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VADE MECUM
OF
EQUINE ANATOMY,

*FOR THE USE OF ADVANCED STUDENTS
AND VETERINARY SURGEONS.*

BY

//
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BY
A. LIAUTARD, M.D., V.S.

TO
GEORGE FLEMING, F.R.C.V.S.

FOR HIS UNTIRING EFFORTS IN ADVANCING THE CAUSE OF
VETERINARY SCIENCE, THIS LITTLE VOLUME
IS RESPECTFULLY DEDICATED, BY

THE AUTHOR.

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P R E F A C E .

In presenting to the veterinary profession of America this *Vade Mecum of Equine Anatomy*, I fully appreciate the difficulties which must beset its introduction, by reason of the unbounded popularity of Chauveau's and Fleming's excellent works upon the subject, and it is not issued with the hope that they shall thereby be supplanted, but that it may fill a vacancy long existing.

During the years I have devoted to the teaching of veterinary anatomy, the fact has grown apace, that advanced students, and practitioners as well, have felt the need of an abridged work in which they could, without the loss of time, review the descriptive anatomy of a region.

It was in view of this want that I assumed the responsibility of attempting to supply the deficiency, and while the reader will find the text of Chauveau and Fleming has been closely followed, there is presented an arrangement of the subject-matter corresponding to my adopted mode of lecturing.

If then, this little volume shall prove a saving of time to students reviewing their studies, and serve to refresh the memory of the busy practitioner who is about to operate, it will have accomplished all the author could desire.

A. LIAUTARD.

NEW YORK, *Nov.* 1878.

VADE MECUM OF EQUINE ANATOMY.

CHAPTER I.

INTRODUCTORY.

Definition.—Anatomy is the Science of Structure.

Division.—Descriptive, General, Microscopical, Human, Veterinary, Comparative, Surgical, Topographical, Vegetable, Animal, Special.

Organs.—Are the instruments of life.

Apparatus.—A collection of organs for the performance of one function.

DIVISION:—Apparatus of Locomotion, Digestion, Respiration, Circulation, Innervation, Urinary Depuration, of different Senses, and of Generation.

OSTEOLOGY.

The study of bones, or passive organs of locomotion.

SKELETON.—Comprises all the bones of the body; natural, if articulated with ligaments; artificial, if by wire or other agents.

DIVISION:—Trunk and extremities.

TRUNK.—Includes the vertebral column, with the head, ribs and sternum.

EXTREMITIES—Are divided into anterior, or thoracic, and posterior, or abdominal.

THE ANTERIOR—Is divided into shoulder, arm, forearm and digital region.

THE POSTERIOR—Into hip, thigh, leg, and digital region.

Bones.—**NOMENCLATURE.**—Has no base; from their form, as the perone; their resemblance to other objects, the tibia; their position, the ribs; their use, the frontal or parietal.

SITUATION.—Relative 1° to the median line: single or symmetrical, as the vertebræ, and double or asymmetrical, the bones of the limbs; or 2° to other parts of the body, the radius is in front of the cubitus.

DIRECTION.—Horizontal, vertical or oblique.

FORM—is absolute: long bone, as the femur; flat,

as the scapula; short, as the patella; elongated, as the ribs; or—

RELATIVE: triangular, as the scapula; prismatic, as the tibia.

EXTERNAL PROULIARITIES.	{	cavities; eminences;	{	articular;	diarthrodial;	{ condyles;
					trochlea;	{ facettes and head;
				non artic.;.....	synarthrodial;	{ denticulated;
						{ tuberosities, crest,
				articular;.....		{ lines, &c.
				(non artic.;.....		{ glenoid, cotyloid;
						{ groove, fissures,
						{ fossæ, notches,
						{ foramen.

STRUCTURE.—Tissue proper, Haversian canals, bone cells, compact and spongy tissue, animal and earthy matter; periosteum, marrow, blood-vessels, nerves and lymphatics.

DEVELOPMENT.—Mucous or gelatinous matter, cartilage, bone. Centres of ossification.

MYOLOGY.

The study of muscles or active organs of locomotion.

DIVISION.—Into those of organic life or internal muscles, and of animal life or external muscles.

SIZE.—They are large, small and very small.

SITUATION.—With the median line or the other organs.

FORM.—Long, fusiform, conical, cylindrical, penni-

form, wide, elliptical, quadrilateral, triangular, etc.

DIRECTION.—Varies : according to their axis, rectilinear or curvilinear ; according to the plumb-line, vertical or horizontal ; according to bony levers, parallel or oblique.

ATTACHMENTS.—Are fixed or origin, and movable or insertion.

CONNECTIONS.—Are with the skin, bones, muscles or other organs.

STRUCTURE.—Red and white fibres, cellular tissue, vessels and nerves.

USES.—Flexors, extensors, abductors, adductors or rotators.

ANNEXES.—Such as aponeurosis of contention, serous bursæ, synovial sheaths.

SYNDESMOLOGY.

The study of joints or articulations.

DIVISION.—Diarthrodial, or movable ; synarthrodial, or immovable ; amphiarthrodial, or mixed.

Diarthrodial Joint.—Offers for study,—

ARTICULAR SURFACES—Facettes, head, condyles, etc.

CARTILAGES OF COVERING—Which are smooth and shining.

COMPLEMENTARY CARTILAGES—As the meniscus.

LIGAMENTS.—White, being peripheric, or capsular

and funicular, as the lateral and interosseous ; or yellow, all peripheric.

SYNOVIAL CAPSULA.—A serous membrane secreting the synovia.

MOTIONS.—Seven : simple gliding, flexion, extension, abduction, adduction, rotation and circumduction.

CLASSIFICATION.—Enarthrosis, with all motions, as the coxo-femoral joint ; angular ginglymus, or perfect hinge, with flexion and extension, as the tibio-tarsal joint ; condyloid or imperfect hinge, with flexion, extension and rotation, as the femoro-tibial ; trochoid or lateral ginglymus, with rotation, as the axoido-atloid ; arthrodia, with simple gliding, as the carpo metacarpal.

NOMENCLATURE.—Made from the bony pieces which form them.

Synarthrodial Joint.—ARTICULAR SURFACES, irregular, denticulated, and on the borders or faces of flat bones.

MEANS OF UNION.—Interosseous ligaments and periosteum.

MOTIONS.—Very limited in young, and absent in old subjects.

CLASSIFICATION.—Sutura vera, or dentata, as the pieces of frontal bone ; sutura squamosa, as the parieto-temporal joint ; sutura harmonia, as the occipito-temporal joint ; schindylesis, mortise-like, as the

submaxillary and nasal bones ; gomphosis, as the teeth.

Amphiarthrodial Joint.—ARTICULAR SURFACES are often smooth like the diarthrodial, or rough and covered by cartilage.

MEANS OF UNION.—Fibro-cartilages or menisci, and peripheric ligaments.

MOTIONS.—Limited, and varying with the thickness of cartilages.

CLASSIFICATION.—Only one kind—the vertebral articulation of the body.

SPLANCHNOLOGY.

The study of viscerae and the annexes, or those of digestion, respiration, urination and generation.

NOMENCLATURE.—Absolute, as the liver, spleen, kidneys ; or from their form, the cœcum, vagina ; their situation, the intestines, epididymis ; their direction, the rectum ; structure, the ovaries, the many leaves or third stomach of ruminants ; uses—as the lungs, œsophagus.

NUMBER.—They are generally single in digestive organs, and double in others.

FORM.—Varies ; are generally asymetrical.

SITUATION.—In the splanchnic cavities ; sometimes outside of them.

ANGIOLOGY.

Study of vascular system, arteries, veins and lymphatics.

ARTERIES.—They form two systems, the pulmonary and aortic.

GENERAL FORM.—Dycotyledonic division, or two by two.

FORM OF ARTERIES.—Regularly cylindrical in their whole length.

MODE OF ORIGIN.—Angular, or at right, acute or obtuse angle.

SITUATION.—Generally deeply situated.

DIRECTION.—Straight or fluxuous.

CONNECTIONS.—With veins, nerves, muscles, bones, skin and cellular tissue, which form their sheath of envelopment.

ANASTOMOSES.—By convergence, arches or transverse communications.

MODE OF DISTRIBUTION.—Terminal and collateral branches; the terminal form the capillary subdivision.

STRUCTURE.—They have three coats, one internal serous, one middle fibro-elastic, one external cellular; they receive nerves from the ganglionic or cerebro-spinal axis, also blood-vessels forming the vasa vasorum. They present some anomalies.

NEUROLOGY.

The study of the nervous system.

DIVISION.—Composed of two portions, a central or cerebro-spinal, and a peripheric, or the nerves.

CENTRAL PORTION.—Consists of the spinal marrow, and the encephalon divided into itlismus, cerebellum and cerebrum.

NERVES—FORM is like fasciculated cords.

ORIGIN.—By two roots, a superior and an inferior, which, in uniting, present a ganglion.

TERMINATION.—In branches to the organs of animal life ; and by pairs, perfectly alike or symmetrical, to the organs of nutrition, or of vegetable life.

STRUCTURE.—A white substance, a neurilemma, nerve fibres and nerve cells.

FUNCTIONS.—They conduct the nervous currents, possessing a centripetal current for the superior root, and a centrifugal for the inferior one.

CHAPTER II.

EXTREMITIES.

ANTERIOR OR THORACIC.

OSTEOLOGY.

Shoulder.

SCAPULA.—Division : Two faces, three borders, three angles. External face : Spine of omoplate or acromion, its tuberosity, supraspinous and infraspinous fossa, medullary foramen. Internal face : sub-scapular fossa, two triangular surfaces. Superior border : cartilage of prolongation. Anterior border : thin and sharp. Posterior border : thick and concave. Cervical angle, thin. Dorsal angle, thick. Humeral angle, glenoid cavity, coracoïd process with its tuberosity and beak.

Development : two nuclei of ossification.

Arm.

HUMERUS.—Division : A body and two extremities. Body has four faces. Anterior face : smooth. Pos-

terior face: smooth and round from side to side. External face: has the groove of torsion, external or deltoid tuberosity with crests above and below. Internal face: has an internal tuberosity, medullary foramen. Superior extremity: has a head, the great and small trochanters, bicipital groove. Inferior extremity: shows median trochlea; externally, a trochlea; internally, a condyle, epitrochlea, epycondyle, coronoid fossa, olecranon fossa, on each side eminences and cavity for ligamentous insertions.

Development: six nuclei of ossification.

Fore-arm.

RADIUS.—Body, two faces: Anterior face, convex and smooth. Posterior face has triangular surface, groove for radio-cubital arch, eminence of implantation. Superior extremity: articular surface for humerus, external and internal tuberosities, coronoid process, facettes for the cubitus. Inferior extremity: articular surfaces for the carpus, external and internal tuberosities, four grooves, a rough crest behind.

Development: three nuclei of ossification.

CUBITUS.—Body with three faces: Anterior face, articulates with the radius. External face, convex. Internal face, concave. Three borders which separate them.

Superior extremity : olecranon, its tuberosity and beak, sigmoid notch. Inferior extremity : sharp.

Development : two centres of ossification.

Digital Region.

CARPUS.—Offers six faces ; anterior face : convex ; posterior face : very rough and irregular ; superior and inferior faces articular ; two lateral faces : rough. It is composed of seven or eight bones arranged in two rows. Superior row has four bones : the trapezium with two facettes, the cuneiform with five, the lunar with six, the scaphoid with four. The inferior row has three bones ; the unciform with four facettes, the magnum with seven, the trapezoid with five.

Development : each one centre of ossification.

METACARPI.—Three. **PRINCIPAL.**—Body has an anterior face, smooth and convex ; a posterior face, with nutritive foramen, articular surfaces for rudimentary metacarpi ; superior extremity, flat facettes for the carpus ; inferior extremity, with two condyles, median spine, cavities on each side.

Development : two nuclei of ossification.

RUDIMENTARY.—Three faces ; a superior extremity : articular ; an inferior, with button.

Development : one nucleus of ossification.

Phalanges.

1. **OS SUFFRAGINIS.**—Body has two faces; anterior face: slightly rough; posterior face: flat. Has two lateral borders. Superior extremity: two glenoid cavities, median grove; inferior extremity: two condyles, median groove.

Development: two nuclei of ossification.

2. **OS CORONÆ.**—Six faces; anterior face: slightly rough; posterior face: elongated facette; lateral face; for muscular insertions; superior face: two glenoid cavities, median eminence; inferior face: two condyles, median groove.

Development: one nucleus of ossification.

3. **COFFIN OR PEDAL BONE.**—Three faces; anterior face: preplantar fissure, patilobe eminence; inferior face: semilunar crest, sole, plantar fissure, plantar foramen; superior face: glenoid cavities, antero-posterior eminence. Three borders; superior border; pyramidal eminence, facettes of insertion; anterior border: sharp and perforated; posterior border: facettes for navicular bone. Two extremities with basilar process above, retrosal below, notch or foramen between these.

Development: one nucleus of ossification.

Appendages: Lateral Cartilages.

SESAMOIDS.—Two in number, three faces; anterior face: articular, concave facettes; external face: for implantation; posterior face: covered by fibro-cartilage. Base for ligamentous insertion and looking down. Apex looks upwards.

Development: one nucleus of ossification.

NAVICULAR.—Anterior face: articular, two concave facettes, median eminence; posterior face: covered with fibro cartilage; anterior border: flat facette; posterior border and two extremities for ligamentous attachments.

Development: one nucleus of ossification.

SYNDESMOLOGY.

SCAPULO-HUMERAL JOINT.—Enarthrosis. Glenoid cavity of scapula and articular head of humerus. Capsular ligament with two re-enforcing bands. One synovial capsula. All motions.

HUMERO-RADIAL JOINT.—Angular ginglymus or perfect hinge. Condyle and double trochlea of humerus, glenoid cavity and double groove of radius with sigmoid notch of cubitus. One anterior capsular ligament and two funicular lateral, the internal the longest, the external the thickest. One synovial capsula with three culs de sac. Flexion and extension.

RADIO-CUBITAL JOINT.—Diarthrodial and synarthrodial. For the first arthrodia, two flat facettes on each bone. For the second, two rough surfaces, having the radio-cubital arch between them. Two interosseous and two peripheral bands. Very limited motion in youth.

CARPAL JOINT.—Division: Radio-carpal, carpo-carpal, carpo-metacarpal, superior inter-carpal, and inferior inter-carpal.

RADIO-CARPAL JOINT.—Imperfect hinge. On radius, outward, a wide groove, small glenoid cavity; inward, condyle with small glenoid cavity. On carpus, superior face of upper row. Three posterior ligaments. One synovial capsula, common to upper part of upper inter-carpal joint. Flexion and extension.

CARPO-CARPAL JOINT.—Imperfect hinge. Articular surfaces irregular, those of the inferior face of the bones of the upper row, and those of the superior face of the bones of the lower row. Three ligaments, two posterior and a third outside, from the trapezium to the cuneiform bone. One synovial capsula, with cul de sac to lower part of superior inter-carpal, and to upper part of lower inter-carpal joint. Flexion and extension.

CARPO-METACARPAL JOINT.—Arthrodia. On both bones flat facettes. Six ligaments: two anterior, two posterior, two interosseous. One synovial capsula,

extending to lower part of inferior inter-carpal joint. Limited gliding.

UPPER INTER-CARPAL JOINT.—Arthrodia. Facettes of lateral faces of the bones of the first row. Six ligaments: three anterior, and three interosseous.

LOWER INTER-CARPAL JOINT.—Arthrodia. Facettes of lateral faces of the bones of the second row. Four ligaments: two anterior, and two interosseous. For both of these joints, more or less gliding motion.

Ligaments common to all joints, four: one anterior capsular; one posterior capsular; one external and one internal funicular. Motions common to all the carpal joints: flexion, extension, abduction, adduction, and circumduction.

METACARPO-PHALANGEAL JOINT.—Perfect hinge. On metacarpus, two condyles, and antero-posterior eminence; on lower surface, two glenoid cavities, separated by median groove on os suffraginis, extended on the anterior face of the large sesamoids. Six ligaments for the bones of the lower surface; three inferior sesamoids; one interosseous sesamoid, two lateral. Four ligaments for the metacarpus, with the bones of the lower surface; one anterior capsular; one posterior, superior sesamoid or suspensory; two laterals. One synovial capsula. Flexion and extension.

FIRST INTER-PHALANGEAL JOINT.—Imperfect hinge.

On os suffraginis, two condyles and antero-posterior groove. On os coronæ, two glenoid cavities separated by median eminence, and extendend backwards by fibro-cartilage. Two lateral ligaments; one synovial capsula. Flexion, extension and limited rotation.

SECOND INTER-PHALANGEAL JOINT.—Imperfect hinge. On os coronæ, two condyles and antero-posterior groove; on os pedis, two glenoid cavities with median eminence, extended upon the anterior face of the navicular. Five ligaments: one interosseous, two anterior, and two posterior lateral; one synovial capsula. Flexion, extension and limited rotation.

MYOLOGY,

Scapular Region.—Division: External and internal. External region, four muscles.

1. **LONG ABDUCTOR OF THE ARM.**—Synonyms. Great scapulo-humeral, (G*). Teres major, (P). Great scapulo-trochiterius, (L). Attachments: Dorsal angle of the scapula, tuberosity of the acromion, external tuberosity of the humerus. Action: Abductor and rotator outwards of the arm.

2. **SHORT ABDUCTOR OF THE ARM.**—Synonyms. Small scapulo-humeral, (G). Teres minor, (P). Attachments: Posterior border of the scapula, infra spinous

* G is abbreviation of Girard; P, of Percivall; L, of Leyh.

fossa—to the humerus between the crest of the trochiter and the deltoid imprint. Action: Abductor and rotator outwards of the arm.

3. SUPERSPINATUS.—Synonyms. Super acromio-trochiterius, (G). Antea spinatus, (P). Anterior spinatus, (L). Attachments: Cartilage of prolongment of the scapula, internal face of the scapular aponeurosis, supraspinous fossa, anterior border and cervical angle of the scapula, summit of the trochiter and trochin. Action: Extensor of the arm, and tensor of the coraco-radialis aponeurosis.

4. SUBSPINATUS.—Synonyms. Sub-acromio-trochiterus, (G). Postea spinatus, (P). Posterior spinatus, (L). Attachments: Infraspinous fossa, acromion spine and tuberosity, cartilage of prolongment of the scapula, the internal face of scapula aponeurosis, inside the convexity of the great trochanter to the crest of the same below. Action: Abductor and rotator outwards of the humerus.

Internal region, four muscles.

1. SUBSCAPULARIS.—Synonyms. Subscapulo-trochineus, (G). Attachments: Sub-scapularis fossa, trochin of humerus. Action: Adductor of the arm.

2. ADDUCTOR OF THE ARM.—Synonyms. Subscapulo-humeralis, (G). Teres major, (P). Great scapulo-humeralis, (L). Attachments: Dorsal angle of the

scapula, posterior border of the subscapularis muscle, internal tuberosity of the body of the humerus. Action: Adductor and rotator inward of the humerus.

3. **CORACO-HUMERALIS.**—Coraco-brachialis, omo-brachialis. Synonyms. Coraco-humeralis, (P). Middle scapulo-humeralis, (L). Attachments: Beak of the coracoïd process, above internal tuberosity of the humerus, and below it towards the anterior face of that bone. Action: Adductor and rotator inward.

4. **SCAPULO-HUMERAL GRELE.**—Synonyms. Not described by P. Tensor of capsular ligament, (L). Attachments: Rim of the glenoid cavity of the scapula, and below the head of the humerus. Action: Raises the capsular ligament of the joint.

Humeral Region.—Division: Anterior and posterior.

Anterior region, two muscles.

1. **LONG FLEXOR OF THE FORE-ARM.**—Synonyms. Coraco-cubitalis or coraco-radialis, (G). Flexor brachii, (P). Scapulo or coraco-radialis, (L). Attachments: Tuberosity of coracoïd process, supero-internal tuberosity of radius and anterior extensor of the metacarpus muscle by a tendinous band. Action: Flexor of the fore-arm, and tensor of the antibrachial aponeurosis.

2. **SHORT FLEXOR OF THE FORE-ARM.**—Synonyms. Oblique humero-cubital or humero-radial, (G). Humer-

alis externus, (P) Humero-radialis, (L). Attachments: Posterior face of the humerus below the head, internal border of the radius under the lateral ligament. Action: Flexor of the fore-arm.

Posterior region, five muscles.

1. LONG EXTENSOR OF THE FORE-ARM.—Synonyms. Long scapulo-olecranius, (G). Portion of the caput magnum of the triceps extensor brachii, (P). Long scapulo-olecranius, (L). Attachments: Posterior border of the scapula, posterior border of the olecranon and the antibrachial aponeurosis. Action: Extensor of the fore-arm, and tensor of the antibrachial aponeurosis.

2. LARGE EXTENSOR OF THE FORE-ARM.—Synonyms. Great scapulo-olecranius, (G). Portion of the caput magnum of the triceps extensor brachii, (P). Attachments: Dorsal angle and axillary border of the scapula, summit of the olecranon. Action: Extensor of the fore-arm.

3. SHORT EXTENSOR OF THE FORE-ARM.—Synonyms. Humero-olecranius externus, (G). Caput medium, (P). Attachments: Curved line extending from the deltoid tuberosity to the head of the humerus, and to the olecranon. Action: Extensor of the fore-arm.

4. MIDDLE EXTENSOR OF THE FORE-ARM.—Synonyms. Humero-olecranius internus, (G). Caput parvum, (P).

Attachments: Internal face of the humerus, summit of the olecranon, and a little below. Action: Extensor of the fore-arm.

5. **SMALL EXTENSOR OF THE FORE-ARM.** Synonyms. *Anconeus*. Small olecrano-humeralis, (G). Attachments: Margin of the olecranon fossa, anterior and external part of the olecranon. Action: Extensor of the fore-arm.

Antibrachial Region.—Division. Anterior and posterior.

Anterior region, four muscles.

1. **ANTERIOR EXTENSOR OF THE METACARPUS.**—Synonyms. *Epicondylo-premetacarpeus*, (G). *Extensor metacarpi magnus*, (P). *Humero-metacarpeus*, (L). Attachments: Crest limiting downwards the groove of torsion of the humerus, above and in front of the inferior articular surface of the humerus, supero-anterior tuberosity of the principal metacarpal bone. Action: Extensor of the metacarpus.

2. **OBLIQUE EXTENSOR OF THE METACARPUS.**—Synonyms. *Cubito or radio-premetacarpeus*, (G). *Extensor metacarpii obliquus vel parvus*, (P). *Radio-metacarpeus*, (L). Attachments: External side of the radius, head of the internal small metacarpal. Action: Extensor and rotator of the metacarpus.

3. **ANTERIOR EXTENSOR OF THE PHALANGES.**—Syno-

nym. Epicondylo-prephalangeus, (G). Extensor pedis, (P). Humero-prephalangeus, (L). Attachments: Below the crest limiting the groove of torsion of the humerus behind, in front of the inferior tuberosity of that bone, external ligament of the elbow joint, supero-external tuberosity of the radius, external border of the same bone, pyramidal eminence of the os pedis. Action: Extends the third phalanx upon the second, this upon the first, and that upon the metacarpal.

4. LATERAL EXTENSOR OF THE PHALANGES.—Synonyms. Cubito or radio-prephalangeus, (G). Extensor suffraginis, (P). Attachments: External tuberosity of the radius, external lateral ligament of the elbow joint, on the body of both bones of the fore-arm, capsular ligament of the fetlock joint, and superior extremity of the os suffraginis. Action: Extensor of the digital region proper.

Posterior region, five muscles.

1. EXTERNAL FLEXOR OF THE METACARPUS.—Synonyms. Epicondylo-supercarpus, (G). Flexor metacarpi externus, (P). Humero-supercarpus externus, (L). Attachments: Summit of epitrochlea, the trapezium and the head of the external small metacarpal. Action: Flexor of the metacarpus.

2. OBLIQUE FLEXOR OF THE METACARPUS.—Synonyms. Epitrochlea supercarpus, (G). Flexor metacarpi med-

ius, (P). Humero-metacarpeus internus, (L). Attachments: Base of the epicondyle, olecranon and the trapezium. Action: Flexor of the metacarpus.

3. INTERNAL FLEXOR OF THE METACARPUS.—Synonyms. Epitrochlea metacarpeus, (G). Flexor metacarpi internus, (P). Humero-metacarpeus internus, (L). Attachments: Base of the epicondyle, the head of the internal metacarpal. Action: Flexor of the metacarpus.

4. SUPERFICIAL FLEXOR OF THE PHALANGES.—Synonyms. Epitrochlo-phalangeus, (G). Flexor pedis perforatus, (P). Humero-coronaris or phalangeus, (L). Attachments: Summit of the epicondyle, the extremities of the pulley behind the superior extremity of the os coronæ. Action: Flexes the second phalanx on the first, this on the metacarpal, and the whole digital region on the fore-arm.

5. DEEP FLEXOR OF THE PHALANGES.—Synonyms. Cubito or radio-phalangeus, (G). Flexor pedis perforatus, (P). Humero-radio-phalangeus, (L). Attachments: Summit of the epicondyle, summit and posterior border of the olecranon, posterior face of the radius, plantar crest of the os pedis. Action: Flexes the phalanges on each other and on the metacarpus, and the whole foot on the fore-arm.

ANGIOLOGY.

Arteries: the superior and inferior scapular with the humeral.

SUPERIOR SCAPULAR, or superescapular—collateral branch of the axillary artery—runs upwards between the subscapularis muscle and the antea-spinatus, and terminates at the lower part of the scapula.

INFERIOR SCAPULAR, or subscapular, also collateral branch of the axillary, runs between the subscapularis muscle and the adductor of the arm to the dorsal angle of the scapula; it has collateral branches to the latissimus dorsi muscle, one forming the posterior circumflex of the shoulder, and also anterior and posterior muscular branches.

HUMERAL ARTERY is the terminal branch of the axillary. It runs down inside of the arm to the inferior extremity of the humerus, where it terminates by the anterior and posterior radial. Its collateral branches are: 1—the prehumeral or anterior circumflex of the shoulder going to the mastoido-humeralis muscle; 2—the external collateral of the elbow, or deep humeral, passing to the large extensor of the fore-arm, and by another branch to the front of the elbow joint; 3—the internal collateral of the elbow, epicondylod or cubital artery, terminating at the carpus anastomosing with

the posterior radial artery ; 4—the principal artery of the coraco radialis, dipping into that muscle by ascending and descending branches.

ANTERIOR RADIAL ARTERY passes in front of the elbow joint, under the flexor muscles of the fore-arm and of the anterior extensor metacarpi, to the anterior face of the radius, to the knee, where it loses itself by anastomosing with the posterior radial and the interosseous of the fore-arm.

POSTERIOR RADIAL ARTERY runs down under the internal ligament of the elbow joint, under the internal flexor of the metacarpus, arrives at the inferior extremity of the radius, and terminates by the common trunk of the interosseous metacarpal and the collateral of the cannon. Its collateral branches are : 1—articular branches ; 2—muscular branches to the posterior anti-brachial muscles ; 3—interosseous of the fore-arm, which runs through the radio cubital arch under the extensor suffraginis ; 4—small muscular and musculocutaneous branches ; 5—branches to the posterior face of the radius.

COMMON TRUNK OF THE INTEROSSEOUS METACARPAL.—Passing inwards and behind the carpus, it reaches the head of the internal small metacarpus, bends outwards under the superior extremity of the suspensory ligament, and anastomoses with a branch from the super-

facial arch which unites the cubital artery with the collateral of the cannon, forming then the sub-carpal arch—the super-carpal arch being formed by the anastomosis of the collateral of the cannon and the epicondylod itself. Collateral branches: two posterior interosseous-metacarpal or palmar, and two anterior or dorsal. The posterior run on the inside of both small metacarpal bones, anastomosing downwards with the collateral of the cannon. The anterior runs on the outside of both small metacarpal bones, and downwards anastomoses also with branches of the collateral of the cannon.

COLLATERAL ARTERY OF THE CANNON.—Passes under the carpal arch downward on the internal side of the flexor tendons to the fetlock, and ends in the digital artery. Collateral branches are: 1—to the epicondylod artery to form the supracarpal arch; 2—synovial, tendinous and cutaneous ramuscles; 3—branch to the posterior interosseous of the metacarpal.

DIGITAL ARTERY.—On each side of the fetlock joint it runs down to the basilar process and terminates in the ungueal plantar and preplantar arteries. Collateral branches: 1—articular to the fetlock; 2—branch to the tissue of the ergot; 3—the perpendicular artery of Percivall, ramifying into anterior and posterior branches; 4—the artery of the plantar cushion run-

ning downwards to that apparatus ; 5—tendinous and cutaneous branches to the first and second phalanges ; 6—the coronary circle or two branches, anterior and posterior, running round the coronet and anastomosing with those of the opposite side.

UNGUEAL PREPLANTAR.—Passes through the notch of the lateral extremity of the os pedis, goes to the preplantar fissure, runs forwards, and ends by divisions dipping into the os pedis.

UNGUEAL PLANTAR.—Lodged in the plantar fissure, then in the plantar canal, and into the semi-lunar sinus of the os pedis, it anastomoses with that of the opposite side, forming the semi-lunar arch. Collateral branches ascend to form the anterior laminal of Spooner, and descend to form the inferior communicating arteries.

Veins.—Digital veins, which form in the foot a rich network—satellite of the arteries of that region—emptying into three metacarpal or collateral of the cannon ; these are two superficial veins on each side of the flexor tendons, and a third, deep, passing under the suspensory ligament. Following these are two groups of antibrachial veins, one formed by the cubital and the posterior radial, which run alongside the arteries of the same name ; the other, the median vein, which receives the superficial anterior radial. These

antibrachial unite with the anterior radial, satellite of the artery of the same name, and form the humeral vein, which receives the subcutaneous thoracic and the subscapular, to form the axillary which empties into the confluent of the jugular.

Lymphatics.—Coming from all parts of the limb, they pass to the prescapular and brachial glands, which send out numerous efferent branches, terminating in the prepectoral glands.

NEUROLOGY.

BRACHIAL PLEXUS.—Formed by the sixth, seventh and eighth cervical, and two first dorsal pairs of rachidian nerves, it lies outside of the two portions of the scalenus muscle, under the shoulder near the scapulo-humeral angle, and divides into fourteen branches.

1. **DIAPHRAGMATIC NERVE** runs inside the thoracic cavity, along the course of the axillary artery with the pneumogastric, there it receives branches from the sympathetic nerve, reaches the base of the heart, runs under the pleura to the phrenic part of the diaphragm, where it ends.

2. **NERVE OF THE ANGULARIS AND RHOMBOIDEUS MUSCLES**, formed by the sixth cervical pair, runs upward to these two muscles.

3. **NERVE OF THE SERRATUS MAGNUS** or superior

thoracic, from the sixth and seventh cervical pairs, runs across the serratus magnus muscle and terminates in it.

4. NERVE OF THE PECTORAL MUSCLES or inferior thoracic: five principal; one to the sterno prescapularis muscle, another passing between the two pectoral muscles and ramifying in the superficial pectoral, the three other branches going to the sterno trochineus muscle.

5. SUBCUTANEOUS THORACIC NERVE rises in common with the cubital nerve and runs backward on the internal face of the long extensor of the fore arm and of the panniculus carnosus, as far as the flank, where it terminates in the subcutaneous muscle of that region.

6. NERVE OF THE LATISSIMUS DORSI formed by the eighth cervical pair, runs upwards and backwards to that muscle, where it is distributed.

7. AXILLARY OR CIRCUMFLEX NERVE, from the eight cervical pair, runs backwards and downwards on the internal face of the subscapularis muscle, passes between it and the teres major, crossing the subscapular artery; behind the scapulo-humeral joint, passes between the short abductor of the arm, the great and middle extensor of the fore arm, reaches the long abductor of the arm and terminates in the two abductors, the mastoido humeralis and the skin.

8. NERVE OF THE ADDUCTOR OF THE ARM, also from

the eighth cervical pair to the adductor muscle.

9. NERVE OF THE SUBSCAPULARIS MUSCLE.—Two branches ramifying in that muscle.

10. SUB-SCAPULAR NERVE.—Formed by the sixth and seventh cervical pairs, running backwards between the angularis scapulæ, the sterno prescapularis and the antea spinatus muscles, reaches the posterior fossa of the external face of the scapula, where it terminates in the postea spinatus muscle.

11. ANTERIOR BRACHIAL NERVE or musculo-cutaneous.—Formed by the seventh and eighth cervical pairs—situated on the inside of the scapulo humeral joint, crossing the axillary artery and passing underneath it, united to the median nerve, running in front of it to the bifurcation of the omo-brachialis muscle, passing between its branches and dipping into the coraco-radialis muscle.

12. RADIAL NERVE.—The largest of the plexus—formed principally by the first dorsal pair. It passes downwards and backwards, under and across the subscapularis and adductor muscles parallel to the humeral artery and posterior to the cubital nerve. At the deep humeral artery it passes behind the humerus, under and then alongside the short flexor of the forearm to the anterior face of the elbow joint and the radius; then under the extensors of the metacarpus

and extensor of the phalanges, meets the radial artery, with which it goes to the oblique extensor of the metacarpus and terminates. Collateral branches are to the tendons of the great dorsal and adductor of the arm, to all the extensors of the fore-arm, the skin, the anterior extensor and external flexor of the metacarpus and to the extensors of the phalanges.

13. CUBITO-CUTANEOUS or cubital nerve—Formed by the dorsal pairs. It runs backwards and downwards, behind the humeral artery; crossing the deep humeral artery, it passes between the long and middle extensors of the fore arm, to the inside of the elbow, over the epitrochlea, under the cubital fasciculus of the middle flexor of the metacarpus, under this muscle to the trapezium bone, where it ends by two branches: one, cutaneous, passing between the tendons of the external and middle flexors of the metacarpus and through the antibrachial aponeurosis to ramify in the skin of this region; the other, with a branch of the median nerve, forms the external plantar nerve. Collateral branches, two: one to the skin of the fore-arm below the elbow on the inside, the other to some muscles of the posterior antibrachial region.

14. CUBITO-PLANTAR OR MEDIAN NERVE.—Formed by the eighth cervical and the dorsal pairs. Starts from the posterior part of the plexus to reach the axillary

artery, there anastomoses with the anterior brachial nerve, places itself in front of the humeral artery, running with it to its terminal bifurcation, passes downwards on the inside of the leg with the posterior radial artery, arrives at the elbow joint, becomes posterior, and above the inferior third of the fore-arm bifurcates to form the plantar nerve. Collateral branches: 1. One branch to the thoracic nerve going to the superficial pectoral muscles. 2. In the middle of the humerus, one branch which passes beneath the coracobrachialis and terminates in two small branches. 3. In the antibrachial region, branches to the internal flexor of the metacarpal and to the flexors of the phalanges.

PLANTAR NERVE.—External and internal. Internal lies beside the collateral artery of the cannon, alongside the perforans tendon to near the fetlock, where it terminates by several digital branches. Collateral branches to the skin of the metacarpal region, and one which crosses obliquely behind the flexor tendons and unites with the external plantar nerve. External plantar nerve is formed by a branch from the cubital and one from the median nerve, runs in company with the external collateral vein of the cannon and an arteriole, outside of the flexor tendons at the superior extremity of the cannon, inside of the head

of the external small metacarpal bone, gives off the deep palmar branch, then passes along the tendon of the perforans muscle, receives the branch of the internal plantar and at the fetlock terminates in the digital branches.

DIGITAL BRANCHES, or collaterals of the digit—three in number—one anterior, one middle and a posterior. The anterior placed in front of the vein goes to the skin of the anterior face of the digit. The middle, between the artery and vein, goes to the coronary cushion and the podophyllous tissue. The posterior, behind the artery and larger than the other, lies first above the artery and then behind it, runs down to the basilar process, into the lateral fissure of the os pedis and ramifies in the podophyllous tissue and the bone. Collateral branches: 1—to the flexor tendons; 2—to the plantar cushion; 3—to the cartilages of the os pedis; 4—to the reticulum of the podophyllous tissue; 5—a plantar branch.

COMPLEMENTARY APPENDAGES AND TEGUMENTARY COVERINGS OF THE DIGITAL REGION.—They consist of the fibro cartilages of the os pedis, the plantar cushion, and of the keratogenous membrane—the whole covered by the horny apparatus or hoof.

FIBRO-CARTILAGES of the os pedis—situated one on each side—offer an external face convex, an internal

face concave, continue downwards and backwards to the plantar cushion; the superior border is thin and flexible, the inferior thick and attached to the basilar and retrosal processes; the posterior border is slightly convex, the anterior is intimately united to the anterior lateral ligament of the articulation of the foot. Structure: is a mixture of fibrous and cartilaginous tissue, liable to calcification.

PLANTAR CUSHION.—Is a wedge placed between the cartilages of the os pedis, between the perforans tendon and the inferior wall of the horny box. It has an antero-superior face covered by a cellulo-fibrous membrane, and is moulded on the aponeurotic termination of the perforans tendon; its infero-posterior face is covered by the keratogenous membrane and offers in its middle the pyramidal body representing the shape of the frog of the foot. The base looks backwards and upwards; it shows on each side the bulbs of the plantar cushion, and is also covered by a cellulo-fibrous covering. The apex is fixed on the plantar face of the os pedis, in front of the semilunar crest and the insertion of the perforans tendon. The lateral borders are continuous with the internal face of the lateral cartilages. Its structure consists of a fibrous network mixed with elastic fibres, connective fibres with adipose cells, blood vessels and nerves.

KERATOGENOUS MEMBRANE, resting upon a fibrous fascia and covered by the hoof. It is composed of the coronary cushion, the velvety and laminal tissues.

CORONARY TISSUE, BOURRELET OR CUTIDURA.—It is lodged in a cavity at the upper border of the horny case. Its inferior border is separated from the laminæ by a white zone; the superior border is limited by the perioplic ring; its extremities are reflexed near the bulbs of the plantar cushion into the lateral lacunæ of the pyramidal body; its surface is covered with papillæ, villi and villous loops; its structure is the same as the cutaneous derma, is very vascular and has many nerves; it is red, and sometimes maculated black by pigment.

VELVETY TISSUE covers the plantar surface of the os pedis and the plantar cushion. Its surface is like those upon which it rests, having a central and a periph-
eric portion covered by the sole. It is provided with numerous villosities, received in the porosities of the sole and frog, and has the same structure as the cutidura.

LAMINAL OR PODOPHYLLOUS TISSUE.—This covers the anterior face of the os pedis. It consists of five or six hundred laminæ, parallel, wider below than above, denticulated on their free border, and having folds on their lateral surfaces; they are received between the

laminæ of the keraphyllous tissue. Its structure is like that of other parts of the keratogenous apparatus.

Hoof—is composed of three parts: wall, sole and frog.

WALL, OR CRUST.—Covers the anterior face of the foot, diminishing in width and thickness posteriorly. It passes round the bulbs of the plantar cushion, is inflected inwards and becomes confounded with the lateral borders of the sole. It is divided into toe, outside and inside toe, quarter, heels and bars. Its external face is smooth and covered above by the periople, which is a dependance of the frog. The internal face presents the laminæ of the keraphyllous tissue. Its superior border offers the cutigeral cavity with many little holes for the villousities of the cutidura; the inferior is united to the sole, and the extremities form the bars.

SOLE—is a horny plate occupying the inferior face of the hoof. The inferior face is more or less concave; the superior has numerous pores for the villi of the velvety tissue; the external border is united to the wall; the internal forms a V shaped notch opening backwards to receive the frog.

FROG—is a pyramidal mass of horn lodged between the bars. Its inferior face has a median lacuna separating the branches; the lateral faces are united to the

bars and internal border of the sole; on each side are found the lateral lacunæ or commissures of the frog; the superior face rests on the pyramidal body of the plantar cushion, has a triangular excavation divided by the frog stay or *spine of the frog*; its base forms the glomes of the frog; the apex rests on the point of the angle formed by the posterior border of the sole.

CHAPTER III.

POSTERIOR OR ABDOMINAL EXTREMITIES.

OSTEOLOGY.

Hip.—*OSSA INNOMINATUM* OR *COXA*, formed of three pieces, ilium, pubis and ischium.

ILIUM.—Division: Two faces, three borders, three angles. The external face presents the iliac fossa; the internal face the iliac surface and an auricular facet for articulation with the sacrum. The anterior border is concave; the external has a medullary foramen and vascular grooves; the internal forms the great sciatic notch. The anterior external angle has four tuberosities, the anterior internal only one; the posterior angle offers a facette for the cotyloid cavity, the supra-cotyloid crest, the ileo pectineal eminence, and some muscular imprints. Development: two nuclei of ossification.

PUBIS.—Division: Two faces, three borders, three angles. The superior face is smooth and concave; the inferior has a large groove for the pubio-femoral

ligament. The anterior border is thin and rough; the posterior thick and concave, and co-operates to form the obturator foramen; the internal is thick and articular. The external or cotyloid angle forms the bottom of the cotyloid cavity; the internal and posterior angles are articular. Development: one nucleus of ossification.

ISCHIUM.—Division: Two faces, four borders, four angles. The superior face is smooth and forms the floor of the pelvic cavity; the inferior is roughened for muscular attachments, and presents the ischial crest. The anterior border forms the obturator foramen, the external the small sciatic notch, the posterior forms the ischial arch, while the internal is articular. The anterior external angle, or cotyloid presents a diarthrodial facet and the posterior extremity of the supracotyloid crest; the anterior internal angle is articulated with the pubis; the posterior external forms the ischial tuberosity and the posterior internal articulates with that of the opposite side. Development: two nuclei of ossification.

Thigh.—**FEMUR.**—Division: Body, and two extremities. Body has four faces. The anterior is smooth; the posterior has a rounded, roughened surface, a slight crest oblique above, in the middle a wide rough surface for muscular attachments, and below a wide vascular

groove; the external face shows the subtrochanterian crest and below, the suscondyloid fossa; the internal face shows the small trochanter, the medullary foramen surrounded by muscular imprints, the origin of the vascular groove of the posterior face and the suscondyloid crest. Extremities: The superior has an articular head and neck, a great trochanter with apex, convexity, and crest, and posteriorly the trochanterian fossa; the inferior has a wide trochlea, with internal border the highest, two condyles separated by intercondyloid notch, two fossæ on the outside of external condyle, a rough impression on the inside of the internal condyle, and a large tubercle outwards; between the external condyle and trochlea a digital impression for muscular attachments. Development: four nuclei of ossification.

Leg.—**TIBIA.**—Division: Body and two extremities. Body has three faces and three borders. The external face is smooth and concave; the internal slightly convex and with muscular imprints above; the posterior offers two triangular surfaces with rough muscular lines, and on their limits the medullary foramen. The anterior border forms the tibial crest; the external, the tibial arch; the internal is thick and rounded. Extremities: the superior has three tuberosities; the anterior or the tibial tuberosity has a depressed centre; the

external is articular and has a facet on the outside for articulation with the fibula—it is separated from the anterior by a groove; the internal tuberosity is also articular and has posteriorly a small tubercle for ligamentous attachment. On the middle of the superior extremity is the tibial spine. The inferior extremity has a double articular pulley, outwards a tuberosity with a vertical groove, and inwards another tuberosity with an oblique groove posteriorly. Development: four nuclei of ossification.

FIBULA.—Division: Middle part and two extremities. Middle part forms the tibial arch. Extremities: the superior, or head, is wide and has inwards a facet for articulation, outwards it shows muscular imprints; the inferior ends in a blunt point. Development: one nucleus of ossification.

PATELLA.—Division: Three faces and a circumference. The anterior face is convex and irregular; the superior roughened for muscular attachments; the posterior is moulded on the femoral trochlea. The circumference unites with the three faces. Development: one nucleus of ossification.

Digital Region.—**TARSUS.**—Division: Six or seven bones arranged in two rows. The superior row has the astragalus with its six faces; the superior, anterior, inferior and posterior are articular; the external and

internal furnished with ligamentous imprints. The os calcis has an external face flat and smooth, an internal face forming the tarsal arch, an anterior border concave, a posterior border thick and rough, a superior extremity divided in three parts: one middle, for muscular attachment; one anterior, smooth, and one posterior for the sliding of a tendon; an inferior extremity, articular—it is developed by two nuclei of ossification and the astragalus by one only. The inferior row has four bones; the cuboid with six faces; the scaphoid, flat bone, with two faces and a circumference; the great cuneiform with two articular faces and three borders; the small cuneiform sometimes divided in two pieces, with four facettes for articulation. Development: all the bones of the inferior row are developed by one nucleus of ossification.

METATARSI.—Similar to the metacarpi.

PRINCIPAL METATARSUS is longer, more cylindrical than the metacarpus, and has on the outside border an oblique fissure. Its superior articular surface is hollowed by a fossa of insertion.

RUDIMENTARY METATARSI.—The external is always the longest and the thickest; the internal has three articular facets on the superior extremity.

PHALANGES.—Almost exactly like those of the anterior extremity.

SYNDESMOLOGY.

COXO-FEMORAL JOINT—Enarthrosis. On the ossa innominatum the cotyloid cavity, on the femur the articular head, both united by the capsular, pubio and coxo-femoral ligaments. One synovial capsula. All motions.

FEMORO-TIBIAL JOINT—Imperfect hinge. On the femur, the articular surface of the trochlea and the two condyles; on the tibia the two large facettes at the base of the tibial spine; on the patella, its posterior face enlarged by fibro-cartilaginous pad. Two inter-articular menisci: the internal attached in front and behind the tibial spine, the external fixed forward near the internal meniscus, and behind by two branches, one on the femur, the other on the tibia. This joint has three anterior patellar ligaments, two lateral, two interosseous, one anterior capsular, with lateral re-enforcing bands, and one posterior capsular ligament; three synovial capsulæ. Motions: flexion, extension and rotation.

TIBIO-FIBULAR JOINT—Arthrodia. Irregular diarthrodial facette on both bones. Interosseous and peripheric ligamentous fibres, two small ligamentous fasciuli and an aponeurotic membrane; below a ligamentous cord. Motions very limited.

TARSAL JOINT.—Division: Tibio-tarsal, superior inter-tarsal, tarso-tarsal, inferior inter-tarsal, tarso-metatarsal.

TIBIO-TARSAL JOINT—Perfect hinge. On the tibia a double pulley, on the astragalus, the trochlea of the supero-anterior faces; two lateral external, three lateral internal, one anterior and one posterior ligaments; the last two are capsular. One synovial membrane. Motions: extension and flexion.

SUPERIOR INTERTARSAL JOINT—Arthrodia. Anterior face of lower extremity of the os calcis and the posterior facettes of the astragalus. Four ligaments: one superior, one interosseous, one external and one internal. Sliding motion.

TARSO TARSAL JOINT—Arthrodia. The facettes on the os calcis and the inferior face of the astragalus above, below the superior face of the scaphoid and cuboid. Six ligaments: two lateral, one calcaneo-metatarsal, one astragalo-metatarsal, one posterior tarso-metatarsal and one interosseous. One synovial capsula. Motion very limited.

INFERIOR INTER-TARSAL JOINT—Arthrodia—with almost no motion. On the cuboid two facettes for the scaphoid and two for the great cuneiform; on the scaphoid, facettes on the inferior surface for both cuneiforms; the two cuneiforms have each one small facet.

Two anterior and two interosseous ligaments, with the astragalo-metatarsal and posterior tarso-metatarsal ligaments are the means of union.

TARSO-METATARSAL JOINT—Arthrodia. The inferior face of the cuboid and the two cuneiforms, with the three metatarsi bones articulate by facettes. As means of union it offers the ligaments of the tibio-tarsal joint, the calcaneo-metatarsal ligament, and the astragalo-metatarsal and tarso-metatarsal ligaments. One synovial capsula. The motions are nearly null.

MYOLOGY.

Gluteal Region, or Region of the Hip.—Three muscles.

1. **SUPERFICIAL GLUTEUS.**—Synonyms. Ilio-trochanterius medius, (G). Gluteus externus, (P). Ilio-trochanterius externus, (L). Attachments: The internal face of the gluteal aponeurosis, the posterior extremity of the ischium, the ischiatic ligament, the external tuberosity of the body of the femur. Action: Abductor of the thigh.

2. **MIDDLE GLUTEUS.**—Synonyms. Ilio-trochanterius magnus, (G). Gluteus magnus, (P). Superior portion of the great ilio-trochanterius, (L). Attachments: The internal face of the gluteal aponeurosis, the superior face and anterior angle of the ilium, the two ilio-

sacral ligaments, the sacro-sciatic ligament, and on the trochanter of the superior extremity of the femur by three branches. Action: Extensor and abductor of the thigh and assists in rearing.

3. **DEEP GLUTEUS.**—Synonyms. Small ilio-trochanterius, (G). Gluteus parvus, (P). Attachments: The neck of the ilium, the supra-cotyloid crest, the inside of the convexity of the great trochanter. Action: Abductor of the thigh, and rotator inward indirectly.

Crural Region, or Region of the Thigh.—DIVISION: Anterior, posterior and internal.

ANTERIOR CRURAL REGION.—Three muscles.

1. **MUSCLE OF THE FASCIA LATA.**—Synonyms. Ilio-aponeuroticus, (G). Tensor vaginae, (P). Ischio rotuleus externus, (L). Attachments: External angle of the ilium, external crest of the femur, and to the patella. Action: Flexor of the femur.

2. **CRURAL TRICEPS.**—DIVISION: Anterior straight, vastus externus, vastus internus.

a. **ANTERIOR STRAIGHT.**—Synonyms. Ilio-rotuleus, (G). Rectus, (P). Anterior ilio-rotuleus, (L). Attachments: By two tendons to the rim of the cotyloid cavity, and to the anterior face of the patella. Action: Extensor of the leg and flexor of the thigh.

* b. **VASTUS EXTERNUS.**—Attachments: External face and external half of the anterior face of the femur,

superior face and external border of the patella. Action: Extensor of the leg.

c. **VASTUS INTERNUS**.—Attachments: Internal face and internal half of the anterior face of the femur, superior face and internal border of the patella. Action: Extensor of the leg.

3. **ANTERIOR GRELE**.—Synonyms. Ilio-femoral grele. (G). Crureus vel cruralis, (P). Attachments: Rim of the ilium, superior part of the anterior face of the femur. Action: Raises the capsular ligament of the coxo-femoral joint.

Posterior Crural Region.—Three muscles.

1. **LONG VASTUS**.—Synonyms. Ischio-tibialis externus, (G). Biceps abductor femoris, (P). Anterior pubio-ischio-tibialis, (L). Attachments: The anterior portion to the sacral spine, sacro-sciatic ligament, coccygeal aponeurosis, ischial tuberosity, behind the sub-trochanterian crest and to the anterior face of the patella; the posterior portion to the ischial and the tibial crests. Action: Abductor of the leg and extensor of the thigh; also flexes the leg, and is a tensor of the tibial aponeurosis.

2. **SEMI-TENDINOSUS**.—Synonyms. Ischio-tibialis medius or posticus, (G). Adductor tibialis, (P). Posterior sacro-ischio-tibialis, (L). Attachments: Sacral spine, sacro-ischiatric ligament, the ischial tuberosity,

and anterior crest of the tibia. Action: Flexor of the leg and tensor of the tibial aponeurosis; it also assists in rearing.

3. **SEMI-MEMBRANOSUS.**—Synonyms. Ischio-tibialis internus, (G). Adductor tibialis, (P). Great ischio-femoralis, (L). Attachments: to the coccygeal aponeurosis, the ischial tuberosity, inferior face of the ischium and external condyle of the femur. Action: Adductor of the limb, extensor of the thigh, and assistant in rearing.

Internal Crural Region.—Nine muscles.

1. **LONG ADDUCTOR OF THE LEG.**—Synonyms. Sub-lumbo-tibialis, (G). Sartorius, (P). Internal ilio-rotuleus, (L). Attachments: To the iliac fascia, near the tendon of the small psoas muscle, and to the internal patellar ligament. Action: Adductor of the leg and flexor of the thigh.

2. **SHORT ADDUCTOR OF THE LEG.**—Synonyms. Sub-pubio-tibialis, (G). Gracilis, (P). Pubio-tibialis, (L). Attachments: Ischio-pubic symphysis, internal patellar ligament, and the internal face of the tibia. Action: Adductor of the leg and tensor of the tibial aponeurosis.

3. **PECTINEUS.**—Synonyms. Superpubio-femoralis, (G). Anterior pubio-femoralis, (L). Attachments: On the inferior face of the pubis, and around the med-

ullary foramen of the femur. Action: Adductor and flexor of the thigh and rotator inwards.

4. **SMALL ADDUCTOR OF THE THIGH.**—Synonyms. Adductor brevis, (P). Middle pubio-femoralis, (L). Attachments: To the inferior face of the pubis, and the posterior face of the femur. Action: Adductor of the thigh.

5. **GREAT ADDUCTOR OF THE THIGH.**—Synonyms. Adductor longus, (P). Posterior pubio-femoralis, (L). Attachments: On the inferior face of the ischium, the posterior face and above the internal condyle of the femur. Action: Adductor, extensor and rotator outwards of the femur.

6. **SQUARE CRURAL.**—Synonyms. Ischio-femoralis, (G). Not described by P. Small ischio-femoralis, (L). Attachments: In front of the ischial tuberosity and on the posterior face of the femur. Action: Extensor and adductor of the femur.

7. **EXTERNAL OBTURATOR.**—Synonyms. Subpubio-trochanterius externus, (G). Attachments: On the inferior face of the pubis and ischium and in the trochanterian fossa. Action: Adductor and rotator outwards of the femur.

8. **INTERNAL OBTURATOR.**—Synonyms. Subpubio-trochanterius internus, (G). Attachments: On the anterior angle of the sacrum, the superior face of the

pubis, around the obturator foramen, and in the trochanterian fossa. Action: Rotator outward of the thigh, and possibly abductor.

9. GEMELLI OF THE PELVIS.—Synonyms. Ischio-trochanterius, (G). Gemini, (P). Bifemoro-calcaneus, (L). Attachments: On the external border of the ischium and in the trochanterian fossa. Action: Rotator outwards of the thigh.

Tibial Region, or Region of the Leg.—DIVISION: Anterior and posterior.

ANTERIOR REGION.—Three muscles.

1. ANTERIOR EXTENSOR OF THE PHALANGES.—Synonyms. Femoro-prephalangeus, (G). Extensor pedis, (P). Attachments: In the digital fossa, situated between the external condyle and the external border of the trochlea of the femur, to the capsular ligament of the fetlock joint, the anterior face of the two first phalanges and the pyramidal eminence of the os pedis. Action: Extends the digits and flexes the whole digital region.

2. LATERAL EXTENSOR OF THE PHALANGES.—Synonyms. Peroneo-prephalangeus, (G). Peroneus, (P). Tibio-prephalangeus, (L). Attachments: On the external femoro-tibial ligament, the fibula and to the tendon of the anterior extensor. Action: Same as the extensor pedis.

3. **FLEXOR OF THE METATARSUS.**—Synonyms. Tibio-premetatarsus, (G). Flexor metatarsi, (P). Attachments: In the fossa of the inferior extremity of the femur with the anterior extensor pedis, the external fossa of the tibia, on the anterior tuberosity of the superior extremity of the principal metatarsal by two tendons, to the anterior face of the cuboid and to the small cuneiform. Action: Flexor of the foot on the leg.

POSTERIOR REGION.—Six muscles.

1. **GEMELLI OF THE LEG OR GASTROCNEMII.**—Synonyms. Bifemoro-calcaneus, (G). Gastrocnemius externus, (P). Attachments: By two fleshy bodies on the rough edge of the sus-condyloid fossa, on the inside of the femur and on the apex of the os calcis. Action: Extensor of the foot on the tibia.

2. **SOLEUS OR SOLEARIS.**—Synonyms. Peroneo-calcaneus, (G). Plantaris, (P). Attachments: Supero-external tuberosity of the tibia and the tendon of the gastrocnemii. Action: Like the gemelli of the leg.

3. **SUPERFICIAL FLEXOR OF THE PHALANGES.**—Synonym. Femoro-phalangeus, (G). Gastrocnemius internus, (P). Attachments: Sus-condyloid fossa and the coronet. Action: Flexes the second phalanx on the first and that on the metatarsus.

4. **POPLITEUS.**—Synonyms. Femoro-tibialis obliq-

uus, (G). Attachments: On the external condyle of the femur, the superior triangular surface of the posterior face of the tibia. Action: Flexor of the leg and rotator inwards.

5. **DEEP FLEXOR OF THE PHALANGES.**—Synonyms. Tibio-phalangeus, (G). Flexor pedis, (P). Great tibio-phalangeus, (L). Attachments: The posterior face of the tibia on its lower triangular surface, the supro-external tuberosity of the same bone, to the fibula, the interosseous ligament of the tibio-fibular joint, and the semilunar crest of the os pedis. Action: Flexes the phalanges on each other and on the metatarsus, and extends the whole digital region on the tibia.

6. **OBLIQUE FLEXOR OF THE PHALANGES.**—Synonyms. Peroneo-phalangeus, (G). Flexor pedis accessorius, (P). Small tibio-phalangeus, (L). Attachments: To the external tuberosity of the superior extremity of the tibia and the tendon of the flexor perforans. Action: Congener of the deep flexor.

ANGIOLOGY.

Arteries.—**FEMORAL** prolongation of the external iliac under the crural crest between the pectineus, the sartorius and the psoas iliacus, runs along the pectineus and the vastus internus, passes between the two branches

of the great adductor of the thigh, through the posterior vascular groove of the femur, and to the superior extremity of the bifemoro-calcaneus muscle where it becomes popliteal. Its collateral branches are: 1—The prepubic, rising with the deep muscular, running through the crural ring on the anterior face of the crural arch, behind the neck of the vaginal sheath, and terminates in the posterior abdominal and the external pubic arteries. The posterior abdominal runs forward between the small oblique and transverse muscles of the abdomen, along the external border of the rectus abdominis, where it ends by anastomosis with the anterior abdominal. The external pubic descends on the posterior wall of the inguinal canal, at the inferior ring of which it ends in the sub-cutaneous abdominal and the anterior dorsal of the penis; the sub-cutaneous abdominal anastomoses with its congener at the umbilicus; the anterior dorsal of the penis passes to the superior border of the penis and ends in ascending branches to the cavernous artery, and descending branches to the erectile tissue at the extremity of the organ. In the female, the dorsal of the penis becomes the mammary, distributed to the mammæ. 2—Deep muscular, or profunda, runs backward between the psoas-iliacus and pectineus muscles, then between the pectineus and the external obturator, under the adductor

of the thigh, behind the femur, and disappears in the crural muscles. 3—The superficial muscular, or great anterior muscular, runs downwards, outwards and forwards, passing between the sartorius, psoas-magnus and iliacus muscles, then between the vastus internus and the straight anterior muscles, and terminates in the triceps cruralis. 4—A number of innominate branches, or small muscular, amongst them the nutritive of the femur. 5—The saphena runs between the two adductors of the leg to the internal face of the limb, or to the surface of the gracilis, where it terminates in two small branches.

POPLITEAL.—Continuation of the femoral; it directs its course downwards between the bodies of the bifemoro calcaneus, under the popliteus muscle and at the tibial arch terminates in the posterior and anterior tibial. Collateral branches: 1—femoro-popliteal, with its ascending and descending terminal ramifications; 2—articular branches; 3—muscular branches.

POSTERIOR TIBIAL.—Situated under the popliteus, the oblique and deep flexors of the phalanges, it runs down to the hock joint and becomes more and more superficial; near the os calcis it runs through the tibial aponeurosis, passes into the tibial arch and at the astragalus ends in the plantar arteries. Collateral branches: 1—musculo-tibial branches; 2—the medul-

lary artery of the tibia; 3—tarsal articular branches; 4—cutaneous branches.

PLANTAR.—One each side of the perforans tendon, they run down in the tarsal arch to the suspensory ligament and anastomose with the perforating pedal artery. Collateral branches: 1—tarsal articular; 2—superficial arteries to the tendons; 3—deep external and internal interosseous plantar arteries.

ANTERIOR TIBIAL.—Runs through the tibial arch on the anterior face of the tibia, under the flexor metatarsi, and at the tibio-tarsal joint becomes the pedal, after sending off collateral muscular branches.

PEDAL.—Passes in front of the hock joint, bending outwards, and on a level with the lower row of bones, divides into perforating pedal and metatarso-pedal arteries.

PERFORATING PEDAL.—Runs through the hock joint and anastomoses posteriorly with the plantar artery of the posterior tibial.

METATARSO-PEDAL.—Passes in the fissure outside of the large metatarsal bone, forward of the external rudimentary one, then to the posterior face of the first named bone above the sesamoid groove, and terminates in the collaterals of the digit or the digital arteries. Collateral branches are tendinous, ligamentous, cutaneous and articular.

DIGITAL.—(See the anterior extremity, page 33).

Veins.—The subungueal network from which rises the two digital veins. To these succeed three metatarsal veins, common origin of all the veins of the leg. These are divided into superficial and deep; two superficial—the saphena, and two deep—the tibial. All empty in the popliteal, which is continued by the femoral, and this by the external iliac, which receives only one important vein, viz.—the circumflex iliac. The external iliac vein uniting with the internal iliac form the primitive iliac or pelvi-crural trunk, which empties into the posterior vena cava.

Lymphatics.—They all converge towards the sub-lumbar ganglions and present in their extent other ganglionic masses constituting the deep and superficial inguinal, popliteal, iliac, and precrural ganglions, to each of which afferent lymphatic vessels arrive, and from which efferent vessels are given off.

NEUROLOGY.

Lumbar Plexus.—Formed by the two last lumbar and three first sacral pairs of nerves, is divided into anterior and posterior portions. The first is concealed by the small psoas muscle, and lies in front of the internal iliac artery. The posterior, on a level with the great sciatic notch, is in connection inwards with

the subsacral blood vessels, outwards and in front with the gluteal vessels. The anterior portion ends in the crural and obturator nerves, and gives off the iliaco-muscular. The posterior is continued by the great sciatic and external popliteal-sciatic nerves, after giving off the small sciatic including the anterior and posterior gluteal nerves.

1. ILIACO-MUSCULAR.—Ramifying in the psoas muscles.

2. CRURAL OR ANTERIOR FEMORAL.—Descends between the small and the great psoas to terminate in the triceps cruralis muscle. Collateral branches: Accessory of the internal saphena and the internal saphena, both becoming sub-cutaneous before terminating.

3. OBTURATOR.—Runs alongside the obturator artery under the internal obturator muscle through the obturator foramen, and ramifies in the deep muscles of the internal crural region.

4. SMALL SCIATIC OR ANTERIOR AND POSTERIOR GLUTEAL.—Anterior gluteal or ilio-muscular: Four or five branches from the two first sacral pairs, going to the middle gluteus muscle. Posterior gluteal or ischio-muscular: Two in number; one, superior, goes to the long vastus; and one, inferior, passes under that muscle, and the semitendinosus towards the ischial tuberosity, where it ends in cutaneous branches.

5. GREAT SCIATIC, OR GREAT FEMORO-POPLITEAL.—

Passes through the great sciatic notch outside the ischiatic ligament, over the small glutens, behind the gemelli of the pelvis and the square crural, bends downwards behind the femur in front of the ischio-tibial muscles, passes between the bellies of the bifemoro-calcaneus, behind the perforatus, reaches the hock, and at the os calcis divides into the external and internal plantar nerves. Collateral branches: 1—The external sciatic-popliteal, or small femoro-popliteal, runs forwards and downwards between the long vastus and the gastrocnemius externus, and on the outside of the superior extremity of the leg terminates in the musculo-cutaneous and anterior tibial branches. The musculo-cutaneous passes under the tibial aponeurosis between the anterior and lateral extensors of the phalanges, becoming subcutaneous to terminate. The anterior tibial runs under the anterior extensor pedis to the front of the hock, with the pedal artery down to the fetlock, where it ends by cutaneous filaments. 2—Branches to the deep muscles of the internal crural region. Leaving the sciatic at the middle of the supra-cotyloid crest, these branches pass behind the coxo-femoral joint and branch off to the muscles. 3—Branches to the posterior crural muscles, rising from the sciatic at the gemelli muscles, and then terminating

by several ramifications. 4—The external saphena passes over the external body of the bifemoro-calca-neous, downwards to the origin of the tendo-Achillis, on the outside of which it passes over to the tarsus and terminates in the metatarsus. 5—Branches to the posterior tibial muscles, several in number, coming from the sciatic as it passes between the gemelli of the leg, and then ramifying in these muscles. 6—Cutaneous branch as it runs along the tendo-Achillis.

PLANTAR.—Situated in the tarsal sheath, behind the perforans tendon, they reach the upper extremity of the metatarsus, and separating from each other run on each side of the tendons of the deep flexors to the fetlock joint, and terminate as those of the anterior extremity.

CHAPTER IV.

HEAD.

OSTEOLOGY.

The **HEAD** is divided into cranium and face.

Cranium.—**DIVISION:** Seven bones—occipital, parietal, frontal, ethmoid, sphenoid and two temporals.

OCCIPITAL.—**DIVISION:** Two faces and a circumference. External face is divided into three parts. Presents parietal crest, occipital protuberance, cervical tuberosity, occipital foramen, basilar process, mastoid crest, muscular imprints, condyles, styloid process, notch, condyloid fossa and foramen. Internal face, concave, forming the posterior cavity of the cranium. Circumference is divided into two anterior and two posterior lateral borders, joined by four angles. Development: four nuclei of ossification.

PARIETAL.—**DIVISION:** Two faces and four borders. External face is convex, and shows the parietal crest

Internal face has digital marks, and the internal parietal protuberance. The borders are divided into superior, inferior and lateral, and are articular. Development: three nuclei of ossification.

FRONTAL.—Division: Two faces and four borders. External face divided into three parts, shows the orbital process, the supra-orbital foramen, and a cavity for the internal oblique muscle of the eye. Internal face is also divided into two parts, superiorly has a median crest and a notch for the sphenoid; inferiorly it opens in the frontal sinuses. Borders: the superior articulates with the parietal, the inferior with the nasal and lachrymal, the lateral has a superior notch for the sphenoid, and one inferior for the orbital foramen. Development: two nuclei of ossification.

ETHMOID.—Division: Perpendicular lamina and two lateral masses. *Perpendicular lamina*: Two faces, flat; four borders: the superior forms the crista-galli process; the inferior, continuous with the septum nasi; the anterior, with the septum of the frontal sinuses; the posterior, with that of the sphenoidal sinuses. *Lateral masses*.—Division: Middle part, base and apex. The external surface of the first is divided into external and internal portions; the internal surface forms the cavities of the volutes. The base has the cribriform plate and the ethmoidal fossa. The

apex forms the inferior extremity of the cells. Development: three nuclei of ossification.

SPHENOID.—Division: Body and wings, two faces and four borders. The external surface, continued with the basilar process, shows the vidian fissure, the vidian canal, the sub-sphenoidal canals, the orbital hiatus, a surface for the orbital cavity. The internal face shows the crista-galli process, the optic fossa, the pituitary fossa, some digital impressions, mastoid fossa, two fissures—one internal cavernous, and one external, both opening in the three super-sphenoidal canals forming the foramen lacerum orbitale, the foramen rotundum magnum and the foramen patheticum. The borders are: superior, articulated with the occipital, and presenting three notches—one internal, the carotid, continuous with the carotid fossa, one external, for the inferior maxillary nerve, and one outward, for the middle meningeal artery; an inferior border assists to form the sphenoidal sinus; two lateral borders, articulated with the frontal. Development: two nuclei of ossification.

TEMPORAL.—Division: Squamous and tuberos portions.

SQUAMOUS.—Two faces and a circumference. The external face shows the zygomatic process with a base having a condyle and a glenoid cavity, an external and an internal face, and an apex; the internal face has a

groove for the parieto-temporal canal. The circumference is divided into an anterior and posterior border. Development: one nucleus of ossification.

TUBEROUS.—Four faces, four borders, a base and an apex. The faces are articular, except the internal, which offers the internal auditory hiatus, the internal opening of the aqueduct of Fallopius. Of the borders, one, the postero-external, forms the mastoid crest and the mastoid process; another, the antero-internal, gives attachments to the tentorium cerebelli. The apex is articular. The base shows the external auditory hiatus, the stylo-mastoid foramen, a sharp subuliform process, the mastoid protuberance, and hyoid process. Development: two nuclei of ossification.

Face—DIVISION: Superior jaw, nineteen bones—great superior maxillary, small superior maxillary, nasal, lachrymal, zygomatic, palate, pterygoid, nasal and maxillary turbinated, and vomer. Inferior jaw, one bone—the inferior maxillary.

GREAT SUPER-MAXILLARY.—DIVISION: Two faces, two borders, and two extremities. The external face presents the maxillary spine and the inferior opening of the super-maxillo-dental canal; the internal face is a part of the maxillary sinus, and exhibits the palatine duct, a crest for attachment of the maxillary turbinated, the palatine process and the palatine fis-

sure. The anterior border is articular; the posterior has the alveolar cavities, the alveolar tuberosity and the inter-dental space. The superior extremity forms the maxillary hiatus, with three openings, the nasal foramen, super-maxillo dental canal, and palatine canal. The inferior extremity has an alveolus for the tusk. Development: one nucleus of ossification.

PRE-MAXILLARY, OR SMALL MAXILLARY.—Division: One body and two processes. Body has three faces—the external, or labial, the internal with a notch to form the incisive canal, and the posterior or buccal. Of the three borders, two are internal, the external has three alveoli for the incisive teeth and one notch for the tusk, between them the interdental space. Processes: the external is the longest and has two faces, two borders and an apex; the internal forms the incisive cleft or opening. Development: one nucleus of ossification.

PALATE.—Division: Two faces, two borders and two extremities. The external face has three regions, one superior or orbital with the staphyloid groove, one inferior, forming the roof of the palate, and one middle, articular. The internal face belongs to the nasal cavities. The anterior border has the nasal foramen, the posterior the palatine crest. The superior extremity articulates with the sphenoid, the inferior with that

of the opposite side. Development: one nucleus of ossification.

PTERYGOID.—Two faces and two extremities; the inferior extremity has a tendinous pulley. Development: one nucleus of ossification.

ZYGOMATIC.—Division: Two faces, two borders, a base and an apex. The external face has two portions, one anterior orbital, one posterior convex; the internal face forms the maxillary sinuses. The anterior border is articular, the posterior shows the zygomatic crest; the base is articular, the apex at the zygomatic arch forms the jugal bridge. Development: one nucleus of ossification.

LACHRYMAL.—Division: Two faces and a circumference. The external face has two regions, one superior or orbital, with the orifice of the lachrymal duct and the lachrymal fossa, and one inferior or facial with the lachrymal tubercle. The internal face forms the maxillary and frontal sinuses. The circumference is articular. Development: one nucleus.

NASAL.—Two faces, two borders, a base and an apex. The external face is smooth; the internal or posterior has a crest for the turbinated bone. The external border articulates above, but is free below to form the nasal spine; the internal is articular, as is the base. Development: one nucleus of ossification.

TURBINATED BONES.—The anterior, superior or ethmoidal, and posterior or maxillary. The internal surface is divided by transverse plates; between these and the surrounding bones are found the three meatuses. Development: one nucleus for each.

VOMER.—Has two faces, smooth, an anterior border grooved, and a posterior sharp superiorly, thick and articular inferiorly; an anterior extremity going to the incisive slit, and a posterior notched and articular. Development: one nucleus of ossification.

INFERIOR MAXILLARY.—Division: Two faces, two borders and two extremities. External face half smooth and half rough, shows below the mental foramen; internal face shows the maxillo-dental canal, the myloid ridge and the glenoid surface. The anterior border is alveolar and divided into two parts; the posterior border has also two parts, and offers the maxillary fissure and maxillary tuberosity. The superior extremity has a condyle, coronoid process and corono-condyloid notch; the inferior forms the body, with an anterior face, buccal, and a posterior, labial. Its circumference has the alveoli for the incisive teeth. The neck of the bone is at the junction of the two branches. Development: two nuclei of ossification.

SYNDESMOLOGY.

Temporo-maxillary joint—Double condyloid. On the temporal, a condyle, glenoid cavity and supra-condyloid process; on the maxillary, a condyle, inter-articular meniscus, capsular ligament. **Motions:** Depression, elevation, lateral motion, horizontal gliding.

Other joints are all synarthrodial, sutura.

MYOLOGY.

Facial Region.—Thirteen muscles.

1. **LABIALIS.**—Synonyms. Orbicularis oris, (P). Attachments: No bony attachments. Action: Constrictor of the lips.

2. **ALVEOLO-LABIALIS.**—Synonyms. Buccinator, (P). Buccinator and molaris, (L). Attachments: Alveolar tuberosity, superior and inferior maxillary. Action: Related to mastication.

3. **ZYGOMATICO-LABIALIS.**—Synonyms. Zygomaticus, (P). Attachments: Surface of the masseter and commissure of the lips. Action: Pulls the commissure backwards.

4. **LACHRYMO-LABIALIS.**—Synonyms. Not mentioned by P. Inferior palpebral, (L). Attachments: Lachrymal and zygomatic bones, cellular fascia covering the alveolo-labialis. Action: Corrugates the skin below the eye.

5. **SUPERNASO-LABIALIS**.—Synonyms. Levator labii superioris alæque nasi, (P). Fronto-labialis, (L). Attachments: Frontal and nasal bones, external alæ of the nose and commissure of the lips. Action: Elevates the alæ of the nose, the upper lip and the commissure.

6. **SUPER-MAXILLO-LABIALIS**.—Synonyms. Nasalis longus labii superioris, (P). Attachments: Super-maxillary and zygomatic bones to upper lip with its congener. Action: Raises the upper lip directly or sideways.

7. **GREAT SUPER-MAXILLO-NASALIS**.—Synonyms. Dilatator naris lateralis, (P). Attachments: The external face of the superior maxillary and the external wing of the nostril. Action: Dilates the external orifice of the nasal cavity.

8. **SMALL SUPER-MAXILLO NASALIS**.—Synonyms. Nasalis brevis labii superioris, (P). Attachments: The premaxillary bone, the nasal spine, and the skin of the false nostrils, which it dilates.

9. **TRANSVERSALIS NASI**.—Synonyms. Dilatator naris anterior, (P). Attachments: Nasal cartilages. Action: Dilatator of the nostrils.

10. **MIDDLE (INTERMEDIATE) ANTERIOR**.—Synonyms. Depressor labii superioris, (P). Incisive muscle of the upper lip, (L). Attachments: The pre-maxillary, and anterior appendix of the inferior turbinated bone.

Action: Dilatator of the entrance of the nasal fossa.

11. **MAXILLO-LABIALIS.** Synonyms. Depressor labii inferioris, (P). Inferior maxillo labialis, (L). Attachments: Anterior border of the lower jaw and the skin of the lower lip. Action: Pulls the lower lip down directly or on one side.

12. **MENTO-LABIALIS.**—Forms the base of the rounded protuberance beneath the lower lip. No bony attachment.

13. **MIDDLE (INTERMEDIATE) POSTERIOR.**—Synonyms. Levator menti, (P). Incisive muscle of the lower lip, (L). Attachments: External surface of the body of the lower jaw and to the mento-labialis. Action: Elevator of the lower lip.

Masseterine Region.—Five muscles.

1. **MASSETER.**—Synonyms. Zygomatico-maxillaris, (G). Attachments: Zygomatic crest, upper half of external surface of inferior maxillary branch. Action: Elevator of the lower jaw.

2. **TEMPORAL.**—Synonyms. Temporo-maxillaris, (G). Attachments: Temporal fossa, orbital hiatus, coronoid process and anterior border of the branch of the lower jaw. Action: Elevates the jaw.

3. **INTERNAL PTERYGOID.**—Synonyms. Pterygoid-eus internus, (P). Attachments: The palatine crest, subsphenoidal process, hollow of the internal face of the

branch of the lower maxillary. Action: Elevates and moves the jaw laterally.

4. **EXTERNAL PTERYGOIDEUS.**—Attachments: Inferior face of the sphenoid, subsphenoidal crest, neck of the condyle of the inferior maxillary. Action: Pulls the maxilla forward directly or sideways.

5. **DIGASTRICUS.**—Synonyms. Stylo-maxillaris, (G). Attachments: Styloid process of the occipital, curved portion of the lower maxilla, internal face of same bone, and straight portion of its posterior border. Action: Pulls the jaw backwards, and at the same time depresses it.

SPLANCHNOLOGY.

Nasal Cavities.—Number, two. Division: Nostrils, nasal fossa proper and sinuses.

NOSTRILS.—Two lips or borders united by two commissures. The superior commissure shows the false nostrils; the inferior the opening of the lachrymal duct. Structure: cartilages; muscles, viz: the transversalis nasi, pyramidalis nasi, super-maxillo-nasalis parvus, middle anterior, and supernaso-labialis; integuments; blood vessels, viz: superior coronary, nasal and palato-labial arteries; nerves, branches of the fifth and seventh cranial pairs.

NASAL FOSSÆ PROPER.—Divisions: Four walls and

two extremities. The superior wall or roof; the inferior or floor with Jacobson's apparatus; the lateral external with the turbinated bones and meatuses; the middle meatus having an opening of communication with the sinuses; the lateral internal is formed by the septum nasi. The anterior extremity forms the nostrils; the posterior looks into the pharynx. Structure: nasal, maxillary, frontal, palate, ethmoid and turbinated bones, middle septum of the nose; pituitary membrane; blood vessels, the ophthalmic and nasal arteries; nerves, first and fifth pairs of cranial nerves.

SINUSES.—Five: the frontal, sphenoidal, ethmoidal and two maxillary. All communicate through the middle meatus. The inferior maxillary sinus opens by itself into the nasal fossa. They are all lined by mucous membrane and develop with age.

Buccal Cavity.—Division: Six regions.

a. Lips. Superior and inferior, united by commissures. Two faces; two borders, one adherent and one free. Structure: skin, mucous membrane, muscles, viz: the orbicularis, super-maxillo labialis, super-naso labialis, great super-maxillo nasalis, tufts of the chin and posterior intermediate; glands, the labial; blood vessels, the palato-labial and coronary arteries; nerves, the fifth and seventh cranial pairs.

b. CHEEKS. Two faces, on the internal the opening of Stenon duct. Structure: skin, mucous membrane; muscles, viz: the alveolo-labialis, and the masseter; blood vessels, the maxillary, coronary and buccal arteries; nerves, the fifth and seventh pairs of cranial nerves.

c. PALATE. Its face is covered with about twenty furrows curved backwards. Structure: bone, the palate and great maxillary; membranes, one fibrous, one mucous; vessels, the palato-labial artery; nerves, fifth pair of cranial nerves.

d. TONGUE.—Situated in the lingual canal and attached to the hyoid apparatus.

HYOID APPARATUS, HYOID BONE.—Formed of seven pieces, a body and three branches. The body has an anterior process or spur, and two lateral branches. It is developed by three nuclei of ossification. The branches; two small, with articular facets at both extremities; two long, with faces smooth; an anterior and posterior border; one inferior extremity articulated with the middle nucleus or third branch; one superior articulated with the temporal bone.

MUSCLES.—Five in pairs, and one single.

1. **MYLO-HYOIDEUS.**—Attached to mylo-hyoid line of the inferior maxillary, to anterior appendix of the body of the hyoid bone, which it elevates.

2. **GENIO-HYOIDEUS.**—Attached to the genial surface and to the anterior opening of the body of the hyoid bone which it draws forward.

3. **STYLO-HYOIDEUS.**—Synonyms. *Hyoidens magnus*, (P). *Kerato-hyoideus magnus*, (L). Attached to the supero-posterior angle of the long branch, to the cornua of the os hyoides, which it draws backwards.

4. **KERATO-HYOIDEUS.**—Synonyms. *Hyoidens parvus*, (P). *Small kerato-hyoideus*, (L). Attached to the posterior border of the cornu and the extremity of the styloid bone, to the superior border of the thyroid wing. Action: Brings the two branches together.

5. **OCCIPITO-HYOIDEUS.**—Attached to the styloid process of the occipital, the superior border of the long branch of the hyoid. Action: Swings the bone downwards and backwards.

6. **TRANSVERSALIS-HYOIDEUS.**—Attachments: Superior extremity of the small branches. Action: Brings them together.

EXTERNAL CONFORMATION OF THE TONGUE.—Three faces, three borders and two extremities. Superior face, papillæ, foramen coecum of Morgagni; lateral faces, large papilla and opening of the lingual glands. The two superior borders are thick; the inferior is fixed at the bottom of the intermaxillary space; the anterior extremity or free part is attached to the maxillary by

the anterior pillar or *froenum linguae*; the posterior extremity shows a median mucous fold going to the epiglottic cartilage; two lateral folds called the posterior pillars of the tongue, and the amygdaloid cavities. Structure: mucous membrane with filiform, fungiform and calciform papillae. Muscles: five.

1. **STYLO-GLOSSUS.**—Synonyms. *Hyo-glossus longus*, (P). *Kerato-glossus externus*, (L). Attachments: External surface of the long branch of the hyoid and near the tip of the tongue. Action: Pulls the tongue backwards or sideways.

2. **GREAT HYO OR BASIO-GLOSSUS.**—Synonyms. *Hyo-glossus brevis*, (P). *Hyo-glossus*, (L). Attachments: The extremity of the cornu and the anterior apex of the hyoid bone to near the superior face of the tongue, which it retracts.

3. **GENIO-GLOSSUS.**—Synonyms. *Genio hyo-glossus*, (P). Attached to the lower jaw near the symphysis, and to the upper surface of the tongue. Action: Carries the tongue forwards, backwards and downwards in the buccal cavity.

4. **SMALL HYO-GLOSSUS.**—Synonyms: *Lingualis*, (P). Attachments: Inner side of the articulation of the two branches of the hyoid bone, to the superior face and sides of the tongue. Action: Contracts and retracts the tongue.

5. **PHARYNGO-GLOSSUS.**—Attachments: The lateral walls of the pharynx and posterior part of the tongue. Glands: racemose and follicular. Blood vessels, the lingual and sub-lingual arteries. Nerves, the lingual, glosso-pharyngeal and great hypo-glossus.

e. **SOFT PALATE**—**VELUM PENDULUM PALATI.**—Two faces: the anterior united to the tongue by the posterior pillars of that organ; the posterior or pharyngeal with longitudinal ridges. Two lateral borders: one anterior, all attached on bones; one posterior border, embracing the epiglottic cartilage with the two posterior folds, forming the posterior pillars of the velum palati. It closes the isthmus of the fauces. Structure: a fibrous membrane and four muscles:

1. **PHARYNGO-STAPHYLEUS.**—Synonyms. Palato-staphyleus, (P). Attachments: Continuous to the fibrous membrane. Action: Stretches the velum palati.

2. **PALATO-STAPHYLEUS.**—Synonyms. Staphyleus, (G). Circumflex palati, (P). Attached to the palatine arch and the free border of the septum, which it raises.

3. **PERYSTAPHYLEUS EXTERNUS.**—Synonyms. Tensor palati, (P). Attachments: The styloid process of the temporal, and fibrous layer of the velum palati. Action: Tensor and depressor.

4. **PERYSTAPHYLEUS INTERNUS.**—Synonyms. Stylo-pharyngeus, (P). Attachments: Same as above. Act-

ion: Elevator of the soft palate. Glands: situated on the anterior face directly under the mucous membrane. Mucous membranes: two in number, one on the anterior and one on the posterior face. Blood vessels, the pharyngeal and staphyline arteries. Nerves, fifth pair of cranial nerves and ganglion of Meckel.

f. TEETH.—Definition: passive organs of mastication.

General characters: general disposition form two parabolic arches interrupted on each side by interdental space. These arches present the incisive teeth in front, the tusks behind them, and the molars in the lateral and posterior parts of the dental arches. External conformation: they have a root or fang encased in an alveolus, and a crown exposed. Structure: Ivory or dentine forming the base of the tooth, and surrounds the internal cavity which is filled by the pulp; it is hollowed with canaliculi, imbedded in amorphous matter. Enamel forms the outside covering of the free part of the tooth, consisting of little prismatic hexagonal rods denticulated on their faces. Cement irregularly spread over both the ivory and enamel, with the structure and properties of spongy bone-substance. Dental pulp, fibrillar and nuclear mass filling the internal dental cavity, and receiving blood vessels and nerves. The gum, a portion of the buccal mucous membrane, surrounds the neck of the tooth. An

alveolar dental periosteum lines the cavity of the alveolus and the external face of the cement of the fang. Development: the dental follicle, or a membrane containing at its bottom the dental pulp and having in its upper part the enamel germ, attached to the gubernaculum dentis. Considering their epoch of development, teeth are divided into caducous, temporary or milk, and replacing or persistent teeth.

INCISORS.—Six in each jaw. Divided into pincers, middle teeth or nippers, intermediate or dividers, and corners. The superior surface exhibits the external dental cavity which, when worn, shows the central and surrounding enamels; and in older animals the dental star, and latter the internal dental cavity, obliterated.

CANINES OR TUSKS.—Two in number, are found, in solipeds, in males only: they seldom are shed, and grow but once.

MOLARS.—Twelve on each jaw; six on each side. The surface of these teeth is inclined from inwards outwards for the lower jaw, and vice versa for the upper one. They present the aspect of a grinding surface, made irregular by the arrangement and projection of the enamel. The first three molars are caducous.

Eye.—Organ of sight, is composed of accessory and essential organs.

ACCESSORY ORGAN—ORBITAL CAVITY.—Formed by the orbital process, the frontal, lachrymal, zygomatic bones, and part of the zygomatic process of the temporal. It is closed by the ocular sheath, a fibrous envelop attached on the orbital hiatus and forward on the internal face of the orbit, and surrounding the seven muscles of the globe of the eye.

1. **POSTERIOR RECTUS OR RETRACTOR-OCULI.**—Attachments: Round the optic foramen, external face of the sclerotic. Action: Pulls the globe backwards.

2. **SUPERIOR, INFERIOR, EXTERNAL AND INTERNAL RECTI.**—Attachments: In the bottom of the ocular sheath, and external surface of the sclerotic. Action: Turns the pupillary opening upwards, downwards, outwards or inwards.

3. **GREAT OBLIQUE OR OBLIQUUS SUPERIOR OCULI.**—Attachments: The bottom of the orbit and the external surface of the sclerotic. Action: Pivots the eye inwards and upwards.

4. **SMALL OBLIQUE OR OBLIQUUS INFERIOR OCULI.**—Attachments: The lacrymal fossa and external face of the sclerotic. Action: Pivots the eye outwards and downwards.

EYE-LIDS.—One superior, and one inferior. They have two surfaces, and are lined internally by the conjunctiva forming the conjunctival sinus; they have

two borders united by commissures or canthi, the free border showing the openings of the Meibonian glands. Structure: 1—fibrous plate having on its free border 2—the tarsus; 3—muscles, the orbicularis-palpebrum and orbito-palpebrum; 4—integuments represented by the skin and conjunctiva; 5.—eye-lashes; 6—Meibonian glands.

MEMBRANA NICTITANS OR THIRD EYELID, OR WINKING EYELID.—A fibro cartilage situated at the inner angle of the eye.

LACHRYMAL APPARATUS—LACHRYMAL GLAND.—Situated on the snperior face of the globe, having numerous ducts called hygrophthalmic canals.

LACHRYMAL CARUNCULA.—A round body in the nasal angle of the eye.

PUNCTA LACHRYMALIS.—Little openings on each eyelid at the nasal commissure.

LACHRYMAL DUCTS.—Continuation of the puncta, and emptying in the

LACHRYMAL SAC.—Little reservoir lodged in the lachrymal fossa and continuous with the lachrymal duct; opening at the lower commissure of the nostrils by one and sometimes two orifices.

ESSENTIAL ORGAN—GLOBE OF THE EYE.—Divided into membranes and humours or media.

MEMBRANES—1. SOLEROTIC.—Two faces, the external

covered by the muscles and adipose tissue, the internal lined by the choroid. The anterior opening is continuous with the cornea, the posterior is run through by the optic nerve. Structure: connective tissue mixed with elastic fibres and pigment.

2. CORNEA.—Two surfaces and a circumference. Structure: three layers; an external, the conjunctival epithelium; a middle, composed of fasciculi of conjunctival fibrilla, between which is a liquid amorphous substance; and an internal, portion of the membrane of the aqueous humour.

3. CHOROID.—Divided by the ora serrata into two zones, one posterior or choroid, internally in contact with the retina and externally with the sclerotic; one anterior or ciliary, formed by ciliary circle, and a ciliary body, from which hangs the ciliary processes. Structure: four layers; an external, composed of connective and elastic fibres with pigmentary cells; a second layer, vascular and nervous, with pigmentary cells; a third layer, or of Ruysch, formed of amorphous substance; and an internal layer, composed of hexagonal cells containing pigment.

4. IRIS.—A septum in front of the crystalline lens, with the pupil in its centre, through which appears the "soot-balls" or corpora nigra, portions of the uvea which covers the posterior face of the iris.

Structure: a proper membrane with unstriped muscular fibres, an anterior epithelial layer, and a posterior epithelial or uvea.

5. RETINA.—An expansion of the optic nerve. **Structure:** connective tissue forming the external and internal limiting membrane and nerve elements, forming seven layers: 1—one of rods and cones; 2—external granular; 3—intermediate; 4—inner granular; 5—molecular; 6—ganglionic; 7—of fibres of optic nerves.

HUMOURS OR MEDIA.—Crystalline lens, transparent lens, enveloped by the crystalline capsula; vitreous humour covered by the hyaloid membrane; aqueous humour secreted by the membrane of Descemet or Demours.

Ear.—Division: External, middle and internal ear.

EXTERNAL.—Composed of: 1—external auditory canal, formed by the petrous portion of the temporal bone; 2—the concha or pavillion formed by the conchal, annular and scutiform cartilages, and moved by ten muscles: 1—Zygomatico auricularis. Synonyms. Attolens anterior, (P). Temporo-auricularis, (L). Attachments: Zygomatic process of the temporal base of the concha and external border of the scutiform cartilage. Action: Pulls the ear forward. 2—Temporo-

auricularis externus Synonyms. **Attolens maximus**, (P). Attachments: The parietal crest and the internal border of the scutiform and conchal cartilages. Action: Adductor of the concha. 3—**Scuto-auricularis externus**. Synonyms. **Anterior conchæ**, (P). Attachments: External face of the scutiform and the internal side of the concha. Action: Rotator outwards. 4—**Three cervico-auricularis**. Synonyms. **Retrahentes aures**, (P). Attachments: The cervical ligament, the superficial to the posterior face of the concha, the middle on the outside of the base, and the deep at the base of the conchal cartilage. Action: Pull the ear backwards and in rotation outwards. 5—**Parotido auricularis**. Synonyms. **Abducens or depri-mens aures**, (P). Attachments: The parotid gland and at the base of the concha. Action: abductor of the external ear. 6—**Temporo-auricularis internus**. Synonyms. **Attolens posterior**, (P). Attachments: On the median crest origin of the parietal crest, and on the internal side of the concha. Action: Abductor of the ear. 7—**Scuto-auricularis internus**. Synonyms. **Posterior conchæ**, (P). Attachments: On the internal face of the scutiform and at the base of the concha. Action: Pivots the ear outwards and backwards. 8—**Mastoido-auricularis**. Attachments on the rim of the external auditory hiatus and the base of the concha.

Action: Constricts the cartilaginous tube of the ear.

MIDDLE EAR OR TYMPANUM.—Division: An external wall formed by the membrana tympani, an internal with the fenestra ovale separated by the promontory from the fenestra rotunda. The circumference is occupied by the mastoid cells. Internally are found four bones, the malleus, incus, orbiculare and stapes; they are moved by the internal muscle of the malleus and the muscle of the stapes; this cavity is lined by a fine mucous membrane and communicates with the pharynx by the Eustachian tube or guttural ducts of the tympanum, a long canal cleft inferiorly, through which the mucous membrane escapes and descends to form the guttural pouches.

INTERNAL EAR OR LABYRINTH.—Division: Osseous labyrinth; 1—a vestibule with eight orifices, the fenestra ovale, five openings of the semi-circular canals, the opening of the scala cochlea and the foramina for the branches of the acoustic nerve; 2—the semi-circular canals, divided into superior, posterior and external. 3—The cochlea or snail shell twisted round the modiolus and divided by the lamina spiralis into superior and inferior scalæ.

MEMBRANOUS LABYRINTH.—1. Membranous vestibule: formed by two sacs, the superior or utriculus, and the inferior or sacculus; and composed of two layers, the

external cellular, the internal epithelial. 2—Membranous semi-circular canals, corresponding to the osseous canals. 3—Membranous cochlea, forming three cavities: one inferior tympanic, one superior or vestibular, one middle or auditory, containing the organ of Costi.

FLUIDS of labyrinth: that of the membranous labyrinth, or endolymph; that of the osseous labyrinth, or peri-lymph.

Cranium.—Formed by the frontal, parietal, occipital, ethmoid, sphenoid and temporal bones. Division: Four planes and two extremities. Superior plane presents the internal occipital protuberance with its lateral and median crests. Inferior plane, the basilar groove, pituitary fossa, optic fossa, foramen lacerum, cavernous sinuses, maxillary fissures and mastoid fossa. Lateral planes covered with digital impressions. Posterior extremity, occipital foramen. Anterior extremity, the crista-galli process, the ethmoidal fossa and the cribriform plate of the ethmoid.

It is lined by three meninges: The external or **DURAMATER**, a fibrous membrane forming three folds: the falx cerebri between the cerebral hemispheres, which, in old animals, has as its posterior extremity the Pacchionian glands or meningeal granulations; the tentorium cerebelli between the cerebrum and cerebellum; the

suprasphenoid or pituitary fold, which circumscribes the sella turcica. The cranial dura mater is more or less adherent to the bone, and is lined by the parietal layer of the arachnoid ; it gives prolonged sheaths to the nerves.

The middle or ARACHNOID is a serous membrane with a parietal and a visceral layer, enclosing a cavity by its internal face, perforated by the roots of the nerves and blood vessels. It shows filaments uniting it to the pia mater ; passes over the circumvolutions of the encephalon, leaving spaces or confluent containing the sub-arachnoid fluid, a slightly yellow or colorless but limpid and transparent liquid.

The internal or PIA MATER, a cellulo-vascular structure, which, by its external face, furnishes the neurilemma of the nerves and filamentous threads to the dura mater. From its internal face rise blood vessels dipping into the nervous substance.

Encephalon.—Volume, closely that of the cranium. Weight, about twenty-two or twenty-three ounces. Division : Isthmus, cerebrum and cerebellum.

ISTHMUS.—*a.* External surface : four faces and two extremities. Inferior face presents annular protuberance or pons Varolii or mesocephalon, crura-cerebri or pedunculum cerebri, rachidian bulb or medulla oblongata ; superior face shows the upper face of the

medulla oblongata, pedunculum cerebelli or crura cerebelli, valve of Vieussens, corpora quadrigemina and thalami optici; lateral faces present the profile of the medulla oblongata, of the pons Varolii, of the pedunculum cerebri and cerebelli, of the corpora quadrigemina and thalami optici; posterior extremity is continuous with the spinal marrow; anterior extremity passes into the corpora striata.

1. **MEDULLA OBLONGATA.**—Division: Four faces: inferior shows the corpora pyramidalia, a transverse band, some arciform fibres, the corpus olivare, the origin of the sixth cranial pair, of glosso pharyngeal and of the pneumogastric; superior face is covered by the cerebellum, forms the floor of the fourth ventricle and shows the calamus scriptorius and the corpora restiforma; lateral face exhibits the profile of the corpora restiforma and corpora pyramidalia.

2. **PONS VAROLII** with its two borders and two extremities, which form the middle crura cerebelli.

3. **CRURA CEREbRI.**—Separated from each other by the interpeduncular fissure which bifurcates to circumscribe forward the mamillary or pisiform tubercle, limited behind by the pons Varolii, in front by the optic nerves, laterally and above by the corpora quadrigemina and thalami optici; it forms laterally the band of Reil or lateral triangular fasciculus.

4. **CRURA CEREBELLI.**—Three in number. The middle is the largest; the posterior the smallest: they dip directly into the cerebellum.

5. **VALVE OF VIEUSSENS.**—Thin lamella, uniting the two anterior cerebellar peduncles.

6. **CORPORA QUADRIGEMINA.**—Anteriorly the tubercula nates, and posteriorly the testes uniting outwardly to the corpus geniculatum externum.

7. **THALAMI OPTICI.**—Inclined inwardly to form a deep fissure containing the anterior peduncles of the pineal gland; this fissure presents at its extremities the anterior and posterior common openings; outwardly shows the corpus geniculatum externum and internum; in front it exhibits the semi-circular band or tænia semi-circularis.

8. **PINEAL GLAND OR CONARIUM.**—Reddish-brown mass resting on the posterior common opening.

9. **PITUITARY GLAND.**—Synonyms. Hypophysis cerebri, supra sphenoidal appendage; fixed to the interpedunculum fissure by the pituitary stem and tubercinereum.

(b.) **INTERNAL CONFORMATION.**—Three cavities. 1.—Middle ventricle of the thalami optici. Division: Two walls, a floor, a roof with the anterior and posterior common openings separated by the grey commissure. The posterior extremity is continuous with the aque-

duct of Sylvius ; the anterior presents the lamina cinerea or grey root of the optic nerves ; 2—Aqueduct of Sylvius posteriorly opens into the fourth ventricle ; 3—Posterior cerebellar or fourth ventricle closed superiorly by the valve of Vieussens and of Renault.

(c.) **STRUCTURE**: formed of three fasciculi of white substance, a superior or corpora restiforma, an inferior or corpora pyramidalia and a lateral or intermediate ; the grey substance is found in the floor of the fourth ventricle, the crura cerebri, the lateral or intermediate fasciculi of the bulb, the corpora quadrigemina, the thalami optici and in the annular protuberance.

CEREBELLUM.—(a.) External surface : one middle lobe forming the anterior and posterior vermiform processes ; two lateral lobes, beneath which the choroid cerebellar plexus is applied. Its external surface is covered with sulci ; (b.) Internal surface on section shows the arbor vitæ and corpus rhomboideum. Structure : the white substance is internal and ramifying, the grey substance forms cortical layer.

CEREBRUM.—Division : Two lateral hemispheres. (a.) External surface shows : 1—Interlobular or longitudinal fissure, which extends down to the corpus callosum and is bound posteriorly by the fissure of Bichat, and lodges the great vena Galeni and falx cerebri ; 2—cerebral hemispheres, with four faces covered with con-

volution, and showing the mastoid lobe, the fissure of Sylvius and the olfactory or ethmoidal lobes ; an anterior extremity lodged in the ethmoidal fossa, a posterior resting on the cerebellum.

(b.) Internal surface. 1—Corpus callosum, an arch thrown over the lateral ventricles uniting the two hemispheres, and offering on its superior face the tractus longitudinalis ; 2—lateral or cerebral ventricles. Division : An anterior and a posterior or reflexed portion ; they are separated by the septum lucidum, a thin median lamella, standing vertically between them, and by the fornix or trigonum cerebri, which serves to support the septum. On the floor of the lateral ventricles are seen from forward backwards ; 1—the corpora striata, showing inwardly and posteriorly the tænia semi-circularis in which floats the choroid plexus ; 2—the hippocampi or cornu Ammonis, occupying the floor of the anterior region of the lateral ventricle, and is prolonged in its reflected portion and having their external extremities resting on the mastoid lobes ; 3—the velum interpositum or choroid plexus, a vascular expansion of the pia mater penetrating in the ventricles by the transverse fissure. A fine membrane, the ventricular arachnoid, lines the cavity of the ventricles ; it secretes a liquid analogous to the cerebro-spinal fluid. Structure : the grey substance forms the cortical layer

of the cerebral convolutions. The white substance forms in the hemisphere the centrum ovale of Vieussens.

Intermaxillary space or throat.—**PHARYNX.**—Its cavity presents seven openings: two for the nasal cavities; two for the Eustachian tubes; one for the larynx; one for the œsophagus, and one for the isthmus of the throat or of the fauces. Structure: 1—a mucous membrane covered by yellow elastic fibres; 2—seven muscles; *a.* palato pharyngeus or pharyngo-staphyleus (described in soft palate); *b.* Pterygo pharyngeus or superior constrictor. Synonyms. Palato pharyngeus. Attachments: Pterygoid process, posterior and superior face of the pharynx. Action: Perfect constrictor of the pharynx; *c.* Hyo-pharyngeus or first middle constrictor; *d.* Thyro-pharyngeus or second middle constrictor; *e.* Crico-pharyngeus or inferior constrictor. Attachments; The first to the corner of the os hyoides, the second from the external surface of the thyroid cartilage, the third from the cricoid cartilage, and all three ending on the median fibrous line above the pharynx, are all constrictors of the pharynx; *f.* Aryteno-pharyngeus. Attachments: The posterior border of the arytenoid to the origin of the œsophagus; *g.* Stylo-pharyngeus. Attachments: Inside the great branch of the hyoid bone to the side of the pharynx. Action: Dilator. 3—Blood vessels, the pharyngeal and thyroid

arteries. 4—Nerves: glosso-pharyngeal, pneumo-gastric, great sympathetic.

Larynx.—Structure: five cartilages. 1—Cricoid, with an external face, presenting two concave articular facettes, and an internal face smooth; a superior and inferior circumference; 2—Thyroid. Division: A body and two wings, the superior border of which presents a mean of articulation with the hyoid and a notch for the superior laryngeal nerve; 3—Epiglottic, with two faces, two borders, a summit and a base, the borders having prolongations or cartilages of Wrisberg extending backwards; 4—Arytenoid, two, whose external face is divided by a ridge in two portions; superior and anterior borders unite with their congeners; posterior border projects into the larynx; and inferior gives attachments to the vocal cord.

ARTICULATIONS.—1—the thyroid cartilage to the hyoid bone, by the extremities of the cornua and through the medium of the thyro-hoid membrane;—2 the thyroid and cricoid cartilages by two small arthrodia and the crico-thyroid membrane; 3—the two arytenoids by their superior borders; 4—the arytenoid and the cricoid cartilages by small movable arthrodia; 5—arytenoid to the thyroid by the vocal cords; 6—the epiglottic to the thyroid cartilages by amphiarthrosis; 7—the epiglottic to the arytenoids by the

superior vocal cords ; 8—the cricoid cartilages to the trachea by the crico-tracheal elastic membrane.

MUSCLES.—Three extrinsic : 1—Sterno-thyroideus (see inferior cervical region) ; 2—Hyo-thyroideus. Attachments : Whole extent of the hyoid cornu, external face of the thyroid cartilages. Action : Carries the larynx forward and upward ; 3—Hyo-epiglottideus. Attachments : Superior face of the body of the hyoid bone, and antero-inferior face of the epiglottic cartilages. Action : Pulls the epiglottic cartilage to normal position. Five intrinsic : 1.—Crico-thyroideus. Attachments : from the cricoid to the posterior border of the thyroid, it shortens the larynx ; 2.—Posterior crico-arytenoideus. Attachments : bezel of the cricoid, the median crest and the posterior tubercle of the arytenoid, it dilates the entrance of the larynx ; 3—Lateral crico-arytenoideus. Attachments : Side of the anterior border of the cricoid, and tubercle of the arytenoid cartilage, it constricts the larynx ; 4—Thyro-arytenoideus. Attachments : Internal surface of the ala of the thyroid and on the arytenoid ; it is a constrictor of the larynx ; 5—Arytenoideus. Attachments : Median raphe and the superior part of the external face of the arytenoid ; it constricts the larynx.

Mucous membrane covered with stratified tessalated epithelium on the epiglottis and the vocal cords, ciliated

elsewhere. Blood vessels: laryngeal arteries. Nerves: the superior and inferior laryngeal, furnished by the pneumo-gastric.

The external surface of the larynx offers four planes: a superior, inferior and two laterals.

The internal surface offers three regions: a middle, the glottis; a superior, the supra-glottis, and an inferior, the sub-glottis. The first is comprised between the vocal cords; the second shows the two ventricles of the larynx, the sub-epiglottic sinus and the entrance of the larynx; the third exhibits the posterior border of the vocal cords and the sub-arytenoid sinus.

Salivary glands.—1. **PAROTID.** Division: Two faces, two borders and two extremities. External face shows a longitudinal groove for the jugular vein, and is covered by the parotido auricularis muscle. Internal face covers the guttural pouch, the insertion of the small oblique muscle of the head and mastoido humeralis, occipito-hyoideus, styloid bone, digastricus, sterno-maxillaris, maxillary gland, external carotid artery and facial nerve. Anterior border rests on the temporo-maxillary joint, subzygomatic vessels and nerves and maxillo-muscular vessels. Posterior border is separated from the wing of the atlas by the levator humeri. Superior extremity embraces concha. Inferior extremity is comprised in the angle formed by the jugular

and glosso-facial veins. Blood vessels: small arterioles. Nerves: facial, inferior maxillary and carotid plexuses.

Duct of Stenon lays on tendon of the sterno-maxillaris, enters the intermaxillary space, alongside the internal masseter, above the glosso-facial vein; reaches the maxillary fissure; runs up in front of the anterior border of the external masseter, obliquely forward under the glosso-facial vein and artery; passes through the cheek to open opposite the third upper molar.

2. MAXILLARY OR SUB-MAXILLARY.—Division: Two faces, two borders and two extremities. External face corresponds to the internal pterygoideus, the digastricus, the sterno-maxillaris and the cellulo aponeurosis, which separates it from the parotid. Internal face applied to the side of the larynx, the guttural pouch, the carotid artery and nerves accompanying it. Superior border margined by the digastricus. Inferior border is in contact with the glosso-facial vein. Posterior extremity rests on the wing of the atlas. Anterior extremity is between the pterygoideus internus and the hypo-thyroideus muscles. Vessels: innominate branches. Nerves: from the carotid plexus.

Duct of Wharton runs from between the mylo-hyoid-eus and great hypo-glossus, crossing outwards the glosso-facial artery and great hypo-glossal nerve, inwardly,

the digastricus and the lingual nerve, passes between the stylo-glossus and the sub-lingual gland, to end in front of the frænum of the tongue.

3. **SUBLINGUAL.**—Division: Two faces, two borders, and two extremities. External face covered by the mylo-hyoideus. Internal face rests on the duct of Wharton, the stylo and genio-glossus muscles. Superior border forms the lingual crest. Inferior border lays between the mylo-hyoideus and the genio-glossus muscles. Posterior extremity receives the lingual nerve. Anterior extremity runs to the angle of the inferior maxillary bone.

Ducts of Rivinus, fifteen or twenty open on the lingual crest. Blood vessels, sublingual artery. Nerves, lingual and carotid plexus.

4. **MOLAR.**—Superior, along the superior border; and inferior along the inferior border of the buccinator.

5. **LABIAL, LINGUAL, STAPHYLINE OR PALATINE,** in the lips, tongue and velum palati.

ANGIOLOGY.

Arteries.—The three terminal branches of the primitive, or common carotid: 1—occipital: 2—internal; 3—external carotid.

a. **OCCIPITAL ARTERY** runs under the transverse process of the atlas, behind the guttural pouch, between

the maxillary gland and the anterior straight muscle of the head, reaches the anterior foramen of the atlas, runs through it into the fissure of the external surface and terminates by the occipito-muscular and cerebro-spinal arteries. Its collateral branches are:

1. **PREVERTEBRAL**.—Terminating by muscular and meningeal branches.

2. **MASTOID**.—Going to the parieto-temporal canal to anastomose with the spheno-spinal.

3. **ATLOIDO MUSCULAR**.—Running backwards and through the atlas to anastomose with the vertebral.

Terminal branches: **OCCIPITO MUSCULAR**.—Terminating by ascending and descending branches, the last anastomosing with the superior cervical.

CEREBRO-SPINAL.—Penetrates the antero-internal foramen of the atlas, enters the vertebral canal, and terminates by two branches—one forming the basilar trunk, the other the median spinal.

BASILAR TRUNK.—Situated on the inferior face of the bulb and pons Varolii, and dividing into two branches which give off the posterior cerebral artery. It sends collateral branches to the bulb and pons Varolii, the posterior and anterior cerebellar arteries, and two branches to the internal carotid.

POSTERIOR CEREBRAL terminate the basilar trunk.

They are given off behind the maxillary tubercle and receive the posterior communicating artery.

MEDIAN SPINAL follows the spinal marrow, backwards to its end, being supplied by branches from the vertebral, intercostal, lumbar and lateral sacral.

b. INTERNAL CAROTID.—Ascends beneath the cranium to the foramen lacerum, reaching through the carotid fossa of the external surface of the sphenoid, the carotid notch of the superior border, and then into the cranium by a double flexure, terminates by the posterior communicating artery, which anastomoses with the posterior cerebral, and by another branch which furnishes the middle and anterior cerebral.

c. EXTERNAL CAROTID.—Continuation of the primitive carotid, runs forward to the posterior border of the long branch of the hyoid bone, passes between it and the stylo-hyoideus, bends upward, and near the neck of the maxillary bone divides into its terminal branches—the superficial temporal and internal maxillary. Its collateral branches are the glosso-facial, the maxillo-muscular and posterior auricular.

1. GLOSSO-FACIAL.—Rises from the external carotid as it passes beneath the stylo-hyoideus, turns downwards on the side of the pharynx in the intermaxillary space, enters the maxillary groove, becomes superficial on the anterior border of the masseter muscle, to the

lateral surface of the face, and divides into ascending and descending branches ramifying in the muscles of that region. Its collateral branches are: 1—Pharyngeal, terminating in the velum palati and the walls of the pharynx; 2—Lingual, goes to the tongue in its upper portion, anastomosing in front with that of the opposite side, forming a large arch; 3—Sublingual, supplies lower part of the tongue and the buccal mucous membrane; 4—Inferior coronary, supplies the lower lip and muscles of the inferior part of the lateral surface of the face; 5—Superior coronary, goes to the upper lip, where it anastomoses with the palate.

2. **MAXILLO-MUSCULAR.**—Passes between the parotid gland and the posterior labial border of the maxillary bone, where it divides into an external superficial and an internal deep, branches going to the masseter muscles.

3. **POSTERIOR AURICULAR.**—Passes upwards under the parotid to the base of the concha, passing on its posterior face to the superior extremity, sending off a few glandular and muscular branches.

SUPERFICIAL TEMPORAL.—Passes upwards between the parotid, guttural pouch and the condyle of the maxillary bone, to terminate in the anterior auricular and sub-zygomatic trunk.

ANTERIOR AURICULAR.—Running behind the temporo-maxillary joint beneath the parotid, to reach the cropaphite muscle, and after giving glandular, auricular and muscular branches terminates.

SUB-ZYGOMATIC.—Passes outwards between the anterior border of the parotid and the posterior border of the maxillary bone with the facial nerve, and divides into the transversal artery of the face, which runs horizontally on the superior border of the external masseter and ramifies in it, and into the masseteric, going to the same muscle.

INTERNAL MAXILLARY.—Running to the subsphenoidal canal, it passes through to the orbital hiatus and arriving at the maxillary opening dips into the palatine canal as the palato-labial. Collateral branches: 1—inferior dental, traverses the inferior maxillo-dental canal to end at the mental foramen in two small twigs, one external anastomosing with the inferior coronary, one deep to the roots of the incisive teeth and tusk. It sends collateral branches to the molar teeth and muscles of the masseteric regions; 2—pterygoid, going to the pterygoid and peristaphilæus muscles; 3—tympanic, to the tympanum with branches to the guttural pouches; 4—spheno-spinal, enters the temporo-parietal canal to anastomose with the mastoid artery of the occipital; 5—posterior deep temporal, to the

crotaphite muscle in the temporal fossa; 6—anterior deep temporal, in the crotaphite also, and the adipose tissue of the fossa; 7—ophthalmic, from the ocular sheath, return into the cranium through the orbital foramen, and divides into meningeal and nasal branches. The orbital portion gives off muscular branches, central artery of the retina, ciliary, supra orbital and lachrymal; the cranial portion, the cerebral branches; 8—buccal, supplies the molar glands, the buccinator and the maxillo-labialis muscles; 9—staphyline, to the velum palati; 10—superior dental, goes to the superior maxillo-dental canal, and distributed like the inferior dental; 11—nasal, runs through the nasal foramen into the nasal fossa, where it ends by external and internal branches.

PALATO-LABIAL, passes from the maxillary hiatus to the palatine canal, through it to the front part of the palate, to the incisive foramen where it anastomoses with the opposite one, forming a single trunk, which, passing through the incisive foramen, reaches the upper lip and terminates by anastomoses with the superior coronary.

Veins.—Three principal trunks: superficial temporal, internal maxillary and sinuses of the encephalic dura mater; they form the root of the jugular.

1. **SUPERFICIAL TEMPORAL.**—Satellite of the temporal

arterial trunk with two principal roots, the anterior auricular and the sub-zygomatic.

2. **INTERNAL MAXILLARY.**—Supplied by the buccal vein. It receives numerous collateral branches, viz: the lingual, inferior dental, a deep temporal trunk and a pterygoid.

3. **CEPHALIC SINUSES** of the dura mater.—Four principal: the sinuses of the falx cerebri, the cavernous or sphenoidal, the occipito-atloid and the rudimentary sinuses, divided into lateral and inferior median. These sinuses are supplied from the dura mater or from nervous substance; some of the last are superficial, the others, internal, are provided by the great vein of the brain or vena Galeni. All the sinuses collect through the means of the parieto-temporal and subsphenoidal confluents, and empty into the temporal, pterygoid and occipital veins.

Other veins of the head considered as affluents of the jugular, are: 1—the maxillo-muscular; 2—the posterior auricular; 3—the occipital; 4—the external maxillary or glosso-facial, formed by the angular of the eye and another small branch, by the alveolar, labial or coronary, buccal and sublingual as collateral branches.

Lymphatics.—Two groups: 1—The pharyngeal, situated on the lateral sides of the pharynx below the

guttural pouch, and receiving all the lymphatics of the head ; 2—The submaxillary, situated in the intermaxillary space, and receiving the lymphatics of the tongue, cheeks, lips, nostrils and nasal fossæ.

NEUROLOGY.

Twelve pair of cranial nerves.

1. OLFACTORY.—Formed by the olfactory lobe, which has the appearance of a ganglion, grey inferiorly, and white superiorly. It rises by two roots of white substance, which unites into one band, and is situated in the ethmoidal fossa, where through the foramina of the cribriform plate of the ethmoid, it sends the true nerves. The olfactory lobes are hollowed, and communicate with the cavity of the lateral ventricles. The nerves, varying in number, ramify in the mucous membrane of the septum nasi and ethmoidal volutes. They are the special nerves of the organs of smell.

2. OPTIC.—Rise on the external side of the thalami optici by white bands, and from the corpora quadrigemina. Course: Pass in front of the cerebral peduncles, arrive at the inferior face of the brain, form the chiasma, reach the optic duct, and perforate the ocular envelope at the bottom of the ocular globe, and enter

the eye as the retina. They are exclusive to the sense of sight.

3. **COMMON OCULO MOTOR.**—Emanates from the cerebral peduncles near the peduncular fissure by eight branches. Course: The single trunk of the nerve runs outwards to the smallest supra sphenoidal canal, passes through the orbital hiatus, and ramifies in the muscles of the eye, except the external and posterior recti and the great oblique. Functions: Essentially motor.

4. **PATHETIC OR INTERNAL OCULO MOTOR.**—Rises from the band of Reil behind the corpora quadrigemina by two roots. Its course is outwards, downwards and forwards to reach the smallest of the susphenoidal canals, penetrate the outer sheath and ramify in the great oblique muscle of the eye. Functions: Motor.

5. **TRIGEMINI OR TRIFACIAL.**—Is a mixed nerve, having an external root, sensitive, and an internal, motor.

SENSITIVE ROOT.—The largest comes from the annular protuberance; it runs forward and downwards to the occipito-spheno-temporal hiatus, and terminates in the Gasserian ganglion. This ganglion is crescent shape, and situated in the cartilaginous substance which closes the foramen lacerum; it gives origin to two branches, one passes out of the cranium, the other is lodged in the external fissure of the cranial face of the sphenoid and bifurcates; thus at its origin is divided

into three branches, the ophthalmic and superior maxillary nerves, the inferior maxillary nerve.

MOTOR ROOT.—Runs forward from the pons Varolii under the inferior face of the ganglion of Gasser, and soon mingles with the inferior maxillary branch of the sensitive root.

a. **OPHTHALMIC.**—Course: Enters the sphenoidal canal with the third and fourth pairs, and in it divides into the frontal, lachrymal and nasal or palpebro-nasal nerves; the frontal going to the orbital foramen, the lachrymal ramifying in the lachrymal gland, the nasal reenters the cranium with the ophthalmic artery, runs through the plate of the ethmoid into the nasal fossa, where it divides.

b. **SUPERIOR MAXILLARY.**—Origin: Internal and superior portion of the Gasserian ganglion. Course: Placed in a groove on the internal face of the sphenoid, soon reaches the largest sphenoidal canal, runs to the orbital hiatus, passes through the supra-maxillo-dental canal, where it dips and runs as far as the lateral surface of the face, where it terminates by suborbital branches. Collateral branches: The orbital to some muscles of the eye; the great or anterior palatine to the palatine groove and to the palate; the staphyline or posterior palatine to the velum palati; the nasal or sphenopalatine to the pituitary membrane; the dental

to the teeth of the superior jaw. Terminal branches : The suborbital to the skin and muscles of the nostrils and upper lip.

c. INFERIOR MAXILLARY.—Course: leaving the cranium, it passes inside the temporo-maxillary joint, runs forwards and downwards towards the maxillo-dental canal, through which it passes and comes out at the mental foramen and terminates in the mental nerves. Collateral branches: 1—the masseterine, to the masseter muscle after giving off the posterior deep and middle deep temporal; 2—the buccal, for the lateral face of the cheek after furnishing the anterior deep temporal; 3—the nerve of the internal pterygoid muscle; 4—the superficial temporal or sub-zygomatic, which anastomoses with the facial; 5—the lingual, to the tongue; 6—the nerve of the mylo-hyoideus muscle; 7—dental branches to the teeth of the inferior jaw. Terminal branches to the inferior lip united with a branch of the facial nerve.

6. EXTERNAL OCULO-MOTOR.—Origin: on the rachidian bulb behind the annular protuberance. Course: runs through the sphenoidal canal to the orbit, ramifying in the external rectus of the eye.

7. FACIAL.—Motor at its origin, it becomes mixed afterwards. Origin: from the bulb immediately behind the pons Varolii. Course: outwards, takes the

internal auditory hiatus to the aqueduct of Fallopius, through the stylo-mastoid foramen, then under the parotid, to the posterior border of the maxillary bone, on the external face of the masseter and terminates by the zygomatic plexus. Collateral branches: 1 and 2—the great and small superficial petrosal nerve; 3—the nerve of the muscle of the stirrup; 4—the nerve of the corda tympanii, all to the internal ear; 5—an anastomotic branch to the pneumogastric; 6—the nerve of the stylo-hyoides muscle; 7—of the digastricus; 8—of the great kerato-hyoides; 9—a cervical branch; 10—nerves to the guttural pouches and to the parotid gland; 11—the three auricular nerves, posterior, middle and anterior. Terminal branches form the sub-zygomatic plexus, over the external surface of the masseter muscle and ramifying in the tissue of the cheeks, lips and nostrils.

8. AUDITORY OR ACOUSTIC.—Origin: From the bulb by two branches, one from the restiform bodies, the other from the floor of the fourth ventricle. Course: Passes behind the seventh into the internal auditory hiatus, and divide in two branches, anterior and posterior, ramifying into the cochlea, the vestibulum and semicircular canals.

9. GLOSSO PHARYNGEAL.—Origin: On the side of the bulb between the restiform bodies and the lateral

fasciculus of the bulb, by eight or ten roots, uniting to form the petrous ganglion. Course: Downwards with a curve concave forward, behind the great branch of the hyoid bone, between the guttural pouches and masseter muscle, runs alongside the hyoid bone and reaches the base of the tongue, where it terminates. Collateral branches: 1—The nerve of Jacobson, giving off the great and small deep petrosal; 2—Branches to the superior cervical ganglion; 3—Branch to the cardiac plexus; 4—a pharyngeal nerve to the superior wall of the pharynx.

10.—PNEUMOGASTRIC OR PAR VAGUM.—Origin: Two roots: the sensitive from the grey mass near the floor of the fourth ventricle behind the glosso-pharyngeal, then passes out of the cranium to the jugular ganglion; the motor root rises more posteriorly from the middle of the respiratory track, runs also outwards and goes to the jugular ganglion, which is elongated, flattened from above below and imbedded in the cartilaginous mass closing the foramen lacerum. Course: After its connection with the ganglion, the mass is united to the spinal, but soon separates from it, leaves the glosso-pharyngeal pass between them alongside and behind the guttural pouches, crosses the occipital artery, unites with the cervical portion of the great sympathetic, passes into the thorax, and then separates from this.

last nerve. In the chest the right nerve turns obliquely round the axillary artery to place itself outside the trachea until the root of the bronchia, where it ends; the left nerve remains attached to the artery, crosses outwards the origin of the aorta, and terminates by branches which give rise to the bronchial plexus and oesophageal nerves. Collateral branches: 1—Branches to the superior cervical ganglion; 2—The pharyngeal to the superior face of the pharynx; 3—The superior laryngeal to the susglottic portion of the larynx; 4—Branches to inferior cervical ganglion; 5—Inferior laryngeal or recurrent nerves, which rise from the tenth into the thoracic cavity, and run forwards and upwards into the larynx, where they divide into the muscles and mucous membrane of the subglottic portion. Terminal branches: Bronchial plexus going to the mucous membrane of the bronchia; oesophageal, divided into superior and inferior, the last terminating in the walls of the stomach; the former into the left sac of that organ, and the solar plexus.

11. SPINAL OR ACCESSORIUS.—Origin: from the cervical marrow, runs upwards and forwards in the vertebral canal till it reaches the tenth pair, with which it comes out of the cranium. Course: first united to the par vagum, it soon leaves it, runs backwards, passes under the maxillary gland, arrives at the posterior

border of the levator humeri ; downwards to the front of the shoulder, then turns upwards under the cervical trapezium muscle and terminates in the dorsal portion of the same ; while it gives several muscular branches, it receives some from the first, second, third, fourth and fifth, and sometimes sixth, cervical pairs.

12. **GREAT HYPOGLOSSUS.**—Origin : from the inferior face of the bulb, by twelve roots, which run through the dura mater by two or three fasciculi and then unite into one trunk. Course : after first communicating with the first cervical pair, it passes between the tenth and eleventh cranial pairs, runs downwards alongside the guttural pouches, communicates with the superior cervical ganglion, goes outside the external carotid on the side of the pharynx and larynx, dips between the mylo-hyoideus and basio-glossus and terminates in the tongue.

Sympathetic Nerve—**CEPHALIC PORTION** is composed of three ganglions : the ophthalmic, resting on the common oculo-motor nerve, is very small ; the sphenopalatine or ganglion of Meckel, varying in disposition, generally found under the superior maxillary nerve, it is the largest of the three ; the otic or ganglion of Arnold, not always present ; when it exists, it is inside the origin of the inferior maxillary nerve.

CHAPTER V.

TRUNK.

Supporting the head at the anterior extremity and terminating posteriorly by the tail ; it has for base, on the median line a series of bones called *vertebræ*, and is composed of three cavities : the thoracic ; the abdominal, separated by the diaphragm muscle ; and the pelvic cavity, a dependance of the abdominal.

Vertebræ—GENERAL CHARACTERS.—They are single bones perforated by the vertebral foramen, which in the series forms the vertebral canal. Division : A body and annular portion. The body has two faces : one superior with two triangular surfaces and two grooves for venous sinuses ; the inferior with a crest sometimes called the inferior spinous process. It has two extremities : an anterior with a round head more or less prominent, one posterior with a cavity for the reception of the head. The annular portion has an internal surface, concave and forming the vertebral foramen ;

and an external, presenting the superior spinous process and two transverse processes. In front and behind are found two articular facets, and at their base notches for the formation of the foramina of conjugation. Development: two principal and five secondary centers.

In the vertebral canal is found the SPINAL MARROW. It is covered by the three membranous envelopes, dura mater, arachnoid and pia mater. It is a thick, white, hollow mass, continuation of the medulla oblongata, and ending in a point at the anterior third of the sacral canal. Weighing about ten ounces, it is slightly depressed from above below, and presents a brachial and lumbar enlargements or bulbs where the nerves of the fore and hind extremities are given off. Its external surface shows on the superior and inferior face a deep fissure, and on each side of these, two others scarcely noticeable. Its internal structure shows that it is hollow, and presents in its middle a mass of grey matter surrounded by white substance. They are so arranged that the superior and inferior fissures of the external surface are separated by a white and a grey commissure, the last tending upwards and downwards towards the surfaces of the organ prolongations or cornua. The medulla receives blood from arteries of the pia mater, and branches of the median spinal artery.

CHAPTER VI.

N E C K .

OSTEOLOGY.

Seven cervical vertebræ.

GENERAL CHARACTERS: They are the longest and thickest of all; the inferior spinous process of the body is well developed; the head well detached; the cavity very deep and larger than the head it receives; the superior spinous process is a rough crest; the transverse processes are very large, bending downwards and perforated at their base by the trachelian foramen; the articular facets are plano-convex and very wide; the foramen of conjugation very large.

SPECIFIC CHARACTERS: *First*, or ATLAS is very large and more flat; the body is quite small; its inferior spinous process is replaced by a tubercle; its superior face is divided into a surface for ligamentous attachment, and an articular surface; it has no head nor cavity behind; in their stead are found forward two deep cavities formed by four concave facets for articulation with

the occipital; behind are two plano convex facets for articulation with the axis; it has no superior spinous process, but a rough surface; its transverse processes are very wide and have three foramina. Development: six nuclei of ossification.

Second, or AXIS.—The longest of all; has no head but the odontoid process: the inferior spinous process is sharp; the superior thick and bifid behind; the transverse process is sharp and has a single tubercle; it has no articular facets forward, and shows a deep notch sometimes a foramen in front of the body.

Third. The space between the anterior and posterior articular processes is deep.

Fourth. These are then united by a thin edge.

Fifth. There by a rough, thick crest. In all three the transverse processes are bitubercular.

Sixth. Transverse processes tritubercular.

Seventh, or PROMINENT has a superior spinous process very high, no inferior one, a concave facet on the border of the posterior cavity; the transverse processes are unitubercular; no trachelian foramen; the vertebral canal is very large.

SYNDESMOLOGY.

GENERAL ARTICULATIONS.—That of body: Amphiarthrosis. Articular surfaces: Head and cavity of the

body. Means of union: Fibro-cartilage and a superior and inferior common vertebral ligament.

That of the annular part: Double arthrodia. Articular surfaces: Articular facets. Means of union: Inter-spinal ligament, inter annular ligament, two capsular, superior spinal ligament (cervical portion) or ligamentum nuchæ, composed of a funicular cord and two median sheets of yellow elastic tissue. Motion: Sliding.

SPECIAL ARTICULATIONS—Atlanto-occipital: Condylod. Articular surfaces: Two condyles of the occipital, two cavities in front of the atlas. Ligaments: One capsular with four reinforcing bands. Two synovial capsulæ, one for each condyle and cavity. Motion: Flexion, extension, lateral inclination and circumduction.

AXOIDO-ATLANTOID.—Trochoid or lateral ginglymus. Articular surfaces: A groove on the superior face of the body of the atlas, and two facets on each side of it, the inferior face of the odontoid process of the axis and the two facets laterally. Ligaments: Superior and inferior atlanto-axoid ligaments, odontoid ligament, one capsular. One synovial capsula. Motion: Rotation.

MYOLOGY.

Superior region: Seventeen muscles.

1. **CERVICAL TRAPEZIUM**.—(See dorsal region, described as cervical portion of the trapezium.)

2. **RHOMBOIDEUS**.—Synonyms. *Rhomboideus longus* and *brevis*, (P). *Cervico-subscapularis*, (G). *Dorso-scapularis*, (L). Attachments: The funicular portion of the cervical ligament, the apex of the spinous processes of the second, third, fourth, fifth or sixth dorsal vertebræ, the internal face of the cartilage of the scapula. Action: Draws the shoulder upwards and forwards.

3. **ANGULARIS SCAPULÆ**.—Synonyms. *Trachelo-subscapularis*, (G). Anterior portion of the *serratus magnus*, (P). Attachments: The transverse processes of the five last cervical vertebræ, the anterior triangular surface of the internal face of the scapula. Action: Pulls the scapula forward, may assist in the lateral inclination of the neck.

4. **SPLenius**.—Synonyms. *Cervico-trachelian*, (G). Attachments: The *ligamentum nuchæ*, the summit of the spinous processes of the first dorsal vertebræ, the mastoid crest of the occipital, the transverse processes of the atlas, and that of the third, fourth and fifth cervical vertebræ. Action: Extensor of head and neck.

5. **GREAT COMPLEXUS**.—Synonyms. *Dorso-occipitalis*, (G). *Complexus major*, (P). Attachments: The summit of the spinous processes of the first dorsal vertebræ, the transverse processes of the two first dorsal, the articular tubercles of the cervical vertebræ,

the posterior face of the occipital protuberance, on each side of the cervical tuberosity. Action: Extensor of the head.

6. **SMALL COMPLEXUS.**—Synonyms. Dorso-mastoidens, (G). Trachelo-mastoidens, (P). Attachments: The transverse processes of the two first dorsal vertebræ, the articular tubercles of the cervical vertebræ, the mastoid process of the temporal, the transverse process of the atlas. Action: Extensor of the head, which is carried sideways.

7. **TRANSVERSE SPINOUS OF THE NECK.**—Synonyms. Dorso-spinalis, (G). Spinalis colli, (P). Attachments: On the five last articular tubercles of the cervical vertebræ, the superior spinous processes of the sixth, fifth, fourth, third and second cervical vertebræ. Action: Extensor and inclinor of the neck.

8. **SIX INTERTRANSVERSAL OF THE NECK.**—Synonyms. Inter-cervical, (G). Not described by P. Attachments: Upon the transverse and articular processes of the cervical vertebræ, except the first. Action: Incline the neck on one side.

9. **GREAT OBLIQUE OF THE HEAD.**—Synonyms. Axoido-atloideus, (G). Obliquus capitis inferior, (P). Attachments: The spinous process of the axis, the transverse process of the atlas. Action: Rotator of the atlas and head.

10. **SMALL OBLIQUE OF THE HEAD.**—Synonyms. *Atloldo-mastoidens*, (G). *Obliquus capitis superior*, (P). *Lateral atloldo-occipitalis*, (L). Attachments: To the styloid process and external face of the occipital bone, near and on the mastoid crest. Action: Inclines and extends the head.

11. **POSTERIOR GREAT STRAIGHT OF THE HEAD.**—Synonyms. Long and short *axoido-occipitalis*, (G). *Rectus capitis posticus major* and *complexus minor*, (P). Attachments: Spinous process of the axis, on the occipital bone. Action: Extensor of the head.

12. **POSTERIOR SMALL STRAIGHT OF THE HEAD.**—Synonyms. *Atloldo-occipitalis*, (G). *Rectus capitis posticus minor*, (P). *Atloldo-occipitalis superior*, (L). Attachments: The superior face of the atlas, external face of the occipital. Action: Extensor of the head.

Inferior region.—Eleven muscles.

1. **SUBCUTANEOUS OF THE NECK.**—Synonyms. Portion of the *panniculus carnosus*, (P). Attachments: *Trachelian* cartilage of the sternum, the lateral surfaces of the superior cervical muscles, the zygomatic crest. Action: Braces the muscles of the neck and pulls the commissure of the lips backwards.

2. **MASTOIDO-HUMERALIS.**—Synonyms. *Levator humeri*, (P). Attachments: The mastoid process and crest, the humerus, the transverse processes of the

four first cervical vertebræ. Action: Carries the anterior leg forward or inclines the head and neck to one side.

3. **STERNO-MAXILLARIS.**—Attachments: The anterior extremity of the sternum, the posterior border of the maxillary. Action: Flexes the head directly or to one side.

4. **STERNO-HYOIDEUS.** 5. **STERNO-THYROIDEUS.**—Synonyms. Sterno-thyro-hyoideus, (P). Attachments: The anterior extremity of the sternum, the body of the hyoid bone, the thyroid cartilage. Action: Depressors of the hyoid bone and of the larynx.

6. **OMO OR SUBSCAPULO-HYOIDEUS**—Synonyms. Subscapulo-hyoideus, (P). Attachments: On the inner surface of the subscapularis muscle, body of hyoid bone. Action: Depressors of the hyoid and larynx.

7. **GREAT ANTERIOR STRAIGHT OF THE HEAD.**—Synonyms. Trachelo-sub-occipitalis, (L). Rectus capitis anticus major, (P). Trachelo-occipitalis, (L). Attachments: The transverse processes of the third, fourth and fifth cervical vertebræ, the sphenoid bone and basilar process of the occipital. Action: Flexes the head directly or to one side.

8. **SMALL ANTERIOR STRAIGHT OF THE HEAD.**—Synonyms. Atloldo-sub-occipitalis, (G). Rectus capitis anticus minor, (P). Atloldo-occipitalis inferior, (L).

Attachments: The body of the atlas, the basilar process of the occipital. **Action:** Coöperates to flex the head.

9. **SMALL LATERAL STRAIGHT.**—Synonyms. Atloido-styloideus, (G). Obliquus capitis anticus, (P). **Attachment:** To the atlas, the styloid process of the occipital. **Action:** Congener of the other straight muscles.

10. **SCALENUS**—Synonyms. Costo-tracheleus, (G). **Attachments:** The transverse processes of the four last cervical vertebræ, the superior extremity, anterior border and external face of the first rib. **Action:** Flexes the neck directly or to one side, or acts as an assistant to respiration.

11. **LONG MUSCLE OF THE NECK.**—Synonyms. Subdorso-atloideus, (G). Longus colli, (P). Dorso-atloideus, (L). **Attachments:** The body of the first six dorsal vertebræ, the transverse processes, and the inferior spinous processes of the first six cervical vertebræ, the tubercle of the inferior face of the atlas. **Action:** Flexor of the neck and of the cervical vertebræ individually.

SPLANCHNOLOGY.

Trachea.—Cartilaginous tube extending from the larynx to the base of the heart, where it divides into the right and left bronchia. **Form:** Cylindroid, slightly

flattened from above below. Connections: In the neck, with the œsophagus, carotid arteries, pneumo-gastric, sympathetic and recurrent nerves; in the thorax, above to the longus colli and œsophagus, below to the bronchial trunks, the anterior aorta, anterior vena cava, cardiac and recurrent nerves, base of the heart; on the sides, to the inferior cervical ganglion of the sympathetic, to the vertebral, superior cervical and dorsal arteries and to the anterior mediastinum; on the right to the vena azygos; on the left, to the cross of the aorta and the thoracic duct. Structure: It consists of about fifty cartilaginous rings, united by inter-cartilaginous ligament, lined by a mucous membrane covered by ciliated epithelium, containing muscular fibres, and receiving blood vessels from the carotid and the bronchial trunks, nerves from the recurrent and sympathetic.

Œsophagus.—Form: A long membranous tube connecting the pharynx with the stomach, it is placed above and to the left of the trachea, passes into the thorax over the base of the heart, to the right pillar of the diaphragm, terminating at the stomach in the cardiac opening. Connections: At its origin, is situated between the guttural pouches and the larynx; in the neck, above between the trachea and the longus colli; on each side the carotid artery and its nerves; below,

with the trachea, scalenus muscle, blood vessels and nerves of the neck; and on the left side with the jugular vein; in the thorax with the inferior cervical ganglion and its branches; the vertebral, superior cervical, and dorsal arteries and veins, with the left bronchia, aorta, lung, œsophageal artery and nerves. Structure: Two coats of muscular fibres, a mucous membrane with longitudinal folds, œsophageal arteries and branches of the pneumo-gastric nerve.

Thyroid Gland.—Composed of two ovoid lobes, one on each side of the first two rings of the trachea, united by a small band running in front of the trachea. Structure: A fibrous envelope, parenchymatous mass, branches of the thyro-laryngeal and thyroid accessorius arteries and nerves from the first and second cervical pairs.

ANGIOLOGY.

Arteries.—PRIMITIVE CAROTID.—Branches of the cephalic trunk: Running along the trachea to the guttural pouches and the larynx, where it terminates in the arteries of the head. (See page 102.) Collateral branches: Innominate to the œsophagus, the trachea and the cervical muscles; the thyro-laryngeal, which runs downwards to the thyroid gland and sends branches to the larynx, and the thyroid accessorius to the thyroid body by its posterior extremity.

Veins.—The jugular, formed by the superficial temporal and the internal maxillary vein, runs downwards and backwards in the inferior extremity of the neck, and terminates with the axillary vein to the gulf of the jugulars. In connection above with the parotid gland, below with the subscapulo hyoideus, panniculus carnosus, trachea and to the left side the œsophagus.

Lymphatics.—They come from the pharyngeal to the prepectoral ganglion or directly to the great lymphatic vein.

NEUROLOGY.

EIGHT CERVICAL RACHIDIAN PAIRS.—The superior roots go to the muscles of the superior cervical region and the cervico and tempero-auricularis muscles; the inferior roots of the six first pairs anastomose and form by their branches the superficial cervical plexus; they ramify upon the sides of the neck and the muscles of the chest. The seventh and eighth unite together, and with the two first dorsal form the brachial plexus.

Sympathetic—SUPERIOR CERVICAL GANGLION.—Elongated and fusiform; it runs along the internal carotid artery in a fold of the guttural pouches in front of the transverse process of the atlas, and in connection with the ninth, tenth, eleventh and twelfth pairs of

cranial nerves forming the guttural plexus. Afferent branches come from the cranial nerves; efferent branches, to the internal carotid to form the cavernous plexus; to the primitive carotid, to form the carotid plexus; to the fauces and the pharynx, forming the pharyngeal plexus. VAGUS NERVE, single without collateral branches united intimately to the pneumogastric, runs down with it and ends at the INFERIOR CERVICAL GANGLION. This ganglion, larger than the superior, is situated on the inside of the scalenus muscle, is of various forms, sometimes single or double forming the middle inferior ganglion. Afferent branches come from the cervical pairs; efferent branches, form the cardiac nerves (five in number), and in front of the trachea the tracheal plexus.

CHAPTER VII.

. THORAX.

OSTEOLOGY.

Dorsal Vertebrae.—GENERAL CHARACTERS: Body very short; head wide and somewhat flattened; cavity is not deep, two small concave articular surfaces on each side; superior spinous processes are very high and inclined backwards; transverse processes are unitubercular with a flat diarthrodial facet; the articular facets are situated at the base of the spinous process; the posterior notches are very deep.

SPECIFIC CHARACTERS.—The vertical diameter increases and the lateral diminishes from forward backwards, the articular surfaces of the body are wider and flatter as they go backwards, the inferior spinous process is well developed forward, disappears from the sixth to the ninth, reappears and increases to the last, the intervertebral cavities diminish from the first to the last, the superior spinous processes increase to the

fifth, then diminish to the last; their obliquity is less pronounced as it is more posterior, the articular facets are closer to the median line, going towards the tenth, and increase to the last; the transverse processes, as well as the articular surfaces, diminish from forward backwards; the last has no facets on the posterior border.

Ribs.—Elongated bones, eighteen on each side, leaving between them the intercostal spaces, and being prolonged downwards by the costal cartilages.

GENERAL CHARACTERS.—Division: A middle part and two extremities. Middle part: External face has a groove in front and muscular impressions above. Internal face is concave and smooth. The anterior border is concave and sharp, the posterior convex, thick and with vasculo-nervous fissure. The superior extremity has a head formed of two convex facets, separated by a groove and a tuberosity with a flat diarthrodial facet. The inferior extremity has a small irregular cavity. Development: three nuclei, one for the head, one for the tuberosity, one for the balance of the bone.

SPECIFIC CHARACTERS.—Division: Eight sternal or true ribs, ten asternal or false ribs; their length increases from the first to the ninth, then diminishes to the last, their width increases from the first to the sixth, then diminishes backwards, their curve is shorter and

more marked as it is more posterior, the groove of the external face becomes less marked as the rib is narrower.

FIRST RIB—Has no groove on the external face, no fissure between the facets of the head, shows large muscular impressions on the external face, and an articular facet on the inferior extremity of the internal face.

LAST RIB—Has no groove externally, the facet of the tuberosity and the posterior facet of the head are united.

Costal Cartilages.—Those of the eight first ribs rest on the sternum by a facet after articulating above with the inferior extremity of the rib. Those of the false ribs are united with their corresponding ribs by their inferior extremity, which terminates in a point, and rests directly upon each other.

Sternum.—Situation: under the thorax. Division: Three faces, three borders, two extremities. The superior face is concave and triangular; the lateral face is divided into a superior portion which shows diarthrodial cavities and an inferior portion for muscular attachments. The lateral border separates the latter from the superior face; the inferior border is convex, thin and resembles the keel of a ship. The anterior extremity forms the trachelian prolongation; the pos-

terior extremity forms the xyphoid cartilage flattened from above below. Structure: bony and cartilaginous. Development: six nuclei.

SYNDESMOLOGY.

INTERVERTEBRAL joints. (See cervical region, page 120.)

VERTEBRO-COSTAL.—Arthrodia.—Formed by the facets of the head of the ribs and the cavities on each side of the body of two adjacent vertebræ. Ligaments: interarticular and inferior peripheric. Two synovial capsulæ. Motion, sliding.

COSTO-TRANSVERSAL.—Arthrodia. — Articular surfaces. Facets on the tuberosity of the rib and transverse process of the posterior vertebræ. Ligaments: posterior and anterior transverse costal; one synovial capsula. Motion, sliding.

CHONDRO-COSTAL.—Synarthrodial. Articular surfaces, inferior extremity of the rib and superior extremity of the cartilage. Ligament: the periosteum.

CHONDRO-STERNAL.—Arthrodia. Articular surfaces: the inferior extremity of the true ribs and the cavities of the sternum. Ligaments: superior and inferior sterno-costal. One synovial capsula.

CHONDRO-CHONDRAL.—Attached by some yellow elastic ligament.

MYOLOGY.

Spinal Region.—Seven pairs.

1. **TRAPEZIUM.**—Synonyms: Dorso and cervico-acromialis, (G). Attachments: The funicular cord of the cervical ligament, the apex of the superior spinous process of the first dorsal vertebræ, the tuberosity of the acromion and external surface of the scapular aponeurosis. Action: Raises the shoulder and carries it forwards or backwards.

2. **GREAT DORSAL**—Synonyms: Dorso-humeralis, (G). Latissimus dorsi, (P). Attachments: The apex of the spinous process of all the lumbar and fourteen or fifteen last dorsal vertebræ, internal tuberosity of the humerus. Action: Carries the arm backwards and upwards.

3. **SMALL ANTERIOR SERRATED.**—Synonyms: Dorso-costalis, (G). Superficialis costarum, (P). Anterior serrated, (L). Attachments: The summit of the spinous process of the thirteen dorsal vertebræ following the first, the external face of the anterior border of the nine ribs following the fourth. Action: Inspiratory.

4. **SMALL POSTERIOR SERRATED.**—Synonyms. Lumbocostalis, (G). Superficialis costarum, (P.) Posterior serrated, (L). Attachments: The spinous processes of

the last dorsal vertebræ from the tenth, the lumbar vertebræ, posterior border and external face of the nine last ribs. Action: Expiratory.

5. **ILIO-SPINALIS.**—Synonyms. Longissimus dorsi, (P). Attachments: The lumbar border, external angle and internal face of the ilium, sacro-iliac ligament, sacrum, spinous processes of all the lumbar, dorsal, and last four cervical vertebræ, articular facets of the lumbar vertebræ, the transverse processes of all the dorsal and last four cervical vertebræ, costiform processes of the lumbar vertebræ, external surface of the fifteen or sixteen last ribs. Action: Extensor of the vertebral column; may act as an expirator.

6. **COMMON INTERCOSTAL.**—Synonyms. Trachelocostalis, (G). Transversal costarum, (P.) Attachments: The external face of the ribs, transverse process of the last cervical vertebræ. Action: Depresses the ribs.

7. **TRANSVERSE SPINOUS OF THE BACK AND LOINS.**—Synonyms. Transverso-spinous, (G). Spinalis and semi-spinalis dorsi, (P). Attachments: The lateral border of the sacrum, the articular processes of the lumbar and transverse processes of the dorsal vertebræ, spinous processes of the sacral, lumbar, dorsal and last cervical vertebræ. Action: Extensor of the spine.

Costal Region.—Fifty-four pairs.

1. **GREAT SERRATUS.**—Synonyms. Costo-subscapularis, (G). Posterior portion of the serratus magnus, (P). Attachments: The external face of the eight true ribs, the anterior and posterior triangular surfaces of the internal face of the scapula. Action: Suspensor of the trunk, and may act as inspirator.

2. **TRANSVERSE OF THE RIBS.**—Synonyms. Costosternalis, (G). Lateralis sterni, (P). Attachments: Sternum, fourth costal cartilage and external face of the first rib. Action: Expiratory.

3. **SEVENTEEN EXTERNAL INTERCOSTALS.**—Attachments: Posterior border of the preceding to external face of succeeding rib. Action: Inspiratory.

4. **SEVENTEEN INTERNAL INTERCOSTALS.**—Attachments: Anterior border of the posterior to posterior border and internal face of the anterior rib. Action: Expiratory.

5. **SEVENTEEN SUPERCOSTALS.**—Synonyms. Transverso-costalis, (G). Levatores costarum, (P). Attachments: Transverse processes of the dorsal vertebræ and external face of the ribs. Action: Inspiratory.

6. **TRIANGULARIS OF THE STERNUM.**—Synonyms. Sterno-costalis, (G). Sterno-costalis, (P). Attachments: Superior face of the sternum and internal face of the cartilages of the true ribs except the first. Action: Expiratory.

MUSCULAR ATTACHMENTS of the anterior extremity to the trunk.

Pectoral or Axillary Region.—1. **SUPERFICIAL PECTORAL.**—Synonyms. Pectoralis transversus, (P). Division: 1—Sterno-humeralis. Attachments: Anterior appendix and inferior border of the sternum, anterior crest of the humerus. Action: Adductor of the fore-arm. 2—Sterno-aponeuroticus. Attachments: Entire inferior border of the sternum, anterior ridge of the humerus, fascia of the external face of the anti-brachial aponeurosis. Action: Adductor of the leg and tensor of the aponeurosis.

2. **DEEP PECTORAL.**—Division: 1—Sterno-trochineus. Synonyms. Pectoralis magnus, (P). Attachments: Tunica abdominalis, two posterior thirds of the inferior border of the sternum, internal tubercle of the superior extremity of the humerus. Action: Draws the leg backwards. 2—Sterno-prescapularis. Synonyms. Pectoralis parvus, (P). Attachments: On the side of the sternal keel, the cartilages of the three or four first ribs, the aponeurosis covering the antea-spinatus muscle, the cervical angle of the scapula. Action: Draws the shoulder backwards and downwards, and tensor of the scapular aponeurosis.

SPLANCHNOLOGY.

Pleura.—Serous membrane lining the thoracic cavity, forming two sacs resting on each other and the mediastinum. The anterior mediastinum is that portion situated in front of the heart; the posterior is the one posterior to that organ. The costal pleura lines the internal face of the ribs; the diaphragmatic pleura lines the anterior face of the diaphragm muscle. With the mediastine pleura, they form the parietal layer of that serous membrane. The pulmonary pleura covers the external face of the lungs and forms the visceral layer. This membrane receives blood vessels, and also nerves from the sympathetic, pneumogastric, diaphragmatic and intercostals.

Bronchia.—Terminal branches for the trachea, one for each lung, they divide in this tissue, affecting the dichotomic division. The right bronchia is the largest. They are perfectly cylindrical to their end, and are composed of cartilaginous rings formed by elongated small pieces of cartilages resting upon each other by their extremities, (these disappear in the smallest tube,) and of a muscular layer lining the whole extent of the tube, which is covered by a mucous membrane. They receive divisions of the bronchial arteries, veins and nerves. Lymphatics pass to the bronchial glands.

Lungs.—General disposition: Essential organs of respiration, divided in two lateral moieties, described as the right and left lung, the former being the larger. Form: Together they have the form of the thoracic cavity, each representing half of a cone with two faces, three borders, a base and an apex.

FACES.—External is convex; internal offers an anterior part resting on the anterior mediastinum, an excavation for the reception of the heart, the root of the lungs; a posterior part resting on the posterior mediastinum, the thoracic groove and œsophageal fissure. The right lung has also a small lobule on that face. Base: Concave and moulded on the anterior face of the diaphragm; on the right lung it has a deep notch for the posterior vena cava. Apex: Forms the anterior lobule of the lung. Borders: Superior is convex and rests in the vertebro-costal groove; the inferior is thin, with a large notch on the left lung for the heart; the posterior bounds the base or diaphragmatic face. Structure: Serous envelope, the pleura. Tissue proper, of a rose color, soft but resisting, elastic, very light, divided in small lobules by conjunctive partitions, each lobule being formed of pulmonary vesicles collected and communicating together with a bronchial tube; each vesicle has a membrane proper lined by pavementous epithelium and is covered with capillary

vessels on its surface. The blood vessels of the lungs are functional branches of the pulmonary artery and nutritive divisions of the bronchial arteries and veins; the nerves come from the sympathetic and pneumogastric; the lymphatics are arranged in superficial and deep layers.

Heart.—General view: Hollow muscle divided by a longitudinal septum in two masses, and each of these by a transverse groove in two others, forming four cavities, two superior, the auricles, two inferior, the ventricles. Situation: opposite the third and sixth ribs, in front of the diaphragm. Form: conoid. Direction: obliquely, backwards, downwards, and slightly from right to left. Size and weight: ten and one quarter inches long, seven and a half at its base from backwards forwards, and five to five and a half from side to side; the average weight is six and three-quarter pounds.

EXTERNAL ASPECT.—Ventricular mass: has two faces, right and left, both divided by a supero-inferior fissure in two portions, the posterior of which forms the left ventricle. Connected through the pericardium to the pleura and lungs, this mass has two borders, one anterior, obliquely backwards; one posterior, almost vertical. Its apex is formed by the left ventricle. Its base has two arterial and two auriculo-ventricular openings.

AURICULAR MASS.—This has three faces, a superior with the openings of the anterior vena cava and azygos in front, and pulmonary veins behind; right face with the openings of the posterior vena cava, coronary and brachial veins; and a left face embracing the aorta and pulmonary arteries. Its extremities are anterior and posterior, its base resting on the ventricular mass.

INTERNAL ASPECT.—Cardiac septum divided into auricular, with the cicatrix of the foramen of Botal; and ventricular much thicker. The right ventricle has two walls, known as anterior and posterior. They have fleshy columns of three kinds; an apex, not extending to the point of the heart; a base, with the pulmonary opening furnished with sigmoid valves, and the auriculo-ventricular opening presenting the tricuspid valve secured by its borders to ventricular walls by the cordæ tendinosæ.

The right auricle presents an anterior cul de sac furnished with fleshy columns of the second and third kinds: a posterior wall showing the fossa ovalis, an external wall with venous openings, and internal wall smooth, a superior wall with venous openings, a base having the auriculo-ventricular opening.

The left ventricle has its walls covered with fleshy columns; its apex forms the point of the heart; the base presents the aortic opening, with the sigmoid

valves and the auriculo-ventricular, with the mitral valve.

The right auricle covers the auriculo-ventricular opening, and on its superior face has the openings of the pulmonary veins, from four to eight in number.

Structure: Annular fibrous frame, made of four bands, one for each orifice at the base of the ventricular mass. Muscular tissue composed of uniting and proper fibres of the ventricles and auricles. The fibres proper of the ventricles form a cone open at both ends. The uniting fibres cover the external surface of the ventricles, twist around them and penetrate into and line the inside of the ventricular cavities. In the auricles the uniting fibres form two thin bands going from one to the other; the proper fibres divide into fasciculi disposed in rings, round the auriculo-ventricular openings, or in sphincters round the openings of the veins. Blood vessels are represented by the coronary arteries and veins. The nerves come from the great sympathetic and pneumogastric. It has two serous membranes, an internal or endocardium, lining the cavities and extending into the cavity of the blood vessels; an external or pericardium, having a fibrous cone for a frame, on the inside of which is spread the serous membrane proper or two layers, parietal covering the fibrous cone, and a visceral resting on the heart itself.

This membrane receives blood from the mediastinal arteries ; it has also some lymphatics.

ANGEIOLOGY.

Arteries.—**PULMONARY.**—Rises from the right ventricle, runs upward and backwards in a curved direction and above the left auricle divides in two branches, one for each lung, where they ramify. Connections: To the right with the aorta, in front and behind is embraced by the auricles and cardiac vessels; near its middle is united to the aorta by the obliterated ductus arteriosus.

PRIMITIVE AORTA.—Rises from the left ventricle, where it forms the sinuses of the aorta, runs upwards and slightly forwards, and after two or two and a half inches divides into the anterior and posterior aorta, its terminal branches. Connections: On the right with the auricular mass; on the left with the pulmonary artery. Its collateral branches are the cardiac or coronary arteries, divided into right and left. The right rises in front of the primitive aorta, passes under the anterior auricle and divides into a vertical branch placed in the right vertical fissure of the ventricular mass, and one horizontal running in the horizontal groove. The left rises opposite the right, passes behind the pulmonary artery under the left auricle, and

divides into two branches, one horizontal and one vertical, disposed like the right cardiac. These two arteries anastomose with those of the opposite side, and from their division send collateral branches to the muscular tissue of the heart.

ANTERIOR AORTA.—The shortest of the terminal branches, runs obliquely upwards and forwards above the right auricle, under the trachea on the left side of the anterior vena cava, and terminates by the two branches :

1. **BRACHIAL OR AXILLARY ARTERY.**—Running a course forward, between the layers of the mediastinum under the trachea, it reaches the entrance of the thorax, twists round the first rib, into the axillary space and becomes humeral (see page 31).

It gives off eight collateral branches :

1 The **DORSAL.**—Synonyms. Dorso-muscular, running towards the second intercostal space, through it outside the thorax, bends slightly backwards and ramifies into the muscles of the anterior part of the dorsal region, having a larger branch passing forward and upwards near the superior border of the neck to anastomose with the superior cervical. It gives off one collateral branch, the subcostal, which passes into the costo-vertebral groove backwards, giving off the second, third and fourth intercostal arteries, and termi-

nates in forming the fifth alone or with another branch from the first posterior intercostal.

2 The SUPERIOR CERVICAL.—Synonyms. Cervico-muscular; runs outside the thorax through the first intercostal space, passing upwards and forwards under the complexus major muscle, reaches the second cervical vertebræ and anastomoses with the occipito-muscular and the dorsal arteries. It gives for collateral branches the first intercostal, muscular and tegumentary branches to the superior cervical regions.

3. The VERTEBRAL.—Passing inside the first rib, outside the trachea and the inferior cervical ganglion, and under the transverse process of the seventh cervical vertebræ, enters the trachelian foramen, runs forwards and upwards to the atlas, where it anastomoses with the occipital. Its external, superior and inferior collaterals go to the muscles of the neck; its internal to form the median spinal.

4. The INTERNAL THORACIC OR MAMMARY.—Descending inside the first rib to the sternum, then backwards upon its superior face, it terminates at the base of the xyphoid cartilage by the anterior abdominal, which passes outside the thorax under that cartilage, on the superior face of the rectus abdominis muscle, where it ramifies and finally anastomoses with the posterior abdominal, and by the asternal artery, which lies inside the cartil-

aginous circle of the false ribs, runs upwards, sending intercostal collateral branches, and anastomoses with the thirteenth intercostal. The mammary furnishes superior branches to the pericardium and pleura, inferior branches to the pectoral muscles, and external ramifications to anastomose with the intercostals.

5. The **EXTERNAL THORACIC**.—Turning over the anterior border of the first rib, it runs backwards inside the two portions of the deep pectoral muscles in which it ramifies.

6. The inferior cervical or trachelo-muscular.—Passing outside the gulf of the jugulars, inside the sterno-prescapularis, it terminates by an ascending and descending muscular branch.

7 and 8.—**Sus and subscapular**. Described in the arteries of the anterior extremity (see page 31).

POSTERIOR AORTA.—True continuation of the primitive aorta. It passes upwards and backwards, forming a curve called the arch of the aorta, reaches the left side of the inferior face of the vertebral column, follows the vertebral bodies, gradually coming to the median line, passes through the diaphragm, into the abdomen as far as the last intervertebral articulation, and terminates by the four iliac arteries. Its collaterals are divided into thoracic and abdominal branches.

THORACIC COLLATERALS.—1. Intercostal arteries: Sev-

enteen in number. Thirteen are from the thoracic portion of the posterior aorta, the first from the cervical artery, and the three following from the subcostal (see page 145); they run through the intercostal space and divide into a superior or dorso-spinal artery, an ascending branch going to the muscles of the dorsal region; and an inferior, intercostal proper, or descending branch running along the posterior border of the rib downwards to anastomose with branches of the internal thoracic, of the anterior and posterior abdominal and even circumflex iliac arteries. The intercostal arteries form the parietal branches of the thoracic aorta.

2. BRONCHO-ŒSOPHAGEAL.—Visceral branch of the thoracic aorta, rises from the convexity of the arch of the aorta and near the bifurcation of the trachea, gives off the two bronchial arteries ramifying with the bronchia; and the œsophageal, divided into superior and inferior, which run above and below the œsophagus backwards to anastomose with branches of the gastric.

3. DIAPHRAGMATIC—See description of diaphragmatic region, page 151.

ABDOMINAL COLLATERAL.—See description of the abdominal cavity, page 59.

TERMINAL BRANCHES.—See arteries of the hind extremity and pelvic cavity, pages 59 and 151.

Veins.—**CARDIAC OR CORONARY.**—The small cardiac empties from the walls of the right ventricle into the right auricle. The great cardiac empties also into the right auricle inside of the opening of the posterior vena cava, after receiving the bronchial veins.

ANTERIOR VENA CAVA.—Formed by the two jugulars and the two axillary veins, terminates on top the right auricle, receiving in its course the internal mammary, the vertebral, the superior cervical, the dorsal and the great vena azygos, which last receives the first lumbar and intercostal veins.

POSTERIOR VENA CAVA.—See description of the abdomen, page 172.

Lymphatics.—Those of the thoracic cavity consist of three ganglions: 1—A series of small granulations placed near the œsophagus and receiving the posterior lymphatics of this organ; 2—The bronchial ganglions, situated at the bifurcation of the trachea and receiving the pulmonary lymphatics; 3—Two long masses of lobules at the inferior face of the trachea, into which the lymphatics of the pericardium, heart and a part of those from the trachea and œsophagus empty. The lymphatics of the thoracic walls are: 1—A mass of small granules on each side of the dorsal column; 2—A large mass at the base of the xyphoid appendix; 3—Some small ones attached to the thoracic vessels.

NEUROLOGY.

Seventeen pairs of dorsal nerves from the spinal marrow, all of which are alike, having a superior branch, running towards the spinous process of the dorsal vertebræ, ramifying in the spinal muscles and the skin of the dorso-lumbar region; and an inferior branch which runs downwards between the intercostal spaces and end in the intercostal, pectoral and abdominal muscles. The first and second pair coöperate to form the brachial plexus (see page 63).

DORSAL PORTION OF THE SYMPATHETIC.—From the inferior cervical ganglion to the diaphragm it forms a double chain of ganglions, seventeen in number, situated in the costo-vertebral groove, continued posteriorly by the lumbar sympathetic. It has afferent branches coming from the dorso-spinal nerves and efferent branches in small number, among which the small and great splanchnic only are important. The latter leaves the main trunk near the sixth or seventh ganglion, runs backwards, penetrates the abdomen, where it terminates in the semi-lunar or solar plexus (see abdominal cavity, page 174).

CHAPTER VIII.

DIAPHRAGMATIC REGION.

Diaphragm.—Situated between the thoracic and abdominal cavities, obliquely downwards and forwards. In form it is flattened from forwards backwards, wider above, convex on its anterior, and concave on its posterior faces. It is divided into a phrenic, central or aponeurotic portion, and a peripheric or fleshy portion. Attachments: By the tendons of its two fleshy pillars on the bodies of all the lumbar vertebræ, by its fleshy peripheral digitations on the superior face of the xyphoid cartilage and the internal face of the last twelve ribs near their inferior extremity. Structure: In the centre of the phrenic portion is a foramen for the posterior vena cava; through the right pillar, one for the œsophagus; between the two pillars another for the posterior aorta and thoracic duct. Action: Essentially inspiratory.

Arteries.—**DIAPHRAGMATIC:** Two or three small branches coming from the posterior aorta and ramifying in the muscle.

CHAPTER IX.

ABDOMEN.

OSTEOLOGY.

LUMBAR VERTEBRÆ.—Seven. General characters : They are longer and wider than the dorsal ; the superior spinous process is short, thin, with a rough crest on the apex ; the transverse processes are very large, horizontal and flattened from above below ; the anterior articular facets are hollow and the posterior prominent and tooth-like.

SPECIFIC CHARACTERS.—The vertical diameter of the body diminishes and the transverse diameter increases from forwards backwards ; the transverse processes of the first and second incline backwards, the third and fourth are nearly straight, the fifth and sixth are bent forward and are quite thick ; the posterior border of the fifth has a wide articular facet, the sixth has one on both the anterior and posterior borders.

SYNDESMOLOGY.

ARTICULATION OF THE TWO LAST LUMBAR VERTEBRÆ.—By wide facets on the borders of the transverse processes forming planiform diarthrosis, united by ligamentous fibres and with one synovial capsula.

MYOLOGY.

The muscles of the abdomen are supported externally by the abdominal tunic. They unite on the median plane forming the white line, and are four in number.

1. **TUNICA ABDOMINALIS.**—A vast expansion of yellow elastic tissue, spread over the external muscles, thick near the pubis and along the white line, and becoming thinner towards its circumference. Posteriorly it becomes lost in the inguinal region, and gives origin to the testicular envelope known as the dartos. Action: assists the abdominal muscles in supporting the intestinal mass.

2. **WHITE LINE.**—*Linea alba.* Formed by the intercrossing of the aponeurosis of the abdominal muscles, it extends from the xyphoid cartilage of the sternum to the anterior border of the pubis.

3. **GREAT OR EXTERNAL OBLIQUE OF THE ABDOMEN.**—Synonyms: *Costo-abdominalis*, (G). *Obliquus externus abdominis*, (P). Structure: fleshy and aponeurotic portions. Attachments: fleshy portion, on the external face of the thirteenth or fourteenth last ribs, on the aponeurosis of the great dorsal muscle; by its internal border it gives origin to its aponeurosis; aponeurotic portion, on the *linea alba*, the anterior border of the

pubis, posteriorly it divides and gives origin to the crural aponeurosis and the crural arch. Action: Expiratory.

INTERNAL CRURAL APONEUROSIS.—Lines the internal face of the leg, covering the muscles of that region.

CRURAL ARCH, FALLOPIUS OR POUPART'S LIGAMENT.—Extends from the anterior border of the pubis to the external angle of the ilium. Inside of the pectineal insertion of the small psoas muscle it forms the anterior line of the crural ring.

INGUINAL CANAL.—An infundibuliform canal through which the means of support for the testicles or the external mammary vessels pass from the abdomen. It presents a superior and an inferior opening.

4. SMALL OR INTERNAL OBLIQUE OF THE ABDOMEN.—Synonyms. Ilio-abdominalis, (G). Obliquus internus abdominis, (P). Structure: like the preceding. Attachments: Fleshy portion, to the external angle of the ilium and the crural arch; aponeurotic portion, to the internal face of the cartilages of the false ribs, and the linea alba. Action: Expiratory.

5. GREAT STRAIGHT OF THE ABDOMEN.—Synonyms. Sterno-pubialis, (G). Rectus abdominis, (P). Attachments: the cartilages of the four last sternal and first asternal ribs, inferior face of the sternum, the internal

face of the great oblique and the anterior border of the pubis. Action: Principal flexor of the vertebral column.

6. **TRANSVERSE MUSCLE OF THE ABDOMEN.**—Synonyms. Lumbo-abdominalis, (G). Transversalis abdominis, (P). Costo-abdominalis internus, (L). Situated on the most internal part of the abdominal walls. It is attached to the internal face of the false ribs, transverse process of the lumbar vertebrae, xyphoid cartilage of the sternum and linea alba. Action: Compresses the abdominal organs against the spine.

Muscles of the Sub-Lumbar Region.—Nine in number, covered by the iliac fascia or lumbo-iliac aponeurosis.

1. **GREAT PSOAS.**—Synonyms. Sub-lumbo-trochineus, (G). Lumbo-femoral, (L). Psoas magnus, (P). Situation: under the transverse processes of the lumbar vertebrae. Attachments: On the body of the two last dorsal and all the lumbar vertebrae, inferior face of the two last ribs, transverse processes of the lumbar vertebrae and internal trochanter of the femur. Action: Flexor and rotator of the thigh, flexor of the lumbar region.

2. **ILIAC PSOAS.**—Synonyms. Ilio-trochineus, (G). Iliacus, (P). Composed of two fleshy bodies. Attachments: On the iliac surface, external angle of the ili-

um, sacro-iliac ligament, ilio-pectineal crest and the internal trochanter. Action: Flexor and rotator of the thigh.

3. **SMALL PSOAS.**—Synonyms. Psoas of the loins, (B). Sub-lumbo pubialis or iliacus, (G). Psoas parvus (P). Lumbo-iliacus (L). It is semi-penniform. Attachments: On the body of the three or four last dorsal and of all the lumbar vertebræ, ilio-pectineal eminence, and lumbo-iliac aponeurosis. Action: Flexor of the pelvis on the spine, arches directly or laterally the ischio-lumbar region, tensor of the lumbo-iliac aponeurosis.

4. **SQUARE MUSCLE OF THE LOINS.**—Synonyms. Sacro-costalis, (G). Sacro-lumbalis, (P). Attachments: The sacro-iliac ligament, posterior border of the last rib, the transverse processes of the lumbar vertebræ, the internal face of the three or four last ribs. Action: Draws the ribs backwards and inclines the lumbar portion of the spine.

5. **INTER-TRANSVERSAL OF THE LOINS.**—Synonyms. Inter-transversalis lumborum, (P). Attachments: The anterior and posterior border of the transverse processes of the lumbar vertebræ. Action: These five muscles incline the lumbar region laterally.

SPLANCHNOLOGY.

Peritoneum.—A serous membrane lining the abdominal cavity and forming a parietal and visceral layer. The former passing over the different regions of the abdomen, gives rise to the ligaments, mesentery and epiploon, viz: in the sus-sternal region it forms a fal-ciform band extended from the umbilicus to the liver; passing over the diaphragmatic region, it forms the right, left and common ligaments of the liver, the cardiac ligament surrounding the œsophagus; behind the liver it furnishes the hepato-gastric ligament, from which rise the great or gastro-colic and gastro-splenic epiploon; in the lumbar region, it presents the hepato-renal ligament, that of the lobe of Spigel, the great mesentery proper supporting the small intestine, the colic mesentery, meso-cœcum and meso-colon. Towards the pelvic cavity it forms the three ligaments of the bladder; in males it covers the dilated portion of the efferent canals, the vesicula seminalis and reflex round the rectum. In females it forms three ligaments, called wide, round, or ligaments of the ovary.

The visceral layer forms an external envelope to all the abdominal organs except the kidneys.

Structure: connective tissue covered with pavimen-

tous epithelium, blood vessels, lymphatics, and nerves from the diaphragmatic, lumbar, intercostal and great sympathetic systems.

ABDOMINAL ORGANS.

In the anterior region: stomach, liver and spleen. In the superior region: pancreas, kidneys, suprarenal capsules and ureters. In the right and left hypochondriac, the flanks and inferior region, the intestines. In the posterior region: the pelvis and its contents.

Stomach.—Situation: posterior face of the diaphragm. Dimension: twelve to fifteen quarts. Form: elongated, laterally flattened from forward backward, curved upon itself and constricted in its middle. Division: Two faces, two curvatures and two extremities. Faces, convex and smooth. Curvatures, the great inferior, convex and gives attachments to the great epiploon; the smaller concave, and attached to the liver by the hepato-gastric ligament. Extremities: the left forms a large conical tuberosity, the right is continued with the duodenum.

The internal face is lined by mucous membrane, varying in aspect in the left and right portion, and presents two openings, the cardiac and pyloric.

STRUCTURE.—Serosus membrane envelops the whole

organ, and furnishes the great epiploon, cardiac ligament and hepato-gastric ligament. Muscular coat formed of three layers, one of which belongs essentially to the right extremity; the left has three coats. Mucous membrane, in the left extremity is covered with white, thick epithelium, in the right with fine simple cylindrical epithelium. In its structure we find tubular, mucous, and pepsine glands. Arteries: gastric, splenic, right and left epiploic and pyloric. Veins: satellites of the arteries. Lymphatics, emptying in the reservoir of Pecquet. Nerves, from the pneumogastric and solar plexus.

Liver.—Situation: obliquely downwards and to the left, to the right of the diaphragmatic region. Weight, about eleven pounds. Form: irregularly elliptical, flattened from forward backward, thick in its centre, thin at its borders. Division: In three lobes. The whole organ has two faces and a circumference. The anterior face is convex, and has a groove for the posterior vena cava; the posterior is smooth and convex, with a groove for the portal vein, hepatic blood vessels, nerves and ducts. The circumference is divided into a superior or left border, offering from right to left the right ligament of the liver, the groove for the vena cava, a notch for the œsophagus, the left ligament of the liver. The inferior or right border presents the two notches separating the three lobes. The right lobe

is the medium in size, and has on its posterior face the lobule of Spigel; the left lobe is the largest. Mode of attachment: Four ligaments, one for each lobe, and one to the phrenic portion of the diaphragm. Structure: Serous membrane covering the faces entirely, except over the fissures. Fibrous or Glisson's capsule, an envelope dipping into the hepatic tissue, and sending from its internal face numerous partitions, which penetrate between the hepatic granulations. Proper tissue of the liver, composed of polyhedric granulations or lobules, in each of which are found the hepatic or biliary cells, biliary ducts, afferent vessels, branches of the portal vein and hepatic artery, the ramifications of the first being called the interlobular or sub-hepatic veins; an efferent vessel with a lobular or supra hepatic vein, lymphatic and connective tissue. Excretory apparatus: ductus choledochus, emptying in the duodenum. It is composed of a fibrous membrane, a cylindrical epithelium and racemose glands. Blood vessels: hepatic artery. Veins: portal and supra hepatic. Lymphatic: abundant, empty in the sub-lumbar reservoir of Pecquet. Nerves: from the solar plexus, pneumogastric and diaphragmatic filaments.

Spleen.—Form: falciform. Direction and situation: to the left of the diaphragmatic region, obliquely downwards and forwards. Division: Two faces, two

borders, a base and an apex. Faces : external, convex ; internal concave, it touches the large colon. Borders : posterior thin and convex ; anterior concave, has a longitudinal fissure for the blood vessels and nerves, and gives attachment to the great epiploon. The base rests on the left kidney, and receives the suspensory ligament. The apex is thin. Weight, thirty-two ounces. Mode of attachments: The suspensory ligament and the great epiploon. Structure: A serous membrane, peritoneal covering ; a fibrous tunic, which from its internal surface send trabeculæ, dividing the organ into numerous spaces, in which the splenic pulp is contained, as well as the Malpighian bodies. Artery : the splenic. Veins : its satellites. Lymphatics : on the external surface of the organ. Nerves : from the solar plexus.

Pancreas.—**ABDOMINAL SALIVARY GLAND.**—Situation : sub-lumbar region, forward of kidneys, posterior to liver and stomach. Weight : seventeen ounces. Form : irregular and variable, flattened from above below and traversed by the pancreatic ring. Faces : superior is in connection with the aorta, posterior vena cava, celiac trunk, solar plexus, right kidney and supra-renal capsule ; inferior is related to base of cœcum and the colon. Borders : anterior is in connection with the duodenum and left sac of the stomach ; posterior

has a notch for posterior vena cava. Extremities : right adheres to the duodenum, left looks towards base of spleen. Structure : Like the salivary glands. Excretory apparatus consists of two canals, that of Wirsung and its accessorius ; they open in the duodenum, opposite each other.

Kidneys.—Situation : To the left and right of the sub-lumbar region, the right being more forward than the left. Form : right is like the heart on a playing card, the left resembles a haricot bean. Division : Two faces, smooth ; three borders, internal forms the fissure or hilus. Weight : right, about twenty-seven ounces, left, twenty-five. Internal aspect : a horizontal section shows : 1. The renal pelvis with the sinus renalis, the crest, and laterally the arms of the pelvis. 2. Cortical, and 3. Medullary layers of the tissue proper. Structure : a fibrous membrane, external envelope ; tissue proper divided into cortical and medullary layer. In the first are found the Malpighian corpuseles, in the latter, the tubuli uriniferi. Blood vessels : renal artery and vein. Lymphatics : numerous. Nerves : from the solar plexus. Development : they appear early in the foetus.

Ureters.—Form, membranous canals. Origin : the infundibulum of the pelvis. Termination : obliquely into the bladder, through its muscular coat. Structure :

three coats, an external of connective and elastic tissue, a median muscular, an internal mucous.

Ovaries.—Situated in the abdominal cavity, hanging to the sub-lumbar region, a little posterior of the kidneys. Modes of attachments: a fold of peritoneum or broad ligament. Structure: a serous coat peritoneal, a tunica albuginea and a tissue proper divided into medullary and cortical layers; in the latter are found the Graafian vesicles, composed of a fibrous envelope and a granular membrane, which contains the ovulum or ovum. Blood vessels: ramification of the utero-ovarian artery. Lymphatics: go to the sub-lumbar ganglion. Nerves come from the small mesenteric plexus.

Oviducts.—Fallopian or uterine tubes. Situation: in the broad ligament, near its anterior border; begins at the ovary by the pavilion or ostium abdominale, and terminates in the cul de sac of the uterine horn by the ostium uterinum. Structure: an external layer of serous membrane, a middle muscular and internal mucous. Functions: carries the ovulum to the uterus and the seminal fluid to the ovulum.

Uterus.—Situation: in the abdominal cavity, sub-lumbar regions at the entrance to the pelvic cavity. Division: A body and two cornua. Body has two faces, superior and inferior; an anterior extremity or

fundus, and a posterior separated from the vagina by the neck or cervix of the uterus. The cornua have an inferior curvature, a superior, shorter ; an anterior and posterior extremity. Modes of attachment : A suspensory or broad ligament. Interior offers many mucous folds and three compartments or cavities, one for the body, two for the cornua. The former is prolonged in the vagina by the *fleur epanouie*. Structure : a serous tunic peritoneal, a muscular coat with longitudinal and circular fibres, a mucous membrane raised into folds, containing many simple or ramified glands. Blood vessels : branches of the uterine and utero-ovarian arteries. Lymphatics, numerous. Nerves supported by the small mesenteric and pelvic plexuses.

Intestines.—Division : Small and large.

SMALL INTESTINE.—Length, twenty-four yards. Form, cylindrical. Course, from the right sac of the stomach, runs forward, turns backwards round the base of the cœcum, passes to the left flank, forms many circumvolutions, returns to the right and ends in the cœcum, below the origin of the large colon. Mode of attachments : by the stomach, cœcum, and principally the mesentery. Interior has longitudinal folds, villi, glandular and follicular openings, communicates with the stomach by the pyloric opening, and with the cœcum by the ileo-cœcal valve ; near the former it shows the

openings of the ducts of the liver and pancreas. Structure: a serous coat expansion of the mesentery; a muscular coat of two layers, one longitudinal superficial, the other circular deep; a mucous membrane soft, spongy, vascular with thin cylindrical epithelial cells and numerous villi. Glands: of Brunner, of Lieberkuhn or Gacati, solitary glands, aggregated follicles or glands of Peyer. Blood vessels: arteries, from the great mesentery and cœliac trunk. Veins empty into the portal vein. Lymphatics from three superposed networks in the mucous membrane. Nerves, from the solar plexus.

LARGE INTESTINE.—Division: Cœcum, colon and rectum. CÆCUM—Situation: the right hypocondriac region, obliquely downwards and forwards. Dimension, little over three feet. Capacity, seven and a half gallons of fluid. Form: conical, terminating in a point inferiorly, with circular furrows interrupted by four longitudinal muscular bands. Mode of attachment: adhering directly to the sub-lumbar region, and to the origin of the colon, by the meso-cœcum. Interior presents valves or transverse ridges, the ileo-coecal valve, and above it the opening of the colon. Structure: a serous coat, longitudinal and circular muscular fibres, a mucous membrane with solitary follicles, glands of Lieberkuhn, and a few villi. Blood

vessels: the cœcal arteries and veins. Lymphatics, emptying into the sub-lumbar receptacle. Nerves, from the great mesenteric plexus.

Colon.—Division: Large, double or fixed, and small or floating.

LARGE COLON.—Length, ten to thirteen feet. Capacity, eighteen gallons. Form and general disposition: represents a large canal with dilatations and contractions, its surface being crossed by longitudinal bands of muscular tissue and folded in two; each part being itself doubled in its turn, thus forming four portions. Course: from the arch of the cœcum, the first portion runs forward to the posterior face of the diaphragm, forms the suprasternal flexure, turned downwards and to the left; the second portion continues backwards to the entrance of the pelvis, where inflected to the left it forms the pelvic flexure; the third portion, running forward above and to the left of the second, reaches the diaphragm and forms the diaphragmatic or gastro-hepatic flexure; the fourth portion bound to the first, extends upwards and backwards to a level with the base of the cœcum, where it ends in the small colon. Modes of attachment: by the meso-cœcum and meso-colon, by its adherence to the pancreas and cœcum directly. Internal surface: like that of the cœcum. Structure: a serous or peritoneal layer, a muscular coat in two layers, and

a mucous coat like the cœcum. Blood vessels : the colic arteries and satellite veins. Lymphatics, empty in the reservoir of Pecquet. Nerves, from the great mesenteric plexus.

SMALL COLON.—Length : ten feet. Form : like the small intestine with its external surface bosselated, and provided with two wide longitudinal muscular bands. Course : from the terminal end of the large colon into the left flank, ending in the rectum. Mode of attachment : colic mesentery. Interior : valvular folds, like the cœcum and colon. Structure : a serous, muscular and a mucous coat, like those of the colon. Blood vessels : from the small and a branch of the great mesenteric artery, veins empty into the portal vein. Lymphatics : as numerous as in the small intestine. Nerves : from the posterior mesenteric plexus.

Rectum,—See pelvic cavity, page 177.

ANGIOLOGY,

ARTERIES—ABDOMINAL AORTA.—Continuation of the posterior aorta after it passes through the diaphragm, terminating at the lumbo-sacral articulation by quadrifurcation forming the two external and internal iliacs. Its collaterals are the lumbar and middle sacral for parietal branches, the cœliac axis, great mesenteric,

renal, small mesenteric, spermatic, and small testicular for visceral branches.

LUMBAR—Five or six in number, analogous in their course and disposition to the inter-costals, terminating by superior and inferior muscular branches.

MIDDLE SACRAL.—Often missing, and when found rises between the two internal iliacs and runs on the inferior face of the sacrum backwards, losing itself gradually.

CÆLIAC AXIS.—Rises from the inferior face of the aorta and after a short course divides into three branches.

1. **GASTRIC**.—Passes upon the left extremity of the stomach and near the œsophagus, divides into an anterior and posterior gastric, both ramifying upon the corresponding faces of the organ. It gives a third branch which passes along the œsophagus, enters the thorax and divides into two branches, which anastomose with the two œsophageal.

2. **HEPATIC**.—Runs outward to the right to reach the posterior face of the liver, which it enters dividing into numerous branches. It has for collaterals the pancreatic, the pyloric, and right gastro-epiploic.

a. **PANCREATIC**.—Small branches to the pancreas.

b. **PYLORIC**.—From the main trunk as it enters the fissure of the liver, it passes towards the small curva-

ture of the stomach, and anastomoses round the pylorus with the posterior gastric and right gastro-epiploic.

c. **RIGHT GASTRO-EPIPLOIC OR OMENTAL.**—Passes along the great curvature of the stomach between the layers of the great omentum, and anastomoses by arcade with the left gastro-epiploic, after sending gastric and omental branches or collaterals. It furnishes also the duodenal, anastomosing with the first artery of the small intestine.

3. **SPLENIC.**—The largest of the three branches of the celiac trunk, places itself in the fissure of the internal border of the spleen, down to its apex, runs between the two layers of the great omentum and goes to anastomose with the right gastro-epiploic, having thus formed the left gastro-epiploic. From both collateral branches gastric, splenic and epiploic are sent in all directions.

GREAT MESENTERIC.—A trunk from one to one and a half inches long, rising from the abdominal aorta about two inches behind the celiac axis, and soon divides into three fasciculi, left, right and anterior.

a. **LEFT FASCICULUS.**—Gives fifteen to twenty arteries, ramifying in the small intestines, running between the layers of the great mesentery and at some distance from the small curvature of that organ, dividing into two branches, which go to anastomose with corresponding branches from the neighboring arteries, forming

arches from which a number of branches start to ramify in the intestinal tract. The first anastomoses with the duodenal, and the last with the ileo-cæcal artery.

b. RIGHT FASCICULUS.—A short trunk which soon divides into four branches :

1. **ILEO-CÆCAL.**—Anastomosing with the last artery of the left fasciculus.

2. **TWO CÆCAL.**—Divided into internal or superior, and external or inferior. Both located in the fissure of the cæcum, running down to the apex, where their divisions anastomose after sending collateral branches to the organ. At its origin the external cæcal gives off the artery of the cæcal arch following the concavity of the arch, where it disappears.

3. **RIGHT OR DIRECT COLIC.**—Runs in the right flexure of the colon to the pelvic curvature, where it anastomoses with the left colic, furnishing collateral branches to that portion of the large intestine.

c. ANTERIOR FASCICULUS.—Furnishes two principal trunks :

1. **LEFT COLIC OR RETROGRADE.**—Acting to the left portion of the large colon as the direct colic does for the right, and anastomosing with it at the pelvic curvature.

2. **FIRST ARTERY OF THE SMALL COLON.**—Placed in the posterior fold of the small mesentery, to anasto-

mose with the first division of the small mesenteric artery.

d. INNOMINATED BRANCHES.—To the lymphatic glands, supra-renal capsules, mesentery and pancreas.

SMALL MESENTERIC.—Descending from the posterior abdominal artery, some four and half to six inches behind the great mesenteric. It runs between the layers of the small mesentery and forms thirteen or fourteen branches, which act somewhat like the arteries of the small intestines and ramifying in the floating colon and rectum.

RENAL OR EMULGENT.—One for each kidney, in the substance of which they penetrate by its notch or inferior face.

SPERMATIC or great testicular in the male, running outside the abdominal cavity into the inguinal canal with the other constituents of the spermatic cord, and after many flexuosities reaching the testicle, in which it disappears; and

UTERO-OVARIAN in the female; lodged between the folds of the broad ligament, and dividing into an ovarian artery to the ovary and a uterine to the cornu of the uterus.

SMALL TESTICULAR.—In male; distributed to the various parts of the spermatic cord.

UTERINE.—In female, to the uterus proper. These

do not always rise from the abdominal aorta, but more commonly from the external iliac.

Veins.—**POSTERIOR VENA CAVA.**—Beginning at the pelvis by the pelvic crural trunks (see page 182) placed under the bodies of the lumbar vertebræ, reaches the superior border of the liver, passes through the phrenic portion of the diaphragm to the posterior and external part of the right auricle of the heart, being thus divided into a sub-lumbar, hepatic and thoracic portions. The numerous collateral afferents are: the diaphragmatic, the vena portæ, the renal, the spermatic and several lumbar veins. The vena portæ does not empty directly into the vena cava, but indirectly by the supra hepatic veins, which rise from its subdivision, the subhepatic veins. It is constituted by three principal roots: the great and small mesenteric and splenic veins; it receives as collateral affluents the right gastro-epiploic and the anterior gastric veins.

Lymphatics.—1. Those of the rectum and floating colon are placed at the base of the tail on each side of the sphincter, also along the small curvature of the rectum and between the folds of the mesentery. Their efferent branches unite to the divisions of the sublumbar ganglions.

2. Those of the folded colon form a double chain on the tract of the colic arteries. Their branches

unite to those of the small intestines, and empty in the reservoir of Pecquet.

3. The lymphatics and ganglions of the cœcum are on the course of the arteries. Their branches unite to the trunk of the small intestine.

4. The small intestine has some thirty ganglions placed in the thickness of the mesentery near the origin of the great mesentric artery; they all empty in the reservoir of Pecquet.

5. The stomach has large ganglions on the small and smaller ones on the large curvature. Their efferent branches empty some directly in the thoracic duct, some after uniting with the anterior trunk of the intestinal lymphatics.

6. The spleen offers several ganglions in its fissure, from which efferent vessels go to the thoracic duct.

7. The liver presents a few in the posterior fissure, whose vessels unite to those of the stomach and spleen.

THORACIC DUCT.—General confluent of all the lymphatics of the body except those of the right anterior leg, right half of the head, neck and thorax. It extends from the first lumbar vertebræ to the entrance of the thorax, beginning by the sub-lumbar reservoir or cistern of Pecquet on a level with the great mesenteric artery. Course: from the reservoir passes be-

tween the pillars of the diaphragm, and in various ways arrives towards the sixth dorsal vertebræ, where it leaves the aorta, crosses the azygos vein between the axillary arteries, comes out of the chest and then terminates with a dilation in the anterior vena cava at the juncture of the two jugulars.

GREAT LYMPHATIC VEIN.—Confluent of the lymphatics of the right leg, right half of the head, neck and thorax. It opens at the junction of the jugulars by one or two openings, alone or by anastomosing with the thoracic duct proper.

NEUROLOGY.

Six pairs of lumbar nerves, whose superior branches ramify in the spinal muscles and integuments of the lumbar region and haunch. The inferior ramify in the abdominal muscles and the region of the flank. The third pair furnishes three inguinal nerves—one internal, two external.

LUMBAR PORTION OF THE SYMPATHETIC.—Continuation of the dorsal chain; it has the same aspect, and lies against the small psoas muscle, runs to the lumbo-sacral joint, where it becomes the sacral portion. Its afferent branches come from the lumbar pairs. Its

efferent branches collect into two or three nerves, and by their anastomoses form the posterior mesenteric plexus, which gives branches to the floating colon and rectum, some to the anterior mesenteric plexus, and to the spermatic arteries forming the spermatic plexus; the last branches co-operating to form the pelvic plexus.

CHAPTER X.

P E L V I S.

OSTEOLOGY.

SACRUM.—Formed by the union of the five sacral vertebræ. Division: Two faces, two borders, a base, an apex and a central canal. Faces: Superior presents the spinous processes forming the sacral spine, bent backwards and diminishing in length posteriorly; it offers on each side the four supra-sacral foramina. The inferior face is smooth and shows the lines of separation of the vertebræ, and on each side the four subsacral foramina. The borders are thick and concave, rough posteriorly, having forward a broad, rough auricular surface, to articulate with the ossa innominata. The base offers on the median line the anterior orifice of the sacral canal and the anterior articular head of the body of the first sacral vertebræ; on the sides the articular processes and the anterior notches of that vertebræ, and outside the two large facets for articulation

with the last lumbar bone. The apex presents the posterior opening of the sacral canal, the posterior articular cavity, the body of the last sacral vertebræ, the vestiges of the articular processes and the posterior notches of that vertebræ. The sacral canal is a part of the rachidian canal, triangular, and is narrowing backwards.

OSSA INNOMINATA—See posterior extremity, page 45.

SYNDESMOLOGY.

SACRO-ILIAO JOINT.—Arthrodia: Facets of the sides on the base of the sacrum and the facets of the internal face of the ilium. Sacro-iliac, superior ilio-sacral, inferior ilio-sacral, sacro-sciatic, or ischiatic ligaments. One small synovial capsula. Very limited sliding motion.

MYOLOGY.

See posterior extremity, page 52 and following pages.

SPLANCHNOLOGY.

RECTUM.—Posterior portion of the digestive canal and continuation of the floating colon, from which it differs by the absence of ridges, is thicker and has more dilatable walls and is susceptible of large disten-

sion. Modes of attachment: the meso-rectum, a fold of the colic mesentery, a fold of the peritoneum, the suspensory ligaments of the penis and a triangular fasciculus of muscular fibres, a prolongation of its fleshy coat. Structure: a serous membrane, a fleshy coat of longitudinal and annular fibres, a mucous membrane with transverse and longitudinal folds; arteries from the small mesenteric and internal pudic; nerves from the pelvic or hypogastric plexus.

ANUS.—The posterior opening of the digestive canal, pierced at the posterior extremity of the rectum under the base of the tail. Structure: mucous membrane of the rectum, muscular fibres of the rectum forming an internal sphincter, an external sphincter, a retractor or ischio-anal muscle and the skin, fine and very adhering to the muscular tissue underneath.

BLADDER.—Form: ovoid with a large extremity or rounded cul de sac turned forward, and a posterior extremity, the neck, continued by the urethra. Its average weight is about sixteen ounces. Modes of attachment: a fold of the peritoneum forming the three ligaments of the bladder. Its interior shows the vesical trigone. Structure: a mucous membrane internally, a muscular coat, longitudinal, circular, oblique and spiroid fibres, and a serous coat in its anterior region; arteries from the vesico-prostratic; nerves from the

pelvic plexus and some inferior branches of the two last sacral pairs.

VAGINA.—Situation: in the pelvic cavity between the rectum and the bladder. Internal surface ridged by longitudinal folds. Structure: an external coat muscular, an internal mucous; and arteries from the internal pudic; nerves from pelvic plexus.

VULVA.—Situating below the anus. It presents an external opening with two lips, a superior and inferior commissure; the latter lodges the clitoris covered by a fold of mucous membrane called the prepuce. At some four or five inches from this external opening the meatus urinarius and its valve. The hymen is a membrane which separates the cavity of the vagina from that of the vulva. Structure: a mucous membrane, an erectile body named the vaginal bulb, the posterior and the anterior constrictor muscles of the vulva, two muscular ligaments and an external layer of skin.

ANGIOLOGY.

Arteries.—**EXTERNAL ILIAC OR CRURAL TRUNK.**—External branch of the termination of the abdominal aorta, running obliquely downwards, backwards and outwards to be continued by the femoral. Its collaterals are the small testicular or uterine (see page 171)

and the circumflex iliac running at a right angle outwardly to divide into anterior and posterior branches, ramifying in the abdominal muscles.

INTERNAL ILIAC OR PELVIC TRUNK.—Extends from the last lumbar vertebræ downwards, outwards and backwards to the insertion of the small psoas, where it terminates by the obturator and the iliaco-femoral. Its collateral branches are :

1. **UMBILICAL**—Almost entirely obliterated in the adult, and found extending to the fundus of the bladder, placed in the free border of its lateral ligaments.

2. **INTERNAL PUDIC.**—In the male; running backwards along the superior border of the internal obturator muscle, into the pelvic cavity to the ischial arch, where it terminates in the bulb of the urethra. Its principal collaterals are the vesico-prostatic, which ramifies in the bladder, and the vesicula seminalis. In the female, it ends in the vagina by rectal, vulvar, vaginal and bulbous branches; its principal collateral is the vaginal artery.

3. **SUB-SACRAL OR LATERAL SACRAL.**—Runs backwards under the sub-sacral foramen to the posterior extremity of the sacrum, where it ends by the ischiatic and lateral coccygeal after furnishing collaterals to the surrounding parts and four spinal branches.

a. **ISCHIATIC.**—Runs through the ischiatic ligament to ramify in the ischio-tibial muscles.

b. **LATERAL COCCYGEAL.**—Extends backwards to the end of the tail between the caudal vertebræ and the depressor muscles of that region, giving off muscular and cutaneous collaterals.

c. **MEDIAN CAUDAL**—branch from the right lateral coccygeal runs between the two depressor muscles of the tail; backwards to its end, where it terminates.

4. ILIACO-MUSCULAR OR ILIO-LUMBAR.—Passes outwardly between the psoas iliacus and the bone that it covers, and near the external angle of the ilium terminates by muscular branches.

5. GLUTEAL.—Ramifying in the gluteal muscles after passing outside the pelvic cavity through the great sciatic notch.

a. **OBTURATOR.**—Directed backwards and downwards towards the obturator foramen, runs through it and divides into branches to the internal crural and ischio-tibial muscles; amongst these branches we find the cavernous, which creeps backwards and inwards towards the crus penis, where it dips and furnishes the posterior dorsal of the penis, which goes along the superior border of that organ to anastomose with the anterior dorsal.

ILIACO-FEMORAL.—Passes outwards the tendon of

the psoas parvus above the origin of the anterior rectus muscle, and ends in the patellar muscles.

Veins.—The internal iliac formed by the iliaco-femoral, obturator, iliaco-muscular, gluteal, lateral sacral and internal pudic, unite with the external iliac to form the pelvi-crural trunk.

Lymphatics.—Empty into the sub-lumbar ganglions.

NEUROLOGY.

SACRAL NERVES—Five pairs. Superior branches like those of the other spinal nerves. The inferior branch co-operates to form the lumbo-sacral plexus (see abdominal extremity, page 63) by the first, second and third pairs; the fourth constitutes the internal pudic, and the fifth the anal or hemorrhoidal nerve.

SACRAL PORTION OF THE SYMPATHETIC.—Formed by four ganglions united by branches communicating with the spinal sacral nerves, and at the posterior extremity of which starts a last nerve, the end of the sympathetic cordon, which terminates in various ways.

CHAPTER XI.

CAUDAL REGION.

OSTEOLOGY.

CAUDAL VERTEBRÆ.—Fifteen to eighteen in number, in which the general characters of the vertebræ are easily recognized in the anterior ones, but which by degrees disappears till the last, where it constitutes a small elongated somewhat conical bone.

SYNDESMOLOGY.

Articular surfaces are the facets of the bodies of the vertebræ. Means of union are an inter articular cartilaginous meniscus and longitudinal ligamentous fibres.

MYOLOGY.

Three sacro-coccygeal and one ischio-coccygeal muscles.

1. SACRO-COCYGEAL SUPERIOR.—Synonyms. Erector coccygis, (P). Attachments: Summits and sides of three or four last processes of the sacral spine and

coccygeal vertebræ. Action: Elevates or pulls the tail to one side.

2. SACRO-COCCYGEAL INFERIOR.—Synonyms. Depressor coccygis, (P). Attachments: The inferior face of the caudal vertebræ. Action: Depresses or inclines the tail to one side.

3. SACRO-COCCYGEAL LATERALIS.—Synonyms. Curvator coccygis, (P). Attachments: The spinous process of the last lumbar vertebræ and of the caudal vertebræ. Action: Inclines the tail sideways.

4. ISCHIO-COCCYGEAL.—Synonyms. Compressor coccygis, (P). Attachments: The sacro-ischiatic ligament, the ischiatic crest and the sides of the last sacral and two first caudal vertebræ. Action: Depresses the entire caudal appendage.

ANGIOLOGY.

Arteries.—LATERAL AND MEDIAN CAUDAL (see page 181).

Veins.—Satellites of the arteries.

NEUROLOGY.

NERVES—Six to seven pairs. They form by the union of their branches, two long nerves, one under the depressor of the tail, the other under the sacro-caudal lateralis, which lose themselves into the ligaments and the muscles of the tail.

CHAPTER XII.

APPENDIX.

Genital organs of the male.—Situated partly in the inguinal region, in the pelvic cavity and between the two internal crural regions.

Testicular envelopes—**SCROTUM.**—Single cutaneous pouch covering the two testicles, thin, covered with short fine hairs and lubricated by unctuous secretion of sebaceous follicles.

DARTOS.—Contractile tissue, one for each testicle, resting on each other on the median line, separated above for the passage of the penis; covered externally by the scrotum, to which it is adherent, and covering the fibrous and erythroid tunics. It is composed of elastic and unstriped muscular fibres.

CREMASTER OR TUNICA ERYTHROIDES.—Bright red band attached above to the peritoneal surface of the lumbar aponeurosis, expanding below and terminating upon the

FIBROUS TUNIC.—(Infundibulum fascia), continuous

with the transversalis fascia, it forms the most complete covering of the serous parietal layer of the tunica vaginalis, to which it is closely adherent.

TUNICA VAGINALIS.—Diverticulum of the abdominal cavity, and lined by the peritoneum. Its interior forms a serous sac, which is elongated downwards, inwards and backwards, and is divided into a parietal layer which lines the inside of the fibrous tunic, and a visceral layer covering the testicle and the spermatic cord. These two layers are made continuous by a posterior frænum. The tunica vaginalis contains usually a certain quantity of serous fluid.

TESTICLES.—External conformation: oval, flattened sideways and suspended at the extremity of the spermatic cord. It has two faces, smooth and round, an inferior border convex and free, and a superior border related to the epididymis. It is hanging in the tunica vaginalis, through the testicular or spermatic cord, formed by the spermatic vessels and the vas deferens. Structure: 1—A fibrous covering or tunica albuginea, which is thicker towards the inner border of the organ where it forms the corpus Higmori; this membrane is dense and inelastic; 2—A tissue proper, greyish yellow pulp contained in the fibrous envelope. It presents the tubuli seminiferi, in the axis of which are perceived the spermatozoa and the remains of the spermatic cells.

A section of the testicle shows the trabeculæ testis, the straight canaliculi (*vasa recta*), the rete testis continued into the epididymis as the *vasa efferentia*; 3—Blood vessels: the spermatic artery, the veins from the pampiniform plexus, the lymphatics are numerous; 4—the nerves come from the sympathetic.

EPIDIDYMIS.—It commences in the excretory canal of the testicle, is an elongated body resting upon the superior border of the testicle, having a middle portion, flat on both sides, an anterior extremity, head or *globus major* and a posterior, tail or *globus minor*, which is continued by the *vas deferens*. Structure: a simple ciliated epithelium resting on a proper amorphous membrane, placed on unstriped circular fibres in the efferent ducts; and beyond a stratified ciliated epithelium, a proper membrane and two layers of circular and longitudinal unstriped fibres, protected by a fibrous tunic.

DEFERENT CANAL—VAS DEFERENS.—A flexuous, then straight duct, running from the *globus minor* to the inside of the pelvic cavity through the inguinal ring, inflected there backwards, suddenly dilated and terminating in the *vesicula seminalis*. Structure: a mucous coat internally, covered by a contractile and a fibrous tunic.

VESICULÆ SEMINALIS—AND EJACULATORY DUCT.—Sit-

uated in the pelvic cavity, above the bladder and the vas deferens, it has a middle portion covered by the rectum; an anterior extremity, the largest forming a cul de sac; a posterior extremity tapering to a narrow neck and receiving at an acute angle the termination of the vas deferens. Structure: an internal mucous coat, a middle muscular and an external fibrous.

The ejaculatory ducts, formed by the union of the vesiculæ seminales and the vas deferens, terminate in the urethra on the side of the veru montanum.

URETHRA.—A membranous canal extending from the neck of the bladder to the end of the penis. Course: from its origin backwards in the pelvic cavity, there bends downwards over the ischial arch between the two roots of the corpus cavernosum, forward to the head (glans) of the penis, terminating by the urethral tube. It is divided into an intra pelvic or membranous, and an extra pelvic or spongy portion.

Interior.—Constricted at its origin, it expands at the prostate gland, forming the cul de sac of the bulb or ventricle; then contracts over the ischial arch, and remains of the same size to the end. Behind the urethral tube is the fossa navicularis. On the mucous membrane it presents the openings of the prostate gland, the urethral ridge or veru montanum and the excretory canals of Cowper's glands. Structure: a

mucous membrane, thin and having longitudinal folds; an erectile envelope or corpus spongiosum, covering the extra pelvic portion only; muscles, represented by that of Wilson, the bulbo-cavernous or accelerator urinæ, the ischio-urethral or compressor urinæ and the transverse perinei. Blood vessels, the two dorsal arteries of the penis and nerves from the internal pudic and great sympathetic.

PERINEAL APONEUROSIS.—Divided into superior and deep layers.

GLANDS ANNEXED—PROSTATE.—Situated in the pelvic cavity at the commencement of the urethra; a conglomerated gland whose secretion is thrown into the urethra.

COWPER'S GLANDS—OR SMALL PROSTATE.—Situated on each side of the urethra, above the ischial arch, and covered by the muscles of Wilson and ischio-urethral.

CORPUS CAVERNOSUM.—Erectile stalk, base of the penis and support of the urethra. Situated between the thighs, prolonged beneath the abdomen, attached to the ischial arch and terminating by the glans penis. External conformation: it offers two lateral faces plane; a superior or dorsal border rounded; an inferior or urethral channeled for the reception of the urethra; a posterior extremity with two roots or crura attached to the ischial arch, and covered by the erector

penis muscle; and an anterior extremity forming a blunt point, surrounded by the spongy tissue of the glands. It is attached by the two crura and the two suspensory ligaments. Structure: erectile tissue, composed externally of white, elastic, fibrous envelope, sending by its inner face numbers of lamellar trabeculæ. The blood vessels are the dorsal arteries of the penis. Nerves from the internal pudic and great sympathetic.

PENIS.—Male organ of copulation. Extending from the ischial arch between the thighs and the two dartoid sacs, beneath the belly, where it terminates. Divided into a fixed and a free portion, which is covered by the cutaneous fold of the skin, the sheath or prepuce. The free portion at its anterior extremity presents the urethral tube, the urethral sinus and the sub-urethral notch. The penis has two suspensory and retractile cords, composed of unstriped muscular fibres, which draw it back into the sheath after erection. The sheath contains a large number of sebaceous or preputial glands, secreting an unctuous fatty matter, the smegma preputii.

GENITAL ORGANS OF THE FEMALE—OVARIES, FALLOPIAN TUBES. UTERUS, VAGINA, VULVA.—(See abdominal and pelvic cavities, page 163.)

MAMMÆ.—Situated in the inguinal region, they

form two hemispherical masses, distinct from each other and having in their centre the teat, nipple or mammillæ. Structure: composed of a yellow elastic fibrous envelope; they consist of a glandular tissue made of acini, clustered in groups around the lactiferous ducts, which, by their union, open in the galactiferous sinuses, from which rise the true excretory canals of the glands. Much connective tissue unite these acini. The arteries of the mammæ come from the external pudic; the nerves from the first lumbar nerve. Their function is to secrete the milk.

CHAPTER XIII.

ARTERIAL SUBDIVISION.

MAIN TRUNK.	COLLATERAL.	TERMINATION.
Primitive aorta.	Right and left cardiac.	Posterior and anterior aorta.
Cardiac arteries.		
Posterior aorta.	Intercostal, diaphragmatic, lumbar, middle sacral, broncho-oesophageal, cœliac axis, great and small mesenteric, renal, spermatic, small testicular or uterine.	External and internal iliacs.
Intercostal.		Inferior intercostal proper, superior or dorso-spinal.
Lumbar.		Superior and inferior muscular branches.
Diaphragmatic.		Muscular branches.
Middle sacral.		
Broncho-oesophageal.	Innominated.	Bronchial and œsophageal arteries.
Bronchial.		
Œsophageal.		Superior and inferior.
Cœliac axis.		Gastric, splenic, hepatic.
Gastric.		Anterior and posterior.
Splenic.	Splenic, gastric, epiploic branches.	Left gastro epiploic.
Hepatic.	Pancreatic branches, pyloric artery.	Right gastro epiploic.
Great mesenteric.	Innominated.	Three fasciculi—left, right and anterior.
Left fasciculus.		Arteries of small intestines.

MAIN TRUNK.	COLLATERAL.	TERMINATION.
Right fasciculus.		Ileo cæcal, two cæcal, right colic.
Anterior fasciculus.		Left colic, first artery of floating colon.
Small mesenteric.		Arteries of small colon
Renal, or emulgent.		
Spermatic, or utero-ovarian.		Uterine and ovarian.
Small testicular, or uterine.		
Internal iliac.	Umbilical, internal pudic, iliaco-muscular, gluteal, subsacral.	Obturator and iliaco-femoral.
Umbilical.		Vesical branches.
Internal pudic.	Vesico-prostatic, muscular branches—(male). Vaginal—(female).	Bulbous branches.
Subsacral.	Innominated branches.	Ischiatic, lateral caudal, median from right caudal.
Iliaco-muscular.		
Gluteal.		
Obturator.	Muscular branches, and artery of corpus cavernosum.	Muscular branches.
Artery corpus cavernosum.		Posterior dorsal of the penis.
Iliaco-muscular.		Muscular branches.
External iliac.	Small testicular, circumflex iliac.	Femoral.
Circumflex iliac.		Anterior and posterior muscular branches.
Femoral.	Anterior pudic, deep muscular, superficial, small muscular and saphena.	Popliteal.
Anterior pudic.		Posterior abdominal, external pudic.
Posterior abdominal.	Muscular branches.	Subcutaneous abdominal, anterior dorsal of the penis (male), mammary (female).
External pudic.		Muscular branches.
Deep muscular.		Muscular branches.
Superficial muscular.		Muscular branches.

MAIN TRUNK.	COLLATERAL.	TERMINATION.
Small muscular.	Medullary of the femur.	Muscular branches.
Saphena.		Cutaneous branches.
Popliteal.	Femoro-popliteal, articular and muscular branches.	Anterior and posterior tibial.
Posterior tibial.	Posterior tibial muscular branches, tibial articular branches, medullary tibial, and branches to anterior part of hock.	Two plantar.
Plantar.	From convexity of the anastomoses—two superficial innominate, two deep interosseous.	Anastomose together in the hock.
Anterior tibial.	Muscular and peroneal branches.	Pedal.
Pedal.	Articular and cutaneous branches.	Perforating pedal, metatarsal pedal.
Perforating pedal.		With plantar.
Metatarsal pedal.	Ligamentous and cutaneous branches.	Digital.
Digital.	Articular and tendinous innominate, perpendicular artery of Percival, artery of plantar cushion, coronary plexus.	Plantar and preplantar.
Ungueal preplantar.		Anterior face of coffin bone.
Plantar.		Plantar circle.
Anterior aorta.	Dorsal, superior cervical, vertebral, internal thoracic, external thoracic, inferior cervical, supra and subscapular.	Brachial or axillary, the right furnishes the brachio-cephalic trunk.
Dorsal.	Sub-costal, second, third and fourth intercostal.	Muscular branches.

MAIN TRUNK.	COLLATERAL.	TERMINATION.
Superior cervical.	First intercostal.	Anastomoses with occipito-muscular and dorsal.
Vertebral.	External, superior and inferior muscular branches, internal spinal.	With occipital.
Internal thoracic.	Superior branch to pericardium and mediastinum, inferior and external muscular branches.	Anterior abdominal, and thoracic or axillary.
External thoracic.		Muscular branches.
Inferior cervical.		Superior, or ascending, and inferior, or descending.
Supra-scapular.		Muscular branches.
Subscapular.	Branches to latissimus dorsi, posterior circumflex of the shoulder, muscular branches.	Muscular branches.
Humeral.	Prehumeral, or anterior circumflex of the shoulder, deep humeral, epicondylar, artery of coracoradialis.	Anterior and posterior radial.
Anterior radial.	Articular and muscular branches.	At knee joint.
Posterior radial.	Articular and muscular branches, interosseous of forearm.	Interosseous metacarpal, collateral metacarpal.
Radio-palmar, or trunk of interosseous metacarpal.		Supra-carpal arch, sub-carpal arch.
Sub-carpal arch.	Two posterior interosseous, two anterior interosseous.	
Collateral metacarpal.	Branches to supra-carpal arch, synovial and tendinous branches anastomose to anterior and posterior interosseous.	Digital.

MAIN TRUNK.	COLLATERAL.	TERMINATION.
Digital.		Like in the hind extremity.
Carotid.	Thyro-laryngeal, thyro-accessorius.	Occipital, internal and external carotid.
Occipital.	Prevertebral, mastoid, atlido-muscular.	Occipito-muscular and cerebro-spinal.
Occipito-muscular.		Muscular branches.
Cerebro-spinal.	{ Branches to medulla oblongata, branches to annular protuberance, posterior cerebellar artery, anterior cerebellar artery, two branches to internal carotid. }	{ One anterior for basilar trunk, one posterior median-spinal, with posterior cerebral. }
Basilar trunk.		
Median-spinal.		
Internal carotid.		{ One posterior cerebral.
External carotid.	Glosso-facial, maxillo-muscular, posterior auricular.	{ One anterior cerebral, one median cerebral.
Glosso-facial.	Pharyngeal, lingual, sublingual, inferior and superior coronary, innominate branches.	Superficial temporal, internal maxillary.
Maxillo-muscular.		One ascending and one descending branch.
Posterior auricular.		Muscular branches.
Superficial temporal.		Muscular and parotid-can branches.
Subzygomatic.		Anterior auricular, subzygomatic.
Internal maxillary.	Inferior dental, pterygoid, tympanic, sphenoidal, deep posterior temporal, deep anterior temporal, ophthalmic, buccal, staphyline, superior dental, nasal.	Transversal of the face and masseterine.
		Palato-labial.

MAIN TRUNK.	COLLATERAL.	TERMINATION.
Ophthalmic.	Muscular of the eye, ciliary and lachrymal.	Meningeal and nasal branches.
Palato-labial.		Anastomose together, and ramify in upper lip.

BONES.

CENTERS OF OSSIFICATION.

Vertebræ, two principal, and five or six complimentary.	Nasal, one.	Sesamoid, one.
Atlas, six.	Turbinated, one.	Navicular, one.
Sacrum, five vertebræ.	Vomer, one.	Ossa innominata, three.
Occipital, four.	Inferior maxillary, two.	Ilium, two.
Parietal, two.	Hyoid, seven.	Ischium, two.
Frontal, two.	Sternum, six.	Pubis, one.
Sphenoid, two.	Rib, three.	Femur, four.
Ethmoid, three.	Scapula, two.	Tibia, four.
Temporal, three.	Humerus, six.	Fibula, one.
Bones of ear, one.	Radius, three.	Patella, one; Tarsus, one, except Os calcis, two.
Supermaxillary, one.	Cubitus, two.	Principal metatarsal, two.
Teeth, one.	Carpus, all one apiece.	Small metatarsal, one.
Intermaxillary.	Principal metacarpal, two.	Phalanges, one apiece.
Palate, one.	Small metacarpal, one.	Sesamoids, one apiece.
Pterygoid, one.	Os suffraginis, two.	Navicular, one.
Zygomatic, one.	Os coronæ, one.	
Lachrymal, one.	Os pedis, one.	

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