What peculiarities exist in the portal veins?

The veins comprised in the portal circulation, after returning the blood from their respective viscera, do not empty themselves into the vena cava, but unite into one great vein, which ramifies throughout the liver, and secretes the bile; another peculiarity of the portal veins is, that they have no valves.

PULMONARY CIRCULATION.

What vessels carry blood to the lungs?
The pulmonary arteries.

Where does the pulmonary artery arise?
From the left side of the base of the right ventricle.

What kind of blood circulates through it?
Venous.

On which side of the aorta at its origin?
The left side.

How long is the artery before the division?
About two inches.

How are its branches arranged?
Into right and left.

What is their ultimate distribution?
The roots of the lungs.

What vessels return the blood to the heart?
The pulmonary veins.

What kind of blood do they carry?
Arterial.

What portion of the heart receives it?
The left auricle.

How many pulmonary veins for each lung?
Two.

Have they valves like other veins?
No.

FŒTAL CIRCULATION.

What peculiarities exist in the fœtal heart?

(*a.*) The eustachian valve is large, so as to guide the current of blood from the vena cava into the foramen ovale. (*b.*) The foramen ovale is widely open. (*c.*) The pulmonary arteries are greatly contracted, so as to prevent much blood from entering the lungs. (*d.*) The ductus arteriosus is large, to allow the blood to pass freely into the descending aorta. (*e.*) And the two ventricles are equal in thickness, having equal work to do.

Describe the position and the permanent remains of the foramen ovale.

It is placed at the lower and back part of the auricular septum; its remains are traced in the fossa ovalis, corresponding to the situation of the foramen ovale in the fœtus.

Where is the eustachian valve situated?

Between the anterior margin of the inferior cava and the auriculo-ventricular orifice.

What becomes of the ductus arteriosus after respiration is established?

It is continued as the pulmonary artery.

By what vessels does the blood reach the placenta?

By the umbilical.

Where do the umbilical arteries arise?

From the internal iliacs.

Describe their course to the umbilicus.

They ascend along the sides and fundus of the bladder, and pass out of the abdomen at the umbilicus.

What vessel returns the blood to the fœtus?
The umbilical vein.

Where does the umbilical vein terminate?
In the liver.

What vessel in the fœtal liver afterwards closed?
The umbilical vein.

Describe the position and use of the ductus vinosus.
It occupies the posterior part of the longitudinal fissure. It conveys a portion of the blood from the placenta by the umbilical vein into the ascending cava.

Trace the course of the adult circulation.
The blood passes through the venæ cavæ to the right auricle; from thence to the right ventricle; it passes from thence by the pulmonary arteries to the lungs. Having become aërated, it leaves the lungs, passes through the pulmonary veins into the left auricle, and from that to the left ventricle, from whence it is distributed by the aorta throughout the whole body.

Does the blood pass from the fœtus to the mother?
No.

THE NERVOUS SYSTEM.

What membranes envelop the brain?
The dura mater, the arachnoid and the pia mater.

What is the character of the dura mater?
Fibrous.

What is the falx cerebri, and its extent?
Duplicatures of the dura mater, which descend vertically in the longitudinal fissure between the two hemispheres of the brain; it is narrow in front, broader behind.

What and where is the tentorium?

An arched lamina of dura mater, elevated in the middle, and inclining downward toward its circumference. Behind it is attached to the transverse ridges upon the inner surface of the occipital bone; in front to the superior margin of the petrous portion of the temporal bone.

What and where is the falx cerebelli?

A small, triangular process of dura mater, placed between the two lateral lobes of the cerebellum behind.

What purpose do these structures serve?

They support the lobes of the brain, separate one from the other, and prevent pressure.

What connection between the dura mater and skull?

The dura mater externally adheres to the inner surface of the bones, forming their internal periosteum.

What cavities are found within the dura mater?

Sinuses.

How are they formed, and for what purpose?

Their outer coat is formed by the dura mater; their inner by a continuation of the serous membrane of the veins. They form venous channels.

What and where is the arachnoid membrane?

A serous membrane, consisting of a parietal and visceral layer, which envelop the brain and inner surface of the dura mater.

What is the pia mater, and what does it invest?

A vascular membrane. It invests the entire surface of the brain, and dips down between the convolutions.

How far prolonged, and what purpose does it serve?
Into the ventricles, and forms the velum interpositum and choroid plexuses. It forms a net-work to blood-vessels which pass into the substance of the brain; as well as a neurilemma to the spinal cord.

What vessels supply the dura mater?
The meningeal—the anterior, middle and posterior.

What arteries supply the pia mater?
Branches of the vertebral and internal carotid.

Do the vessels of dura mater and pia mater freely communicate?
Yes.

THE BRAIN.

What is meant by encephalon?
The cerebrum, cerebellum, the pons varolii and the medulla oblongata.

What is meant by cerebro-spinal system?
The chief part of the nervous system which includes the brain and spinal cord, with the nerves connected with them, and the ganglia seated upon these.

How is the cerebrum divided?
Into two hemispheres.

How is each hemisphere divided?
By a longitudinal fissure.

Is the line of separation clearly shown?
It is, excepting in the middle, where it is interrupted by a transverse portion of white substance, named the corpus callosum.

What separates the hemispheres?

The longitudinal fissure, the Sylvian fissure, and behind by a deep notch.

What connects the hemispheres?

The vermiform process.

What are commissures?

Points of union.

What are the principal commissures of the brain?

Anterior, middle and posterior.

What is their structure and object?

They consist of white and gray matter, and connect together the two thalami optici.

What is the course of the convolution of the corpus callosum?

Commencing on the under surface of the brain, immediately before the part named the anterior perforated space, it ascends a short distance in front of the anterior recurved extremity of the corpus callosum; it then runs backward above that body as far as its posterior extremity; there it turns forward and outward, embracing the cerebral peduncle, to reach the entrance of the Sylvian fissure.

Where is the anterior commissure, and what does it connect?

It is placed in front of the anterior cura of the fornix, and unites the hemispheres.

Where is the middle commissure situated?

It is continuous with the gray matter lining the anterior part of the third ventricle.

Describe the position and connection of the posterior commissure.

It is situated in front of and beneath the pineal gland, and connects the two thalami optici posteriorly.

What are ventricles?
Serous cavities.

How many and what ventricles in the brain?
Five; right and left lateral, third, fourth and fifth.

What kind of membrane lines them?
A delicate epitheliated membrane.

How extensive are the lateral ventricles?
Each extends into the three lobes of which the cerebral hemisphere is composed.

What is above the lateral ventricle?
The corpus callosum.

What forms the floor of the lateral ventricles?
The corpus striatum, tænia semi-circularis, thalamus opticus, choroid plexus, corpus fimbriatum and fornix.

What is the corpus striatum, and where is it?
A large ovoid mass of gray matter in front and to the outer side of the thalami.

What and where are the thalami optici?
Two large oblong white masses, situated between the diverging portions of the corpora striata.

By what other name are they known?
Posterior ganglia of the brain.

Where does the anterior cornu of the ventricle terminate?
Into the substance of the anterior lobe.

Where does the posterior cornu terminate?
In the substance of the posterior lobe.

Name the course and boundaries of the middle cornu.
It winds round the back part of the optic thalamus, which appears in its cavity and forms its anterior boundary; it is covered in by the thalamus, and the medullary substance of the middle lobe.

What projects into this middle cornu?
The hippocampus major.

Where is the pineal gland situated?
Beneath the back part of the corpus callosum, and rests upon the anterior pair of the corpora quadrigemina.

Where are the corpora quadrigemina?
Behind the third ventricle, and in front of the cerebellum.

By what other names are they known?
The optic lobes; also nates and testes.

What is their shape and size?
Rounded eminences, relatively smaller in man than in any other animal.

What and where is the valve of the brain?
A thin translucent lamina of medullary substance, situated between the two *processus e cerebello ad testes.*

Where is the septum lucidum situated?
It extends vertically between the corpus callosum above, and the anterior part of the fornix below.

What is its structure, and how thick?
It is a thin, translucent partition.

Where is the fifth ventricle situated?
Between the two laminæ of the septum lucidum.

Does the fifth ventricle communicate with the third?
It does in the fœtus, but not in the adult.

What is the nature of the fornix?
They are the form of pillars or crura.

What names are given to its different parts?
Body, anterior and posterior crura.

What cavity below the fornix?
The third ventricle.

What are its lateral boundaries?
It forms part of the floor of the lateral ventricles.

What and where is the choroid plexus?
They appear like two red knotted fringes, reaching from the foramen of Monro to the point of each descending cornu.

What and where is the vellum interpositum?
A portion of pia mater which penetrates into the ventricles through the fissure beneath the posterior border of the corpus callosum.

Where is the fourth ventricle situated?
Between the cerebellum and the posterior part of the medulla oblongata.

With what other one does it communicate?
The third.

What is the channel of communication called?
The aqueduct of Sylvius.

What opening from the third to the lateral ventricle?
The foramen of Monro.

How deep are the sulci of the cerebrum?
Generally about an inch.

How extensive are the convolutions?
Co extensive with the cerebral surface.

Are they symmetrical on the two sides?
No, or but seldom.

In what fossæ does the cerebrum rest?
Anterior and middle fossæ.

What separates it from the cerebellum?
The tentorium.

Where is the cerebellum situated?
Beneath the hinder part of the cerebrum and in the inferior occipital fossa.

How is it divided, and what covers it?
Into hemispheres and lobes, crura pons varolii and medulla oblongata, and covered by the pia mater, arachnoid, and the tentorium cerebelli and falx cerebelli.

With what is the cerebellum connected?
The cerebrum and spinal cord.

Describe its interior structure.
The cerebellum consists of an internal white medullary mass, containing on each side the corpus dentatum.

What and where are the crura cerebri?
Two cylindrical bundles of white matter, which emerge from the anterior border of the pons, and diverge forward and outward to enter the under surface of either hemisphere.

Where are the crura cerebelli, and what do they connect?
Two ascend to the cerebrum, two pass down into the medulla oblongata, and two embrace the peduncles of the brain; they connect the cerebrum and cerebellum.

What is the structure of the cerebellum?
It consists of gray and white matter.

What and where is the pons varolii?
It is the bond of union of the various segments of the encephalon; is situated above the medulla oblongata and below the cerebrum.

Where is the medulla oblongata?
Situated between the lower border of the pons varolii and upper border of the atlas.

Name its general shape and position.
Pyramidal in form, with broad extremity, directed upward; directed downward and backward, and its posterior border forms the floor of the fourth ventricle.

How is it divided?
Into anterior and posterior pyramids.

Where are the corpora pyramidalia situated?
One on either side of the anterior median fissure.

Describe the shape and position of the corpora olivaria.
Two oval masses behind the anterior pyramids, slight grooves existing between.

Where are the corpora restiformia?
Between the lateral tracts in front, and the posterior pyramids behind.

Where are the posterior pyramidal bodies?
They are situated in contact with each other, one on either side of the posterior median fissure.

What and where is the subarachnoidean space?
The interval between the arachnoid and pia mater; narrow on the surface of the hemispheres, but wide at the base of the brain, between the two middle lobes.

What occupies that space in the normal state?
A serous secretion—cerebro-spinal fluid.

CRANIAL NERVES.

How many cranial nerves?

Nine on each side.

Name each in order from before backward.

1, Olfactory; 2, optic; 3, motor oculi; 4, pathetic; 5, trifacial, or trigemini; 6, abducens; 7, facial, or portio dura, including auditory, or portio mollis; 8, includes glosso-pharyngeal, pneumogastric, or par vagum, and spinal accessory; and, 9, hypoglossal.

Where is the olfactory nerve situated?

Arising by three roots which unite and lie on the under surface of the anterior lobe to the outer side of the longitudinal median fissure, and reaches the cribriform plate of the ethmoid, where it expands into the olfactory bulb.

Where does the optic nerve arise?

Chiefly from the corpora quadrigemina; also from the geniculate bodies and the thalami optici.

Describe its direction and place of exit.

It winds round the crura cerebri to the base of the brain, and unites in the middle line to constitute the optic commissure; from the commissure each nerve passes through the foramen opticum.

Where is the optic nerve distributed?

To the retina.

Where does the third nerve arise?

The inner side of the crus cerebri, in front of the pons.

Where does this nerve leave the cranium?

The sphenoidal fissure.

To what muscles are they distributed?

All the muscles of the eye, except the superior oblique and the external rectus.

Name the origin and distribution of the fourth.

It arises from the valve of Vieussens, and superior oblique muscle of the eye.

By how many roots does the fifth nerve arise?

By two roots.

What are its divisions within the cranium?

Three—ophthalmic, superior maxillary and inferior maxillary.

Name the place of exit for each branch.

The ophthalmic passes through the orbital fissure, the superior maxillary through the foramen rotundum, and the inferior maxillary through the foramen ovale.

Name the principal branches of the ophthalmic.

Frontal, lachrymal and nasal.

Describe their distribution and function.

The frontal supplies the forehead and scalp, likewise the skin of the upper eyelid and nose; the lachrymal runs along the outer side of the orbit through the lachrymal gland, and is distributed to the upper eyelid, and the nasal to the integument of the side of the nose—the pituitary membrane—and furnishes a few offsets to the eyeball. They confer sensibility on the structures in which they ramify.

What is the second division of the trifacial?

The superior maxillary.

Name its principal branches, and their distribution.

a. Orbital to the temple and prominent part of the cheek.

b. Branches to the spheno-palatine ganglion.

c. One or two palatine nerves, distributed to the hard and soft palate.

d. Posterior dental, two or three branches that run up the fangs of the molar teeth to supply the pulp. They also supply the gums and the lining membrane of the antrum.

e. Anterior dental branch, which gives filaments to the fangs of the first molar, canine and incisor teeth; also the gums and mucous lining of the antrum.

f. The terminal branch, which supplies the elevators of the upper lip and the muscles of the nose.

Which division of the trifacial is the largest?

The inferior maxillary.

Where does this branch leave the cranium?

It passes through the foramen ovale.

Where does the gustatory nerve arise?

A branch of the inferior maxillary, it, at first, is situated near the dental nerve, and under the pterygoid muscle.

What are the principal branches of the inferior maxillary?

The sensitive branches are, temporo-auricular, inferior dental, gustatory and buccal. The motor branches are to the temporal, masseter, external and internal pterygoid, tensor palato, mylo-hyoideus, and anterior belly of digastricus.

What becomes of the mental nerve?

It is distributed to the skin of the chin and papillæ of the lower lip.

Where does the sixth nerve arise?

From the medulla oblongata, close to the pons.

Name its exit and distribution.

Sphenoidal fissure, and supplies the external rectus muscle of the eye.

Name each of the nerves that enter the orbit.

The optic, the third, fourth, first division of the fifth and sixth nerves.

What is the origin of the seventh?

The apparent origin of its two branches is from the lower parts of the pons varolii. The real origin of the portio dura is in the lateral columns of the medulla, and of the portio mollis is from the floor of the fourth ventricle.

By what different names is it known?

Portio dura and portio mollis, or facial and auditory.

Describe its place of exit and distribution.

It passes through the meatus auditorius internus. It supplies all the muscles of expression, except those which move the eye, and the auditory nerve supplies the internal ear.

What power does it confer on the parts supplied?

Special nerve of the sense of hearing.

Where does the eighth nerve arise?

From the medulla oblongata.

Name its divisions.

Glosso-pharyngeal, pneumogastric and spinal accessory.

Which foramen do they pass through?

The jugular.

Where are these branches distributed?

The glosso-pharyngeal to the tongue and pharynx. The pneumogastric supplies nerves to the organs of

voice and respiration, to the alimentary canal as far as the stomach, and to the heart. The spinal accessory divides into two parts, one of which joins the pneumogastric, and the other supplies the sterno-mastoid and the trapezius.

Name the origin and distribution of the ninth nerve.

The filaments of the hypoglossal nerve arise from the medulla oblongata, and is distributed to the fore part of the neck and under part of the tongue.

Where does it pass out of the skull?

By the anterior condyloid foramen.

SPINAL CORD.

Where is the spinal cord situated?

Within the spinal canal.

How is the spinal canal formed?

By the vertebræ being piled one over the other, with their rings in apposition.

What openings from the canal, and how formed?

The intervertebral foramina; they are formed by the notches on the pedicles, which, when placed together, the contiguous margins of each pair of them form rounded apertures.

What membranes envelop the spinal cord?

The dura mater, pia mater, and the arachnoid membrane, which is the intermediate serous sac.

What separates the dura mater from the vertebræ?

Theca.

How does this differ from the dura mater cerebri?

In not having any attachment to the bones.

Describe the character and position of the arachnoid.

A delicate serous membrane, forming a shut sac, and consists of two layers, a visceral and a parietal; the former passes over the various eminences and depressions on the cerebrum and cerebellum, without dipping into the sulci and smaller fissures; the latter adheres to the dura mater of the brain and spinal cord.

Describe the structure and position of the pia mater.

A cellulo-vascular membrane, less vascular, but more *fibrous* in its structure than in the brain; it is prolonged upon the spinal nerves; from each side of the cord, along its whole length, it sends off a series of ligaments—*ligamenta dentata.*

Describe the space between the arachnoid and pia mater.

The interval existing between the pia mater and the visceral portion of the arachnoid membrane is known as the subarachnoid space.

What occupies that space, and for what purpose?

Cerebro-spinal fluid; it serves as an equalizer of the pressure within the cranial cavity, and it lubricates surrounding tissues.

How far down does the spinal cord extend?

To the upper border of the second lumbar vertebræ.

What difference exists in different ages?

In the early period of fœtal life it is the same length as the canal, but soon afterward the vertebral canal and the roots of the lumbar and sacral nerves begin to grow more rapidly in proportion.

How is the spinal cord divided?

By an anterior and posterior fissure, an anterior and posterior lateral groove; three longitudinal columns—an anterior, posterior, and a lateral.

Describe the anterior fissure.

It penetrates about a third of the thickness of the cord; it contains a fold of the pia mater and numerous blood-vessels.

How do the nerves arise from the cord?

By two roots, anterior and posterior, which unite immediately beyond the ganglion on the posterior one; and the trunk thus formed separates immediately into two divisions—anterior and posterior.

Where and in what manner do they emerge from the cord?

Each springs from the spinal cord by two roots which approach one another, and, with few exceptions, join in the corresponding intervertebral foramen into a single cord.

What is the function of these roots respectively?

Sensitive and motor.

How long are the roots before they unite?

They vary in the different regions of the spine, because the respective parts of the cord from which they arise are not opposite the foramina through which the nerves pass. In the upper part of the cervical region the nerves are very short, but they increase in obliquity and length as we descend from the neck.

Which of these roots has a ganglion upon it?

The posterior.

Where is that ganglion situated?

In the intervertebral foramen, just where the roots of the nerves pass through the dura mater.

SPINAL NERVES.

How many spinal nerves?

Thirty-one pair.

How are they divided by regions?

Into eight cervical, twelve dorsal, five lumbar, five sacral, and one coccygeal.

What is the comparative size of anterior and posterior roots?

In the cervical region the posterior roots are to the anterior, as 2.1.

In the dorsal region the posterior roots are to the anterior, as 1.1.

In the lumbar and sacral regions the posterior roots are to the anterior, as $1\frac{1}{2}.1$.

Where do the roots unite?

Immediately beyond the ganglion on the posterior one.

Where do these spinal nerves leave the canal?

The intervertebral foramina.

What becomes of the first four cervical nerves?

They form the cervical plexus.

Describe the origin and distribution of the phrenic.

It commences by two roots from the third and fourth cervical nerves, and a fasciculus from the fifth, and distributed chiefly to the diaphragm.

What becomes of the last four cervical?

The anterior division go to form the brachial plexus, the posterior are distributed to the muscles and the integument behind the spine.

What other nerve unites with them?

The first dorsal.

What is formed by this union of five nerves?

The brachial plexus.

Where is the brachial plexus situated?

Between the lower border of the neck and the axillary space.

Name the five principal branches going down the arm.

Musculo-spiral, internal and external cutaneous, median and ulnar.

Give the distribution of each.

The musculo-spiral supplies the extensor muscles, and, to some extent, the skin likewise.

Internal cutaneous is distributed to the anterior and posterior surface of the forearm.

External cutaneous (musculo cutaneous) is distributed to the biceps, coraco-brachialis, brachialis anticus, and to the integument on outer side of forearm.

The median nerve supplies all the muscles on front of the forearm, except flexor carpi ulnaris, and part of the deep flexor of the fingers, to the integument of the palm, and sends filaments to the ball of the thumb.

The ulnar is distributed to the flexor carpi ulnaris, part of the deep flexor, all the interosseous muscles of the hand, the little finger and inner side of the ring finger, and to the muscles of the ball of the little finger.

THE DORSAL AND LUMBAR NERVES.

How many dorsal nerves?

Twelve.

What becomes of the first dorsal nerve?

It contributes to form the brachial plexus.

Where are the next ten situated and distributed?

They lie in the intercostal spaces upon an intercostal muscle, and between the two planes of muscle to the front part of the chest, where they come into contact with the pleura.

What becomes of the last dorsal nerve?

It pierces the aponeurosis of the transverse muscle, and sometimes connected with the ilio-hypogastric branch of the lumbar plexus.

How many lumbar nerves?

Five.

How many and what nerves form the lumbar plexus?

The four upper lumbar nerves.

What nerves arise from the lumbar plexus?

Ilio-hypogastric, ilio-inguinal, genito-crural, external cutaneous, obturator and anterior crural.

Where are the cutaneous branches distributed?

Fore part and outside of the thigh and inside of the leg.

What becomes of the obturator?

It is distributed to the adductor muscles of the thigh and to the hip and knee-joints.

Which is the largest nerve from the lumbar plexus?

Anterior crural.

Where does it leave the abdominal cavity?

Poupart's ligament.

What are the principal branches of the anterior crural?

Middle and internal cutaneous, the long saphenous and muscular branches.

Where is the long saphenous distributed?

Near the femoral vessels in the thigh, but becomes subcutaneous at inner side of the knee by piercing the fascia between the tendons of the sartorius and gracilis muscles.

What becomes of the short saphenous?

It descends along the leg, resting on the gastrocnemius, and turns forward beneath the outer malleolus to end in the skin at the side of the foot, and on the little toe.

SACRAL NERVES.

How many sacral nerves?

Five.

What nerves form the sacral plexus?

The fifth and part of the fourth lumbar, the anterior divisions of the first three sacral nerves and part of the fourth.

What are the principal nerves from this plexus?

The pudic, the small and great sciatic.

Where are the gluteal nerves distributed?

To the gluteal region.

What becomes of the pudic nerve?

It terminates in two branches—one perineal; the other ends on the dorsum of the penis.

Where is the small sciatic nerve distributed?

To the integument over the posterior aspect of the thigh, and furnishes branches to the gluteus maximus.

Where does the great sciatic nerve leave the pelvis?
Through the sacro-sciatic foramen, below the pyriformis muscle.

What are its principal divisions?
Internal and external popliteal.

What is the course of the peroneal nerve?
Descending obliquely along the outer side of the popliteal space, it lies between the biceps and gastrocnemius muscles, and, turning round the fibula, it divides into the anterior tibial and the musculo-cutaneous nerves.

Describe the course of the popliteal nerve.
Following the same course as the parent trunk, it continues along the back of the thigh, and through the middle of the popliteal space, and crosses the artery near the knee-joint.

Where is the posterior tibial nerve distributed?
To the tibialis posticus and the long flexor of the toes.

QUESTIONS ON SURGICAL ANATOMY.

Name the three important hernial regions?
Inguinal, femoral and umbilical.

At what period does umbilical hernia usually occur?
In children soon after birth.

What circumstances favor its occurrence?
A large umbilicus, straining while crying, especially where the bandage around the body securing the umbilical dressing is too loose.

INGUINAL HERNIA.

In what region does this variety of hernia occur?
Inguinal.

What is the extent of the inguinal region?
About two inches.

What makes this a region of so much interest?
Because the spermatic cord in the male and the round ligament in the female pass out of the pelvis within this region, and, also, because it is a common seat of hernia.

By what openings does the testis reach the scrotum?
The internal and external abdominal rings.

In what structures do these openings exist?
External and internal oblique muscles, fascia transversalis, and the conjoined tendons of the two deeper abdominal muscles.

What structures exterior to the external oblique muscle?
The integument and superficial fascia.

In what structure is the external abdominal ring situated?
The external oblique muscle.

How far is this ring from the median line of the body?
About two inches.

How is the external abdominal ring bounded?
At the base by the crista of the pubis, at the apex, the point of separation of the two columns.

What structure covers the cord as it emerges at the ring?
The spermatic fascia.

What other opening, and in what structure is it situated?

The internal abdominal ring, and situated in the transversalis fascia.

What space between the two abdominal rings?

From one and a half to two inches in the adult male.

What occupies this inguinal canal?

The spermatic cord with its various coverings, and the vas deferens, or excretory duct of the testis.

What forms its anterior boundary?

The aponeurosis of the external oblique, and at the outer end by the fleshy part of the internal oblique.

What behind?

The fascia transversalis.

What above?

The lower fleshy fibres of the internal oblique and transversalis.

What below?

The crural arch.

What are the components of the spermatic cord?

Composed of arteries, veins, lymphatics, nerves, vas deferens, with a quantity of loose cellular membrane.

What artery is of interest in this region?

The internal epigastric.

What is the origin and direction of the internal epigastric?

It arises from the external iliac just before this vessel passes under the crural arch. It ascends inward, forms a slight curve and enters the rectus muscle, and terminates in the internal mammary.

In what structure is the internal ring formed?
The fascia transversalis.

What protects the ring from more frequent hernia?
The infundibuliform.

How is the external ring protected?
By two pillars.

How do direct and indirect hernia differ?
In the one the protruded part does not follow the length of the canal, but is forced through the external abdominal ring; in the other it does.

Does any part of the cord perforate the peritoneum?
No.

What are the ordinary structures to cover direct hernia?
The peritoneal sac, with its cellular membrane, fascia transversalis, common tendon of the internal oblique and transverse muscles, intercolumnar fascia, superficial fascia and the integument.

FEMORAL HERNIA.

Where does femoral hernia occur?
Behind Poupart's ligament.

What are the boundaries of the femoral region?
Internally by Gimbernat's ligament. Externally by the femoral vein, in front by Poupart's ligament, and behind by the bone.

What structure next beneath the integument?
The superficial fascia.

What structure next beneath that?
Fascia propria.

What opening in the fascia lata?
Saphenous opening.

Describe the iliac portion of the fascia lata.
It is intimately united with the anterior portion of the sheath of the femoral vessels; the inner side of this sheath forms an arched margin; it expands transversely, nearly corresponding to the entire width of the groin, and is attached to the crest and anterior superior spine of the ilium.

What is the form and size of Gimbernat's ligament?
It is triangular, about three-quarters of an inch to an inch in breadth.

What are the terminal attachments of Poupart's ligament?

The anterior spine of the ilium to the spine of the pubes.

What and where is the femoral ring?
A small space in the hollow under the crural arch, and on the inner side of the femoral vein.

What parts pass beneath Poupart's ligament?
The great vessels of the thigh, with muscles and nerves.

What are the boundaries of the femoral ring?
In front by the crural arch; behind by the bone; on the outer side by the femoral vein, and on the inner side by the edge of Gimbernat's ligament.

What covers the saphenous opening?
The cribriform fascia.

How is the sheath of the femoral vessels formed?
By a continuation of the fascia transversalis uniting with the muscular fascia behind the femoral vessels, forming a funnel-shaped sheath.

SURGICAL ANATOMY OF THE NECK.

What are the quadrilateral boundaries of the neck?

Bounded below by the clavicle, above by the margin of the jaw, and a line continued back from it to the mastoid process; before by the median line, and behind from the mastoid process to near the sternal end of the clavicle.

What muscle divides it into two triangles?

Sterno-mastoid.

Name the boundaries of the triangles thus formed?

The anterior—its base formed by the lower jaw; its sides by the mesial line and the front border of the sterno-mastoid.

The posterior—its base is the clavicle; its sides are bounded by the posterior border of the sterno-mastoid and anterior border of the trapezius.

What muscle divides the posterior triangle into two lesser triangles?

The omo-hyoid.

Into how many parts is the subclavian artery divided?

Into three.

What muscles cover the first part of the right subclavian artery?

The platysma, sterno-mastoid, sterno-hyoid and sterno-thyroid.

What is understood by the second division of the subclavian?

The portion concealed by the anterior scalenus.

What is the position of the subclavian vein with reference to the artery?

It is anterior to and lower than the artery.

Define the same respecting the external jugular.
It lies over the artery.

Name the four triangles formed by the omo-hyoid muscle crossing the neck.
The superior carotid, inferior carotid; the sub-occipital and the subclavian.

What structures cover the first part of the right subclavian artery?
The sternal end of the clavicle, sterno-mastoid, sterno-hyoid and sterno-thyroid muscles, with a layer of fascia; also by the confluence of the internal jugular and subclavian veins, and crossed by the pneumogastric and phrenic nerves, and filaments of the sympathetic.

What covers the second part of this artery?
The anterior scalene muscle.

Does this part furnish any branches?
No.

Where should ligature be performed?
In the last part of its course, or outer side of the scalenus.

Describe the course of the external jugular vein.
It is formed within the substance of the parotid gland, it passes along its lower border, crosses obliquely over the sterno-mastoid muscle, and joins the subclavian vein.

Of what is it a continuation?
The temporal and internal maxillary.

Which of the two triangles, suboccipital or subclavian, is of the greater surgical importance?
The subclavian.

Why?
Because it contains the subclavian vessels, and the brachial plexus of nerves.

Name the salivary glands.
The sublingual, the submaxillary and the parotid.

Which is the largest?
The parotid.

Where is it situated?
Between the ramus of the jaw and the mastoid process.

What separates it from the submaxillary gland?
The stylo-maxillary ligament.

What part of the subclavian artery is the most favorable to ligature?
Its last division, or that beyond the anterior scalenus muscle.

Why is this the most favorable part?
Because the vessel is here nearest to the surface and farthest from the origin of the large branches.

What covers the third part of the artery?
The platysma and two layers of cervical fascia.

What crosses the same?
The external jugular, and frequently the supra and posterior scapular veins.

From what does the left subclavian artery arise?
From the aorta.

What is the origin of the right?
The innominate artery.

In what part do they differ in their relations to surrounding textures?
In the first.

Which one is longer and deeper in the chest than the other?

The left.

What is situated on the right side of the left subclavian?

The thoracic duct and the œsophagus.

What nerves are nearly parallel with it?

The phrenic, pneumogastric and sympathetic.

What relation do these nerves sustain to the right subclavian?

They cross the artery at right angles.

What does the subclavian triangle contain?

The subclavian vessels, brachial plexus of nerves, and absorbent glands.

What is the origin of the external jugular vein?

It is formed by the junction of the temporal and internal maxillary veins.

What is the direction of the anterior belly of the omohyoid?

It ascends nearly vertically.

What veins cross the sheath of the common carotid artery?

The facial, the superior and inferior thyroid.

Where do these veins empty themselves?

Into the internal jugular.

What is the origin of the descendens noni?

It is a branch of the hypoglossal.

To where is it distributed?

To the depressor muscles of the hyoid bone.

What nerve joins it, and from what source?

One or more communicating branches from the second and third cervical nerves.

Between what is the pneumogastric situated above and below the thyroid cartilage?

It is between the internal carotid artery and the internal jugular vein, above the thyroid cartilage, and between that vein and the common carotid artery, below that cartilage.

Where is the operation of laryngotomy performed?

At the projecting angle of the thyroid cartilage to rather below the cricoid.

Wherein do laryngotomy, laryngo-tracheotomy, and tracheotomy differ?

The operation is one of laryngotomy when the incision is made through the crico-thyroid membrane; laryngo-tracheotomy when through the cricoid cartilage and first ring of the trachea, but it is described as tracheotomy when the incision is made below the isthmus of the thyroid body.

What is the size and position of the thyroid gland?

Each lateral lobe is about two inches long and three-quarters of an inch at its thickest part; the transverse part is nearly half an inch in breadth, and from a half to three-quarters of an inch in thickness; it is connected to the sides of the trachea and cricoid cartilage.

What muscles cover it anteriorly?

Sterno-hyoid and sterno-thyroid.

What arteries supply the thyroid body?

The superior, inferior and middle thyroid.

Are any of them involved in tracheotomy?

The middle thyroid is liable to be.

What veins in front of the trachea?

The middle thyroid, and occasionally the innominate.

Describe the position and length of the œsophagus.

Commencing at the fifth cervical vertebra as the continuation of the pharynx, it runs in front of the descending aorta, and passes through an opening in the diaphragm to reach the stomach; it is nine or ten inches long.

Describe the position and size of the submaxillary gland.

It lies upon the mylo-hyoideus, the hyo-glossus, and the tendon of the digastric muscles; its upper margin is covered by the body of the jaw, and is about two inches in length.

What is the name and where the termination of its excretory duct?

Wharton's duct; it opens into the floor of the mouth by the side of the frenum linguæ.

What plexus is formed by the portio dura, and where?

The pes anserinus, within the substance of the parotid.

Describe the boundaries of the buccal cavity.

It is bounded above by the palatine arch; below by the tongue; before by the lips, and behind by the vellum palati and pharynx.

What cavity immediately behind this?

The soft palate.

Describe its structure.

It is largely composed of mucous glands, above which is the aponeurosis of the palate.

What arches descend from the soft palate?
The anterior and posterior arches of the palate.

What muscles form those arches?
The palato-glossi and palato-pharyngeal muscles.

What is the structure and position of the tonsils?
They consist of an aggregation of muciparous glands, and are situated between the arches of the palate at the entrance of the fauces.

What vessels supply the tonsils?
The tonsilar branch of the external maxillary artery.

What plexus of veins is found near there?
The tonsilar plexus.

How do the enlarged tonsils affect the hearing?
Because the mucous membrane of the ear extends by continuity into the eustachian tube.

What is the next space behind the fauces?
The pharynx.

What is the shape and length of the pharynx?
It forms an oblong sac, imperfect in front, and open at the lower end, and about four inches and a half in length.

Name its muscles and lining membrane?
Superior, middle and inferior constrictors, the stylo-pharyngeus, and the palato-pharyngeus. At the upper end of the pharynx there is a dense fascia, termed the pharyngeal aponeurosis.

How many and what openings lead into the cavity of the pharynx?
Seven; the two posterior of the nares, the apertures of the eustachian, the passage from the mouth, the

superior opening of the larynx, and, lastly, the passage into the œsophagus.

What is the direction of the lower meatus of the nose?

It extends nearly the whole length of the outer wall of the nose.

Where is the opening of the eustachian tube situated?

Behind the inferior turbinated bone.

What is the size and position of the nasal duct?

It is about six or seven lines in length, and extends through the upper maxillary bone to the fore part of the lower meatus of the nose.

Where is the lachrymal sac situated?

At the side of the nose, near the inner canthus of the eye.

What is the size of the lachrymal gland, and how many ducts has it?

About the size of an almond; and it has from six to eight ducts.

Under what circumstances may it become necessary to tie the common carotid artery?

When the vessel is wounded or any of its branches, in aneurism, or where there is a pulsating tumor of the skull or orbit.

When should the artery be ligatured both above and below the wounded part?

In cases where the trunk of the vessel is involved.

Should the lower part of the carotid be preferred in cases of ligature of that vessel?

No.

Why not?

Because it is deeply seated in the neck, and covered by three layers of muscles.

Should the upper part be selected?
No.

Why not?
Because the superior thyroid, lingual and facial veins being placed near the upper part of the carotid, their presence would render ligation very difficult.

Where, then, should the ligation be effected?
Opposite the lower part of the larynx, above the omo-hyoid muscle.

What length of incision, and by what muscle should it be guided?
Three inches; and made along the anterior border of the sterno-mastoid.

Is ligature of the external carotid often resorted to?
No.

Why not?
On account of its numerous branches.

What artery is liable to be severed in cases of cut throat?
The superior thyroid.

When the cervical part of the internal carotid is wounded, where should the ligature be applied?
To the common carotid.

What circumstances may demand ligature of the subclavian artery?
Wounds or aneurism of the axillary artery.

Describe the boundaries of the incision made in the operation of tying the third part of the subclavian artery.
The incision is made through the integument down-

ward upon the clavicle from the anterior border of the trapezius to the posterior border of the sterno-mastoid.

Which vessels mainly supply the collateral circulation in such cases?

Supra-scapular, posterior scapular, infra-scapular, and the short and long thoracic arteries.

To which vessel should a ligature be applied in cases of aneurism of the upper part of the brachial?

The axillary.

To what part of the axillary?

The third or lower portion.

After the areolar tissue and fascia are dissected, what nerve and vein are exposed?

The median nerve and axillary vein.

When the aneurism extends too high up for the application of a ligature in the lower part of the axillary, where should the operation be performed?

In the third part of the subclavian.

What circumstances may demand the ligature of the brachial artery?

In wounds of the brachial or palmar arch, if compression of the radial and ulnar arteries fails to arrest the hemorrhage; also in aneurism of the brachial, radial, ulnar, or interosseous arteries.

Where should it be ligatured?

It may be ligatured in any part of its course.

What muscles are a guide to its course?

The inner borders of the coraco-brachialis and biceps.

Which two nerves lie on the inner, and which one on the outer side of the artery in the upper third of the arm?

The ulnar and internal cutaneous, and the median.

Which of these are occasionally superficial to the artery?

The median.

After ligature of the upper third of the brachial artery, by what vessels are the circulation carried on?

By branches from the circumflex and subscapular arteries anastomosing with ascending branches from the superior profunda.

When tied below the origin of the profunda arteries, what branches maintain the circulation?

The branches of the profunda, which anastomose with the recurrent radial, ulnar and interosseous arteries.

What muscles overlap the upper third of the radial artery?

The supinator longus and pronator radii teres muscles.

Where should the incision be made for tying the artery in the middle third of the arm?

Along the inner margin of the supinator longus.

Where is the artery situated in the lower third?

Between the tendons of the supinator longus and flexor carpi radialis muscles.

In what part of the ulnar artery may a ligature be easily applied?

In its middle or lower third.

Where should the incision be made?

On the radial side of the tendon of flexor carpi ulnaris.

What requires to be divided and separated to expose this portion of the artery?

The deep fascia must be divided, and the flexor

sublimis and flexor carpi ulnaris being separated, the artery is exposed.

When may ligature of the common iliac artery become necessary?

In aneurism, or hemorrhage of the external or internal iliacs; or in secondary hemorrhage, after amputation high up in the thigh.

What anastomoses of vessels supply the collateral circulation?

Hemorrhoidal branches of the internal iliac, with the superior hemorrhoidal from the inferior mesenteric; the anastomoses of the uterine and ovarian arteries, and vesical arteries of the opposite sides; the lateral sacral with the middle sacral artery; the epigastric with the internal mammary, inferior intercostal and lumbar arteries; of the ilio-lumbar with the last lumbar artery; the obturator with the vessels of the opposite side, and the internal epigastric; also the gluteal with the posterior branches of the sacral arteries.

In what cases may it be necessary to ligature the external iliac?

In aneurism of the femoral artery, or in secondary hemorrhage, after the femoral has been tied for popliteal aneurism.

Why should this vessel never be tied either near its upper or lower ends?

On account of the circulation of the internal iliac, and the origin of the epigastric and circumflex iliac vessels.

What is the extent and direction of the incision required?

It should extend from an inch above, and to the

inner side of the anterior superior spinous process of the ilium to the outer end of Poupart's ligament.

What muscles and fascia have to be divided in the operation?

The abdominal muscles and transversalis fascia.

Which side of the artery is the vein situated?

The inner side.

What anastomoses conduct the collateral circulation?

The ilio-lumbar with the circumflex iliac; the gluteal with the external circumflex; the obturator with the internal circumflex; the sciatic with the profunda; the internal pudic with the external pudic and internal circumflex; the epigastric from the internal mammary and inferior intercostals; and from the internal iliac by the anastomoses of its branches with the obturator.

Where is the femoral artery most superficial?

Immediately below Poupart's ligament.

Name the three points in the femoral artery where it may be ligated.

At Scarpa's triangle, where it is covered by the sartorius muscle, and near its passage through the adductor magnus muscle.

What are the boundaries of Scarpa's triangle?

It is bounded above by Poupart's ligament, outside by the sartorius muscle, inside by the adductor longus, and its apex is formed by the meeting of the sartorius and adductor longus.

Is ligation of the femoral artery within two inches of its origin considered safe?

No.

Why not?

Because the epigastric, circumflex iliac, and the profunda branches arise within that space.

Where is the most favorable situation for the application of a ligature?

About four or five inches from its origin.

At what part of the vessel is the pulsation faintest?

At the point where it is crossed by the sartorius muscle.

What textures must be divided, and what muscle drawn aside, in order to expose the sheath containing the artery?

The integument, cellular tissue and fascia lata, and the sartorius.

Where at this point is the femoral vein situated in relation to the artery?

It lies behind it.

Which of the three parts of the popliteal artery lies deepest?

The middle.

Briefly describe the operation for ligation at the upper third of the artery.

The patient being in the prone situation, with the limb extended, an incision of about three inches is to be made along the posterior border of the semi-membranosus, which, on being drawn inward, the pulsation of the artery may be felt, and the vessel having been separated from the nerve and vein, the aneurism needle should be passed around the artery from without inward.

When may it be requisite to ligate the posterior tibial?

In cases of wound of the sole of the foot.

Describe the operation as performed at the ankle.

An incision is made through the integument, two inches or more in length, and midway between the heel and inner ankle; and, having exposed the internal annular ligament, it is to be divided upon a director, when the sheath of the vessel is exposed; then place the aneurism needle round the vessel from the heel toward the ankle.

Why is ligation of the posterior tibial in the middle of the leg a difficult operation?

Because of the depth of the vessel, being covered by the gastrocnemius and soleus muscles.

THE AXILLA AND ARM.

What muscles bound the axillary space?

In front it is bounded by the pectoralis major and minor, behind by the latissimus dorsi, teres major and subscapular muscles; the inner side by the serratus magnus, and the outer by the subscapular, coracobrachialis and biceps muscles.

What veins unite to form the cephalic vein?

The external median and radial.

Trace its course to its termination.

It runs along the outer border of the biceps to the groove between the pectoralis major and deltoid, where it terminates in the axillary.

What becomes of the ulnar vein?

It terminates in the basilic vein.

Trace the course and termination of the basilic vein.
It ascends along the inner border of the biceps muscle, and terminates in the axillary vein.

What vein usually along the middle of the forearm?
The median cutaneous.

Give the names and position of its branches.
The median basilic passes in front of the brachial artery, and the median cephalic directed outward to unite with the cephalic vein.

Which branch has nerves in front of it?
The median basilic.

Where does a deep vein communicate with it?
Near its bifurcation.

What superficial veins in this region?
Radial, ulnar and median.

Where are the branches of the external cutaneous situated?
In the integument of the forearm.

Are they liable to be wounded in venesection?
Yes.

Where is the internal cutaneous situated?
Arising on the inner side of the axillary artery, as it descends it approaches the surface, becoming cutaneous about the middle of the arm.

Where are its branches found at the bend of the arm?
The external branch crosses at the bend of the elbow. The internal branch inclines obliquely downward at the inner side of the basilic vein, and winds to the back of the forearm.

What structures cover these superficial veins?
The skin.

What artery lies in this region?
The brachial.

What branch of the median vein in front of it?
The basilic vein.

What lies between the vein and the artery?
The fascia derived from the biceps.

What thickness of structure usually between them?
Remarkably thin.

What large nerve near the artery in this region?
The median nerve.

How far apart and on which side is the nerve?
The inner side.

Which vein will ordinarily bleed best, and why?
The median basilic bleeds first because of its large size, but it is easily compressible on account of the strong fascia beneath.

What covers the radial artery from elbow to wrist?
The integument, fascia and a portion of the supinator longus.

Describe its course from bifurcation of the brachial.
It runs down the radial side of the forearm to the wrist, where it turns over the external lateral ligament of the carpus.

Where is the radial artery reached for ligation?
The upper third of the forearm.

What nerve accompanies the radial artery, and how far?
The radial, to its lower third.

On which side of the artery is the nerve situated?
The outer.

Where is the radial artery found below the carpus?
It sinks into the space between the first and second metacarpal bones.

Which palmar arch is formed by the radial?
The deep.

With what do the branches of this arch unite?
The ulnar.

What course does the ulnar take in the forearm?
It runs obliquely inward along the ulnar side of the forearm to the wrist.

What muscle covers it along the lower half?
The flexor carpi ulnaris.

What nerve accompanies the ulnar artery?
The ulnar.

What portion of its course, and on which side of it?
From the middle of its course, and is situated to its inner side.

Where do the artery and nerve enter the hand?
They pass over the anterior annular ligament.

Describe the direction and position of the palmar arch.
It describes a curve, having its convexity directed toward the fingers; it rests on the annular ligament of the wrist, and the tendons of the superficial flexor of the fingers.

Where are the digital arteries situated?
Downward from the convexity of the palmar arch to the side of the fingers.

THE ANATOMY OF THE PERINEUM.

Describe the line which divides it into triangles.

An imaginary line drawn from one tuber ischii to the other.

What are the boundaries of the anterior triangle?

The sides are formed by the branches of the ischium and pubes meeting at the symphysis pubis, the base by a line between the two tuberosities of the ischia.

What is contained in the anterior triangle?

The urethra and the penis.

What structure next beneath the skin?

Cellular membrane, or superficial fascia.

With what is this superficial fascia continued?

Superficial perineal fascia.

Describe the superficial perineal fascia.

It invests the muscles of the perineum, provides a sheath for each one, and is more elastic though less dense than the strong fascia of the limbs.

What muscles are exposed in removing it?

Accelerator urinæ, erector penis, and transversus perinei.

How is the penis divided, and to what attached?

Corpora cavernosa, and corpus spongiosum; it is attached to the two crura.

Describe the structure of the corpora cavernosa.

The external fibrous investment is white, dense, strong and elastic, the internal is erectile and spongy looking.

Describe the form and position of the crura.

They are attached to the rami of the ischia and

pubes; they unite to each other at the root of the penis, and somewhat resemble the capital letter Y.

What position does the urethra occupy, and where its extremities?

From the bladder to the end of the penis, and when it hangs flaccid, is like the letter S reversed.

Which is the most contracted part of the urethra?

The meatus urinarius.

Where is the membranous portion of the urethra situated?

Between the apex of the prostate, and the bulb of the corpus spongiosum.

What structure invests the urethra there?

Muscular.

Through what fascia does this urethra pass?

The deep perineal-posterior layer of the triangular ligament.

What is contained in the posterior perineal triangle?

The anus.

What muscle first beneath the skin?

Cutaneous sphincter ani.

Describe it.

It arises from the point of the coccyx, and from the ano-coccygeal ligament. The muscular fibres surround the anus, and are lost in a pointed manner in the tendinous centre of the perineum; elliptical in form.

What muscle is internal to that sphincter?

The internal sphincter.

How are the longitudinal fibres of the rectum arranged?

They form a uniform layer around it, and cease near the lower end of the intestine.

What arteries supply the lower end of the rectum?

The middle hemorrhoidal and the inferior hemorrhoidal.

What veins are here, and with what do they communicate?

The hemorrhoidal plexus; they communicate with the internal iliac and inferior mesenteric vein.

What becomes of the inferior mesenteric vein?

It terminates in the splenic vein.

What fills the ischio-rectal fossa?

Fat, levator ani muscle, obturator fascia and muscle, pudic artery, nerve and veins.

What muscle crosses the perineal space?

The transverse muscle.

Describe the transversalis perinei.

It arises from the inner surface of the ascending ramus of the ischium, and is directed transversely forward and inward to join with the muscle of the opposite side; also with the sphincter ani and accelerator urinæ at the middle of the perineum.

What vessel and nerve parallel with this muscle?

Superficial perineal artery and nerve.

Where is the lateral operation of lithotomy made?

The left half of the perineum.

Between what muscles is the incision carried?

The accelerator urinæ and the transversus perinæi.

What disease is apt to occur here?
Fœtid gangrenous abscesses.

What is at the base of the bladder behind the prostate?
The reflection of the peritoneum at the cul-de-sac.

Describe the shape and position of the seminal vesicles.
Two oblong sacculated bodies, flattened above, convex below, and situated, one on each side, upon the base of the bladder, between it and the rectum.

To what extent are the bladder and rectum united?
The upper part of the rectum is in contact in front with the back of the bladder, (or uterus in the female.)

What structures envelope the testicle?
The skin, superficial fascia, dartos tissue, intercolumnar fascia, cremaster muscle and fascia, the infundibuliform fascia, and a special serous tunic, tunica vaginalis.

What parts contribute to form the spermatic cord?
The excretory duct of the testicle or vas deferens, spermatic artery and veins, lymphatics, connecting cellular tissue, besides its several coverings.

Describe the cremaster muscle and its formation.
This is the suspensory muscle of the testicle; it is continuous with the lower border of the internal oblique.

What reasons for varicocele so often on the left side?
Because the left spermatic vein is more liable to be pressed upon by fæcal accumulations in the sigmoid flexure of the colon, and because its course is longer and less direct than that of the right vein.

Describe the whole course of the vas deferens.
It commences at the lower end of the epididymis, at first tortuous, afterward becoming straight, it

ascends upon the inner side of the epididymis, and along the back of the testicle; continuing to ascend in the spermatic cord, it accompanies the spermatic artery, veins and nerves, as far as the internal abdominal ring. Having passed obliquely upward and outward along the inguinal canal, and reached the inner border of the internal abdominal ring, it leaves the spermatic vessels, and turns suddenly downward and inward into the pelvis, crossing the external iliac vessels, and turning round the iliac side of the epigastric artery. Running beneath the peritoneum, it passes the side of the bladder until it reaches its fellow on the opposite side.

THE ABDOMEN AND ITS CONTENTS.

Into what regions is the abdominal cavity divided?

The right and left hypochondriac and epigastric, the right and left lumbar and umbilical, right and left iliac and hypogastric or pubic.

What is contained in the right hypochondriac region?

Great lobe of the liver, the gall-bladder, the hepatic flexure of the large intestine, and a small portion of the duodenum.

What parts occupy the epigastric region?

Cardiac and pyloric extremity of the stomach, lesser curvature and a portion of the lower curvature, commencement of the duodenum, and a portion of the liver.

What parts are contained in the left hypochondriac region?

Cul-de-sac of the stomach, a portion of the liver,

spleen, left end of the pancreas, and a knuckle of the large intestine.

What in the umbilical region?

The small intestines, the transverse colon, and part of the great omentum and mesentery.

What in the right lumbar?

Ascending colon, lower part of right kidney and convolutions of small intestines.

What in the left lumbar?

Descending colon, lower part of left kidney and convolutions of small intestines.

What in the hypogastric region?

Convolutions of the small intestines, the bladder in children, and in adults if distended, and uterus during pregnancy.

What in the right inguinal?

The cæcum with its appendage, ureter and spermatic vessels.

What in the left inguinal?

Sigmoid flexure of the colon, ureter and spermatic vessels.

What membrane lines the abdominal cavity?

The peritoneum.

To what class of membranes does it belong?

Serous.

What amount of surface does this membrane present?

Besides lining the cavity and all the viscera within the same, it forms folds to support the organs in position, some of which are ligaments, besides constituting the mesenteries and omenta.

What do the layers of the mesentery embrace?

Some fat, nerves, lacteal vessels, mesenteric glands, the jejunum and ilium.

Describe the mesenteric glands and the vessels.

These are the lymphatic glands of the small intestine, and are termed mesenteric, because they are placed between the layers of the mesentery. The branches of the mesenteric artery pass round the border of the intestine, dividing into numerous ramifications, and frequently anastomosing at its free border; they run beneath the serous tunic, pierce the muscular, and ramify in the submucous cellular layer to form a net-work.

Describe the five ligaments of the liver.

1. The round ligament (the only one that is not formed by folds of the peritoneum) is a dense fibrous cord which ascends from the umbilicus, within the lower edge of the broad ligament, toward the notch in the anterior border of the liver, and there enters the longitudinal fissure on the under surface.

2. The broad or suspensory ligament is composed of two layers of peritoneum. It is connected by one of its margins with the under surface of the diaphragm, and with the posterior surface of the sheath of the right rectus muscle; and by the other it is attached along the convex surface of the liver, from its posterior border to the notch in its anterior border; the remaining margin is free, with the round ligament between its layers.

3. The coronary ligament is formed by the reflection of the peritoneum from the diaphragm to the posterior border of the liver.

4 and 5. Both on the right and left end of the peritoneum; also forms a triangular reflection, extending to the adjacent part of the diaphragm; these are the lateral or triangular ligaments.

What is meant by the alimentary canal.

The long membranous tube, commencing at the mouth and terminating at the anus, composed of several coats, and lined by mucous membrane from one end to the other.

How is the intestinal canal divided?

Into two portions by the diaphragm.

What are the subdivisions of the small intestines?

Duodenum, jejunum, and ilium.

State the length of each.

Duodenum is from eight to ten inches; the jejunum forms two-fifths and the ilium three-fifths of the small intestine.

How is the large intestine divided?

Into the cæcum, colon, and rectum.

Give the length of the cæcum.

The cæcum is about two inches and a half in length.

Give the divisions of the colon and the position of each.

The *right, or descending colon*, is situated in the right lumbar and hypochondriac regions.

The *transverse colon* passes across from the right hypochondrium, through the upper part of the umbilical region, into the left hypochondrium.

The *left, or descending colon*, commencing by a sudden bend, (the splenic flexure,) descends through the left hypochondriac and lumbar regions to the left iliac fossa, where it terminates in the sigmoid flexure.

The *sigmoid flexure* of the colon, situated in the left iliac fossa, consists of a double bending of the intestine upon itself in the form of the letter S, immediately behind the abdominal parietes.

What is the aggregate length of the intestines?

About twenty-five feet; but as they vary according to the height of the subject, it is more correct to say that they are from five to six times the length of the body.

Name the orifices of the stomach and their positions.

The cardiac and the pyloric; the cardiac is continuous with the œsophagus, and is fixed to the œsophageal opening in the diaphragm, and to the gastro-phrenic ligament. The pyloric orifice is continuous with the duodenum; it is covered by the concave surface of the liver, and sometimes touches the neck of the gall-bladder.

Describe the curvature and vessels of the stomach.

The lesser curvature, on the upper border, is concave, and about three inches in length. The greater curvature, on the lower border, is much longer, and is convex, except toward the pylorus. Its arterial branches are derived from the three divisions of the cæliac axis, which reach the stomach between the folds of the peritoneum, and anastomose to form two principal arterial arches, which are placed along its two curvatures. The veins, corresponding with the arteries, return the residual blood into the splenic and superior mesenteric veins, and also *directly* into the vena portæ.

What are the different coats of the stomach?

The serous, muscular, cellular and mucous.

How is the pyloric orifice closed?

It is provided with a sphincter muscle for that purpose.

Over what portion is the mucous membrane thickest?

The pyloric.

Describe the glandular apparatus connected with it.
The gastric follicles or tubes found in the whole extent of the mucous membrane are longer toward the pylorus, and are lined throughout with columnar epithelium; these are the *mucous glands.*

Where are the peptic glands and peptic cells found?
Throughout the organ, except at the pylorus.

What becomes of the blood from the stomach?
It enters the splenic and portal veins.

What nerves are distributed to the stomach?
The right and left pneumogastric, and branches of the sympathetic.

What coats exist in the intestines?
Serous, muscular, cellular and mucous.

What is next internal to the serous covering?
The muscular.

How many muscular fibres do they have?
An external, longitudinal, and an internal circular.

What is their arrangement in the large intestines?
The longitudinal fibres are collected into three flat longitudinal bands. The circular fibres form a thick layer, especially at the lower part of the rectum; they spread out to form the sphincter ani.

What causes their sacculated appearance?
The longitudinal bands being shorter than the membranous part of the tube serve to produce those sacculi characteristic of the cæcum and colon.

In what manner does the ilium unite with the cæcum?
By the mucous membrane forming two valvular folds at the termination of the ilium, which project into the large intestine to form the ilio-cæcal valve

Describe the arrangement of the ilio-cœcal valve.
The opening is a transverse fissure; it has two flaps arranged like an upper and a lower eyelid.

What is the vermiform appendix, and where situated?
A worm-shaped tube, usually coiled behind the cæcum.

How is the colon held in its position?
By the peritoneum.

What is meant by valvulæ conniventes?
Permanent folds of the peritoneum.

In what part of the intestines do they first appear?
About an inch or more from the pylorus in the duodenum.

How far down the canal do they extend?
To about the middle of the ilium.

Describe their structure and general appearance.
They are crescentric projections of the mucous membrane.

Describe the villi, and to what extent they are found.
They are small, elongated, and highly vascular processes, and are found over every part of the mucous membrane.

What vessels commence in these villi?
The lacteal.

How are these lacteal vessels arranged, and where do they terminate?
They consist of a superficial and deep set; the former lie beneath the peritoneal coat; the latter are in the submucous tissue, course round the intestine, pass between the layers of the mesentery, enter the

mesenteric glands, and unite into several trunks, which terminate in the thoracic duct.

What glands are found in the duodenum?
Brunner's glands.

What collection of glands in the ilium?
Peyer's glands and Lieberkuhn's glands.

In what portion of the ilium are Peyer's glands most numerous?
The lower part.

Describe the follicles of Lieberkuhn, and where situated.
They are minute tubular depressions of the mucous membrane, and are distributed over every portion of the mucous membrane of the small intestines.

What glands are found in the large intestines?
Lieberkuhn's glands and solitary glands.

Does absorption occur in all intestines alike?
No.

What is absorbed in the small intestines?
The chyme.

ANTERIOR FEMORAL REGION.

What is meant by Scarpa's triangle?
The depression seen below the groin.

What are the boundaries of this triangle?
The sides are formed externally by the sartorius, internally by the adductor longus, and the base by Poupart's ligament, its apex being downward.

How far down the thigh does this triangle extend?
It varies in some cases not two inches, in others four.

What important structures are contained within it?
The femoral artery and its branches, the veins and the anterior crural nerve.

What forms the floor of the triangle?
The iliacus, psoas, pectineus, adductor longus, and small part of adductor brevis.

What structures cover the femoral artery?
In the upper third of the thigh by the integument, fascia lata, whilst below by the sartorius, and a dense fibrous band.

What branches arise from the femoral artery?
Superficial epigastric, superficial circumflex iliac, superficial external pudic, deep external pudic, profunda, (with its external and internal circumflex, and three perforating,) muscular and anastomotica magna.

Where does the profunda femoris arise?
From the outer and back part of the femoral, from one to two inches below Poupart's ligament.

What relation does the femoral vein bear to the artery?
At first close to its inner side, but lower down it passes beneath, and afterward to its outer side.

What is the position of the anterior crural nerve?
Outer side.

What branches of the nerve accompany the artery?
Long saphenous and internal cutaneous.

Where is the femoral artery usually ligated?
From four to five inches from Poupart's ligament.

What structures will require division to reach it?
Integument, fascia lata and its sheath, the sartorius muscle being drawn aside.

What position does the internal saphenous vein occupy?
It is situated on the outer side of the artery, in the middle third of the thigh.

Where does this vein terminate, and by what opening?
In the femoral vein at the saphenous opening.

THE POPLITEAL REGION.

What is the extent of the popliteal space?
It extends from the lower third of the thigh to the upper fifth of the leg.

What constitutes its internal boundary?
Above the joint, by the semi-membranosus, semi-tendinosus, gracilis and sartorius; below the joint, by the inner head of the gastrocnemius.

Describe the the external boundary.
Above the joint, by the biceps, and below the articulation, by the plantaris and external head of the gastrocnemius.

What passes through the space?
The popliteal vessels and nerves.

Describe the whole course of the popliteal nerve.
It lies at first at the outer side of the artery, but from the knee-joint downward is close to the vessel, and crosses over it to the inner side.

In what part of the space is the peroneal nerve found?
Along its outer side.

What is next deeper than the popliteal nerve?
Popliteus muscle.

What is immediately underneath the vein?
The popliteal artery.

What separates the artery from the bone?
The posterior ligament of the knee-joint, and afterward the popliteal muscle.

Where would the artery be reached for ligation?
Either at the upper or lower part of its course.

What branches does the artery give off?
Muscular, cutaneous and articular.

Into what does the popliteal artery divide?
Anterior and posterior tibial.

Describe the course of the posterior tibial.
It extends from the lower border of the popliteus muscle, down to the inner border of the calcaneum, between the superficial and deep layers of muscles.

The peroneal artery, a branch of the posterior tibial, arising from it an inch below the lower border of the popliteus, descends nearly perpendicularly along that bone.

The anterior, the second terminal branch of the popliteus, extends from the division of the popliteal artery to the bend of the ankle.

What nerve accompanies the posterior tibial artery?
Posterior tibial nerve.

THE LEG.

What groups of muscles on the leg?
Superficial, posterior and anterior tibial, and peroneal.

What muscles overlie the posterior tibial artery and nerve?
Gastrocnemius, soleus and plantaris.

How high may the posterior tibial be ligated?
The lower third.

On which side of the leg, and under what muscle?
Inner side, under the soleus.

What parts cover and bound the anterior tibial artery above the middle?
Integument, fascia, tibialis anticus, and extensor communis digitorum.

What nerve accompanies the anterior tibial artery?
Anterior tibial.

Describe the origin and course of that nerve.
A branch of the peroneal, it runs on the fibular side of the artery; afterward, crossing above the ankle, it is situated at the top of the foot on its tibial side.

Describe the position of the internal saphenous vein.
Arising from a plexus at the dorsum and inner side of the foot, it ascends in front of the inner ankle and leg, accompanied by the internal saphenous nerve. It passes backward behind the inner condyle of the femur, and ascends on the inside of the thigh to terminate in the femoral vein.

THE MALLEOLAR AND PLANTAR REGIONS.

What tendons between the malleoli in front?
Those of the extensor muscles.

Name the muscles whose tendons pass the posterior part of ankle-joint from within without.
Tibialis posticus most internal, flexor longus digitorum in the centre, and flexor longus pollicis most external.

Where do the posterior tibial artery and nerve lie at this point?
Between the flexor longus digitorum, and flexor longus pollicis.

What tendons behind the outer malleolus?
Those of the peroneus longus and brevis.

Are any vessels endangered in dividing the tendo Achillis?
No.

What structures cover the sole of the foot?
Tegument fat, plantar fascia, a superficial and deep layer of muscles.

Describe the plantar fascia and its attachments.
It is remarkably dense and strong; it not only protects the plantar vessels and nerves, but assists in supporting the arch of the foot; it extends from the under and back part of the os calcis to the distal ends of the metatarsal bones.

What muscles next beneath the fascia?
Flexor brevis digitorum, abductor pollicis and abductor minimi digiti.

What arteries on the sole, and where situated?

The internal and external plantar arteries, with the digital branches. The principal is the external plantar which alone forms the plantar arch; it runs obliquely outward across the sole toward the base of the fifth metatarsal, and sinks deep, bending inward across the bases of the metatarsal bones. Its digital branches supply both sides of the fifth, fourth, third and outer side of the second toe; the great toe, and inner side of the second, being supplied by the dorsal artery of the foot.

The internal plantar passes between the abductor pollicis and flexor brevis digitorum to the base of the great toe.

Describe the division of the posterior tibial artery.

It passes between the internal malleolus and os calcis to enter the sole where it divides into internal and external plantar arteries.

Describe the nerves accompanying these branches.

The internal plantar supplies three toes and inner side of the fourth, passes under the abductor of the great toe, and divides into four digital branches. The external plantar supplies the little toe and half of the fourth.

Are these vessels and nerves near the fascia?

The former are placed beneath the first layer of muscles, the latter above.

ANATOMY OF THE RESPIRATORY APPARATUS.

What is the frame-work of the larynx, and its position?

Cartilages; and placed at the upper and fore part of the neck, in the middle line between the large vessels of the neck, and below the tongue, and is suspended to the hyoid bone.

Which is the largest cartilage, and what is its position?

The thyroid, which is formed by two flat lamellæ, united in front, at an acute angle along the middle line.

Describe its shape and connections with other cartilages.

It somewhat resembles a shield, and is connected to the cricoid cartilage in front and at each side; the epiglottis is connected to the receding angle between the two alæ of the thyroid cartilage.

Where is the cricoid situated, and what is its shape?

It occupies the lower and back part of the cavity of the larynx; it resembles a signet ring.

What is the shape and position of the arytenoid cartilage?

In shape like the mouth of a pitcher when the two are approximated; they rest by their bases on the posterior and highest part of the cricoid cartilage.

Where and for what purpose is the epiglottis placed?

Situated in front of the superior opening of the larynx. In direction vertical, except during the act of swallowing, when it is carried downward and backward over the larynx; indeed, it bridges over the food and drink to the stomach.

Where and what is the glottis?

Is a narrow fissure between the inferior vocal cords. The adjustment of the glottis to the tension of the vocal cords is a necessary condition for the production of a clear and definite sound.

How many and where are the vocal cords?

Four, and they extend from the angle of the thyroid cartilage to the base of each of the arytenoid.

What space between the superior and inferior vocal cords?

The ventricles of the larynx.

What do we meet with next below the larynx?

The trachea.

What is the structure and length of the trachea?

Composed of cartilages and fibrous membrane, and about four inches and a half in length.

Where does the division of the trachea occur?

About the third dorsal vertebra.

Which bronchial tube is the largest, and which the longest?

The right is larger than the left, and the left is longer than the right.

How do they differ in their general arrangement?

The right passes more horizontally to the root of its lung, and the left more obliquely; on the right side the lower branch sends a small division to the third lobe.

How do the bronchial tubes differ from trachea?

The rings are shorter and narrower.

What is the importance of cartilage in these structures?

It is both strong and elastic.

What other elementary tissues besides cartilage?
Muscular fibres and elastic tissue.

What is the purpose of the muscular structure?
It endows them with tonicity and contractility.

What use does the elastic tissue serve?
To impart elasticity and extensibility.

How do the bronchial tubes finally terminate?
Like the branches of a tree.

Describe all the structures concerned in their formation.
Cartilage, muscular fibres, elastic fibres and mucous membrane.

What is the nature of the lining membrane of bronchia?
It is mucous covered with epithelium.

What kind of epithelium characterizes this membrane?
Columnar ciliated.

Does the epithelium line the air cells?
No.

How large are the air cells in human lungs?
They vary from about the $\frac{1}{70}$ to the $\frac{1}{200}$ of an inch in diameter.

How many air cells in the entire lungs?
They have been reckoned at six hundred millions.

What is the estimated surface of lung for æration?
About three hundred square inches for the male, and two hundred and forty-seven for the female.

How thick is the tissue between blood and air?
From 2,800th to 3,800th part of an inch in thickness.

Where are the pulmonary capillaries distributed?
They are spread beneath the thin transparent mucous membrane of both the terminal and lateral air cells, and wherever the finest air tubes have lost their cylindrical character.

Name the structure that incloses the lungs?
The two pleura.

What forms the base of the thoracic cavity?
The diaphragm.

What forms its lateral boundary?
Ribs and intercostal muscles.

By what bounded in front and behind?
In front by the sternum, six superior intercostal cartilages, ribs and intercostal muscles; laterally, by the ribs and intercostal muscles.

By what means are the lungs filled with air?
By the inspiratory act.

By what means are they emptied of air?
By the expiratory act.

What is the action of the diaphragm in this work?
Principally engaged in the act of expiration.

What other muscles engage in expiration?
The abdominal muscles, and the serratus posticus inferior.

What muscles are engaged in inspiration?
The pectoral, the trapezius, sterno-mastoid, latissimus dorsi, serratus magnus, rhomboidei, serratus posticus superior and the intercostals.

THE UTERUS.

What is the shape, size and weight of the virgin uterus?

It is a hollow pear-shaped organ, about three inches in length, two in breadth at its upper and wider part, and nearly an inch in thickness; its weight is from seven to twelve drachms.

Describe it position and means of support.

It is situated between the bladder and the rectum, projecting into the upper end of the vagina, and supported by the anterior and posterior ligaments, the broad and round ligaments.

What are its structures?

An external serous layer, an intermediate muscular (which, at the full period of gestation, consists of three coats,) and an internal mucus.

Describe the course and termination of the round ligaments.

From the upper angles of the uterus they proceed upward, outward and forward, pass through the inguinal canal, reach the fore part of the symphysis pubis, and unite with the substance of the mons veneris.

What are the structures of the fallopian tube?

Serous, muscular and mucous.

What are its attachments and relations?

By one end to the uterus, the other or fimbriated extremity to the outer end of the ovary, by one or two of its fingers; it is situated along the upper

border of the broad ligament, and bends backward and downward to reach the ovary.

Where are the ovaria situated, and how connected?

At the back of the broad ligament; it is connected by the ligament of the ovary, and by a short peritoneal fold at the back of the broad ligament.

What is the structure of the ovary, and its size?

The serous coat, tunica albuginea, and the stroma, in which are lodged Graafian vesicles; in size, about one inch and a half in length, three-quarters in width, and nearly half an inch in thickness.

How are the uterus and vagina connected?

By the neck of the womb becoming smaller toward its lower extremity, and projecting into the upper end of the vagina, which is attached all around to the substance of the uterus, but extending to a greater distance behind than in front.

What is the weight of the gravid uterus?

From one to two or even three pounds.

Where do mucous and serous membranes unite?

At the free end of the fallopian tube with the cavity of the peritoneum.

Is there any other instance of a mucous membrane communicating with a serous one?

No.

GENITO-URINARY APPARATUS.

What position do the kidneys occupy?

The back part of the abdominal cavity, between the last dorsal and two or three upper lumber vertebræ.

Which one is situated rather lower than the other?

The right.

What maintains them in position?

Their vessels, and a quantity of cellular tissue.

What is their average size and weight?

Four inches in length, two in breadth, and rather over an inch in thickness; weight about four and a half ounces.

Which is the largest?

The left.

What parts of the intestinal canal are in contact with the right and left kidneys respectively?

The duodenum, and ascending colon, and the descending colon.

What arteries supply the kidneys with blood?

The right and left renal.

What vessels unite to form the renal vein?

The venous radicles.

How are the venous radicles formed?

The capillaries of the kidney terminate in the radicles.

What are the structures of the kidney?

Beneath the layer of fatty tissue is dense fibro-cellular tissue, which lines the sides of the sinus, and furnishes sheaths to the blood-vessels; the solid

substance of the organ consists of a cortical and medullary substance.

What is the arrangement of the medullary substance?
It is collected into a series of conical masses which are called the pyramids of Malpighi.

What are the Malpighian corpuscles?
Small red bodies invested in the cortical substance, composed of little vascular tufts formed by the convolutions of two vessels; an afferent and efferent.

What is meant by pelvis of the kidney?
The enlarged funnel-shaped cavity at the upper end of the ureter.

How are the calices formed?
The pelvis having divided into two or three principal tubes, which again subdivide into smaller tubes named the calices.

How many calices, and what do they embrace?
They vary in number from seven to thirteen, and embrace prominent parts of the pyramids.

What vessels conduct the urine from the kidneys into the bladder?
The ureters.

What is their average length?
Sixteen or eighteen inches.

In what part of the bladder do they terminate?
Its side and base.

What position does the urinary bladder occupy?
In the pelvic cavity behind the pubes, and in front of the rectum, in the male, but separated from the rectum by the uterus and vagina in the female.

What is the structure of the bladder?
Composed of a peritoneal coat, a muscular and mucous, and an intermediate layer of cellular tissue.

What supplies the bladder with blood?

The superior, middle and inferior vesical arteries.

Describe the position of the prostate gland.

Situated in front of the neck of the bladder, around the urethra, behind and below the arch of the pubes, and above the rectum.

What secretion is furnished by this gland?

A whitish viscid humor.

What purposes does this secretion serve?

It lubricates the interior of the urethra, and is a vehicle for the sperm in its ejaculation.

What are the structures of the scrotum?

Beneath the skin is a reddish tissue (the dartos) which is continuous with the superficial fascia of the groin, intercolumnar fascia, muscular tissue, including the cremaster muscle and the infundibuliform fascia.

What is the average size and weight of the testes?

An inch and a half to two inches long, an inch and a quarter from the anterior to the posterior border, and an inch from side to side; three-quarters of an ounce to an ounce each.

What is the proper coat called?

Tunica albuginea.

What are the seminal vesicles, and where placed?

They are two membranous receptacles, situated, one on each side, upon the base of the bladder, between it and the rectum.

What purpose do they serve?

As receptacles or reservoirs for the semen.

APPENDAGES OF THE ALIMENTARY CANAL.

What glands are found in the mucous membrane of the mouth.

Labial glands.

What is the position and use of the tonsils?

They occupy either side of the fauces, between the anterior and posterior palatine arches; they yield a mucous fluid, which lubricates the fauces.

What region of the abdomen does the liver occupy?

The whole of the right hypochondriac, epigastric, and a small portion of left hypochondriac regions.

What vessels carry blood to the liver?

The hepatic artery and venæ portæ.

What vessels carry material from the liver?

The hepatic veins.

What is the origin and distribution of the hepatic artery?

It arises from the cœlic axis, enters the transverse fissure, and divides into a right and left branch for the two principal lobes of the liver.

What vessels unite to form the portal vein?

Nearly all the veins of the chylopoietic viscera.

What is the ultimate structure of the liver?

Cellular.

How are the lobules held together?

By fine cellular tissue, and by the blood-vessels and ducts.

Name the bile ducts.

Hepatic duct, the cystic, gall-bladder and ductus communis choledochus.

Where is the bile discharged?

Into the back part of the second portion of the duodenum.

Describe the size and shape of the pancreas.

Six to eight inches in length, one and a half in breadth, and one in thickness, and said to resemble the shape of a dog's tongue.

MISCELLANEOUS QUESTIONS ON THE ORGANS OF THE SPECIAL SENSES.

VISION.

How many coats is the globe of the eye composed of?

Three.

Name them.

The sclerotic, the choroid and the retina.

Of what does the retina consist?

The expansion of the optic nerve.

What is its function?

Its use is for the reception of the impression of light.

What is the use of the crystalline lens?

It concentrates the rays of light to a focus upon the retina.

What is the use of the iris?

It regulates the quantity of light admitted through the pupil.

How much of the front part of the globe does the cornea occupy?

About one-fifth.

What is the use of the pigment found in the eye?
To absorb the rays of light and prevent their being reflected.

What is the general structure of the iris?
It is highly vascular.

What are its blood-vessels derived from?
The anterior and posterior ciliary arteries.

What is the size of the crystalline lens?
It measures from side to side from a third to half an inch, and from before backward about a quarter of an inch.

What is myopia?
Short-sightedness.

What is presbyopia?
Long-sightedness.

What is the cause of these affections?
They arise from a defect in the optical adaptation of the eye.

In what respect is the refractive power at fault in myopia?
It is too great.

What is at fault in the presbyopic eye?
The refractive power is deficient.

What aids vision in a case of myopia?
Convex glasses.

What in presbyopia?
Concave glasses.

Who are most obnoxious to myopia?
Young persons.

Which are most liable to presbyopia, the young or old?
The old.

What is the diameter of the nerve fibres in the retina?

They vary in size; the largest being only about $\frac{1}{6000}$, while the smallest do not exceed the $\frac{1}{30000}$ of an inch.

Where is the yellow spot of Sœmmering situated?

In the centre of the retina.

What is the smallest square magnitude usually visible to the naked eye?

About $\frac{1}{4110}$ of an inch.

What assists the eye in distinguishing very minute objects?

The circumstance of the object being pointed out to the observer.

What is the most sensitive portion of the retina?

The yellow spot of Sœmmering.

By what is the amount of light admitted to the eye regulated?

By the contraction and dilatation of the pupil.

What is the largest and what the smallest diameter of the pupil?

The largest is about one-third, and the smallest one-twentieth of an inch.

What is the character of the muscular structure of the iris?

It is non-striated.

To what special senses are our notions of the external world mostly dependent?

On those of vision and touch.

On what does our estimate of the size of a remote object depend?

It depends partly on the visual angle under which we see it, and partly upon our estimate of its distance.

HEARING.

What is the function of the membrana tympani?
It receives the sonorous undulation from the air in such a manner as to cause reciprocal vibration, which is communicated to the chain of bones.

What are the uses of the tympanic cavity?
It renders the vibrations of the membrane quite free, and it so isolates the bones as to avoid their vibrations from being weakened by diffusion through the surrounding solid parts.

What is generally considered to be the chief use of the eustachian tube?
To secure an equilibrium between the air within the tympanum and the external air.

Has it any other use; if so, what is it?
Yes; it removes mucus secreted in the cavity of the tympanum by the vibratile cilia which clothe its lining membrane.

Where are the sonorous vibrations brought to bear upon the auditory nerve?
In the labyrinth.

What liquids are found in the labyrinth?
The endo-lymph and peri-lymph.

What is supposed to be the use of the semi-circular canals?
They are supposed to receive the impressions by which we can distinguish the direction of sounds.

In how many ways may sounds be propagated amongst solid or fluid bodies?
Three.

Name these.
By reciprocation, resonance and conduction.

In what ways may the cartilage of the external ear propagate sonorous vibration?
By reflection and conduction.

What part chiefly receives the reflected undulations?
The concha.

Into what parts is the internal ear or labyrinth divided?
An anterior or cochlea, a middle or vestibule, and a posterior.

Of what does the posterior portion consist?
Of three semi-circular canals.

What do these contain?
Endo-lymph and the membranous labyrinth.

Why is the anterior part of the internal ear termed cochlea?
From its resemblance to a snail's shell.

Into what does the auditory nerve divide?
Into an anterior and posterior branch.

Where does the division take place?
At the bottom of the internal ear.

Where distributed?
To the cochlea and vestibule.

After these nerves break up into numerous fasciculi where do they pass?
Through the foramina, at the bottom of the meatus, into the osseous labyrinth.

How are the filaments then arranged?
Into six bundles.

Where are these distributed?

Two supply the vestibular sac, one for each of the ampullæ of the semi-circular canals, and one for the cochlea.

From whence and to where does the eustachian tube convey air?

From the pharynx to the tympanum of the ear.

TASTE.

What is commonly understood by the term TASTE?

All the knowledge of the qualities of a body which we obtain through the sensory apparatus situated within the mouth.

Of what other special sense is taste somewhat allied to?

Touch.

Is the impression made by the same nerve on both the front and back of the tongue?

No.

What, then, supplies the front and what the back of that organ?

The lingual branch of the fifth pair supplies the front, whereas the glosso-pharyngeal supplies the back.

What condition is essential for the proper exercise of this sense?

A temperature not greatly departing from that natural to the body.

To what other parts besides the tongue is the organ of taste diffused, more or less?

The soft palate, the arches of the palate and the fauces.

How are the lingual papillæ classified?

Into simple and compound.

How are the compound subdivided?

Into circumvallate, the fungiform and the filiform.

SMELL.

Where do the olfactory nerves form a plexus?

Upon the surface of the Schneiderian membrane.

By what is the common sensibility of the mucous membrane of the nose supplied?

By branches from the fifth pair of nerves.

Is the sense of smell independent of the common sensibility of the nose?

Yes.

How can this be proved?

In catarrh affecting the olfactory nerve the sense of smell is impaired, whereas the common sensation of the part remains as acute as before, or even more so.

What useful purpose does the great vascularity of the Schneiderian membrane serve?

It serves to elevate the temperature of the inspired air.

TOUCH.

What is the seat of touch?
The cutaneous surface.

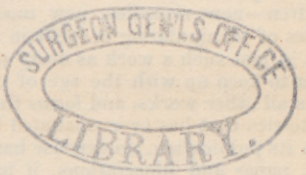
What is the skin endowed with that renders it especially adapted for such a use?
Sensory nervous fibres and numerous papillæ.

Is the sensibility of different parts of the skin equal?
No.

Name a few points where it is greatest.
The point of the tongue, lips, tip of the nose and palm of the hand.

Where is it least?
Skin over spine; middle of the arm and thigh.

What persons have their sense of touch greatly augmented?
Those deprived of other senses.



~~1784~~ .50

12720-