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A Companion to Manuals of Practical Anatomy

SEVENTH EDITION

E. B. JAMIESON

A COMPANION TO MANUALS OF PRACTICAL ANATOMY

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A COMPANION TO MANUALS OF PRACTICAL ANATOMY

DEDICATED

TO

SIR WILLIAM TURNER, K.C.B., F.R.S.

WHOSE STIMULATING TEACHING ALWAYS

MADE ANATOMY AN

INTERESTING

STUDY

PREFACE TO THE SEVENTH EDITION

THIS book was begun in 1911 at the request of the late Mr. J. Keogh Murphy, F.R.C.S., who was then the Medical Editor of the Oxford University Press. It was meant "to provide, in an easily portable form, an account of naked-eye Anatomy expressed in terms of the Basle nomenclature".

The structures were described under their Systems, for both Mr. Keogh Murphy and the late Professor Arthur Robinson (who was my guide and counsellor) preferred that method. But the more crowded regions were dealt with topographically also; and I included such things as the movements in Swallowing, the relations of the Joints, the relation of Articular Capsules to Epiphyseal Lines, and the relations of the chief structure in the "no man's land" of each Boundary Region.

Throughout, relative positions were given fairly fully—perhaps rather more so than had been customary. As structures vary in different bodies, I examined many specimens in order to estimate what was probably the most common arrangement; and I was at some pains to harmonise the accounts of relations.

At the end of the book (against the counsel of my advisers) I added a compressed account of Development.

To include all this matter and keep the size of the book within the prescribed bounds, I employed very condensed language and made frequent use of contractions.

The *first* edition was published in 1913; and, after several reprints, it was followed by the *second* edition in 1925. In that edition several changes were made:—The division of the Abdomen into artificial regions was omitted; the section on the Lymphatic System was re-written; the account of the Tracts of Nerve-fibres was re-arranged; alterations were made in the chapters on Development, Ductless Glands and the Urogenital Apparatus, and new matter was included in them; and brief descriptions of Bone-marrow, Paraganglia and the Autonomic Nervous System were added.

The *third* edition appeared in 1932, and in it the whole text was drastically revised. Many parts were re-written—and even whole sections, including those on the Perineum, the Heart and Pericardium, the Fœtal Circulation, the Central Nervous System, and certain viscera such as the Liver. This was largely the result of longer practice in teaching and was chiefly an endeavour to make the text more explanatory and more easily read, but it was partly due to the insertion of new matter, especially in the Nervous System. In that system, further, I described the Brain from above downwards, in the belief that the student can follow the narrative better than is possible when it is described from below upwards. In preparing the

third edition, I gained much from consultations with a former pupil and colleague—Professor T. B. Johnston, who was then in Guy's Hospital.

In 1928, the Anatomical Society appointed a sub-committee of three—Professor T. B. Johnston, the late Professor A. Francis Dixon and myself—to revise the Basle Nomina Anatomica ; and in 1933, at Birmingham, the Society approved of our revised version. In the *fourth* edition (1935), the text was altered to fit this " Birmingham Revision " of the nomenclature (B.R.) ; and the *fourth* edition underwent very little other change.

The only new matter in the *fifth* edition (1942) was a short description of the Pterygo-mandibular Ligament (accidentally omitted in previous editions) and a description of the origin, circulation and functions of the Cerebro-spinal Fluid. But there was a great alteration in the arrangement. A large part of the text was re-cast and put into " regional " form, and only a brief outline of the course and distribution of Vessels and Nerves was left in their " systematic " description. This was done in order that the book might have a better claim to its title of *A Companion to Manuals of Practical Anatomy* and because I had come to think that that was the better plan. This re-arrangement seems to have been justified by the rapidity with which the fifth edition and all subsequent impressions ran out of print.

In the *sixth* edition and in this edition—the **Seventh**—there has been no change in scope or in general arrangement, and no change in substance beyond small excisions and additions here and there.

But in these two editions, as in all editions after the first, I have lessened the condensation and tried to make the text more easily read ; and I have seen cause in some places to break up paragraphs and to alter the phraseology in order to make statements more emphatic and more likely to be remembered.

The alterations and additions have increased the number of pages from 519 in the *first* edition to 715 in the *sixth* and *seventh*—the biggest increases being 92 pages in the *third* and 75 in the *fifth*.

During the war and after the war, various impediments coupled with rapid exhaustion of printed copies have created regrettable gaps between the issues from the *fourth* edition onwards ; and, as the latest reprint of the *sixth* edition was bespoken before it came from the binders, there is a gap between issues again.

As a conclusion, I should like to thank reviewers for their friendly notices—especially the younger reviewers of the later editions, for they had obviously used a previous edition for study, and the favourable opinion expressed by them is therefore very comforting.

E. B. J.

April, 1950.

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COMPANION

TO

MANUALS OF PRACTICAL ANATOMY

OSTEOLOGY

THE **vertebrate skeleton** is divisible into: (1) an **exo-skeleton,** comprising hair, feathers, scales, armour-plates, nails, teeth, etc.; (2) an **endo-skeleton,** comprising bones with their cartilages and ligaments; (3) a **splanchnic skeleton,** which may be included in endo-skeleton, and comprises the cartilages of larynx, trachea and bronchi, and the os cordis and os penis of certain mammals.

The **endo-skeleton** is the framework of the body, and accounts for about one-seventh of the body-weight. It is divided into an **axial skeleton,** which belongs to head, neck and trunk, and an **appendicular skeleton,** which belongs to the limbs. The bones and the costal cartilages of the endo-skeleton are dealt with under Osteology.

Uses of Bones.—1. They give lasting form to the body.

2. They provide attachments and support for muscles, tendons, ligaments, fibrous membranes and fasciæ.

3. They articulate with one another to form joints and are the passive levers in the movements at joints; and by means of them precision is given to movements.

4. They protect organs in the cavities of the body.

5. The marrow in them is a blood-forming organ.

Classification.—1. **Long bones,** each possessing a shaft and two ends, *e.g.*, the femur. Metacarpals, metatarsals and phalanges are *miniature long bones.*

2. **Short bones,** *e.g.*, carpal and tarsal bones. *Sesamoid bones* are short bones in tendons.

3. **Flat bones,** *e.g.*, scapula, parietal bone of skull, ribs.

4. **Irregular bones,** *e.g.*, vertebræ.

5. **Pneumatic bones** are certain bones of the skull, *e.g.*, maxilla, which contain air-spaces or sinuses that communicate directly or indirectly with the nasal cavity.

Characters.—Bone is the hardest and most enduring tissue in the body, except the enamel of the teeth; it is elastic, and very strong—almost as strong as cast iron, about twice the strength of oak.

The osseous tissue on the surface of a bone is dense and hard, and is called **compact bone**. The tissue in the interior also is hard, but contains numerous spaces, like a sponge, and it is called **spongy bone** The spongy substance is arranged in planes adapted to withstand strain and stress; and the spaces are filled with **red marrow.**

Short bones and the bulky parts of irregular bones consist of spongy tissue encased in a shell of compact tissue.

Flat bones and the thinner parts of irregular bones consist of two plates or **tables** of compact tissue separated by a thin layer of spongy tissue. In flat *skull-bones* the outer table is thick; the inner table is thin, dense and brittle. Spongy tissue appears between the tables after the 5th or 6th year and is called the **diploe.**

The *ends* of long bones consist of spongy bone enclosed in a thin crust of compact bone. They are expanded in order :—

1. To provide a larger articular surface, thus reducing the risk of disarticulation and facilitating accuracy of movement.

2. To diffuse shocks received at the joint.

3. To provide a larger area for muscular attachments.

The *shaft* of a long bone is a hollow cylinder, consisting of a thick wall of compact tissue lined with some wide-spaced spongy tissue, and enclosing a **medullary cavity,** which is filled with **yellow marrow.** The shaft is always curved, and usually in more than one plane. This adds to its strength and resistance, which are further ensured by the greater thickness of the compact tissue on the concave sides of the curves. The presence of a cavity makes the bone lighter, with very little diminution of the strength and stability.

Except in skull-bones, the articular surfaces are coated with permanent **articular cartilage**; but in the preparation of specimens used in reading that cartilage has been removed. The non-articular parts present ridges and tubercles for tendons and ligaments, and flatter areas for fleshy attachments.

Bones are covered with a vascular fibrous membrane called **periosteum.** Vessels from the periosteum enter the bone through small foramina on the surface. The **nutrient artery** and **vein,** though small, are the most constant in position. They enter the shaft of a long bone through the **nutrient foramen** to reach the yellow marrow.

Articular cartilage has no membranous covering except at its edges, but other cartilages, *e.g.*, costal cartilages, have a similar vascular covering called **perichondrium.**

Medullary cavity of a long bone and the spaces in spongy bone are lined with membrane called **endosteum.**

Development.—Bones are developed from mesoderm. A condensation of mesodermic tissue takes place to form a **membranous "bone".** In some regions, *e.g.*, vault of cranium, ossification occurs in this membrane. In most situations, chondrification of the membrane-bone takes place before ossification begins, and a **cartilage "bone"** is formed. In any bone, a point at which bony tissue begins to form is called a **centre of ossification.** One or more such **centres** appear in the cartilaginous model, and it is converted into bone proper.

Centres which first appear are called **primary centres.** They appear usually before birth. The part of a bone formed from a primary centre is called the **diaphysis.** In a long bone, this is the shaft. **Secondary** or **epiphyseal centres** appear usually after birth. Parts of bones formed from secondary centres are called **epiphyses.** The unossified plate of cartilage between an epiphysis and the diaphysis is called the **epiphyseal cartilage.** It unites the epiphysis and diaphysis and the union is a **primary cartilaginous joint.** The position of the edge of the epiphyseal cartilage, on the surface of the bone, is called the **epiphyseal line.**

Ossification and growth take place continually at the surfaces of the epiphyseal cartilage, until the cartilage disappears and the epiphysis joins the diaphysis, and then

growth, in the direction at right angles to the surface of cartilage, ceases. Ossification never spreads into the superficial layers of articular cartilage. Osseous tissue formed in cartilage is all destroyed during the process of growth of the bone, and is replaced by bone formed in the deeper layers of the periosteum.

In a long bone, increase in length takes place by proliferation of cells of epiphyseal cartilage and of the deep layers of the articular cartilage, followed by the preliminary ossification. Increase in girth takes place by deposition of bone under the periosteum.

In a long bone, the epiphysis whose centre appears last is the first to join the diaphysis, except in the fibula.

The nutrient artery is directed towards the epiphysis which joins first. In long bones with only one epiphysis, *e.g.*, clavicle, the artery is directed towards the end which has no epiphysis; and the epiphysis is at the more movable end of the bone.

When an epiphysis has more than one centre, *e.g.*, upper end of humerus, these centres coalesce before the epiphysis joins the diaphysis.

AXIAL SKELETON

Vertebral column	Skull, including mandible
Ribs and costal cartilages	Hyoid bone
Sternum	Auditory ossicles

APPENDICULAR SKELETON

Upper Limb		Lower Limb	
Shoulder-girdle	Clavicle, Scapula	Pelvic-girdle = Hip-bone	
Upper arm	Humerus	Thigh	Femur, (Patella)
Forearm	Radius, Ulna	Leg	Tibia, Fibula
Wrist	8 Carpal bones	Foot	7 Tarsal bones, 5 Metatarsal bones
Palm	5 Metacarpal bones	Digits	Big toe, 2 phalanges; Other toes, 3 phalanges each
Digits	Thumb, 2 phalanges; Fingers, 3 phalanges each	Sesamoid bones	
Sesamoid bones			

Definitions

Aveolus, a deep, narrow pit.
Antrum, a cavity.

Condyle, a smooth, rounded articular eminence.
Distal, applied to limbs, means farther away from root of limb.
Epicondyle, a prominence above an articular surface.
External, farther away from centre of a cavity or an organ.
Fossa, a broad depression, usually shallow.
Fovea, a small shallow depression.
Hamulus, a hook-shaped process.
Hiatus, a slit or a gap.
Incisura, a notch.
Internal, nearer the centre of a cavity or an organ.
Lamella or **Lamina,** a thin plate or sheet.
Lateral, farther away from median plane.
Meatus, a short canal.
Medial, nearer median plane.
Median plane is the antero-posterior or dorso-ventral plane that divides the body into a right and a left half.
Planum, a flat surface.
Processus or **process,** any kind of projection.
Proximal, applied to limbs, means nearer root of limb.
Sinus (1), a cavity in a bone.
(2), a venous blood-channel without muscular walls.
(3), a venous blood-space in an organ.
(4), a cavity within a viscus.
(5), a narrow space lined with serous or mucous membrane.
Spina or **Spine,** a sharp, pointed process.
Sulcus, a groove or furrow.
Trochlea, a pulley or a pulley-shaped surface.
Tuber, tuberculum } a rounded eminence, usually rough.
Tubercle, tuberosity }

VERTEBRAL COLUMN

33 **vertebræ** grouped according to regions :—

Movable or **true** : 7 cervical, 12 thoracic, 5 lumbar.

Fixed or **false** : 5 sacral, fused in adult to form **sacrum** ; 4 (3 to 5) coccygeal, fused to form **coccyx.**

Common features are seen best in mid-thoracic region.

Parts of a vertebra: (1) **Body** is the bulky part in front, and it varies in size and shape in different regions. *Superior* and *inferior surfaces,* slightly concave and attached to intervertebral discs. *Anterior surface,* convex from side to side ; *posterior surface,* slightly concave from side to side.

(2) **Pedicles** are a pair of horizontal bars that jut backwards from upper part of back of body ; borders are concave, and form floors of (3) **superior** and **inferior vertebral notches,** of which the inferior is the deeper and wider.

(4) **Laminæ** are a pair of broad, flat, sloping plates, joined to each other at median plane, and to the pedicles

laterally. Their borders and internal surfaces are rough for attachments of ligamenta flava.

(5) Pedicles and laminæ together form the **vertebral arch.**

(6) **Vertebral foramen** is bounded by the vertebral arch and the back of the body.

(7) **Spine** extends backwards from junction of laminæ.

(8) **Transverse process** stands out from the junction of the pedicle and the lamina.

(9) **Articular processes, superior** and **inferior,** jut upwards and downwards from the junction of pedicle and lamina, and have smooth surfaces for articulation with articular processes of contiguous vertebræ. The superior pair are farther forward than the inferior.

When vertebræ are placed together, the vertebral foramina form the **vertebral canal,** for the lodgment and protection of the spinal cord and its membranes ; and the vertebral notches, assisted by articular processes, bodies and discs, form a series of **intervertebral foramina,** for the transmission of spinal nerves and vessels.

CERVICAL VERTEBRÆ

Special Characters.—*Small size ; irregular outline ; three foramina*—a small one in each transverse process, and the vertebral foramen in the middle.

Typical Cervical Vertebra.—Body: small ; but is wide transversely.

Pedicles : short and rounded.

Laminæ : long, narrow, sloping.

Vertebral foramen: large ; triangular or semilunar.

Spine : short, bifid.

Transverse process : short ; encloses foramen ; is bifid, ending in two **tubercles—anterior** and **posterior.**

Articular facets of **articular processes** are nearly circular.

Upper surface of **body** is concave from side to side, convex dorso-ventrally ; rounded off anteriorly, raised up at sides. *Lower surface* is correspondingly concavo-convex. *Anterior surface* is slightly elevated in the middle, slightly hollowed out on each side. *Posterior surface* is flat. *Lateral surface* is fused with transverse process and pedicle ; and it helps to bound transverse foramen.

Pedicle springs from the dorso-lateral part of the body. It is directed backwards and sidewards ; and its **vertebral notches** are nearly equal in depth.

Vertebral foramen is larger than in thoracic or lumbar regions.

Spine, compressed vertically, points backwards and downwards.

Transverse process extends sidewards and slightly forwards and downwards. Has two parts: (1) posterior part—the *true transverse process*—springs from vertebral arch; (2) anterior part — the *homologue of a rib*—is attached to the side of the body. The two parts are united laterally by **costo-transverse lamella**, and enclose **foramen transversarium**. Bifid, free end terminates in **anterior** and **posterior tubercles**. These are separated by upper surface of costo-transverse lamella, which is grooved to support the anterior primary ramus of a cervical nerve. Anterior tubercle in 6th vertebra is sometimes enlarged, and is called **carotid tubercle** because the common carotid artery can be compressed against it.

Foramen transversarium is bounded by the parts of the transverse process, and by pedicle and side of body. In upper 6 vertebræ it transmits vertebral artery and plexus of veins, and sympathetic plexus from inferior cervical ganglion.

Articular processes assist bodies in supporting weight of head. Articulating surfaces of *superior pair* look upwards and backwards; of *inferior pair*, downwards and forwards.

Typical cervical vertebræ—3rd, 4th, 5th, 6th—of any one skeleton can be distinguished from one another. Costo-transverse lamella in 3 and 4 is oblique. It is more oblique in 3 than in 4, and vertical depth of side of body is greater in 3. The lamella is horizontal in 5 and 6; and 6 often has an enlarged "carotid tubercle".

Special Cervical Vertebræ.—First vertebra or **Atlas** has no body and no spine. Its parts are a pair of **lateral masses** united by an **anterior arch** and a **posterior arch.**

Anterior arch has a circular facet on its posterior surface for articulation with odontoid process of second vertebra; and a small **anterior tubercle** on its anterior surface for the attachment of ligaments.

Posterior arch is much longer than anterior. It has a groove for vertebral artery and first cervical nerve on its upper surface, near lateral mass; and a small **posterior tubercle** on its posterior surface, in median plane.

Upper surface of lateral mass is elongated and concave, and articulates with occipital condyle; lower surface, nearly circular, articulates with upper facet of second vertebra; medial surface presents a tubercle for the attachment of the transverse ligament.

Transverse process juts out from lateral side of lateral mass. It is not bifid; it is large, to provide leverage

for the muscles that rotate the head ; and it may be felt in the space behind mandible, below the auricle.

Lateral masses are closer together in front than behind.

Superior articular surface is oval, looks upwards and medially ; often notched at the sides. **Inferior articular surface** is slightly concave and looks downwards and medially.

Rectus capitis anterior arises from anterior surface of mass ; and accessory ligament of atlanto-axial joint is attached to postero-medial aspect. Transverse ligament crosses the ring and divides it into small anterior compartment for odontoid process, and larger posterior compartment for spinal cord and its membranes.

Transverse process gives attachment to rectus lateralis, obliquus superior and inferior, levator scapulæ, scalenus medius and splenius cervicis. Its anterior tubercle is absent ; but its posterior tubercle is often divided into two.

Anterior arch joins the antero-medial part of each mass. Ant. atlanto-occipital membrane is attached to its upper border, and ant. longitudinal lig. and longus cervicis to its **anterior tubercle.**

Posterior arch, tilted upwards posteriorly, is continuous with the back of the mass and with posterior root of transverse process. Posterior atlanto-occipital membrane is attached to upper border, and lig. flava to lower border. Groove on upper surface is overhung by tubercle on back of mass. This tubercle is sometimes sufficiently developed to convert the groove into a canal. **Posterior tubercle,** at median plane, represents the spine, and gives origin to the right and left rectus posterior minor.

Second Cervical Vertebra or **Axis.**—Recognised by the tooth-like **odontoid process** that stands up from its upper surface. The front of this process is faceted for the anterior arch of atlas ; and the back is grooved by the transverse ligament of atlas.

Spine is stout, broad, bifid, and can be felt about two inches below the external occipital protuberance.

Transverse process is small and not bifid.

Body : Elevation on the front juts down as a lip.

Odontoid process represents body of atlas ; its apex is blunt, and the apical and alar ligaments are attached to it.

Pedicles : Hidden under upper articular surfaces ; deeply grooved below.

Laminæ are thick and prismatic.

Spine is the broadest of the cervical series (for muscular attachments), and it is deeply grooved on its under surface.

Superior articular processes are on pedicles and anterior roots of transverse processes, and slightly on body. Weight of head is

transmitted through them to vertebral column. They are nearly circular, slightly convex ; look upwards and a little sidewards ; are grooved inferiorly by foramina transversaria. Behind each there is a groove for second cervical nerve. (1st and 2nd cervical nerves, unlike others, are behind articular surfaces.)

Inferior articular processes resemble others of the cervical region.

Transverse process : Not bifid ; small ; turned downwards and backwards. Its foramen is directed upwards and sidewards.

Seventh cervical vertebra has a longer **spine** than any other cervical vertebra ; the tip of the spine is the upper knob at the root of the back of the neck.

End of **spine** is broad and not bifid. **Transverse process** is large and broad ; its anterior tubercle is small or absent ; its costal element may form a separate **cervical rib. Foramen transversarium** is small and transmits a vertebral vein (when there are two).

THORACIC VERTEBRÆ

Special Characters — *Facets on sides of bodies for heads of ribs, and facets on most transverse processes for tubercles of ribs.* Each thoracic vertebra articulates with rib with which it is in numerical correspondence ; and bodies of upper 8 or 9 articulate each with rib below, as well.

Typical Vertebra. — Body is heart-shaped. Deeper behind than in front, owing to curve of column. **Costal facets, superior** and **inferior,** are demi-facets on upper and lower margins of posterior part of side of body.

Pedicles are short.

Laminæ : Broad and flat ; overlap the laminæ below.

Vertebral foramen : Nearly circular. Small, because there is less movement in the thoracic region and less risk therefore of compression of spinal cord.

Spine is long, sloping and slender.

Transverse process is thick. Its free end is expanded and bears, on anterior surface, a facet for articulation with tubercle of rib of corresponding number.

Articular surfaces of **articular processes** are nearly flat ; those on superior pair are directed mainly backwards, on inferior pair, mainly forwards.

Upper and *lower surfaces* of **body** are nearly flat. *Anterior surface* is very convex from side to side, slightly concave from above downwards. *Posterior surface* is concave from side to side, and flat from above downwards. In upper and lower members the shape of body resembles that of cervical and lumbar, respectively. **Superior**