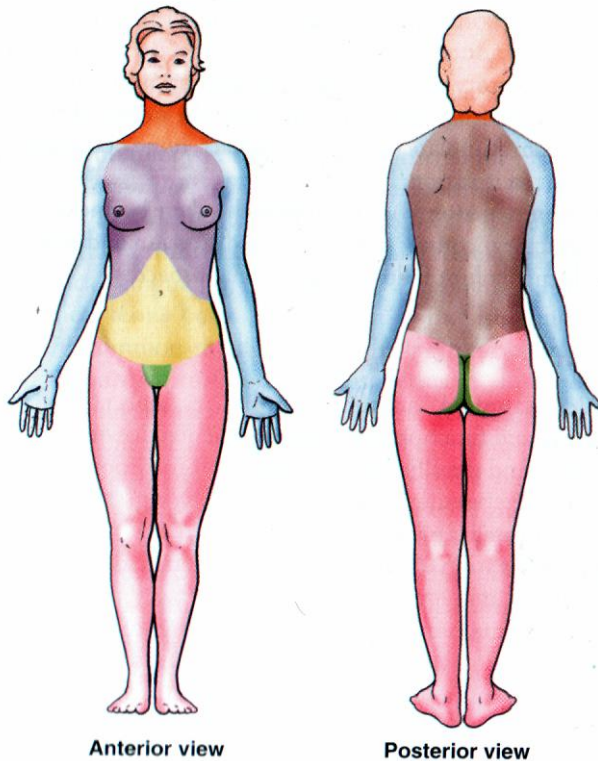


Introduction

THE FORM, SIZE OF THE HUMAN BODY

The human body is made up of the **head** (*caput*), **neck** (*collum*), **trunk** (*truncus*), and two pairs of

Key			
 Head	 Thorax	 Abdomen	 Lower limb
 Neck	 Back	 Pelvis/perineum	 Upper limb



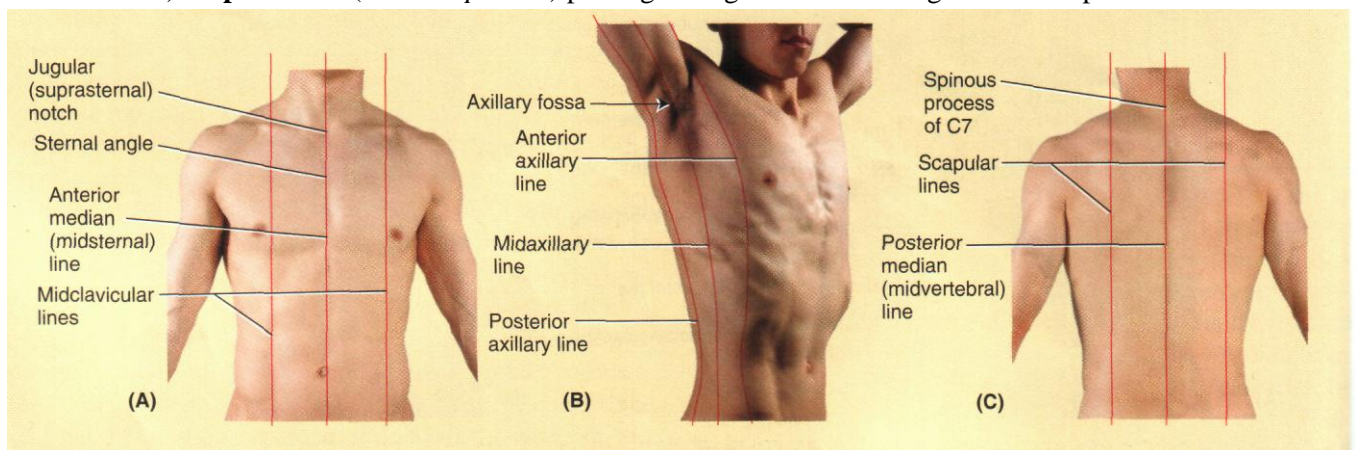
limbs, or **extremities**, the upper (*membra s. extremitates [BNA] superiores*) and lower (*membra s. extremitates [BNA] inferiores*). The following parts are distinguished in the head: the **forehead** (*frons*), the **highest point of the skull** (*vertex*); the **back of the head** (*occiput*); the **temples** (*tempora*) and the **face** (*facies*). The trunk consists of the **chest** (*thorax*), the **abdomen** (*abdomen*) and the **back** (*dorsum*).

The following lines are drawn for orientation on the chest surface:

- 1) **midline** (*linea mediana anterior*);
- 2) **sternal line** (*linea sternalis*) stretching along the sternal border;
- 3) **mamillary line** (*linea mamillaris s. medioclavicularis*) passing through the nipple or the middle of the clavicle;
- 4) **parasternal line** (*linea parasternalis*) passing midway between the sternal and mamillary lines;
- 5) **anterior**, (6) **middle**, and (7) **posterior axillary lines** (*lineae axillares anterior, media and posterior*), the first and last passing through the anterior and posterior folds of the axilla, respectively,

and the middle line passing through the point midway between these folds;

- 8) **scapular line** (*linea scapularis*) passing through the inferior angle of the scapula.



The abdomen is divided by two horizontal lines, one drawn between the ends of the 10th ribs and the other between the anterior superior iliac spines, into three parts, one located above another: the **upper part of the abdomen** (*epigastrium*), the **middle part** (*mesogastrium*) and the **lower part** (*hypogastrium*). Each of these three parts of the abdomen is subdivided by two vertical lines into three secondary regions: the epigastrium is divided into a **middle epigastric region** (*regio epigastrica*) and two **lateral regions**, the **right and left hypochondrium** (*regiones hypochondriacas dextra and sinistra*).

The middle abdomen is divided in the same manner into a **medial umbilical region** (*regio umbilicalis*) and two lateral, **right and left lumbar regions** (*regiones abdominales laterales, dextra and sinistra*) Finally, the hypogastrum is divided into the **pubic region** (*regio pubica*) and two lateral, **right and left inguinal regions** (*regiones inguinales, dextra and sinistra*).

The upper limb is divided into the **arm** (*brachium*), the **forearm** (*antebrachium*) and the **hand** (*manus*), the **palm** (*palma manus*), the **back** (*dorsum manus*) and the **fingers** (*digiti manus*) are distinguished in the hand.

The lower limb, in turn, is divided into the following parts: the **thigh** (*femur*), the **leg** (*crus*), and the **foot** (*pes*), in which the **sole** (*planta*), the **dorsum of foot** (*dorsum pedis*), and the **toes** (*digiti pedis*) are distinguished.

ANATOMICAL TERMINOLOGY

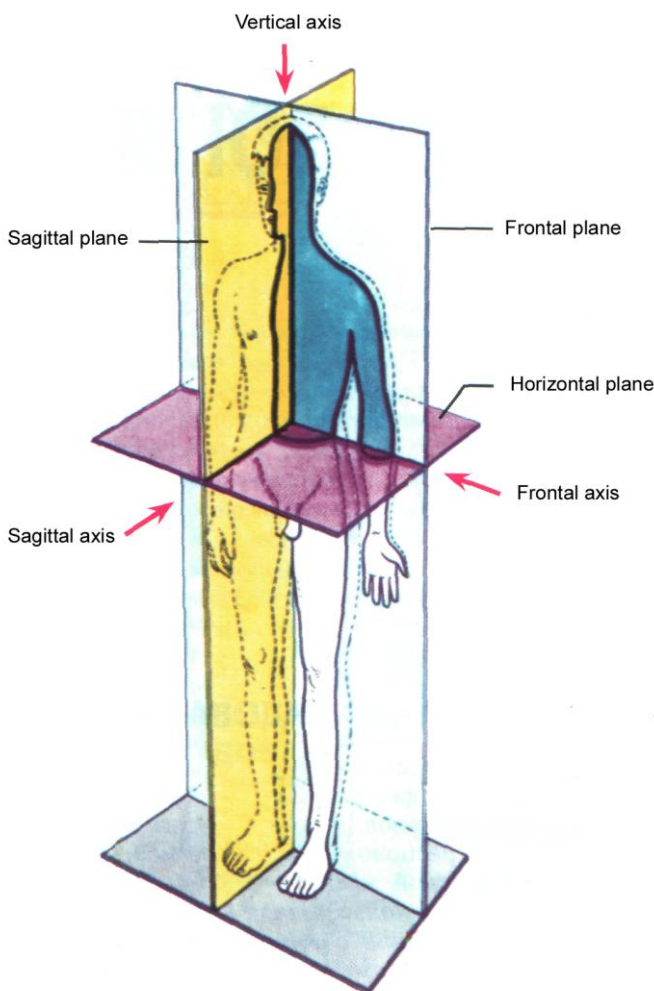
A person beginning to study anatomy is struck first of all by the copious terminology that must be firmly understood and completely mastered by every student and physician. These terms usually designate spatial relations, the shape or size of various organs, and so forth.

In mathematics and physical geography, certain initial points and planes are accepted from which distances are measured to establish spatial relations. In anatomy as well, there are generally accepted designations of perpendicular planes by means of which the position of organs or their parts in space is determined exactly. Three such planes are of primary importance; **sagittal**, **frontal**, and **horizontal**. It should be borne in mind that the planes are related to an erect human body.

The **sagittal plane** is a vertical plane by means of which we divide the body mentally (for example, a fixed, frozen cadaver) with an arrow (*L sagitta* - arrow) piercing it from front to back and with an arrow along the length of the body. The sagittal plane that passes through the middle of the body and divides it into two symmetrical, right and left, parts is called the median plane (*L medius* - middle). A plane drawn also vertically but at right angles to the sagittal plane is called the **frontal plane** and is parallel to the forehead (*L frons* - forehead). The frontal plane divides the body into the front and back parts. The third, **horizontal plane** in accordance with its name passes

horizontally, i.e. at right angles to both the sagittal and the frontal planes. It divides the body into the upper and lower halves.

The positions of the different points or lines in these planes are designated as follows: those located nearer to the median plane are called **medial** (*medialis*) (*L medius* - middle); those located further from the median plane the designated **lateral** (*lateralis*) (*L latus* - side). Points and lines found on a front to back plane are designated as follows: those located nearer to the front surface of the body are called **anterior or ventral** (*ventralis*) (*L venter* - belly), those nearer to the back are known as **posterior or dorsal** (*dorsalis*). The following points and lines are distinguished in the vertical plane: those nearer to the upper end of the body are called **upper, superior, or cranial** (*cranialis*) (*Gk kranion* - skull); those nearer to the lower end and are referred to as **lower, inferior or caudal** (*caudalis*) (*, cauda* - tail).



The terms **proximal** and **distal** are used in reference to the parts of the limbs. **Proximal** (*proximus* - nearest) is applied to parts nearer to the point of origin of the limb from the trunk; **distal**, in contrast, is a term applied to parts farthest from the trunk (*distare* - to be distant). On the upper limb, for instance, the elbow is proximal in comparison to the fingers, while the latter are distal in relation to the elbow.

The terms **external** (*externus*) and **internal** (*internus*) are used mainly to designate positions in relation to the body cavities and whole organs, either outward or inward; the terms **superficial** (*superficialis*) and **deep** (*profundus*) are used for organs located "less deep" or "more deep" in relation to the surface of the body or organ.

The commonly used terms for size are **great** (*magnus*); **small** (*parvus*); **greater** (*major*); **lesser** (*minor*). The last two terms, major and minor, are used to designate the comparative size of two related or identical structures, e.g. tuberculum majus and minus on the humerus. The term *magnus* (**great**) does not imply the presence of another identical but smaller structure. For instance, nervus auricularis magnus, the great auricular nerve, is called so because of its thick trunk; there is no nervus auricularis parvus.

The motor apparatus, the sensory organs, and the nervous system form the group of organs of *animal* life because the function of movement and nervous activity are inherent only in animals and are almost absent in plants.

The separate grouping of organs of vegetative from those of animal life is justified not only because they differ in function but because they differ in development. Thus, two tubes are laid in the body of the embryo, a vegetative tube which gives rise to the organs of digestion and respiration with which the urogenital organs become related, and an animal tube from which the nervous system forms.

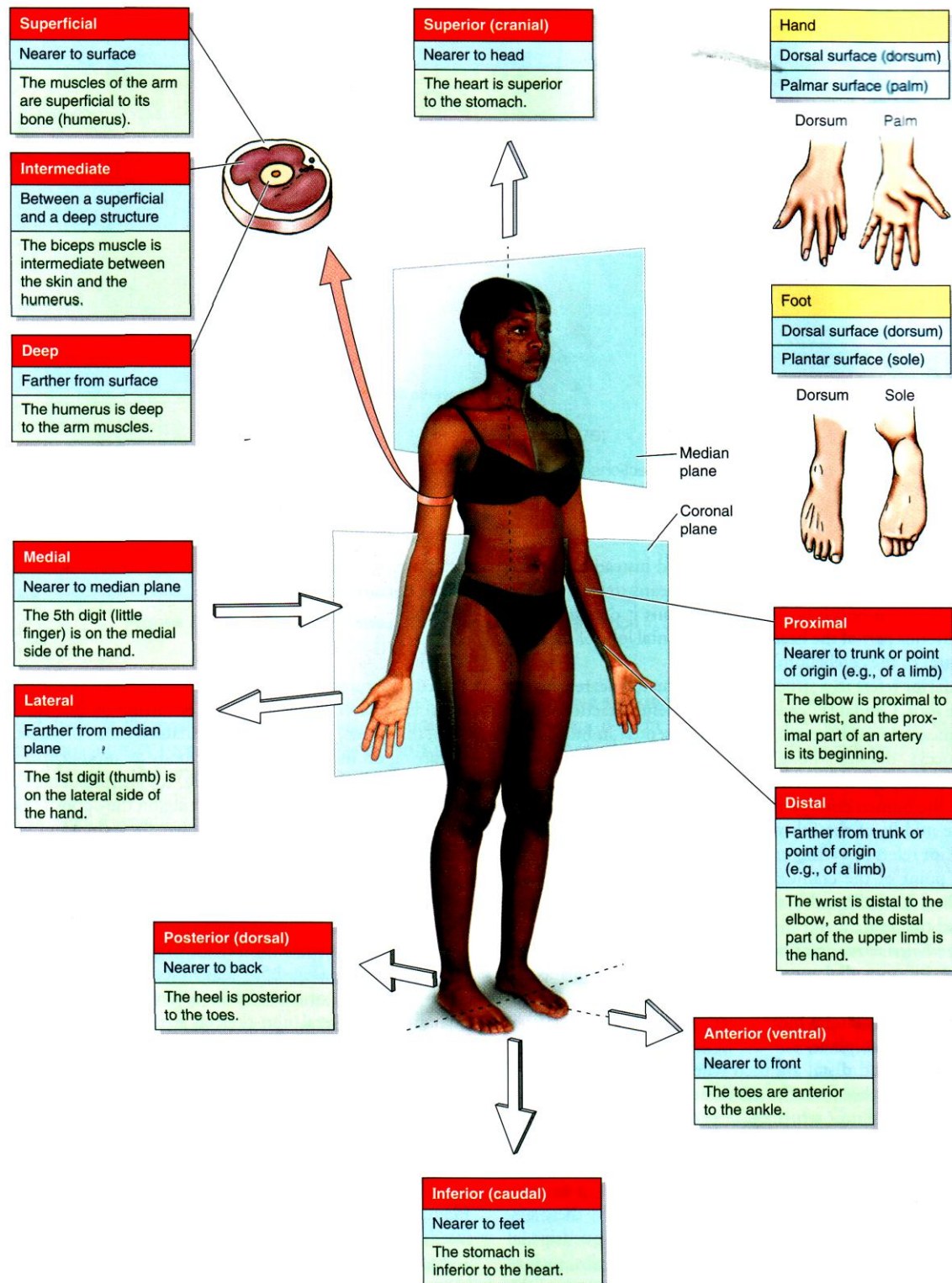
In view of the unity of the vegetative and animal processes in the integral organism, however, it should be borne in mind that such separate grouping is relative and necessary for the convenience of study.

The motor apparatus and the skin covering it (i.e. the organs of animal life) form the body proper, the *soma*, within which there are the thoracic and abdominal cavities. Therefore, the soma forms the walls of the cavities. The contents of these cavities are called the *viscera*. These are the digestive, respiratory, urinary, and the reproductive organs, and the endocrine glands connected with them (i.e. the organs of vegetative life). The viscera and soma are supplied with *tracts conveying fluids*, i.e. vessels that carry blood and lymph, and make up the vascular system, and *tracts that conduct stimuli*, i.e. nerves which together with the spinal cord and brain form the nervous system.

The tracts conveying fluids and stimuli form the anatomical basis for uniting the organism by means of neurohumoral regulation in which the nervous system plays the principal role. The viscera and soma are therefore parts of a single whole organism and are set apart conditionally.

As a result the following scheme of the organism's structure can be marked out: *the organism—the system of organs—the organ—the morphofunctional unit of the organ—the tissue—the tissue elements*.

It should be emphasized, however, that the different organs and systems are so closely related that it is impossible to isolate one system from another in the organism from the anatomical or from the functional standpoint. But for the convenience of studying the vast factual material and because the structure of the integral organism cannot be thoroughly understood at once, anatomy is traditionally studied according to systems. A definite branch of anatomy corresponds to each system: the study of the bone system (osteology), the articulations of bones (arthrosyndesmology), the muscular system (myology), the viscera (splanchnology), the cardiovascular system (angio-fogy), the nervous system (neurology), the sensory organs (aesthesiology), and the endocrine glands (endocrinology).



The shapes of the various structures, particularly in osteology, have many designations whose meaning is best mastered during study of these structures. Some of the terms are given in abbreviated form: art.—articulatio (joint); lig.—ligament-um (ligament), a.—arteria (artery), aa.—arteriae (arteries); v.—vena (vein), vv.—venae (veins); n.—nervus (nerve), nn.—nervi (nerves); m.—musculus (muscle), mm.—musculi (muscles).

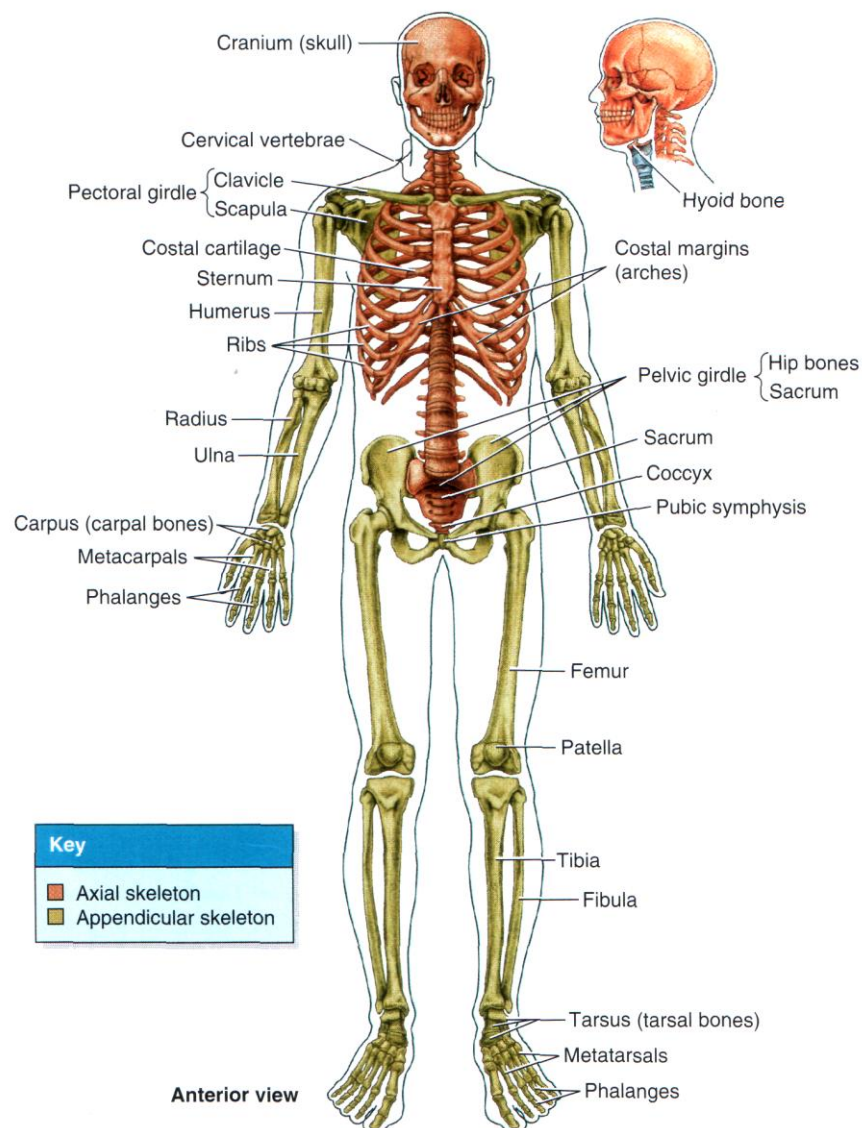
LOCOMOTOR APPARATUS

The main functions of locomotor apparatus are: movement of the human body and weight-bearing and antigravitation functions. It consist of passive (the skeleton and its joints) and active (muscles) parts.

SKELETAL SYSTEM (OSTEOLOGY)

The skeleton are divided into axial and apendicular skeleton.

Bones of the axial skeleton are subdivided into bones of the trunk and skull.
Bones of the trunk comprise vertebrae, sternum and ribs.



The apendicular skeleton includes bones of the upper and lower extremites.

Classification of bones

Bones are classified according to their shape.

- *Long bones* are tubular (e.g., the humerus in the arm).
 - *Short bones* are cuboidal and are found only in the ankle (tarsus) and wrist (carpus).
 - *Flat bones* usually serve protective functions (e.g., those forming the cranium protect the brain).
 - *Irregular bones* (e.g., in the face) have various shapes other than long, short, or flat.
- Sesamoid bones* (e.g., the patella or knee cap) develop in certain tendons and are found where tendons cross the ends of long bones in the limbs; they protect the tendons from excessive wear and often change the angle of the tendons as they pass to their attachments.

Bone Markings and Formations

Bone markings appear wherever tendons, ligaments, and fascias are attached or where arteries lie adjacent to or enter bones. Other formations occur in relation to the passage of a tendon (often to direct the tendon or improve its leverage) or to control the type of movement occurring at a joint.

Capitulum: small, round, articular head (e.g., the capitulum of the humerus).

Condyle: rounded, knuckle-like articular area, usually occurring in pairs (e.g., the lateral femoral condyle).

Crest: ridge of bone (e.g., the iliac crest).

Epicondyle: eminence superior to a condyle (e.g., the lateral epicondyle of the humerus).

Facet: smooth flat area, usually covered with cartilage, where a bone articulates with another bone (e.g., the superior costal facet on the body of a vertebra for articulation with a rib).

Foramen: passage through a bone (e.g., the obturator foramen).

Fossa: hollow or depressed area (e.g., the infraspinous fossa of the scapula).

Groove: elongated depression or furrow (e.g., the radial groove of the humerus).

Head (L. caput): large, round articular end (e.g., the head of the humerus).

Line: linear elevation (e.g., the soleal line of the tibia).

Malleolus: rounded process (e.g., the lateral malleolus of the fibula).

Notch: indentation at the edge of a bone (e.g., the greater sciatic notch).

Protuberance: projection of bone (e.g., the external occipital protuberance).

Spine: thorn-like process (e.g., the spine of the scapula).

Spinous process: projecting spine-like part (e.g., the spinous process of a vertebra).

Trochanter: large blunt elevation (e.g., the greater trochanter of the femur).

Trochlea: spool-like articular process or process that acts as a pulley (e.g., trochlea of the humerus).

Tubercle: small raised eminence (e.g., the greater tubercle of the humerus).

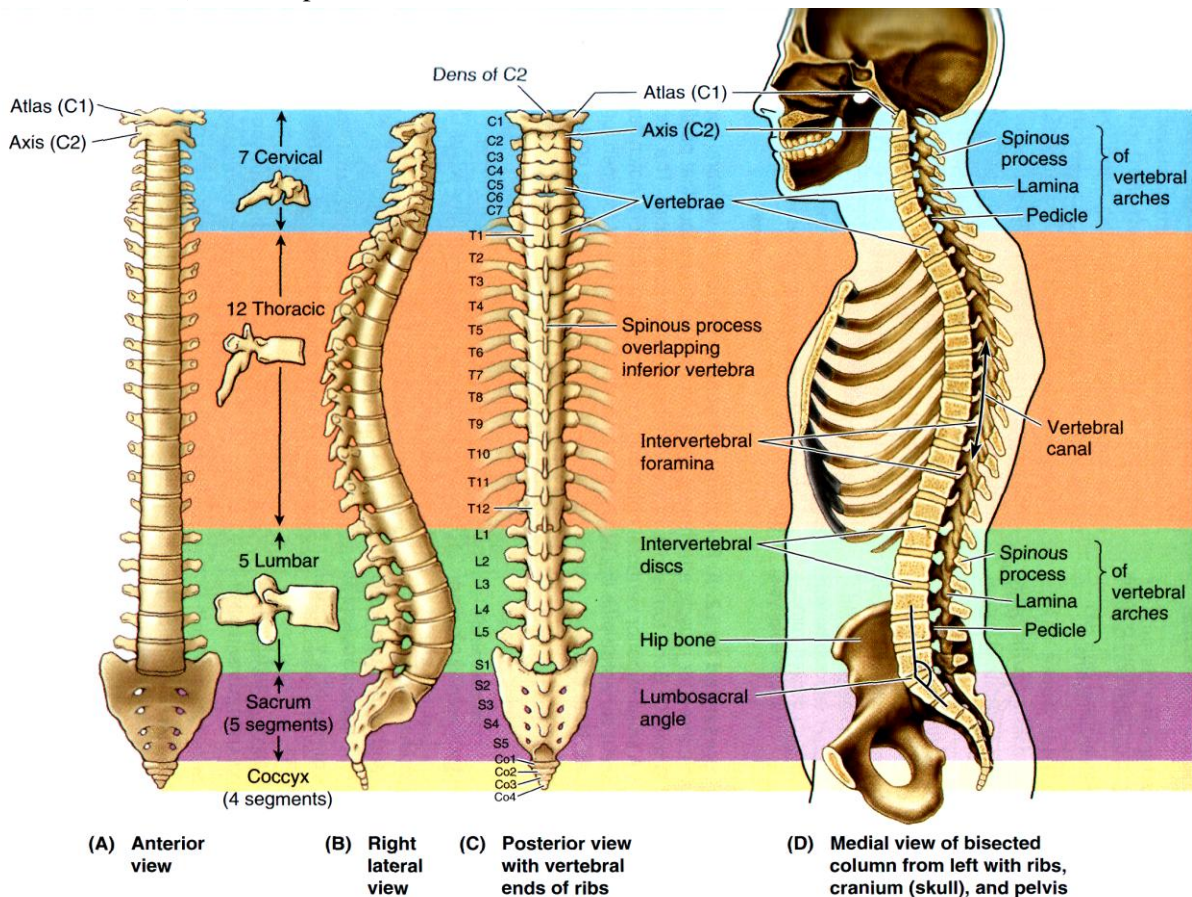
Tuberosity: large rounded elevation (e.g., the ischial tuberosity).

Bones of the trunk

VERTEBRAE

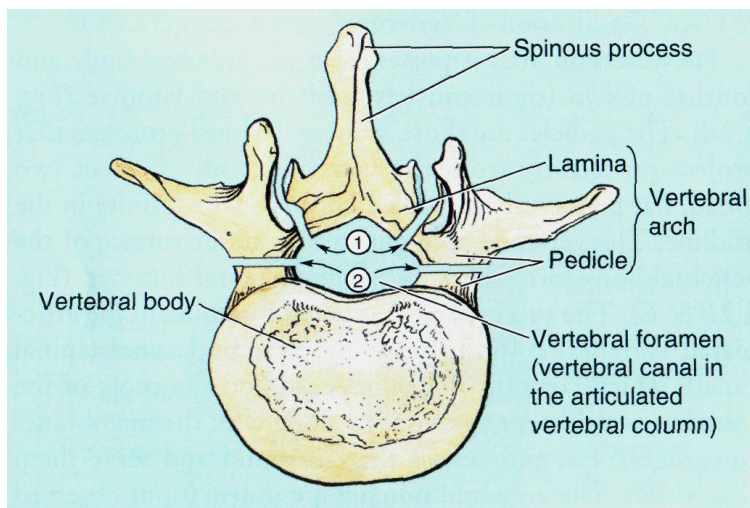
The vertebral column consists of 33-34 vertebrae: 7 cervical, 12 thoracic, 5 lumbar, 5 sacral and 4-5 coccygeal vertebrae. The sacral vertebrae fuse to form the sacrum and the coccygeal vertebrae fuse to form the coccyx. Thus the sacral and coccygeal vertebrae are false vertebrae while the others are true vertebrae.

Function of the vertebrae: 1) Supporting and amortisation; 2) Defence; 3) Motor; 4) Metabolic; 5) Hoemeopoetic.



General data about the structure of the vertebra.

Vertebrae made up of 2 parts: a body and vertebral (neural) arch. The *vertebral foramen* is surrounded by this parts.



Body is largest and heaviest part. **Vertebral arch** has 2 *pedicles*. Pedicle joins arch to posterolateral surface of the vertebral body and *lamina* and has 7 *processes*: 1 *spinous*, 4 *articular*, and 2 *transverse*. Concavities on the upper and lower margins call *vertebral notches*.

Lamina: plates extending posteriorly and medially from pedicle.

Spinous processes directed anteriorly and caudally from

union of lamina.

Articular processes extend upward and downward from point where pedicles and lamina join:

- a) 2 superior, articular surfaces face posteriorly
- b) 2 inferior, articular surfaces face anteriorly

Transverse processes project laterally between the superior and inferior articular processes.

The Cervical vertebrae

I. Typical cervical vertebrae: smallest among others vertebrae.

- A. Body is small;
- B. Vertebral foramen is large and triangular;
- C. Spinous process is short and bifid;
- D. Transverse process contains a foramen—*transverse foramen*. There are anterior and posterior tubercles on processes transverses.

Thus at last each vertebra has:

- A. Body;
- B. Arch;
- C. Pedicles with 2 superior and 2 inferior notches;
- D. Vertebral foramen is large and triangular;
- E. 7 pairs of *processes*:
2 pairs – *articular*,
1 pairs – *transverse*,
1 unpairs – *spinous*.

II. Untypical cervical vertebrae (only points of difference will be given):

A. The first cervical vertebrae —**atlas**:

1. Atlas has anterior and posterior arch and lateral masses with superior and inferior articular surfaces (facet);
2. Superior articular facets are very large concave ovals, facing upward;
3. Inferior articular facets are circular;
4. Transverse processes are large, anterior and posterior tubercles fused;
5. On superior margin of posterior arch is groove of vertebral artery;
6. On posterior surfaces of anterior arch is fovea dentis.

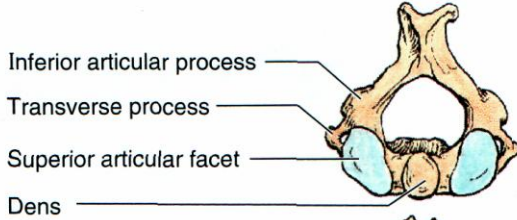
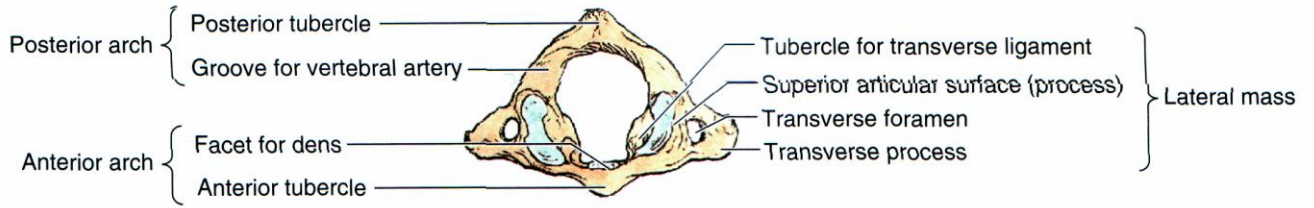
B. The second cervical vertebrae —**axis** (or epistropheus):

1. Body has a long, pointed projection directly cranially—the *dens* (odontoid process). Process has an oval articular facet on anterior surface.
2. Pedicles are strong, are fused with sides of body and *dens* (odontoid process), and their upper surface forms the superior articular facet;
3. Transverse processes are small, end in single tubercle. Foramen transversarium set obliquely.

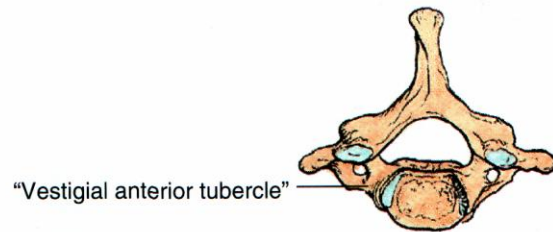
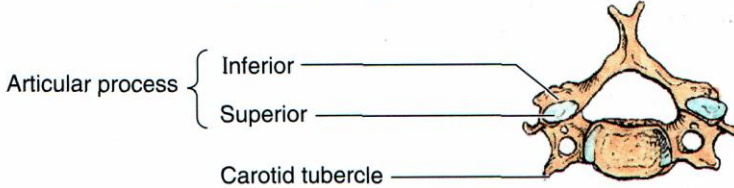
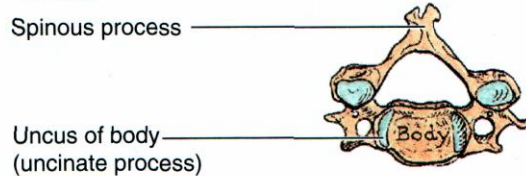
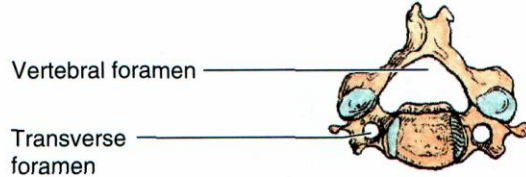
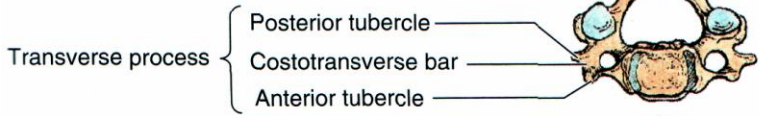
C. Seventh—**vertebra prominens**:

1. Spinous process: thick, directed almost straight posteriorly; is not bifid, but ends in tubercle to which is attached the lower end of the ligamentum nuchae;
2. Transverse processes are large, tubercles not clear;
3. The costal process can be slender and fragile and the vertebral artery does not usually pass through the foramen transversarium.

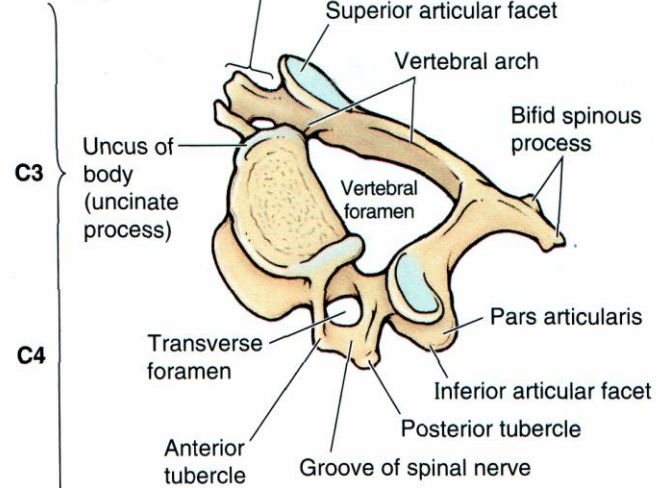
Cervical Vertebrae^a



Atlas (C1)



Axis (C2)



(B) Left anterior superior oblique view of "typical" cervical vertebra

Superior views, vertebrae C1-C7

The Thoracic and Lumbar Vertebrae. Sacrum and Coccyx.

I. Thoracic vertebrae

A. General characteristics: body increases in size from above downward, has facets or hemifacets for rib articulation; laminae are broad and thick; spinous processes are long and directed obliquely caudally; the superior articular processes are thin with facets directed posteriorly; the inferior articular processes are short, and their facets are directed anteriorly; the transverse processes are thick, strong, and have articular facets for rib tubercles.

B. Special features (untypical vertebra);

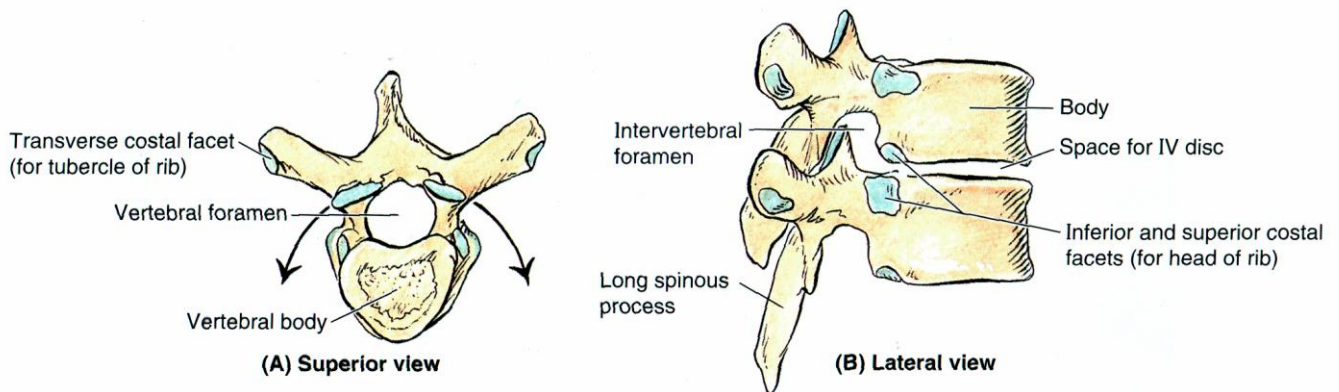
1. T1 has one entire facet on each side of body for 1st rib and one half facet for second rib;

2. T10 has a single half articular facet on each side;

3. T11 has large body, large articular entire facet; spinous process is short and almost horizontal; transverse process is short without articular facet for rib tubercles;

4. T12 resembles both T1 and L1; inferior articular facet is directed laterally; transverse process has not articular facet for rib tubercles.

Thoracic Vertebrae



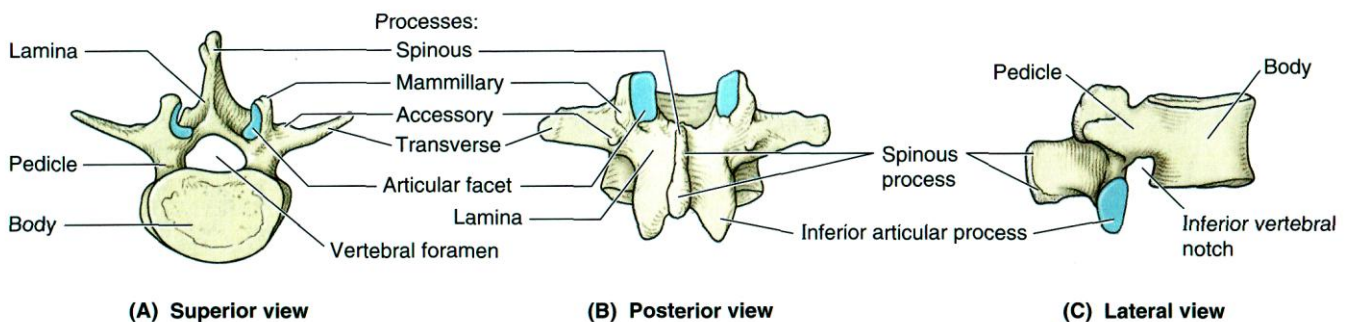
II. Lumbar vertebrae (largest)

A. General characteristics: body is large, wide, and thick; pedicles are strong and directed posteriorly; laminae are broad and strong; spinous processes are thick, broad, and directed posteriorly; superior articular processes are directed medially and posteriorly; inferior articular processes are directed anteriorly and laterally; transverse processes are long, slender, and have upper tubercle at junction with superior articular process called mammillary process and inferior tubercle at base of process called accessory process.

B. Special feature: L5 has a heavy body, small spinous process, and thick transverse process;

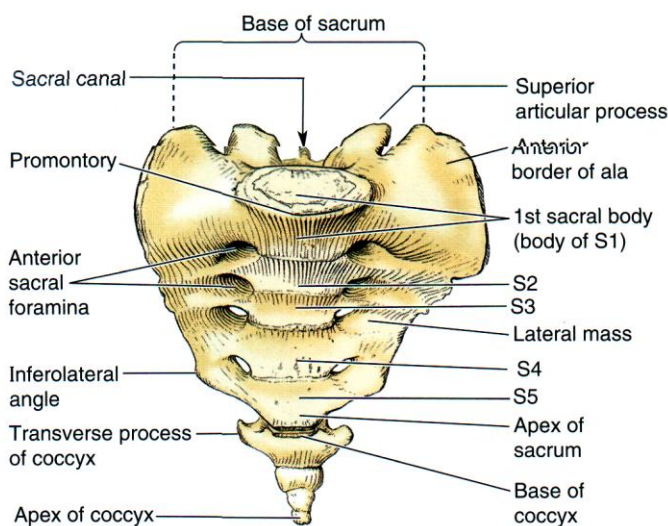
C. The transverse process of L5 is short and massive with the strong iliolumbar ligament arising from its tip.

Lumbar Vertebrae

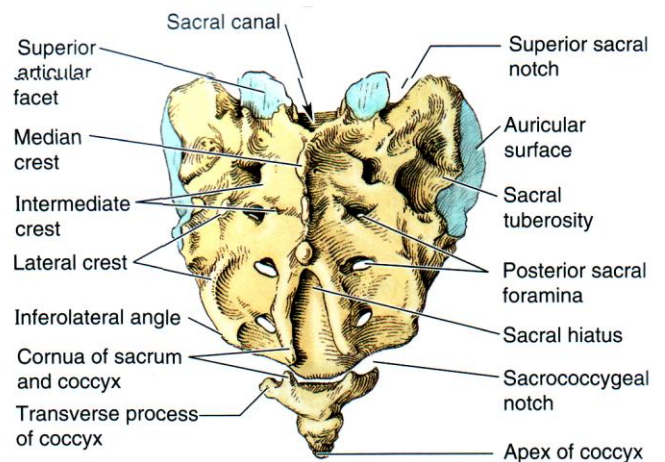


III. Sacrum: a fusion of 5 segments, triangular in shape.

- A. Pelvic surface: concave, crossed by 4 transverse ridges; pelvic (anterior) sacral foramina are seen at ends of the ridges;
- B. Posterior surface: convex, median sacral crest at midline, sacral groove on either side of median crest, sacral articular (medial) crest lateral to groove, which terminate as the sacral cornua, row of posterior sacral foramina lateral to articular crest; lateral crests lie lateral to foramina;
- C. Lateral surface: upper half, auricular surface with sacral tuberosity just behind this; infero lateral angle is at lower end of this surface;
- D. Base: directed upward with a large, oval articular surface in middle of body just behind which is the sacral canal;
- E. Superior surface exhibits a projecting anterior border—the sacral promontory; superior articular processes are supported by short, heavy pedicles and laminae which enclose sacral canal;
- F. Ala: on either side of body of sacrum, formed of costal and transverse processes;
- G. Apex: directed caudally.



(A) Base and pelvic surface of sacrum and coccyx (anteroinferior view)



(B) Dorsal surface of sacrum and coccyx (posterosuperior view)

IV. Coccyx: formed by fusion of 3 to 5 segments.

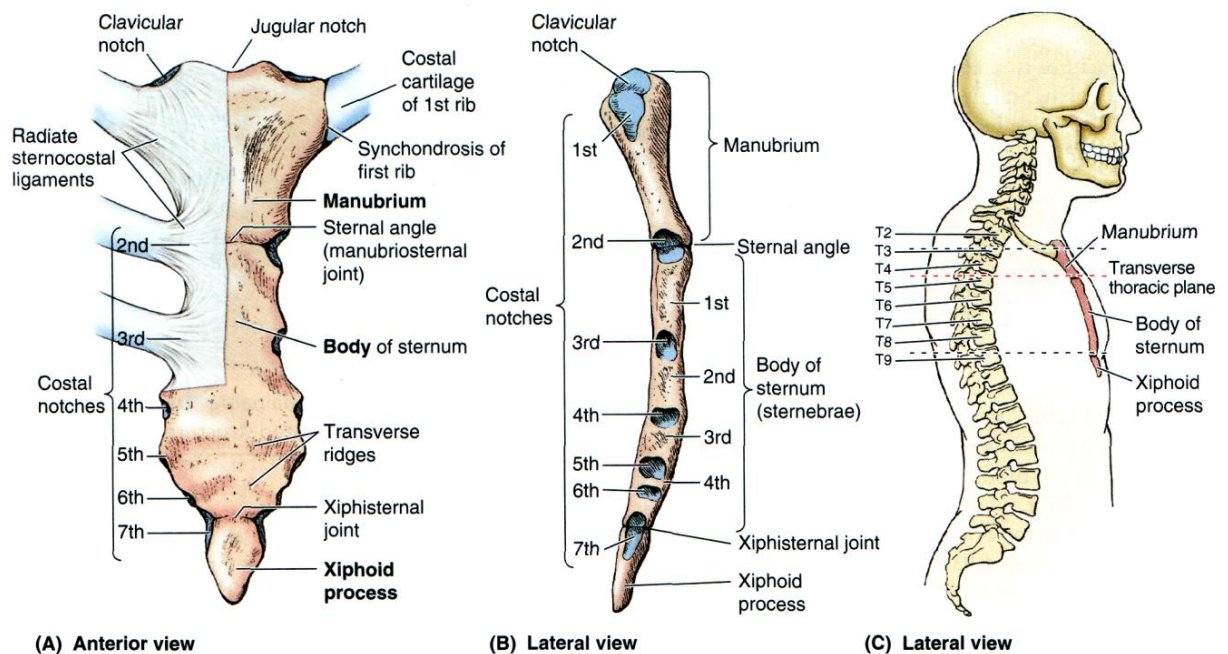
- A. Anterior surface: slightly convex with transverse ridges;
- B. Posterior surface: convex, with transverse ridges; has articular crest (as sacrum), the cephalic end of which projects upward as coccygeal cornua;
- C. Base: oval articular facet;
- D. Apex: caudally directed, rounded, but may be bifid.

STERNUM

The sternum is a flat bone that may be divided into three parts: the manubrium, the body, and the xiphoid process.

Manubrium. The manubrium is the upper part of the sternum. It has on each side clavicular notch, costal notch for joint with first rib and half of costal notch for articulates with the second rib. **Body** of the sternum also has costal notches for joint with ribs on each side. The sternal angle (angle of Louis) is formed by the articulation of the manubrium with the body of the sternum. This ridge is an important surface landmark and lies at the level of the second costal cartilage.

The xiphoid process is a thin plate of hyaline cartilage that becomes ossified at its proximal end in adult life.



RIBS

There are 12 pairs of ribs, all of which are attached posteriorly to the thoracic vertebrae.

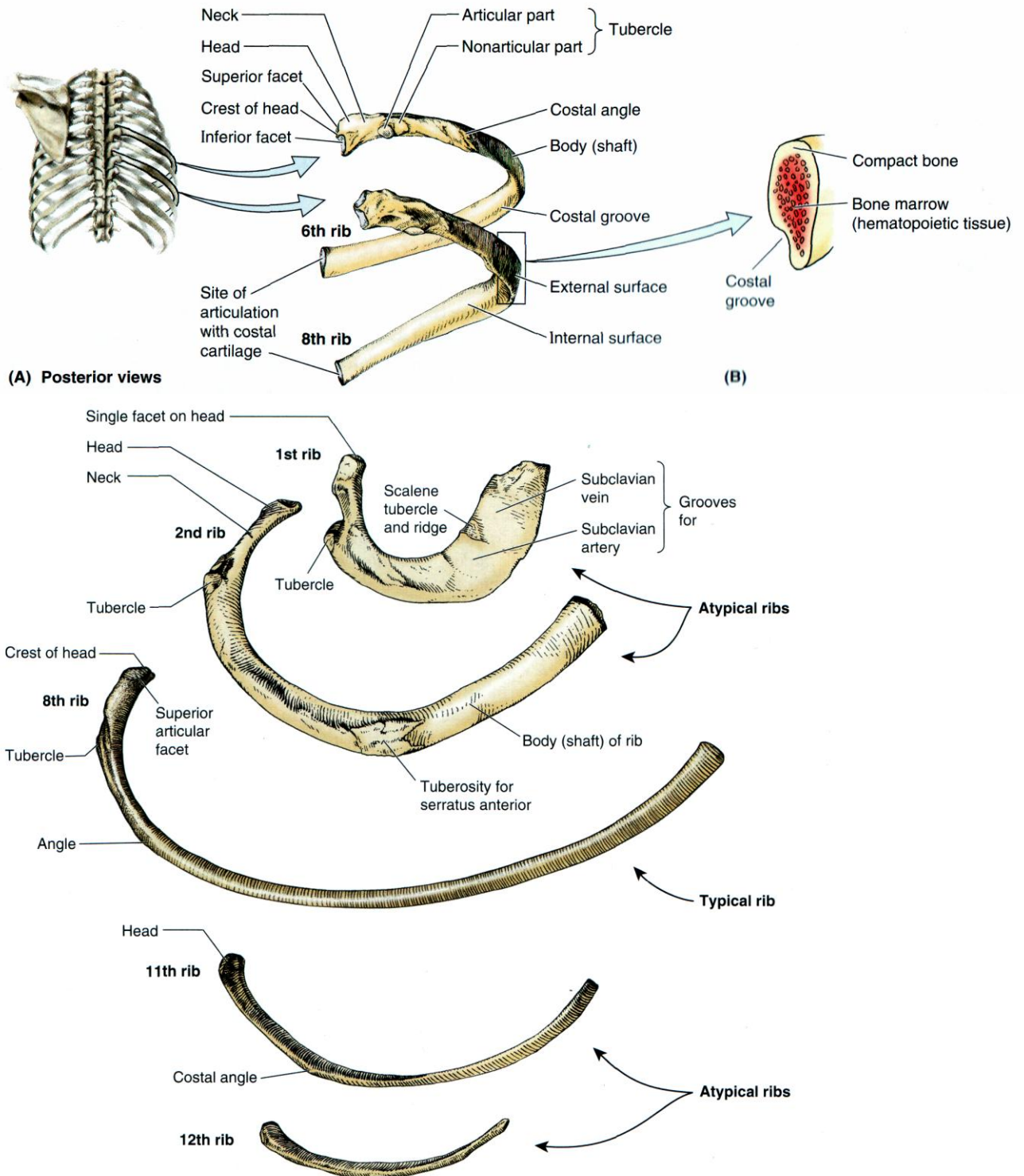
1. True ribs: The upper seven pairs are attached to the sternum by their costal cartilages.
2. False ribs: The eighth, ninth, and tenth ribs are attached anteriorly to each other and to the seventh rib by means of their costal cartilages and small synovial joints.
3. Floating ribs: The eleventh and twelfth pairs have no anterior attachment.

I. Typical Rib. Each rib consist of bone part and costal cartilage. The typical rib is a long, twisted flat bone with a rounded superior border and a grooved inferior border, the costal groove, which accommodates the intercostal vessels and nerve.

A rib has a head, neck, tubercle, shaft, and angle. The head has two facets for articulation with the numerically corresponding vertebral body and with the vertebra immediately above and crest for ligament. The tubercle has a facet for articulation with the transverse process of the numerically corresponding vertebra. The angle is where the shaft bends sharply forward.

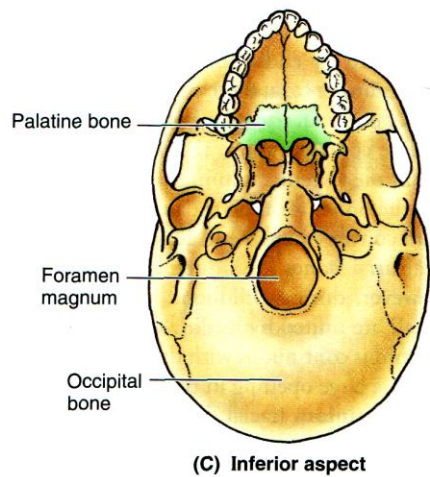
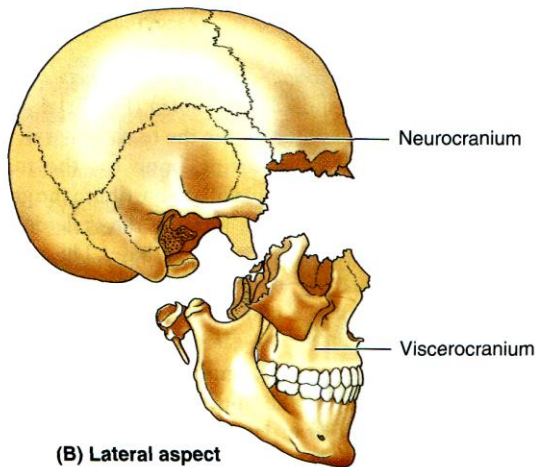
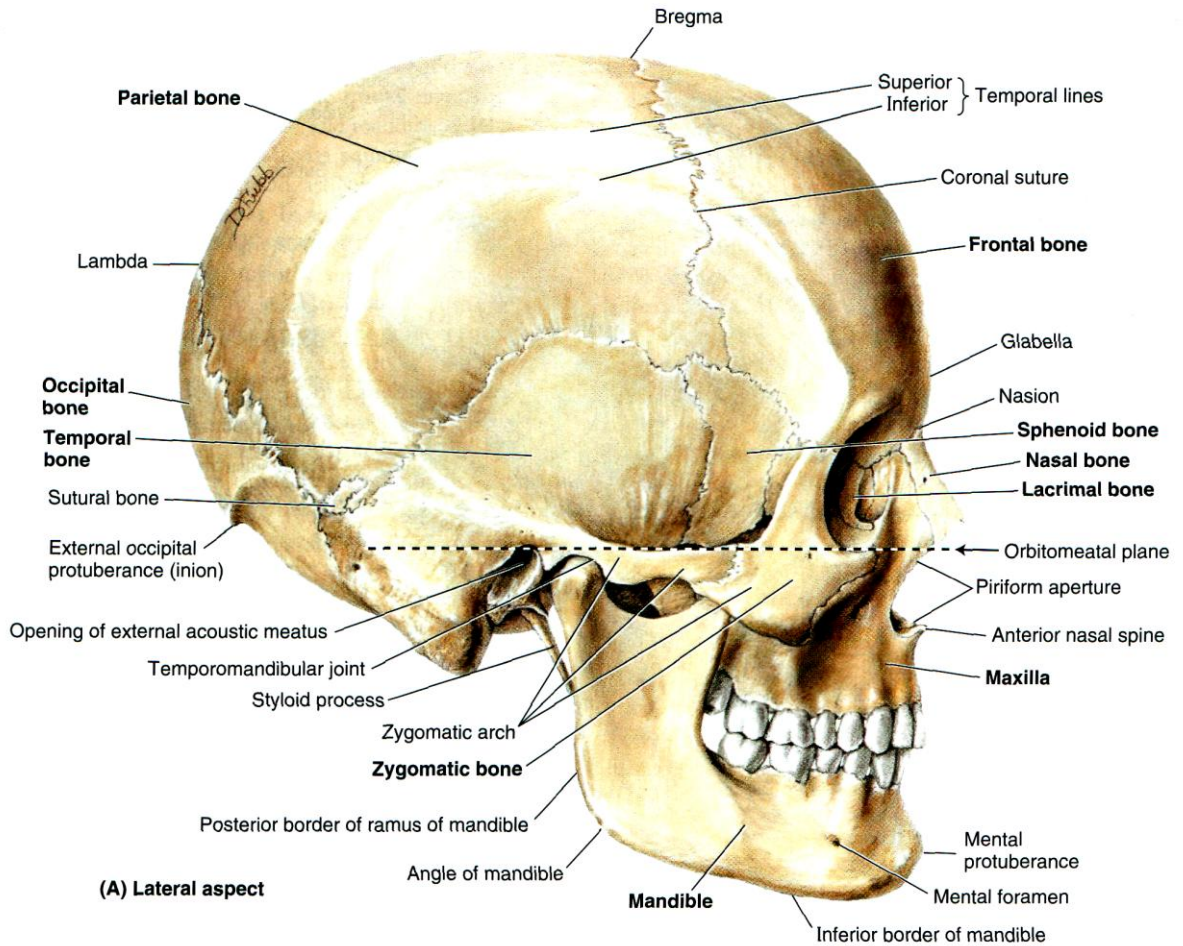
II. Untypical Rib. The head of I, XI, XII ribs have not crest. The XI, XII ribs have not tubercle and articular facet for articulation with the transverse process of vertebra.

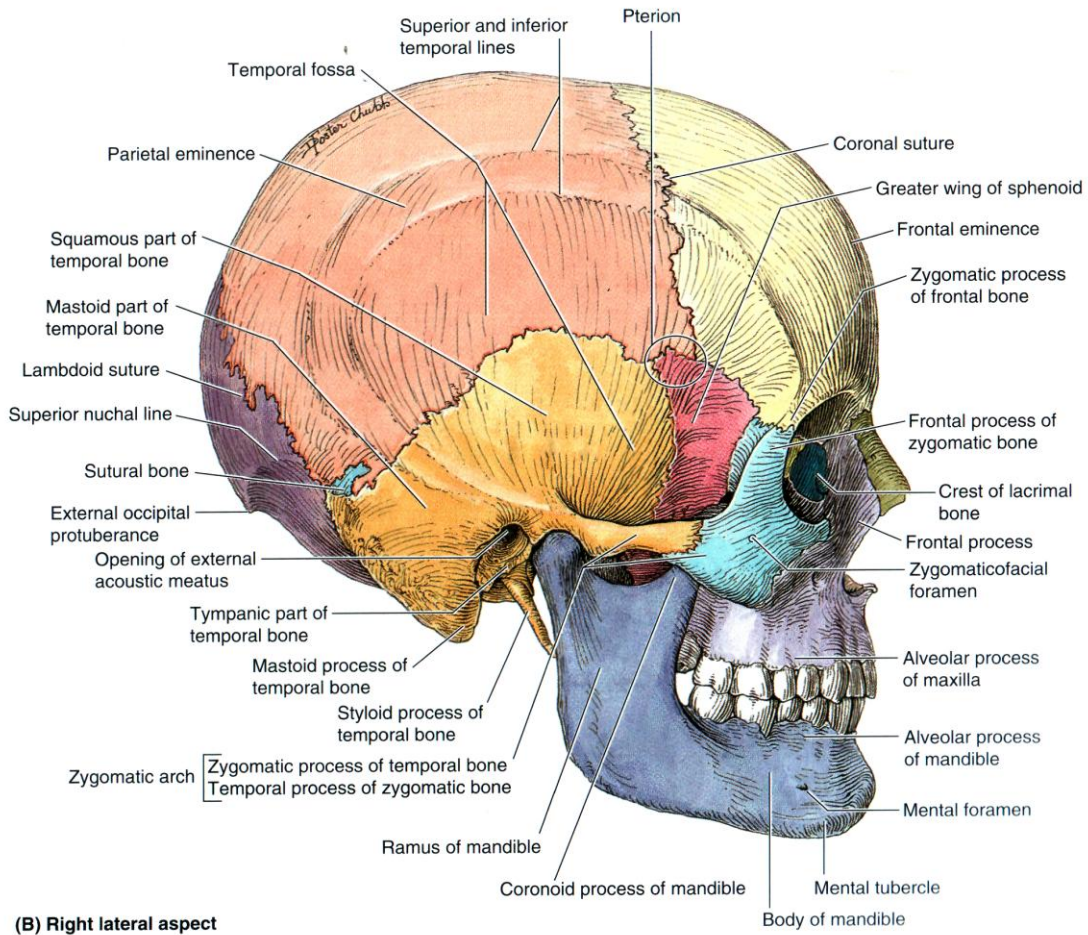
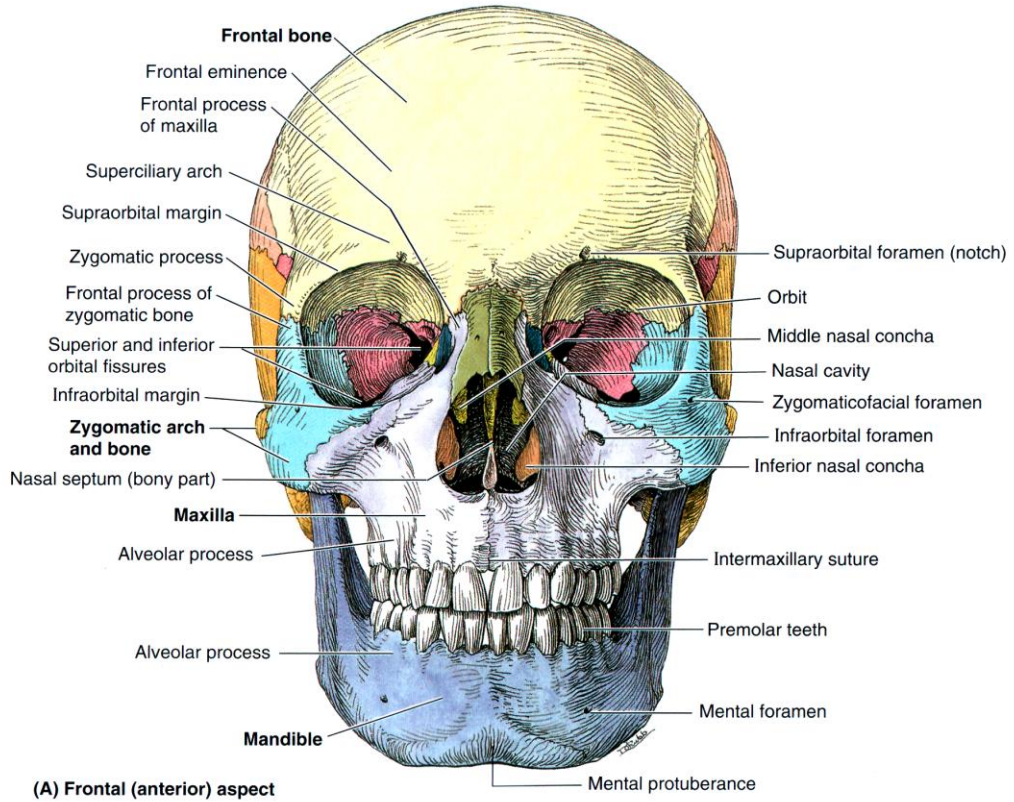
The first rib is small and flattened from above downward. It has superior and inferior surface and anterior and posterior margin. Scalene tubercle is located on the superior surface of the first rib (area for attaching of scalenus muscle). Anteriorly to the scalene tubercle is the groove for subclavian vein, posteriorly to the scalene tubercle is the groove for subclavian artery. The costal cartilages are bars of hyaline cartilage connecting the upper seven ribs to the lateral edge of the sternum, and the eighth, ninth, and tenth ribs to the cartilage immediately above. The cartilages of the eleventh and twelfth ribs end in the abdominal musculature.



THE SKULL

The skull surrounds and protects the brain and brain stem; houses the organs of special sensation for seeing (the eyes), hearing (middle and inner ear), taste (tongue, etc.), and smell (nasal structures); and contains openings that lead into the digestive tract (oral cavity), respiratory tract (nasal and oral cavities), and skull (foramen magnum). Bones of skull divide into neurocranium and viscerocranium bones.

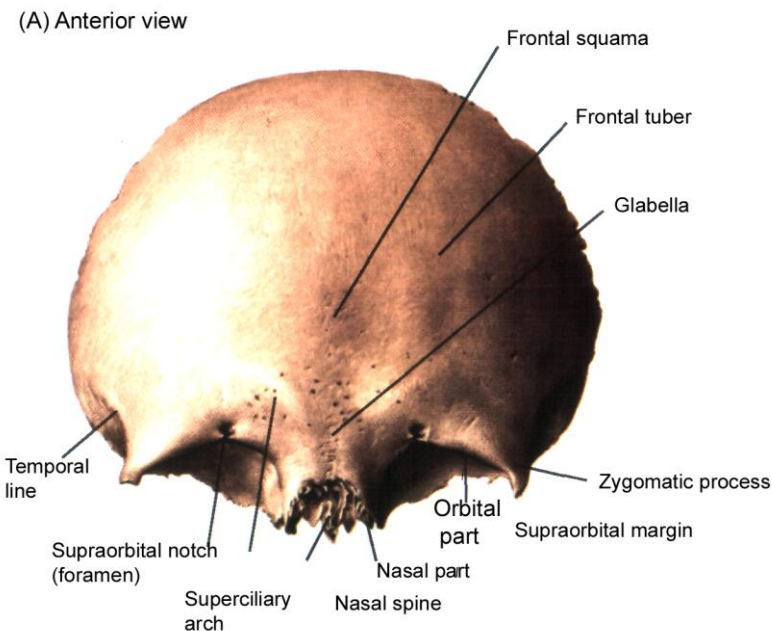




Bones of the neurocranium

FRONTAL BONE

Frontal bone It consists of four portions—the **squama**, corresponding with the region of the forehead; two **orbital** portion, which enters into the formation of the roofs of the orbital and nasal cavities and **nasal** portion.

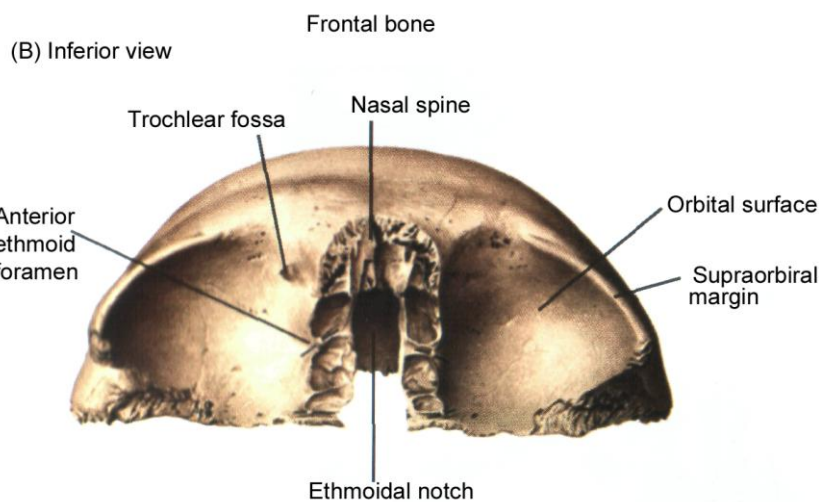


Squama (*squama frontalis*) has external and internal surfaces, parietal and sphenoid borders.

The **external surface** of this portion is convex and usually exhibits, in the lower part of the middle line, the remains of the *frontal* or *metopic suture*. On either side of this suture, about 3 cm. above the supraorbital margin, is a rounded elevation, the *frontal eminence* (*tuber frontale*). Below the frontal eminences, and separated from them by a shallow groove, are two arched elevations, the *superciliary arches*; these are prominent medially, and are joined to one another by a smooth elevation named the

glabella. Below each superciliary arch is a curved and prominent margin, the *supraorbital margin*, which forms the upper boundary of the base of the orbit, and separates the squama from the orbital portion of the bone. At the junction of its medial and intermediate thirds is a notch, sometimes converted into a foramen, the *supraorbital notch* or *foramen*, which transmits the supraorbital vessels and nerve. The supraorbital margin ends laterally in the *zygomatic process*, which is strong and prominent, and articulates with the zygomatic bone. Running upward and backward from this process is a well-marked line, the *temporal line*, which divides into the *upper* and *lower temporal lines*.

The **internal surface** of the squama is concave and presents in the upper part of the middle line a vertical groove, the *sagittal sulcus*, the edges of which unite below to form a ridge, the *frontal crest*; the sulcus lodges the superior sagittal sinus, while its margins and the crest afford attachment to the falx cerebri. The crest ends below in a small notch which is converted into a foramen, the *foramen cecum*, by articulation with the ethmoid bone.



Orbital or Horizontal Part (*pars orbitalis*)

This portion consists of two thin triangular plates, the *orbital plates*, which form the walls of the orbits. The **inferior surface** of each orbital plate is smooth and concave, and presents, laterally, under cover of the zygomatic process, a shallow depression, the *lacrimal fossa*, for the lacrimal gland; near the nasal part is a depression, the *fovea trochlearis*, or occasionally a small *trochlear spine*, for the

attachment of the cartilaginous pulley of the obliquus oculi superior muscle.

The *superior surface* is convex, and marked by depressions for the convolutions of the frontal lobes of the brain, and faint grooves for the meningeal branches of the ethmoidal vessels.

Nasal part

The *ethmoidal notch* separates the two orbital plates; it is quadrilateral, and filled, in the articulated skull, by the cribriform plate of the ethmoid bone. Nasal spine form the nasal sept. In front of the ethmoidal notch, on either side of the frontal spine, are the openings of the *frontal air sinuses*. These are two irregular cavities, which extend backward, upward, and lateralward for a variable distance between the two tables of the skull; they are separated from one another by a thin bony septum, which often deviates to one or other side, with the result that the sinuses are rarely symmetrical. Absent at birth, they are usually fairly well-developed between the seventh and eighth years, but only reach their full size after puberty. They vary in size in different persons, and are larger in men than in women.

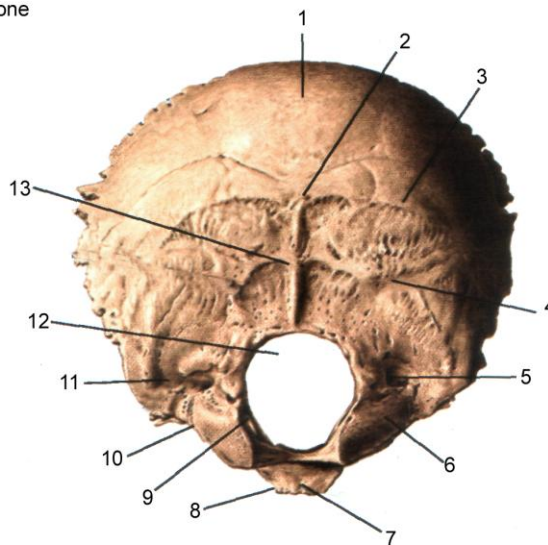
OCCIPITAL BONE

Occipital bone consists of occipital squama, 2 lateral and basilar parts.

Squama is situated above and behind the foramen magnum and has *external occipital protuberance* and *external crest* on outer surface of it. Also there are the *superior and inferior nuchal lines*.

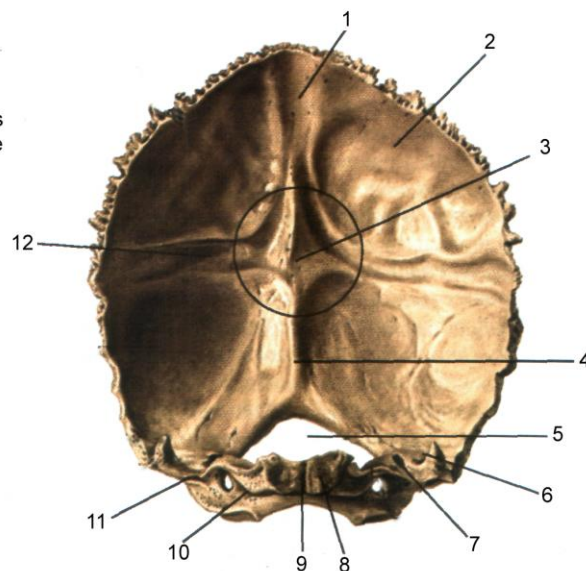
(A) Posterior view

- Occipital bone
- 1 - squamous part of occipital bone
 - 2 - external occipital protuberance
 - 3 - superior nuchal line
 - 4 - inferior nuchal line
 - 5 - condylar foramen
 - 6 - occipital condyle
 - 7 - pharyngeal tubercle
 - 8 - basilar part
 - 9 - lateral part
 - 10 - jugular notch
 - 11 - condylar fossa
 - 12 - foramen magnum
 - 13 - external occipital crest



(B) Internal view

- 1 - groove of superior sagittal sinus
- 2 - squamous part of occipital bone
- 3 - internal occipital protuberance
- 4 - internal occipital crest
- 5 - foramen magnum
- 6 - groove of sigmoid sinus
- 7 - condylar canal
- 8 - clivus
- 9 - basilar part
- 10 - lateral part
- 11 - jugular notch
- 12 - groove of transversal sinus



The internal surface is deeply concave and carries a *crucial eminence*. At the point of intersection of the four divisions of the crucial eminence and *internal occipital protuberance*. Right and left sides of them is a deep groove, the superior sagittal sulcus, lower there is the *internal occipital crest*.

Lateral Parts (*pars lateralis*) are situated at the sides of the foramen magnum; on their under surfaces are the *condyles* with and the *hypoglossal canal*. Behind either condyle is the *condyloid fossa*. Laterally is the *jugular process*, excavated in front by the *jugular notch*.

Basilar Part (*pars basilaris*) extends forward and upward from the foramen magnum and form the back part of the clivus. On its lower surface is the *pharyngeal tubercle* which gives attachment to the fibrous raphe of the pharynx.

PARIETAL BONE

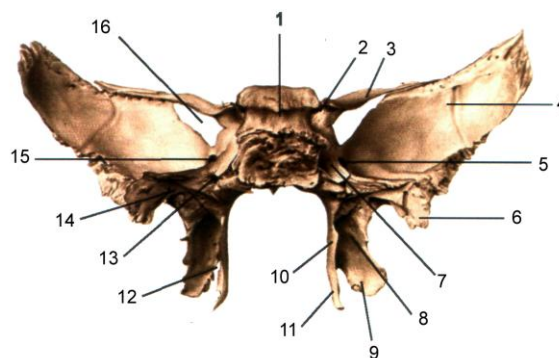
The **Parietal bone (*os parietale*)** is irregularly quadrilateral in shape and has convex external (with *tuber parietale*) surface and concave internal surfaces. Bone has four *corners: frontal, sphenoid, mastoid and occipital*; and *four margins: sagittal, frontal, squamous, occipital*. Near the sagittal margin are several depressions for the arachnoid granulation. Along sagittal margin the *groove for superior sagittal sinus* is present.

SPHENOID BONE

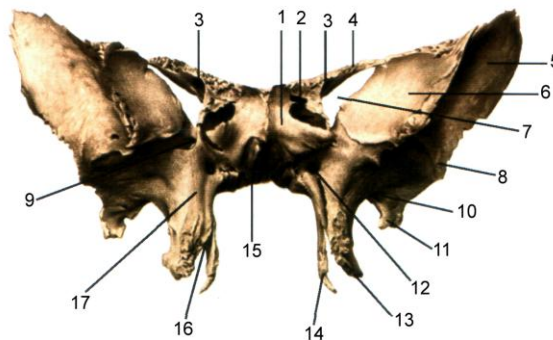
The **Sphenoid bone (*os sphenoidale*)** is divided into a median portion or body, two great and two small wings extending outward from the sides of the body, and two pterygoid processes which project from it below.

Body (*corpus sphenoidale*).—The body, more or less cubical in shape, is hollowed out in its interior to form two large cavities, the *sphenoidal air sinuses*, which are separated from each other by a septum. Surfaces of the body: superior, posterior, 2 lateral, anterior, inferior.

- Sphenoid bone
- (A) Posterior view
- 1 - body
 - 2 - optic canal
 - 3 - small wing
 - 4 - greater wing
 - 5 - foramen ovale
 - 6 - spine of sphenoid bone
 - 7 - carotid groove
 - 8 - pterigoid fossa
 - 9 - lateral plate of pterigoid process
 - 10 - medial plate of pterigoid process
 - 11 - pterigoid hamulus
 - 12 - pterigoid notch
 - 13 - pterigoid canal
 - 14 - groove of auditory tube
 - 15 - foramen rotundum
 - 16 - superior orbital fissure



- (B) Anterior view
- 1 - body
 - 2 - aperture of sphenoidal sinuse
 - 3 - optic canal
 - 4 - small wing
 - 5 - temporal surface of greater wing
 - 6 - orbital surface of greater wing
 - 7 - superior orbital fissure
 - 8 - infratemporal crest
 - 9 - foramen rotundum
 - 10 - foramen ovale
 - 11 - spine of sphenoid bone
 - 12 - pterigoid canal
 - 13 - lateral plate of pterigoid process
 - 14 - medial plate of pterigoid process
 - 15 - rostrum of sphenoid bone
 - 16 - pterigoid notch
 - 17 - maxillary surface



The **superior surface** is bounded behind by a transverse groove, the *chiasmatic groove* (*optic groove*). The groove ends on either side in the *optic foramen*, which transmits the optic nerve and ophthalmic artery into the orbital cavity. Behind the chiasmatic groove is an elevation, the *tuberculum sellae*; and still more posteriorly, a deep depression,. On the superior surface of the body presents the *sella turcica*, the deepest part of which lodges the hypophysis cerebri and is known as the *fossa hypophysealis*, which is bordered posteriorly by a square-shaped plate of bone, the *dorsum sellae*.

The **posterior surface**, Behind the dorsum sellae is a shallow depression, the *clivus*, which slopes obliquely backward, and is continuous with the groove on the basilar portion of the occipital bone. Between the eighteenth and twenty-fifth years this becomes ossified, ossification commencing above and extending downward.

The **lateral surfaces** of the body are united with the great wings and the medial pterygoid plates. Above the attachment of each great wing is a broad *carotid groove*.

The **anterior surface** of the body presents in the middle line a vertical crest, the *sphenoidal crest*, which articulates with the perpendicular plate of the ethmoid bone, and forms part of the septum of the nose. On either side of the crest is an irregular opening leading into the corresponding *sphenoidal air sinus*. These sinuses are two large, irregular cavities hollowed out of the interior of the body of the bone, and separated from one another by a bony septum, which is commonly bent to one or the other side. They vary considerably in form and size, are seldom symmetrical, and are often partially subdivided by irregular bony laminae. They begin to be developed before birth, and are of a considerable size by the age of six. They are partially closed, in front and below, by two thin, curved plates of bone, the *sphenoidal conchae*, leaving in the articulated skull a round opening at the upper part of each sinus by which it communicates with the upper and back part of the nasal cavity and occasionally with the posterior ethmoidal air cells. The **inferior surface** presents in the middle line a triangular spine, the *sphenoidal rostrum*, which is continuous with the *sphenoidal crest* on the anterior surface, and is received in a deep fissure between the alae of the vomer.

The **Great Wings surfaces: orbital, maxillar, temporal, infratemporal and superior or cerebral surface.**

The **cerebral surface** of each great wing forms part of the middle fossa of the skull; it is deeply concave. At its anterior and medial part is a circular aperture, the *foramen rotundum*, behind and lateral to this is the *foramen ovale* and short canal, sometimes double, the *foramen spinosum*.

The **temporal surface** is convex and forms a wall of the temporal fossa. The infratemporal, smaller in size and concave, enters into the formation of the infratemporal fossa. The *infratemporal crest* is situated between temporal and infratemporal surface of the greater wing of the sphenoidal bone.

The **orbital surface** of the great wing smooth, and quadrilateral in shape, is directed forward and medialward and forms the posterior part of the lateral wall of the orbit.

The **Small Wings (alae parvae).**—The small wings are two thin triangular plates, which arise from the upper and anterior parts of the body. Surfaces: superior and inferior.

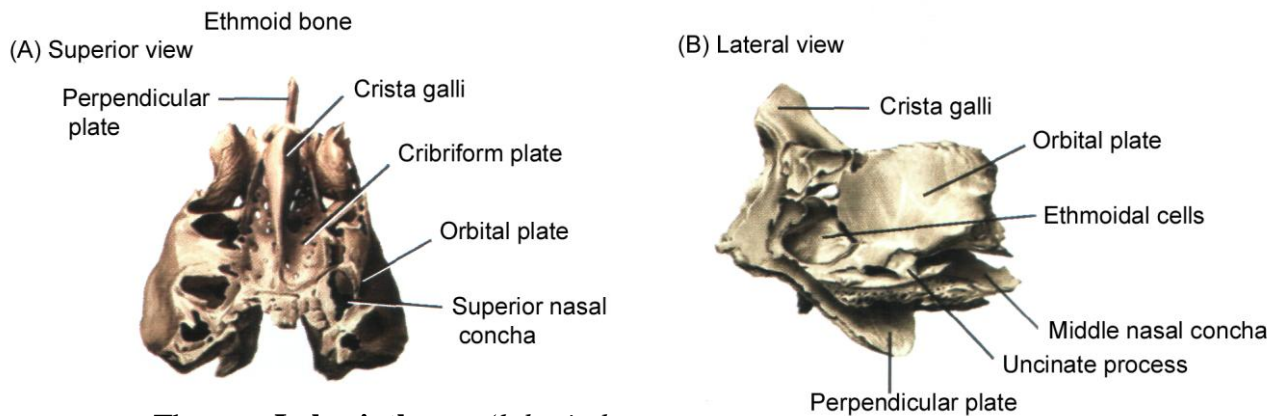
The **superior surface** of each is flat, and supports part of the frontal lobe of the brain. The **inferior surface** forms the back part of the roof of the orbit, and the upper boundary of the *superior orbital fissure*.

Pterygoid Processes (processus pterygoidei) descend perpendicularly from the regions where the body and great wings unite. Each process consists of a *medial* and *lateral plate*, the upper parts of which are fused anteriorly; a vertical sulcus, the *pterygopalatine groove*. The plates are separated below by the *pterygoid incisura*. The two plates diverge behind and enclose between them a V-shaped fossa, the *pterygoid fossa*. *Pterygoid canal* is in base of process. The medial pterygoid plate has the *pterygoid hamulus*.

ETHMOID BONE

Ethmoid bone (*os ethmoidale*) is situated at the anterior part of the base of the cranium, between the two orbits, at the roof of the nose. It consists of cribriform plate, a perpendicular plate, constituting part of the nasal septum; and two lateral labyrinths.

Cribriform Plate (*lamina cribrosa*) is perforated by foramina carries the *crista galli* which borders the *foramen coecum*.



The **Labyrinth** (*labyrinthus ethmoidalis*) consists of a number of thin-walled cellular cavities, the *ethmoidal cells*, arranged in three groups, anterior, middle, and posterior, and interposed between two vertical plates of bone; the lateral plate forms part of the orbit - *lamina frontalis*. Medially labyrinth has *concha nasalis superior* and *concha nasalis media*. There is superior nasal meatus between them.

TEMPORAL BONE

The **Temporal bone** (*os temporale*) is situated at the sides and base of the skull. Each consists of the squama, the petrous (pyramid) with mastoid process and tympanic part. Between this parts are *fissure petrosquamosa*, *tympanomastoidea*, *petrotympanica*.

The **squama** has a *groove for the middle temporal artery* on internal surface and the *temporal line*, *zygomatic process* and *mandibular fossa* on the external surface. The mandibular fossa is bounded, in front, by the *articular tubercle*.

Petrous Portion (*pars petrosa [pyramis]*) is pyramidal and is wedged in at the base of the skull between the sphenoid and occipital. Directed medially, forward, and a little upward, it presents for examination a base, an apex, three surfaces, and three angles, and contains, in its interior, the essential parts of the organ of hearing.

Base.—The base is fused with the internal surfaces of the squama and mastoid portion.

Apex.—The apex is situated into the angular interval between the posterior border of the great wing of the sphenoid bone and the basilar part of the occipital bone; it presents the *anterior or internal orifice of the carotid canal*, and forms the postero-lateral boundary of the *foramen lacerum*.

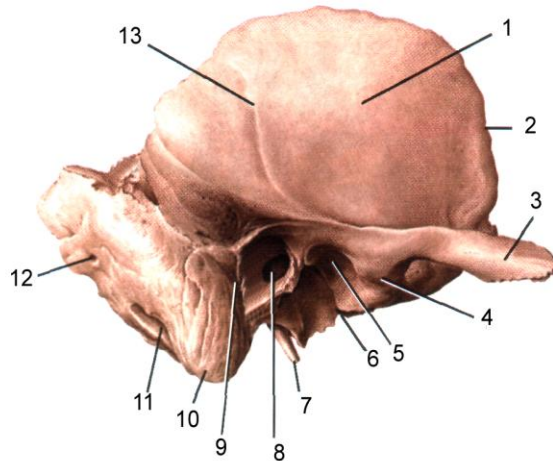
Margins of the Petrous Portion: anterior, posterior, superior.

The **anterior margin** is situated between inferior and anterior surface. It has *orifice of the musculotubar canal*. The **superior margin** is the longest and has *groove for the superior petrosal sinus*, and gives attachment to the tentorium cerebelli. The **posterior margin** is intermediate in length between the superior and the anterior surfaces of pyramis. Its medial half is marked by a sulcus, which forms, with a corresponding sulcus on the occipital bone, the channel for the inferior petrosal sinus.

Surface of the Petrous Portion: anterior, posterior, inferior.

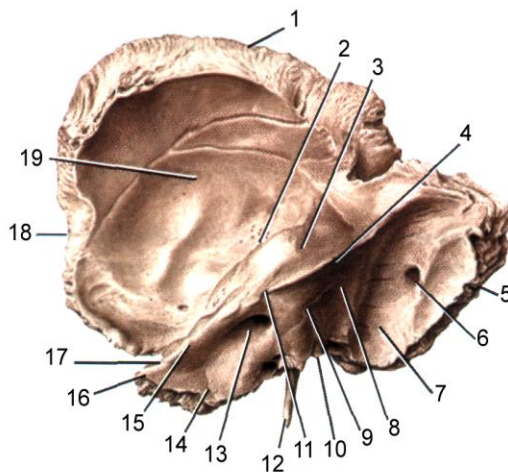
Temporal bone

(A) Lateral view



- 1 - squamous part
- 2 - sphenoidal margin
- 3 - zygomatic process
- 4 - articular tubercle
- 5 - mandibular fossa
- 6 - petrotympanic fissure
- 7 - styloid process
- 8 - external auditory opening
- 9 - tympanomastoid fissure
- 10 - mastoid process
- 11 - mastoid groove
- 12 - mastoid foramen
- 13 - groove of middle temporal artery

(B) Inner view



- 1 - parietal margin
- 2 - petrosquamous fissure
- 3 - arcuate eminence
- 4 - groove for superior petrosal sinus
- 5 - occipital margin
- 6 - mastoid foramen
- 7 - groove for sigmoid sinus
- 8 - posterior surface of petrous part
- 9 - aperture of aqueduct of vestibule
- 10 - jugular notch
- 11 - subarcuate fossa
- 12 - styloid process
- 13 - internal auditory opening
- 14 - groove of inferior petrosal sinus
- 15 - superior margin of petrous part
- 16 - apex of petrous part
- 17 - trigeminal impression
- 18 - sphenoidal margin
- 19 - cerebral surface

The **anterior surface** forms the posterior part of the middle cranial fossa of the base of the skull. It is marked by depressions for the convolutions of the brain, and presents six points for examination:

- (1) near the center, an *eminence (eminentia arcuata)* which indicates the situation of the superior semicircular canal;
- (2) the *tegmen tympani* indicating the position of the tympanic cavity;
- (3) the *hiatus and sulcus of the lesser and greater petrosal nerve*;
- (4) near the apex of the bone, the termination of the carotid canal, the wall of which in this situation is deficient in front;
- (5) above this canal the shallow *trigeminal impression* for the reception of the semilunar ganglion. The **posterior surface** forms the front part of the posterior fossa of the base of the skull, and is continuous with the inner surface of the mastoid portion. Near the center is a large orifice, the *internal acoustic opening* it leads into *internal acoustic meatus*. Behind the internal acoustic meatus is a small slit almost hidden by a thin plate of bone, leading to a canal, the *aquaeductus vestibuli*, which transmits the ductus endolymphaticus together with a small artery and vein. Above and between these two openings is an irregular depression which lodges a process of the dura mater - *subarcuate fossa*.

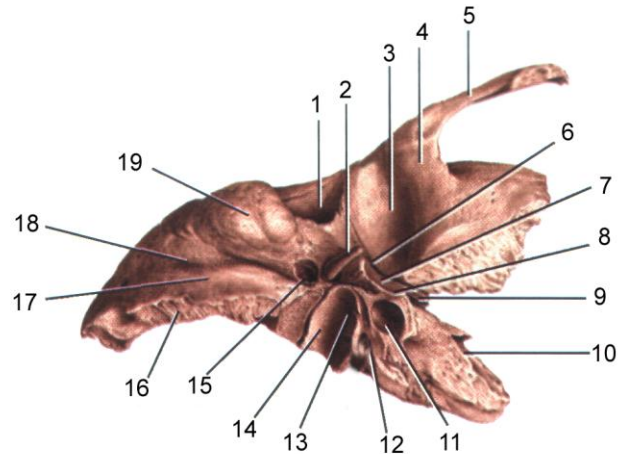
The **inferior surface** is rough and irregular, and forms part of the exterior of the base of the skull. It presents eleven points for examination:

- (1) aperture of the *carotid canal*;

- (2) *jugular fossa*, which connect with jugular notch of the occipital bone and together they form *jugular foramen*;
- (3) between the carotid opening and jugular fossa the crest with *fossula petrosa* is situated;
- (4) *aquaeductus cochleae*;
- (5) in the lateral part of the jugular fossa is the *mastoid canaliculus*;
- (6) between laminae of *vaginal process* is the *styloid process*, a sharp spine, about 2.5 cm. in length;
- (7) between the styloid and mastoid processes is the *stylomastoid foramen*.

Temporal bone

- 1 - external auditory opening
- 2 - styloid process
- 3 - mandibular fossa
- 4 - articular tubercle
- 5 - zygomatic process
- 6 - petrosquamous fissure
- 7 - tympanic part
- 8 - petrotympanic fissure
- 9 - musculotubal canal
- 10 - internal opening of carotid canal
- 11 - external opening of carotid canal
- 12 - petrous fossula
- 13 - mastoid canaliculus
- 14 - jugular fossa
- 15 - stylomastoid foramen
- 16 - occipital margin
- 17 - groove of occipital artery
- 18 - mastoid notch
- 19 - mastoid process



Inferior view

Mastoid process situates posteriorly the external acoustic porus. It has rough external surface. Behind the mastoid process are the *mastoid groove* and *groove for occipital artery*. On the internal surface the *groove for the sigmoid sinus*. There are cells inside the mastoid process.

Tympanic Part (pars tympanica) forms the walls and the floor of the bony *external acoustic meatus*.

Canals of the temporal bone:

Name of canal	start	finish
Carotid canal	external foramen on lower surface of the pyramis	internal opening in apex of pyramis
<i>Caroticotympanic canaliculi</i>	medial wall of the external carotid foramen	tympanic cavity
Musculotubarius canal (consist of semicanalis m. tensoris tympani and semicanalis tubae auditivae)	on anterior margin of the pyramis	tympanic cavity
Facial canal	internal acoustic meatus on back surface of the pyramis	stylomastoid foramen on
<i>Canaliculus for chorda tympani</i>	facial canal	passes through the tympanic cavity and finishes in petrotympanic fissura
<i>Tympanic canaliculus</i>	petrosal fossula	hiatus canalis nervi petrosi minoris
<i>Mastoid canaliculus</i>	on the floor of the jugular fossa	tympanomastoid fissura

Bones of viscerocranium (maxilla, palatine, nasal, lacrimal, zygomatic bones, mandible, hyoid, inferior nasal concha, vomer).

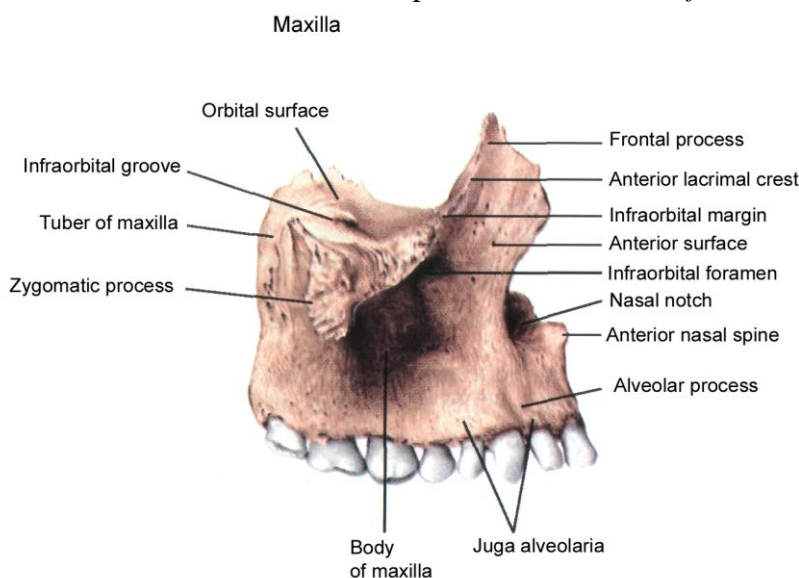
MAXILLA

The **Maxilla (Upper Jaw)** are the largest bones of the face, excepting the mandible, and form, by their union, the whole of the upper jaw. Each assists in forming the roof of the mouth, the floor and lateral wall of the nose and the floor of the orbit; it also enters into the formation of two fossae, the infratemporal and pterygopalatine, and two fissures, the inferior orbital and pterygomaxillary.

Each bone consists of a body and four processes—zygomatic, frontal, alveolar, and palatine.

The **Body** (*corpus maxillae*) is somewhat pyramidal in shape, and contains a large cavity, the *maxillary sinus (antrum of Highmore)*. It has four surfaces—an anterior, a posterior or infratemporal, a superior or orbital, and a medial or nasal.

The **anterior surface** is directed forward and lateralward. It presents at its lower part a series of eminences corresponding to the positions of the roots of the teeth. Just above those of the incisor teeth is a depression, the *incisive fossa*. Lateral to the incisive fossa is



another depression, the *canine fossa*.

Above the fossa is the *infraorbital foramen*, the end of the infraorbital canal.

Above the foramen is the *infraorbital margin*. Medially, the anterior surface is limited by a deep concavity, the *nasal notch* and *anterior nasal spine*.

The **infratemporal surface** is convex, directed backward and lateralward, and forms

part of the infratemporal fossa. At the lower part of this surface is a rounded eminence, the *maxillary tuber*. It is pierced about its center by the apertures of the *alveolar canals*.

The **orbital surface** is smooth and triangular, and forms the greater part of the floor of the orbit. It is bounded *medially* by an irregular margin which in front presents a notch, the *lacrimal notch*. Near the middle of the posterior part of the orbital surface is the *infraorbital groove*, which continues into *infraorbital canal*, opens just below the margin of the orbit.

The **nasal surface** forms the lateral wall of nasal cavity. It has hiatus maxillaries leading into the maxillary sinus. Near this opening is the *lacrimal groove*, which is converted into the nasolacrimal canal, which finishes in orbita. More anteriorly is an oblique ridge, the *conchal crest*, for articulation with the inferior nasal concha.

The **Zygomatic Process** (*processus zygomaticus*) is a rough triangular eminence, pass laterally and serrated for articulation with the zygomatic bone.

The **Frontal Process** (*processus frontalis*) is a strong plate, which projects upward, medialward, and backward, by the side of the nose, forming part of its lateral boundary. Its *lateral surface* is smooth, continuous with the anterior surface of the body. On the *medial surface* is the *ethmoidal crest*, the posterior end of which articulates with the middle nasal concha.

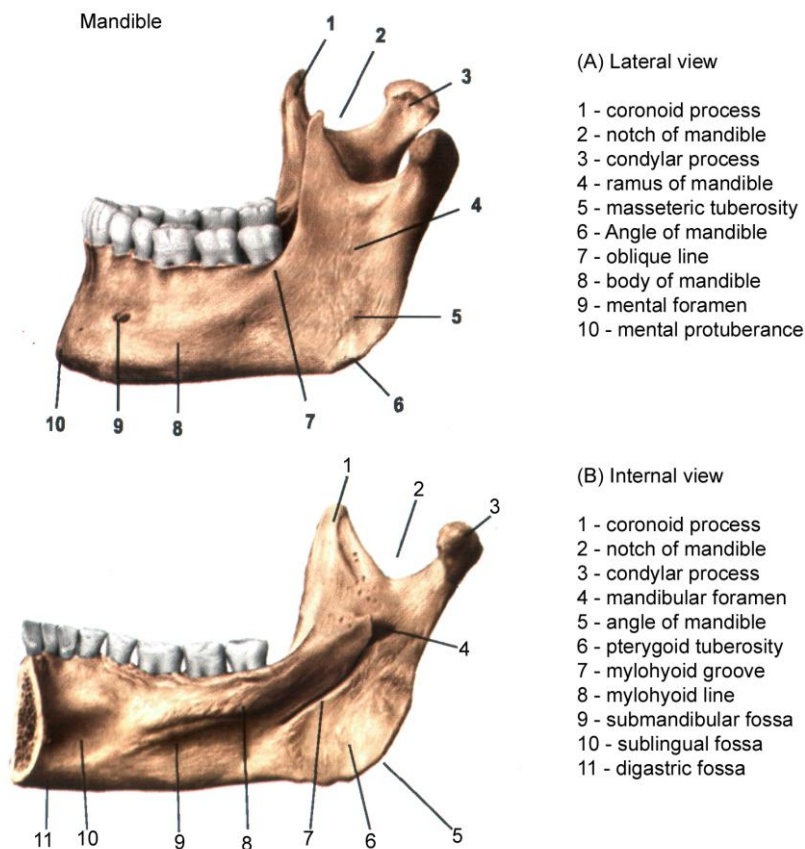
On the lateral surface is the the *anterior lacrimal crest*, which continuoses in *infraorbital margin*. Together they bordered *lacrimal groove*, which serves as a guide to the position of the lacrimal sac.

The **Alveolar Process** (*processus alveolaris*) is the thickest and most spongy part of the bone. It is broader behind than in front, and excavated into deep cavities for the reception of the teeth. When the maxillae are articulated with each other, their alveolar processes together form the *alveolar arch*; the center of the anterior margin of this arch is named the alveolar point.

The Palatine Process (*processus palatinus; palatal process*).—The palatine process, thick and strong, is horizontal and projects medialward from the nasal surface of the bone. It forms a considerable part of the floor of the nose and the roof of the mouth and is much thicker in front than behind. When the two maxillae are articulated, a funnel-shaped opening, the *incisive foramen*, is seen in the middle line, immediately behind the incisor teeth. In this opening the orifices of two lateral canals are visible; they are named the *incisive*. The *medial border* is form the *nasal crest* for the reception of the vomer. The front part of this ridge rises forms, together with a similar process of the opposite bone, the *anterior nasal spine*. The *posterior border* is serrated for articulation with the horizontal part of the palatine bone.

MANDIBLE

The **Mandible, or lower jaw**, is the largest and strongest bone of the face. The mandible consists of a horseshoe-shaped body and a pair of rami.



The **Body** of the mandible meets the ramus on each side at the *angle*.

The upper part of the body is called the *alveolar part*; in the adult it consist of 16 sockets for the roots of the lower teeth. The *mental foramen* can be seen below the second premolar tooth on the external surface. On the internal surface of the body of the mandible is the *submandibular fossa* for the submandibular salivary gland. In front of this fossa is the *sublingual fossa* for the sublingual salivary gland. Between the two fossae runs an oblique ridge called the *mylohyoid line*.

The **ramus of the mandible** is vertical and has an anterior *coronoid process* and posterior *condyloid process* or *head*; the two processes are separated by the *mandibular notch*. Below the condyloid process is a short *neck*. The *mandibular foramen* lies on the medial surface of the ramus. The foramen leads into the *mandibular canal* and opens onto the lateral surface at the *mental foramen*. The *condyloid process* (or head) of the mandible articulates with the term bone at the temporomandibular joint.

ZYGOMATIC bone (paired) has frontal and temporal processes; lateral, temporal and orbital surfaces.

NASAL bone (paired) forms bony part of nasal dorsum.

PALATINE bone (paired) has perpendicular and horizontal laminae. It forms part of nasal cavity, mouth, orbit and pterygopalatine fossa.

LACRIMAL bones (paired) forms anterior part of the medial orbital wall.

VOMER (unpaired) is located in nasal cavity and forms bony septum nasi with perpendicular lamina (ethmoid bone).

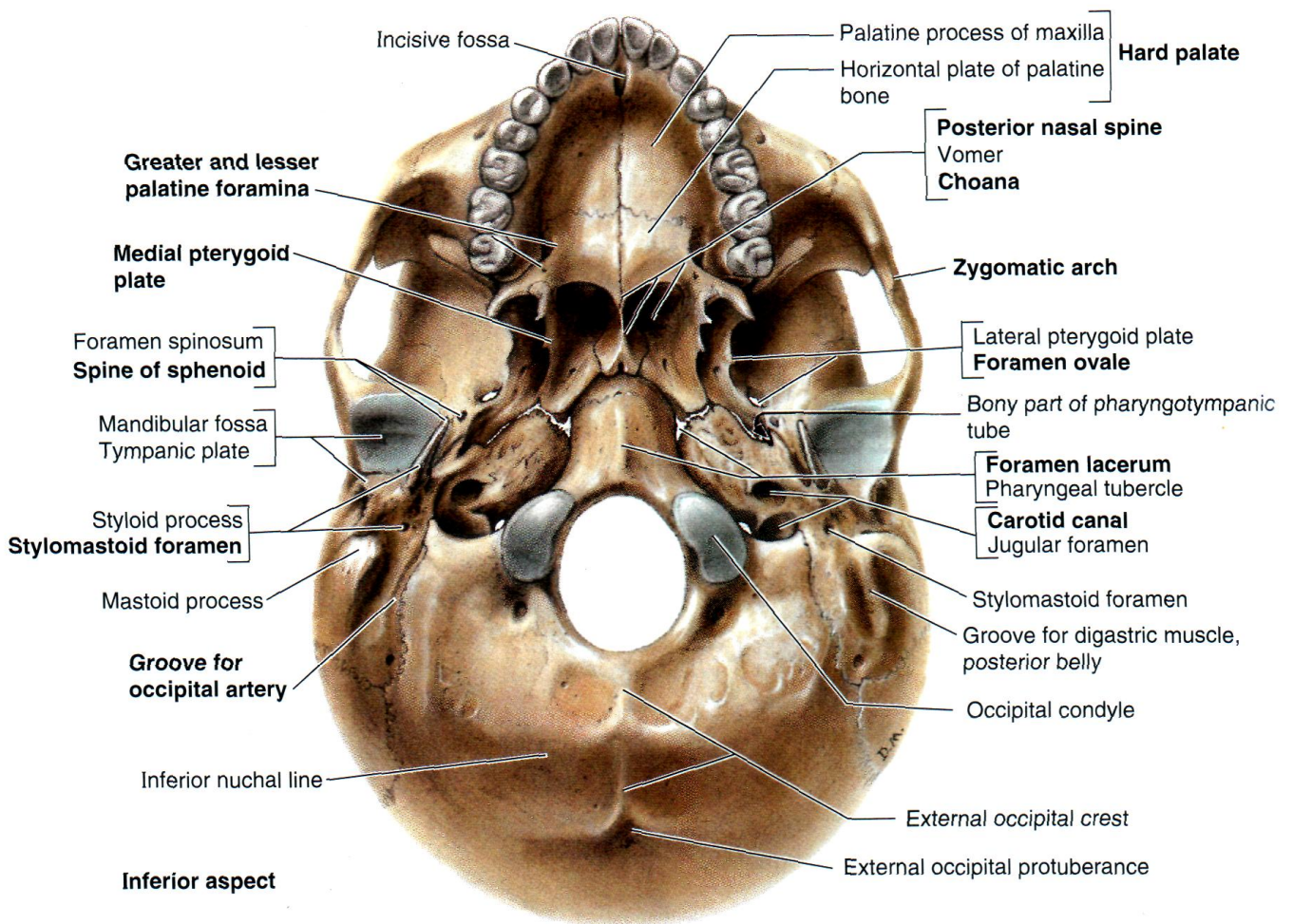
INFERIOR NASAL CONCHA (paired) - thin plate that separate middle and inferior nasal meatus.

HYOID bone is positioned in neck between mandible and larynx. It has body, large and small horns.

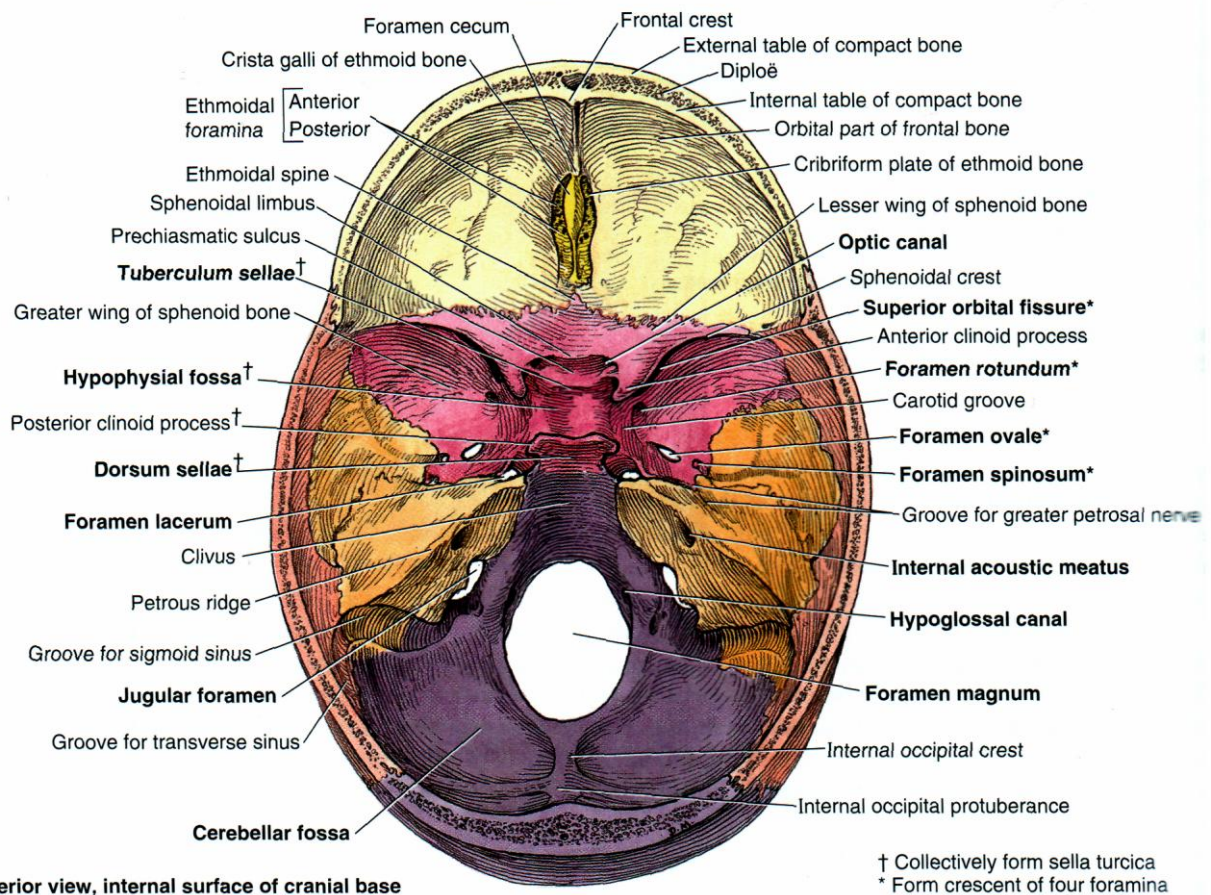
Neurocranium bones form the base of the skull and the roof or calvaria of the skull.

Calvaria is called skullcap and is formed anteriorly by the frontal bone and posteriorly by parietal and occipital bones, all articulating with each other via sutures.

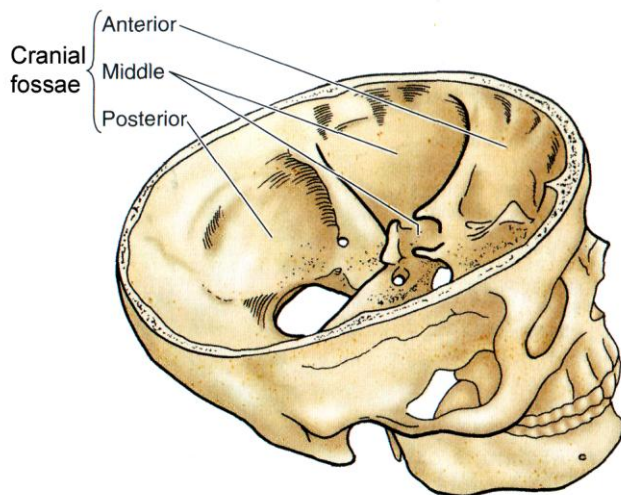
Base of the skull has an inner and outer surfaces.



Inner base consists of anterior, middle and posterior cranial fossae.



Superior view, internal surface of cranial base



I. Anterior cranial fossa

A. Boundaries: anteriorly and laterally by squamous frontal bone, the ethmoid bone in the midline, and posteriorly by the posterior margin of lesser wing of sphenoid and anterior margin of chiasmatic sulcus;

B. Floor: orbital plate of frontal bone, cribriform plate of ethmoid bone, the crista galli, and body and lesser wing of sphenoid bone;

C. Special features: frontal crest, foramen cecum, crista galli, olfactory groove, ant. and post, ethmoidal foramina, and grooves for anterior meningeal vessels.

II. Middle cranial fossa

A. Boundaries: anterior: lesser wings of sphenoid, ant. clinoid processes, and ant. margin of chiasmatic groove; posterior: sup. angles of petrous bone and dorsum sellae; lateral: squamous temporal, petrous bone, great wing of sphenoid, and parietal bones;

B. Floor: squamous temp., petrous bone, great wing of sphenoid, and sella turcica;

C. Special features: sella turcica, posterior clinoid processes, carotid sulcus (groove), carotid canal, superior orbital fissure, optic foramina, foramen rotundum, ovale, spinosum, and lacerum, arcuate eminence, tegmen tympani of petrous temporal, hiatus for greater petrosal n., grooves for greater and lesser petrosal nerves, and grooves for branches of middle meningeal arteries.

III. Posterior fossa

A. Boundaries: anterior: dorsum sellae, basal occipital, and crest of petrous bone; lateral: parietal bone; posterior: squamous occipital bones;

B. Floor: occipital and temporal bones;

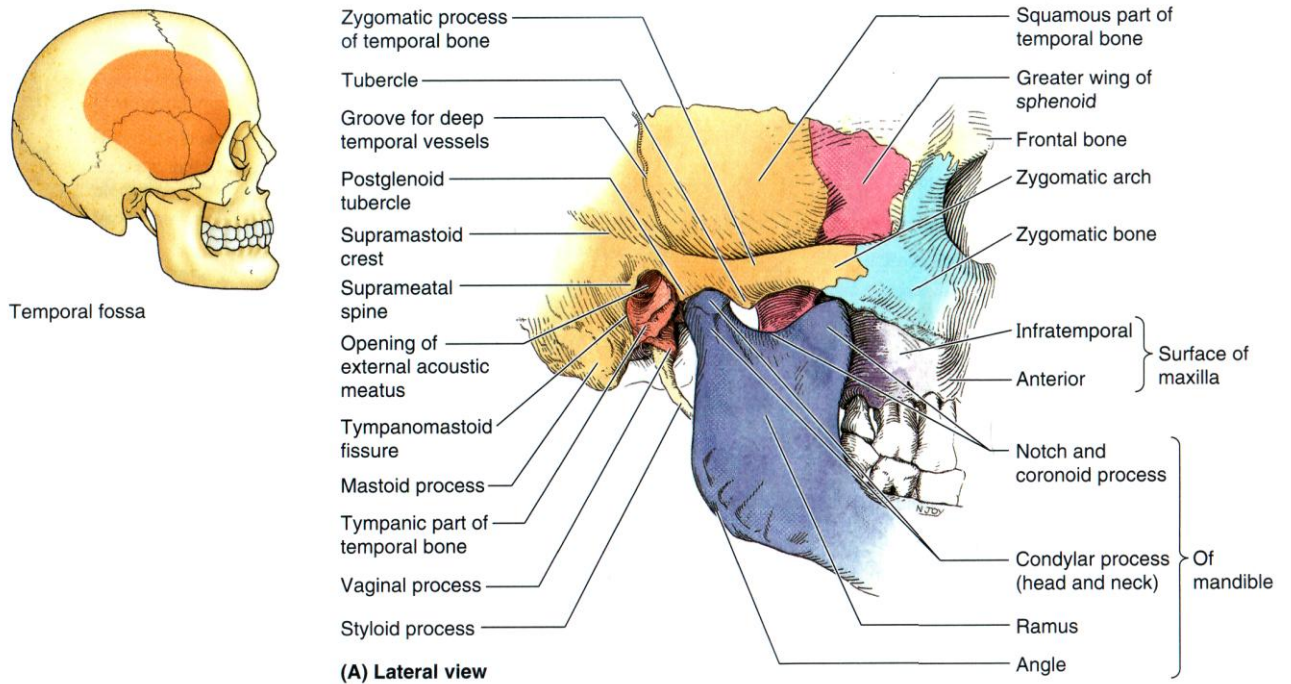
C. Special features: grooves for superior petrosal sinus, foramen magnum, hypoglossal canal, condylar canal, petro-occipital fissure, jugular foramen, internal acoustic (auditory) meatus, vestibular aqueduct, internal occipital crest, grooves for the transverse and sigmoid sinuses, and mastoid foramen.

Foramina or other openings and their principal contents

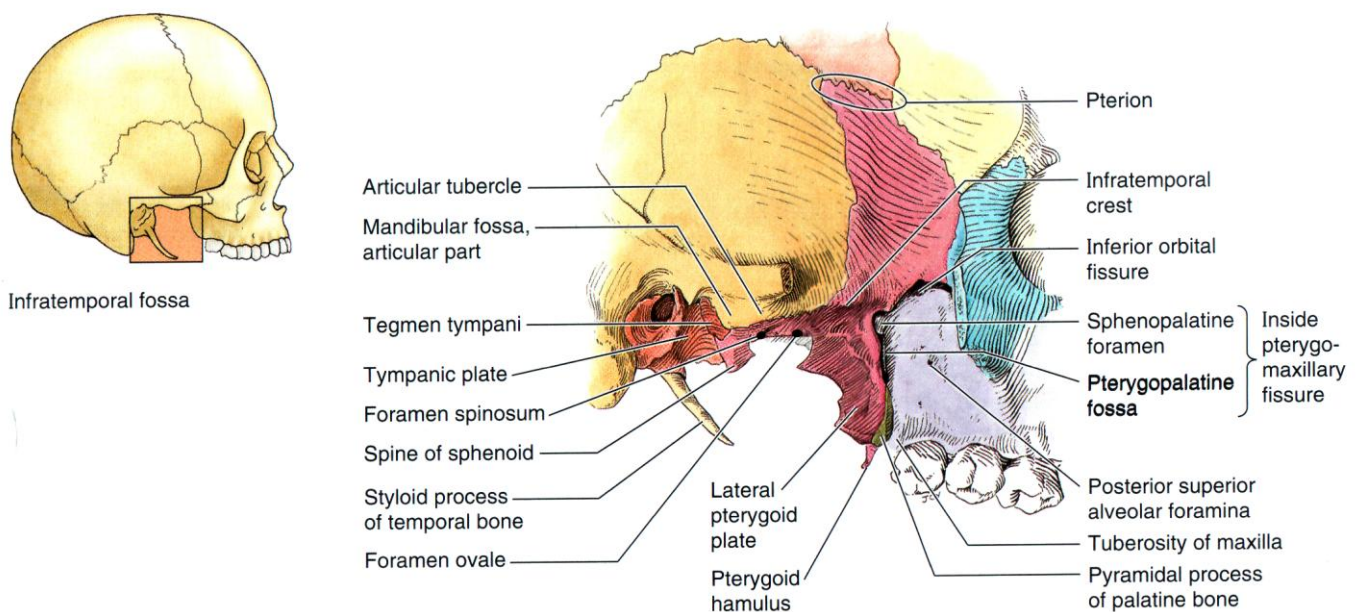
Name	Cranial fossa	Contents
Foramina of cribriform plate	Anterior	Fibers of the olfactory nerve
Anterior ethmoidal foramen	Anterior	Anterior ethmoidal vessels and nerve
Posterior ethmoidal foramen	Anterior	Posterior ethmoidal vessels and nerve
Foramen cecum	Anterior	Origin of superior sagittal venous sinus
Optic canal	Middle	Optic nerve and ophthalmic artery
Superior orbital fissure	Middle	III, IV, VI, V (ophthalmic) nerves;
Rotundum foramen	Middle	V (maxillary) nerve
Ovale foramen	Middle	V (mandibular) nerve, accessory branch of meningeal artery
Spinosum foramen	Middle	Middle meningeal artery, meningeal branch of mandibular nerve
Hiatus of canal for greater petrosal nerve	Middle	Greater petrosal nerve, petrosal branch of middle meningeal artery
Carotid canal	Middle	Internal carotid artery
Magnum foramen	Posterior	Spinal cord, accessory nerve, vertebral arteries, ant. and post, spinal arteries
Jugular foramen	Posterior	IX, X, XI nerves; internal jugular vein; posterior meningeal branch of ascending pharyngeal artery
Hypoglossal canal	Posterior	XII nerve
Internal auditory meatus	Posterior	VII, VIII nerves; labyrinthine (internal auditory) artery

Special features on the lateral view of the skull

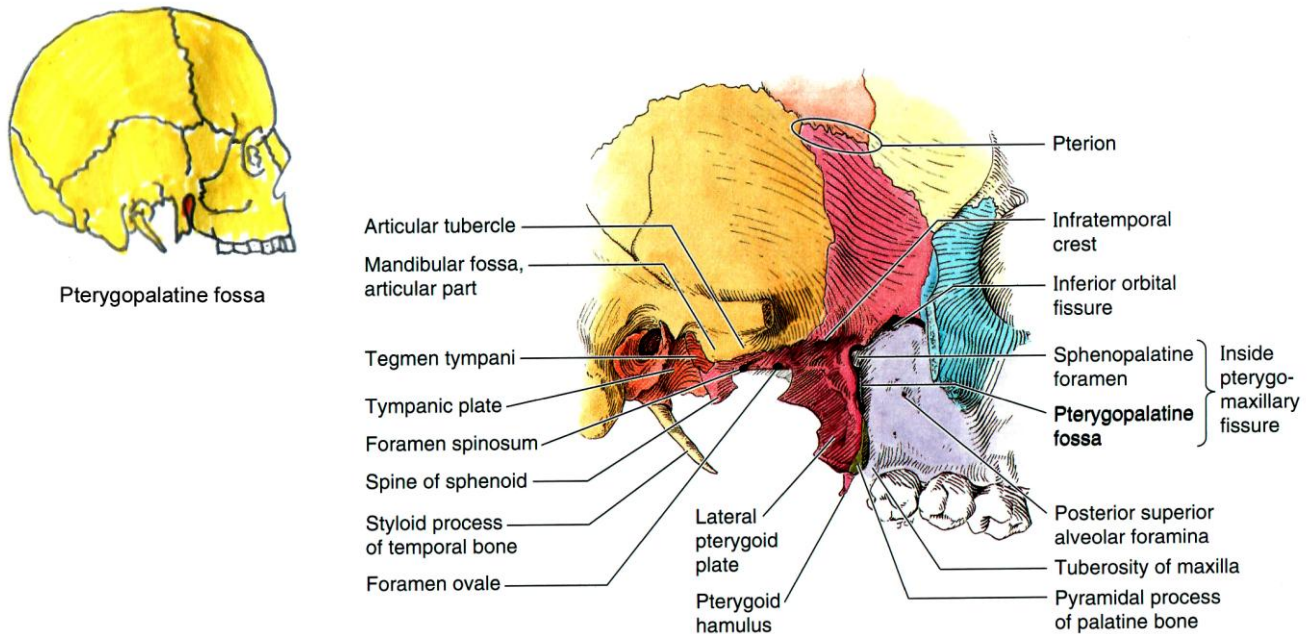
A. Temporal fossa: deep to zygomatic process of temporal bone; bounded above and behind by temporal lines, in front by frontal and zygomatic bones, laterally by the zygomatic arch, and below by the infratemporal crest;



B. Infratemporal fossa: deep to ramus of mandible; bounded in front by the maxilla, behind by the articular tubercle of the temporal and angular spine of sphenoid, above by great wing of sphenoid, below by the infratemporal crest and alveolar border of the maxilla, and medially by the lateral pterygoid plate;



C. Pterygopalatine fossa: bounded above by body of sphenoid, in front by maxilla, behind by pterygoid process and great wing of sphenoid, and medially by palatine bone. Five foramina open into fossa: rotundum, pterygoid canal, pharyngeal canal, sphenopalatine foramen, and greater and lesser palatine canals. In addition, anteriorly, the fossa communicates with the orbit via the inferior orbital fissure, and via the pterygomaxillary fissure connects laterally with the infratemporal fossa. Contains: terminal branches of maxillary a., maxillary n., and pterygopalatine ganglion;



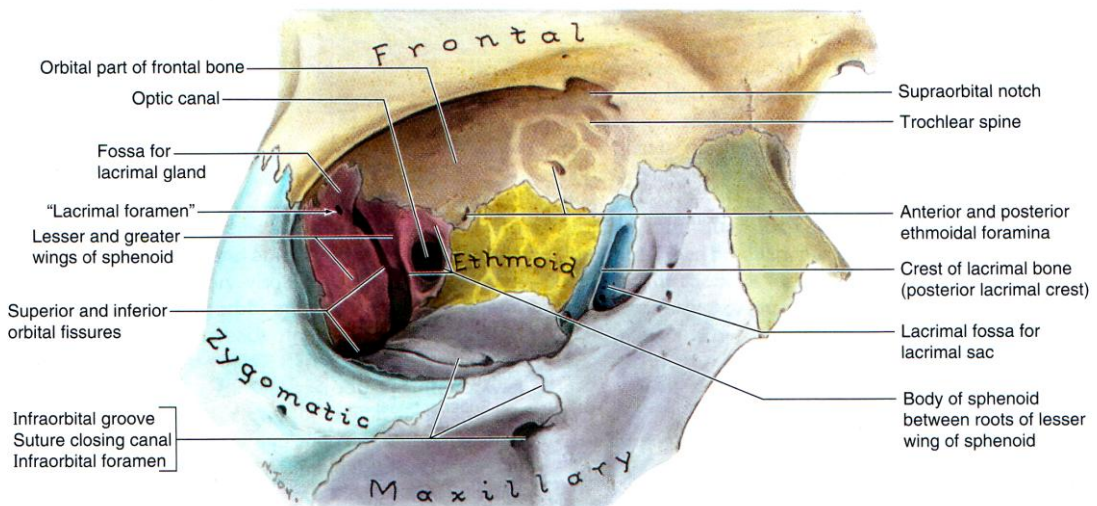
D. Pterygomaxillary fissure: between pterygoid process posteriorly and maxillary bone anteriorly. Leads into the pterygopalatine fossa.

Facial parts of the skull

The Orbit

Bony orbit: a pyramidal cavity, with base, apex, roof, floor, medial and lateral walls. Apex points dorsomedially; base directed rostrally.

A. Apex: optic foramen for optic nerve;



Anterior view

B. Floor: orbital part of maxilla, orbital process of zygomatic bone, orbital

process of palatine bone. Medially: opening of nasolacrimal duct; in floor, groove for infraorbital nerve;

C. Roof: orbital plate of frontal bone and small wing of sphenoid. Medially, trochlea for superior oblique muscle; laterally, lacrimal fossa;

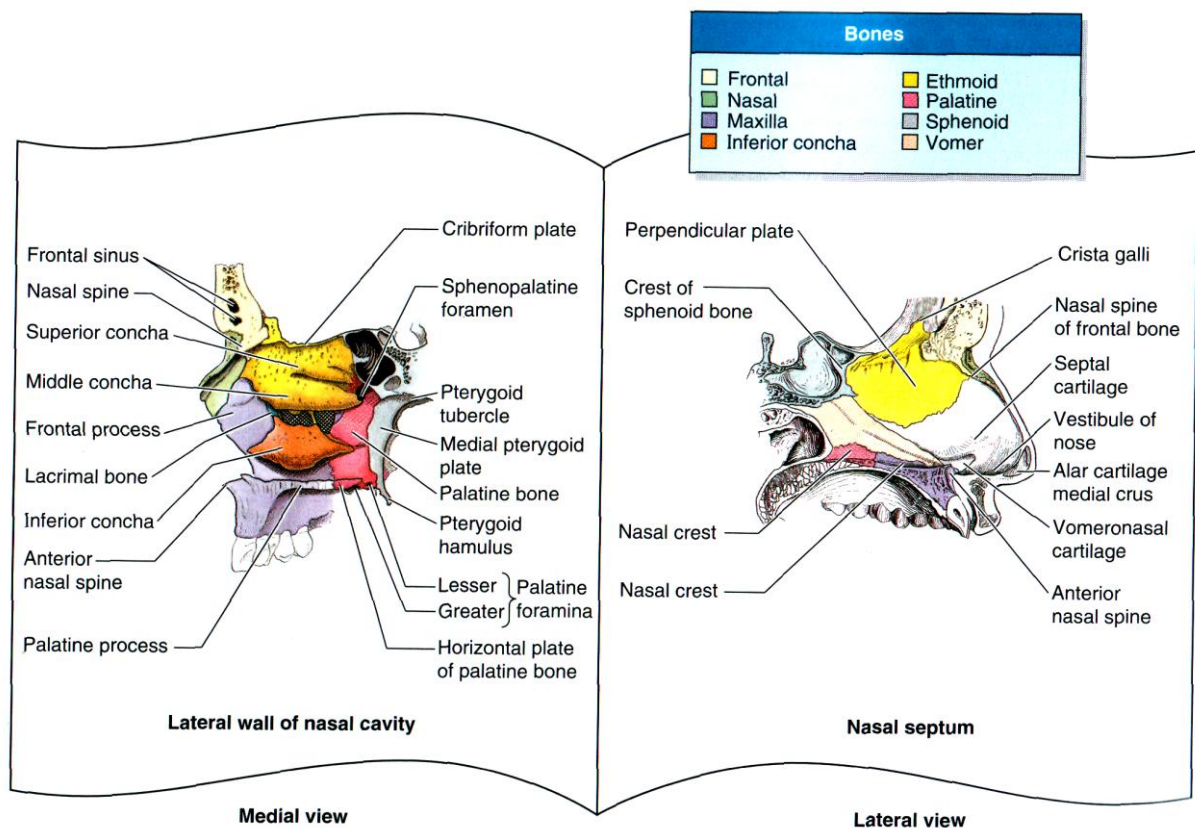
D. Medial: frontal process of maxilla, lacrimal bone, orbital lamina (lamina papyracea) of ethmoid, body of sphenoid bone, lacrimal groove with posterior lacrimal crest near rostral end of wall, and near roof, anterior and posterior ethmoidal foramina;

E. Lateral: orbital process of zygomatic bone and orbital part of great wing of sphenoid bone. Orifices for branches of zygomatic nerve, superior orbital fissure, inferior orbital fissure;

F. Base (orbital margin): above, supraorbital arch of frontal bone with its supraorbital notch (foramen); laterally, zygomatic and zygomatic process of frontal bone; below, zygomatic and maxillary bones; medially, frontal bone and frontal process of maxillary bone.

Nasal cavity

A. Anterior aperture: pear-shaped, bounded by nasal bone and anterior border of maxillae;



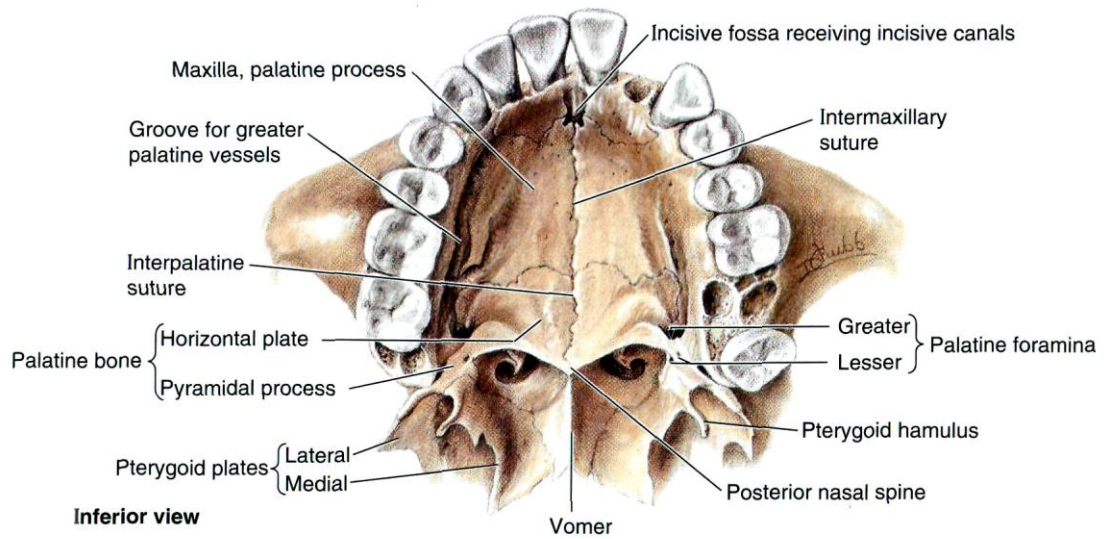
B. Medial (septal) wall: perpendicular plate of ethmoid, vomer;

C. Lateral wall: superior and middle conchae (turbinates) of ethmoid bone, inferior concha (turbinate), nasal bone, frontal process and nasal surface of maxilla, lacrimal bone, perpendicular plate of the palatine, medial pterygoid plate and body of sphenoid;

The inferior and middle conchae project medially and inferiorly, creating air passageways beneath them called the inferior and middle meatuses. The short superior concha conceals the superior meatus. The space posterosuperior to the superior concha into which the sphenoid sinus opens is called the sphenoidal recess.

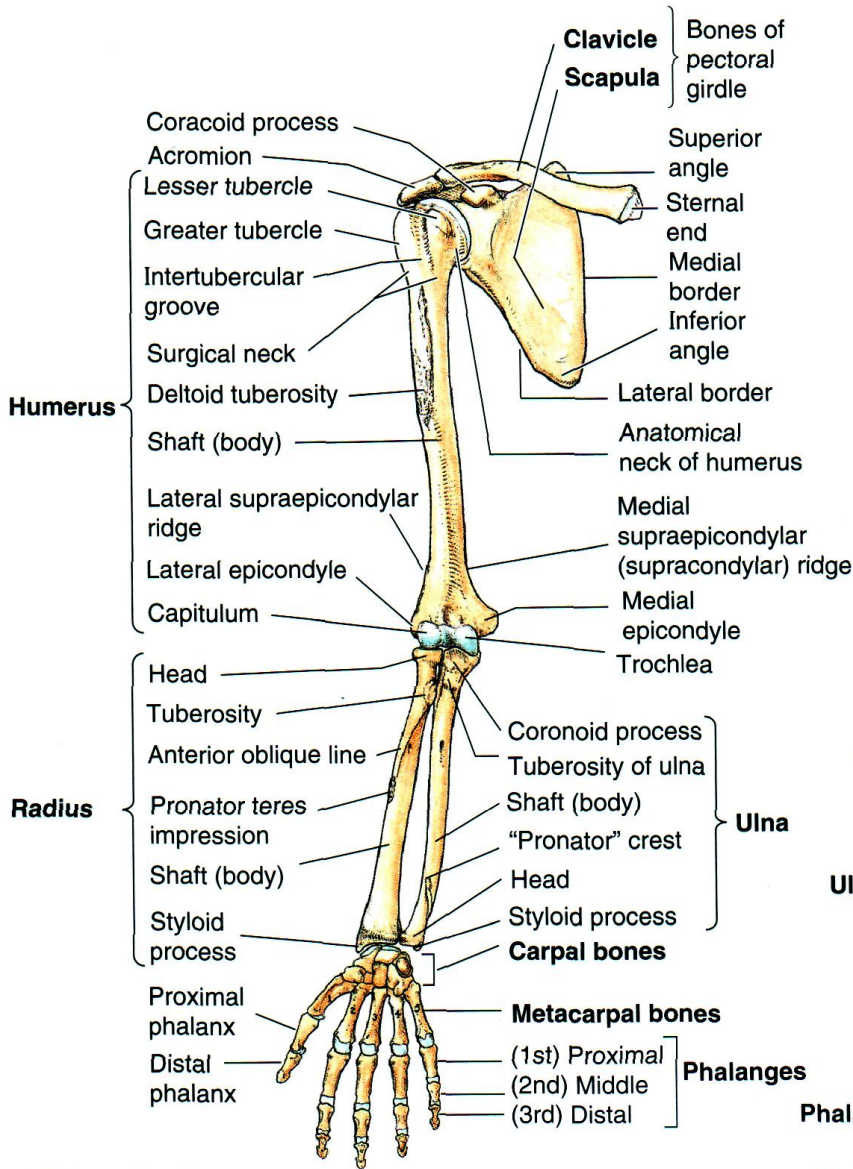
- D. Roof: upper nasal cartilage, nasal bone, spine of frontal bone, cribriform plate of ethmoid bone, body of sphenoid bone;
- E. Floor: palatine process of maxilla, horizontal plate of palatine bone;
- F. Posterior aperture (choana) opens into the nasopharynx.

Hard palatum is formed by palatine process of maxilla, horizontal plate of palatine bone.

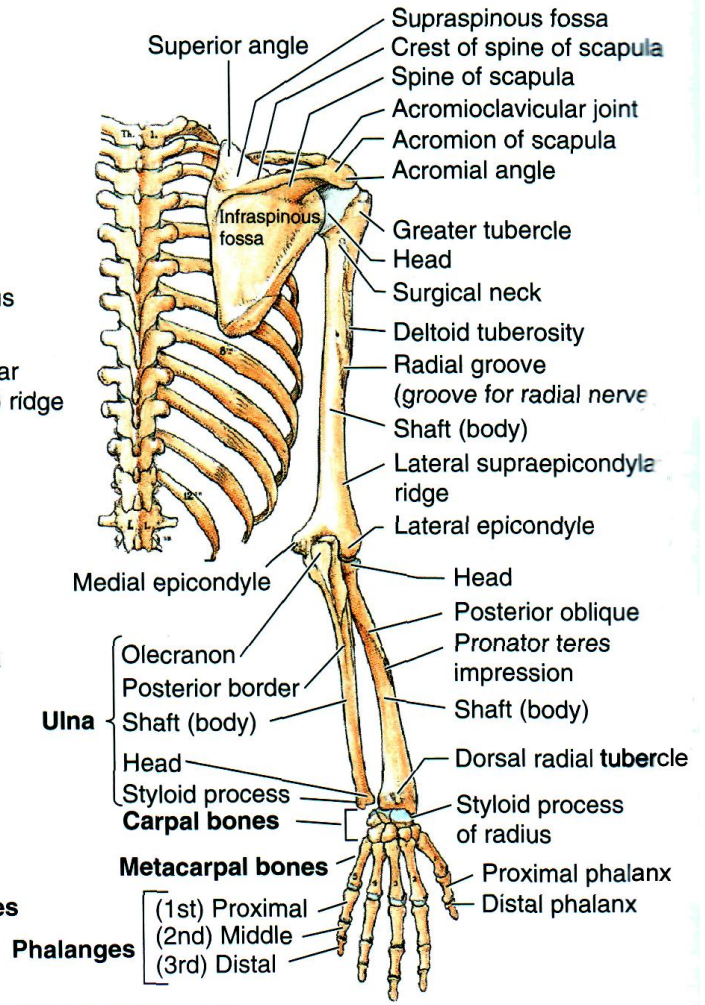


Bones of the upper limb

In the skeleton of the upper limb we distinguish the shoulder girdle and the free extremity.



(A) Anterior view



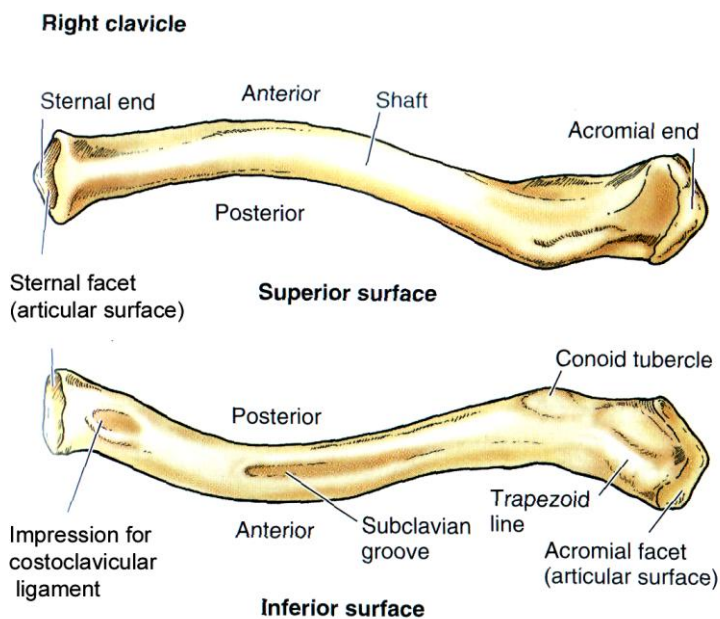
(B) Posterior view

Bones of the Shoulder Girdle

CLAVICLE

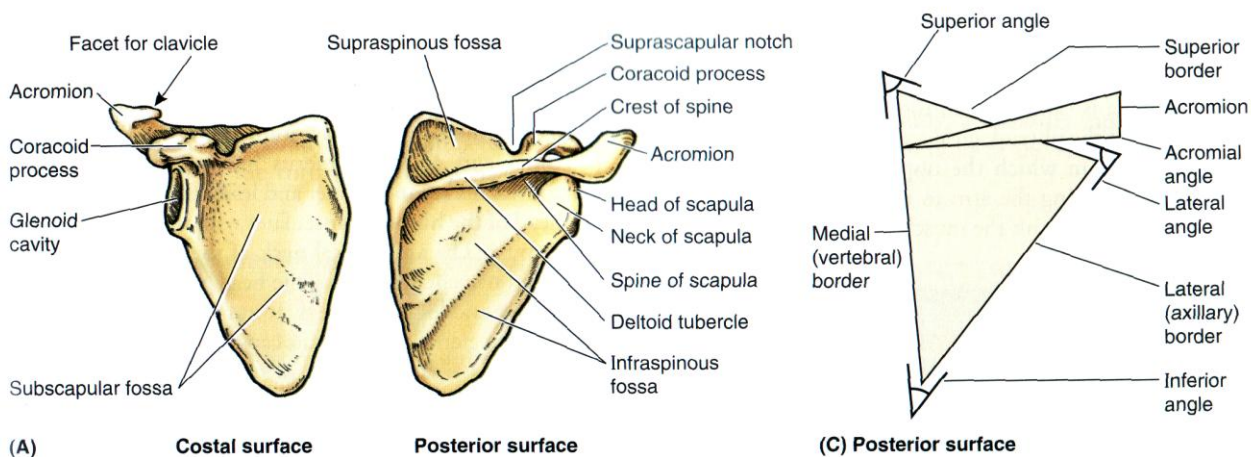
The clavicle acts as a strut that holds the upper limb away from the trunk. Clavicle is an S-shaped bone. Its medial two-thirds is convex forward, and its lateral third is concave forward. It articulates medially with the sternum and first costal cartilage and with the scapula laterally. Toward the sternum is the **sternal end** with the *sternal articular facet* and toward the scapula the flat **acromial end** with *acromial articular facet* and between the two lies the

body of the clavicle. Near the sternal end, on the lower surface of the clavicle, is the *impression for the costoclavicular ligament*. The *sulcus for the subclavian muscle* lies on the undersurface of the clavicular body. The prominent *conoid tubercle* lies near the acromial end close to the *trapezoid line*.



SCAPULA

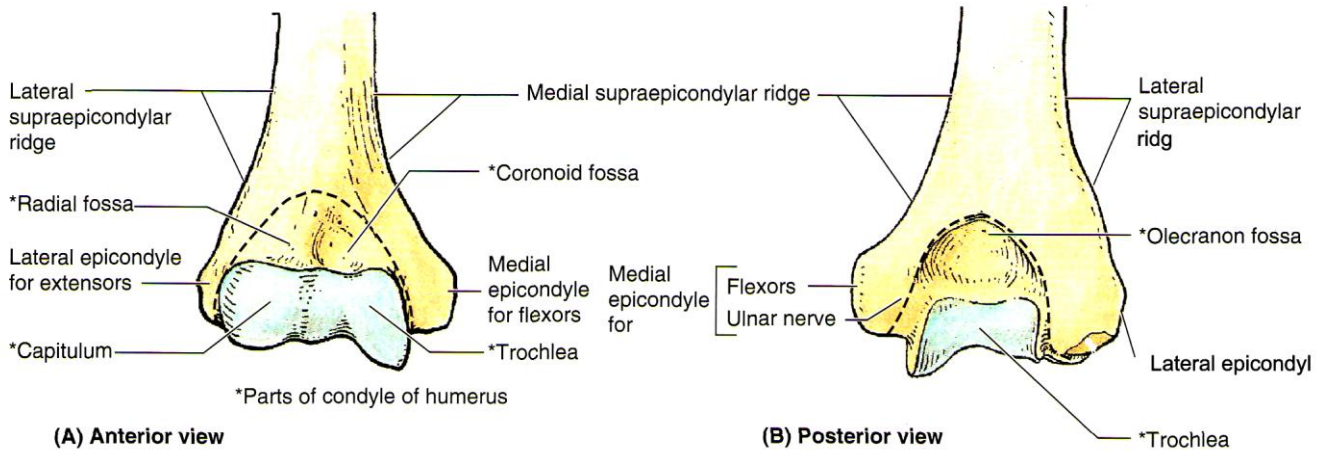
The scapula is a flat triangular bone. It has a **medial margin**, **lateral margin** and **superior margin**, which are separated from each other by the **superior**, **inferior** and **lateral angles**. On its **posterior surface**, the *spine* of the scapula projects backward. The *lateral end* of the spine forms the *acromion*, which articulates with the clavicle. The **lateral angle** of the scapula forms the *glenoid cavity* for articulation with the head of the humerus. The *coracoid process* projects upward and forward and provides attachment for muscles and ligaments. Medial to the base of the coracoid process is the *supra-scapular notch*. The subscapular fossa is the name given to the concave anterior surface of the scapula. The *supraspinous fossa* lies above the spine, and the *infraspinous fossa* lies below the spine on the posterior surface of the scapula.



Bones of the Arm

HUMERUS

The *head* of the humerus lies at the **upper end** and forms about a third of a sphere that articulates with the glenoid cavity of the scapula. Immediately below the head is the *anatomical neck*. Below the *neck* are the *greater* and *lesser tuberosities*, separated from each other by the *bicipital groove*. Distal to the tuberosities is a narrow region that is frequently fractured called the *surgical neck*. The *deltoid tuberosity* is a roughened area about halfway down the lateral aspect of the **shaft**; it is for the insertion of the deltoid muscle. Behind and



Distal end of right humerus.

below the tuberosity is a *spiral groove*, in which lies the radial nerve. The *medial* and *lateral epicondyles* lie at the **lower end** of the humerus for the attachment of muscles and ligaments. The rounded *capitulum* articulates with the head of the radius, and the pulley-shaped *trochlea* articulates with the trochlear notch of the ulna. The *radial fossa* lies above the capitulum and receives the head of the radius in full flexion of the elbow joint. Above the trochlea anteriorly is the *coronoid fossa*, which receives the coronoid process of the ulna during full flexion of the elbow joint. Above the trochlea posteriorly is the *olecranon fossa*, which receives the olecranon process of the ulna when the elbow joint is extended.

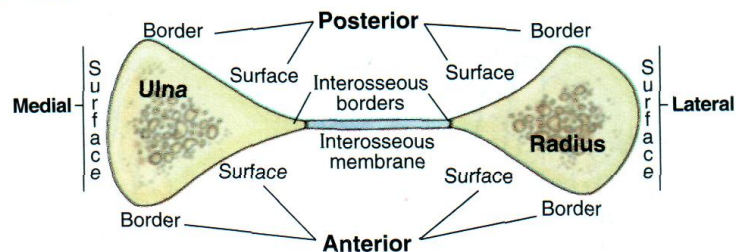
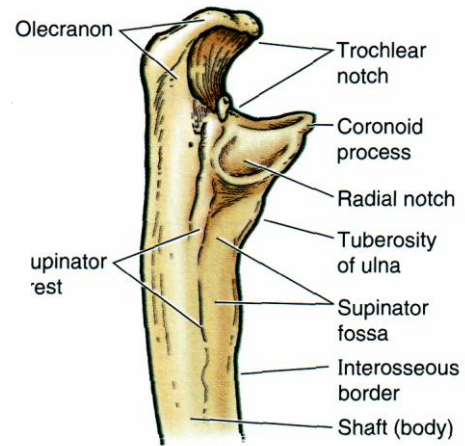
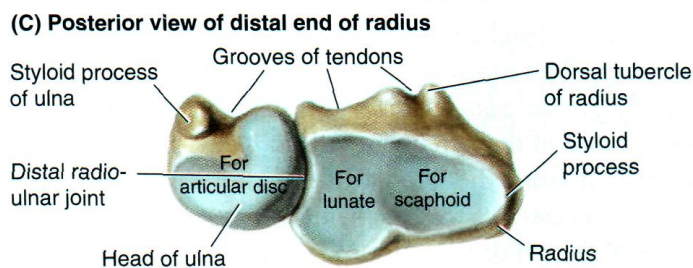
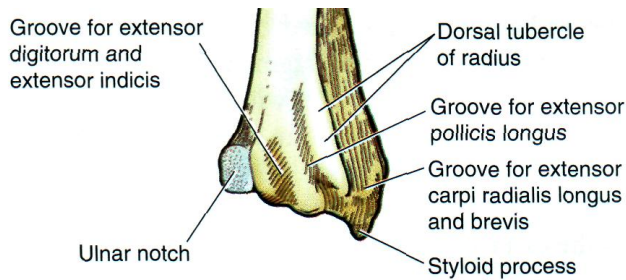
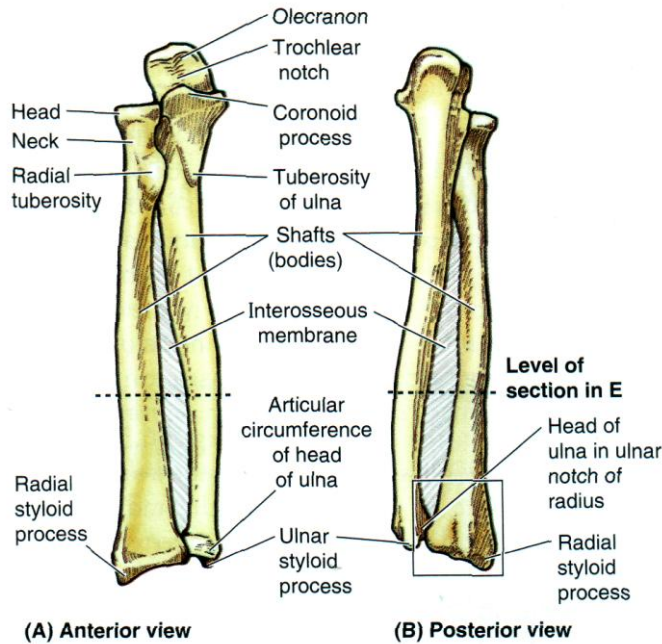
Bones of the Forearm

RADIUS

The radius is the lateral bone of the forearm. The *head* lies on the **upper end** and is small and circular. The upper concave surface articulates with the convex capitulum. The *circumference of the head* articulates with the radial notch of the ulna. The bone is constricted below the head to form the *neck*. Below the neck is the *bicipital tuberosity* for the insertion of the biceps brachii muscle. The **shaft** has a sharp *interosseous* border medially for the attachment of the interosseous membrane that binds the radius and ulna together. The *styloid process* projects distally from the *lateral margin* of the **lower end**. On the medial surface of the lower end is the *ulnar notch*, which articulates with the head of the ulna. The *inferior surface* of the lower end articulates with the scaphoid and lunate bones.

ULNA

The ulna is the medial bone of the forearm. The *olecranon process* is the large **upper end** that forms the prominence of the elbow. The *trochlear notch* lies on the anterior surface of the olecranon process and articulates with the trochlea of the humerus. Below the trochlear notch is the triangular *coronoid process*, which has on its lateral surface the radial notch for articulation with the *head* of the radius. The **shaft** has a sharp *interosseous border* laterally for the attachment of the interosseous membrane. The small rounded *head* lies at the **lower end** of the ulna. The *styloid process* projects from the medial aspect of the head.



(E) Inferior view of cross section through shafts (bodies) of ulna and radius and interosseous membrane

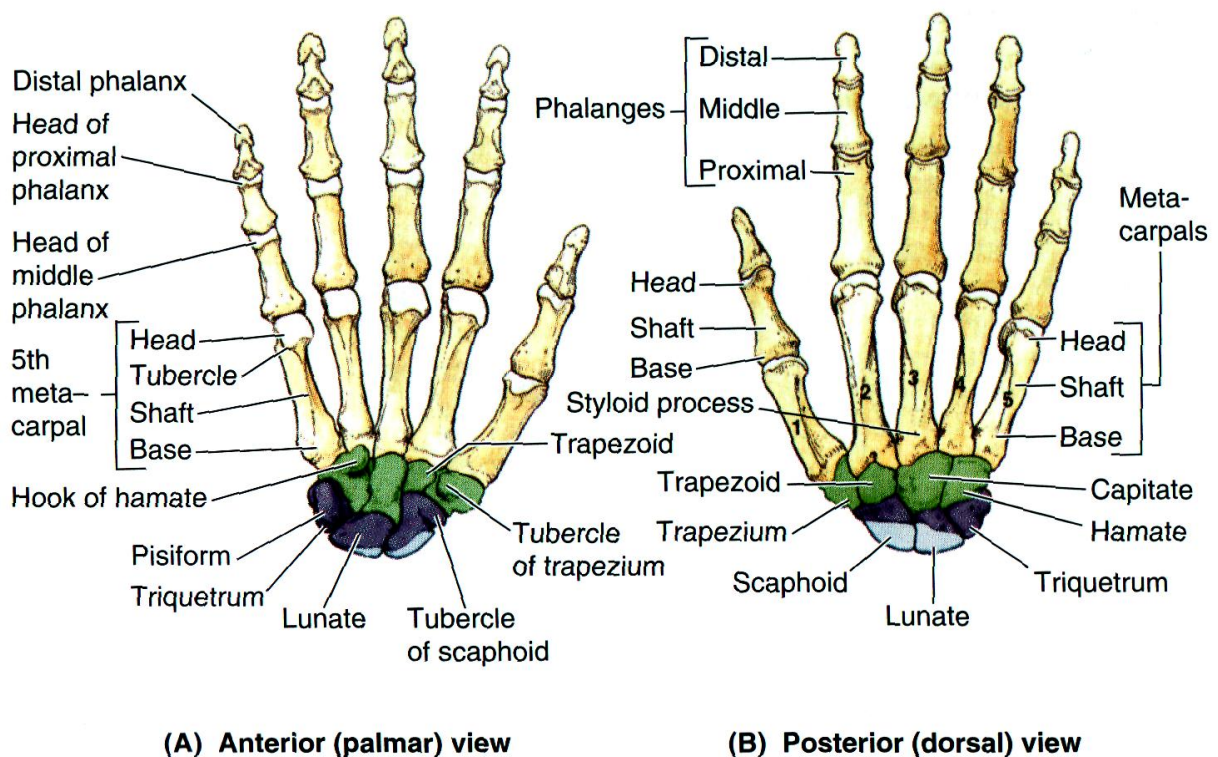
Bones of the Hand

Bones of the hand consist of carpus, metacarpus and digits.

CARPAL BONES. There are eight carpal bones arranged in two rows of four. The **proximal row** consists of (from lateral to medial) the *scaphoid*, *lunate*, *triquetral*, and *pisiform bones*. The **distal row** consists of (from lateral to medial) the *trapezium*, *trapezoid*, *capitate*, and *hamate bones*. The bones are united to one another by strong ligaments. Distally trapezium has a saddle-shaped articular facet for the 1st metacarpal bone.

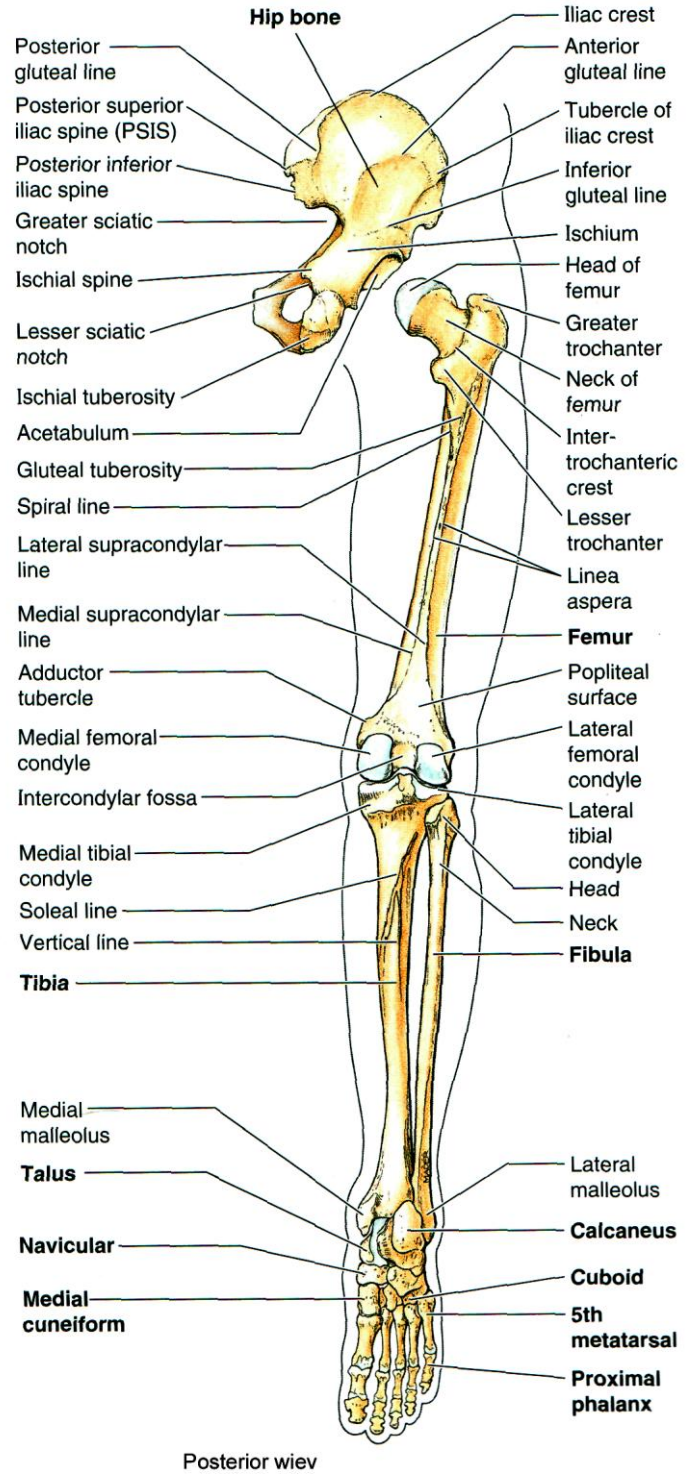
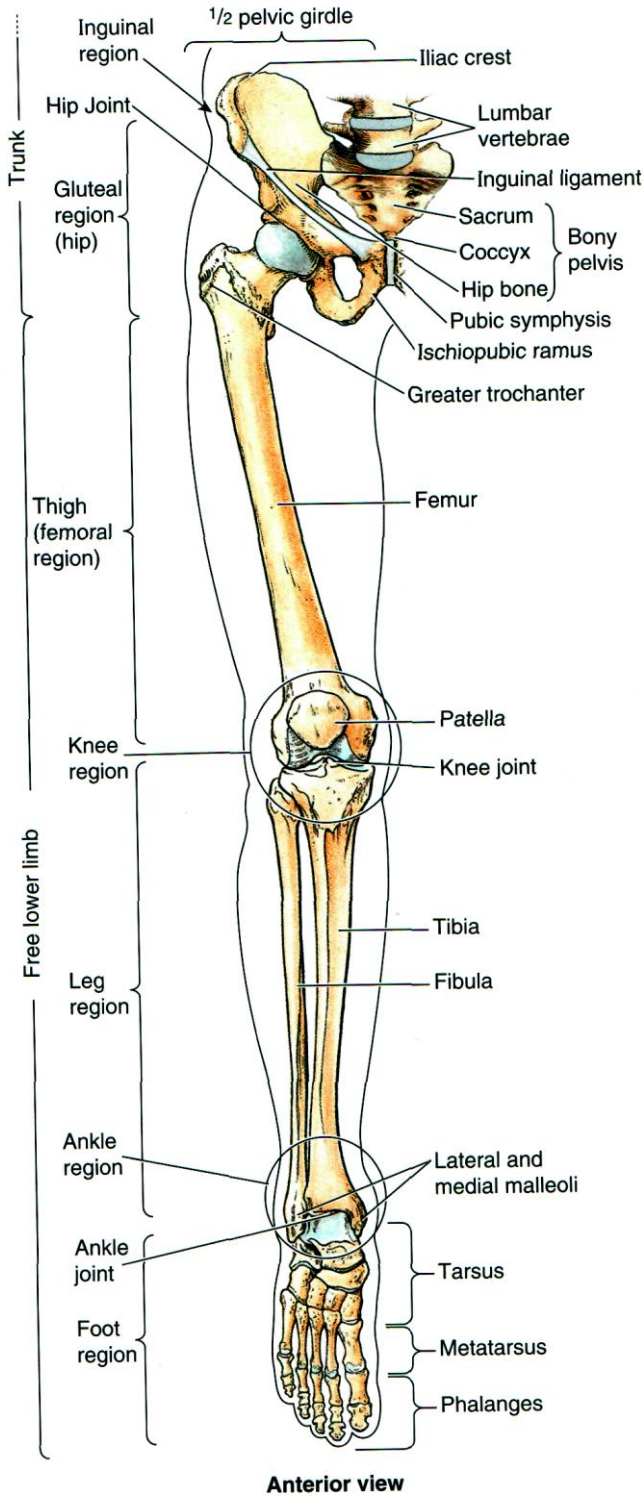
METACARPAL BONES. There are five metacarpal bones, each of which has a **proximal base**, **a shaft**, and **a distal head**. The bases of the metacarpals articulate with the distal row of the carpal bones. The heads, which form the knuckles, articulate with the proximal phalanges.

PHALANGES. There are three phalanges for each of the fingers, but only two for the thumb. Each phalanx has a **proximal base**, **a shaft**, and **a distal head**.



Bones of the lower limb

In the skeleton of the lower limb we distinguish the pelvic girdle and the free extremity.

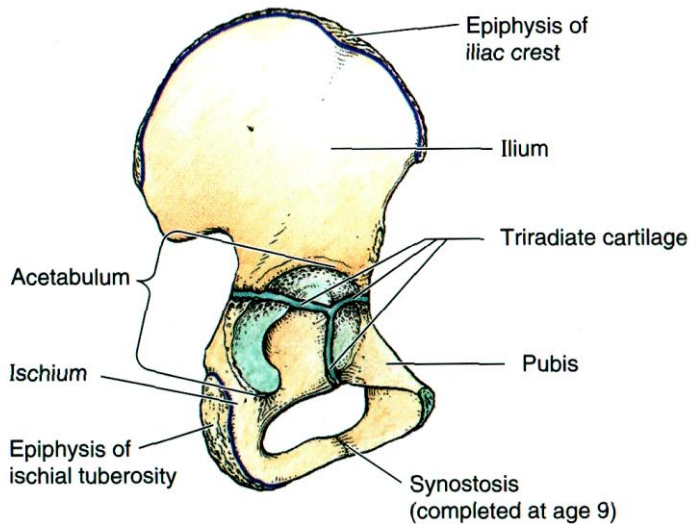


Bones of the pelvic girdle

The pelvic girdle is composed of four bones: the two hip bones, the sacrum, and the coccyx. The pelvic girdle provides a strong and stable connection between the trunk and the lower limbs.

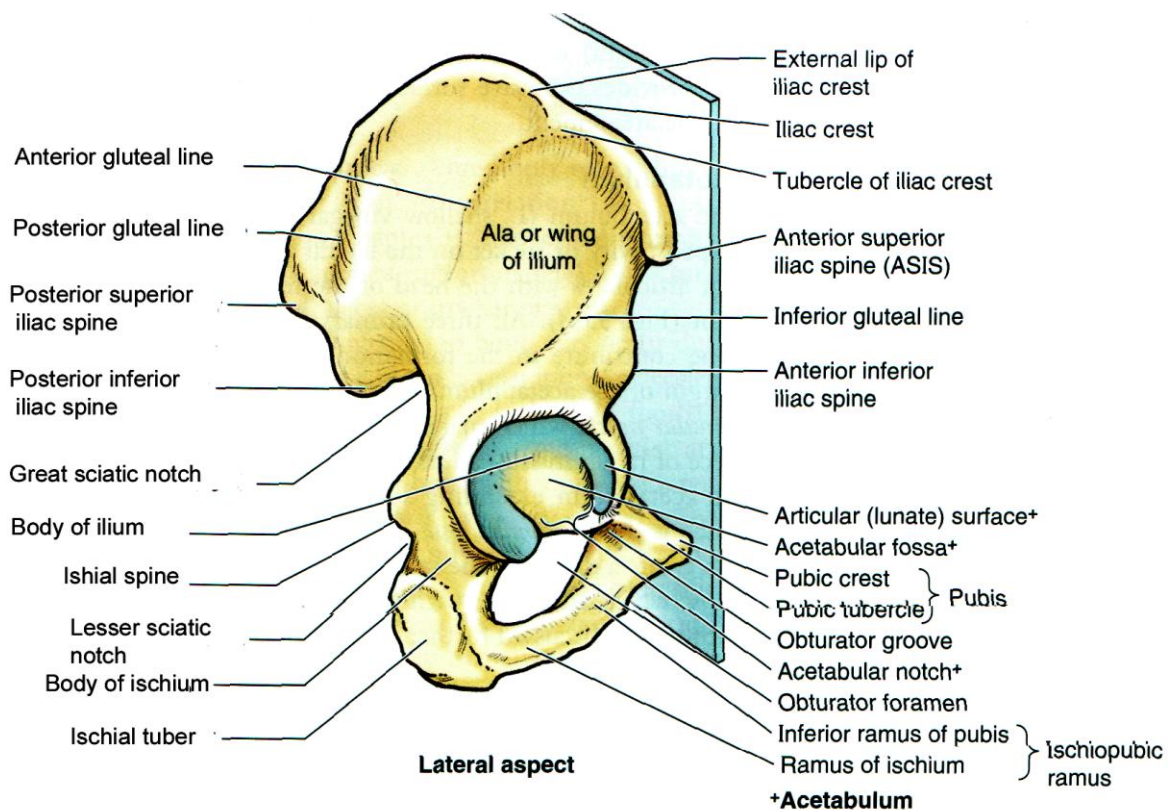
HIP BONE

Each hip bone in the child consists of the ILIUM, the ISCHIUM, and the PUBIC BONE. At puberty these three bones fuse together to form one large irregular bone. The *acetabulum* is a cup-shaped depression on the outer surface of the hip bone. It is formed by the ilium, ischium, and the pubis. The acetabulum articulates with the hemispherical head of the femur. The articular surface of the acetabulum is limited to a *lunate-shaped area* and is covered with hyaline cartilage. The acetabular fossa is the floor of the acetabulum, which is nonarticular. The *acetabular notch* is situated on the inferior margin of the acetabulum. In the lower part of the hip bone is a large opening, the *obturator foramen*, which is bounded by the parts of the ischium and pubis.



The *iliopectineal eminence* indicates the point of junction of the ilium and pubis.

The **Ilium** is divisible into two parts, the **body** and the **ala**; the separation is indicated

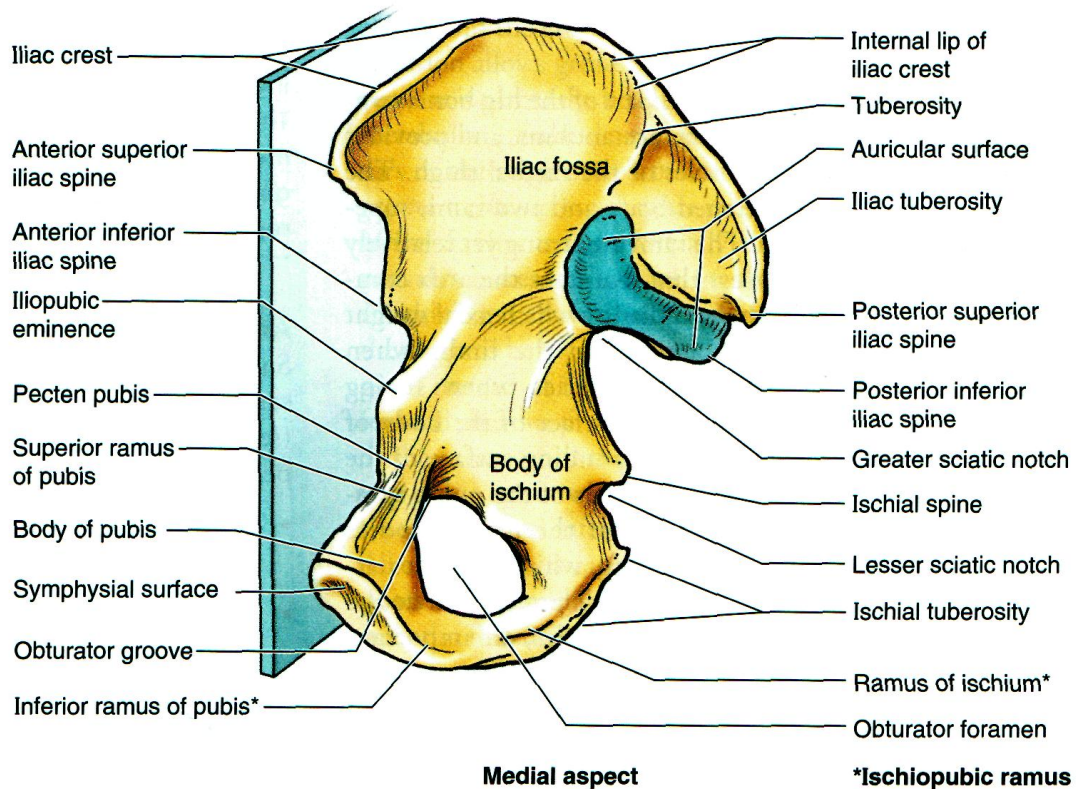


on the internal surface by a curved line, the *arcuate line*, and on the external surface by the margin of the acetabulum. *Anterior superior* and *inferior spines* project ventrally. *Posterior superior* and *inferior spines* project dorsally.

The *iliac crest* runs between the anterior and posterior superior iliac spines. On the posterior surface there are *posterior, anterior and inferior gluteal lines*. *Iliac fossa*, on its medial side.

The **Ischium** forms the lower and back part of the hip bone. It is divisible into three portions—a **body** and **two rami**. The **body** of the ischium has *ischial spine* and the **ramus** have the *ischial tuber* with *lesser sciatic notch* between them. Between the posterior inferior iliac spine and ischial spine is a deep notch, the *greater sciatic notch*.

The **Pubis** is the anterior part of the hip bone; it has a **body** and **superior and inferior pubic rami**. The **body** of the pubis has the *pubic crest* and the *pubic tubercle* and articulates with the pubic bone of the opposite side at the *symphysis pubis*.



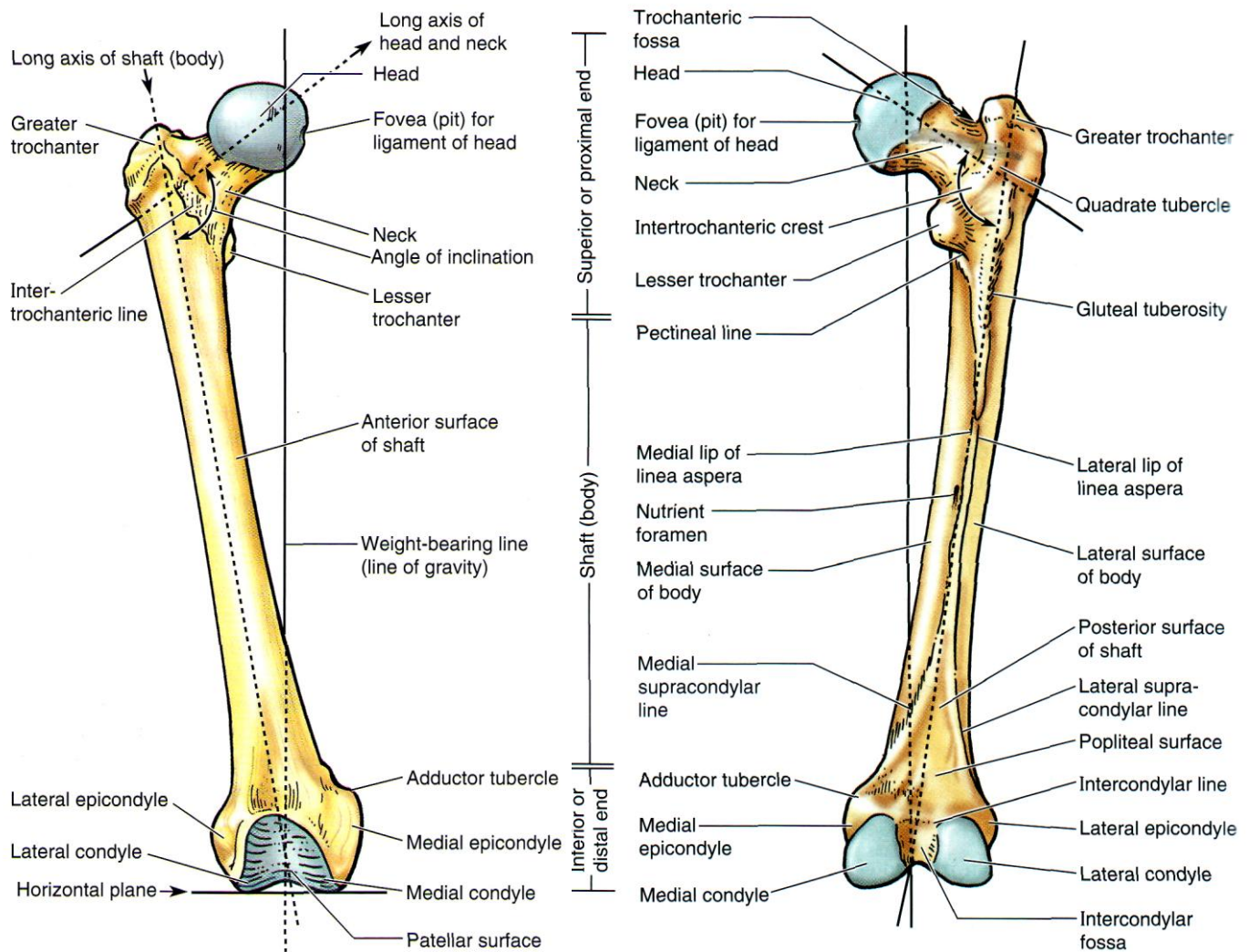
Bones of the Thigh

FEMUR

On the **proximal extremity** *head* and *fovea* are situated. The head of the femur forms about two-third of a sphere and fits into the acetabulum of the hip bone to form the hip joint. The *fovea capitis* is a small depression in the center of the head for the attachment of the ligament of the head. The *neck* connects the head to the **shaft** and passes downward, backward, and laterally. The *greater and lesser trochanters* are large eminences situated at the junction of the neck and the shaft. Connecting two trochanters are the *intertrochanteric line* anteriorly, and a prominent *intertrochanteric crest* posteriorly on which is the *quadratus tubercle*.

The **shaft** is smooth on its anterior surface but has a ridge posteriorly, the *linea aspera*, to which are attached muscles and intermuscular septa. The medial margin of the linea aspera continues below as the medial supracondylar ridge to the *adductor tubercle* on the *medial condyle*. The lateral margin becomes continuous below with the lateral supracondylar ridge.

On the posterior surface of the shaft below the greater trochanter is the *gluteal tuberosity* for the insertion of the gluteus maximus muscle. A flat triangular area on the posterior surface of the lower end of the shaft is called the *popliteal surface*.

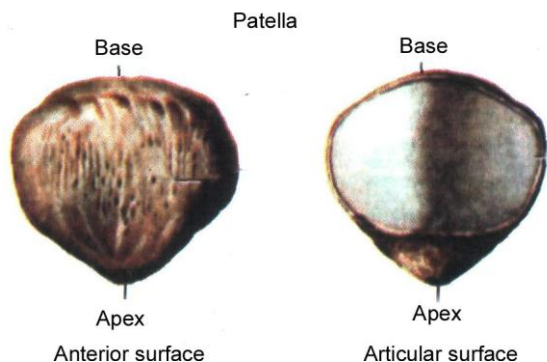


Anterior and posterior view of right femur

The **lower end** of the femur has *lateral* and *medial condyles*, separated posteriorly by the *intercondylar notch*. The anterior surfaces of the condyles are joined by an articular surface for the patella. The two condyles take part in the formation of the knee joint. Above the condyles are the *medial* and *lateral epicondyles*. The adductor tubercle is continuous with the medial epicondyle.

PATELLA

The patella is the largest sesamoid bone (i.e., a bone that develops within a tendon); it lies within the tendon of the quadriceps femoris muscle in front of the knee joint. It is triangular in shape and its apex lies inferiorly; the apex is connected to the tuberosity of the tibia by the ligamentum patellae. The posterior surface articulates with the condyles of the femur.



Bones of the Leg

TIBIA

The tibia has parts: shaft, proximal and distal extremity.

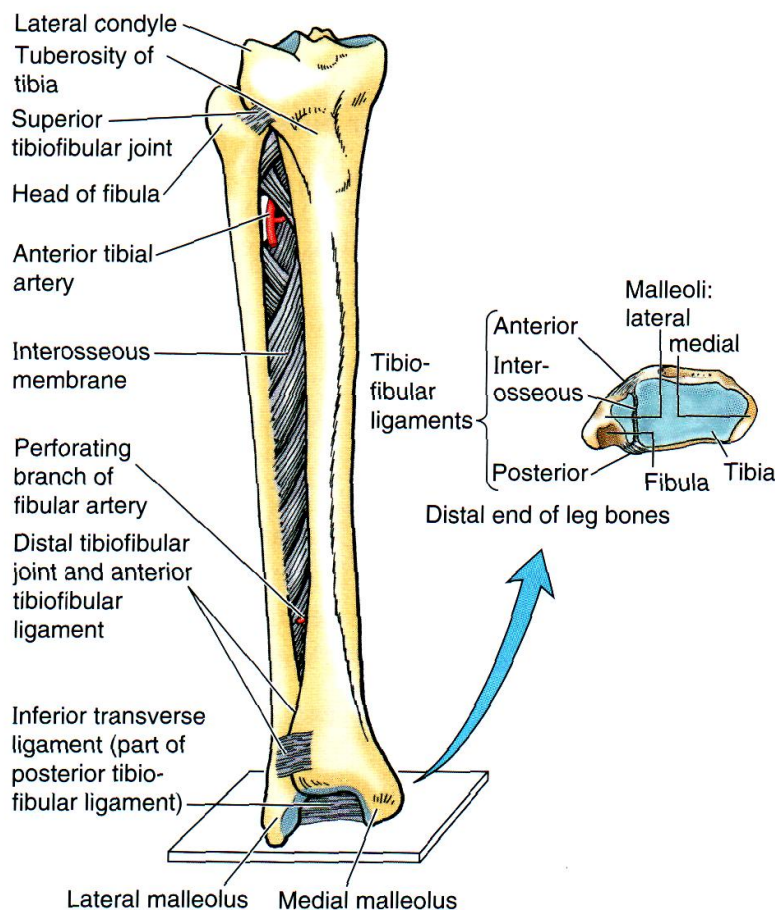
The tibia is the large weight-bearing medial bone of the leg.

At the **upper end** are the *lateral* and *medial condyles*, which articulate with the lateral medial condyles of the femur, with the lateral and medial semilunar cartilages intervening. The proximal surface, the *superior articular facet* is separated by the *intercondylar eminence*. This elevation is subdivided into *medial* and *lateral tubercles*. In front of and behind the eminence lie the *anterior* and *posterior intercondylar areas*. The lateral condyle possesses an oval articular facet for the head of the fibula on its lateral aspect.

The three-sided **shaft** of the tibia has medial, lateral and anterior margins. Margins separate the *medial*, *lateral* and *posterior surfaces*. Proximally on the posterior surface of the shaft is a slightly area, the *muscle solei line*. The *anterior margin* proximally becomes *tuberosity* (the attachment of the ligamentum patellae). The *lateral border* of the tibia gives

attachment to the interosseous membrane which binds the tibia and the fibula together.

The **lower end** is prolonged downward and medially to form the *medial malleolus* with *articular surface* on it. The inferior articular surface of lower end of the tibia articulates with the talus. On the lateral side is the *fibular notch* for fibrous joint with the fibula.



FIBULA

The fibula has parts: shaft, proximal and distal extremity.

It takes no part in articulation at the knee joint, but below forms part of the ankle joint. The *head* forms its **upper end**; it has a *styloid process* and *articular surface* and a small protuberance of head the *apex of the head*. The **shaft** of the fibula is approximately triangular in its middle part and has three

margins and three surfaces. The **lower end** of the fibula forms the *lateral malleolus* with a *facet for articulation with the talus on its inner surface*.

Bones of the Foot

The bones of the foot are the tarsal bones, the metatarsal bone and the phalanges.

TARSAL BONES.

The tarsal bones are the *calcaneum*, *talus*, *navicular*, *cuboid* and *three cuneiform bones*.

Proximal group:

Calcaneum. The calcaneum is the largest bone of the foot. It articulates above with the talus and in front with the cuboid bone. The posterior surface forms the prominence of the heel. The medial surface possesses a large shelflike ridge, the sustentaculum tali, which assist in the support of the talus.

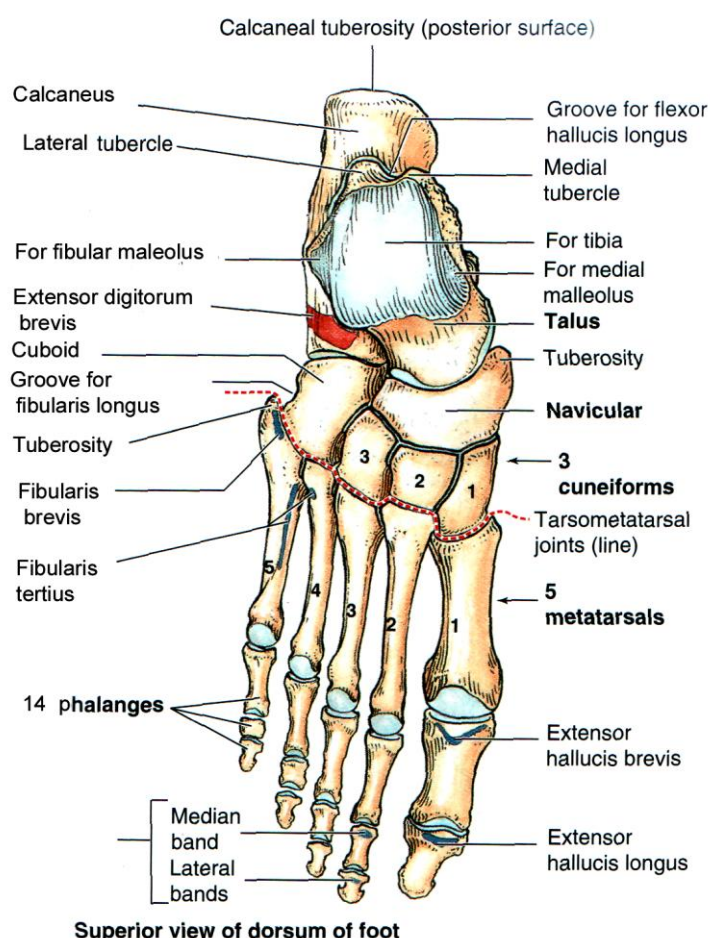
Talus. The talus articulates above at the ankle joint with the tibia and the fibula below with the calcaneum, and in front with the navicular bone. It possesses a head, a neck, and a body. Numerous important ligaments are attached to the talus but no muscles are attached to this bone.

Distal group:

Navicular. The navicular lies between the head of the talus and the three cuneiform bones. The tuberosity lies in front of and below the medial malleolus and attaches to the main part of the tibialis posterior tendon.

Cuboid. The cuboid articulates with the anterior end of the calcaneum. There is a deep groove on its inferior aspect for the tendon of the peroneus longus muscle.

Cuneiform bones(lateral, intermedial, medial). The cuneiform bones are small, wedge-shaped bones that articulate proximally with the navicular bone and distally with the first three metatarsal bones. Their wedge shape contributes greatly to the formation and maintenance of the transverse arch of the foot.



phalanx.

METATARSAL BONES AND PHALANGES. The **metatarsal bones** (five) have a distal head, a shaft, and a proximal base. The fifth metatarsal has a prominent tubercle on its base, which can be easily palpated along the lateral border of the foot.

The bones of the digits: each digits consist of a proximal, a medial and a distal phalanx, except the big toe (halux), which has only two. At the distal end of the distal phalanx there is the *tuberosity of the distal*

Necessary terms

Latin	English
<i>Skeleton axiale</i>	<i>Axial skeleton</i>
Columna vertebralis	Vertebral column
Canalis vertebralis	Vertebral canal
Corpus vertebrae (-ale)	Body of vertebra
Foramen vertebrale	Vertebral foramen
Arcus vertebralis	Arch of vertebra
Incisura vertebralis superior	Upper vertebral incisure
Incisura vertebralis inferior	Lower vertebral incisure
Foramen intervertebrale	Intervertebral foramen
Processus spinosus	Spinous process
Processus transverses	Transverse process
Processus articularis superior	Superior articular process
Processus articularis inferior	Inferior articular process
Processus costalis	Costal process
Vertebrae cervicales (CI - CVII)	Cervical vertebrae (CI - CVII)
Foramen transversum	Transverse foramen
<i>Atlas (CI) (Vertebra cervicalis I)</i>	<i>Atlas (CI) (Vertebra cervicalis I)</i>
Massa lateralis atlantis	Lateral mass of Atlas
Facies articularis superior	Superior articular surface
Facies articularis inferior	Inferior articular surface
Arcus anterior atlantis	Anterior arch of Atlas
Fovea dentis	Fovea of tooth
Tuberculum anterius	Anterior tubercle
Arcus posterior atlantis	Posterior arch of Atlas
Sulcus arteriae vertebralis	Sulcus of the vertebral artery
Tuberculum posterius	Posterior tubercle
<i>Axis (CII)</i>	<i>Axis (CII)</i>
Dens axis	Dens axis
Apex dentis	Apex (top) of tooth
Facies articularis anterior	Anterior articular surface
Facies articularis posterior	Posterior articular surface
<i>Vertebra prominens (CVII)</i>	<i>Vertebra prominens (CVII)</i>
Vertebrae thoracicae (TI - TXII)	Thoracic vertebrae (TI - TXII)
Fovea costalis superior	Superior costal fovea
Fovea costalis inferior	Inferior costal fovea
Fovea costalis processus transverses	Costal fovea of transverse process
Vertebrae lumbales (LI - LV)	Lumbar vertebrae (LI - LV)
Vertebrae sacrales (SI - SV)	Sacral vertebrae (SI - SV)
Os sacrum	Sacrum
<i>Facies dorsalis</i>	Dorsal surface
Crista sacralis mediana	Median crest of sacrum
Crista sacralis intermedia	Intermediate crest of sacrum
Crista sacralis lateralis	Lateral crest of sacrum
Foramina sacralia dorsalia	Dorsal sacral foramina
Canalis sacralis	Sacral canal
Hiatus sacralis	Sacral hiatus

Necessary terms (continuation)

Latin

Facies pelvina
Promontorium
Lineae transverse
Foramina sacralia pelvina
Basis ossis sacri
Pars lateralis
Facies auricularis
Tuberositas sacralis
Apex ossis sacri

Vertebrae coccygeae (CoI - CoIV)

Os coccygis, Coccyx

Ossa thoracis

Costae (I - XII)
Costae verae (I - VII)
Costae spuriae (VIII - X)
Costae fluctuantes (XI - XII)
Cartilago costalis
Os costale (Costa)
Caput costae
Crista capitis costae
Collum costae
Corpus costae
Tuberculum costae
Angulus costae
Sulcus costae
Costa prima (I)
Tuberculum musculi scalene anterioris
Sulcus venae subclavia
Sulcus arteriae subclavia
Costa secunda (II)
Tuberositas musculi serrate anterioris

Sternum

Manubrium sterni
Incisura jugularis
Incisura clavicularis
Angulus sterni
Corpus sterni
Incisura costalis
Processus xiphoideus

**Compages thoracis
(Skeleton thoracicum) (Thorax)**

Cavitas thoracis
Apertura thoracis superior
Apertura thoracis inferior
Arcus costalis
Angulus infrasternalis
Spatium intercostale

English

Pelvic surface
Promontory
Transverse lines
Pelvic sacral foramina
Base of sacrum
Lateral part
Auricular surface
Sacral tuberosity
Apex of the sacrum

Coccygea vertebrae (CoI - CoIV)

Coccyx

Bones of the thoracic cage

Ribs (I - XII)
True ribs (I - VII)
False ribs (VIII - X)
Floating ribs (XI - XII)
Costal cartilage
Rib bone
Head of rib
Crest of head of rib
Neck of rib
Shaft of rib
Tubercle of rib
Angle of rib
Costal groove
The first rib (I)
Tubercle of scalene anterior muscle
Groove of subclavian vein
Groove of subclavian artery
The second rib (II)
Tuberosity of serrate anterior muscle

Sternum, breast bone

Manubrium of sternum
Jugular notch
Clavicular notch
Angle of sternum
Body of sternum
Costal notches
Xiphoid process

**Chest, Thoracic cage
(Thoracic skeleton) (Thorax)**

Thoracic cavity
Superior thoracic aperture (inlet)
Inferior thoracic aperture (outlet)
Arch of rib
Infrasternal angle
Intercostal space

Necessary terms (continuation)

Latin

Linea mediana anterior
Linea parasternalis
Linea medioclavicularis
Linea axillaris anterior
Linea axillaris media
Linea axillaris posterior
Linea scapularis
Linea paravertebralis
Linea mediana posterior

Cranium

Os Frontale

Pars nasalis
Spina nasalis
Incisura ethmoidalis
Sinus frontalis
Pars orbitalis
Fossa glandulae lacrimalis
Fovea trochlearis
Squama frontalis
Facies externa
Tuber frontale
Arcus superciliaris
Glabella
Margo supraorbitalis
Foramen (incisura) supraorbitale
Facies interna
Sulcus sinus sagittalis superior
Foramen cecum
Facies temporalis
Linea temporalis
Processus zygomaticus

Os Ethmoidale

Lamina cribrosa (horizontalis)
Crista galli
Lamina perpendicularis
Labyrinthus ethmoidalis
Cellulae ethmoidales
Lamina orbitalis
Foramina ethmoidalia
Concha nasalis superior
Concha nasalis media

Os Parietale

Margo frontalis
Margo occipitalis
Margo squamosus
Margo sagittalis
Angulus frontalis

English

Median anterior line
Parasternal line
Midclavicular line
Anterior axillary line
Middle axillary line
Posterior axillary line
Scapular line
Paravertebral line
Median posterior line

Skull

The Frontal bone

Nasal part
Nasal spine
Ethmoid notch
Frontal sinus
Orbital part
Lacrimal fossa
Trochlear fossa
Frontal squama
External surface
Frontal tuber
Above-eyebrow arch
Glabella, glabellum
Supraorbital border
Supraorbital foramen (notch)
Internal surface
Groove of the superior sagittal sinus
Foramen cecum
Temporal surface
Temporal line
Zygomatic process

The Ethmoid Bone

Cribriform plate (horizontal)
Crista galli
Perpendicular plate
Ethmoidal labyrinth
Ethmoidal cells
Orbital plate
Ethmoidal foramina
Superior nasal concha
Middle nasal conchae

The Parietal Bone

Frontal border
Occipital border
Squamous border
Sagittal border
Frontal angle

Necessary terms (continuation)

Latin

Angulus occipitalis
Angulus sphenoidalis
Angulus mastoideus
Facies externa
Linea temporalis superior
Linea temporalis inferior
Facies interna
Sulcus sinus sagittalis superior
Sulcus sinus sigmoidei
Sulci arteriosi

Os Occipitale

Foramen magnum
Pars basilaris
Tuberculum pharyngeum
Clivus
Pars lateralis
Condylus occipitalis
Fossa (canalis) condylaris
Canalis hypoglossalis
Processus jugularis
Incissura jugularis
Squama occipitalis
Protuberantia occipitalis externa
Linea nuchalis superior
Linea nuchalis inferior
Linea nuchalis suprema
Eminentia cruciformis
Protuberantia occipitalis interna
Sulcus sinus sagittalis superior
Sulcus sinus transversi
Sulcus sinus sigmoidei

Os Sphenoidale

Corpus
Sella turcica
Fossa hypophysialis
Dorsum sellae
Sulcus praechiasmaticus
Sulcus caroticus
Crista sphenoidalis
Concha sphenoidalis
Sinus sphenoidalis
Ala minor
Canalis opticus
Fissura orbitalis superior
Ala major
Facies cerebralis
Facies temporalis
Facies orbitalis

English

Occipital angle
Sphenoid angle
Mastoid angle
External surface
Superior temporal line
Inferior temporal line
Internal surface
Groove of the superior sagittal sinus
Groove of the sigmoidal sinus
Grooves of arteries

The Occipital Bone

Foramen magnum
Basilar part
Pharyngeal tubercle
Clivus
Lateral part
Occipital condyle
Condylar fossa (canal)
Hypoglossal canal
Jugular process
Jugular notch
Occipital squama
External occipital protuberance
Superior nuchal line
Inferior nuchal line
Highest nuchal line
Cruciate eminence
Internal occipital protuberance
Groove of the superior sagittal sinus
Groove of the transverse sinus
Groove of the sigmoid sinus

The Sphenoid Bone

Body
Sella Turcica
Hypophysial fossa
Dorsum sellae
Praechiasmatic groove
Carotid sulcus
Crest of sphenoid
Sphenoidal concha
Sphenoidal sinus
Lesser wing
Optic canal
Superior orbital fissure
Greater wing
Cerebral surface
Temporal surface
Orbital surface

Necessary terms (continuation)

Latin	English
Facies maxillaries	Maxillary surface
Crista infratemporalis	Infratemporal crest
Foramen rotundum	Foramen rotundum
Foramen ovale	Foramen ovale
Foramen spinosum	Foramen spinosum
<i>Processus pterygoideus</i>	<i>Pterygoid process</i>
Lamina lateralis	Lateral plate
Lamina medialis	Medial plate
Fossa pterygoidea	Pterygoid fossa
Fossa scaphoidea	Scaphoid fossa
Canalis pterygoideus	Pterygoid canal
Incissura pterygoidea	Pterygoid notch
Os Temporale	The Temporal Bone
<i>Pars tympanica</i>	<i>Tympanic part</i>
Porus acusticus externus	External auditory opening
Meatus acusticus externus	External auditory meatus
Fissura tympanomastoidea	Tympanomastoid fissure
Fissura tympanosquamosa	Tympanosquamous fissure
Fissura petrotympanica	Petrotympanic fissure
Fissura petrosquamosa	Petrosquamous fissure
<i>Pars squamosa</i>	<i>Squamous part</i>
Facies temporalis	Temporal surface
Sulcus arteriae temporalis mediae	Groove for the middle temporal artery
Processus zygomaticus	Zygomatic process
Fossa mandibularis	Mandibular fossa
Tuberculum articulare	Articular tubercle
Facies cerebralis	Cerebral surface
<i>Pars petrosa</i>	<i>Petrous part</i>
Processus mastoideus	Mastoid process
Incissura mastoidea	Mastoid notch
Sulcus sinus sigmoidei	Groove for the sigmoid sinus
Sulcus arteriae occipitalis	Groove for the occipital artery
Facies anterior	Anterior surface
Tegmen tympani	Roof (tegmen) of tympanic cavity
Impressio trigemini	Trigeminal impression
Margo superior	Superior border
Sulcus sinus petrosi superioris	Groove for the superior petrous sinus
Facies posterior	Posterior surface
Porus acusticus internus	Internal auditory (acoustic) opening
Meatus acusticus internus	Internal auditory (acoustic) meatus
Margo posterior	Posterior border
Sulcus sinus petrosi inferioris	Groove for the inferior petrous sinus
Facies inferior	Inferior surface
Fossa jugularis	Jugular fossa
Processus styloideus	Styloid process
Foramen stylomastoideum	Stylomastoid foramen
Canalis caroticus	Carotid canal
Foramen caroticum externum	External carotid foramen
Apex parties petrosae	Apex of petrous part

Necessary terms (continuation)

Latin	English
Foramen caroticum internum	Internal carotid foramen
Fossula petrosa	Petrous fossula
Maxilla	The Maxilla (Upper Jaw)
<i>Corpus maxillae</i>	<i>Body of maxilla</i>
<i>Facies orbitalis</i>	<i>Orbital surface</i>
Canalis infraorbitalis	Infraorbital canal
Margo infraorbitalis	Infraorbital margin
<i>Facies anterior</i>	<i>Anterior surface</i>
Foramen infraorbitale	Infraorbital foramen
Fossa canina	Canine fossa
Incisura nasalis	Nasal notch
<i>Facies infratemporalis</i>	<i>Infratemporal surface</i>
Foramina alveolaria	Alveolar foramens
Canales alveolares	Alveolar canals
Tuber maxillae	Maxillary tuber
<i>Facies nasalis</i>	<i>Nasal surface</i>
Sulcus lacrimalis	Lacrimal groove
Hiatus maxillaris	Maxillary hiatus
Sinus maxillaris (Highmori)	Maxillary sinus (Highmore)
Sulcus palatinus major	Great palatine groove
Processus frontalis	Frontal process
Processus zygomaticus	Zygomatic process
Processus palatinus	Palatine process
Canalis incisivus	Incisive canal
Processus alveolaris	Alveolar process
Arcus alveolaris	Alveolar arch
Alveolae dentales	Dental alveolae (sockets)
Septum interalveolaris	Interalveolar septum
Juga alveolaria	Juga alveolaria
Foramen incisivum	Incisive foramen
Mandibula	The Mandible (Lower Jaw)
Corpus mandibulae	Body of mandible
Basis mandibulae	Base of mandible
Protuberantia	Mental protuberance
Foramen mentale	Mental foramen
Linea obliqua	Oblique line
Fossa digastrica	Digastric fossa
Spina mentalis	Mental spine
Linea mylohyoidea	Mylohyoid line
Fovea sublingualis	Sublingual fovea
Fovea submandibularis	Submandibular fovea
Pars alveolaris	Alveolar part
Arcus alveolaris	Alveolar arch
Alveolae dentales	Sockets for teeth
Septum interalveolaris	Interalveolar septum
Juga alveolaria	Juga alveolaria (Alveolar projections)
Ramus mandibulae	Ramus of mandible
Angulus mandibulae	Angle of mandible

Necessary terms (continuation)

Latin

Tuberositas masseterica
Tuberositas pterygoidea
Foramen mandibulae
Canalis mandibulae
Processus coronoideus
Incisura mandibulae
Processus condylaris
Caput mandibulae
Collum mandibulae
Fovea pterygoidea

Os hyoideum

Corpus ossis hyoidei
Cornu minor
Cornu majus

Os zygomaticum

Facies lateralis
Facies temporalis
Facies orbitalis
Processus temporalis
Processus frontalis
Foramen zygomaticoorbitale
Foramen zygomaticofaciale
Foramen zygomaticotemporale

Os zygomaticus

Facies lateralis
Facies temporalis
Facies orbitalis
Processus temporalis
Processus frontalis

Vomer

Os lacrimale

Os palatinum

Lamina perpendicularis
Incisura sphenopalatina
Sulcus palatinus major
Canales palatini minores
Lamina horizontalis
Foramina palatina minora
Processus pyramidalis
Crista conchalis
Crista ethmoidalis
Processus orbitalis
Processus sphenoidalis

English

Masseteric tuberosity
Pterygoid tuberosity
Mandibular foramen
Canal of mandible
Coronoid process
Notch of mandible
Condylar process
Head of mandible
Neck of mandible
Pterygoid fovea

The Hyoid bone

Body of the hyoid bone
Lesser horn
Greater horn

The Zygomatic bone

Lateral surface
Temporal surface
Orbital surface
Temporal surface
Frontal process
Zygomaticoorbital foramen
Zygomaticofacial foramen
Zygomaticotemporal foramen

Zygomatic bone

Lateral surface
Temporal surface
Orbital surface
Temporal process
Frontal process

The Vomer

Lacrimal bone

The Palatine bone

Perpendicular plate
Sphenopalatine notch
Greater palatine sulcus
Lesser palatine canals
Horizontal plate
Lesser palatine foramina
Pyramidal process
Crest of concha
Ethmoidal crest
Orbital process
Sphenoid process

Necessary terms (continuation)

Latin	English
Skull in a total	
Basis cranii	Base of the skull
Calvaria	Roof of the skull (Calvaria)
Norma facialis	Facial norm (aspect)
Norma verticalis	Vertical norm (aspect)
Norma lateralis	Lateral norm (aspect)
Norma inferior	Inferior norm
Neurocranium	Neurocranium
Viscerocranium	Viscerocranium
Cavitas cranii	Cavity of the skull
Basic anatomical structures of the Exterior of the Skull	
Fossa temporalis	Temporal fossa
Arcus zygomaticus	Zygomatic arch
Fossa infratemporalis	Infratemporal fossa
Fossa pterigopalatina	Pterigopalatin fossa
Fissura pterigomaxillaris	Pterigomaxillar fissure
Porus acusticus externus	External auditory opening
Orbita (cavitas orbitalis)	Orbita (orbital cavity)
Aditus orbitalis	Opening into orbit
Fissura orbitalis superior	Superior orbital fissure
Fissura orbitalis inferior	Inferior orbital fissure
Cavitas nasi	Nasal cavity
Apertura piriformis	Piriform aperture
Meatus nasi superior	Superior nasal meatus (passage)
Meatus nasi medius	Middle nasal meatus (passage)
Meatus nasi inferior	Inferior nasal meatus (passage)
Meatus nasi communis	Common nasal meatus (passage)
Septum nasi osseum	Bony nasal sept
Canalis nasolacimalis	Nasolacrimal canal
Choana	Choana
Foramen sphenopalatinum	Sphenopalatin foramen
Palatum osseum	Osseal palate
Canalis incisivus	Incisive canal
Foramen palatinum majus	Greater palatine foramen
Canalis palatinum majus	Greater palatine canal
Foramina palatina minora	Lesser palatine foramina
Canales palatini minores	Lesser palatine canals
Foramen lacerum	Foramen lacerum
Canalis caroticus	Carotid canal
Foramen ovale	Foramen ovale
Foramen spinosum	Foramen spinosum
Fossa mandibularis	Mandibular fossa
Foramen jugulare	Jugular foramen
Processus styloideus	Styloid process
Processus mastoideus	Mastoid process
Foramen stylomastoideum	Stylomastoid foramen
Fossa (canalis condylaris)	Condylar fossa (canal)
Canalis hypoglossalis	Hypoglossal canal
Foramen magnum	Foramen magnum

Necessary terms (continuation)

Latin	English
Basic anatomical structures of the Interior of the Skull	
Fossa cranii anterior	Anterior cranial fossa
Foramen cecum	Foramen cecum
Lamina cribrosa	Cribriform plate
Crista galli	Crista galli
Fossa cranii media	Medial cranial fossa
Canalis opticus	Optic canal
Fissura orbitalis superior	Superior orbital fissure
Sulcus praechiasmatis	Prechiasmatic groove
Sulcus caroticus	Carotid groove
Sella turcica	Sella Turcica
Fossa hypophysialis	Hypophysial fossa
Foramen rotundum	Foramen rotundum
Foramen ovale	Foramen ovale
Foramen spinosum	Foramen spinosum
Foramen lacerum	Foramen lacerum
Fossa cranii posterior	Posterior cranial fossa
Foramen magnum	Foramen magnum
Clivus	Clivus
Foramen jugulare	Jugular foramen
Porus acusticus internus	Internal auditory opening
Meatus acusticus internus	Internal auditory meatus
Canalis facialis	Facial canal
Canalis hypoglossalis	Hypoglossal canal
Protuberantia occipitalis interna	Internal occipital protuberance
Sulcus sinus petrosi superioris	Groove for the superior petrous sinus
Sulcus sinus petrosi inferioris	Groove for the inferior petrous sinus
Sulcus sinus sagittalis superioris	Groove for the superior sagittal sinus
Sulcus sinus sigmoidei	Groove for the sigmoid sinus
Sulcus sinus transverse	Groove for the transverse sinus

Skeleton appendiculare

Ossa membri superioris

Cingulum membri superioris

Clavicula

Extremitas sternalis
Corpus claviculae
Extremitas acromialis
Tuberculum conoideum

Scapula

Facies costalis
Fossa subscapularis
Facies dorsalis
Spina scapulae
Fossa supraspinata
Fossa infraspinata
Margo superior
Margo medialis
Margo lateralis

Appendicular skeleton

Bones of the upper limb

Sholder girdle

Clavicle

Sternal end
Body of the clavicle
Acromial end
Conoid tubercle

Scapula, Shoulder blade

Costal surface
Subscapular fossa
Dorsal surface
Spine of the scapula
Supraspinous fossa
Infraspinous fossa
Superior border
Medial border
Lateral border

Necessary terms (continuation)

Latin	English
Angulus superior	Superior angle
Angulus inferior	Inferior angle
Angulus lateralis	Lateral angle
Cavitas glenoidalis	Glenoid cavity
Acromion	Acromion
Processus coracoideus	Coracoid process

Pars libera membri superioris

Humerus

Caput humeri
Collum anatomicum
Collum chirurgicum
Tuberculum majus
Tuberculum minus
Corpus humeri
Tuberositas deltoidea
Sulcus nervi radialis
Condylus humeri
Trochlea humeri
Fossa coronoidea
Fossa radialis
Fossa olecrani
Epicondylus medialis
Sulcus nervi ulnaris
Epicondylus lateralis
Capitulum humeri

Ulna

Olecranon
Processus coronoideus
Incissura trochlearis
Incissura radialis
Tuberositas ulnaris
Corpus ulnae
Margo interosseus
Caput ulnae
Processus styloideus

Radius

Caput radii
Collum radii
Corpus radii
Tuberositas radii
Margo interosseus
Processus styloideus
Incissura ulnaris
Facies articularis carpea

Skeleton of free upper limb

Humerus

Head of humerus
Anatomical neck
Surgical neck
Greater tubercle
Lesser tubercle
Body of the humerus
Deltoid tuberosity
Groove of radial nerve
Condyle of humerus
Trochlea of humerus
Coronoid fossa
Radial fossa
Olecranon fossa
Medial epicondyle
Groove of ulnar nerve
Lateral epicondyle
Capitulum of humerus

Ulna

Olecranon
Coronoid process
Trochlear notch
Radial notch
Tuberosity of ulna
Body of ulna
Interosseous border
Head of ulna
Styloid process

Radius

Head of radius
Neck of radius
Body of radius
Tuberosity of radius
Interosseous border
Styloid process
Ulnar notch
Carpal articular surface

Necessary terms (continuation)

Latin

Ossa manus

Ossa carpi

Os scaphoideum

Os lunatum

Os triquetrum

Os pisiforme

Os trapezium

Os trapezoideum

Os capitatum

Os hamatum

Ossa metacarpi

Os metacarpale primum

Os metacarpale secundum

Os metacarpale tertium

Os metacarpale quartum

Os metacarpale quintum

Basis metacarpalis

Corpus metacarpale

Caput metacarpale

Ossa digitorum

Phalanx proximalis (5 bones)

Phalanx media (4 bones)

Phalanx distalis (5 bones)

Basis phalangis

Corpus phalangis

Caput phalangis

Ossa membri inferioris

Cingulum membri inferioris

Os coxae

Acetabulum

Foramen obturatum

Os ilium

Corpus ossis ilii

Ala ossis ilii

Crista iliaca

Spina iliaca anterior superior

Spina iliaca anterior inferior

Spina iliaca posterior superior

Spina iliaca posterior inferior

Fossa iliaca

Facies glutea

Facies sacropelvina

Facies auricularis

Tuberositas iliaca

Os ischium

Corpus ossis ischii

English

Bones of the hand

Carpal bones

Scaphoid bone

Lunate bone

Triquetral bone

Pisiform bone

Trapezium

Trapezoid

Capitate bone

Hamate bone

The metacarpal bones

The first metacarpal bone

The second metacarpal bone

The third metacarpal bone

The fourth metacarpal bone

The fifth metacarpal bone

Base of metacarpal bone

Body of metacarpal bone

Head of metacarpal bone

Bones of the fingers

Proximal phalanx (5 bones)

Middle phalanx (4 bones)

Distal phalanx (5 bones)

Base of phalanx

Body of phalanx

Head of phalanx (Trochlea)

Skeleton of the lower limb

Pelvic girdle

Hip bone

Acetabulum

Obturator foramen

Ilium

Body of ilium

Wing of ilium

Crest of ilium

Anterior superior iliac spine

Anterior inferior iliac spine

Posterior superior iliac spine

Posterior inferior iliac spine

Iliac fossa

Gluteal surface

Sacropelvic surface

Auricular surface

Iliac tuberosity

Ischium

Body of ischium

Necessary terms (continuation)

Latin

Spina ischiadica
Incisura ischiadica major
Incisura ischiadica minor
Ramus ossis ischii
Tuber ischiadicum

Os pubis

Corpus ossis pubis
Ramus superior ossis pubis
Eminentia iliopubica
Crista pubica
Sulcus obturatorius
Ramus inferior ossis pubis
Tuberculum pubicum
Facies symphysialis

Pars libera membri inferioris

Femur (Os Femoris)

Caput ossis femoris
Collum ossis femoris
Trochanter major
Trochanter minor
Corpus ossis femoris
Linea aspera
Labium mediale
Labium laterale
Facies poplitea
Condylus medialis
Condylus lateralis
Facies patellaris
Epicondylus medialis
Epicondylus lateralis

Patella

Basis patellae
Apex patellae
Facies anterior
Facies articularis

Tibia

Condylus medialis
Condylus lateralis
Facies articularis superior
Facies articularis lateralis
Eminentia intercondylaris
Corpus tibiae
Tuberositas tibiae
Margo anterior
Malleolus medialis
Incisura fibularis
Facies articularis inferior

English

Ischiadic spine
Greater sciatic foramen
Lesser sciatic foramen
Ramus of ischium
Tuber ischiadicum
The pubic bone
Body of the pubis
Superior ramus of the pubis
Iliopubic eminence
Pubic crest
Obturator groove
Inferior ramus of the pubis
Pubic tubercle
Symphyseal surface

Skeleton of free lower limb

Femur (Thigh bone)

Head of femur
Neck of the femur
Greater trochanter
Lesser trochanter
Body of femur
Linea aspera
Medial lip
Lateral lip
Popliteal surface
Medial condyle
Lateral condyle
Patellar surface
Medial epicondyle
Lateral epicondyle

Patella (Knee-cap)

Base of patella
Apex of patella
Anterior surface
Articular surface

Tibia

Medial condyle
Lateral condyle
Superior articular surface
Lateral articular surface
Intercondylar eminence
Body of tibia
Tuberosity of tibia
Anterior border
Medial malleolus
Fibular notch
Inferior articular surface

Necessary terms (continuation)

Latin	English
Sulcus malleolaris	Malleolar sulcus
Fibula	Fibula
Caput fibulae	Head of fibula
Corpus fibulae	Body of fibula
Malleolus lateralis	Lateral malleolus
Fossa malleoli lateralis	Malleolar fossa
Ossa pedis	Bones of the foot
Ossa tarsi	Tarsal bones
Talus	Talus
Trochlea tali	Trochlea of talus
Calcaneus	Calcaneus (heel bone)
Os naviculare	Navicular bone
Os cuneiforme mediale	Medial cuneiform bone
Os cuneiforme intermedium	Intermediate cuneiform bone
Os cuneiforme laterale	Lateral cuneiform bone
Os cuboideum	Cuboid bone
Ossa metatarsi	The metatarsal bones
Os metatarsale primum	The first metatarsal bone
Os metatarsale secundum	The second metatarsal bone
Os metatarsale tertium	The third metatarsal bone
Os metatarsale quartum	The fourth metatarsal bone
Os metatarsale quintum	The fifth metatarsal bone
Basis metatarsalis	Base of metatarsal bone
Corpus metatarsale	Body of metatarsal bone
Caput metatarsale	Head of metatarsal bone
Ossa digitorum	Bones of the digits:
Phalanx proximalis (5 bones)	Proximal phalanx (5 bones)
Phalanx media (4 bones)	Middle phalanx (4 bones)
Phalanx distalis (5 bones)	Distal phalanx (5 bones)
Basis phalangis	Base of phalanx
Corpus phalangis	Body of phalanx
Caput phalangis	Head of phalanx (Trochlea)

ARTHROLOGY

Types of the joints

I. Synarthrosis (immovable joints)			
Name	Characteristic	Example	
Syndesmoses	Skeletal elements are joined by fibrous and elastic connective tissue	Suture	Plane, dentate, squamous suture of the skull
		Ligaments fibrous elastic	Interspino ligaments of the vertebral column; Ligamentum flava between arches of vertebrae.
		Membranes	Interosseal membranes of forearm
Synchondroses	Skeletal elements are joined by hyaline and fibrous cartilage	Temporary	Joints between sacral vertebrae until 14-16 years
		Permanent	Joint between sternal bone and first rib
Synostoses	Skeletal elements are joined by osseous tissue	Joints between sacral vertebrae after 14-16 years	
Gomphoses	Teeth bound into alveoli of bone by periodontal ligament		

II. Hemy-artroses

Symphyses	Articulating bones separated by piece of fibrocartilage	Intervertebral joints; symphysis pubis
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III. Diarthrosis

(Synovial joints, movable joints)

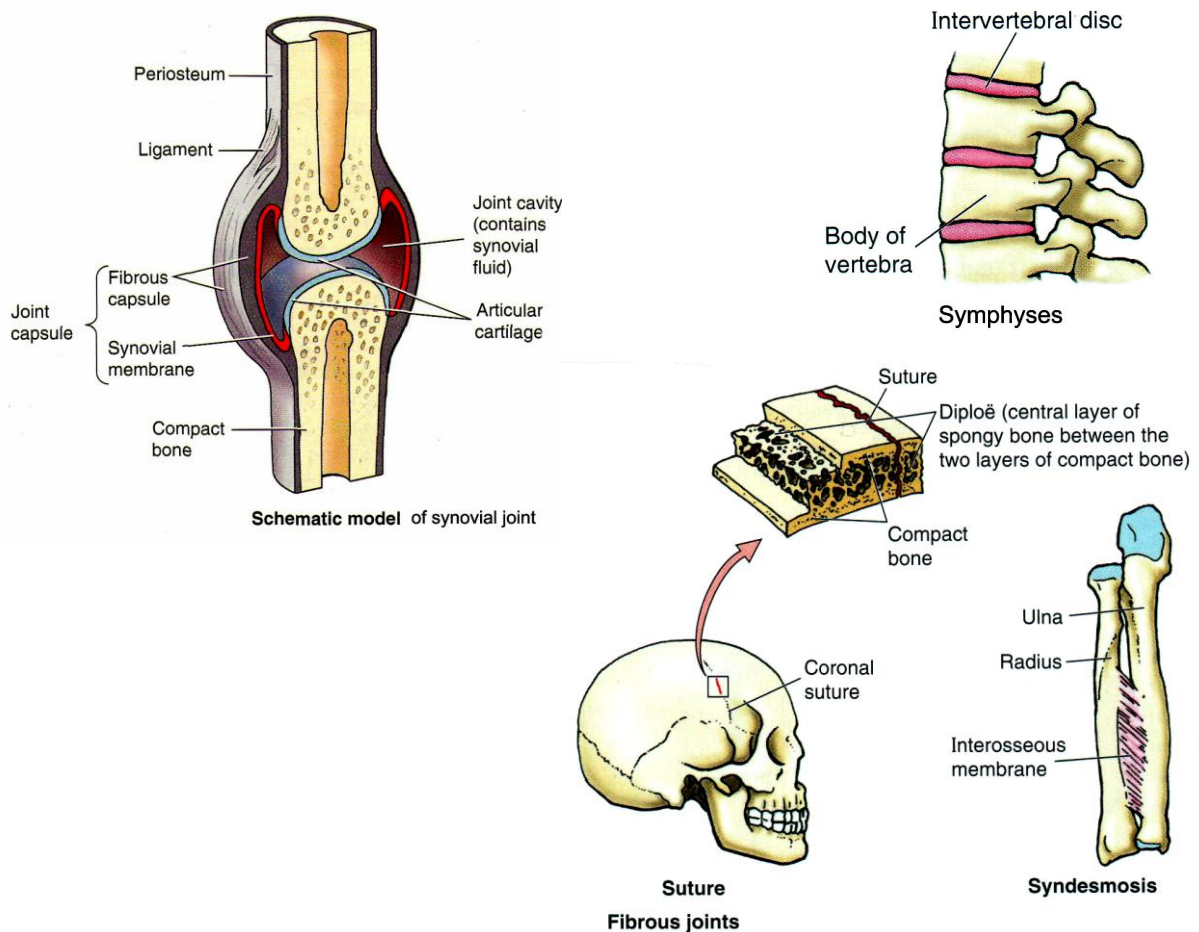
Necessary elements: *Articular capsule* containing synovial membrane and *synovial fluid*, *articular surfaces* which covered by hyaline or fibrous cartilage, *articular cavity*.

Type according at function	Type according at shape	Characteristic	Example
1 axial articulations	Cylindrical or Pivot joint (articulation cylindrical)	Conical surface of one bone articulates with a depression of another	Atlantoaxial joint
	Hinge joint (Ginglimus or articulation trochoidea)	Concave surface of one bone articulates with convex surface of another	Elbow-joint; joints of phalanges
2 axial articulations	Ellipsoid joint or Condylloid joint (articulation ellipsoidea)	Oval condyle of one bone articulates with elliptical cavity of another	Radiocarpal joint; Temporomandibular joint
	Bicondylloid joint (articulation bicondylaris)	Two oval condyle of one bone articulates with elliptical cavity of another	Knee joint

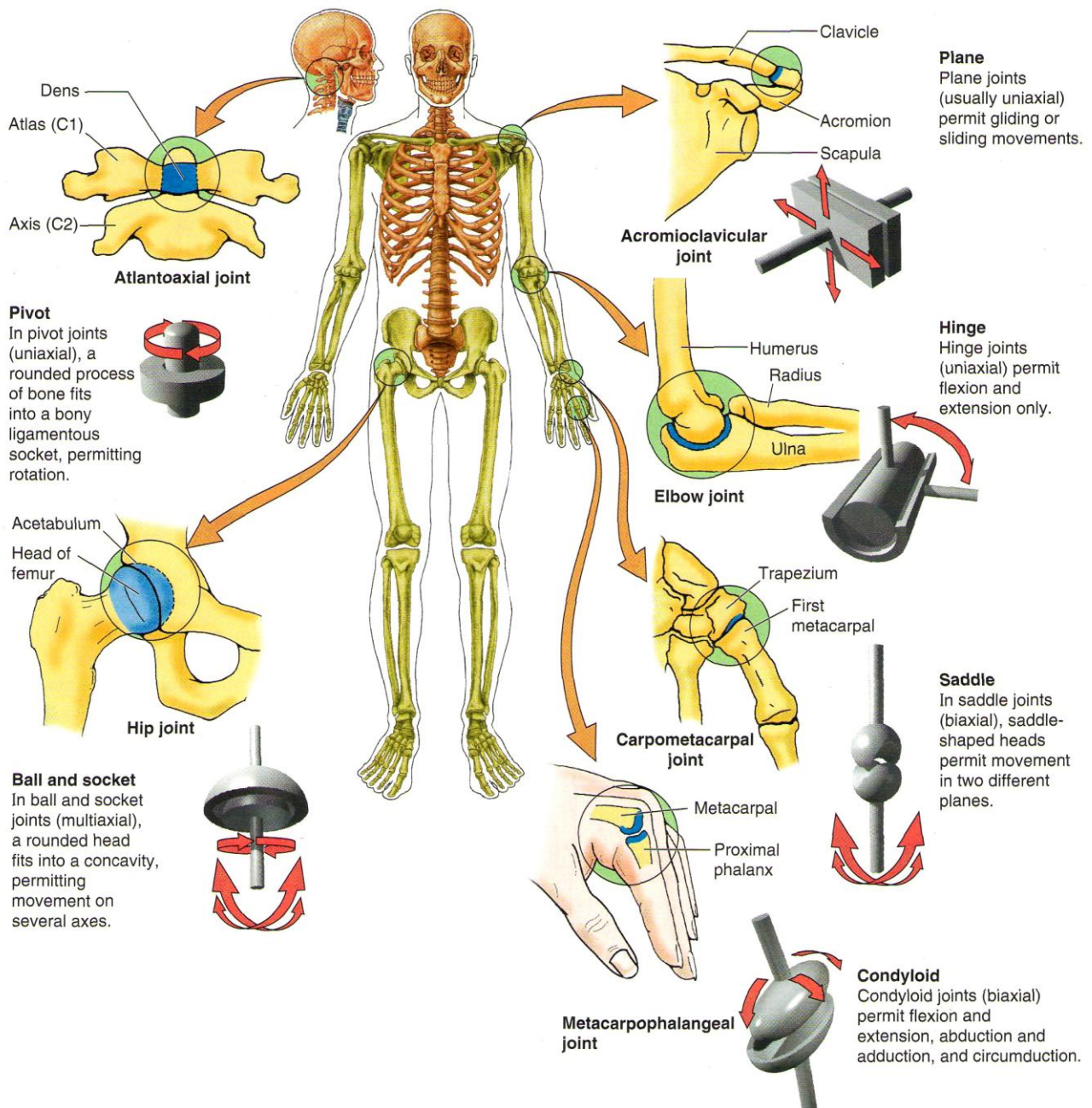
	Saddle (articuatio sellaris)	Concave and convex surface on each articulating bone	Carpometacarpal joint of thumb
3 axial articulations	Spheroideal joint, or Ball-and-socket joint (articuatio spheroidea)	Rounded convex surface of one bone articulates with plane or cuplike socket of another	Shoulder joint
	the kind of Ball-and-socket joint is Cup-joint(articuatio cotylica);		Hip joint
	Plane joint, or Gliding joint (articuatio plana).	Flattened or slightly curved articulating surfaces	Intercarpal and intertarsal joints

According to the structure articulations are divided into:

- 1) **simple** - is composed articulation surface of two bones. (Shoulder joint).
- 2) **complicated or compound** - is composed of three or more articular surfaces. (Elbow joint).
- 3) **complex** - is characterised by being in cavity discs or menisc and divide articular cavity into two floores. (Knee joint).
- 4) **combinated** is called two anatomic separated articulations, which move at the same time. (Temporomandibular joint – right and left).



Synovial joints are classified according to the shape of their articulating surfaces:



Accessory elements of synovial joints:

Ligaments – they hold the bones together while allowing the appropriate movements to take place: to help to limit movements to the normal range. Ligaments may be extracapsular and intracapsular (are located outside or inside to joint cavity).

Intracapsular discs or menisci – fibrocartilage plates, which make the articular surfaces more appropriate one to another.

Articular labrums - fibrocartilage formation, which located along the ridg of articular surface and increase it.

Synovial bursae. It is protrusion of synovial capsule. Its function is increase the volume of articular cavity.

Movements at synovial joints are broadly classified as angular and circular.

Angular Movements

Angular movements increase or decrease the joint angle produced by the articulating bones. The four types of angular movements are flexion, extension, abduction, and adduction.

Concerning to the sagittal axis two movements can take place in the joint: abduction and adduction. Abduction is the movement of a body part away from the main axis of the body, or away from the sagittal plane, in a lateral direction. Adduction, the opposite of abduction, is the movement of a body part toward the main axis of the body.

Concerning to the frontal axis two movements can take place in the joint: flexion and extension.

Circular movements

Joints that permit circular movement are composed of a bone with a rounded or oval surface that articulates with a corresponding depression on another bone. The two types of circular movements are rotation and circumduction.

Concerning to the vertical axis two movements can take place in the joint: supination (or external rotation), and pronation (or internal rotation).

Rotation is the movement of a bone around its own axis.

Supination is a specialized rotation of the limbs that as results the distal part of it being turned forward (anteriorly).

Pronation is the opposite of supination. It is a rotational movement of the the limbs that as results the distal part of it being directed backward (posteriorly).

Special Movements

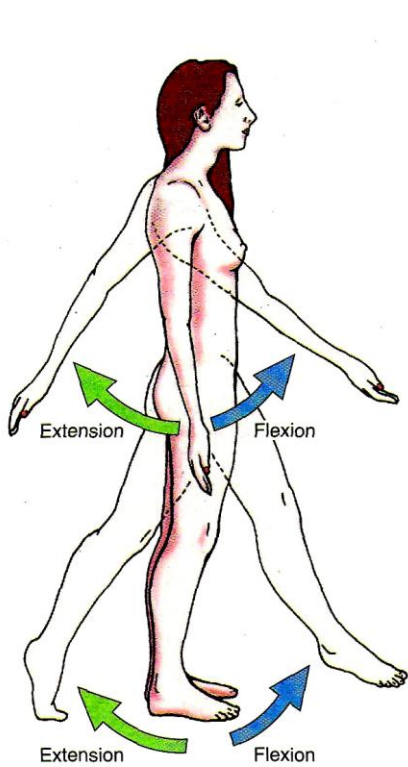
Because the terms used to describe most movements around an axis do not apply to all joints, other terms must be used.

Inversion is the movement of the sole of the foot inward or medially. Eversion, the opposite of inversion, is the movement of the sole outward or laterally.

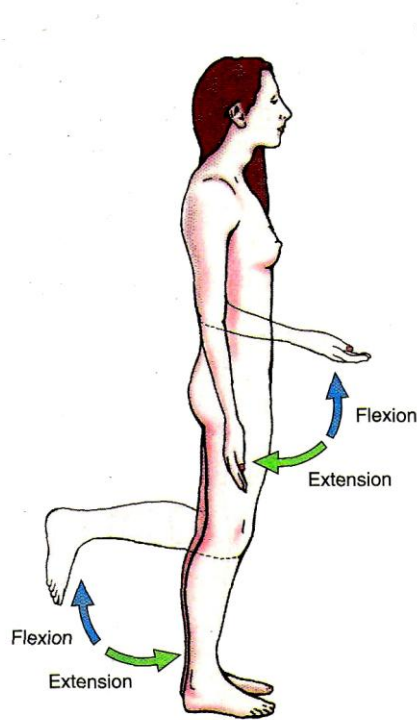
Protraction is the movement of part of the body forward on a plane parallel to the ground, such as the thrusting out of the lower jaw. Retraction is the opposite of protraction and is the pulling back of a protracted part of the body on a plane parallel to the ground.

Elevation is a movement that raises a body part. Examples include elevating the mandible to close the mouth and lifting the shoulders to shrug. Depression is the opposite of elevation.

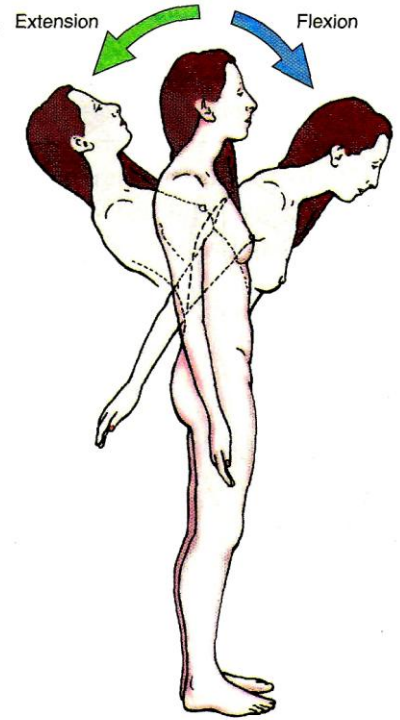
Types of movements:



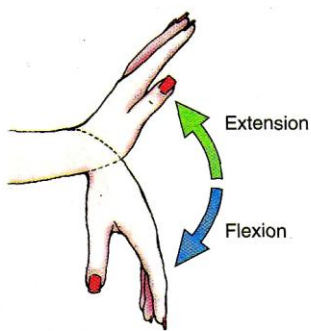
Flexion and extension of upper limb at shoulder joint and lower limb at hip joint



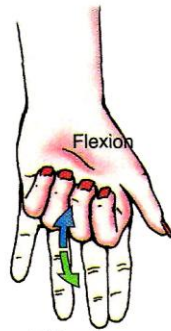
Flexion and extension of forearm at elbow joint and of leg at knee joint



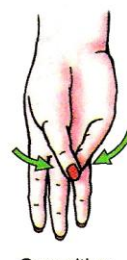
Flexion and extension of vertebral column at intervertebral joints



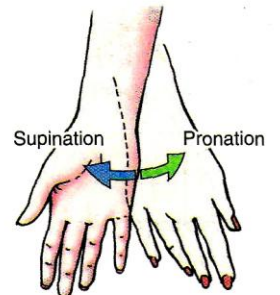
Flexion and extension of hand at wrist joint



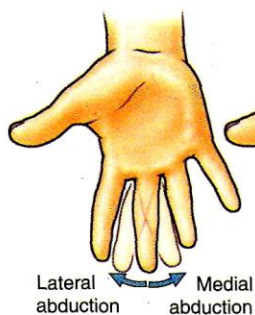
Flexion and extension of digits (fingers) at metacarpophalangeal and interphalangeal joints



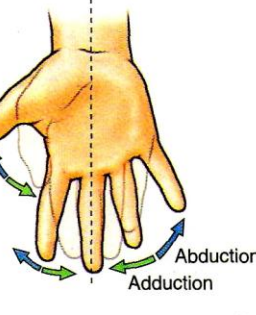
Opposition and reposition of the thumb and little finger



Pronation and supination of forearm at radioulnar joints



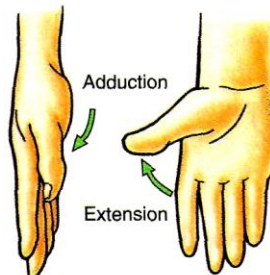
Lateral abduction Medial abduction
Abduction of 3rd digit



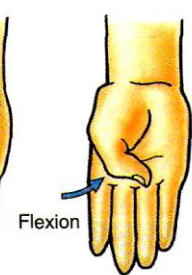
Abduction and Adduction of 1st, 2nd, 4th, and 5th digits



Abduction

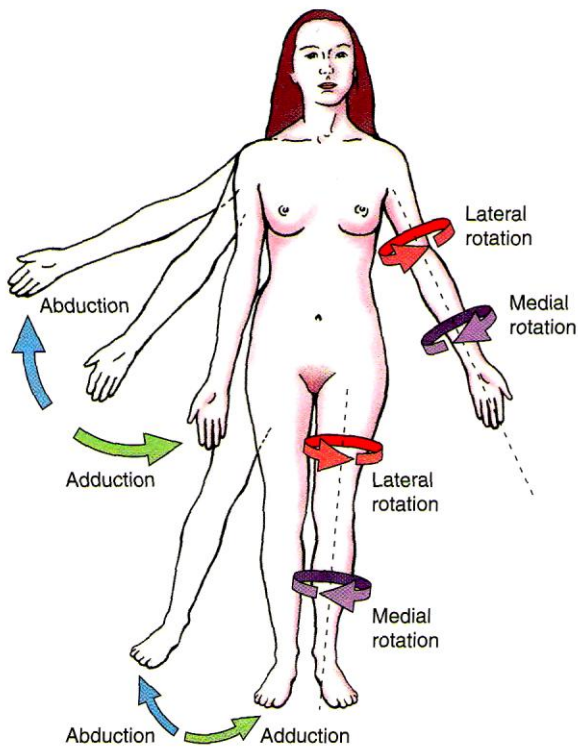


Adduction, extension, and flexion of the thumb

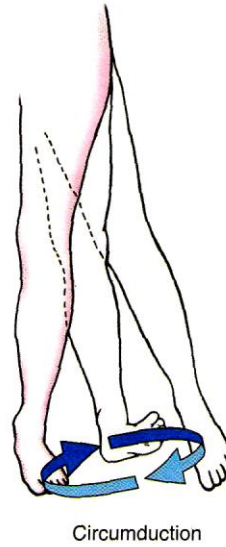


Flexion

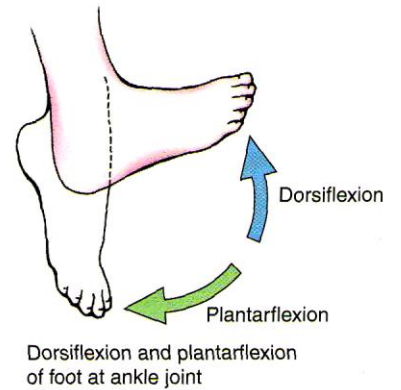
Types of movements(continuation):



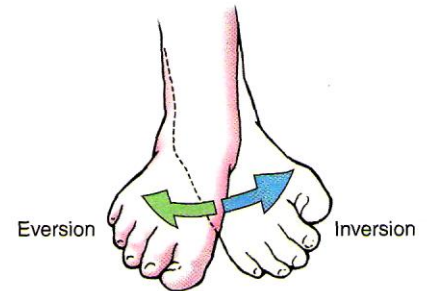
Abduction and adduction of right limbs and rotation of left limbs at glenohumeral and hip joints, respectively



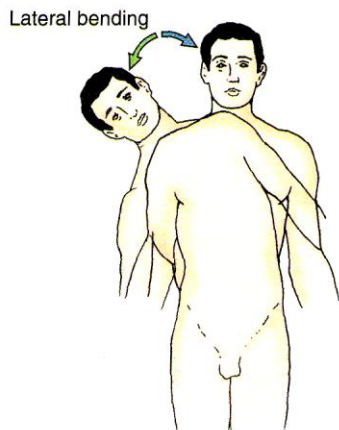
Circumduction (circular movement) of lower limb at hip joint



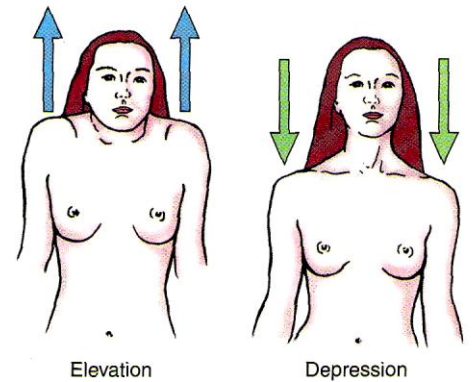
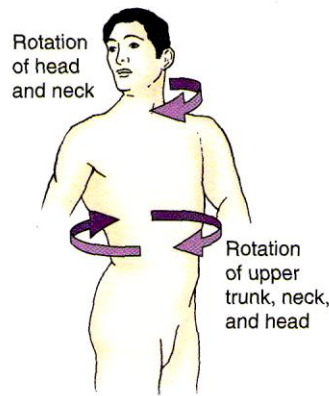
Dorsiflexion and plantarflexion of foot at ankle joint



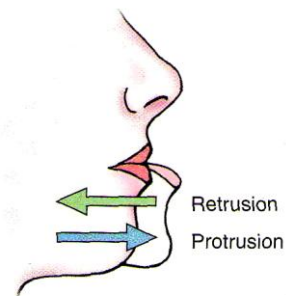
Inversion and eversion of foot at subtalar and transverse tarsal joints



Lateral bending (lateral flexion) of trunk and rotation of upper trunk and neck



Elevation and depression of shoulders



Protrusion and retrusion of jaw at temporomandibular joints

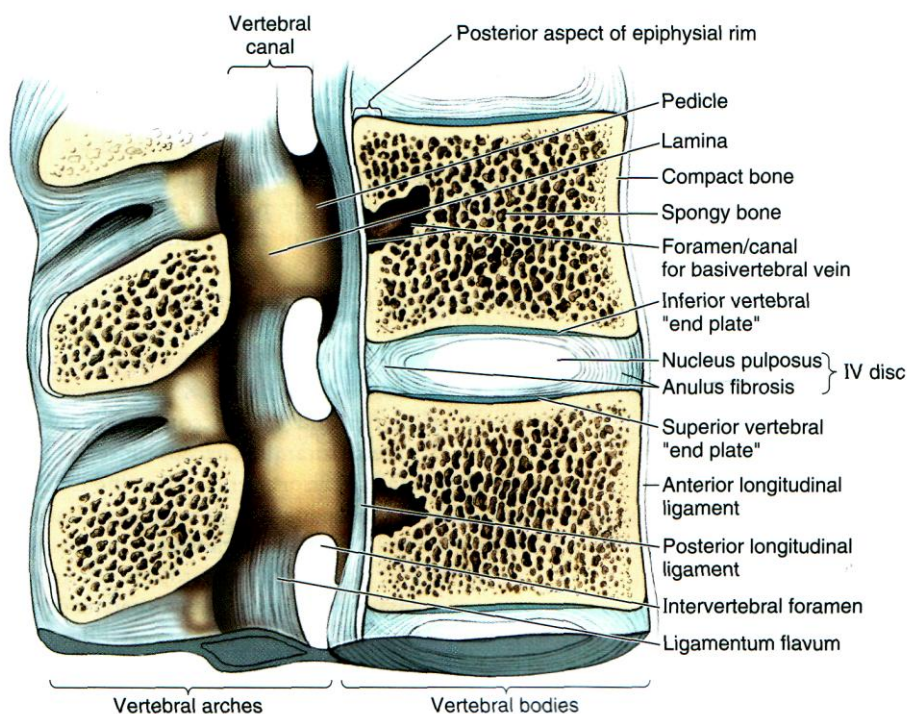
Joints between bones of the trunk

Joints between bones of the Vertebral Column

The articulations of the vertebral column are the amphiarthrosis. Movement: slight. Its consist of:

1. joints between bodies of vertebra;
2. joints between arches of vertebra;
3. joints between processes of vertebra.

Joints between bodies of vertebra. Type: syndesmosis.



Medial view of left halves of two adjacent hemisected vertebrae

Intervertebral disks are situated between adjacent superior and inferior surfaces of bodies of the vertebrae from C2 to sacrum.

Intervertebral disc contents the nucleus pulposus (soft, pulpy, yellowish elastic material lying in centre) and fibrous ring (annulus; concentric ring of fibrous tissue and fibrocartilage).

Fibrous connective tissue (the type of structure is syndesmosis) units

the all parts of vertebrae with the help of 2 long ligaments: the anterior longitudinal ligament covers anterior surface of vertebrae from C2 to sacrum; the posterior longitudinal ligament in vertebral canal on posterior surface of vertebrae from C2 to sacrum.

Joints between arches of vertebra. Type: syndesmosis.

Short ligament is the ligamenta flava. The ligamenta flava consists of yellow elastic tissue, the fibers of which, are attached to the vertebral arches.

Joints between processes of vertebra.

- 1). Between spinous and transverse processes. **Type: syndesmosis**

The supraspinal ligament is a strong fibrous cord, which connects together the tops of the spinous process from the seventh cervical vertebra to the sacrum. The ligamentum nuchae is a fibrous membrane, which, in the neck, represents the supraspinal ligament. It extends from the external occipital protuberance and the median nuchal line to the spinous process of the seventh cervical vertebra. The intertransverse ligaments are interposed between the transverse processes. The interspinal ligaments connect adjoining spinous process.

2). Between the vertebral articular processes. **Type: diarthrosis (synovial joint).**

Articulatio zygapophysialis

The essential features of the intervertebral articulation (zygapophysial) are: *facies articularis*: *facies articulares* of the superior articular process and inferior articular process. *Articulatio intervertebralis* (or *zygapophysialis*) is *combinata* in type. It is plane in form. *Combinata*. Simple.

Movements: Movements permitted in this joint are between three axis and planes.

Joints between atlas and axis consists of a medial and 2 lateral joints.

Articular surfaces of *articulatio atlantoaxialis mediana*: dens (odontoid process) of axis, anterior arch and transverse ligament of atlas.

Articular surfaces of *articulatio atlantoaxialis lateralis*: inferior articular surfaces of atlas and superior articular surfaces of axis.

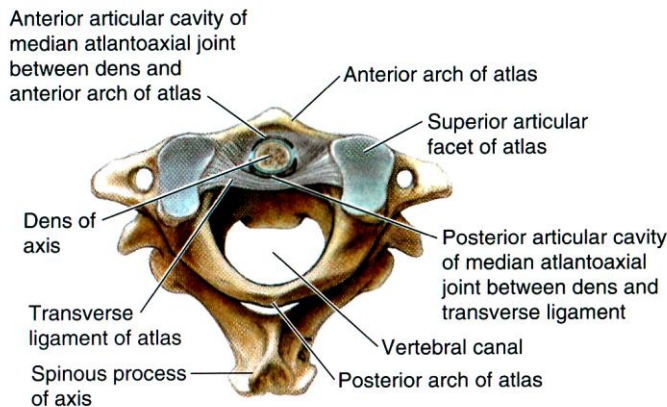
Ligaments:

Anterior atlantoaxial: from body of axis to border of anterior arch of atlas. Posterior atlantoaxial: lamina of axis to posterior arch of atlas.

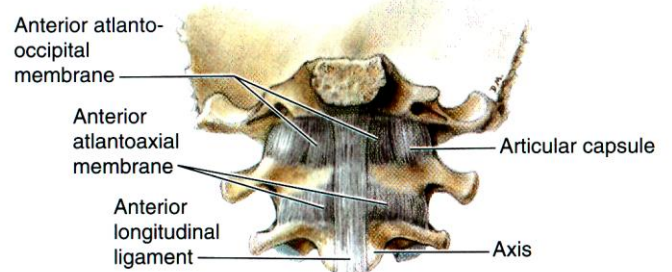
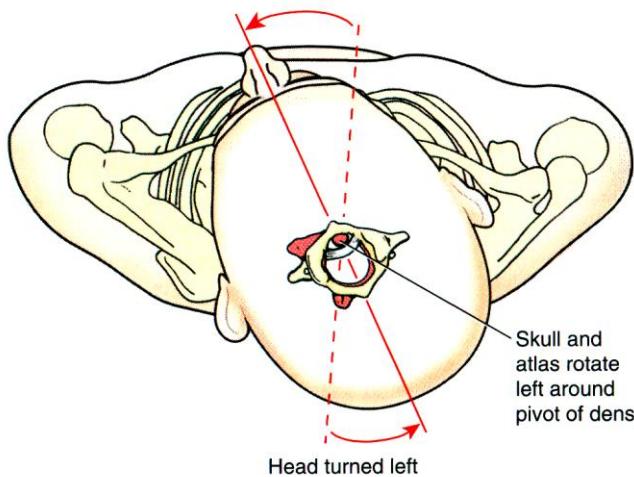
Transverse: across arch of atlas to hold dens against anterior arch of atlas. It has an upward prolongation to occipital bone (superior band) and a caudal extension to the posterior surface of body of axis (inferior band), forming cruciform ligament of atlas.

Type: middle is pivot, simple. Two lateral is plane, *combinata*.

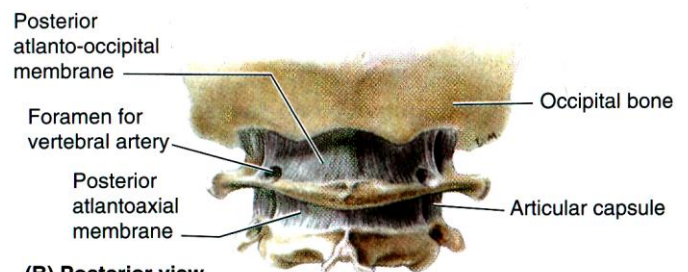
Movements: rotation.



(C) Superior view



(A) Anterior view



(B) Posterior view

Joints between atlas and occipital bone – *Articulatio atlantoaxialis*

Articular surfaces of: condyles of occipital bone and superior facets of atlas

Ligaments and membranes:

Articular capsules surround condyles and superior articular processes of atlas.

Anterior atlanto-occipital membrane: between foramen magnum and anterior arch of atlas.

Posterior atlanto-occipital membrane: between margin of foramen magnum and posterior arch of atlas. Lateral: fibers from transverse processes of atlas to jugular processes of occipital.

Tectorial membrane: inside vertebral canal and is a cephalic extension of posterior longitudinal ligament extending from body of axis to occipital bone.

Alar ligaments: from sides of dens to condyles of occipital bone.

Apical odontoid ligament: from apex of dens to foramen magnum.

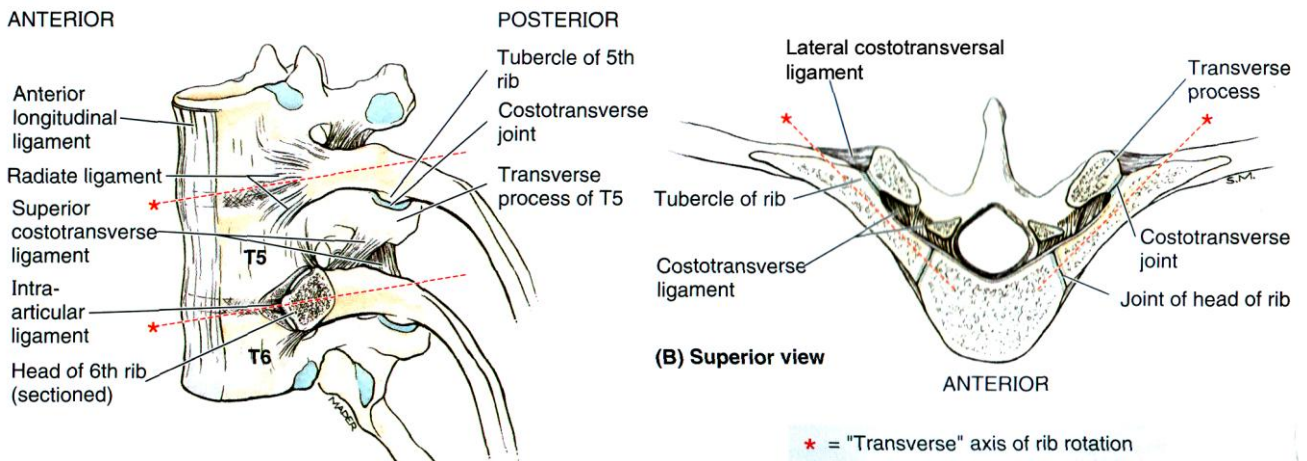
Type: condyloid, simple, combined.

Movements: flexion, extension, and lateral motion (adduction)

Joints between ribs and vertebrae

1). Articulations of the head of the rib (*Articulatio costovertebralis, L.*)

Articular surfaces of *Costovertebral joints* –: head of rib and superior and inferior facet on side of vertebral body. Articular capsule surrounds joint.

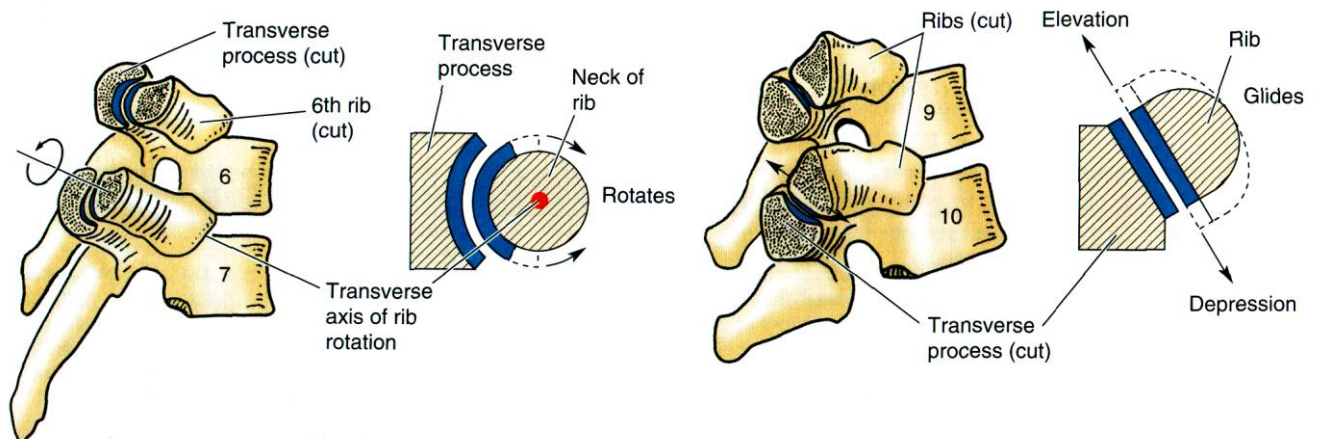


Ligaments:

Radiate: from anterior head of rib to bodies and intervertebral disk.

Intra-articular: from interarticular crest of the head of Th2-10 ribs to fibrocartilage of intervertebral disk of the Th2-10 vertebra. Located within joint and divides it into 2 parts

Type: Spheroidal. Simple(1, 11, 12), complicated (1-10). Combined.



2). Costovertebral joints (*Articulatio costovertebralis, L.*) between tubercle of rib and transverse process of the vertebra.

Articular surfaces of: tubercle of Th1-10 ribs with transverse process of vertebrae.

Articular capsule attached to edges of articular facets.

Ligaments:

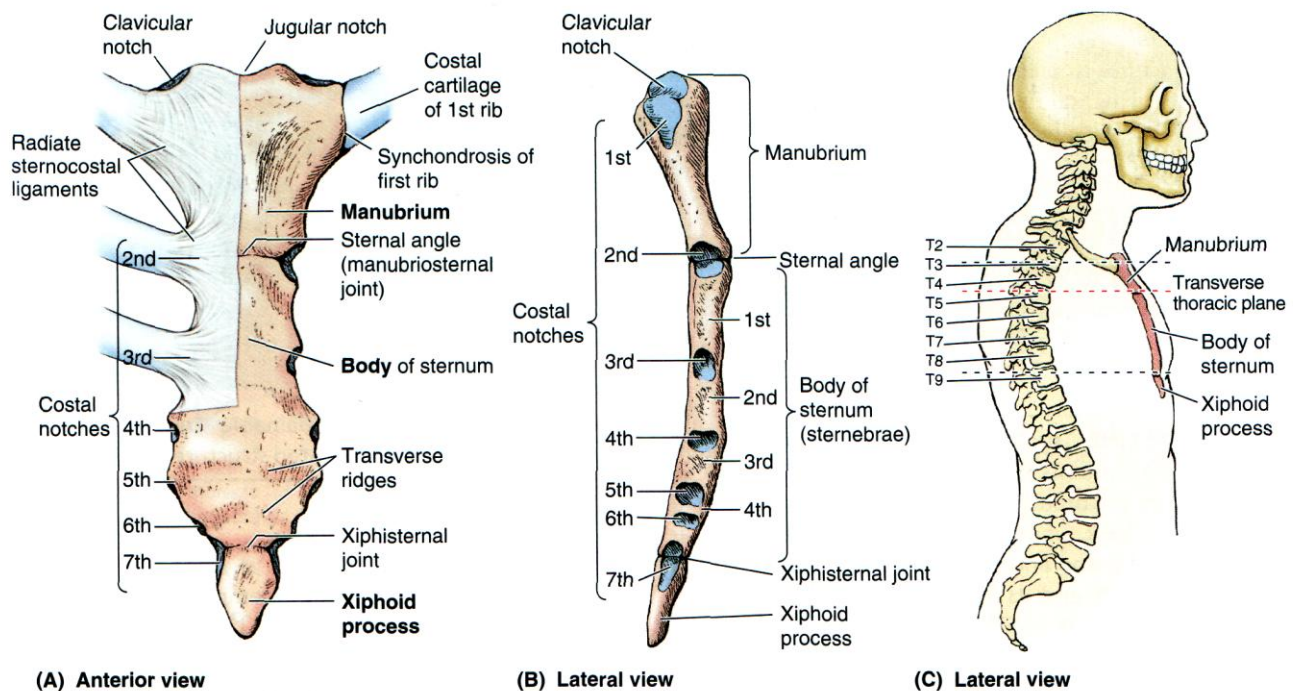
- Superior costovertebral.
- Posterior costovertebral.
- Lateral costovertebral ligament from tubercle of rib to apex of transverse process.

Type: Plane. Simple. Combined.

Movement of ribs: gliding and total effect is a rotation of head of rib in its own axis so that ribs are raised or lowered.

Sternocostal joints

1). Between first rib and sternum (*Synchondrosis costae primae, L.*).



Type: Permanent synchondroses: bones firmly united by cartilage tissue

Ligaments: anterior and posterior chondrosternal ligaments

2). Between sternum and ribs from 2 to 7 (*Articulatio sternocostales, L.*).

Articular surfaces of: cartilages of 2-7 ribs and costal notches of sternum

Ligaments:

Radiate sternocostal: from dorsal and ventral side of sternal ends of cartilages to dorsal and ventral side of sternum.

Intra-articular sternocostal: usually found in 2nd rib joint only, where ligament runs from end of cartilage to the fibrocartilage between manubrium and body of sternum

Type: Spheroidea. Simple. Combined.

Movements: gliding

3). Interchondral between costal cartilages of ribs 8 to 10 join together at adjacent articular facets. The articulations are plane synovial joints. Each of these articulations is enclosed in a fibrous capsule lined with a synovial membrane.

The cartilages of 11 and 12 ribs didn't join with sternum. Because according classification – 11,12 ribs are floating.

Intrasternal joints

A. Between manubrium and body of sternum

Type: symphyses with fibrocartilage between the edges of bone, strengthened by fibrous tissue (probably periosteum). In some cases, a synovial cavity is found. In old age, ossification sometimes is found (a true synostosis)

The bony ridge indicating the manubriosternal joint, called the sternal angle, is clinically important because it is the best guide to the numbering of the ribs. The 2nd rib cartilage articulates here

The articulating surfaces are covered with hyaline cartilage

In most people, the joint moves slightly during respiration, but in some adults it can become ossified (synostosis) and no movement occurs

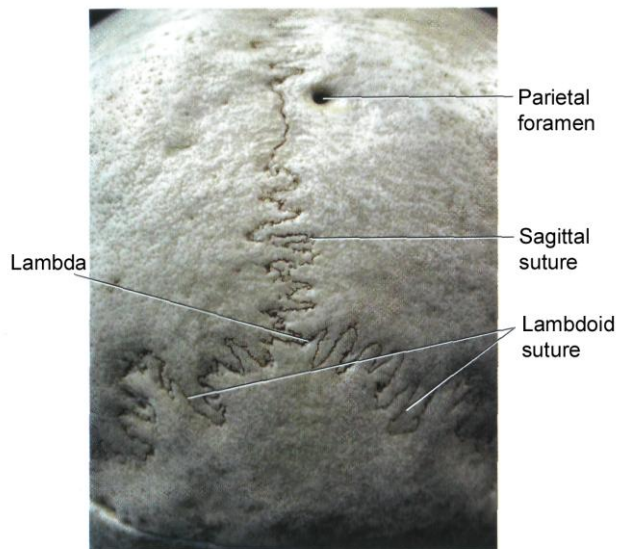
B. Between xiphoid and body of sternum

Type: Symphyses. Bones are united by hyaline cartilage

In general, after the 40th year the cartilage is replaced by bone in a synostosis

Joints between bones of the skull

Bones of the skull are jointed due to synarthroses (sutures, and synchondroses). Only lower jaw forms articulation with temporal bone.



(A) Posterior view of skull

Sutures of roof of the skull:

Sagittal: between the parietal bones on either side.

Coronal: between frontal and the 2 parietal bones; bregma is that point of union of coronal and sagittal sutures.

Lambdoidal: between occipital and 2 parietal bones.

Frontal may not be visible in adults.

Fontanelles: portions of the skull not ossified at birth, usually 6 in number:

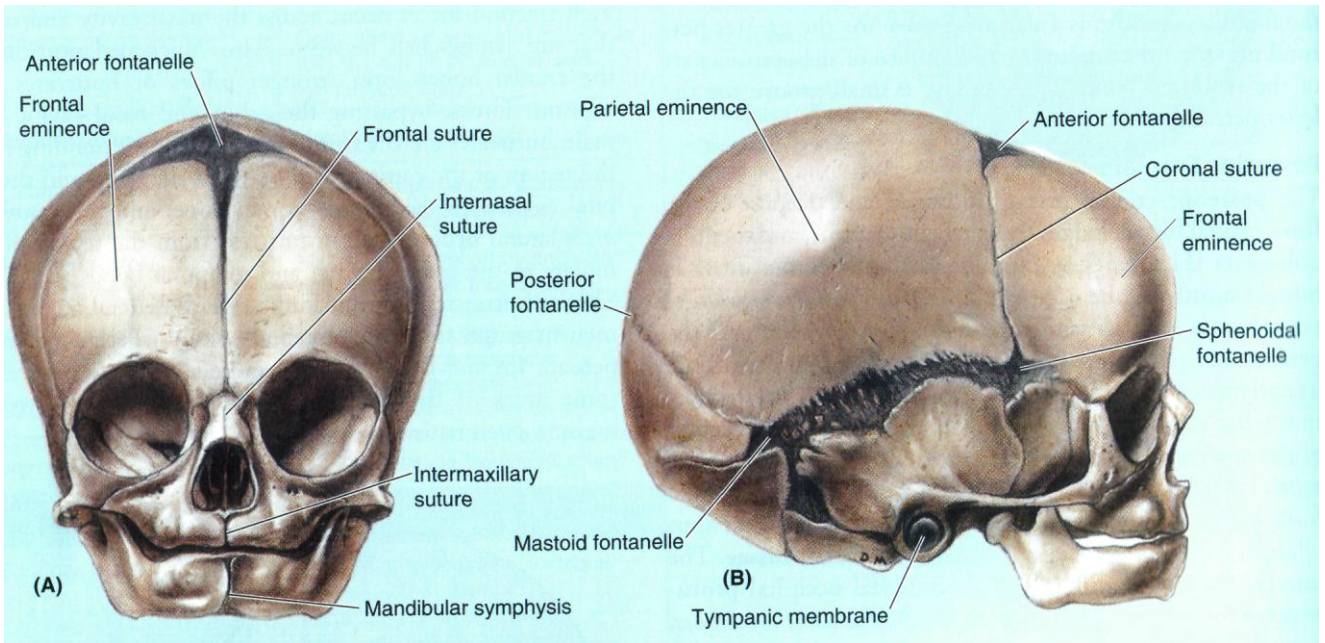
A. Anterior (bregmatic) is largest and diamond-shaped, located at junctions of coronal, sagittal, and frontal sutures. Closes middle of second year;

B. Posterior: triangular in shape, is located at union of sagittal and lambdoidal sutures. Closes 2 months after birth;

C. Sphenoidal: 1 on each side, is a small gap between parietal, great wing of sphenoid, and squamous temporal bones. Closes 1 to 2 months after birth;

D. Mastoid: 1 on each side, is a small gap between parietal, temporal, and occipital bones. Closes 1 to 2 months after birth.

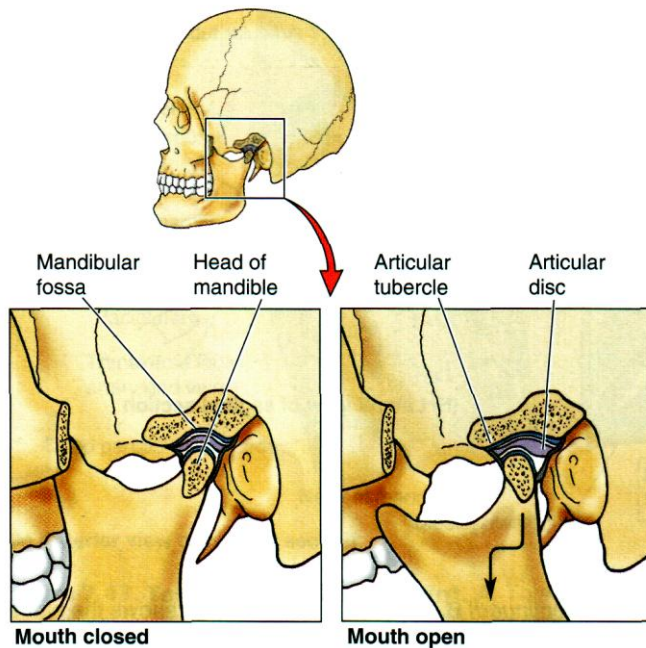
Fontanelles of newborn



Temporomandibular joint (*Articulatio temporomandibularis, L.*)

Articular surfaces of: mandibular fossa and the articular tubercle of the temporal bone and the head of the mandible.

Articular capsule encloses the joint.



Ligaments:

Lateral temporomandibular ligament is attached above to the articular tubercle at the root of the zygomatic arch and below to the neck of the mandible. The fibres extend downward and backward. The ligament limits the posterior movement of the mandible.

Sphenomandibular ligament is attached above to the spine of the sphenoid and below to the bony projection (lingula) of the mandibular foramen. Its function is unknown.

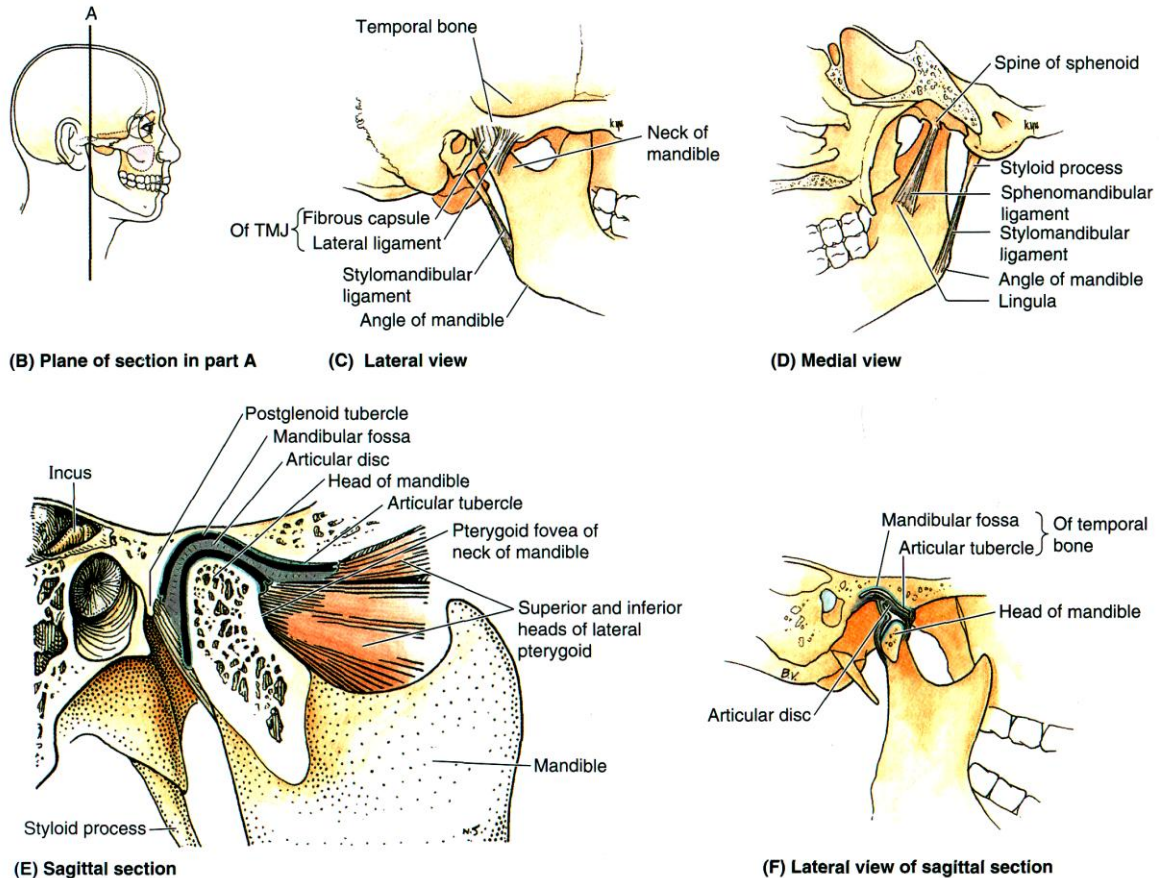
Stylomandibular ligament is attached to the styloid process above and to the angle of the mandible below. Its function is unknown.

Articular Disc. This is an oval disc of fibrocartilage. It is attached in front to

the tendon of the lateral pterygoid muscle and posteriorly by fibrous tissue to the head of the mandible. The circumference of the disc is attached to the capsule.

The disc permits gliding movement in the upper part of the joint and hinge movement in the lower part of the joint.

Type: Ellipsoid. Simplex. Complex.



Movements:

Protrusion: The head of the mandible and the articular disc move forward in the upper part of the joint.

Retraction: The head of the mandible and the articular disc move backward in the upper part of the joint.

Depression of mandible (mouth is opened): The head of the mandible rotates the undersurface of the articular disc around a horizontal axis.

Elevation of mandible (mouth is closed): The head of the mandible rotates on the undersurface of the articular disc. At the same time, the head of the mandible, and the articular disc are pulled backward by fibroelastic tissue, which connects the disc to the temporal bone posteriorly.

Lateral chewing movements: Alternate protruding and retracting the mandible on each side.

Joints of the upper limb

Joints of the sholder girdle

Sternoclavicular joint (Articulatio sternoclavicularis, L.).

Articular surfaces of: sternal end of clavicle with clavicular notch of manubrium of the sternum and articular disk. Articular disk between sternum and clavicle. Helps limit depression of shoulder

Articular capsule surrounds sternoclavicular articulation.

Ligaments:

Anterior sternoclavicular from clavicle to ventral surface of manubrium of the sternum.

Posterior sternoclavicular between dorsal surfaces of clavicle and manubrium of the sternum.

Interclavicular ligament.

Costoclavicular from the first costal cartilage to costal tuberosity on caudal surface of clavicle. Limits elevation of shoulder

Type: saddle type of synovial joint. Simple. Complex. Combined.

Movements: elevation and depress; retract and protract; circumduction.

Acromioclavicular joint (Articulatio acromioclaviculare, L.).

Articular surfaces of: acromial end of clavicle and acromion of scapula. Articular capsule completely surrounds articular areas.

Ligaments:

Superior acromioclavicular covers joint cephalically

Articular disk frequently absent or incomplete

Coracoclavicular ligament is divided into:

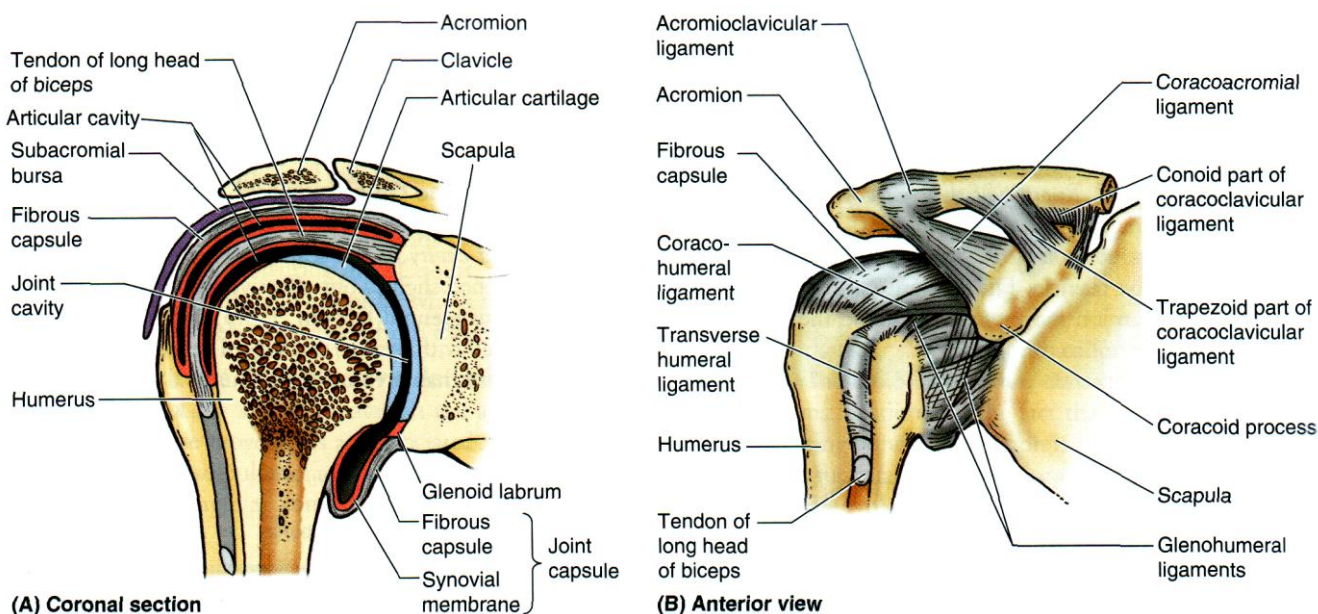
- a) Trapezoid ligament. from upper coracoid process to oblique line on caudal surface of clavicle. Limits ventral rotation of scapula.
- b) Conoid ligament from base of coracoid process to coracoid tuberosity on caudal surface of clavicle. Limits dorsal rotation of scapula.

Type: Plane. Simple. Combined.

Movement: gliding, rotation of scapula on clavicle.

Joints of the free upper limb

Shoulder joint (Articulatio humeri, L.).



Articular surfaces of: head of humerus and glenoid cavity of scapula.

Articular capsule from edge of glenoid fossa and glenoidal labrum go to anatomical neck of humerus. Glenoidal labrum: fibrocartilage attached to edges of glenoid fossa to deepen it and protect bone. Above, it is continuous with biceps tendon (long head). Synovial membrane: from glenoid cavity over labrum; lines inside of capsule and is reflected on anatomical neck to articular cartilage. Encloses tendon of long head of biceps muscle into a tubular sheath, the intertubercular synovial sheath

Ligaments:

Coracohumeral from coracoid to greater tubercle of humerus.

Transverse humeral bridges intertubercular sulcus (groove)

Type: Spheroidal (Ball-and-socket). Simple.

Movements: flexion, extension, abduction, adduction, medial rotation, lateral rotation, and circumduction.

Elbow joint (Articulatio cubiti, L.)

Consist of 3 joints: humeroulnar, humeroradial and proximal radioulnar

I. Humeroulnar joint (Articulatio humeroulnaris, L.)

Articular surfaces of: trochlea of humerus with trochlear notch of ulna

Type: ginglymus (hinge). Simple. Combined.

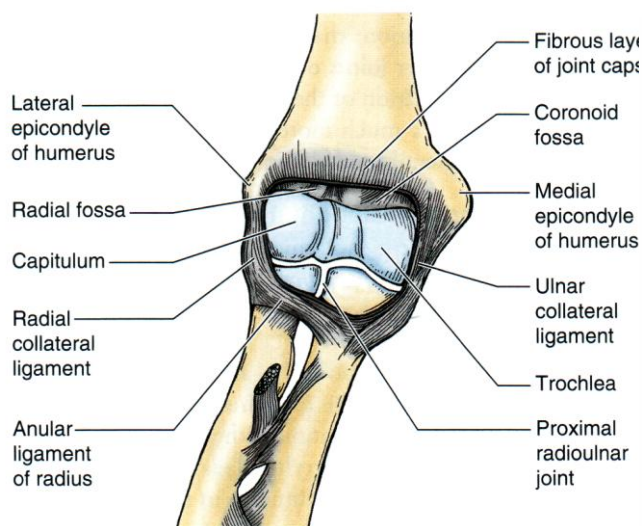
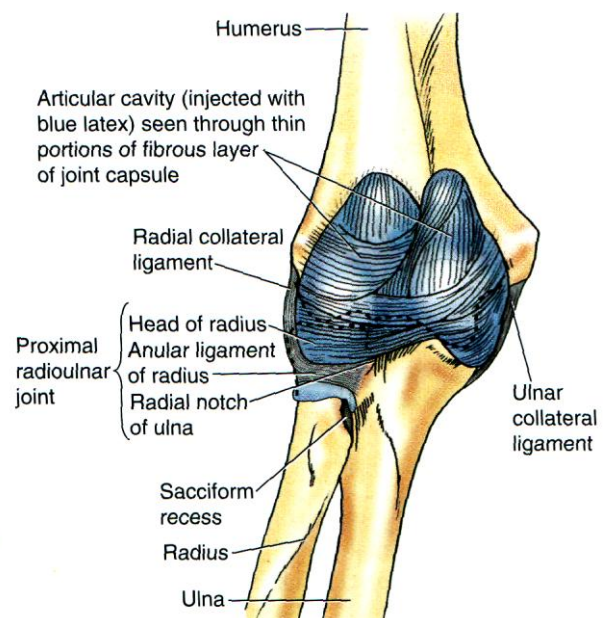
Movements: flexion and extension.

II. Humeroradial joint (Articulatio humeroradialis, L.)

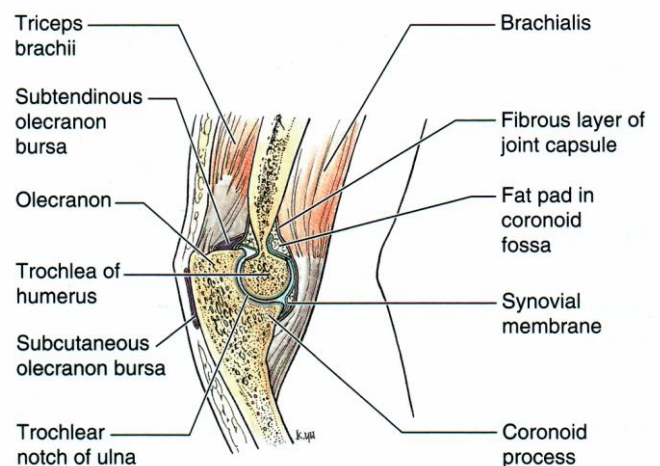
Articular surfaces of: capitulum of humerus with fovea of radial head.

Type: Spheroida. Simple. Combined.

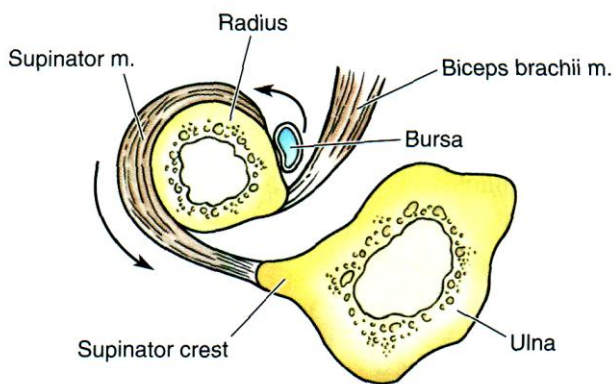
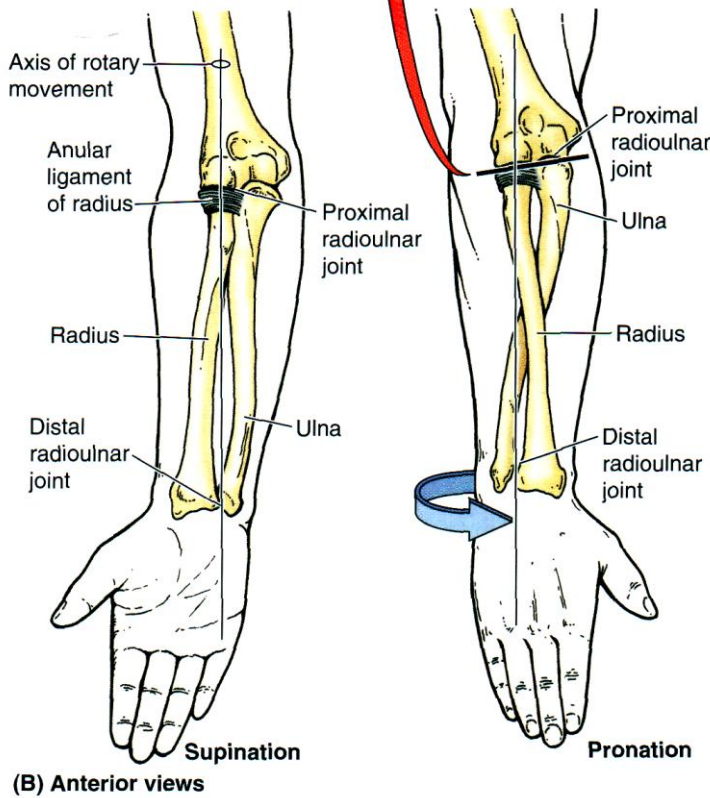
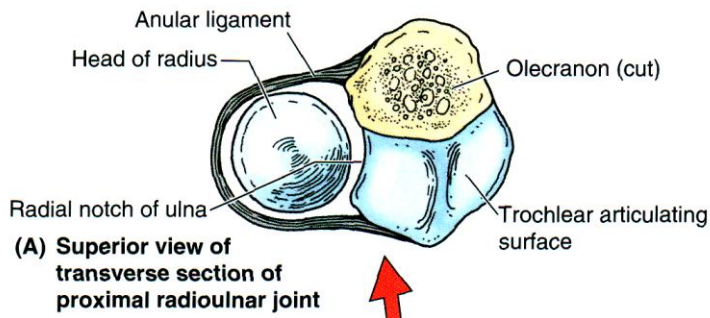
Movement: gliding.



(A) Anterior view



(B) Sagittal section



Type: Pivot. Combined.
Movements: rotation (pronation, supination).

III. Radioulnar proximal (*Articulatio radioulnaris proximalis, L.*)

Articular surfaces of: head of radius and radial notch of ulna.

Type: Pivot. Simple. Combined.

Movements: pronation and supination of forearm

Articular capsule of elbow joint in front, extends from medial epicondyle and front of humerus above coronoid and radial fossae to the anterior coronoid process.

Ligaments of elbow joint: Ulnar collateral. Radial collateral. Anular. Quadrate.

Type of elbow joint in general: Trochoid (ginglimus). Complicated.

Movement: flexion and extension, pronation and supination of forearm with the movement in distal radioulnar joint.

The bodies of radius and ulna are jointed due to interosseal membrane (syndesmoses).

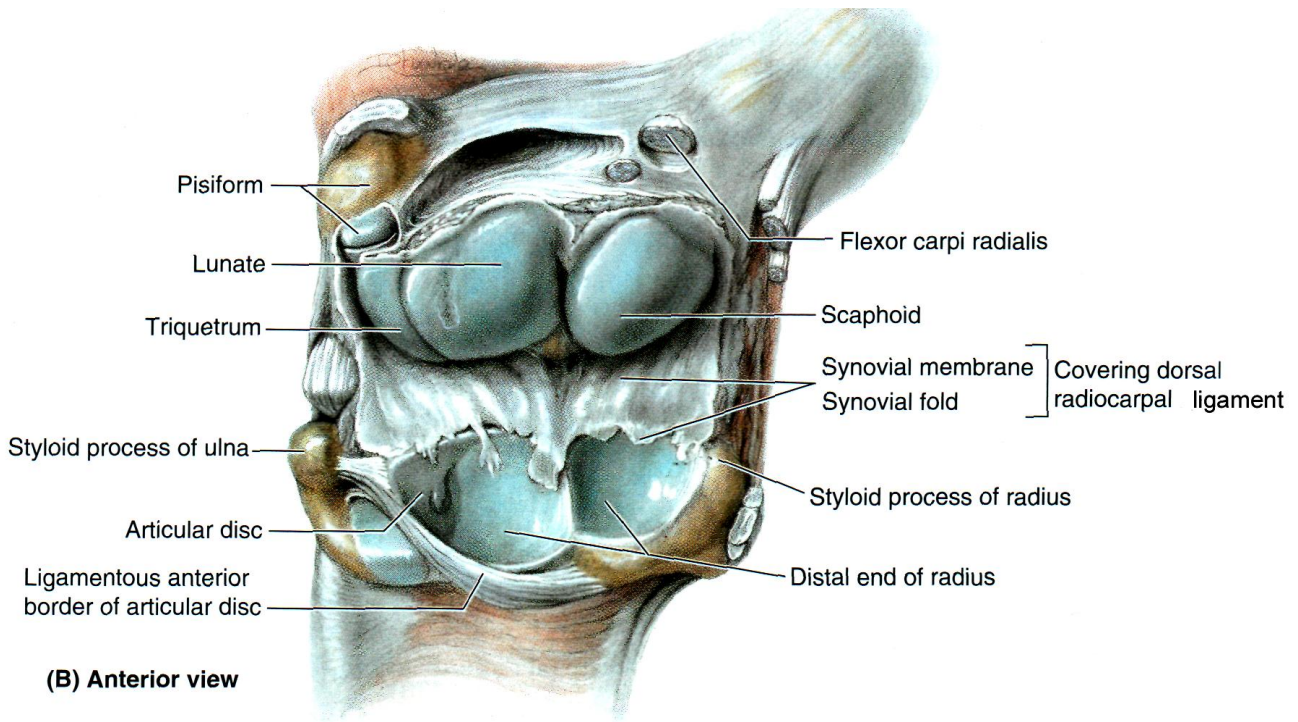
Radioulnar distal joint (*Articulatio radioulnaris distalis, L.*)

Articular surfaces of: head of ulna and ulnar notch of radius.

Articular capsule surrounds joint.

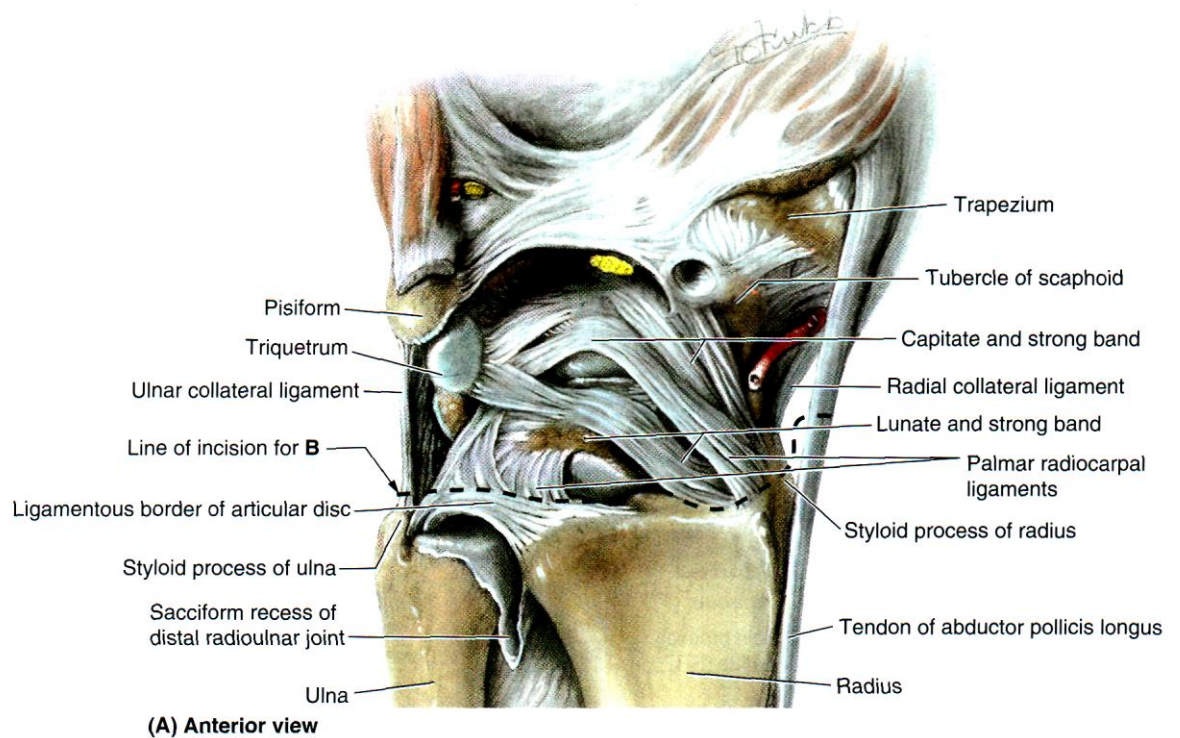
Ligaments: Palmar and dorsal radioulnar ligaments.

Wrist joint (radiocarpal articulation) (*Articulatio radiocarpalis, L.*)
Articular surfaces of: distal radius and articular disk with proximal row of carpals bones.
 Articular capsule surrounds joint.

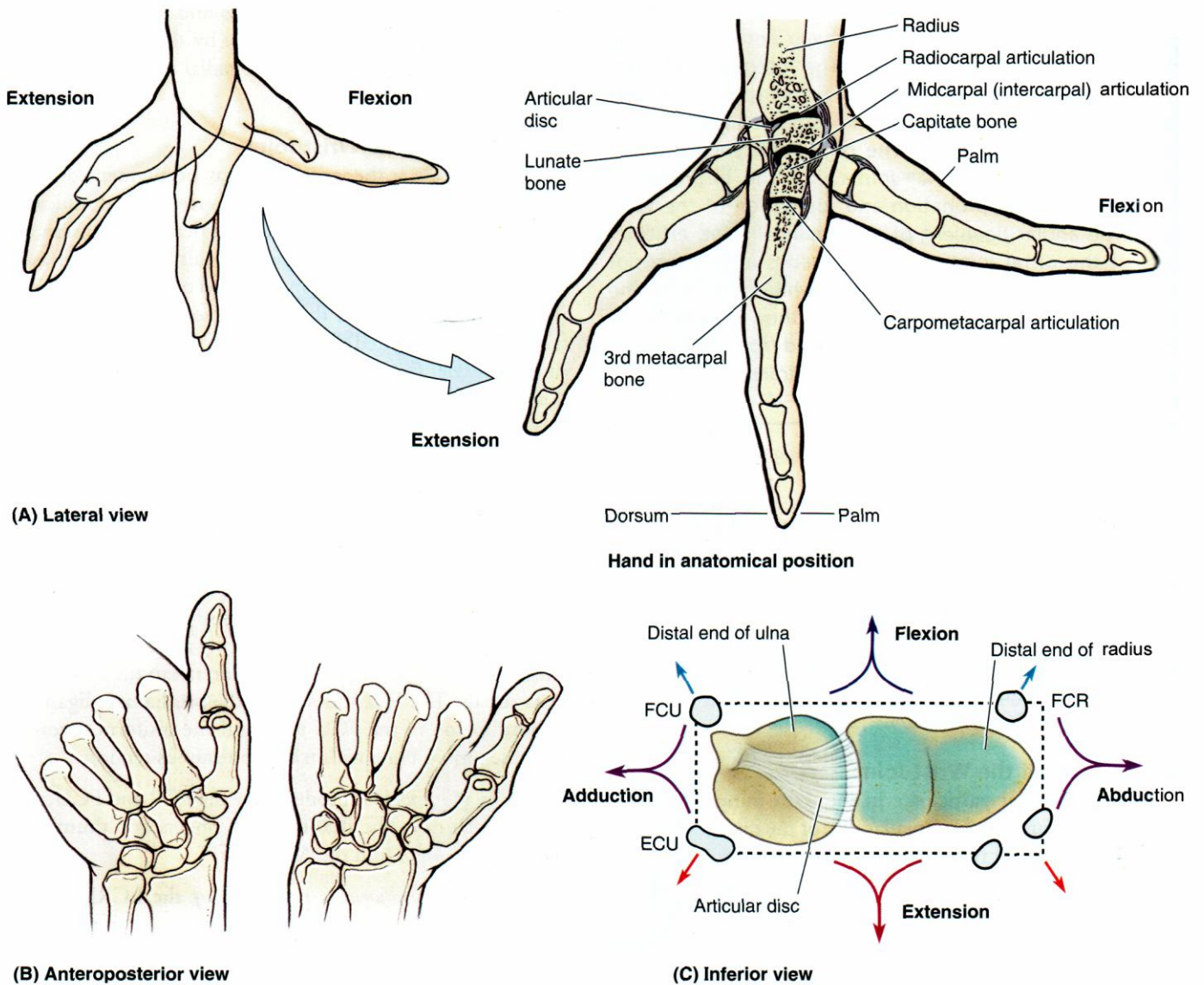


Ligaments: palmar radiocarpal, dorsal radiocarpal, ulnar carpal collateral, radial carpal collateral.

Type: Ellypsoid. Complicated. Complex.



Movements: flexion, extension, abduction, adduction, circumduction.

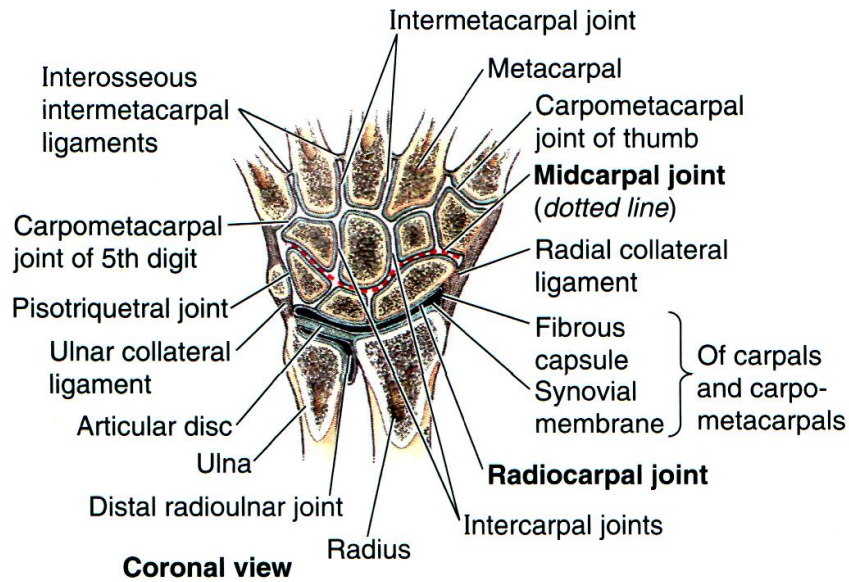


Intercarpal articulation (*Articulationes intercarpalis, L.*)

- A. Articulations of carpals with each other: plane joints, amphiarthrosis. Has dorsal, palmar, and interosseous ligaments.
- B. Articulations between the 2 rows of carpals (the midcarpal joint): a plane joint, amphiarthrosis. Has dorsal, palmar, and collateral ligaments.

Carpometacarpal joints (*Articulationes carpometacarpales, L.*)

- A. Between first metacarpal and trapezium: a saddle joint, simple, permitting flexion, extension, abduction, adduction, and opposition
 - B. All others between distal row of carpals and bases of metacarpals: plane joints, amphiarthrosis, with dorsal, palmar, and interosseous ligaments
- Intermetacarpal among bases of metacarpals: dorsal, palmar, and interosseous ligaments.
 Deep transverse metacarpal ligaments join heads of metacarpals

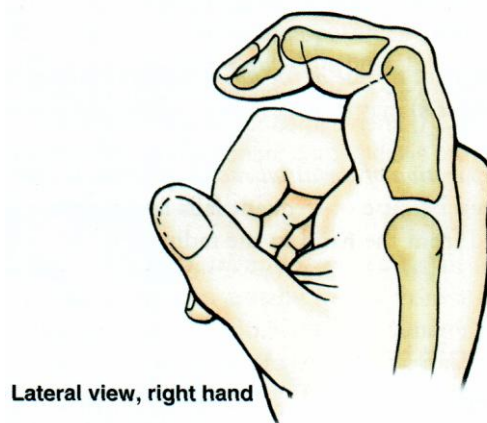
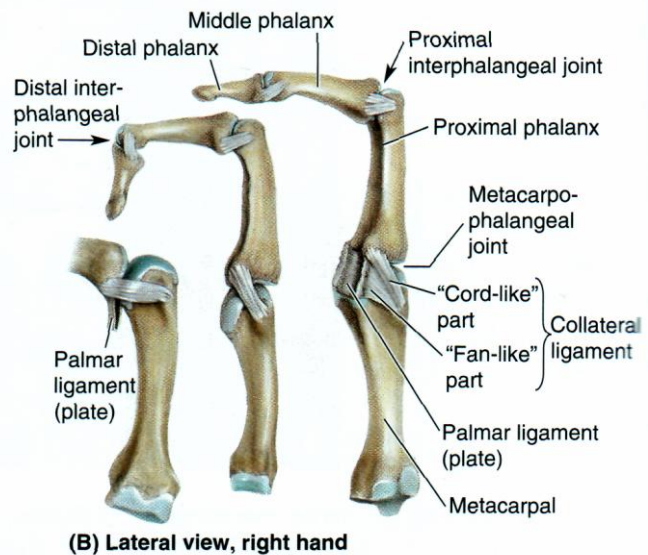


Metacarpophalangeal joints (*Articulationes metacarpophalangeae, L.*): condyloid, joined by 1 palmar and 2 collateral ligaments

Movements: flexion, extension. Abduction, adduction. Circumduction.

Interphalangeal joints: hinge joints, with 1 palmar and 2 collateral ligaments

Movements: flexion, extension.



Joints of the lower limb

Joints of the pelvis

Bony pelvis

Pelvis is formed by hip bone and sacrum, which joint with help of sacroiliac articulation, symphysis, obturator membrane and sacrotuberal, sacrospinous ligaments. Hip bone consist of iliac, pubic and ischial bones, which are jointed by synchondrosis(until 17-22 years) or synostosis(after 22 years). Pelvis is divided on upper portion or major pelvis and lower portion or minor pelvis. Major pelvis is separated from minor by terminal line, which passes from promontorium, arcuate line of iliac bone, pubic crest to upper margin of the symphysis. Major pelvis is bounded posteriorly by body of 5th lumbar vertebra, laterally by internal surface of iliac wings. Minor pelvis is bounded by iliac, pubic bone, obturator membrane and internal surface of sacrum. It has upper orifice (entrance) and lower orifice(exit).

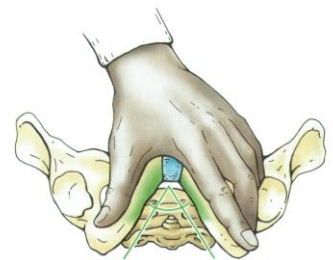
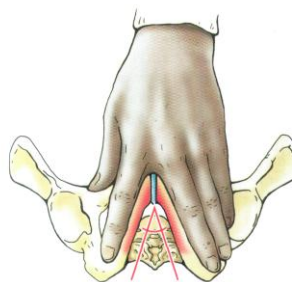
Bones of female pelvis are thinner and lighter; muscle markings are not as prominent; cavity is less funnel-shaped; distance between ischial spines and tuberosities is greater; sciatic notch is wider; surfaces of sacrum for articulation with ilium and with the 5th lumbar vertebra are smaller; and the subpubic angle is close to a right angle in the female and is more acute in the male. Bones of the male pelvis in addition to above, the ischial spines in the male are heavier and project farther into the pelvic cavity.

Bony Pelvis	Male (♂)	Female (♀)
General structure	Thick and heavy	Thin and light
Greater pelvis (pelvis major)	Deep	Shallow
Lesser pelvis (pelvis minor)	Narrow and deep, tapering	Wide and shallow, cylindrical
Pelvic inlet (superior pelvic aperture)	Heartshaped, narrow	Oval and rounded; wide
Pelvic outlet (inferior pelvic aperture)	Comparatively small	Comparatively large
Pubic arch and subpubic angle	Narrow (< 70°)	Wide (> 80°)
Obturator foramen	Round	Oval
Acetabulum	Large	Small
Greater sciatic notch	Narrow (~ 70°); inverted V	Almost 90°

Pubic arch

male

female



External sizes of the pelvis:

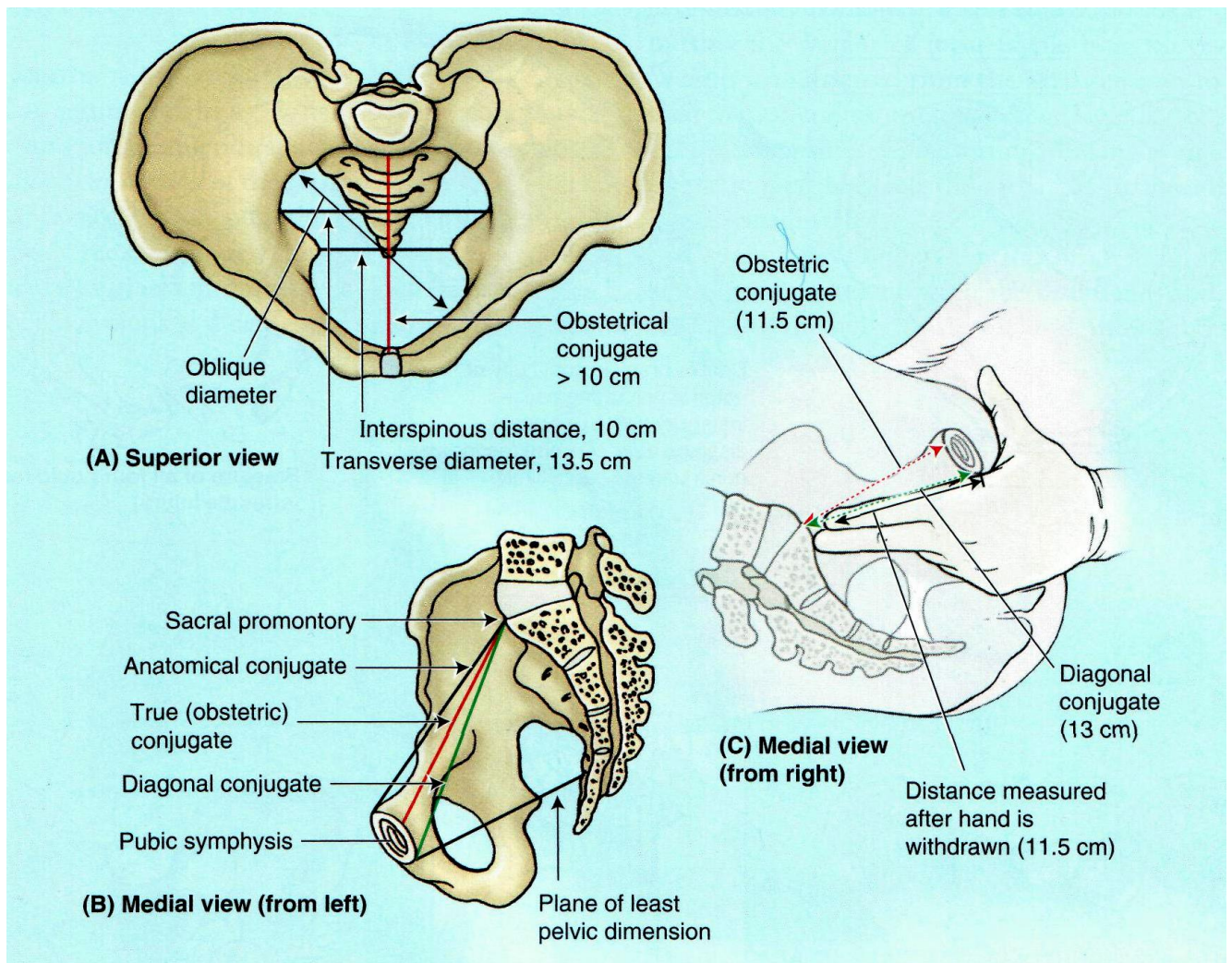
Spinorum distance (between right and left anterior superior iliac spine)	25-27 cm
Cristarum distance (between widest points on right and left iliac crest)	28-29 cm
Trochanteric distance (between right and left greater trochanter of the femur)	31-33cm

Sizes of the entrance into the minor pelvis:

1. Straight size
 - a) Anatomical conjugate (between superior margin of symphysis and promontorium) 11 cm
 - b) Gynecological conjugate (between protruding point of symphysis and promontorium) 10,5 cm
 - c) Diagonal conjugate (between inferior margin of symphysis and promontorium) 13 cm
2. Oblique size – between sacroiliac joint in one side and iliopubic eminence other side 12 cm
3. Transverse size – between widest points of the terminal lines 13 cm

Sizes of the exit of the minor pelvis:

1. Straight size (between lower margin of pubic symphysis and apex coccyges) 9-11 cm
2. Transverse size (between inner margin of ischiadic tuber) 10,5-11 cm



Bones of the pelvis joint by: Syndesmoses, Synchondroses, Synostoses, Symphyses, Diarthrosis.

Sacroiliac articulation (*Articulatio sacroiliaca, L.*)

Articular surface: between auricular surface of sacrum and ilium

Ligaments:

Anterior, posterior and interosseous sacroiliac ligaments.

Type: Plane, amphiarthrosis. Simple. Combined.

Interpubic symphyses (*Symphysis pubica, L.*)

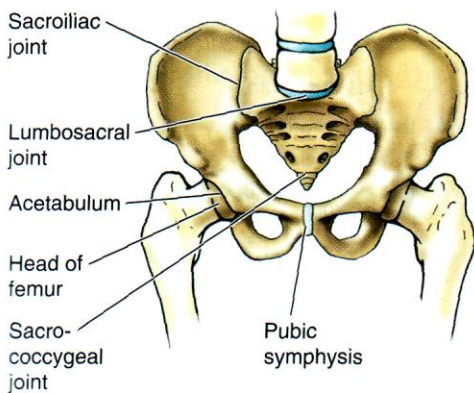
Articular surface: between the pubic bones of opposite sides and fibrocartilage disk between them

Ligaments:

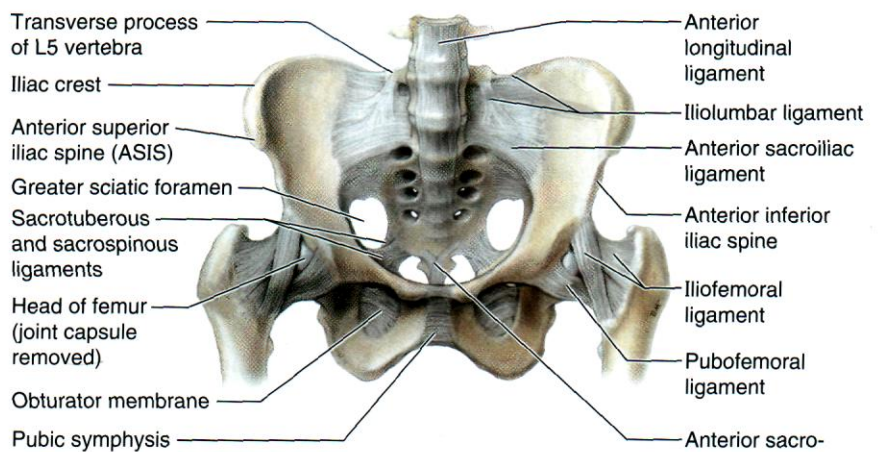
Superior pubic ligament connects bones superiorly.

Arcuate ligament connects bones inferiorly.

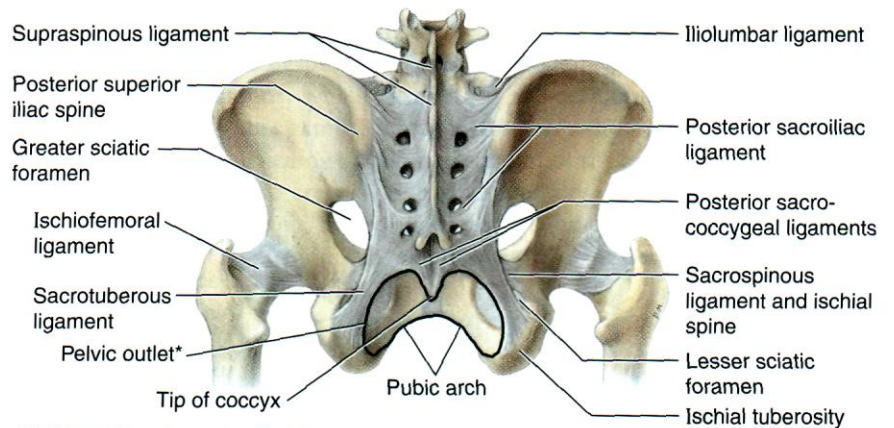
Interpubic ligament.



(A) Anterior view—joints of pelvic girdle



(B) Anterior view—ligaments



(C) Posterior view—ligaments

*Inferior pelvic aperture

Syndesmoses of the pelvis

I. Ligaments between sacrum and ischium –

1. Sacrotuberous ligament from posterior inferior iliac spine, 4th and 5th transverse tubercles and sides of sacrum, and side of coccyx to the inner ischial tuber.
2. Sacrospinous from side of sacrum and coccyx to spine of ischium.

Greater sciatic foramen are situated between margin of great sciatic notch, sacrotuberous ligament and sacrospinous ligament.

Structures passing through or lying in it: piriformis muscle, superior gluteal vessels and nerve, inferior gluteal vessels and nerve, internal pudendal vessels and nerve, sciatic nerve, posterior femoral cutaneous nerve, nerves to obturator internus and quadratus femoris muscles.

Lesser sciatic foramen are situated between margin of ischium, sacrotuberous ligament and sacrospinous ligament.

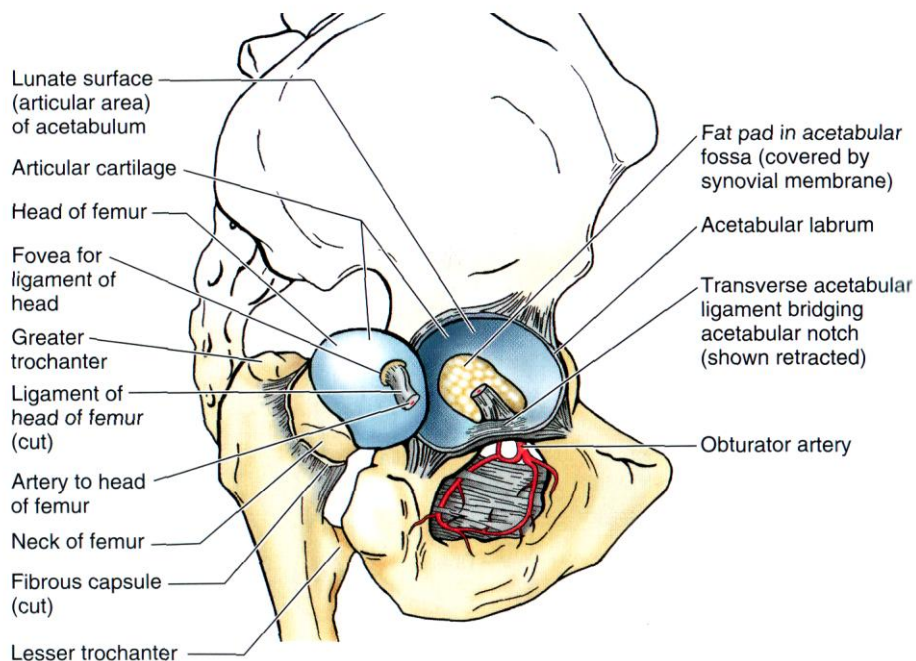
Structures passing through: tendon of obturator internus muscle, nerve to obturator internus muscle, internal pudendal vessels and nerve.

II. Obturator membrane closes obturator foramen, except margo of obturatorial groove, where membrane form obturator canal for nerve and vessels.

Joints of the free lower limb

Hip Joint (*Articulatio coxae, L.*)

Articular surface of: head of femur and lunate surface of acetabulum of hip bone. Acetabular labrum (glenoid labrum) deepens acetabulum, helps to hold head of femur. Articular capsule extends from margin of acetabulum to the intertrochanteric crest and line. Zona orbicularis: band of circularly arranged fibers in capsule. Ligamentum capitis femoris from acetabular notch and transverse ligament to fovea of femur; little function as ligament but guides artery to head of femur. Synovial membrane lines articular capsule. Covers labrum, ligamentum teres, neck of femur, from the attachment of capsule, below, to the articular cartilage of head of femur.



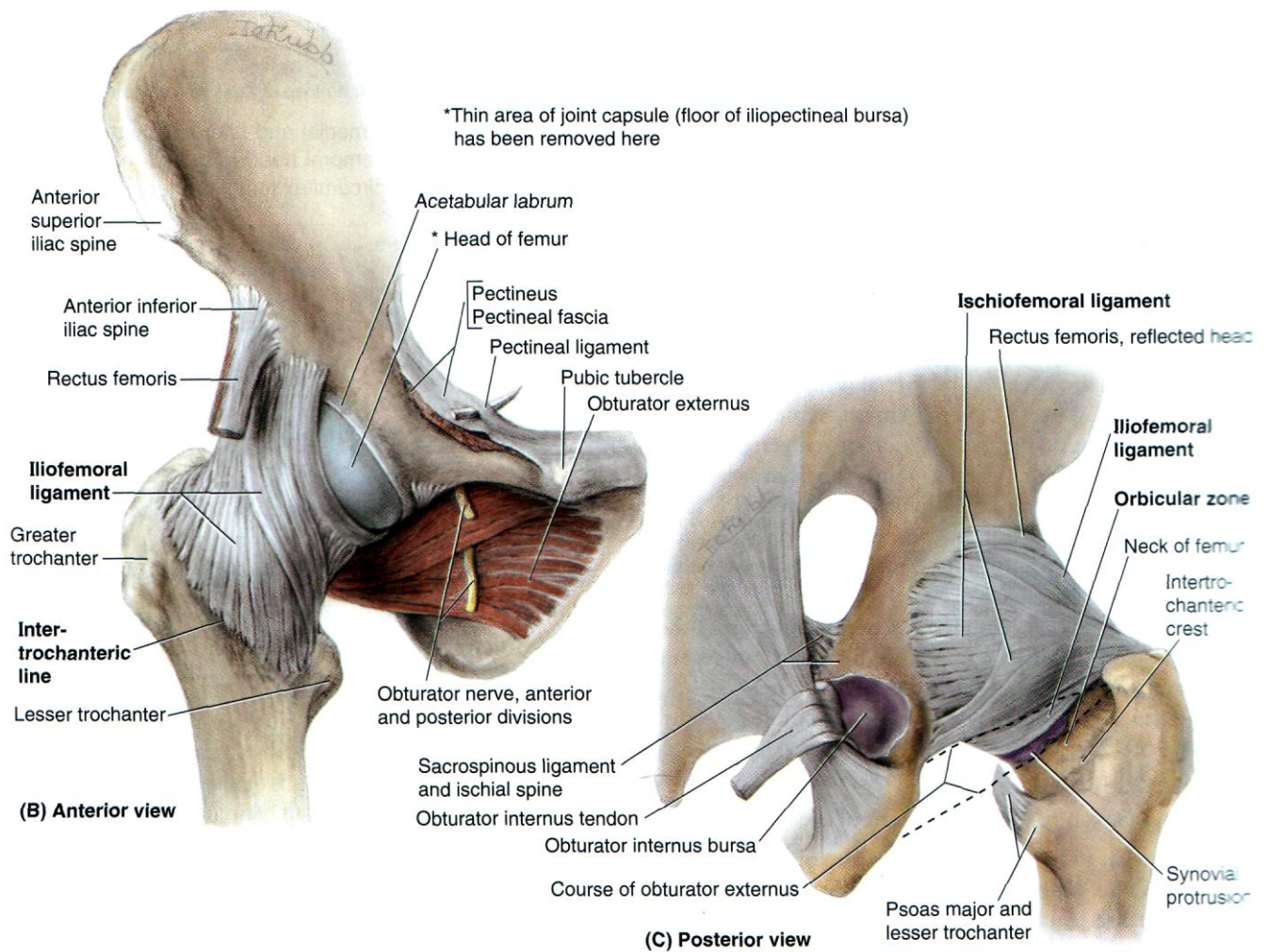
Ligaments:

- a) Transverse acetabular completes notch of acetabulum.

- b) Iliofemoral (Y-shaped ligament of Bigelow): from anterior inferior iliac spine to intertrochanteric line, prevents overextension, abduction, and lateral rotation.
- c) Ischiofemoral: from ischium behind the acetabulum to blend with the capsule, checks medial rotation.
- d) Pubofemoral: from superior pubic ramus, joins iliofemoral ligament, checks abduction.

Type: Ball and socket. Simple. Complex.

Movements: flexion, extension, abduction, adduction, lateral (external) rotation, and medial (internal) rotation.



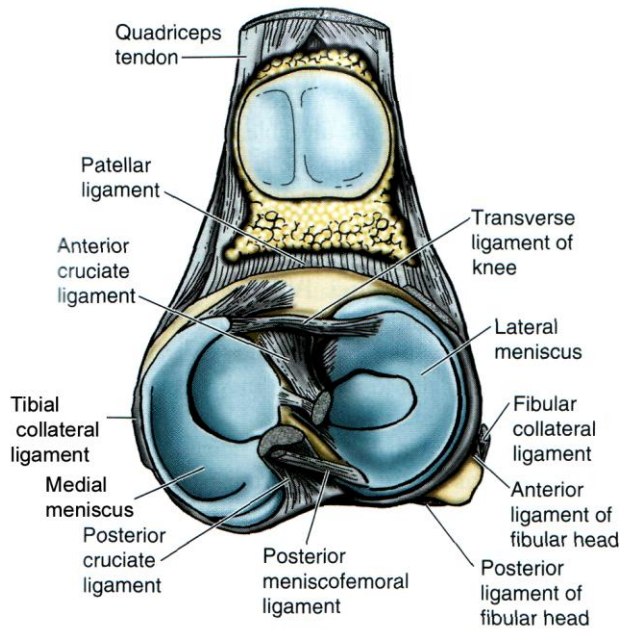
Knee Joint (*Articulatio genus, L.*)

Articular surface of: medial and lateral condyles of femur, medial and lateral condyles of tibia; patella.

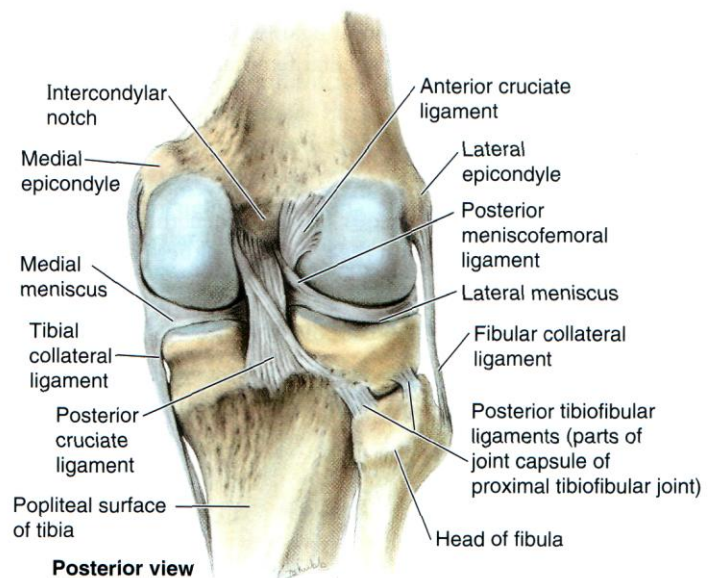
Knee-joint has lateral and medial meniscus. Synovial membrane lines articular capsule. Covers articular surface and forms villi synovialis, plica synovialis. The bigger plica is alaris plica.

Lateral meniscus: nearly circular; attached to tibia in front of anterior cruciate ligament, blending with latter; posteriorly attached behind intercondylar eminence in front of medial meniscus. Through the anterior menisiofemoral and posterior menisiofemoral (ligament of Wrisberg) ligaments, it is attached to medial femoral condyle. Deepens lateral tibial condyle.

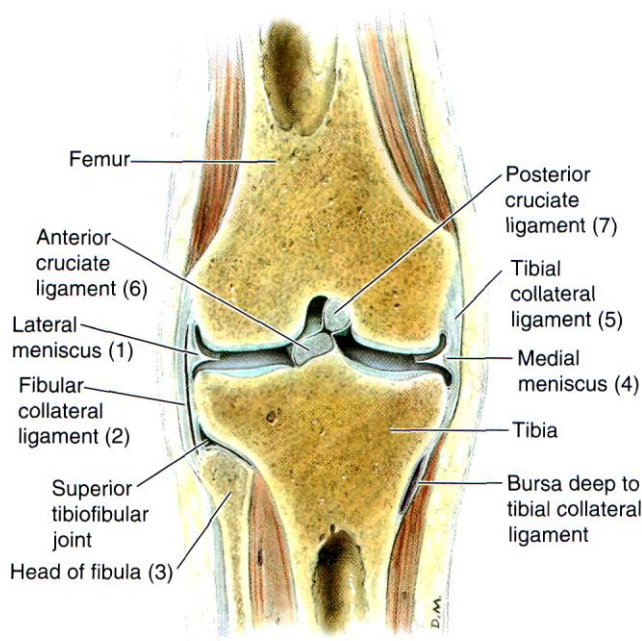
Medial meniscus: crescent-shaped (oval); attached to tibia in front of anterior cruciate ligament and in posterior intercondylar fossa. Deepens medial tibial condyle.



Superior view



Posterior view



Anterior view of coronal section of right knee

Ligaments:

1. Intercapsular:

- a) Transverse: interconnects anterior parts of 2 menisci.
- b) Anterior cruciate: from medial back of lateral femoral condyle to front of tibial intercondylar eminence. Checks extension, lateral rotation, and anterior slipping of tibia on femur (or posterior displacement of femur on tibia).
- c) Posterior cruciate: from front and lateral side of medial femoral condyle to posterior intercondylar fossa and posterior end of lateral meniscus. Checks flexion, lateral rotation, and posterior slipping of tibia on femur (or anterior displacement of femur on tibia).
- d) Anterior menisiofemoral ligament: from anterior end of medial meniscus to medial surface of the lateral femoral condyle.
- e) Posterior menisiofemoral ligament from posterior end of lateral meniscus to lateral surface of the medial femoral condyle.

2. Extracapsular

- a) Tibial collateral (medial ligament): from medial side of medial femoral condyle to medial condyle and body of tibia. Prevents lateral bending; checks extension, hyperflexion, and lateral rotation.
- b) Fibular collateral (lateral ligament): from back of lateral femoral condyle to lateral side of head and styloid process of fibula; checks hyperextension; is relaxed in flexion.
- c) Ligamentum patellae: from apex of patella to tuberosity of tibia. Helps hold patella in place; serves as part of tendon of quadriceps muscle.
- d) Oblique popliteal: from lateral femur, over condyles to posterior head of tibia. Checks extension.
- f) Arcuate popliteal: from lateral condyle of femur to styloid process of fibula. May check medial rotation of leg.

Bursae of Knee: usually named according to immediately adjacent structures (as tendons, etc.)

- (1) Subcutaneous prepatellar bursa, between front of patella and skin;
- (2) suprapatellar or quadriceps bursa, between front of femur and quadriceps femoris m. (generally communicates with joint cavity);
- (3) deep infrapatellar bursa, between patellar ligament and upper tibia;
- (4) subcutaneous bursa, between tibial tuberosity and skin.

Type: Bycondilar. Complicated. Complex.

Movements: flexion and extension; slight rotation when leg is flexed.

Joints between bones of leg:

Tibiofibular joint (proximal) (*Articulatio tibiofibularis, L.*). Diarthrosis.

Articular surfaces of: head of fibula and fibular facet, below lateral condyle of tibia

Articular capsule surrounds joint

Ligaments: anterior and posterior capitular

Type: Plane. Simple.

Movements: limited gliding.

Interosseous membrane. Syndesmoses.

Between interosteal margin of tibia and of fibula.

Function: holds shaft together, strengthens fibula, for muscle attachments.

Tibiofibular syndesmoses (*Syndesmosis tibiofibularis*).

Bones elements: fibular notch of tibia and lateral malleolus of fibula

Movements are absent.

Ligaments: anterior and posterior tibiofibular.

Ankle joint (talocrural) (Articulatio talocruralis, L).

Articular surfaces of: medial malleolus of tibia, lateral malleolus of fibula, and talus.

Articular capsule surrounds joint.

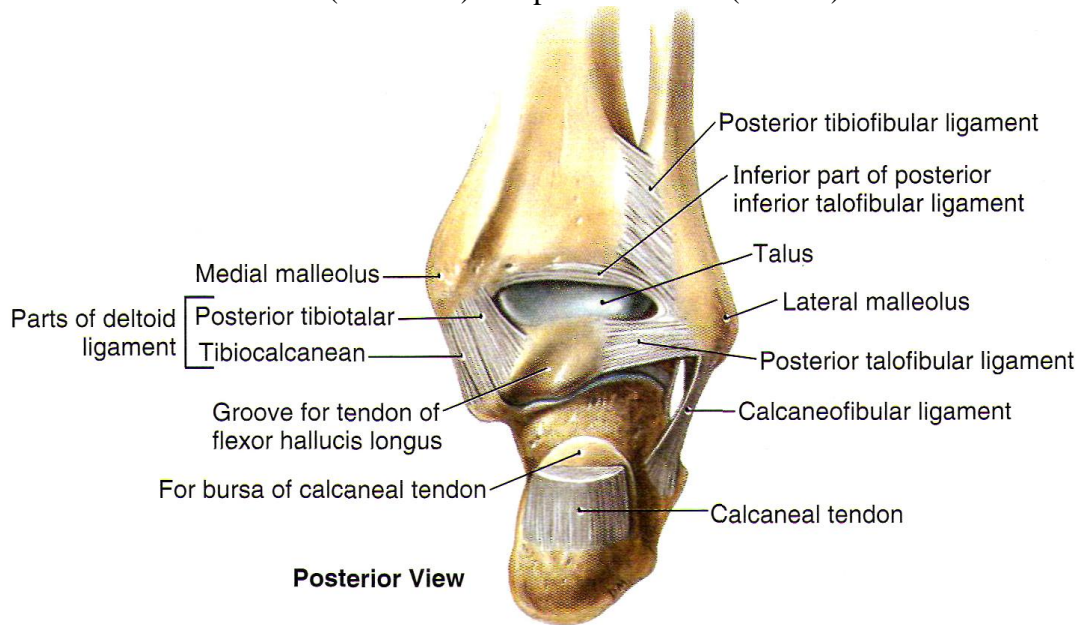
Ligaments:

Medial (deltoid) consists of 4 ligaments—the anterior and posterior tibiotalar, the tibionavicular, and the tibiocalcaneal. The anterior and posterior fibers check plantar and dorsiflexion, respectively. The anterior fibers also limit abduction.

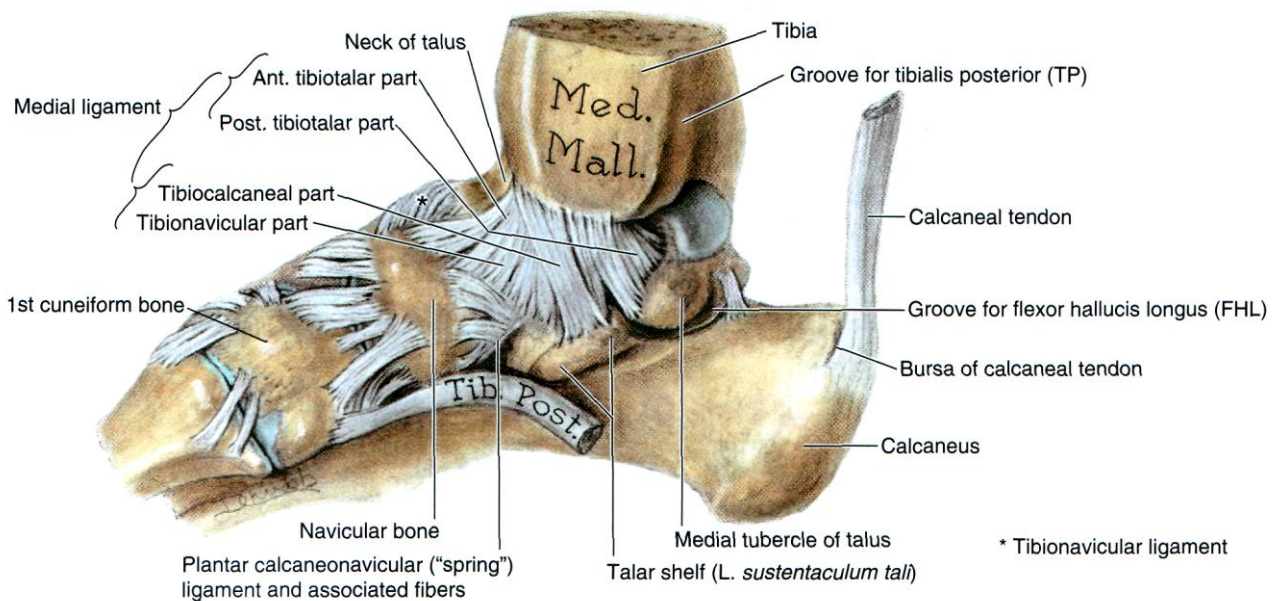
Lateral ligaments: the anterior and posterior talofibular and calcaneofibular.

Type: Ginglymus (hinge). Complicated.

Movements: dorsoflexion (extension) and plantar flexion (flexion).



Structure of medial ligament (lateral view)



Subtalar (talocalcaneal) joint (*Articulatio talocalcanea, L*).

Articular surfaces of: talus and calcaneus.

Ligaments: anterior, posterior, medial, and lateral talocalcaneal.

Interosseous talocalcaneal.

Type: Pivot.Simple.

Movements: limited rotation.

Talocalcaneonavicular joint

(*Articulatio talocalcaneonavicularis, L*).

Articular surfaces of: talus, navicular, and calcaneus

Articular capsule surrounds joint.

Ligaments:

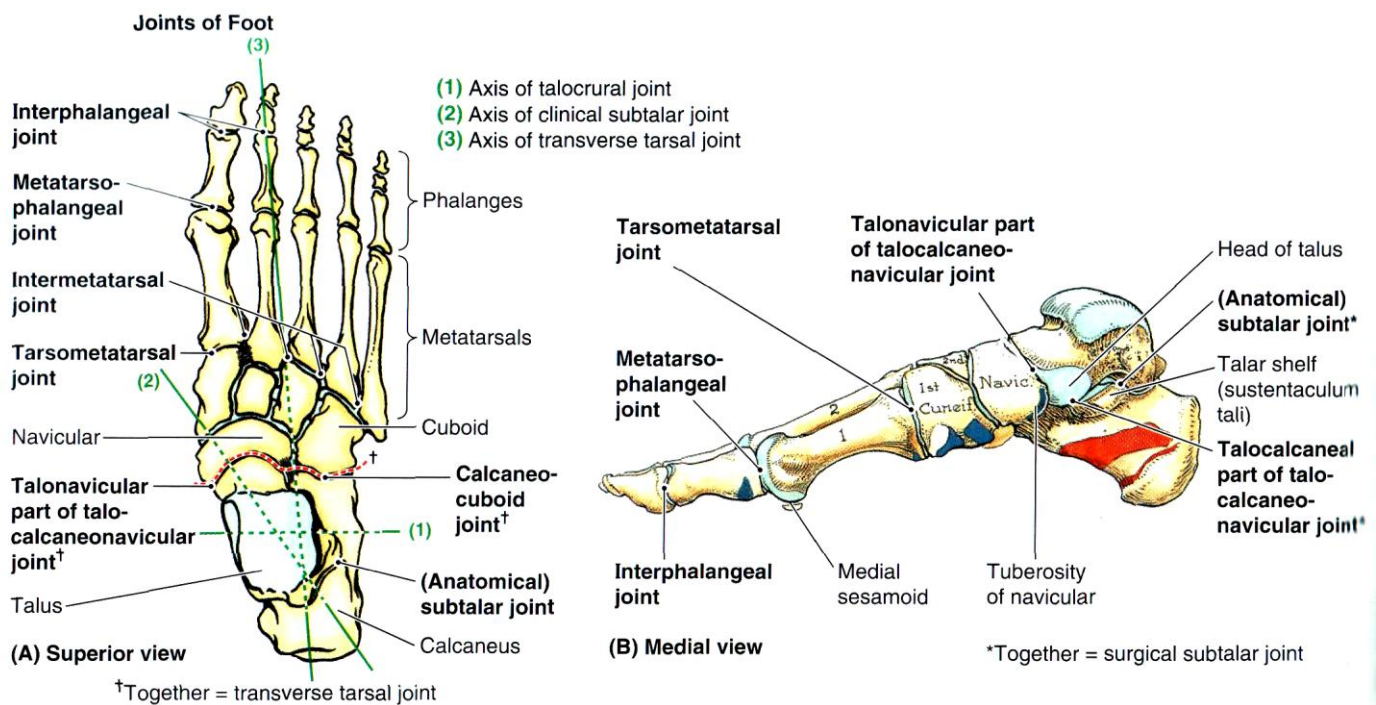
Dorsal talonavicular.

Plantar calcaneonavicular supports the head of the talus (spring ligament).

Interosseous talocalcaneal.

Type: Spheroidal. Complicated. Combined with talocalcaneal.

Movements: gliding and some rotation.



Calcaneocuboid joint (*Articulatio calcaneocuboideum, L*)

Articular surfaces of: cuboid and calcaneus.

Articular capsule surrounds joint.

Ligaments: Dorsal and plantar calcaneocuboid. Long plantar.

Type: Sellar.Simple. Combined with talocalcaneal and talocalcaneonavicular joints.

Movements: gliding and slight rotation.

Transversal tarsal joint (*Articulatio tarsi transversa, L*)

Shopar's joint consist of: **Calcaneocuboid and Talonavicular joints.**

Articular surfaces of this joints form S-shaped transversal line of foot.

Ligament (key) of joint is bifurcated ligament: from the calcaneus to the cuboid and navicular.

Movements are limited.

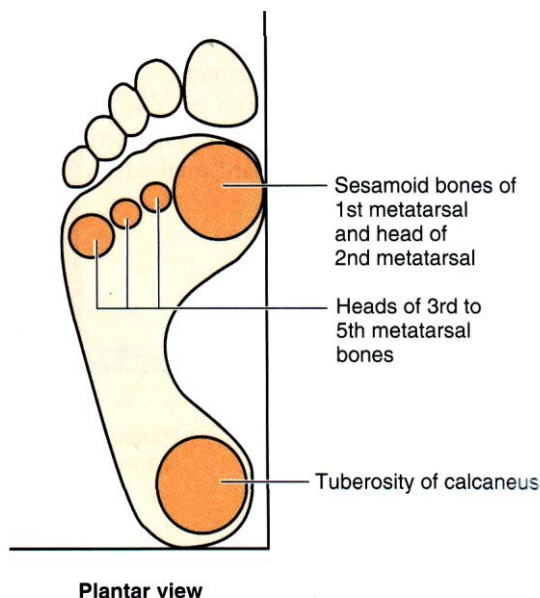
Tarsometatarsal joints (*Articulatio tarsometatarsales, L*), (Lisfrank's joint) between the bases of the metatarsals, the 3 cuneiforms, and the cuboid. Are complicated with slight gliding movements. Each has dorsal, plantar, and interosseous ligaments.

Metatarsophalangeal joints (*Articulatio metatarsophalangeae, L*) between the heads of the metatarsals and the bases of the proximal phalanges. Are simple, condyloid joints, permitting flexion, extension, abduction, and adduction. Each has plantar and 2 collateral ligaments.

Interphalangeal joints (*Articulatio interphalangea pedis,)L* between bases and heads of adjoining phalanges. Are simple, ginglymus joints permitting flexion and extension. Each has plantar and collateral ligaments. The extensor aponeurosis acts as dorsal ligaments.

Arches of the Foot

If the feet were more rigid structures, each impact with the ground would generate extremely large forces of short duration (shocks) that would be propagated through the skeletal system. Because the foot is composed of numerous bones connected by ligaments, it has considerable flexibility that allows it to deform with each ground contact, thereby absorbing much of the shock. Furthermore, the tarsal and metatarsal bones are arranged in longitudinal and transverse arches passively supported and actively restrained by flexible tendons that add to the weight-bearing capabilities and resiliency of the foot. Thus much smaller forces of longer duration are transmitted through the skeletal system.



The arches distribute weight over the pedal platform (foot), acting not only as shock absorbers but also as springboards for propelling it during walking, running, and jumping. The resilient arches add to the foot's ability to adapt to changes in surface contour. The weight of the body is transmitted to the talus from the tibia. Then it is transmitted posteriorly to the calcaneus and anteriorly to the "ball of the foot" (the sesamoids of the 1st metatarsal and the head of the 2nd metatarsal), and that weight/pressure is shared laterally with the heads of the 3rd-5th metatarsals as necessary for balance and comfort. Between these weight-bearing points are the relatively elastic arches of the foot,

which become slightly flattened by body weight during standing. They normally resume their curvature (recoil) when body weight is removed.

The longitudinal arch of the foot is composed of medial and lateral parts. Functionally, both parts act as a unit with the transverse arch of the foot, spreading the weight in all directions. The medial longitudinal arch is higher and more important than the lateral longitudinal arch. The medial longitudinal arch is composed of the calcaneus, talus, navicular, three cuneiforms, and three metatarsals. *The talar head is the keystone of the medial longitudinal arch.* The tibialis anterior, attaching to the 1st metatarsal and medial cuneiform, helps strengthen the medial longitudinal arch. The fibularis longus tendon, pass lateral to medial, also helps support this arch. The *lateral longitudinal arch* is much flatter than the medial part of the arch and rests on the ground during standing. It is made up of the calcaneus, cuboid, and lateral two metatarsals.

The transverse arch of the foot runs from side to side. It is formed by the cuboid, cuneiforms, and bases of the metatarsals. The medial and lateral parts of the longitudinal arch serve as pillars for the transverse arch. The tendons of the fibularis longus and tibialis posterior, crossing union sole of the foot like a stirrup, help maintain curvature of the transverse arch. The integrity of the head

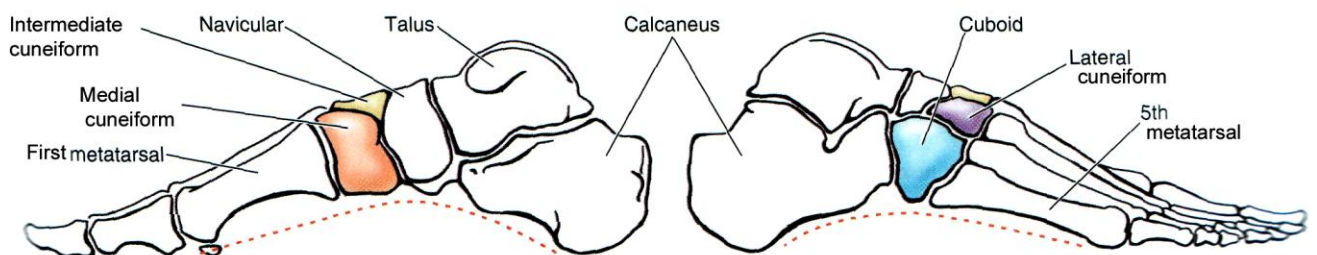
arches of the foot is maintained by both passive factors and dynamic supports.

Passive factors involved in forming and maintaining the arches of the foot include

The shape of the united bones (both arches, but especially the transverse arch).

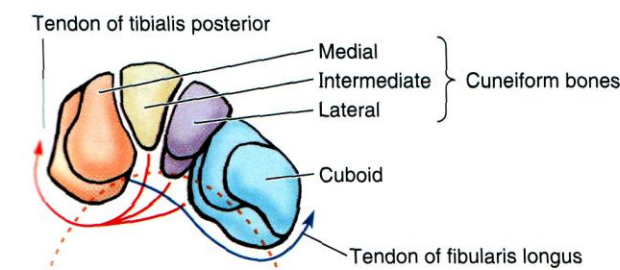
Four successive layers of fibrous tissue that bowstring the longitudinal arch (superficial to deep):

1. Plantar aponeurosis.
2. Long plantar ligament.
3. Plantar calcaneocuboid (short plantar) ligament.
4. Plantar calcaneonavicular (spring) ligament.

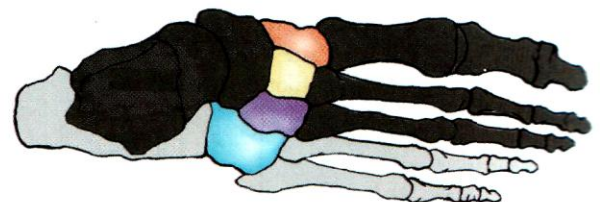


(A) Medial longitudinal arch (medial view)

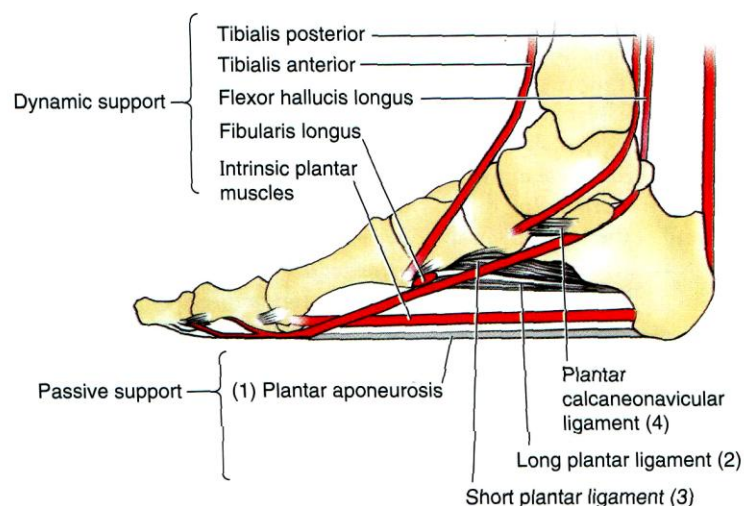
(B) Lateral longitudinal arch (lateral view)



(C) Transverse arch (anterior view)



(D) Superior view



(E) Medial longitudinal arch (medial view)

Dynamic supports involved in maintaining the arches of the foot include

- Active (reflexive) bracing action of intrinsic muscles of foot (longitudinal arch).
- Active and tonic contraction of muscles with long tendons extending into foot:
 - Flexors hallucis and digitorum longus for the longitudinal arch.
 - Fibularis longus and tibialis posterior for the transverse arch.

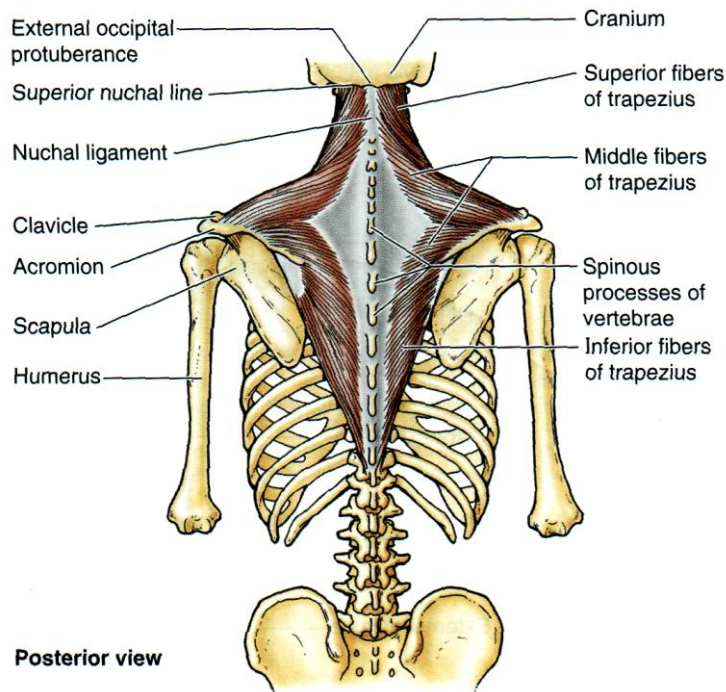
Of these factors, the plantar ligaments and the plantar aponeurosis bear the greatest stress and are most important in maintaining the arches of the foot.

MYOLOGY

Muscles of the back

There are many muscles in the back, some of them being formed by autochthonous muscles that originate from the dorsal parts of the trunk myotomes. They are covered by muscles which are displaced to the back from the head (visceral muscles) and upper limbs (truncopetal muscles). As a result the muscles of the back are arranged in two layers, the superficial and the deep layers.

A. Superficial muscles

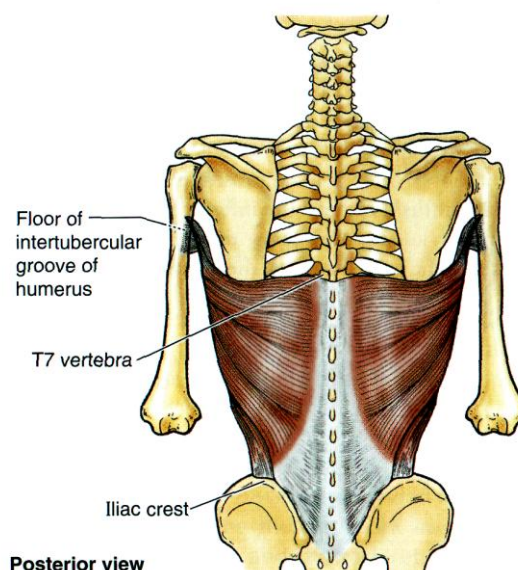


Trapezius (*m. trapezius, L.*) arises from the medial third of the superior nuchal line (directly adjacent to the sternocleidomastoid), and from the spines of the cervical and thoracic vertebrae, the lateral directly but the former via the ligamentum nuchae owing to the backward facing concavity of the cervical vertebrae. It is inserted in to the spine of the scapula, the lateral surface of the acromion and the lateral third of the clavicle above the origion of deltoid. Owing to its widespread attachments, its action is complicated. By means of its attachment to the skull, trapezius can extend the head as in looking upwards. Acting in the opposite direction, the muscle can shrug the

shoulders (the standard clinical test for the integrity of the spinal accessory nerve), and the tone in the trapezius muscles is responsible for maintaining the position of the shoulders, especially when carrying heavy weights. Together, the two muscles (left and right) brace the shoulders back, and they are also important fixator muscles for the scapula when other muscles such as the deltoid are acting on the humerus. The muscle also helps in rotating the scapula during abduction of the upper limb. The upper fibres will elevate the tip of the shoulder while the lower fibres depress the medial end of the scapular spine. The couple thus produced will rotate the scapula to turn the glenoid upwards,

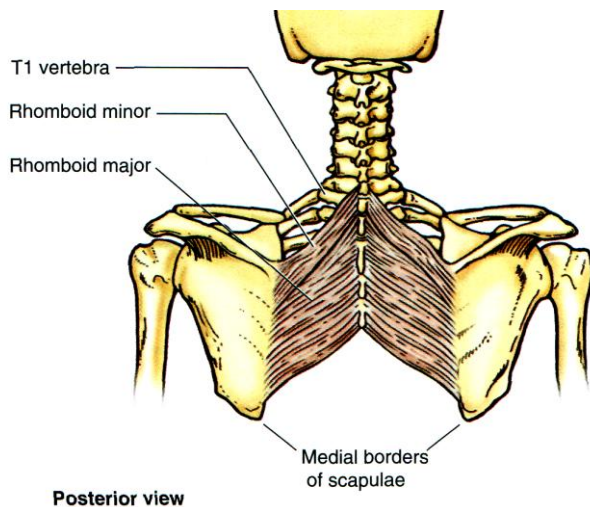
Latissimus dorsi (*m. latissimus dorsi, L.*)

This is an extensive flat muscle that connects the trunk to the humerus. Its origin overlaps that of trapezius by six-spines, i.e. it arises from the lower six thoracic spines (deep to trapezius) and continues downwards to be attached to the lumbar spines via the thoracolumbar fascia.



It continues even further by being attached to the medial part of the iliac crest.

The fibres converge to form a very strong tendon that is inserted into the floor of the intertubercular sulcus. The upper border loops across the inferior angle of the scapula, holding it in a 'waistcoat pocket', while its lowermost fibres pass up the side of the abdomen and chest as a free border that can be nicely seen during a cough. Acting as a prime mover, latissimus dorsi is a powerful adductor and medial rotator of the humerus and it can extend the previously flexed arm.

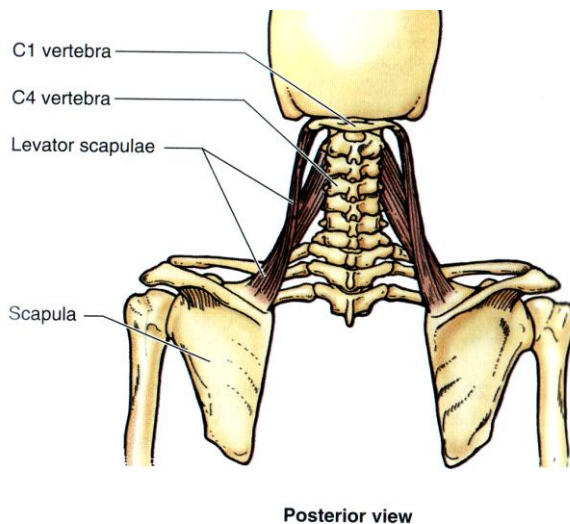


Rhomboids (*mm. rhomboideus major and minor, L.*)

These are two flat muscles that form a continuous sheet passing from the spines of lower cervical and upper thoracic vertebra to the medial border of the scapula. They brace the scapula back.

Levator scapulae (*m. levator scapulae, L.*)

This arises from the transverse processes of the upper cervical vertebrae and is attached to the medial border of the scapula above the spine and superior angle of the scapula. It elevates the scapula as in shrugging the shoulders.



Movements of the scapula and clavicle

The scapula is an extremely mobile bone, being held in place only by muscles. Its movements are closely associated with those of the upper limb and of the clavicle. The chief function of the clavicle is to act as a prop, holding out the scapula and therefore the upper limb, from the trunk. The coracoclavicular ligament is the main bond between the bones, so when the clavicle is fractured medial to this ligament, the prop action is lost, the patient holds up his arm

with the other hand and the broken ends of the bone usually overlap.

The movements of the scapula are as follows:

Elevation and depression

The whole scapula can be elevated, carrying the lateral end of the clavicle with it, as in shrugging the shoulders. Muscles responsible: trapezius and levator scapulae for elevation; pectoralis major and minor (plus gravity) for depression.

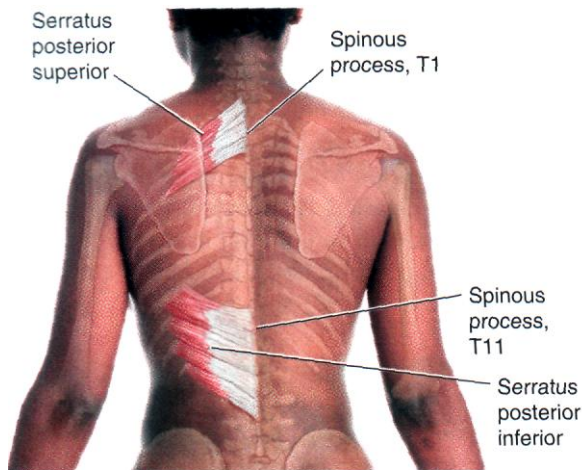
Protraction and retraction

Protraction involves the movement of the scapula forwards around the chest wall and is carried out by serratus anterior and pectoralis minor. Retraction results in bracing the shoulders back and is done by rhomboids and middle fibres of trapezius.

Rotation

The scapula can rotate so that the glenoid points upwards or downwards. The former movement is carried out by the lower fibres of serratus anterior and the upper and lower fibres of trapezius acting as a couple. The opposite movements is usually carried out by gravity but pectoral minor, levator scapulae and the rhomboids can assist.

The **serratus posterior superior and inferior muscles** attached to the ribs are in the third layer of the superficial muscles of the back. They have the shape of two thin plates and are called the posterior serratus muscles.



Serratus posterior superior muscle

(*m. serratus posterior superior, L.*) lies in the upper part of the back under the rhomboid muscle. It originates from the spinous processes of the lower two cervical and upper two thoracic vertebrae, runs obliquely downward and laterally, and is inserted by four slips into the posterior surfaces of the second to fifth ribs laterally of their angles.

Serratus posterior inferior muscle

(*m. serratus posterior inferior, L.*) lies in the same plane as the superior muscle, but its fibres run in the opposite direction.

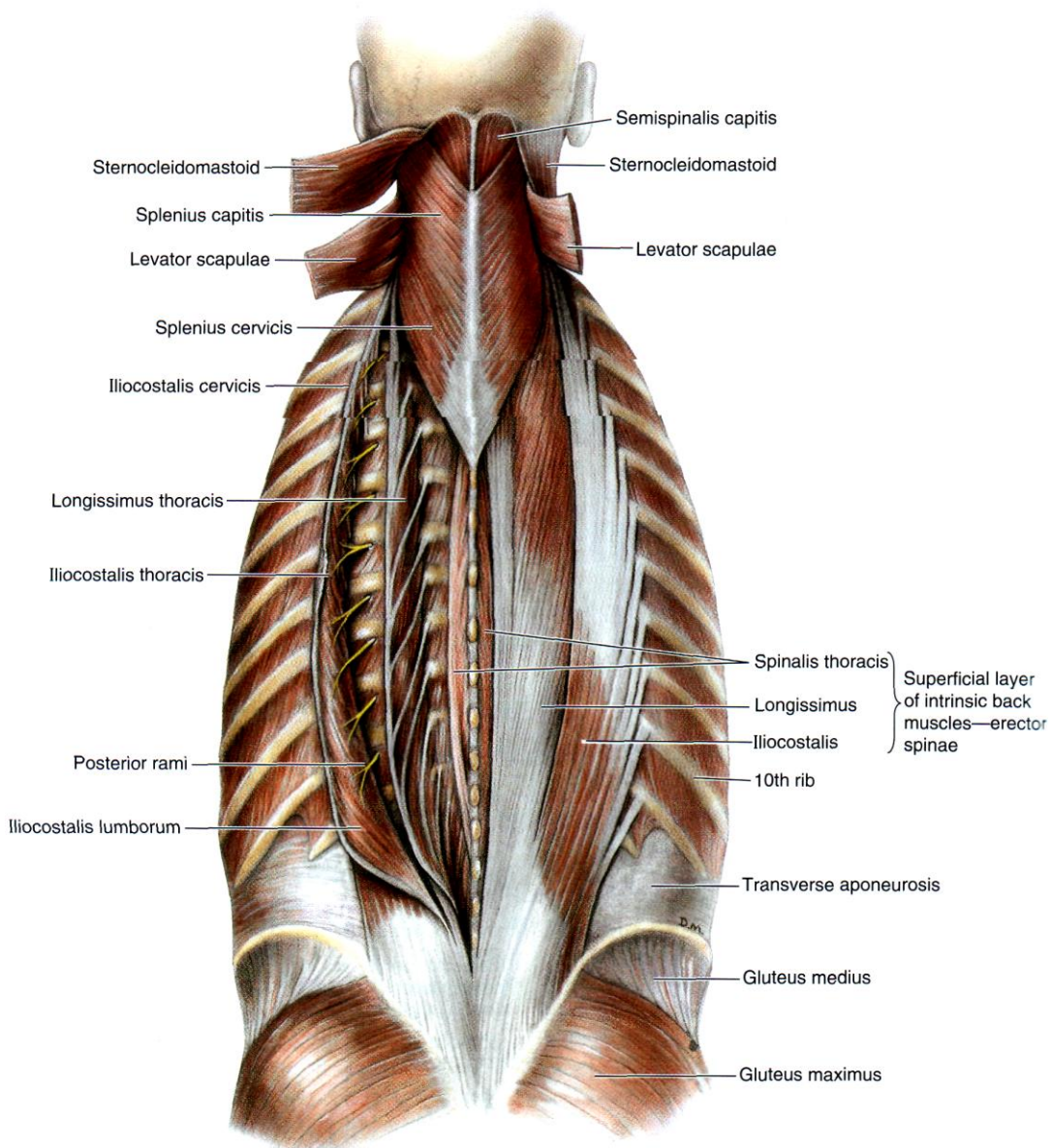
Originating from the thoracolumbal fascia in the region of the spinous processes of the lower two thoracic and upper two lumbar vertebrae, it is inserted by four slips into the posterior surfaces of the ninth to twelfth ribs.

Superficial muscles of the back

Name of muscle	Origin	Insertion	Action
Trapezius	Occipital bone, ligamentum nuchae, spines of all thoracic vertebrae	Upper fibers into lateral third of clavicle, middle fibers and lower fibers into spine of scapula	medially, lower fibers pull
Latissimus dorsi	Iliac crest, lumbar fascia, spines of Th6-12, lower three or four ribs, inferior angle of scapula	Floor of bicipital groove of humerus	medial border of scapula downward
Levator scapulae	Transverse process of C1-4	Medial border of scapula (above the spine and superior angle)	Extends, adducts, and medially rotates the arm
Rhomboid minor	Ligamentum nuchae and C1-7, Th1	Medial border of scapula	Raises medial border of scapula
Rhomboid major	Spines of Th2-5	Medial border of scapula	Raises medial border of scapula
Serratus posterior superior	Spinous processes of C6-7 and Th1-2	Posterior surfaces of the second to fifth ribs laterally of their angles	Raises the ribs
Serratus posterior inferior muscle	Thoracolumbal fascia, spinous processes of Th11-12 and upper L1-4	Posterior surfaces of the ninth to twelfth ribs	Pulls the lower ribs downwards

B. Deep muscles of the back

The autochthonous muscles of the back form on each side two longitudinal (lateral and medial) muscular tracts which are lodged in the groove between the vertebral spinous and transverse processes and the angles of the ribs. In the deep parts, nearest to the skeleton, they are made up of short muscles arranged in segments between the vertebrae (medial tract); the long muscles are closer to the surface (lateral tract). In addition the splenius muscle covers both tracts in the posterior cervical region.



The splenius capitis and splenius cervicis muscles (*m. splenius capitis* and *m. splenius cervicis*, *L.*) originate from the spinous processes of the lower five cervical and upper six thoracic vertebrae, run upward and laterally, after which the splenius muscle of the head is inserted into the lateral half of the superior nuchal line and the mastoid process, while the splenius muscle of the neck is inserted into the transverse processes of the second and third cervical vertebrae.

Action. In contraction of one muscle the head turns in its direction; bilateral contraction bends the head and neck backwards.

The lateral tract

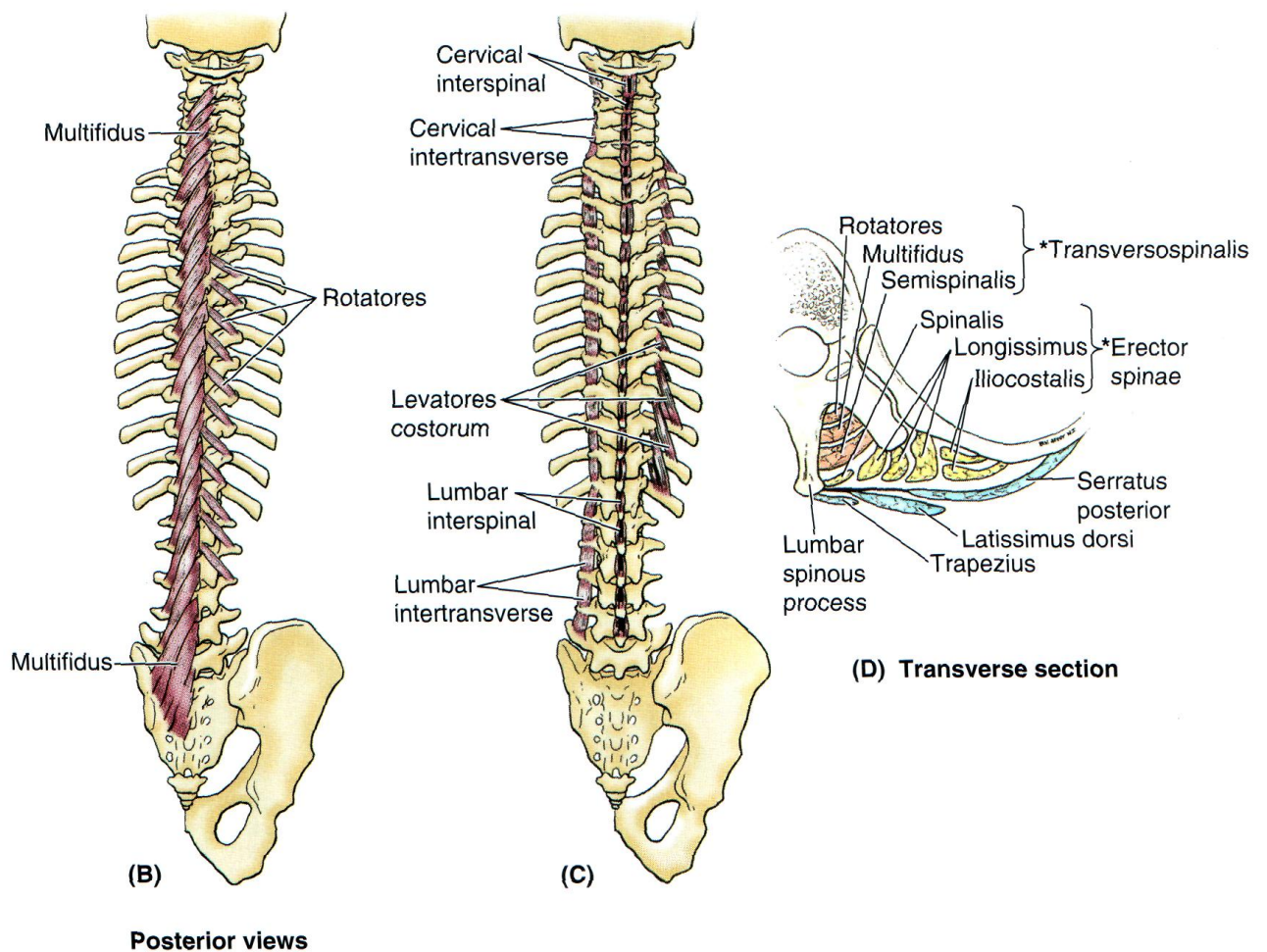
Erector spine muscle (*m. erector spinae*: *m. iliocostalis*, *m. longissimus*, *m. spinalis*, L.)

The characteristic feature of this tract is the attachment of muscles to the vertebral transverse processes and the ribs or to their rudiments.

The medial tract

Transversospinal muscle (*m. transversospinalis*: *m. semispinalis*, *mm. multifidi*, *mm. rotatores*, L.) **and Interspinal muscle** (*mm. interspinales*, L.).

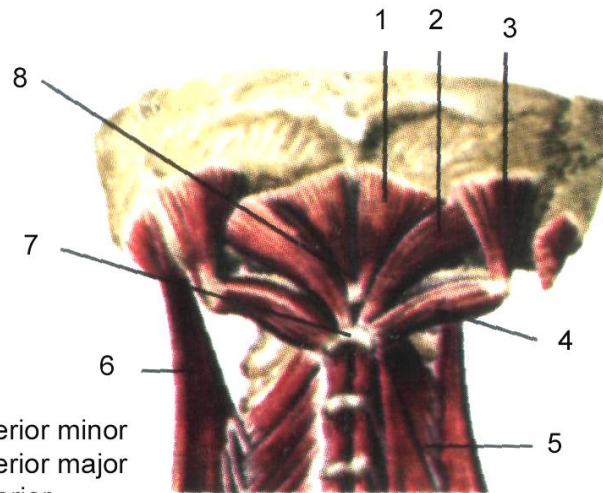
The muscles of this tract lie under the lateral tract and consist of separate bundles running obliquely from the transverse processes of one vertebra to the spinous processes of the contiguous vertebra above. Because of this they are known by the common name of transversospinalis muscle. They extend from the sacrum to the occipital bone in three layers that are distinguished by their depth and by the number of vertebrae they overlap.



Muscles of suboccipital region

In the most mobile part of the spine, in its articulation with the occipital bone, *m. transversospinalis* is particularly well developed and is made up of four paired muscles, two oblique and two straight muscles lying to the back of the atlanto-occipital joint under *m. semispinalis* and *m. longissimus*.

The oblique muscles differ from one another in location and are divided into the superior and inferior muscles. The **obliquus capitis superior muscle** (*m. obliquus capitis superior, L.*) stretches from the transverse process of the atlas to the inferior nuchal line. The **obliquus capitis inferior muscle** (*m. obliquus capitis inferior, L.*) passes from the spinous process of the second cervical vertebra to the transverse process of the first cervical vertebra.



- 1 - Rectus capitis posterior minor
- 2 - Rectus capitis posterior major
- 3 - Oblique capitis superior
- 4 - Oblique capitis inferior
- 5 - Semispinalis cervicis
- 6 - Longissimus capitis
- 7 - Spinous process of C II
- 8 - Posterior tubercle of atlas

The straight muscles are distinguished by their length and are divided into the greater and lesser muscles. The **greater** (*m. rectus capitis posterior major, L.*) passes from the spinous process of the second cervical vertebra to the inferior nuchal line. The **lesser** (*m. rectus capitis posterior minor, L.*) stretches to the same line from the posterior tubercle of the first cervical vertebra. These muscles exert their action on the atlanto-occipital and atlanto-axial joints. Contraction of the muscles on one side contributes to turning of the head to the corresponding side. Bilateral contraction pulls the head backward.

Deep muscles of the back

Name	Origin	Insertion	Action
Splenius capitis	Lig. nuchae, spinous processes of C1, Th1-3	Lat. part of occipital bone, mastoid of temporal bone	Draws head back, bends head laterally, rotates face to same side
Splenius cervicis	Spinous processes of Th3-6	Trans. proc. C1-3	
The lateral tract Erector spinae			
1. Iliocostalis lumborum thoracis cervicis	Sacrum, iliac crest, spinous processes of T11-L5 Upper borders of angles of lower 6 ribs Angles of ribs 3-6	Angles, lower six ribs Lower borders of upper six ribs, transversal processes of C7 Transversal processes of. C4-6	<u>Same for all:</u> 1. <u>bilateral</u> Extension of vertebral column, retention of erect posture, stabilization of vertebral column during flexion, acting in contrast to abdominal muscles and the action of gravity; 2. <u>unilateral</u> Bend column to one side, depress ribs Extends head, bends head to side, rotates face to same side
2. Longissimus thoracis cervicis capitis	Sacrum, iliac crest, spinous processes of T11-L5 Transversal processes of T1-5 Transversal processes of T1-3 and C3-7	Trans. proc. lumbar and thoracic vertebrae, lower 10 ribs Transversal processes of C2-6 Posterior aspect of mastoid proc.	
3. Spinalis thoracis cervicis capitis	Spinous processes of L 1-2 and T11-12 Spinous processes of Th 1-2 and C6-7 Spinous processes of lower cervical and upper thoracic vertebrae	Spinous processes of Th1-8 Spinous processes of Th2-4 Between superior and inferior nuchal lines of occipital bone	

The medial tract

Name	Origin	Insertion	Action
Transversospinalis muscle 1. Semispinalis thoracis cervicis capitis	Transversal processes of T7—12 Transversal processes of T1—6 Transversal processes of T1-6 and C4-7	Spinous processes of C4-7 and Th1-4 Spinous processes of C2-5 Between superior and inferior nuchal lines of occipital bone	In general to extend column; contracting of one side extends column to same side. Rotates to opposite side
2. Multifidus cervical part thoracic part lumbar part	Articular processes of C4-7 Transversal processes of T1—12 Posterior surface of sacrum, posterior part of iliac crest, all mammillary processes of lumbar vertebrae	Each muscle crosses 2-4 vertebrae above and attach to spinous processes of spines of vertebrae	Rotates column to same side Assists in extending the column
3. Rotatores	Transversal processes of cervical, thoracic and lumbar vertebrae	Each muscle crosses 1-2 vertebrae above and attach to spinous processes of spines of vertebrae	
Deepest muscles Interspinalis Intertransverse	Spinous processes of each vertebrae Transverse process of each vertebrae	Spinous process next vertebrae above Transverse process next vertebrae above	

Muscles of the suboccipital region

Name of muscle	Origin	Insertion	Action
Rectus capitis posterior major	Spine of axis	Occipital bone	Extension of head
Rectus capitis posterior minor	Posterior arch of atlas	Occipital bone	Extension of head
Obliquus capitis inferior	Spine of axis	Transverse process of atlas	Rotates face to the same side
Obliquus capitis superior	Transverse process of atlas	Occipital bone	Extends head to same side

The action of the complex of the autochthonous muscles of the back consists in holding the trunk erect. The specific features of their insertion by many bundles into many points on the bones ensure the distribution of the muscle force over a large area.

Contraction of all the parts of these muscles on both sides effects general extension of the spine, while contraction of separate parts on one side effects extension between the separate vertebrae. Contraction of these muscles on one side causes lateral flexion of the spine and the trunk together with it to this side. The oblique bundles of the autochthonous muscles accomplish rotation of the spine. The upper parts of the muscles, nearest to the skull, participate in the corresponding places to movements of the head, as pointed out above. The deep muscles of the back also take part in the respiratory excursions. The lower part of the iliocostal muscle lowers the ribs, while its upper part raises them. It should be noted that the erector spine muscle contracts not only in extension of the spine, but also in flexion of the trunk to counteract the backward pull of gravitational force.

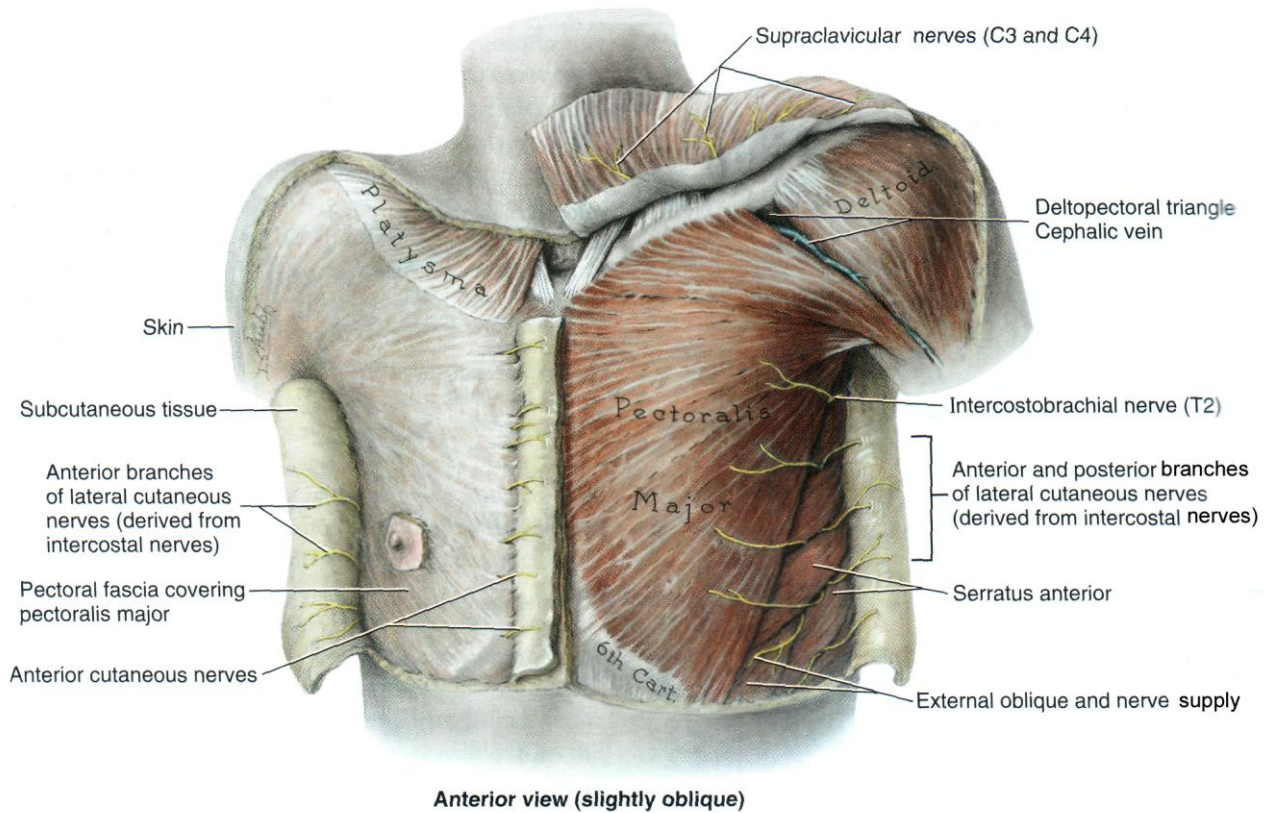
Fasciae of the back

The outer surface of the trapezius and latissimus dorsi muscles is covered with a thin superficial fascia, which thickens in the posterior portion (fascia nuchae, nuchal fascia). In addition, there is another fascia on the back which lies deeper and separates the autochthonous musculature of the back from the muscles lying more superficially. It is called the lumbar fascia (fascia thoracolumbalis), and two layers are distinguished in it, the superficial or posterior, and the deep or anterior layers. The superficial layer stretches from the pelvis to the head. Its upper part in the region of the posterior serratus muscle is thin, but its lower part is very strong where it is continuous with the aponeurosis of the latissimus dorsi muscle; medially it is attached to the spinous processes, laterally it is continuous with the ribs. The deep layer of the lumbar fascia originates from the transverse processes of the lumbar vertebrae and stretches only between the twelfth rib and the iliac crest and is attached to them above and below. Running laterally the deep layer covers the anterior surface of the erector spine and on the lateral border of this muscle merges with the superficial layer. The deep autochthonous muscles are thus invested in a closed osteofibrous sheath, with the initial portion of the erector spine being enclosed in a fibrous sheath.

Muscles of the thorax

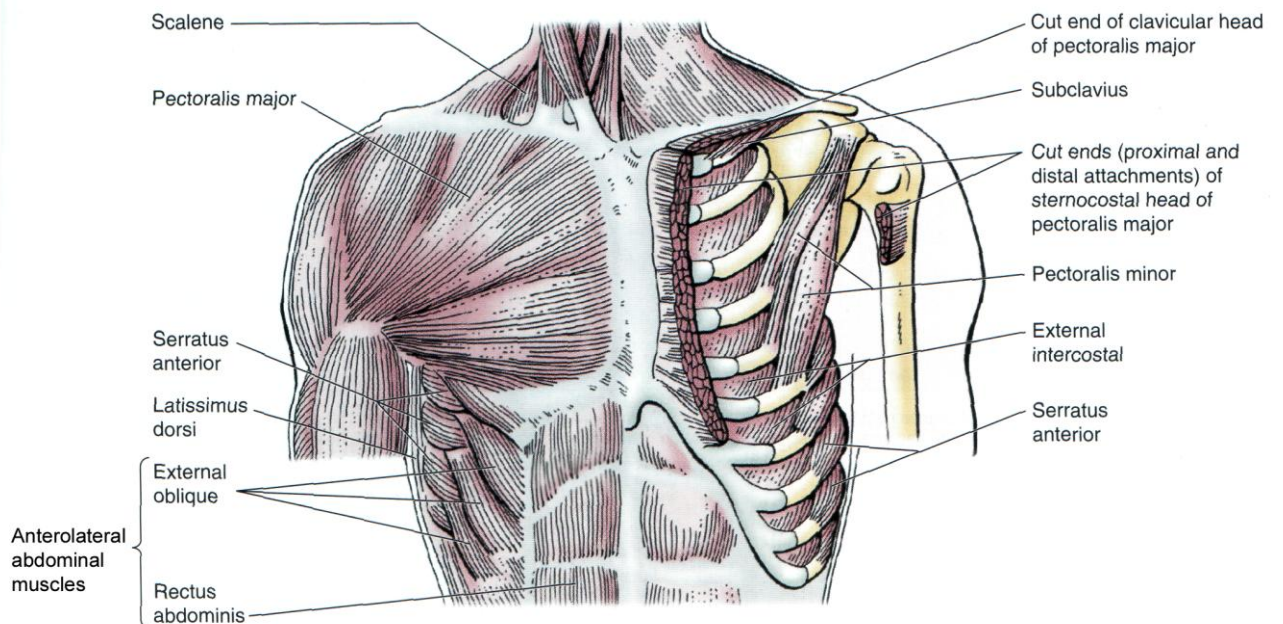
Muscles of the thorax subdivide into superficial and proper (deep) groups.

A. Superficial group

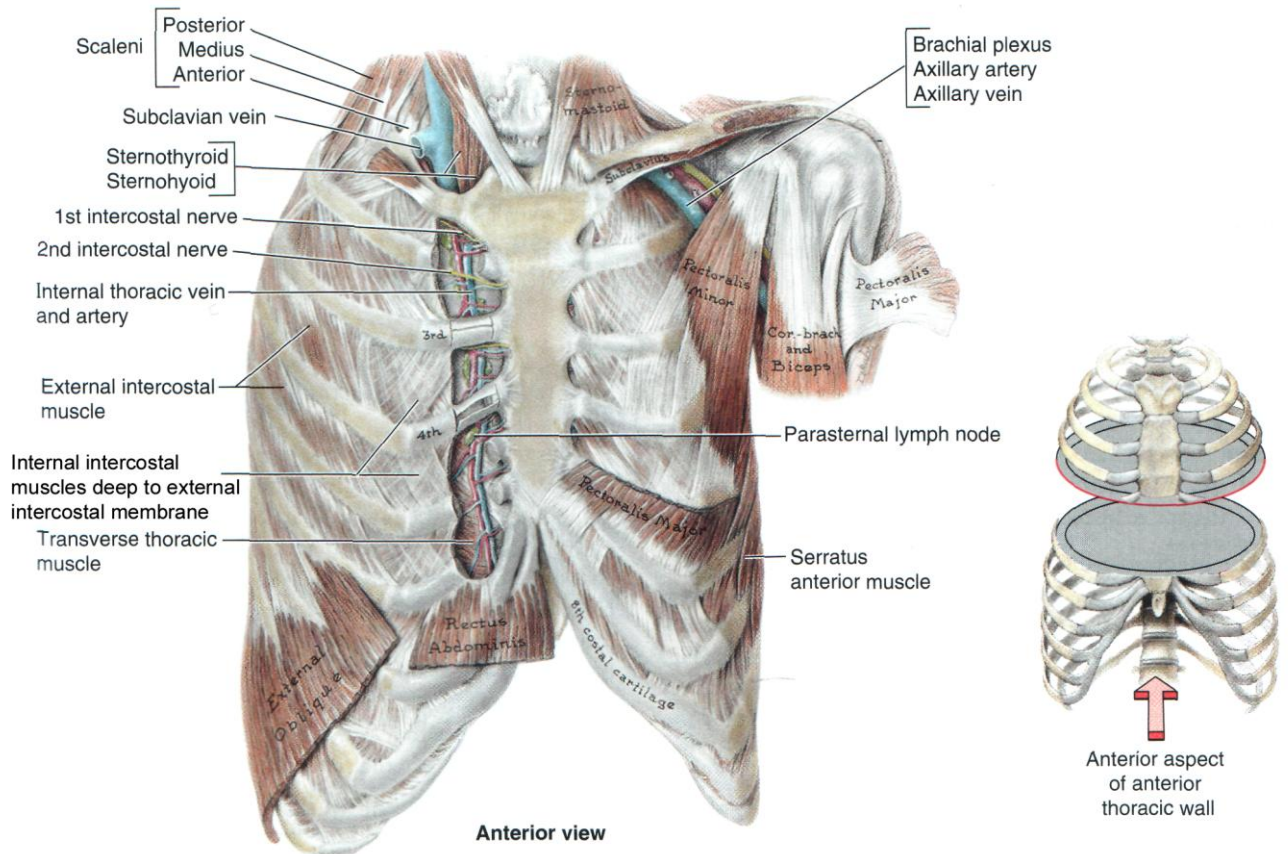


Pectoralis major muscle (*m. pectoralis major, L.*)

This is a large and powerful muscle upon which, in the female, the breast sits. It is attached by means of two heads to the front of the chest. The clavicular head arises from the medial half of the clavicle (opposite the clavicular head of sternocleidomastoid) while the sternocostal head is attached to the anterior surface of the sternum almost up in the midline and to the upper six costal cartilages. The muscle fibres converge to be inserted into the prominent lateral lip of the intertubercular sulcus. The upper (clavicular) fibres fold under the



sternocostal fibres to form a thick bilaminar tendon so that the anterior wall of the axilla feels thick right up to its insertion. Pectoralis major is an adductor and medial rotator of the arm the clavicular fibres can flex and the sternocostal fibres extend the arm at the shoulder joint. Acting in the opposite direction it can pull the trunk upwards if the arm is flex above the head as in grasping wall bars.

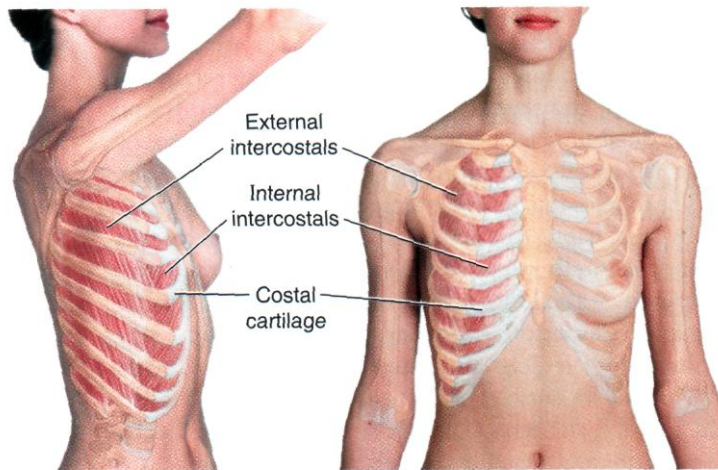


Pectoralis minor muscle (*m. pectoralis minor, L.*)

This is a small muscle that passes obliquely from the anterior ribs and costal cartilages (usually 3, 4 and 5) to the coracoid process. It can bring the scapula forward around the ribs (protraction) and depress the tip of the shoulder or, at least, prevent it rising.

Serratus anterior muscle (*m. serratus anterior, L.*)

This arises from the upper eight ribs (the external oblique arises from the lower eight so they interdigitate on the middle four). It then passes as a flat sheet between the scapula and the subscapularis to reach the medial border of the scapula.



The fibres from the lower part of the origin converge to the inferior angle and form the strongest part of the muscle. These fibres pull the inferior angle forwards and thus rotate the scapula which carries the humerus with it, held in place by the rotator cuff muscles.

Acting as a whole, the muscle will pull the scapula bodily forwards (protraction) and is used by boxers delivering a straight left.

Muscles that attach the scapula to the trunk

Subclavial muscle (*m. subclavius, L.*)

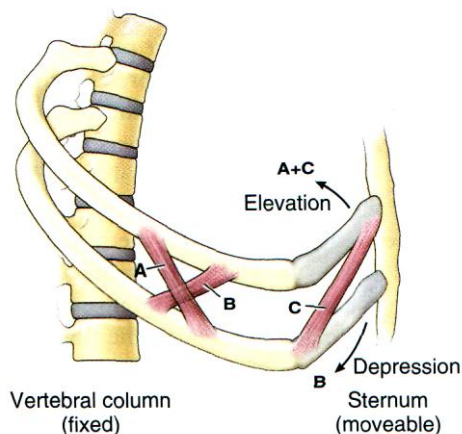
The only joint between the upper limb and the trunk is the sternoclavicular joint. The scapula is held in place by pieces of wire in mounted skeletons but entirely by muscles in real life. These muscles can move the scapula in various directions and thus augment movements at the shoulder joint, or they can act as fixators so that other muscles can act from a fixed base to move the humerus. One of the most important of these muscles has been mentioned already, namely the trapezius. The others are the serratus anterior, the romboids and the levator scapulae, the first named being the one that you must remember.

Muscles of the thorax. Superficial group

Name of muscle	Origin	Insertion	Action
Pectoralis major	Clavicle, sternum and upper six, costal cartilages	Lateral lip of bicipital groove of humerus	Adducts arm and rotates it medially; clavicular fibers also flex arm
Pectoralis minor	Third, fourth, and fifth ribs	Coracoid process of scapula	Depresses point of shoulder; if the scapula is fixed, it elevates ribs of origin
Subclavius	First costal cartilage	Clavicle	Depresses the clavicle and steadies this bone during movements of the shoulder girdle
Serratus anterior	Upper eight ribs	Medial border and inferior angle of scapula	Draws the scapula forward around the chest wall; rotates the scapula

B. Proper (deep) group of the thorax:

External intercostal muscles (*mm. intercostales externi, L.*) fill the intercostal spaces from the spine to the costal cartilages. They originate from the inferior border of each rib, descend posteroanteriorly, and attach to the superior border of the contiguous rib above. Between the costal cartilages the muscles are replaced by a fibrous band with fibres lying in the same direction (membrana intercostalis externa or anterior intercostals membrane.).

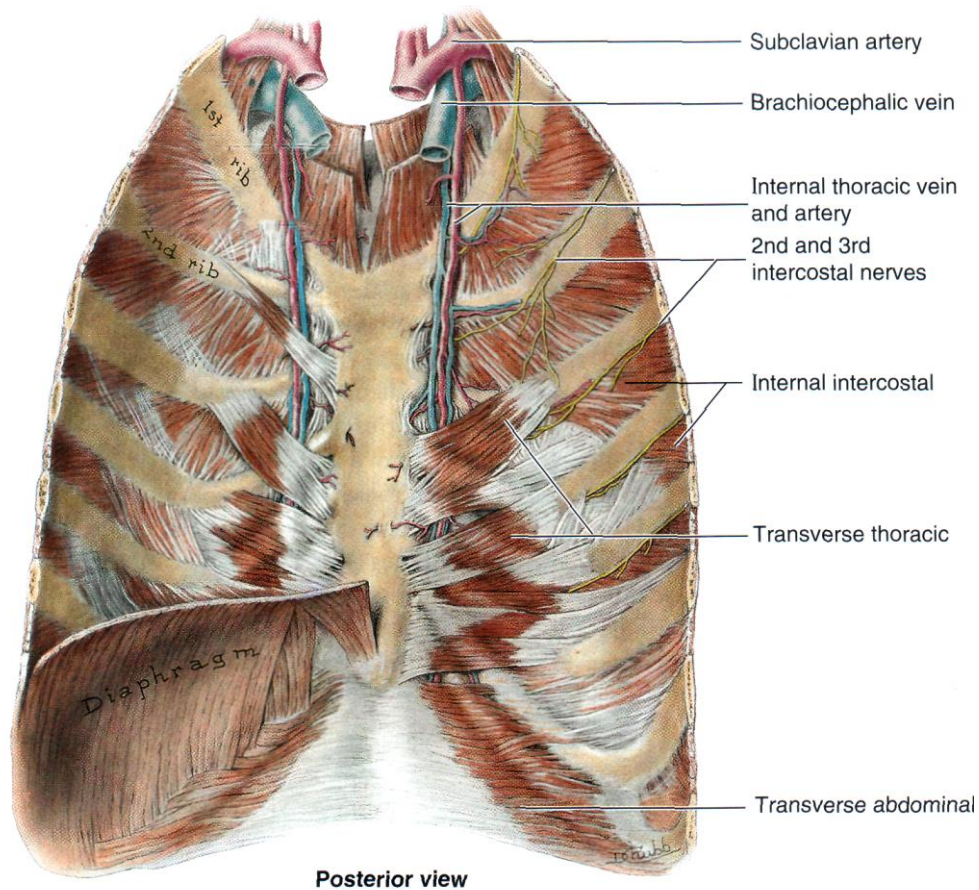


- A = external intercostal m.
- B = internal (and innermost) intercostal m. interosseus part
- C = internal intercostal m. interchondral part

Internal intercostal muscles (*mm. intercostales interni, L.*) are under the external muscles, and the direction of their fibres is opposite to that of the fibres of the latter, which they intersect at an angle. Originating from the superior border of the contiguous rib below, they ascend anteriorly and attach to the contiguous rib above. In contrast to the external muscles, the internal intercostal muscles

stretch between the costal cartilages and reach the sternum. Posteriorly, the internal intercostal muscles reach only the costal angles and are further replaced by the posterior intercostal membrane (*membrana intercostalis interna*) stretching between the posterior ends of the ribs.

Subcostal muscles (*mm. subcostales, L.*) are thin muscular bundles found on the inner surface of the lower part of the thoracic cage in the region of the costal angles. Their fibres are directed like the fibres of the internal intercostal muscles, but the muscles overlap one or two ribs.



Transversus thoracis muscle (*m.transversus thoracis, L.*) is also on the inner surface of the thoracic cage, on its anterior surface, and is a continuation of the transverse muscle of the abdomen.

Action. The external costal muscles raise the ribs and expand the thoracic cage in the anteroposterior and transverse directions and are, consequently, muscles of inspiration during normal quiet breathing. Other muscles also take part in forced respiration; these are muscles capable of raising the ribs (the scalene, sternocleidomastoid, the major and minor pectoral muscles, etc.) provided the mobile points of their attachment in other places are held firmly fixed, as occurs, for instance, instinctively in patients suffering from dyspnoea. Diminution in the capacity of the thorax in expiration is mainly due to the elasticity of the lungs and the thoracic cage itself.

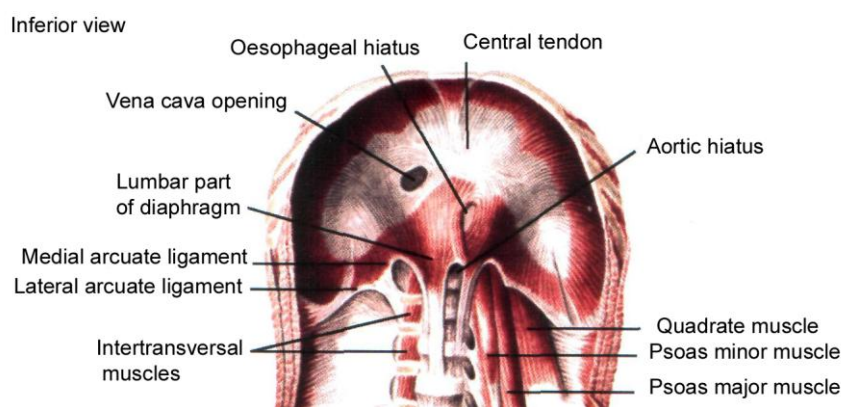
Muscles of the thorax. Deep group

Name of muscle	Origin	Insertion	Action
External intercostal (fibers pass downward and forward)	Inferior border of rib above	Superior border of rib below	With first rib fixed, they raise ribs during inspiration and thus increase anteroposterior and transverse diameters of thorax; with last rib fixed by abdominal muscles, they lower ribs during expiration
Internal intercostal (fibers pass downward and backward)	Inferior border of rib above	Superior border of rib below	Assist external intercostal muscles
Transversus thoracis (fibers pass transversely, forms incomplete layer of muscle)	Adjacent ribs	Adjacent ribs	Assist external and internal intercostal muscles
Levatores costarum (12 in number)	Transverse processes of seventh cervical to eleventh thoracic vertebra	Superior border of ribs	Elevates ribs
Serratus posterior superior	Ligamentum nuchae and upper thoracic spines	Lower ribs	Elevates ribs
Serratus posterior inferior	Lower thoracic and upper lumbar spines	Lower ribs	Lowers ribs

Diaphragm

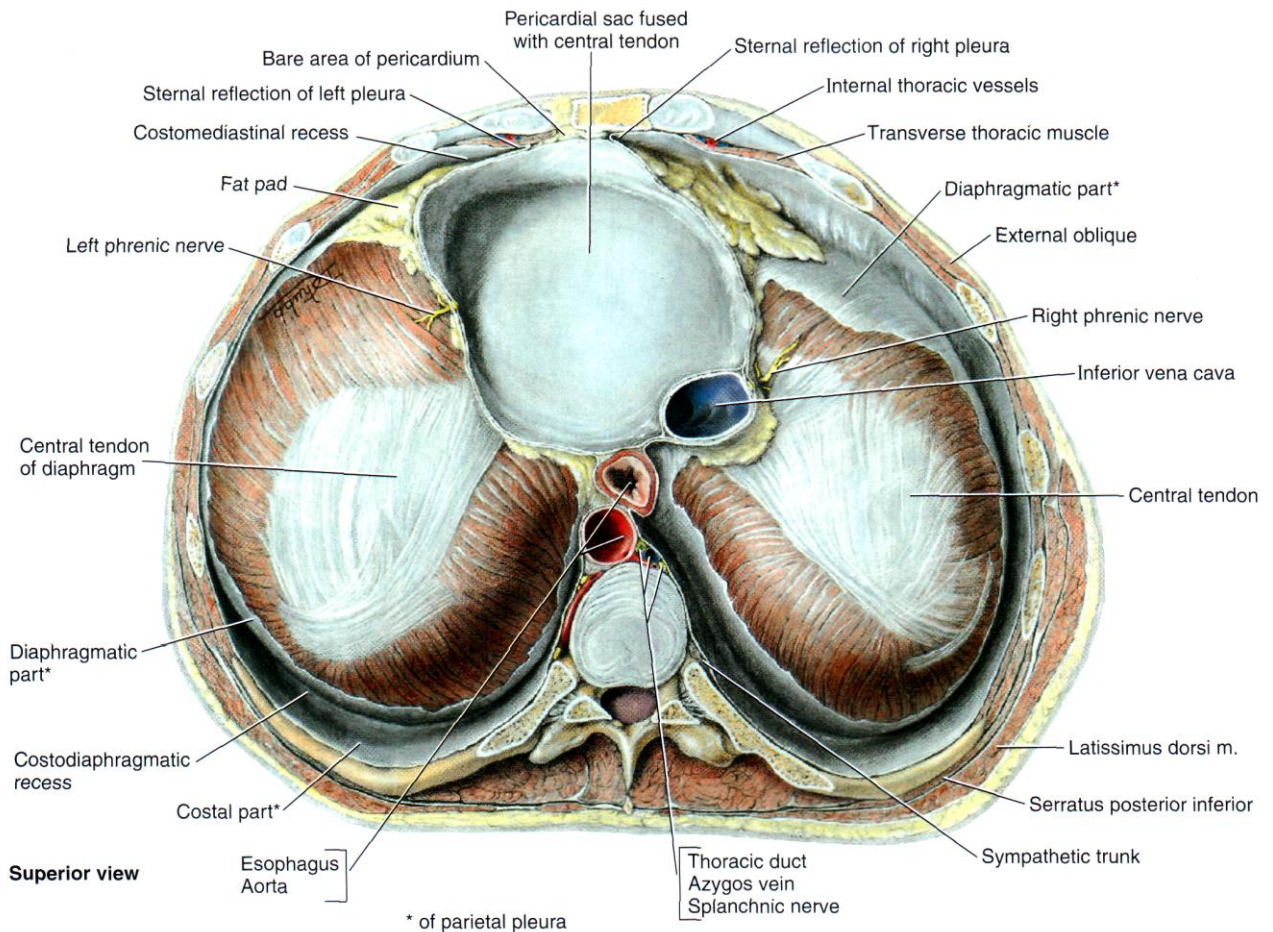
The thoracoabdominal diaphragm forms the partition between the thoracic and abdominal cavities. It is a flat thin dome-shaped muscle, covered above and below with fasciae and serous membranes. The muscle fibres arise from the whole circumference of the inferior thoracic aperture, run upwards, and are contiguous with an aponeurotic tendon occupying the centre of the diaphragm and called the central tendon (centrum tendineum). According to the origin of the fibres, the lumbar, costal, and sternal parts are distinguished in the muscular part of the diaphragm.

The **lumbar part** (pars lumbalis) is the strongest and consists of two crura, right and left (crus dextrum and sinistrum). Both crura originate by means of a long tendon from the anterior



surface of the bodies of the first to fourth lumbar vertebrae (the left crus arises at a higher level than the right) and from two tendinous ligaments which are thickenings of the thoracolumbar fascia. One of these ligaments, the medial arcuate ligament (lig. arcuatum mediale) passes above the psoas major muscle and stretches between the body of the first or second lumbar vertebra and its transverse process; the second, lateral arcuate ligament (lig. arcuatum laterale) runs above the quadratus muscle of the loins from the transverse process of the first lumbar vertebra to the free border of the twelfth rib.

The **sternal part** (pars sternalis), the smallest of all the parts of the diaphragm, is made up of several short slips arising from the posterior surface of the sternal xiphoid process and stretching to the tendinous centre. A paired triangular opening, the sternocostal triangle (trigonum sternocostale) is left between the sternal part and the costal part of the diaphragm near the sternum; the internal thoracic artery (superior epigastric artery) passes in it.



The **costal part** (pars costalis) originates by separate slips from the inner surface of the cartilages of the seventh to twelfth ribs; these slips interdigitate with the initial slips of the transversus abdominis muscle and ascend, curving toward the tendinous centre.

A **triangular space (hiatus aorticus)** is left between both crura and the spine; it transmits the aorta and the thoracic duct stretching behind it. The edge of this opening is bordered with a tendinous band as a result of which contraction of the diaphragm does not affect the lumen of the aorta. Ascending, the crura converge in front of the aortic hiatus, but somewhat to the left and above it they separate again to form an opening, the **oesophageal hiatus** (hiatus esophageus), through which the oesophagus and both vagus nerves attendant to it pass. The oesophageal hiatus is bordered with muscle bundles which act as a sphincter resulting the movement of food. Narrow openings form between the muscle bundles of each crus. They transmit the splanchnic nerves, the azygos vein (hemiazygos vein on the left), and the sympathetic trunk.

Another, larger, paired space, the **lumbocostal triangle (trigonum lumbocostale)**, lies between the costal and lumbar parts. It corresponds to the communication existing between the thoracic and abdominal cavities in embryonal life. It is covered by the pleura and endothoracic fascia above and by the subperitoneal fascia, retroperitoneal fat and peritoneum below.

Diaphragmatic hernias may protrude through it. The posterior surfaces of the kidney and adrenal enclosed in a fatty capsule are contiguous to the lumbocostal triangle. The central tendon of the diaphragm (centrum tendineum) has a trifoliate shape. Its surface shines like a mirror, and it was formerly called Helmont's mirror or speculum. A little to the back and to the right of the midline is a **quadrangular opening** in the central tendon (**foramen venae cavae**), which transmits the inferior vena cava. As pointed out above, the diaphragm is dome-shaped, but it is asymmetrical in height: its right part, abutting inferiorly on the voluminous liver, stands higher than the left part.

Action:

Muscle of inspiration. On contraction, the diaphragm pulls down its central tendon and increases the vertical diameter of the thorax.

Muscle of abdominal straining. The contraction of the diaphragm assists that of the muscles of the anterior abdominal wall in raising the intra-abdominal pressure for micturition, defecation, and parturition.

Weight-lifting muscle. By taking a deep breath and holding it (fixing the diaphragm), the diaphragm assists the muscles of the anterior abdominal wall in raising the intra-abdominal pressure to such an extent that it will help support the vertebral column and prevent its flexion.

Thoracoabdominal pump. The descent of the diaphragm decreases the intrathoracic pressure and increases the intra-abdominal pressure. This mechanism assists in the return of venous blood in the inferior vena cava to the right atrium and the passage of lymph upward in the thoracic duct.

Fascia of the thorax

The anterior surface of the pectoralis major muscle is covered by the superficial sheet of the pectoral fascia (fascia pectoralis), which is continuous medially with the sternal periosteum, superiorly with the clavicular periosteum, and laterally with the deltoid fascia (fascia deltoidea). In females this sheet separates the muscle from the mammary gland. Under the pectoralis major muscle is the more conspicuous deep sheet of the pectoral fascia; it is thickest in the region of the clavipectoral triangle and is known here as the clavipectoral fascia (fascia clavipectoralis). Separating and then rejoining, the deep sheet of the pectoral fascia encloses the subclavius and lesser pectoral muscles. Both sheets of the pectoral fascia join in two places: in the deltoideopectoral sulcus and at the inferior border of the greater pectoral muscle where the pectoral fascia is continuous with the axillary fascia (fascia axillaris). This fascia forms the floor of the axillary fossa; from the periphery of the fossa it spreads to the adjacent muscles, while in the centre it forms a depression with the overlying skin, as the result of which the axilla or armpit is formed. Besides the fasciae covering the external surface of the thoracic cage, here is the endothoracic fascia (fascia endathoracica) which lines its inner surface and also passes over to the diaphragm as a very thin layer of fat.

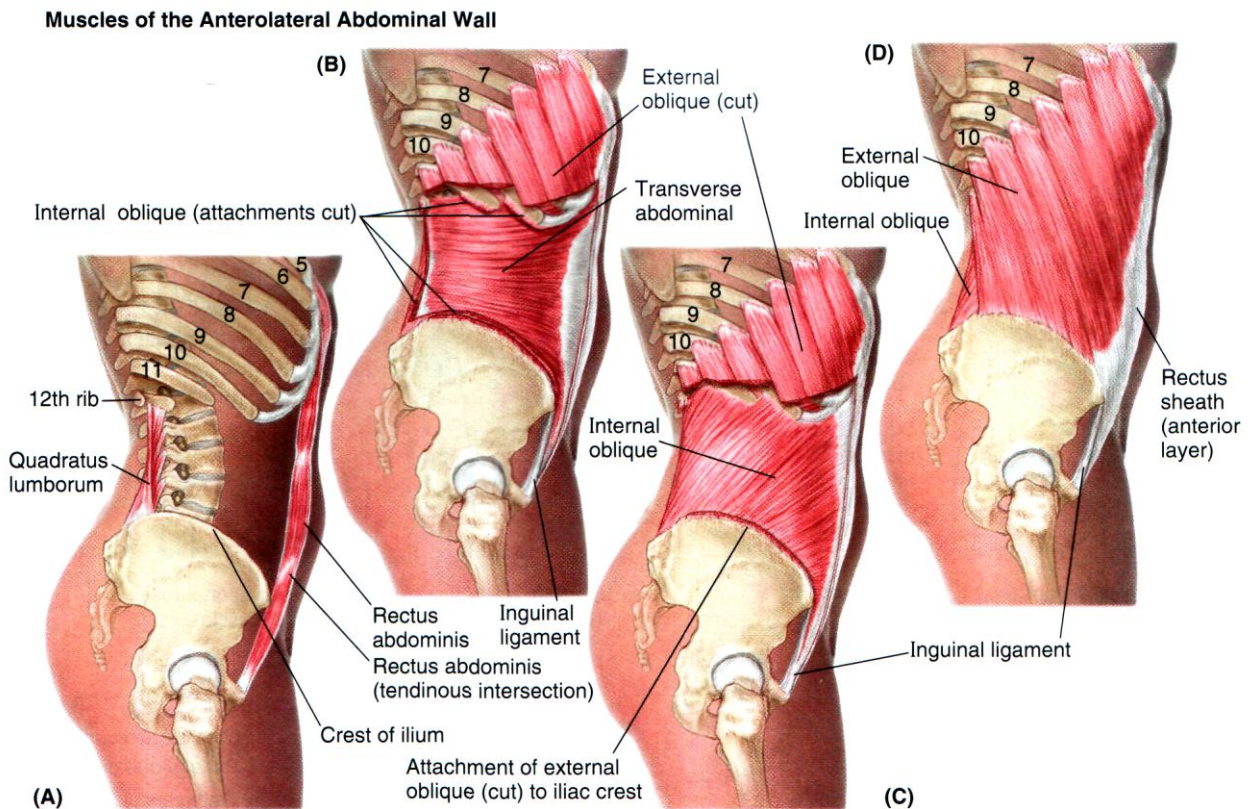
Muscles of the abdominal wall

The muscles of the anterior abdominal wall consist mainly of three broad thin sheets that are aponeurotic in front; they are the external oblique, internal oblique, and transversus from exterior to interior. On either side of the midline anteriorly there is, in addition, a wide vertical muscle, the rectus abdominis. As the aponeuroses of the three sheets pass forward, they enclose the rectus abdominis to form the rectus sheath.

In the lower part of the rectus sheath, there may be present a small muscle, the pyramidalis.

The cremaster muscle, which is derived from the lower fibers of the oblique, passes inferiorly as a covering of the spermatic cord and enters the scrotum.

The muscles of the abdomen may be divided into three groups: (1) **anterior muscles**; (2) **lateral muscles**; (3) the **posterior muscles**.



A. Lateral muscles

External oblique (*m. obliquus externus abdominis, L.*)

For the most part, the fibres of this muscle run downwards and forwards from their posterior attachments. The muscle arises, from the outer surfaces of the lower eight ribs.

The muscle fibres posteriorly pass vertically down to the iliac crest so that there is a posterior free border. The attachment to the ilium continues forward as far as anterior superior spine where it becomes aponeurotic and the aponeurosis jumps from here to the pubic tubercle, bridging across the muscles, nerves and vessels that are entering the thigh. The free lower border of the aponeurosis is folded back upon itself to form the inguinal ligament. The anterior end of the inguinal ligament splits on medial and lateral crus. Some fibres of the medial crus form the reflex ligament. The lateral crus round off the acute angle between the ligament and the pubis to form the lacunar ligament. The lacunar ligament, which extends backward and upward to the pectineal line on the superior ramus of the pubis and becomes continuous with the pectineal ligament (thickening of periosteum). The lower border of the inguinal ligament is attached to the deep fascia of the thigh, the fascia lata.

Internal oblique (*m. obliquus internus abdominis, L.*)

The fibres of this muscle run roughly at right angles to those of the external oblique. It arises from the thoracolumbar fascia, **the ilense** fascia that covers the back muscles. The fascia leads the origin down to the iliac crest and thence, via the anterior superior spine, to the lateral half of the inguinal ligament. Its fibres run on the whole, upward, or, to be more precise, they fan out. The posterior muscular bundles ascend and attach to the inferior margins of the twelfth, eleventh, and tenth ribs. The anterior bundles of the muscle are continuous with a broad aponeurosis which on the lateral border of the rectus abdominis muscle splits into two layers contributing to the formation of the sheath of this muscle. The aponeurosis meets the contralateral aponeurosis medially to the rectus muscle, on the linea alba. On the outer and inner surfaces the internal oblique muscle is covered with fascial laminae.

Transversus abdominis (*m. transversus abdominis, L.*)

The transversus abdominis muscle is the deepest and thinnest of the broad abdominal muscles. It arises from the inner surface of the lower six ribs. Above the diaphragm, it extends as the transverse muscle of the thorax. Inferiorly and posteriorly the muscle originates from the deep layer of the thoracolumbar fascia, and, finally, its lowest part arises from the iliac crest and the lateral two-thirds of the inguinal ligament. From the sites of origin the fibres of the muscle run horizontally forward and medially and end in a wide aponeurosis, which passes to linea alba.

B. Anterior muscles

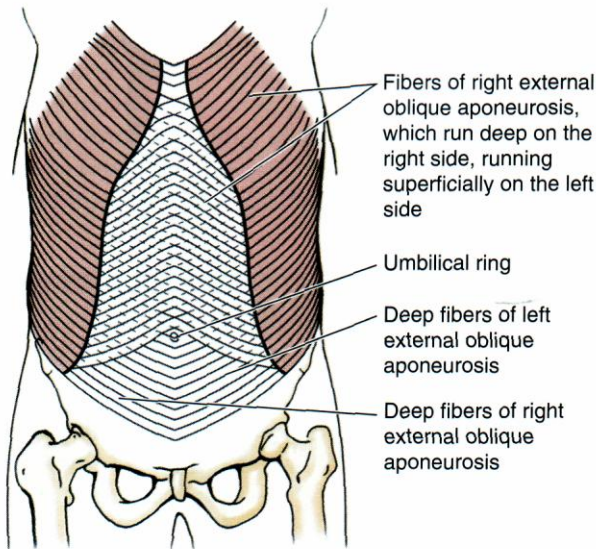
Rectus (*m. rectus abdominis, L*) extends from the 5th, 6th and 7th costal cartilages to the pubic crest and tubercle and the front of the symphysis pubis. The vertical muscle fibres are interrupted by (usually) three tendinous intersections in the upper part of the muscle, which are adherent to the anterior rectus sheath. The lateral border of each rectus muscle can often be recognized in a thin person's abdomen as a curved line, the linea semilunaris. It crosses the costal margin at the tip of the 9th costal cartilage and on the right side.

Muscles of the abdomen

Name of muscle	Origin	Insertion	Action
External oblique	Lower eight ribs	Xiphoid process, linea alba, pubic crest, pubic tubercle, iliac crest	Compresses abdominal contents; assists in flexing and rotation of trunk; pulls down ribs in forced expiration
Internal oblique	Lumbar fascia, iliac crest, lateral two-thirds of inguinal ligament	Lower three ribs and costal cartilages, xiphoid process, linea alba, pubic symphysis; conjoint tendon with transversus	Compresses abdominal contents; assists in flexing and rotation of trunk; pulls down ribs in forced expiration
Transversus	Lower six costal cartilages, lumbar fascia, iliac crest, lateral third of inguinal ligament	Xiphoid process, linea alba, symphysis pubis, forms conjoint tendon with internal oblique	Compresses abdominal contents
Rectus abdominis	Symphysis pubis and pubic crest	Fifth, sixth, and seventh costal cartilages and xiphoid process	Compresses abdominal contents and flexes vertebral column; accessory muscle of expiration
Pyramidalis (often absent)	Anterior surface of pubic bone	Linea alba	Tenses the linea alba

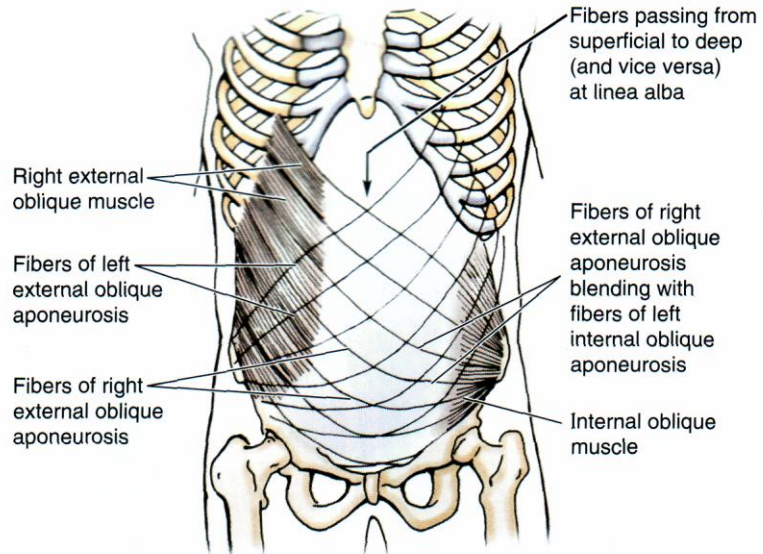
Rectus sheath.

The muscle is enclosed in the rectus sheath which is derived from the aponeurosis of the other abdominal muscles. Throughout the greater part of the length of the muscle there are 1 1/2 aponeuroses in front and 1 1/2 behind. The aponeurosis of the internal oblique splits, part going in front of the muscle and part behind so that the anterior sheath is composed of the external oblique aponeurosis and the anterior layer of the internal oblique. The posterior sheath is composed of the

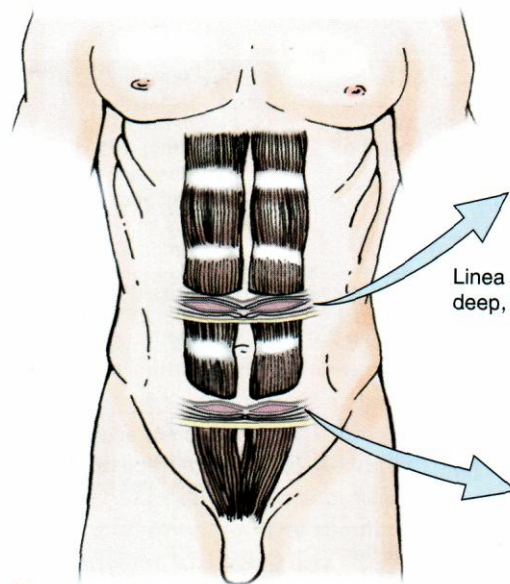


Intramuscular exchange of superficial and deep fibers within aponeuroses of contralateral external oblique muscles.

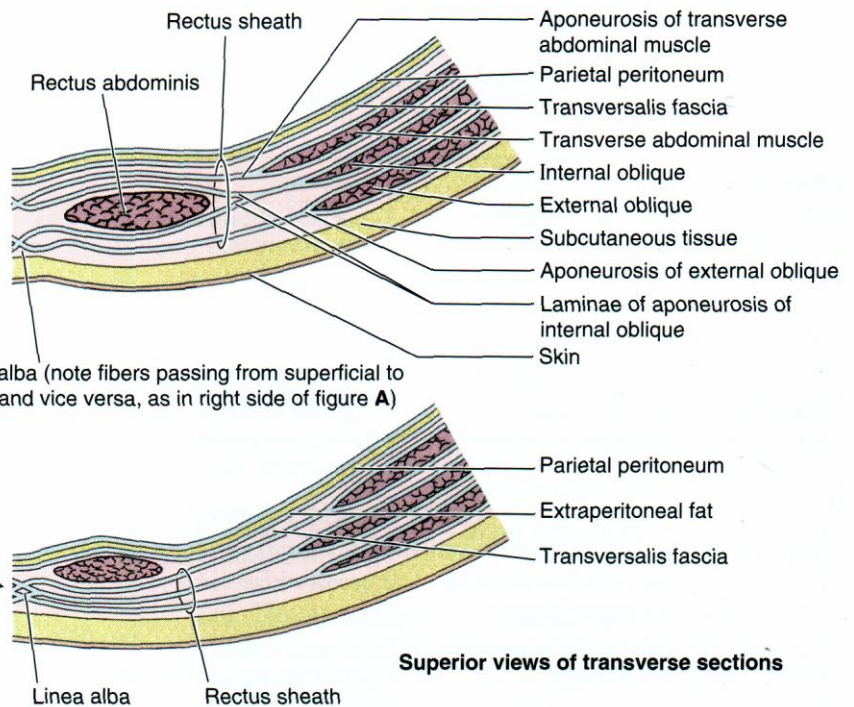
(A) Anterior views



Intermuscular exchange of fibers between aponeuroses of contralateral external and internal oblique muscles.



(B) Anterior view



Superior views of transverse sections

posterior layer of the internal oblique and the transversus.

Above the costal margin, only the external oblique aponeurosis is present so that this forms the anterior rectus sheath. Posteriorly the muscle lies directly on the chest wall. About halfway between the umbilicus and the pubis, the 1 1/2 layers of the posterior rectus sheath come to an abrupt stop, their free lower borders being known as the arcuate line.

Below this level, all three aponeuroses pass in front of the rectus so that posteriorly the muscle lies directly on the transversalis fascia.

In the middle line aponeurosis of the obliqui muscles and transversus abdominis muscles fuse with each other and with muscles from opposite side to form the **Linea alba**, which extends from the xiphoid process to the symphysis pubis. Linea alba is the place of middle section (laparotomy).

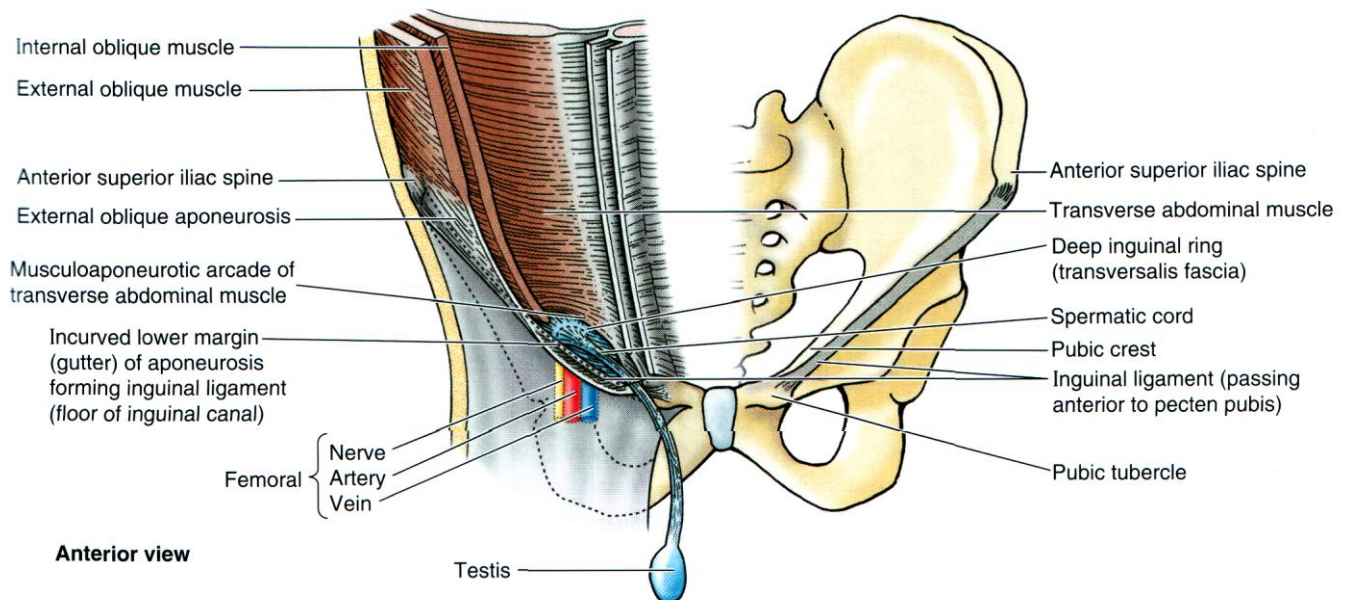
The inguinal canal (*canalis inguinalis, L.*)

The inguinal canal is an oblique passage the lower part of the anterior abdominal wall and is present in both sexes, structures to pass to and from the testis to the abdomen in the male. It is a passage of the round ligament of the uterus from the uterus to the labium majus

The canal is about 4 cm long in the adult and extends from inguinal ring, a hole in the fascia transversalis, downward and medially to the superficial inguinal ring, a hole in the aponeurosis of the external oblique muscle. It lies parallel to and immediately above the inguinal ligament.

The **deep inguinal ring, an oval opening** in the fascia transversalis, lies about 1.3 cm above the inguinal ligament. The margins of the ring give attachment to the internal spermatic fascia.

The **superficial inguinal ring** is a triangular-shaped defect in the aponeurosis of the external oblique muscle and it is bordered by: medial and lateral crus, intercrural fibres, reflex ligament.



Walls of the inguinal canal:

Anterior wall: External oblique aponeurosis;

Posterior wall: Fascia transversalis laterally;

Superior wall: Arching fibers of internal oblique and transverses;

Inferior wall: Inguinal ligament.

Superficial Fascia. The superficial fascia may be divided into the superficial fatty layer (fascia of Camper) and a deep membranous layer (Scarpa's fascia).

The fatty layer is continuous with the superficial fascia over the rest of the body and may be extremely thick in obese individuals. The membranous layer fades out laterally and above. Inferiorly, it passes over the inguinal ligament to fuse with the deep fascia of the thigh (fascia lata) about one finger breadth below the inguinal ligament. In the midline it is not attached to the pubis, but forms a tubular sheath for the penis (clitoris). In the perineum it is attached on each side to the margins of the pubic arch and is known as Colles' fascia. Posteriorly, it fuses with the perineal body and the posterior margin of the perineal membrane.

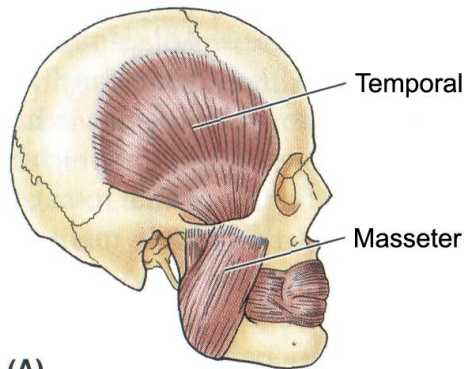
Transversal fascia. In the anterior abdominal wall, the deep fascia is merely a thin layer of areolar tissue covering the transversal muscles inside.

Muscles of the head

Muscles of the head subdivided into Mastication and Facial expression groups

Muscles of mastication

The four muscles of mastication on each side are related genetically (they originate from a single visceral arch, the mandibular arch), morphologically (they are all attached to the mandible which they move when they contract), and functionally (they accomplish the chewing movements of the mandible, which determines their location).



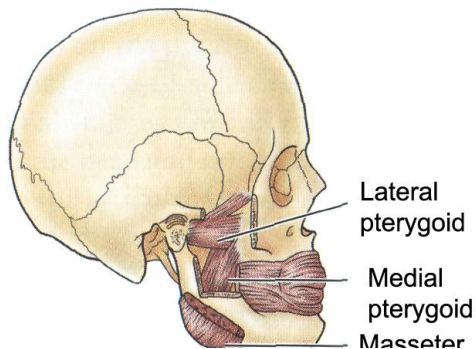
(A)

Lateral views

Masseter muscle (*m. masseter, L.*) is thick and quadrangular. It arises from the inferior border of the zygomatic bone and the zygomatic arch and is attached to the masseteric tuberosity and the external surface of the mandibular ramus.

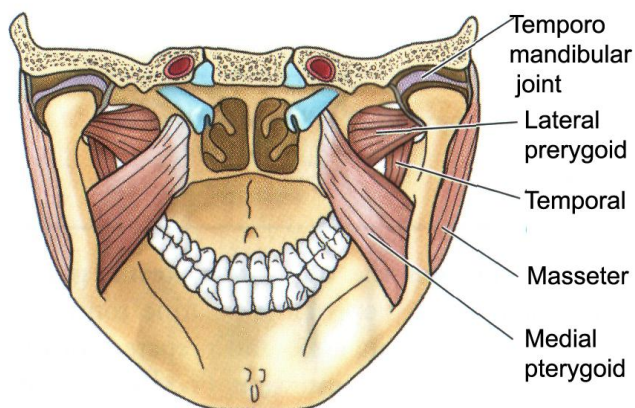
Temporal muscle (*m. temporalis, L.*) is wide at its origin and occupies the whole temporal fossa of the skull up to the temporal line. The muscle fibres converge like a fan and form a strong tendon which passes under the zygomatic arch and is attached to the coronoid process of the mandible.

Lateral pterygoid muscle (*m. pterygoideus lateralis, L.*) arises from the inferior surface of the greater wing of the sphenoid bone and the pterygoid process. It is directed almost horizontally backward and laterally and is attached to the neck of the mandibular condylar process and to the capsule and articular disk of the temporomandibular joint.



Medial pterygoid muscle (*m. pterygoideus medialis, L.*) arises in the pterygoid fossa of the pterygoid process, passes downward and laterally, and attaches to the medial surface of the mandibular angle, symmetrically with the masseter muscle, at the pterygoid tuberosity.

Action. The temporal, masseter, and medial pterygoid muscles pull the mandible to the maxilla when the mouth is open and thus close the mouth. On simultaneous contraction of both lateral pterygoid muscles the mandible protrudes forward. Movement in the opposite direction is accomplished by the posterior fibres of the temporal muscle which pass almost horizontally forward. Unilateral contraction of the lateral pterygoid muscle displaces the mandible to the contralateral side of the mouth. The temporal muscle is



(C) Posterior view of viscerocranium

associated with articulate speech; it sets the mandible in a definite position when a person speaks.

Muscles of mastication

Name of muscle	Origin	Insertion	Action
Masseter	Zygomatic arch	Lateral surface of ramus of mandible	Raises mandible occlude teeth in mastication
Temporalis	Floor of temporal fossa and covering fascia	Coronoid process of mandible	Anterior and superior fibers elevate the mandible, posterior fibers retract the mandible
Lateral pterygoid	Greater wing of sphenoid and lateral pterygoid plate	Neck of mandible and articular disc of temporomandibular joint	Pulls neck of mandible and to forward
Medial pterygoid	Tuberosity of maxilla and lateral pterygoid plate	Mandibular division of trigeminal nerve	Elevates mandible

Muscles of Facial expression

Groupings of **facial muscles**, with principal actions only

A. Scalp (*m. epicranius, L.*):

1. **Frontal belly** (*venter frontalis, L.*): raises brows and wrinkles forehead as in surprise or frowning.

Arises from the galea aponeurotica (*galea aponeurotica, aponeurosis epicranialis, L.*) and inserts into the skin and dense subcutaneous connective tissue at the level of the eyebrows.

2. **Occipital belly** (*venter occipitalis, L.*): acts with the frontal in raising the eyebrows.

Arises from the lateral 2/3 of the highest nuchal line of the occipital bone, the mastoid part of the temporal bone, and ends in the galea aponeurotica.

Procerus (*m. procerus, L.*): a small muscle that is continuous with the occipitofrontalis, passing from the forehead over the bridge of the nose where it inserts. It draws the medial angle of the eyebrow downward and produces wrinkles over the bridge of the nose.

Corrugator muscle of the eyebrow (*m. corrugator supercilii, L.*): draws the eyebrows toward each other and causes the formation of vertical wrinkles in the space between the eyebrows above the bridge of the nose.

B. Ear (less critical in human):

Anterior auricular (*m. auricularis anterior, L.*) draws ear up and forward.

Superior auricular (*m. auricularis superior, L.*) draws ear up.

Posterior auricular (*m. auricularis posterior, L.*) draws ear back.

C. Eye:

Orbicularis oculi (*m. orbicularis oculi, L.*)

Consists of 3 parts: a thick **orbital part** for closing the eyes tightly to protect against the glare of light (squinting) and dust; a thin **palpebral part** for closing the eyelids lightly to keep the cornea from drying (responsible for blinking); and a **lacrimal part** (deep to the palpebral part and often a part of it) for drawing the eyelids and the lacrimal puncta medially. The latter part encloses the lacrimal canaliculi and passes behind the lacrimal sac (important in control of tears).

When all parts contract, the eyes are firmly closed and adjacent skin is wrinkled. These wrinkles become permanent by age 30 to 35 and are called "crow's feet".

Paralysis results in drooping of the lower lid (ectropion) and the spilling of tears (epiphora).

D. Nose:

Depressor septi nasi (*m. depressor septi nasi, L.*): runs from the incisor fossa of the maxilla to the mobile part of the nasal septum. It assists the dilator nares in widening the aperture during deep inspiration and also depresses the nasal septum.

Nasalis (*m. nasalis, L.*): consists of transverse (compressor naris) and alar (dilator naris) portions.

Compressor nares (*m. compressor nares, L.*): from the maxilla above the incisor teeth to the dorsum of the nose. Compress the anterior nasal openings.

Dilator nares (*m. dilatator nares, L.*): from the maxilla into the alar cartilages of the nose. They widen the anterior nasal openings. In children, a marked or increased action of these muscles suggests respiratory distress (pneumonia).

E. Mouth:

Orbicularis oris (*m. orbicularis oris, L.*): completely surrounds the mouth, with no bony attachments. It is a complex muscle with layers, some parts intrinsic to the lips, and others derived from the buccinator, levator anguli oris, depressor anguli oris, and zygomaticus major and minor. It closes the lips, protrudes and purses the lips, and presses the lips to the teeth aiding in articulation and mastication (chewing).

Levator labii superioris (*m. levator labii superioris, L.*): descends from maxilla just above the infraorbital foramen (below infraorbital margin) to insert into upper lip. It raises upper lip.

Levator labii superioris alaeque nasi (*m. levator labii superioris alaeque nasi, L.*): from frontal process of maxilla to insert on ala of nose and on lip. It raises the lip and dilates the nares.

Zygomaticus major (*m. zygomaticus major, L.*): from the zygomatic bone to insert into the orbicularis oris near angle of mouth. It draws the angle of mouth up and back, as in laughing and smiling.

Zygomaticus minor (*m. zygomaticus minor, L.*): an occasional muscle slip almost continuous with the orbicularis oculi and inserts on the angle of the mouth. With 1 and 2 above, it helps form the nasolabial groove. It helps lift the angles of the mouth in smiling and deepen the nasolabial groove in sorrow.

Levator anguli oris (caninus) (*m. levator anguli oris, L.*): from the maxilla below the infraorbital foramen to insert on the corner of the mouth (on a deeper plane than the zygomaticus and levator labii superioris muscles). With the levator labii superioris, alaeque nasi, and zygomaticus minor, it helps express contempt or disdain by raising the angle of the mouth.

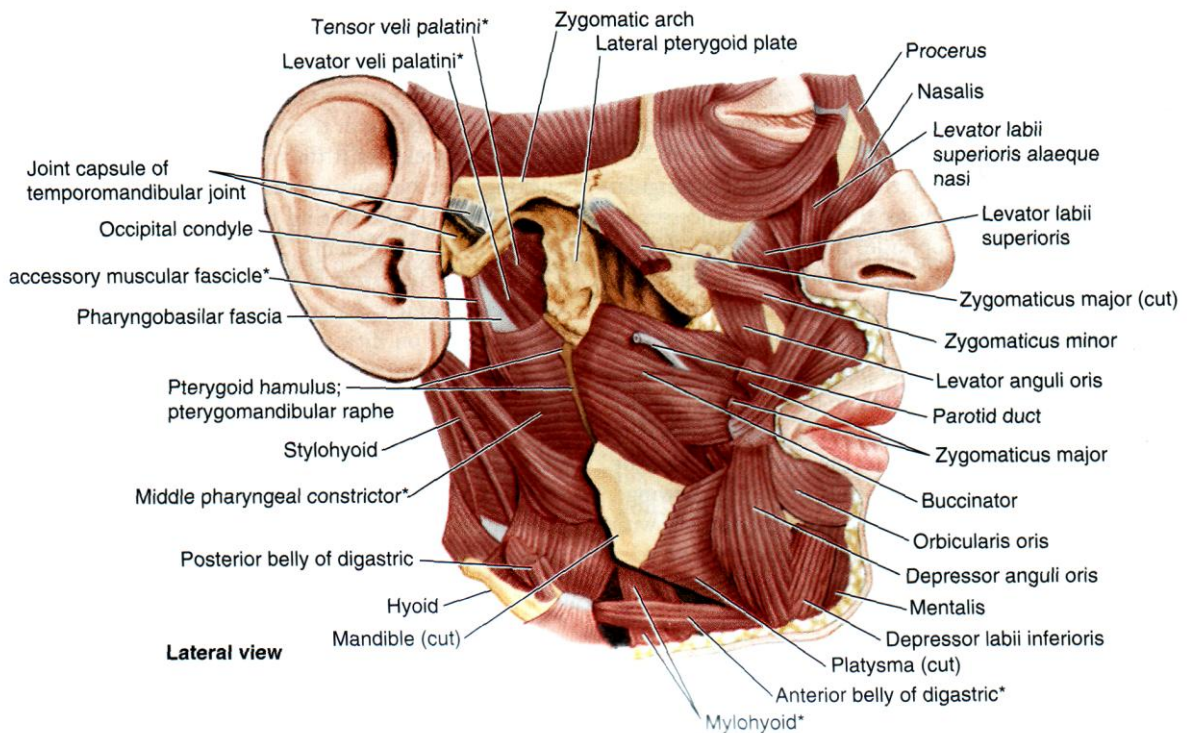
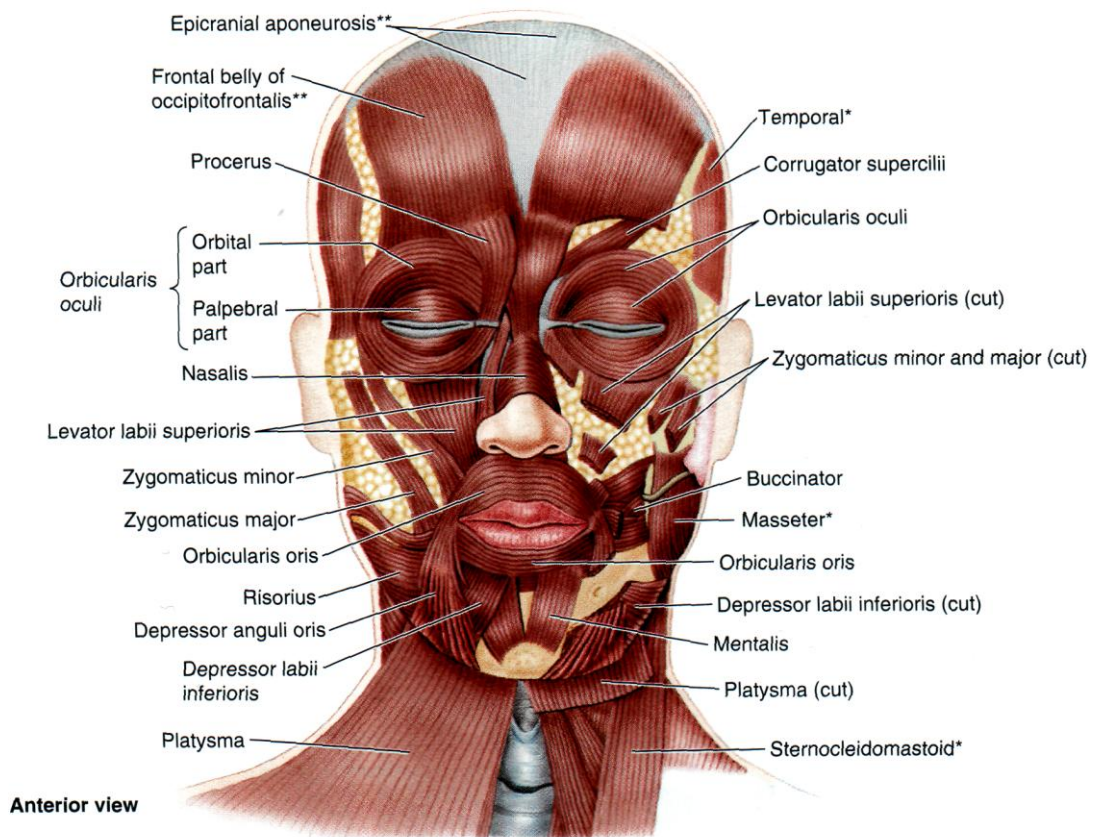
Risorius (*m. risorius, L.*): extends posterior from corners of the mouth as a small, very superficial muscle which pulls the corners of the mouth laterally, retracting the angle of the mouth. These are the so-called "laughter" muscles.

Depressor labii inferioris (*m. depressor labii inferioris, L.*): deep to the depressor anguli oris, arising from the mandible just above the depressor anguli oris, and inserts into the lower lip. It depresses the lower lip, drawing the lip down and back.

Depressor anguli oris (*m. depressor anguli oris, L.*): from the mandible near the attachment of the platysma to insert on the corners of the mouth. It pulls down or depresses the corner of the mouth.

Mentalis (*m. mentalis, L.*): is named for its location, not its action. It is a small muscle just anterior to the mental foramen, arising from the mandible and inserting just inferior to the incisor teeth. It raises and wrinkles the skin of the chin and pushes up the lower lip.

Buccinator (*m. buccinator, L.*): from the pterygomandibular ligament and lateral surfaces of the mandible and maxilla to insert into the muscles around the mouth, with fibers crossing to the upper and lower lip. It compresses the cheek, holds food under the teeth in mastication, and is important in blowing when the cheeks are distended with air.



* Not part of muscles of fascial expression
 ** Collectively =epicranium

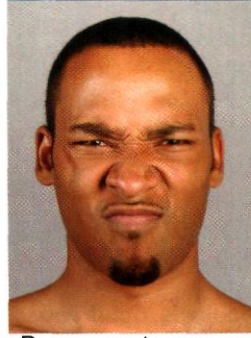
Facial expression:



Occipitofrontalis



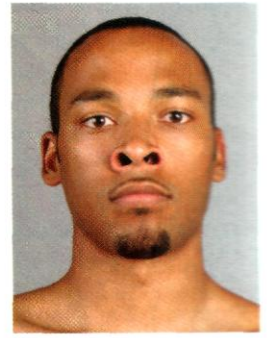
Corrugato supercilii



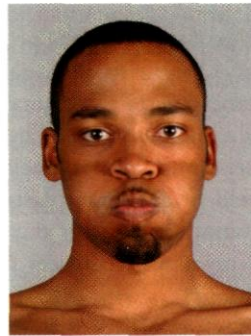
Procerus + transversal part of nasalis



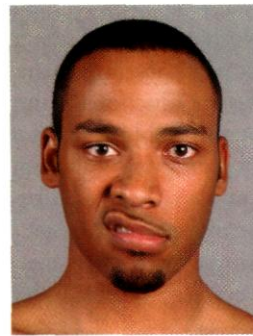
Orbicularis oculi



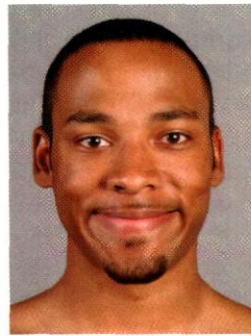
Levator labii sup. alaeque nasi+alar part of nasalis



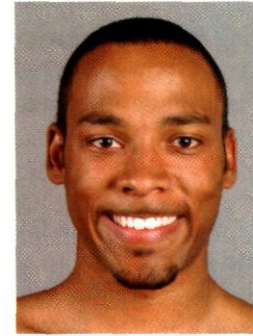
Buccinator + orbicularis oris



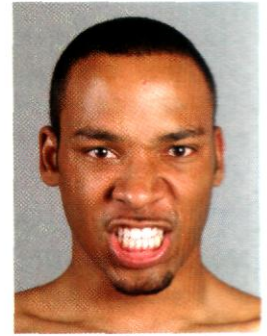
Zygomatic muscles



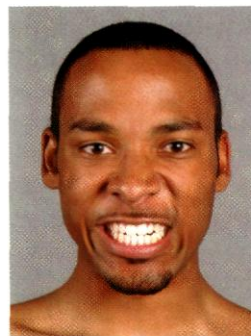
Risorius



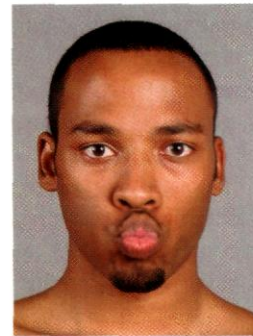
Risorius + depressor labii inferioris



Levator labii superior + depressor labii inferioris



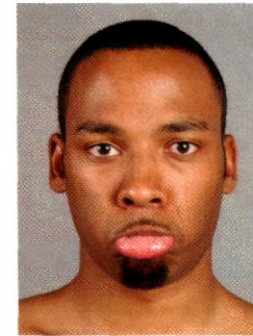
Dilatators of mouth:
Risorius+levator labii superior
+depressor labii inferior



Orbicularis oris



Depressor anguly oris



Mentalis



Platysma

Muscles of the head

Name of muscle	Origin	Insertion	Action
MUSCLE OF SCALP			
Occipitofrontalis 1.Occipital belly	Occipital bone	Epicranial aponeurosis	Moves scalp on skull and raises eyebrows
2.Frontal belly	Skin and fascia of eyebrow	Epicranial Aponeurosis	Moves scalp on skull and raises eyebrows
Procerus	Nasal bone and lateral nasal cartilage	Skin between eyebrows	Wrinkles skin at root of nose
Corrugator supercilii	Medial part of superciliary arch of frontal bone	Skin of eyebrow	Pulls eyebrows medially
MUSCLES OF EXTERNAL EAR			
Auricularis anterior	Epicranial aponeurosis	Auricle	Small amount of auricular movement in some individuals
Auricularis superior	Epicranial aponeurosis	Auricle	
Auricularis posterior	Epicranial aponeurosis	Auricle	
MUSCLES OF EYELIDS			
Orbicularis oculi 1.Orbital part	Frontal bone, maxillary bone, medial palpebral ligament	No interruption, forms concentric loops	Pulls skin of forehead, temple and cheek like a purse string: "screws up the eye"
2.Palpebral part	Medial palpebral ligament	Lateral palpebral ligament	Closes eyelids
3.Lacrimal part	Lacrimal bone	Both eyelids	Empties tears from lacrimal sac
MUSCLES OF NOSTRILS			
Depressor septi nasi	Incisor fossa of maxilla	Cartilaginous part of nasal septum	Depresses the nasal septum
Nasalis	Alveolar juga above the incisors of the maxilla	Ala of nose	Narrows nasal aperture
MUSCLES OF LIPS AND CHEEKS			
Orbicularis oris margin part labial part	Maxilla and mandible, skin of lips, some fibers from buccinator muscle	Surrounds orifice of mouth	Sphinctor muscles of lips - compresses lips together
Dilator muscles of lips	Bones and fascia around oral aperture	Skin of lips	Separates lips
1.levator labii superioris alaeque nasi	Frontal process of maxilla	Skin of lips and alae nasi	Elevate upper lip
2.levator labii superioris	Infraorbital margin of maxilla	Skin of lips	Elevate upper lip
3.zygomaticus minor	Anterior surface of zygomatic bone	Skin of lips and angle of mouth	Elevate upper lip and angle of mouth
4.zygomaticus major			
5.levator anguli oris	Fossa canina of maxilla	Skin of angle of mouth	Elevate angle of mouth
6.depressor anguli oris	Body of mandibula	Skin of lower lips	Depress angle of mouth
7.depressor labii inferioris	Body of mandibula	Skin of lower lips	Depress lower lips
8.mentalis	Alveolar margins of mandible	Skin of chin	Depress lower lips
9.risorius(may be absent)	pterygomandibular fascia	Fibers enter in orbicularis oris muscle and skin of lips	Move laterally angle of mouth

10.buccinator	Alveolar margins of maxilla and mandible; pterygomandibular fascia	Fibers decussate and enter upper and lower lips	Compresses cheeks and lips against teeth
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Fascia of the head

The epicranial aponeurosis covering the dome of the skull becomes very thin on the lateral parts of the dome to become a loosely fibrous lamina, under which is a strong temporal fascia (fascia temporalis) shining like a tendon that covers the temporal muscle and arises above from the temporal line. Below the temporal line it attaches to the zygomatic arch and separates into two layers: a superficial layer, which fuses with the external surface of the arch, and a deep layer, which fuses with the internal surface of the arch.

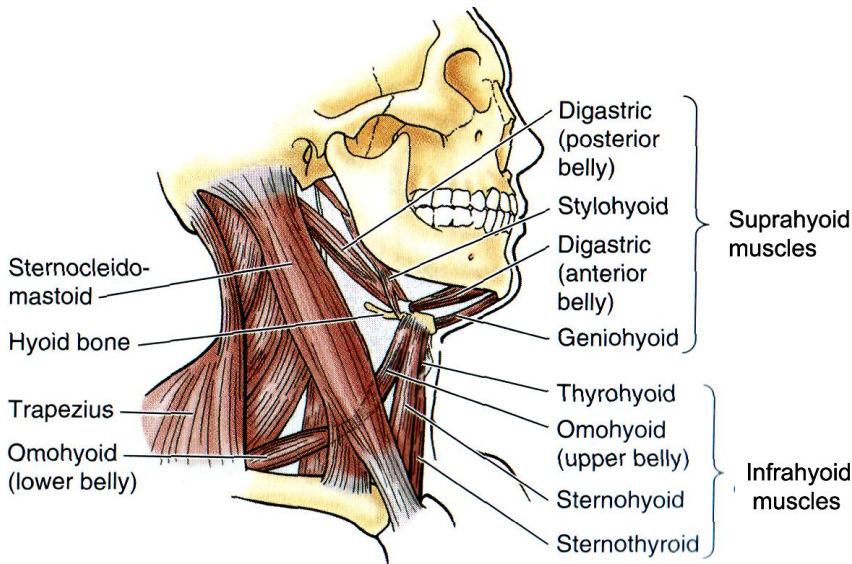
The space between the two layers is filled with fatty tissue. The temporal fascia closes the cranial fossa temporalis in the osteo-fibrous receptacle that lodges the temporal muscle with fatty tissue. The masseter muscle is covered by the masseteric fascia (fascia masseterica), which invests the muscle and attaches to the zygomatic arch above, to the mandibular border below, and to the mandibular ramus posteriorly and anteriorly. Posteriorly and partly externally, this fascia is connected with the parotid fascia (fascia parotideae), which forms a capsule around the gland.

Fasciae do not exist on the face because the muscles of the facial expression lie directly under the skin. The only exception is the buccinator muscle; its posterior section is covered with the thick buccopharyngeal fascia (fascia buccopharyngea), which becomes loose anteriorly and blends with the fatty tissue of the cheek, fuses posteriorly with the pterygomandibular raphe, and is continuous with the connective-tissue covering of the pharyngeal muscles.

Muscles of the neck

A. Superficial muscles of the neck

Platysma is a subcutaneous muscle of the neck lying directly under the fascia as a thin sheet. It arises on the level of the second rib from the pectoral and deltoid fascia, runs upward over the clavicle, and then attaches to the edge of the mandible and the parotid and masseteric fascia and is partly continuous with the muscles of the mouth. A triangular space not covered with the muscle remains on the midline.



Anterolateral view with head rotated slightly to left

protects the subcutaneous veins from compression; it can also depress the angle of the mouth, which is important for facial expression.

Sternocleidomastoid muscle (*m. sternocleidomastoideus, L.*) lies immediately under the platysma and is separated from it by the cervical fascia. It originates from the sternal manubrium and the sternal end of the clavicle. Both heads fuse proximally, and the muscle is attached to the mastoid process and linea nuchae superior of the occipital bone. This muscle originated as part of the trapezius muscle.

Action. In unilateral contraction, the muscle flexes the cervical segment of the spine to the same side; the head is raised at the same time, and the face turned to the opposite side.

In bilateral contraction, the muscles hold the head in a vertical position (head-holder); that is why the muscle itself and the place of its attachment (the mastoid process) are most developed in man, who walks erect. Bilateral contraction may also bend the cervical spine forward and simultaneously raise the face. When the head is fixed, the muscle can raise the chest in respiration (an accessory muscle of inspiration).

Superficial muscle of the neck

Name of muscle	Origin	Insertion	Action
Platysma	Deep fascia of upper part of chest	Lower margin of body of mandible and angle of mouth	Depresses mandible and draws down upper lip and of mouth
Sternocleidomastoid	Manubrium sterni and medial third of clavicle	Mastoid process of temporal bone and occipital bone	Muscles of the two sides acting together extend head and flex the neck, one muscle alone rotates head to opposite side

B. The sprayed muscles

The **sprayed muscles** are localized between the mandible and the hyoid bone.

Mylohyoid muscle (*m. mylohyoideus, L.*) is a flat muscle with parallel fibres that arise from the mandibular mylohyoid line, run medially, and terminate on the tendinous line, raphe, stretching from the inner surface of the chin to the body of the hyoid bone on the midline along the border between both mylohyoid muscles. The posterior part of the muscle is attached to the body of the hyoid bone. Both mylohyoid muscles meet and form the floor of the mouth (diaphragma oris) which closes the bottom of the oral cavity.

Digastric muscle (*m. digastricus*) consists of two bellies connected by a round intermediate tendon. The whole muscle is shaped like an arch concave upwards. The anterior belly, venter anterior, located on the inferior surface of the oral diaphragm, arises in the digastric fossa of the mandible and runs back and laterally to the hyoid bone. The posterior belly, venter posterior, arises in the mastoid notch of the temporal bone and descends obliquely forward and medially, gradually narrowing, to the tendon by means of which it is joined to the anterior belly. The intermediate tendon is attached to the body and greater horn of the hyoid bone by a fascial loop.

Stylohyoid muscle (*m. stylohyoideus, L.*) descends obliquely from the styloid process of the temporal bone to the body of the hyoid bone and embraces the intermediate tendon of the digastric muscle with two slips.

Geniohyoid muscle (*m. geniohyoideus, L.*) lies above the mylohyoid muscle laterally of the raphe. It stretches from the spina mentalis of the mandible to the body of the hyoid bone. It is a derivative of the anterior longitudinal muscle of the trunk.

Action. All the four muscles raise the hyoid bone. When the bone is steadied, three muscles (mylohyoid, geniohyoid, and digastric) lower the mandible and thus are antagonists of the muscles of mastication. The hyoid bone is steadied by muscles lying below it (sternohyoid, omohyoid, etc.). Without this steadying the mandible cannot be lowered since the hyoid bone, which is lighter and more mobile than the mandible, will be raised. The same three muscles, the mylohyoid in particular, on contraction during swallowing raise the tongue and press it to the palate, as a result of which food is pushed into the pharynx.

Muscles which are situated above the hyoid bone are components of a complex apparatus including the mandible, hyoid bone, larynx, and trachea. This apparatus plays an important role in the act of articulate speech.

- a) the site of attachment of the posterior belly of the digastric muscle, the mastoid notch, was flat in the Neanderthal man but became deep in modern man;
- b) the site of attachment of the anterior belly of this muscle, the digastric fossa, has moved medially in modern man;
- c) the site of attachment of the mylohyoid muscle, the mylohyoid line, is more conspicuous and lower, as a result of which the oral diaphragm is situated lower in modern man;
- d) the site of attachment of the geniohyoid muscle, the mental spine, was hardly present in the

Neanderthal man and occurs only in modern man in whom the mental protuberance has also appeared. These changes in the bones occurred with the development of the muscles that take part in the act of articulate speech, inherent only to man.

Suprahyoid muscles of the neck

Name of muscle	Origin	Insertion	Action
Digastric muscles Posterior belly	Mastoid process of temporal bone	Intermediate tendon that is bound to hyoid bone Intermediate tendon as above	Depresses mandible or elevates hyoid bone
Anterior belly	Lower border of mandible near mid line		Depresses mandible or elevates hyoid
Stylohyoid	Styloid process of temporal bone	Intermediate tendon as above	Elevates hyoid bone
Mylohyoid	Mylohyoid line on inner surface of body of mandible	Body of hyoid bone and raphe that extends from mandible to hyoid bone	Elevates floor of mouth and hyoid bone or depresses mandible
Geniohyoid	Inferior mental spine on back of symphysis menti of mandible	Body of hyoid bone	Elevates hyoid bone or depresses mandible

C. The infrahyoid muscles localize below hyoid bone are related to the system of the straight muscles of the neck and are situated on both sides of the midline directly under the skin, in front of the larynx, trachea, and thyroid gland. They stretch between the hyoid bone and the sternum. An exception is the omohyoid muscle which extends to the scapula and in origin is a muscle displaced from the trunk to the shoulder girdle (truncofugal).

Sternohyoid muscle (*m. sternohyoideus, L.*) originates from the posterior surface of the sternal manubrium, sternoclavicular joint, and the sternal end on the clavicle, runs upward as a flat band, joins its contralateral fellow, and attaches to the inferior edge of the hyoid bone. Between the medial borders of both sternohyoid muscles is a narrow vertical space closed by fascia; this is the linea alba cervicalis. Action. Pulls the hyoid bone downward.

Sternothyroid muscle (*m. sternothyroideus, L.*) lies under the sternohyoid muscle and is broader. It arises from the posterior surface of the manubrium sterni and the cartilage of the first rib; its medial border touches that of its fellow. It then ascends and attaches to the lateral surface of the thyroid cartilage (to its linea obliqua). Action. Lowers the larynx.

Thyrohyoid muscle (*m. thyrohyoideus, L.*) seems to be a continuation of the sternothyroid muscle from which it is separated by a tendinous intersection. It stretches from the oblique line of the thyroid cartilage to the body and greater horn of the hyoid bone. Action. Pulls the larynx upwards when the hyoid bone is steadied.

Omohyoid muscle (*m. omohyoideus, L.*) is a long narrow muscle consisting of two bellies joined almost at a right angle by an intermediate tendon. The inferior belly arises medially of the scapular notch, overlaps the spatium antescalenum under cover of sternocleidomastoid muscle where it joins the superior belly by means of the intermediate tendon; the superior belly rises almost perpendicular and is attached to the body of the hyoid bone. Action. The omohyoid muscle lies in the thickness of the cervical fascia which it tightens on contraction and thus aids in dilation of the large veins situated under the fascia. It also pulls the hyoid bone downwards.

Infrahyoid muscles of the neck

Name of muscle	Origin	Insertion	Action
Sternohyoid	Manubrium sterni and medial end of clavicle	Body of hyoid bone	Depresses the hyoid bone
Sternothyroid	Manubrium sterni	Oblique line of lamina of thyroid	Depresses the larynx
Thyrohyoid	Oblique line of lamina of thyroid cartilage	Body of hyoid bone	Depresses the hyoid bone or elevates the larynx
Omohyoid muscles	Upper margin of scapula and suprascapular ligament	Intermediate tendon bound to clavicle and first rib	Depresses the hyoid bone
Inferior belly			
Superior belly	Body of hyoid bone	Intermediate tendon bound to clavicle and first rib	Depresses the hyoid bone

D. Deep muscles of the neck. Lateral group

The three scalene muscles are attached to the ribs.

Scalenus anterior muscle (*m. scalenus anterior, L.*) arises from the anterior tubercles of the transverse processes of the third to sixth cervical vertebrae and is attached to the scalene tubercle of the first rib and the sulcus of the subclavian artery.

Scalenus medius muscle (*m. scalenus medius, L.*) is the largest scalene muscle. It originates from the anterior tubercles of the transverse processes of all the cervical vertebrae and is attached to the first rib behind the sulcus of the subclavian artery.

Scalenus posterior muscle (*m. scalenus posterior, L.*) arises from the posterior tubercles of the three lower cervical vertebrae and is attached to the outer surface of the second rib.

Action. The scalene muscles raise the upper ribs and act as muscles of inspiration. When the ribs are steadied, bilateral contraction of the muscles accomplish forward flexion of the cervical spine; in unilateral contraction, they flex and rotate this segment of the spine to their side.

Deep muscles of the neck. Lateral group

Name of muscle	Origin	Insertion	Action
Scalenus anterior	Transverse processes of third, fourth, fifth, and sixth cervical vertebrae	Scalene tubercle of first rib	Elevates first rib, laterally flexes an: rotates cervical part of vertebral column
Scalenus medius	Transverse processes of upper six cervical vertebrae	Behind subclavian groove of first rib	Elevates first rib, laterally flexes an: rotates cervical part of vertebral column
Scalenus medius	Transverse processes of lower cervical vertebrae	Outer second rib	Elevates second rib, laterally flexes an: rotates cervical part of vertebral column

E. Deep muscles of the neck. Medial group

Longus cervicis muscle (*m. longus colli, L.*) is triangular and lies on the anterolateral surface of the cervical and upper thoracic vertebrae, on both sides of it. Stretching from the anterior tubercles of the transverse processes and bodies of the vertebrae and attached to the anterior tubercles of the transverse processes and bodies of the vertebrae several vertebrae above.

Longus capitis muscle (*m. longus capitis, L.*) overlaps the upper part of longus colli. It originates from the anterior tubercles of the transverse processes of the third, fourth, fifth, and sixth cervical vertebrae and is attached to the basilar part of the occipital bone.

The **rectus capitis anterior and lateralis muscles** (*mm. recti capitis anterior and lateralis, L.*) stretch from the lateral mass of the atlas (anterior muscle) and its transverse process (lateral muscle) to the occipital bone.

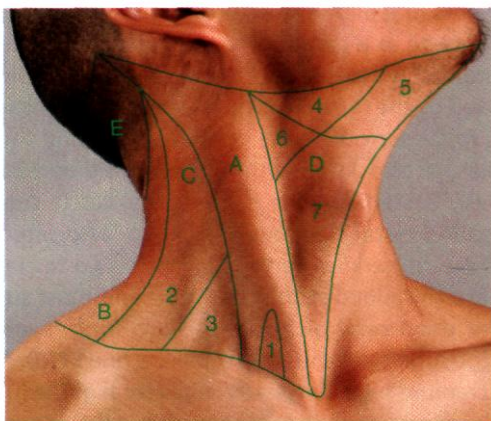
Action. Rectus capitis anterior and longus capitis flex the head forward. Longus colli flexes the cervical spine on bilateral contraction of all its fibres; in unilateral contraction the spine is flexed laterally; the oblique portions take part in rotation and flexion of the head to the side; rectus capitis lateralis helps this muscle.

Deep muscles of the neck. Medial group

Name of muscle	Origin	Insertion	Action
Longus colli	Anterior surface of vertebrae between atlas and third thoracic vertebra	Same as origin	Flexes cervical part vertebral column
Longus capitis	Transverse process of lower cervical vertebrae	Occipital bone	Flexes head
Rectus capitis anterior	Front of lateral mass of atlas	Occipital bone	Flexes head
Rectus capitis lateralis	Transverse process of atlas	Occipital bone	Lateral flexion of head

Topography and fascia of the neck

Cervical Regions/Triangles and Contents^a



of the parotid gland, nerves, and vessels. Median line divides the anterior region into two anterior triangles.

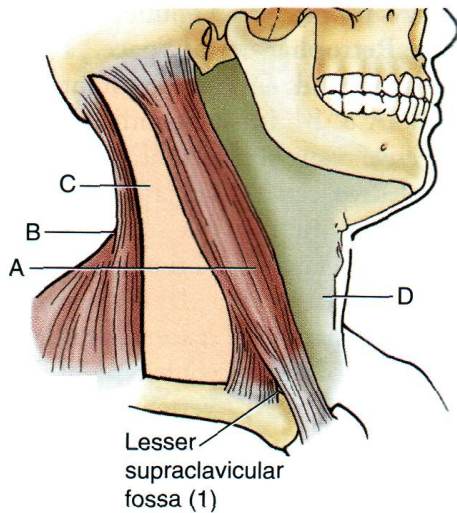
The neck (collum) is divided into four regions: the region of the sternocleidomastoid muscle (A), posterior (B), lateral (C), and the anterior region (D).

The **anterior region** (regio colli anterior) is in front of the sternocleidomastoid muscle and is bounded posteriorly by this muscle, in front by the midline of the neck, and above by the border of the mandible. A small area behind the mandibular angle and in front of the mastoid process is called the fossa retromandibularis. It lodges the posterior part

The **posterior region** (regio colli posterior) is behind the lateral border of the trapezius muscle and is the nape, or nucha.

The **lateral region** (regio colli lateralis) is behind the sternocleidomastoid muscle and is bounded in front by this muscle, below by the clavicle, and behind by the trapezius muscle.

The **sternocleidomastoid region** (regio sternocleidomastoidea) corresponds to the projection of this muscle.

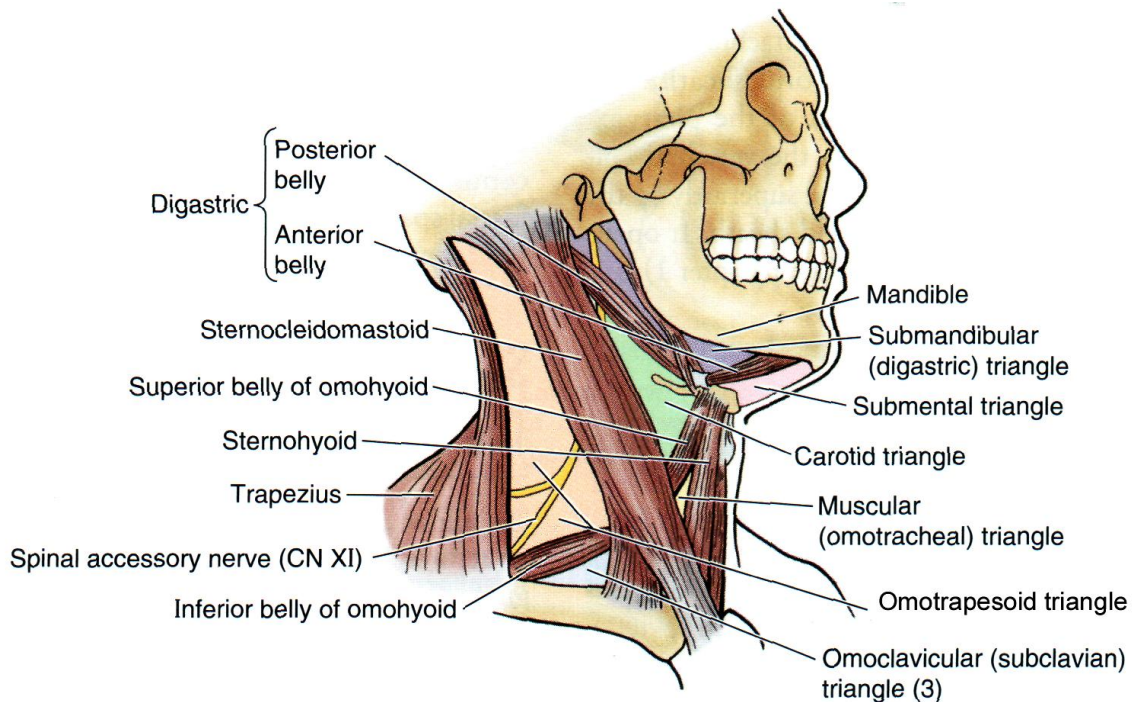


The anterior and lateral regions are divided into a number of triangles by the omohyoid muscle descending obliquely from front to back and crossing the sternocleidomastoid muscle.

The digastric, stylohyoid, and superior belly of the omohyoid muscles cross the **anterior triangle (D)**.

They further subdivide it into 4 smaller triangles:

1. **Carotid:** bounded by the posterior belly of digastric, superior belly of omohyoid, and anterior border of the sternocleidomastoid
2. **Omotracheal:** bounded by, anterior border of sternocleidomastoid, and anterior median line of neck



3. **Submandibular:** bounded by mandible and two bellies of the digastric muscle
4. **Submental** (suprahyoid): bounded by body of hyoid bone and anterior belly of digastric muscle of each side. Extends across anterior median line of neck

Omohyoid muscle subdivide the **lateral region (C)** into 2 smaller triangles:

1. **Omoclavicular:** bounded by the sternocleidomastoid muscle in front, the inferior belly of the omohyoid muscle above, and the clavicle below.
2. **Omotrapsoid:** bounded by the sternocleidomastoid muscle in front, the inferior belly of the omohyoid muscle below, and the omotrapsoid muscle behind.

Triangular slits or spaces form between the scalene muscles; they transmit nerves and vessels of the upper limb.

1. Between the anterior and middle scalene muscles is **spatium interscalenum**; bounded by the first rib below (it transmits the subclavian artery and the brachial plexus).

2. In front of the anterior scalene muscle is **spatium antescalenum** covered in front by the sternothyroid and sternohyoid muscles (it transmits the subclavian vein, the suprascapular artery, and the omohyoid muscle).

The **fasciae of the neck** (*fascia cervicalis, L.*) reflect the topography of organs located in the cervical region.

According to the Paris Nomina Anatomica, all fasciae of the neck are embraced under the term fascia cervicalis, which is divided into three layers as follows.

1. The **superficial layer** (fascia) (*lamina superficialis, L.*) encloses the whole neck like a collar and forms synovial sheath for the sternocleidomastoid and trapezium muscles. It is attached above to the mandible and the mastoid process and is continuous on the face with the parotid and masseteric fasciae which cover the parotid gland and the masseter muscle. Below, the superficial layer is attached to the anterior border of the manubrium sterni and the clavicle.

2. The **pretracheal layer** (fascia) (*lamina pretrachealis*) is manifest only in the middle part of the neck behind the sternocleidomastoid muscle where it is stretched like a trapezium over a triangular space bounded above by the hyoid bone, on both sides by the omohyoid muscles, and below by the clavicles and the sternum. Since the deep layer of the cervical fascia proper is attached below to the posterior border of the manubrium sterni and the clavicles, while the superficial layer is attached to the anterior border of these bones, a narrow space is left between these layers; this is **spatium interaponeuroticum suprasternale** containing loose fatty tissue and the superficial veins of the neck, the jugular venous arch (*arcus venosus juguli*), injury to which is fraught with danger. Laterally this space communicates with **recessus lateralis**, a blind space behind the inferior end of the sternocleidomastoid muscle into which pus may penetrate. The deep layer, separating and again fusing, forms fascial sheaths for the infrahyoid muscles (the sternohyoid, sternothyroid, and thyrohyoid muscles). It unites these muscles to form a thick connective-tissue muscular expansion, like their aponeurosis (*aponeurosis omoclavicularis*), which tenses when the omohyoid muscles contract and thus facilitates the flow of blood in the cervical veins perforating it and fusing with it. This tension and the triangular shape suggested the image-bearing name of the aponeurosis, the "cervical sail".

3. The **prevertebral layer** (fascia) (*lamina prevertebralis, L.*) covers anteriorly the prevertebral and scalene muscles stretching on the spine, and by fusing with the transverse processes of the vertebrae forms sheaths for these muscles.

Above, the prevertebral fascia arises from the base of the skull behind the pharynx, descends through the entire length of the neck, and enters the posterior mediastinum where it merges with the endothoracic fascia.

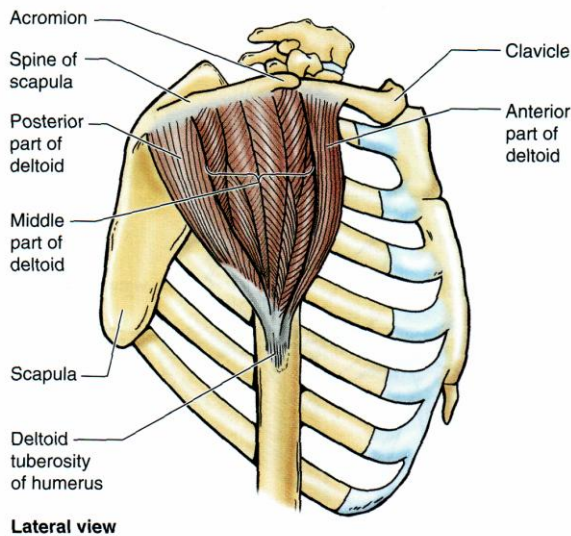
Between the fourth and fifth fasciae, behind the pharynx and oesophagus, is a narrow space filled with loose fatty tissue; this is **retrovisceral space** (*spatium retroviscerale*), which is continuous downwards with the posterior mediastinum. corresponding to the fifth fascia, i. e. fascia prevertebralis.

Muscles of upper limb

Musculature of upper limb divides into muscles of the shoulder girdle and free limb.

Muscle of the shoulder girdle

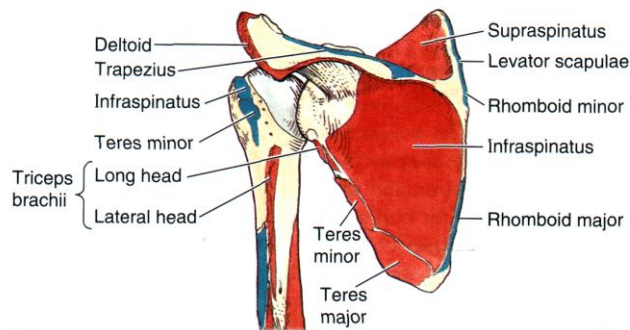
Deltoid (*m. deltoideus, L.*) arises from the scapula and clavicle immediately below the



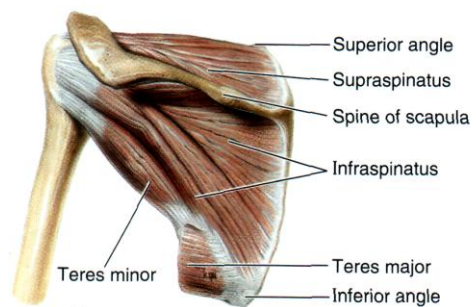
attachment of trapezius. It is inserted by means of a tough tendon into the deltoid tuberosity on the lateral surface of the humerus. The central part of the muscle is multipennate. When viewed from the lateral side the muscle is thus triangular in shape, hence its name (Greek delta, A). The most important function of deltoid is abduction at the shoulder joint, this movement being carried out by the powerful multipennate part of the muscle that arises from the acromion. When the arm is thus abducted, the anterior and posterior fibres act as braces like the stays of a television mast. Deltoid cannot, however, initiate abduction since

when the arm is by the side its central fibres are vertical so that the muscle will pull the humerus bodily upwards. The initial movement is therefore carried out by supraspinatus. The anterior fibres acting on their own are flexors of the shoulder and posterior fibres are extensors. Deltoid acts eccentrically when lowering the arm to the side.

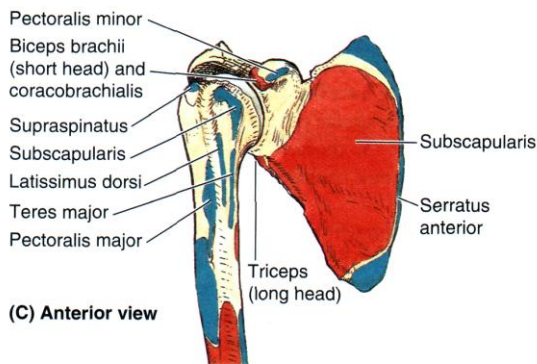
Teres major (*m. teres major, L.*) passes from the minor tubercle of humerus to the lateral border of the scapula. The tendon of latissimus dorsi curves round its lower border comes to lie in front of it and is inserted lateral to it.



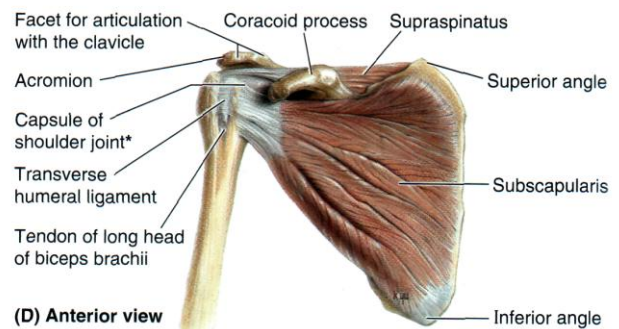
(A) Posterior view



(B) Posterior view



(C) Anterior view



(D) Anterior view

*Musculotendinous rotator cuff

Teres minor (*m. teres minor, L.*) arising from the lateral margin of the scapular its tendon is attached to the back of the greater tubercle below infraspinatus. Another lateral rotator and a weak adduction.

Subscapularis (*m. suprascapularis, L.*)

This is originating to most of the subscapular fossa of the scapula and since it contains strong tendinous. Its humeral attachment is to the lesser tubercle so that it is obviously a medial rotator.

Supraspinatus (*m. supraspinatus, L.*)

Arising from the supraspinous fossa, this muscle narrows down to a flattened tendon that lies in the floor of the subacromial bursa under the coraco-acromial ligament and is attached to the upper surface of the greater tubercle of the humerus. It is a weak abductor but is important because it is the only muscle capable of starting the movement of abduction.

Infraspinatus (*m. infraspinatus, L.*)

Arising from the infraspinous fossa, it passes behind the shoulder joint to be attached to the back of the greater tubercle. A lateral rotator.

The main function of these muscles in helping to keep the head of the humerus in place has already been mentioned and it remains only to describe the attachments of the muscles and their roles in producing movements at the shoulder joint. Deltoid and trapezius muscles are dealt with together although they have quite different actions. They may be regarded, however, as being one large continuous muscle sheet with the spine of scapula, the acromion, and the lateral third of the clavicle forming a bony outcrop between them. Thus, during abduction of the upper limb, trapezius elevates the tip of the.

Muscles of the free upper limb subdivide into muscles of the arm, forearm and hand.

Muscles of the arm

The muscles of the arm are disposed around the humerus, the brachialis in front and the triceps behind being attached to very large areas of the shaft.

A. Anterior group

Brachialis (*m. brachialis, L.*)

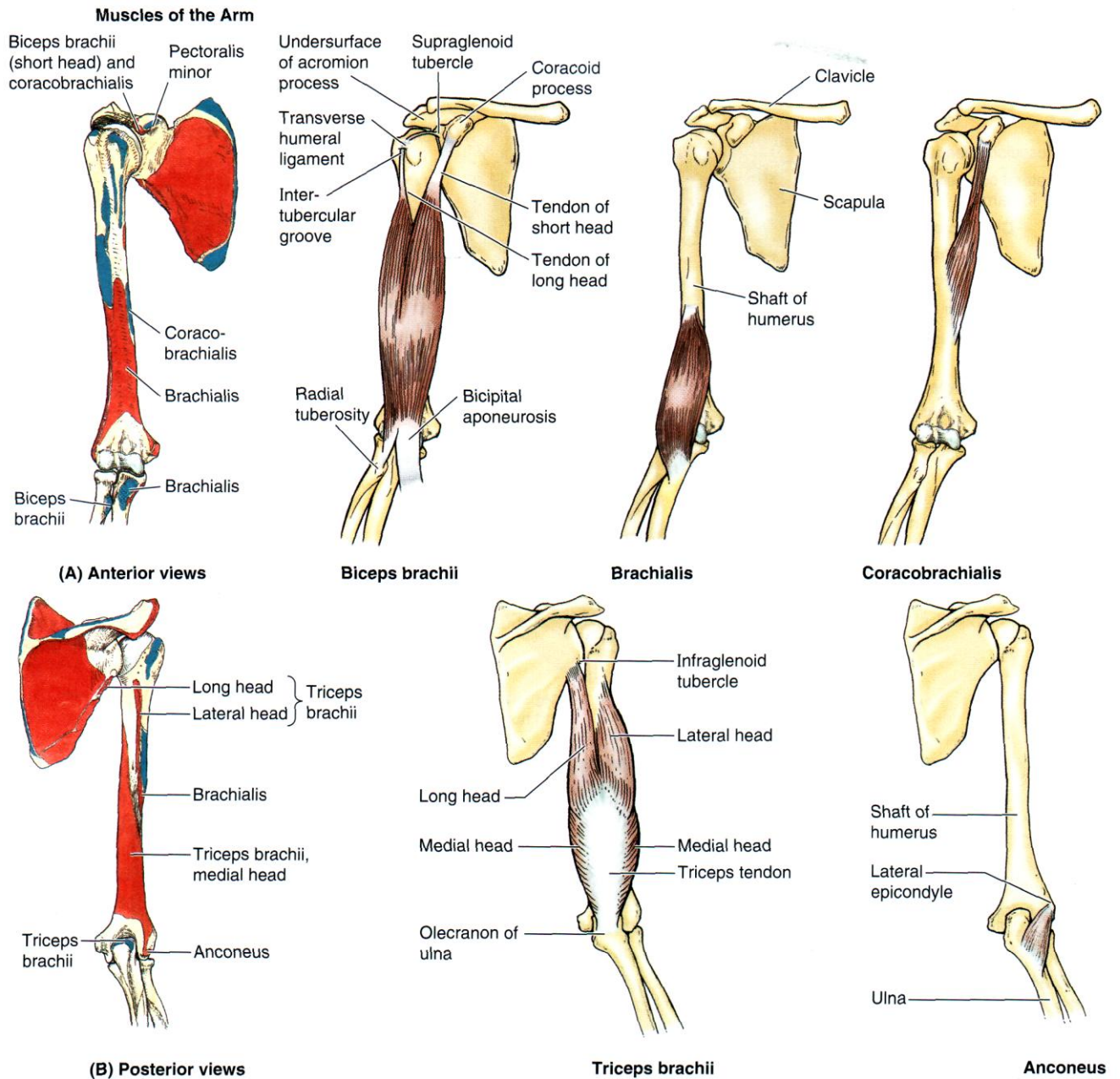
The muscle arises from the front of the shaft of the humerus, crosses the anterior of the elbow joint and is inserted into the tuberosity of the ulna by a powerful tendon. It flexes the elbow joint.

Coracobrachialis (*m. coracobrachialis, L.*) arises from the coracoid process of the scapula along with the short head of the biceps brachii and pectoralis minor and attaches by a short tendon to the medial surface of the humerus distal from the crista tuberculi minoris. Action. Elevates forward and adducts the arm.

Biceps brachii (*m. biceps brachii, L.*)

As its name implies, this muscle has two heads, the long head arising from above the glenoid fossa of the scapula and passing through the shoulder joint to emerge, surrounded by a tube-like sheath of synovial membrane, at the top of the intertubercular sulcus. It lies in the sulcus and then joins the short head which arises in common with coraco-brachialis from the coracoid process. The muscle lies in front of brachialis with the musculocutaneous nerve sandwiched between the two. The thick tendon of insertion is attached to the radial tuberosity.

An extension from the tendon, the bicipital aponeurosis, is a thin sheet of dense fascia that passes medially to blend with the deep fascia the forearm. It is very prominent when biceps contracts and must not be mistaken for the main tendon when eliciting a stretch reflex. It is a powerful flexor and of the forearm. Its long head helps in flexion at the shoulder.



A. Posterior group

Triceps (*m. triceps, L.*)

This is the only muscle on the back of the arm and its three heads are unfortunately misused lateral, medial and long. It would be much easier to understand if its heads were named superficial (with two components) and deep since it is in two well defined layers in the upper part of the arm, with the radial nerve lying between them.

The medial head (which one would prefer to be called deep) is attached to the whole of the lower part of the back of the humerus overflowing onto the back of the medial and lateral intermuscular septa.

The long and lateral heads arise, respectively, from the infraglenoid region and an oblique line on the back of the humerus.

These heads unite and insert into the olecranon at the upper end of the ulna. It is a powerful extensor of the elbow but remember that in the upright position extension is carried out by gravity, so when testing triceps, extension must be carried out against resistance.

Muscles of the shoulder girdle

Name of muscle	Origin	Insertion	Action
Deltoid	Lateral third of clavicle, acromion process, spine of scapula	Middle of lateral surface of shaft of humerus	Abducts arm; anterior fibers flex arm, posterior fibers extend arm
Supraspinatus	Supraspinous fossa of the scapula	Greater tubercle of the humerus	Abducts arm
Infraspinatus	Infraspinous fossa of the scapula	Greater tubercle of the humerus	Rotates arm laterally
Teres minor	Lateral margin of the scapular	Greater tubercle of the humerus	Rotates arm laterally and abducts arm
Teres major	Minor tubercle of humerus	Lateral border of the scapula	Extends and abducts arm, rotates arm medially
Subscapularis	Subscapular fossa of the scapula	Lesser tubercle of the humerus	Rotate arm medially

Muscles of the arm

Name of muscle	Origin	Insertion	Action
Anterior group Biceps brachii			
Long head	Supraglenoid tubercle of scapula Coracoid process of scapula	Tuberosity of radius and bicipital aponeurosis into deep fascia of forearm	Supinator of forearm, flexor of elbow joint, weak flexor of shoulder joint
Short head			
Coracobrachialis	Coracoid process of scapula	Medial aspect of shaft of humerus	Flexes and adducts arm
Brachialis	Front of lower half of humerus	Coronoid process of ulna	Flexor of elbow joint
Posterior group Triceps			
Long head	Infraglenoid tubercle of scapula Upper half of posterior surface of shaft of humerus Lower half of posterior surface of shaft of humerus	Olecranon process of ulna	Extensor of elbow joint
Lateral head			
Medial head			
Anconeus	Lateral epicondyle of humerus	Olecranon process of ulna	Extends elbow joint

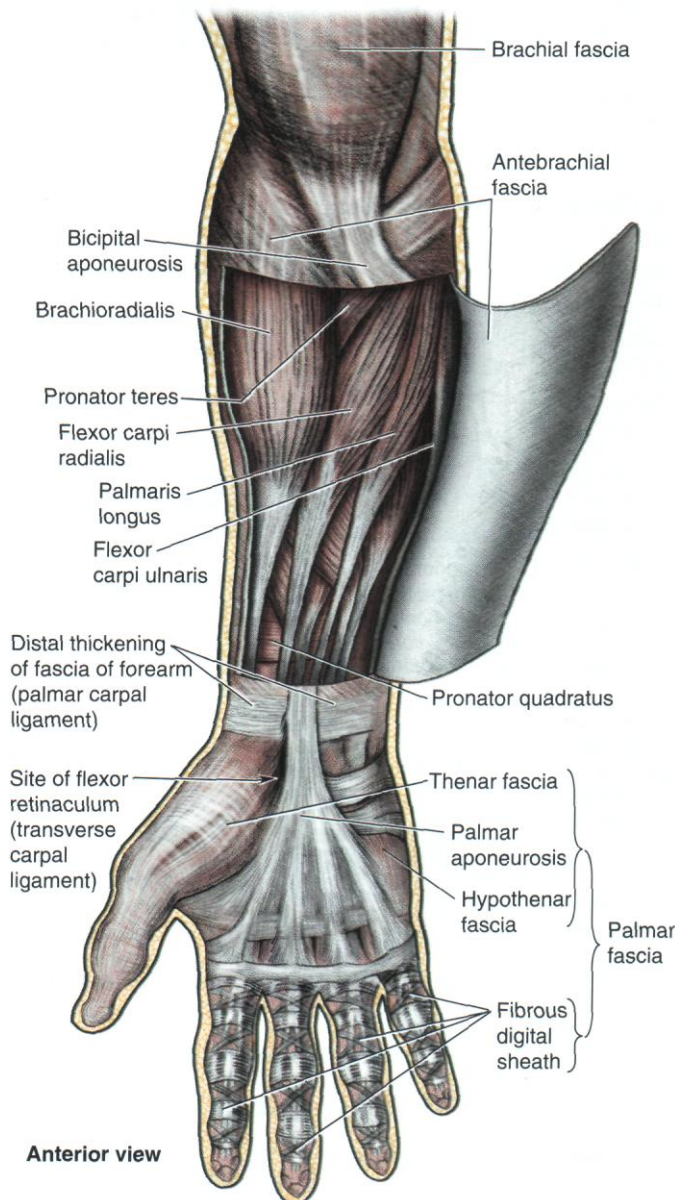
Muscles of forearm

The muscles of the front of the forearm

Most of these arise above the elbow joint so that they may have some flexor activity on this joint. They are best thought of as lying in three strata. The most superficial layer consists of four muscles, pronator teres, flexor carpi radialis, palmaris longus and flexor carpi ulnaris. They arise from a common flexor origin on the medial epicondyle and are partly fused together in the upper part of the forearm so that the muscle that forms the intermediate layer (flexor digitorum superficialis) cannot be seen. Towards the wrist, however, they narrow down to tendons so that the tendons of flexor superficialis can surface between them.

A. Anterior group

1. Superficial layer



Brachioradialis (*m. brachioradialis, L.*) is situated on the front of the forearm and although a flexor. It is cross the elbow joint and then travels down to the lower end of the radius before inserting just above the styloid process. It is a flexor of the elbow joint when the forearm is *semiprone* (as in carrying a coat over the arm) and it can supinate the already pronated forearm and probate it when it is already urinated.

Pronator teres (*m. pronator teres, L.*). This is the only one of the four superficial muscles that only travels halfway down. It is inserted into a small area halfway down the radius at the summit of its convexity, thus gaining the maximum mechanical advantage in pronation.

Flexor carpi radialis (*m. flexor carpi radialis, L.*). Passes deep to the flexor retinaculum in its own compartment and is inserted into the bases of the 2nd and 3rd metacarpals. It is a flexor

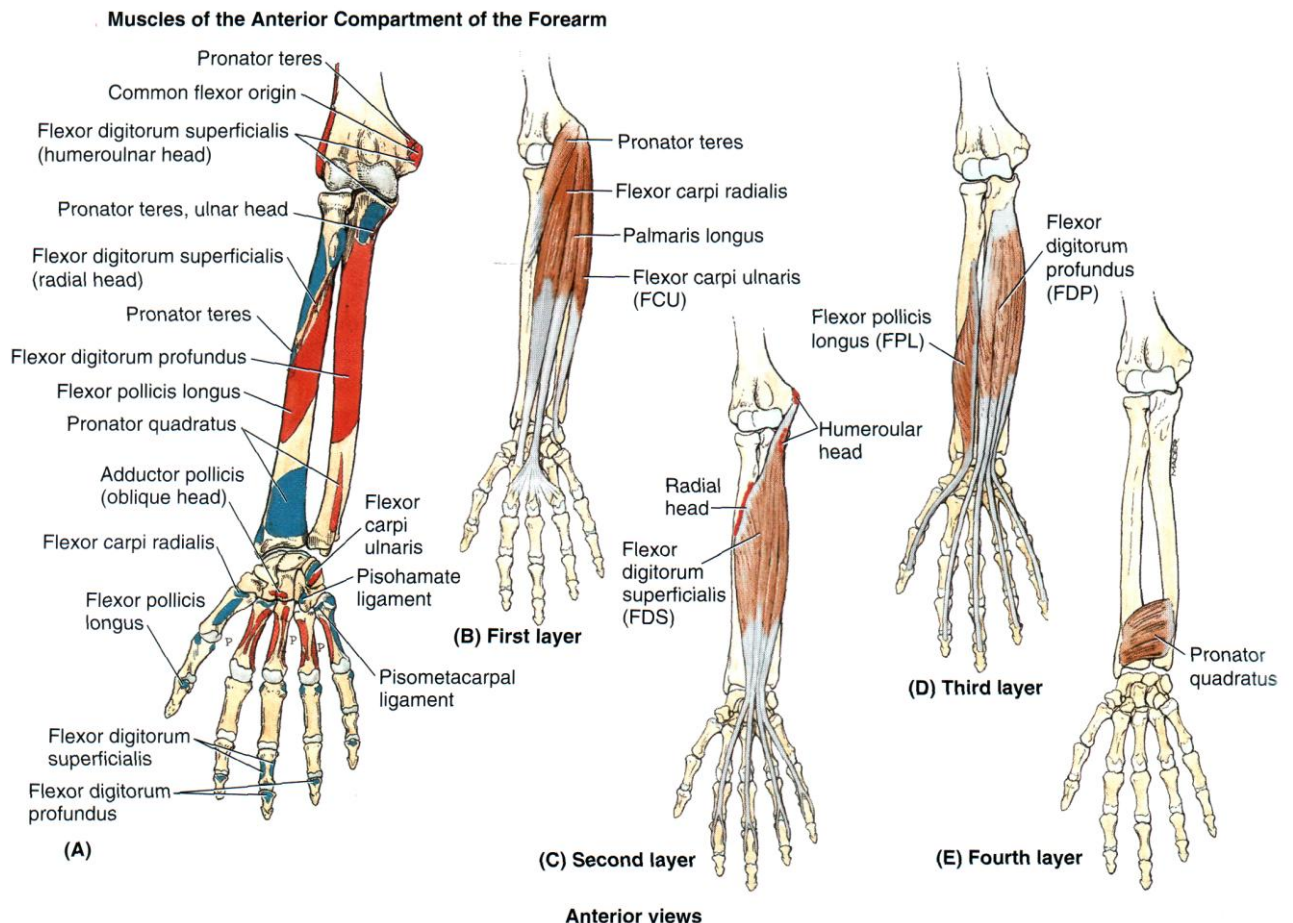
and abductor of the wrist.

Palmaris longus (*m. palmaris longus, L.*). Often absent, and unimportant except as a landmark, it is inserted into the palmar aponeurosis and flexor retinaculum.

Flexor carpi ulnaris (*m. flexor carpi ulnaris, L.*). This muscle has an extra origin by means of an aponeurosis from the subcutaneous posterior border of the ulna which forms a 'pocket' in this region. It is officially inserted into the pisiform bone but the pisometacarpal ligament passes from the pisiform to the base of the 5th metacarpal and is said to be the true tendon of insertion of flexor carpi ulnaris. Thus the pisiform bone is really a sesmoid bone in the tendon. This muscle is a flexor and an adductor of the wrist.

2. Intermediate layer

Flexor digitorum superficialis (*m. flexor digitorum superficialis, L.*). This muscle also has an extra head which is a thin sheet of muscle attached to the oblique line on the radius. The two heads join to form an arch under which passes the median nerve and the ulnar artery. The tendons pass beneath the flexor retinaculum as two pairs, those to the ring and middle fingers in front and to the index and little fingers behind. In the palm, they splay out and pass to the four fingers to enter the fibrous flexor sheaths. These are tough fibrous arches that pass across the palmar surface of the phalanges (although they are thinner and more flexible over the interphalangeal joints to allow movement). They thus form tunnels which contain the long flexor tendons (superficialis and profundus) and their synovial sheaths. As they enter the fibrous flexor sheaths, each tendon splits into two, the two halves each twist



through 180 and they then reunite, only to split up again to be attached to the sides of the middle phalanx. The perforation in the tendon allows for the passage of flexor digitorum profundus which is inserted into the distal phalanx. Superficialis is thus a flexor of all the joints that it crosses but it cannot flex the distal interphalangeal joint.

3. Deep layer

These three muscles lie in contact with the bones and the ligaments of the joints.

Flexor digitorum profundus (*m. flexor digitorum profundus, L.*) arises from the front of the ulna and the interosseous membrane. It splits into four tendons rather low down in the forearm and these pass under the flexor retinaculum (lying side by side), through the fibrous flexor sheaths and re inserted into the distal phalanges of the fingers. They pass through the gap in the tendons of flexor digitorum superficialis. It is the low division of the muscle belly into its four tendons that stops flexion of the distal phalanx of the ring finger when the muscle is stretched by extending the other fingers (see above). The four lumbrical muscles are attached to the four tendons of profundus. This muscle can flex all the joints over which it passes, including the distal interphalangeal joint.

Flexor pollicis longus (*m. flexor pollicis longus, L.*) arises from the shaft of the radius and the interosseous membrane. It is inserted, like profundus, into a distal phalanx of the thumb.

Pronator quadratus (*m. pronator quadratus, L.*). The only muscle of the forearm that runs transversely. It passes from the lower few centimeters of the ulna to a similar area on the radius. It pronates the forearm.

Flexor pollicis longus (*m. flexor pollicis longus*) has its own sheath and flexors digitorum superficialis and profundus share one as they pass through the carpal tunnel. This sheath ends, however, in the palm of the hand except for the sheath for the little finger, but in the fibrous flexor sheaths the tendons for the index, middle and ring fingers have their own synovial sheaths. There is often a communication between the sheath of flexor pollicis longus and that of the long flexors behind the flexor retinaculum. The sheaths are important because if an infection in the fingers (for example, a whitlow) is inadequately treated, the sheaths may become infected and this is an extremely serious condition, sometimes leading to restriction of finger movement.

B. Posterior group of muscles of the forearm

The muscles can be divided into superficial and deep groups.

1. Superficial group of extensor muscles

These arise from a common extensor origin on the lateral epicondyle of the humerus.

Extensor carpi ulnaris (*m. extensor carpi ulnaris, L.*) has an additional aponeurotic origin from the posterior border of the ulna and it is inserted into the base of the 5th metacarpal. It is an extensor and adductor of the wrist joint.

Extensor digiti minimi (*m. extensor digiti minimi, L.*). Small and unimportant, it joins the tendon of extensor digitorum to the little finger.

Extensor digitorum (*m. extensor digitorum, L.*). It arises from the lateral epicondyle of humerus. In the middle of the forearm, the muscle separates into four bellies, each ending in a long tendon. The tendons descend to the dorsal surface of the hand, pass under the retinaculum extensor and then diverge toward the four fingers. On the dorsal surface of the hand near the metacarpophalangeal joints, the tendons are joined by means of oblique fibrous bands, intertendinous connexion (conexus intertendineus), with the result that the middle and ring fingers can be extended only jointly; the index finger and partly the little finger retain their independence because they have their own extensors.

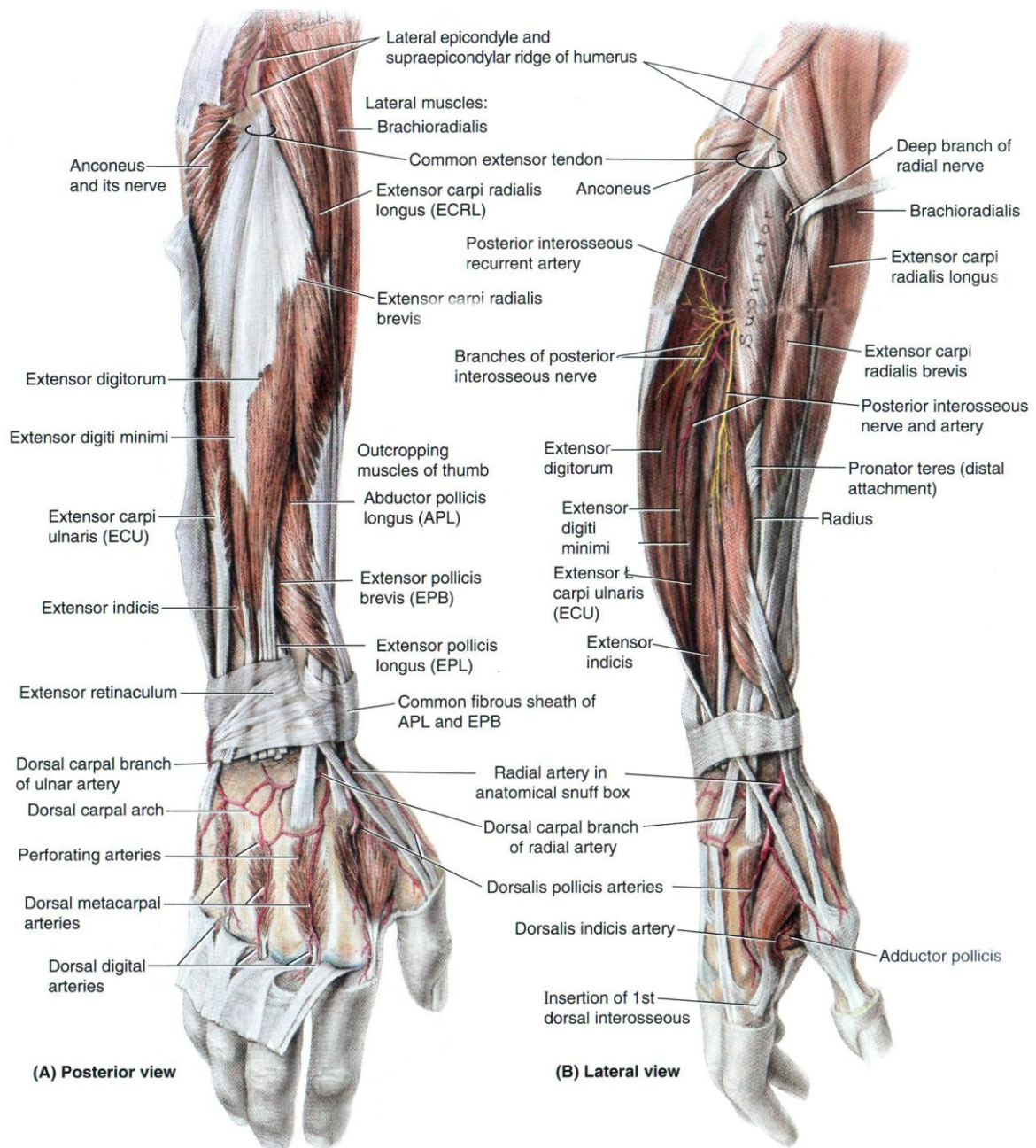
On the dorsal surface of each finger each tendon of the common extensor forms a triangular tendinous expansion separating into three slips; a middle slip is attached to the base of the middle phalanx and two collateral slips are attached to the base of the distal phalanx.

Action. Extends the index, middle, ring, and little fingers and accomplishes dorsal flexion of the wrist.

Extensor carpi radialis longus and brevis (*m. extensor carpi radialis longus and brevis, L.*). The corresponding extensor is split into two parts, longus and brevis, which are inserted respectively into the bases of the 2nd and 3rd metacarpals. They extend and abduct the wrist.

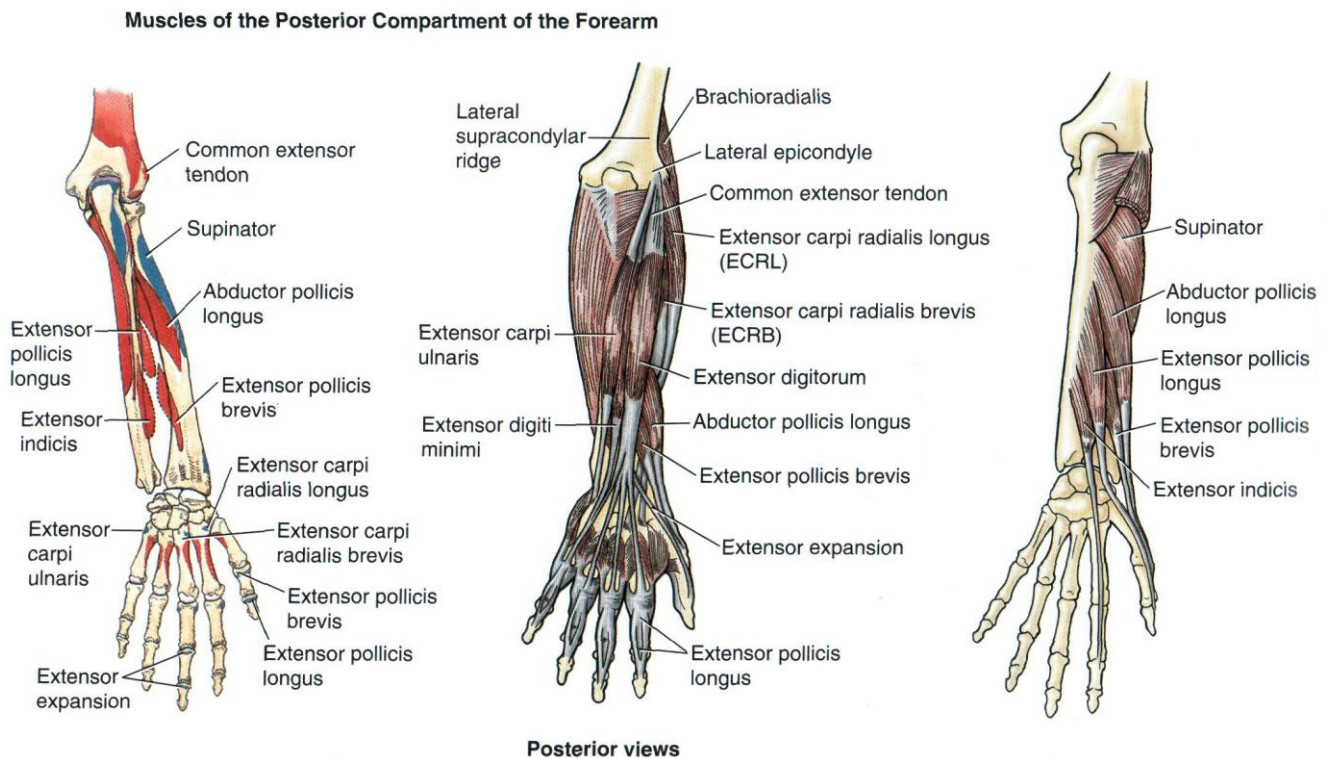
2. Deep group of extensor muscles

Supinator (*m. supinator, L.*). Just as, on the flexor surface, pronator teres does not have a tendon that reached the wrist, supinator, on the extensor surface, is also restricted to the upper forearm.



It arises from the supinator crest of the ulna as well as the common extensor origin and the annular ligament, and then wraps around the back of the radius to be attached to the upper third of the shaft.

Abductor pollicis longus, extensor pollicis brevis and extensor pollicis longus (*mm. abductor pollicis longus, extensor pollicis brevis and extensor pollicis longus, L.*). They arise along with extensor indicis from the backs of the radius, or ulna, or both (plus the interosseous membrane) and are each inserted into the base of a different bone of the thumb, the metacarpal, proximal phalanx and distal phalanx in the order shown above. The tendons of abductor pollicis longus and extensor pollicis brevis come to the surface by emerging from under cover of the lateral border of extensor digitorum and winding round the lateral border of the forearm, while extensor pollicis longus is easily recognized because it uses the dorsal



tubercle of the radius. They form the boundaries of the anatomical snuffbox. In its floor can be felt the styloid process of the radius and the scaphoid and also the pulsation of the radial artery. Tenderness in the snuffbox is an important sign of fracture of the scaphoid.

Extensor indicis (*m. extensor indicis, L.*). Small and unimportant, its tendon joins the tendon of extensor digitorum to the index finger.

All the muscles mentioned above, except for supinator, have synovial tendon sheaths in the region of the wrist, where they pass under the extensor retinaculum, but there are no synovial sheaths on the dorsal aspect of the fingers.

Muscles of the forearm. Anterior group

Name of muscle	Origin	Insertion	Action
Brachioradialis	Lateral epicondyle of humerus	Styloid process of radius	Flexes forearm at elbow joint, pronates forearm
Pronator teres Humeral head Ulnar head	Medial epicondyle of humerus Coronoid process of ulna	Lateral aspect of shaft of radius	Pronates and flexes the forearm
Flexor carpi radialis	Medial epicondyle of humerus	Bases of second and third metacarpal bones	Flexes and abducts hand at wrist joint
Palmaris longus (often absent)	Medial epicondyle of humerus	Flexor retinaculum and palmar aponeurosis	Flexes hand
Flexor carpi ulnaris Humeral head Ulnar head	Medial epicondyle of humerus Olecranon process and posterior border of ulna	Pisiform bone, hook of hamate, base of fifth metacarpal bone	Flexes and adducts the hand at the wrist joint
Flexor digitorum superficialis Humeroulnar head Radial head	Medial epicondyle of humerus Oblique line on anterior surface of shaft of radius	Middle phalanx of 2-5th fingers	Flex middle phalanges of 2-5 th fingers and assists in flexing proximal phalanx and hand
Flexor pollicis longus	Anterior surface of shaft of radius	Distal phalanx of thumb	Flexes distal phalanx of thumb
Flexor digitorum profundus	Anterior surface of shaft of ulna, interosseous membrane	Distal phalanges of 2-5th fingers	Flexes distal phalanges of the 2-5 th fingers, then assists in flexion of middle and proximal phalanges and the wrist
Pronator quadratus	Anterior surface of shaft of ulna	Anterior surface of shaft of radius	Pronates the forearm

Muscles of the forearm. Posterior group

Name of muscle	Origin	Insertion	Action
Extensor carpi radialis longus	Lateral supracondylar ridge of humerus	Base of second metacarpal bone	Extends and abducts hand at wrist joint
Extensor carpi radialis brevis	Lateral epicondyle of humerus	Base of third metacarpal bone	Extends and abducts the hand at the wrist joint
Extensor digitorum	Lateral epicondyle of humerus	Middle and distal phalanges of the 2-4 th fingers	Extends fingers and hand
Extensor digiti minimi	Lateral epicondyle of humerus	Extensor expansion of little finger	Extends metacarpophalangeal joint of little finger
Extensor carpi ulnaris	Lateral epicondyle of humerus	Base of fifth metacarpal bone	Extends and adducts hand at the wrist joint
Supinator	Lateral epicondyle of humerus, ulna	Shaft of radius	Supinates the forearm
Abductor pollicis longus	Shaft of radius and ulna	Base of first metacarpal bone	Abducts and extends thumb
Extensor pollicis brevis	Shafts of radius and interosseous membrane	Base of proximal phalanx of thumb	Extends metacarpophalangeal joints of thumb
Extensor pollicis longus	Shafts of ulna and interosseous membrane	Base of distal phalanx of thumb	Extends distal phalanx of thumb
Extensor indicis	Shafts of ulna and interosseous membrane	Base of distal phalanx index finger	Extends metacarpophalangeal joint of index finger

Muscles of the hand

These are arranged in two main groups around the first and the fifth metacarpals, forming the thenar and hypothenar eminences, along with a number of deeper muscle in the central 'hollow' of the palm. The skin in the centre of the palm is particularly thick and cannot easily be pinched up. This is because it is attached deeply to the palmar aponeurosis, a thick triangular mass of fascia that is attached proximally to the flexor retinaculum, blending in with the tendon of palmaris longus. Distally, it splits up into slips for the four fingers and blends with the fibrous flexor sheaths.

A. Thenar muscles

Abductor pollicis brevis (*m. abductor pollicis brevis, L.*). Arises from flexor retinaculum and some carpal bones to the lateral side of the proximal phalanx of the thumb.

Flexor pollicis brevis (*m. flexor pollicis brevis, L.*). Attachments similar to abductor.

Opponens pollicis (*m. opponens pollicis, L.*). Origin similar but it is inserted into the shaft of the first metacarpal.

Adductor pollicis (*m. adductor pollicis, L.*). This muscle lies deeper than the other three. It has an oblique head from some of the carpal bones and transverse head from the third metacarpal. It is inserted into the medial side of the base of the proximal phalanx of the thumb, along with the first palmar interosseous.

A sesamoid bones are found in the combined tendon on each side and the flexor pollicis longus tendon between them on its way to the distal phalanx.

B. The hypothenar muscles

Abductor digiti minimi (*m. abductor digiti minimi, L.*). Arises from the pisiform and is inserted into the ulnar side of the base of the proximal phalanx of the little finger.

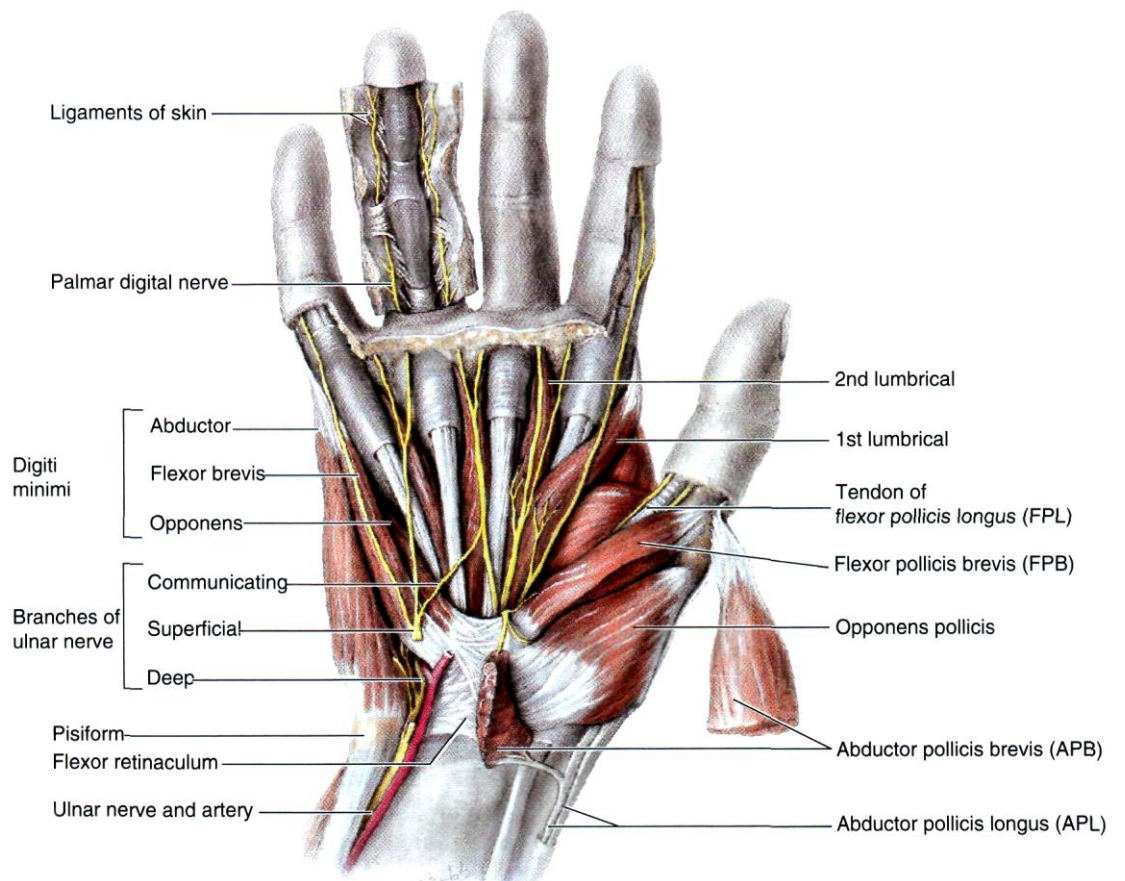
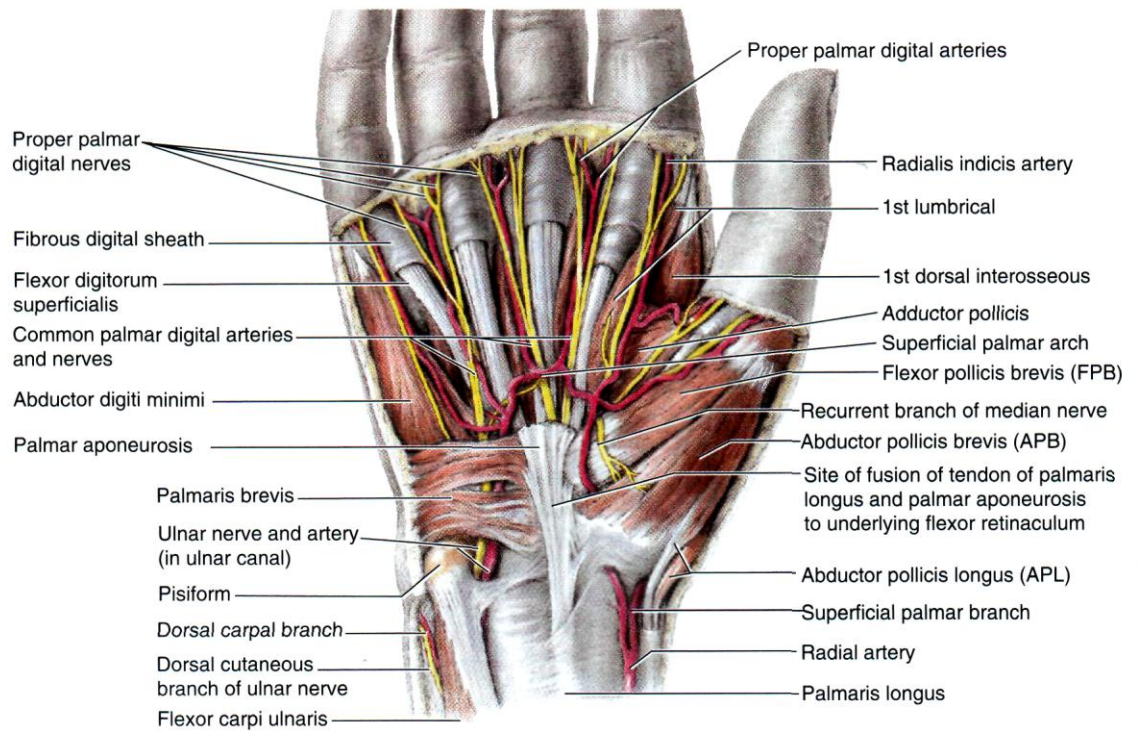
Flexor digiti minimi (*m. flexor digiti minimi, L.*). From the flexor retinaculum to the ulnar side of the proximal phalanx.

Opponens digitti minimi (*m. ipponens digitti minimi, L.*). From the flexor retinaculum to the shaft of the 5th metacarpal.

Action of thenar and hypothenar muscles

The name of the muscles indicates their actions but note that since the muscles often work together (for example opposition of the thumb involves both flexion and medial rotation) the muscle bellies are often fused. Opposition of the little finger is slight but important in gripping.

Muscles of the hand:



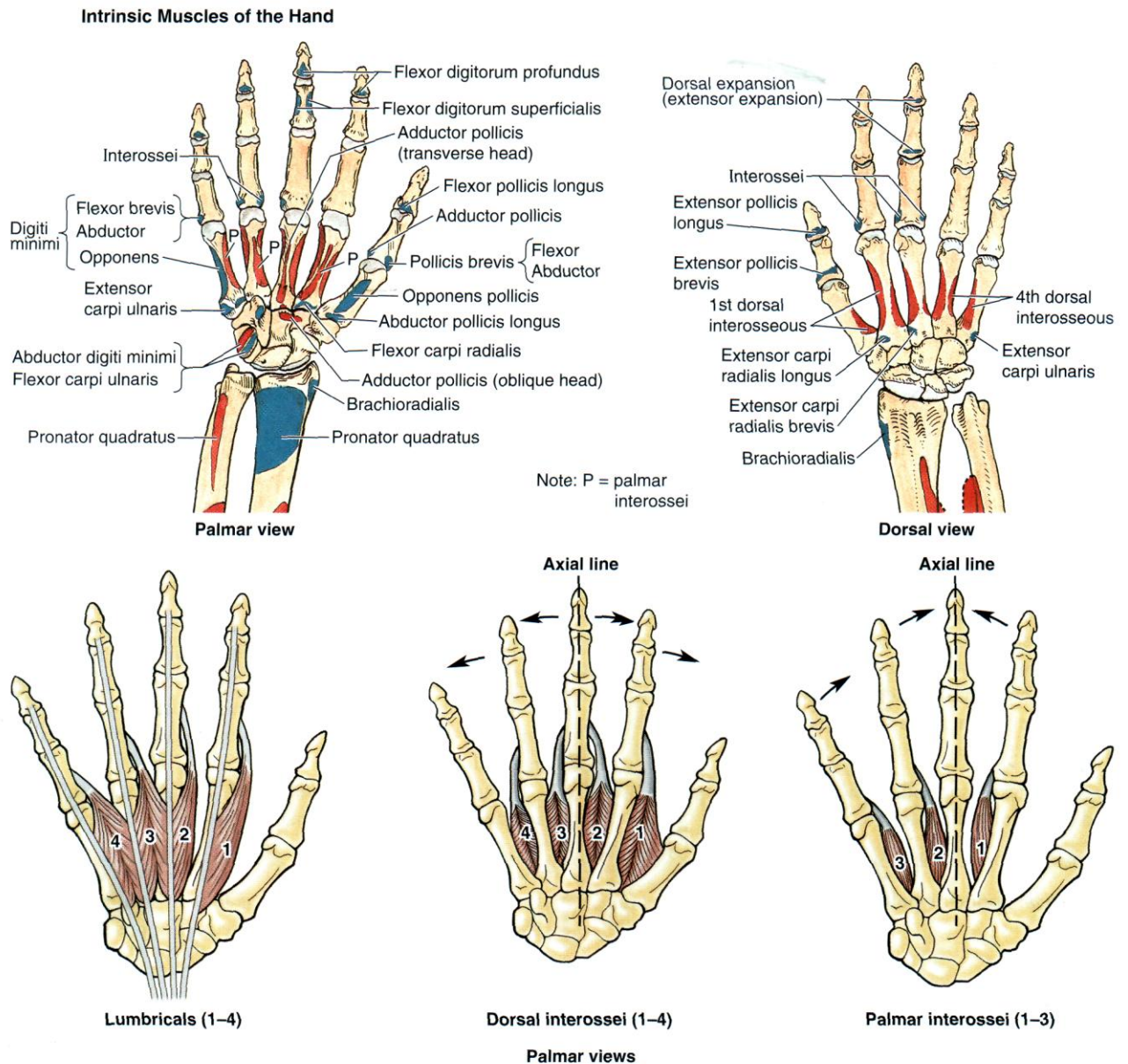
C. Middle group

Lumbrical muscles (*mm. lumbricales, L.*)

These are four slender muscles which arise from the tendons of flexor digitorum profundus. Their tendons are inserted into the radial side of each of the proximal phalanges of the fingers and into the dorsal extensor expansion. They have similar actions to those of the interossei in flexing the metacarpophalangeal joints without flexing the interphalangeal joints.

The interosseous muscles (*mm. interossei, L.*)

These are eight muscles that arise from the shafts or bases of the metacarpals and insertion into the sides of the proximal phalanges, the interossei are also inserted into the dorsal extensor expansion. Both palmar and dorsal interossei flex the metacarpophalangeal joints and extend the interphalangeal joints.



Muscles of the hand

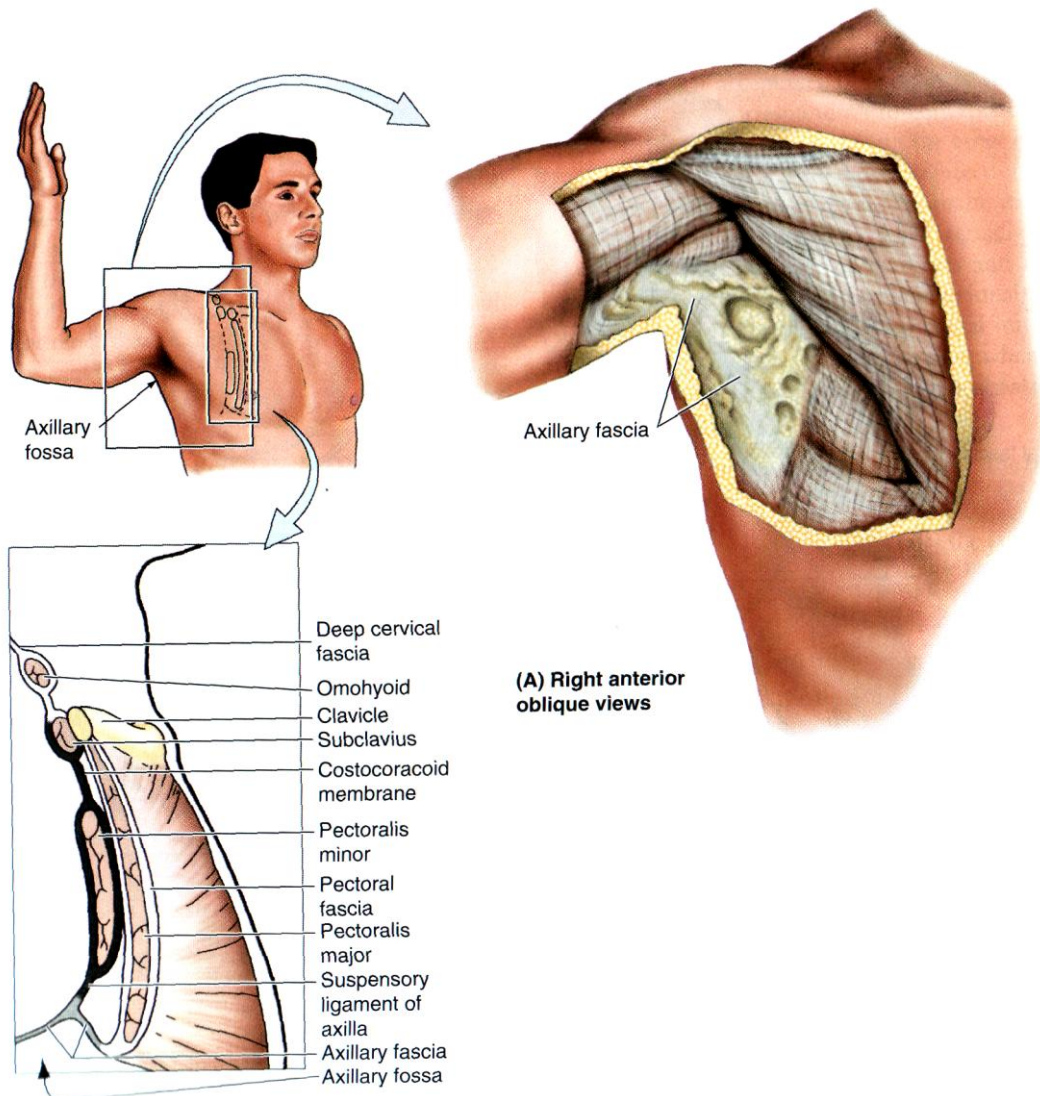
Name of muscle	Origin	Insertion	Action
Thenar muscles Abductor pollicis brevis	Scaphoid, trapezium, flexor retinaculum	Base of proximal phalanx of thumb	Abduction of thumb
Flexor pollicis brevis	Trapezium, trapezoidium, flexor retinaculum	Base of proximal phalanx of thumb	Flexes thumb
Opponens pollicis	Trapezium, flexor retinaculum	Shaft of metacarpal bone of thumb	Opposes the thumb to the fingers
Adductor pollicis Oblique head Transverse head	Base of 1 st , 2 nd , 3 rd metacarpal bones Third metacarpal bone	Base of proximal phalanx of thumb	Adducts thumb
Hypothenar muscles Abductor digiti minimi	Pisiform bone	Base of proximal phalanx of little finger	Flexes little finger
Flexor digiti minimi	Flexor retinaculum	Base of proximal phalanx of little finger	Flexes little finger
Opponens digiti minimi	Flexor retinaculum	Shaft of metacarpal bone of little finger	Flexes little finger and pulls fifth metacarpal bone forward as in cupping the hand
Middle group Lumbricals	Tendons of flexor digitorum profundus	Extensor expansion of medial four fingers	Flexes metacarpophalangeal joints and extend interphalangeal joints of fingers (except thumb)
Interossei Palmar (4)	First, second, fourth, and fifth metacarpal bones	Base of proximal phalanges of fingers, extensor expansion	Adduct fingers toward center of third finger
Dorsal (4)	Contiguous sides of five metacarpal bones	Base of proximal phalanges of fingers, extensor expansion	Abduct fingers from center of third finger

Topography and fascia of the upper limb

The axillar fossa is a deepening between lateral surface of the chest and medial surface of the arm. It is bordered at the front by fold of skin (lower margin of pectoral major muscle level), from behind – by fold of skin (lower margin of latissimus dorsi muscle level).

The axillar cavity (axilla) is an important region because through it pass all the nerves, vessels and lymphatic of the upper limb and it also contains a number of groups of lymph nodes which drain the whole upper limb, a good deal of the trunk and, in particular, the breast. The axilla itself is a truncated four sided pyramid in shape with its apex consisting of the narrow triangular gap between the first rib, the clavicle through which the nerves and vessels have to pass.

Axillar cavity



The **anterior wall** of the axilla - pectoralis major and minor muscles.

The **posterior wall** of the axilla - latissimus dorsi, teres major and the subscapular muscles.

The **medial wall** of the axilla - upper part of serratus anterior muscles.

The **lateral wall** of the axilla – biceps and coracobrachial muscles.

There are two orifices in posterior wall of the axilla:

The **trilateral foramen** is bounded above by the teres minor and scapular muscles, below by the teres major muscle and laterally by long head of triceps brachii.

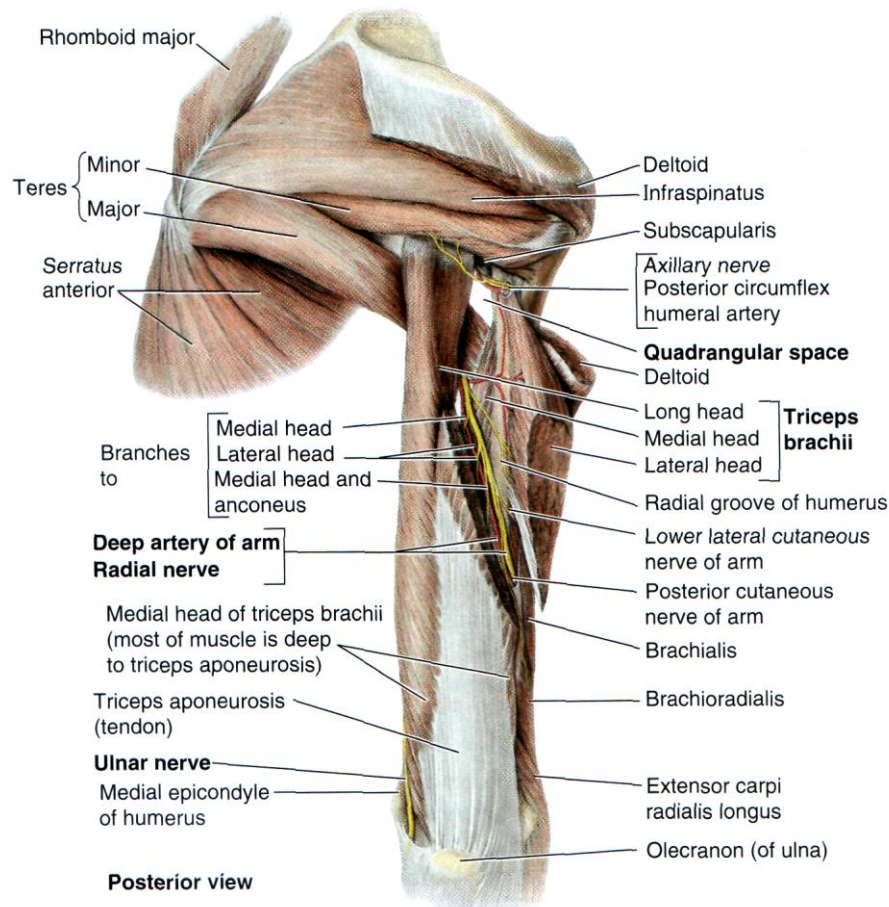
The **quadrilateral foramen** is bounded above by the teres minor and scapular muscles, below by the teres major, medially by long head of triceps brachii, laterally surgical neck of humerus.

There are three triangles in anterior wall of axilla:

1. claviculo-pectoral triangle – bordered by lower margin of clavicle and upper margin of pectoral minor muscle;
2. pectoral triangle – bordered by upper and lower margin of pectoral minor muscle;
3. subpectoral triangle – bordered by lower margins of pectoral minor and pectoral major muscles.

The deltoid muscle lying in the region of the shoulder is covered by a thin **deltoid fascia** (fascia deltoidea), which gives off processes projecting between the muscular bundles. This fascia is continuous anteriorly with the pectoral fascia and posteriorly with the superficial fascia of the back. Distally it blends with the brachial fascia. The **brachial fascia** (fascia brachii) form fibrous **lateral and medial intermuscular septas** that separate anterior group of brachii from posterior and form two fascial compartment, each having its own muscles, nerves and arteries.

The sulcus of the **radial nerve** of the humerus is covered by the triceps muscle, and thus converted in a canal (canalis humeromuscularis, s. canalis n. radialis, s. canalis spiralis).



It transmits the radial nerve and the attendant deep brachial artery and vein.

Two grooves, the **medial bicipital groove** and **lateral bicipital groove** are located on the anterior surface of the humerus, between the brachial muscle and the borders of the biceps. The deeper, medial sulcus lodges the neurovascular bundle of the arm.

In the bend of the arm, the brachial fascia is continuous with the **forearm fascia** (fascia antebrachii) which is attached to the periosteum of the posterior subcutaneous border of the ulna. This fascial sheath, together with the interosseous membrane and fibrous **intermuscular septa**, divides up the forearm into a number of compartments, each having its own muscles, nerves, and blood supply.

There are three grooves between the forearm muscles.

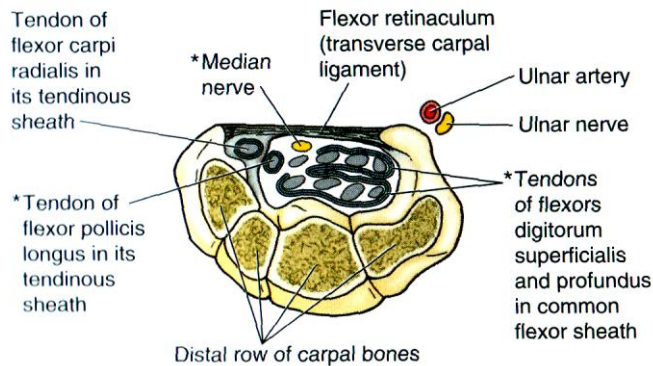
1. The **medial, ulnar groove** lies between m. flexor carpi ulnaris (medially) and m. flexor digitorum superficialis (laterally). It transmits the ulnar nerve, artery, and veins.

2. The **lateral, radial groove** lies between m. brachioradialis (laterally) and m. flexor carpi radialis (medially). It transmits the radial nerve, artery, and veins.

3. The **median groove** (sulcus medianus) lies between the flexor carpi radialis (laterally) and the flexor digitorum superficialis (medially). It transmits the median nerve.

The retinaculas are bands of deep fascia that hold the long flexor and extensor tendons in position at the wrist.

The carpal bones together form a concavity on their anterior surface, to the lateral (tubercle of the scaphoid and the trapezium) and medial (pisiform bone and the hook of the hamate) edges of which is attached a **flexor retinaculum**. The bridge and the bones form the **carpal canal (tunnel)** for the passage of the median nerve and the synovial sheaths for tendons of superficial and deep flexor of the fingers and tendon of long flexor pollicis.



* = Structures traversing carpal tunnel

Cross section of carpus (wrist)

Inferior views of transverse cross sections, right upper limb

These synovial sheaths are formed by deep fascia of hand.

1. Tendon of long flexor pollicis muscle is situated in own synovial sheaths (it passes from distal third of forearm till nail phalanx) till nail phalanx).

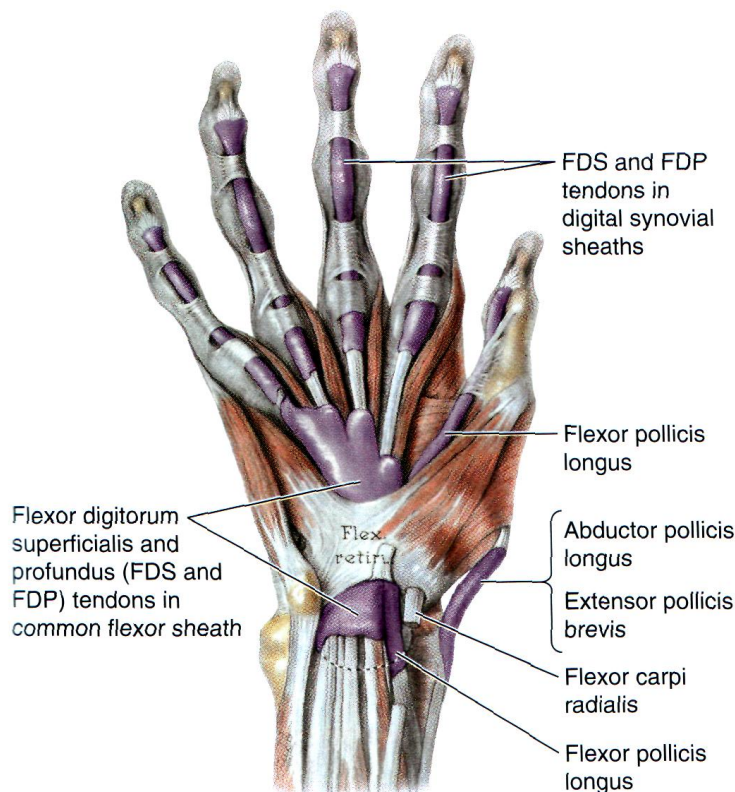
2. Common synovial sheaths for tendons of superficial and deep flexor of the fingers (it passes from distal third of forearm till middle of palm; in little finger it passes till nail phalanx)

3. Synovial sheaths for tendons of superficial and deep flexor of 2nd, 3rd, 4th fingers cover tendons of these muscles from base of proximal phalanx till top of the distal phalanx.

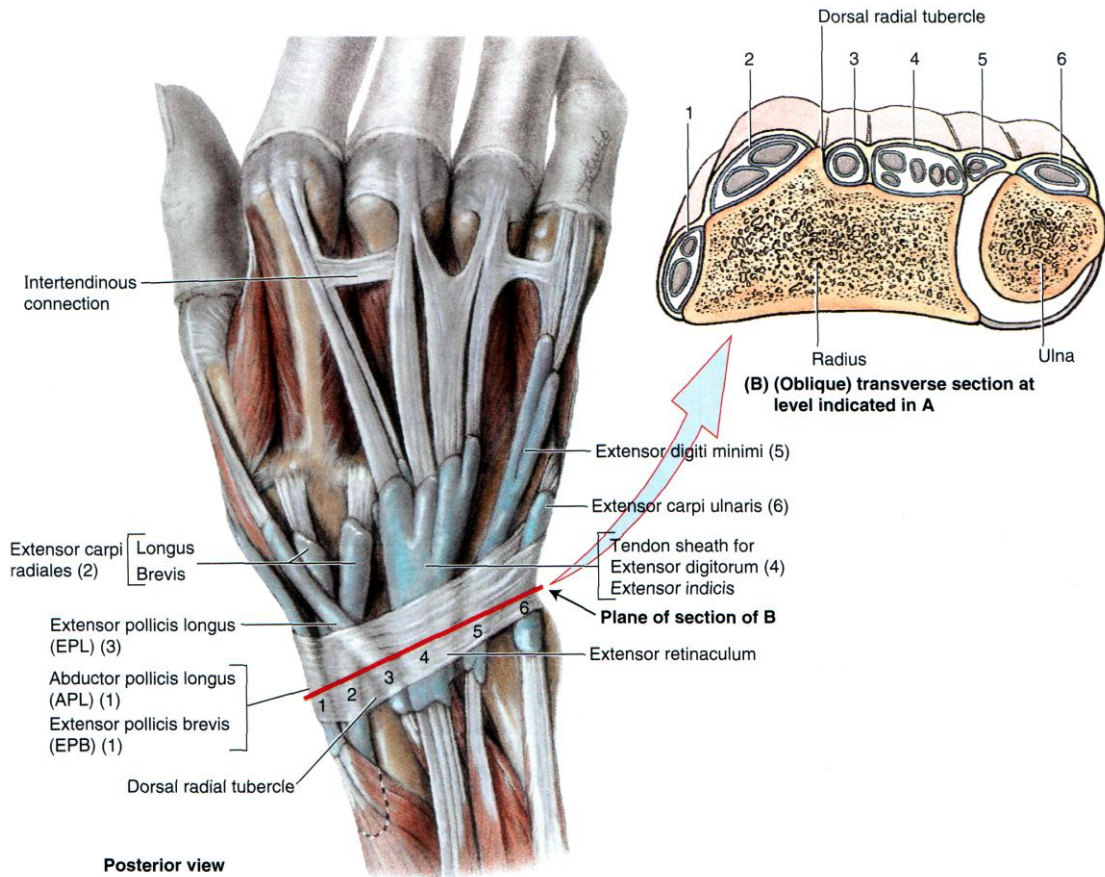
nail phalanx).

2. Common synovial sheaths for tendons of superficial and deep flexor of the fingers (it passes from distal third of forearm till middle of palm; in little finger it passes till nail phalanx)

3. Synovial sheaths for tendons of superficial and deep flexor of 2nd, 3rd, 4th fingers cover tendons of these muscles from base of proximal phalanx till top of the distal phalanx.



Extensor retinaculum: antebrachial fascia strengthened by circular fibers. Attached to styloid process of ulna, the triquetral and the pisiform bones, and the radius. Between the medial and lateral attachments of the retinaculum, osteofibrous canals are formed for the

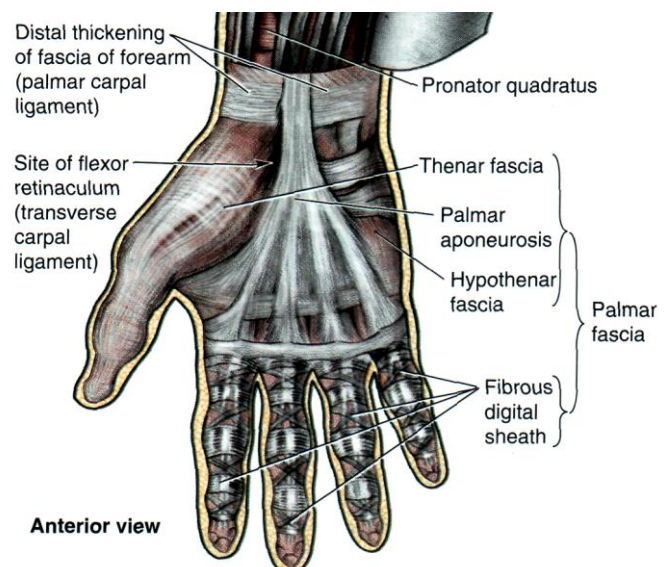


tendons of the dorsal antebrachial muscles

Canals for synovial sheaths for tendons of muscles, 6 in number, from lateral to medial:

1. for synovial sheaths for tendons of abductor pollicis longus and extensor pollicis brevis;
2. for synovial sheath for tendon of extensor carpi radialis longus and brevis;
3. for synovial sheaths for tendon of extensor pollicis longus;
4. for synovial sheaths for tendons of extensor digitorum and extensor indicis;
5. for synovial sheaths for tendons of extensor digiti minimi;
6. for synovial sheaths for tendons of extensor carpi ulnaris.

Palmar aponeurosis. In the palm, the deep fascia is greatly thickened to protect the underlying tendons, nerves, and blood vessels. It is known as the palmar aponeurosis. It is continuous proximally with the palmaris longus tendon and attaches to the flexor retinaculum. It is also continuous with the fasciae covering the thenar and hypothenar eminences.



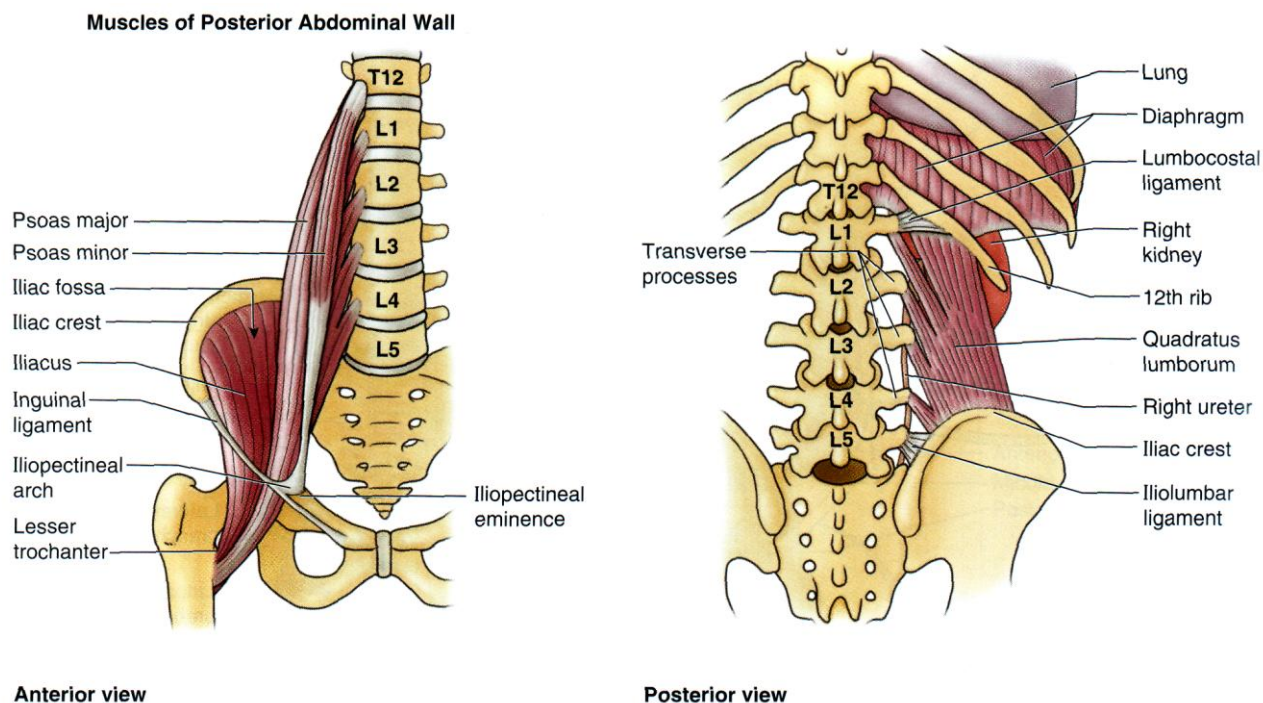
Muscles of the lower limb

Muscles of the lower limb divide into muscles of the pelvic girdle and free limb.

Pelvic (gluteal) musculature

A. Internal group

Psoas major (*m. psoas major, L.*) arises from the transverse processes and sides of the bodies and inter-vertebral discs of the five lumbar vertebrae and forms a series of fibrous arches that span the concave sides of the vertebral bodies.



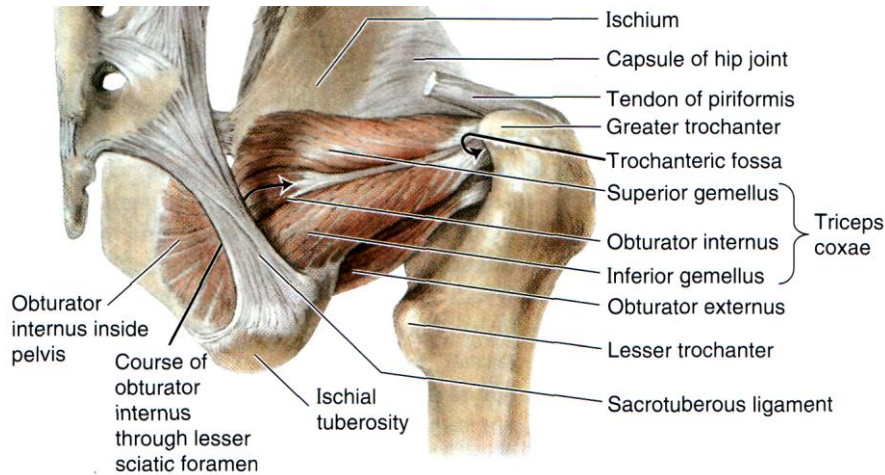
Iliacus (*m. iliacus, L.*) originates from the inner surface of the upper part of the iliac fossa and the inner lip of the iliac crest. The psoas major passes with the iliacus under the inguinal ligament and are inserted into the lesser trochanter, partly fusing with the iliacus so that these muscles are often referred to as **iliopsoas**.

Iliopsoas is a powerful flexor of the hip joint both in flexing the lower limb and in raising the trunk from the lying to the sitting position. Since the greater part of the muscle is intra-abdominal in conditions such as acute appendicitis the hip is often held slightly flexed to relax the muscle.

Psoas minor (*m. psoas minor, L.*) (may be absent) arises from the transverse processes and sides of the bodies and inter-vertebral discs of the twelfth thoracic and first lumbar vertebrae. It has a small belly and long tendon, which attaches to the iliopectineal eminence and iliac fascia. Assists to iliopsoas muscle.

Obturatorius internus (*m. obturatorius internus, L.*) arises from the internal aspect of the margins of the obturator foramen and obturator membrane. It passes through the small ischial foramen, forms a strong tendon with the gemelli muscles and attaches to the medial aspect of the greater trochanter.

Superior gemellus (*m. gemellus superior, L.*) arises from ischial spine and **inferior gemellus** (*m. gemellus inferior, L.*) arise from ischial tuberosity to medial aspect of greater trochanter via upper tendon of obturator internus. They rotate femur laterally and abduct thigh when flexed.

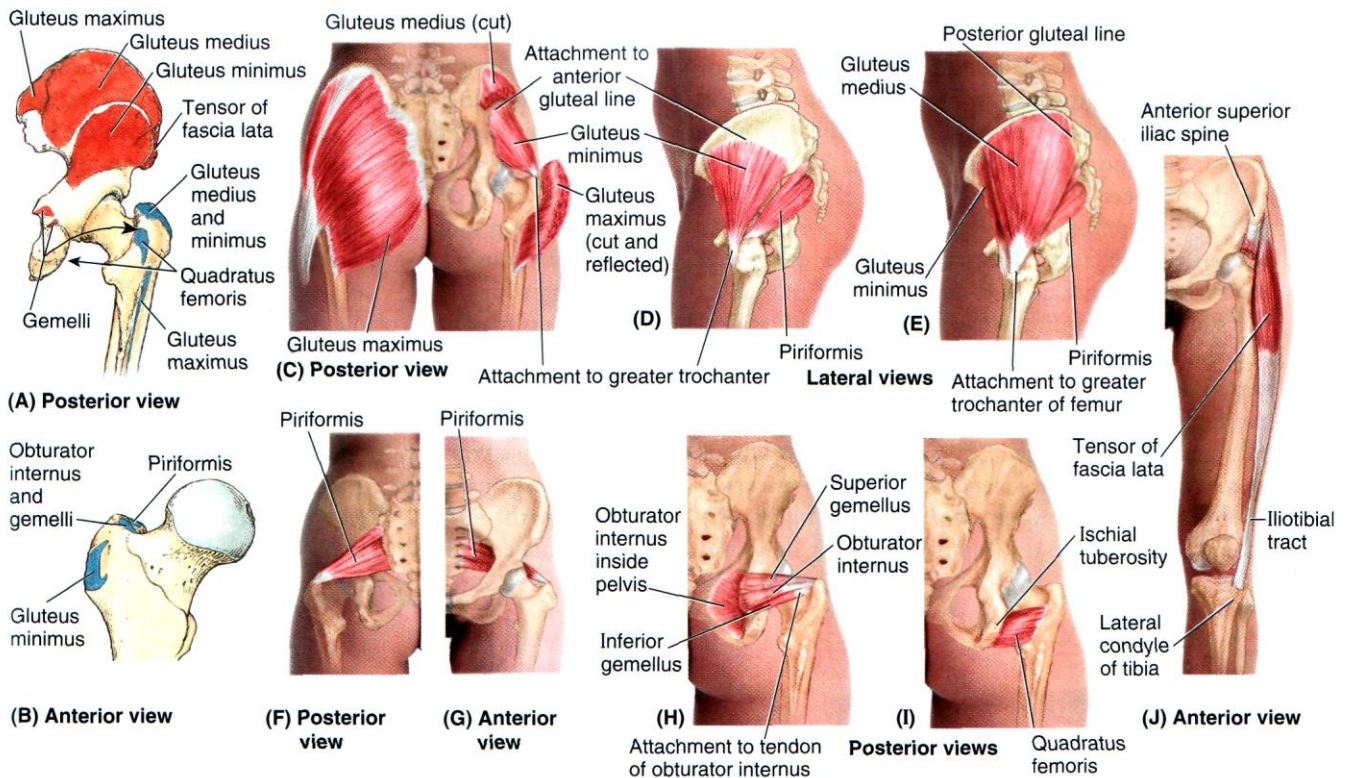


Piriformis (*m. piriformis, L.*) arises from the front of the sacrum and passes through greater ischiatic foramen and attaches to apex of great trochanter.

B. External group.

Tensor fasciae latae (*m.tensor fasciae latae, L.*). This small muscle arises from the iliac crest and is inserted into the iliotibial tract. It is an abductor of the hip and therefore supplied by the superior gluteal nerve. Via the iliotibial tract it can also extend the knee.

Muscles of Gluteal Region: Abductors and Rotators of the Thigh



Gluteus maximus (*m. gluteus maximus, L.*). This is the largest muscle in the body. It arises from the posterior part of the ilium and the adjacent part of the sacrum and is inserted into the gluteal tuberosity of the femur. This bony attachment only receives about one quarter of the fibres, the remaining three quarters being inserted into the iliotibial tract along with tensor fasciae lata. The two muscles have sometimes been known collectively as the deltoid of the hip joint and, acting together, they can abduct the thigh. The muscle is a powerful extensor, being used especially in such activities as climbing stairs, and rising from a sitting position. It is also an abductor and lateral rotator and via its insertion into the iliotibial tract it helps to balance the trunk on the tibia and femur.

Gluteus medius and minimus (*mm. gluteus medius et minimus, L.*). Both extend from the outer surface of the ilium to the greater trochanter, the former muscle covering the latter and both being partly covered by gluteus maximus. The action is: when standing on the right leg, the right glutei contract and prevent the pelvis sagging to the left. Thus the glutei contract alternately during walking.

Obturator externus (*m. obturatorius externus, L.*). This arises from the external surface of the obturator membrane and margin of obturator foramen, passes behind neck of femur and is inserted into the trochanteric fossa.

Quadratus femoris (*m. quadratus femoris, L.*) arises from lateral aspect of ischial tuber to the quadrate line (along posterior aspect of femur and intertrochanteric crest). Action: together with obturator externus rotate the thigh laterally.

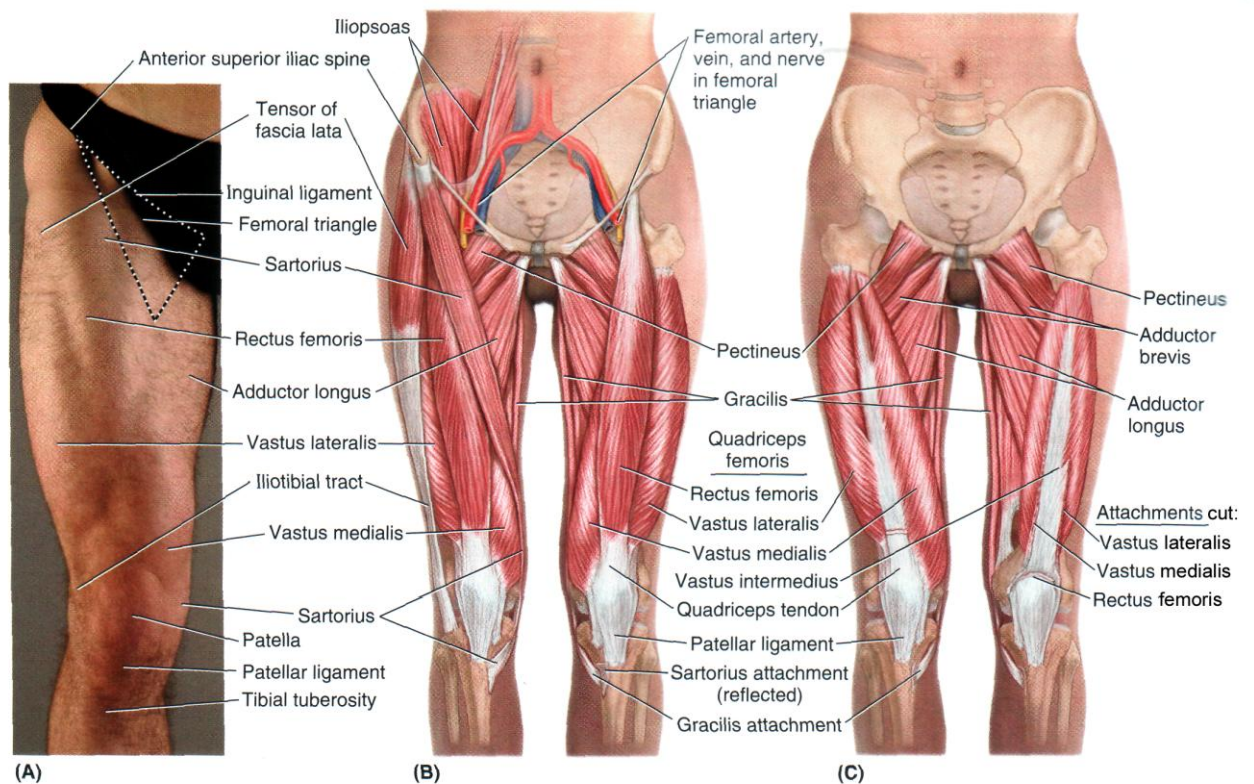
Muscles of the free limb subdivide into muscles of the thigh, leg and foot.

Muscles of the thigh

A. Anterior group

Sartorius (*m. sartorius, L.*)

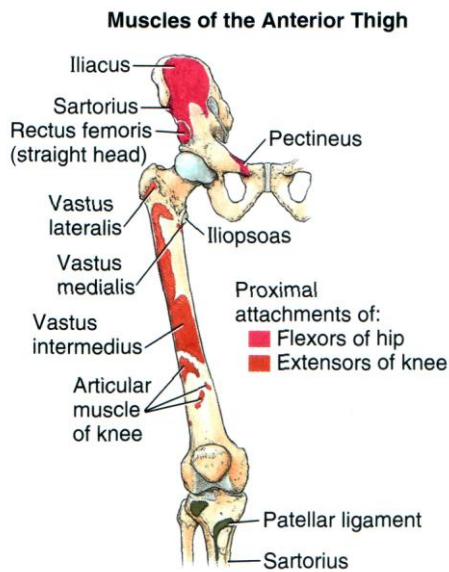
Arising from the superior anterior iliac spine, this muscle descends medially as a long band of parallel fibres and is attached to the fascia of the leg and the tibial tuberosity.



Anterior views

Action. Flexes the knee joint, and, when the knee is flexed, rotates the leg medially, acting with the other muscles that have attachment in common with it. It can also flex the thigh at the hip joint, thus assisting the iliopsoas and rectus femoris.

Quadriceps femoris (*m. quadriceps femoris, L.*) has four components:



Rectus femoris arises from the anterior inferior iliac spine and also has an oblique head from just above the acetabulum;

Vastus medialis arises from the medial lip of the linea aspera and wrap around the femur;

Vastus lateralis arise from the lateral lip of the linea aspera and wrap around the femur too;

Vastus intermedius arises from the shaft.

Under the knee-joint these parts of the quadriceps muscle form a common tendon, which is attached to the base and sides of the patella and is then continuous with the patellar ligament attached to the tibial tuberosity. Some of the tendon fibres of the vastus lateralis and vastus medialis pass on the sides of the patella downward and obliquely to form the retinaculum of the patella. Rectus femoris lies in front of these three muscles. All four muscles converge and fuse to be officially inserted into

the patella which is, itself, connected to the tibial tuberosity by the ligamentum patellae. In fact, the ligamentum is the true tendon of the insertion so that the patella is a sesamoid bone in the tendon. There are fibrous expansions, the patellar retinacula, from the sides of the tendon which partly enclose the knee joint blending with its capsular ligament and helping to strengthen it.

Action. Flexes the leg at the knee joint. The rectus femoris flexes the hip joint as it passes over it.

B. The posterior group (hamstring) muscles

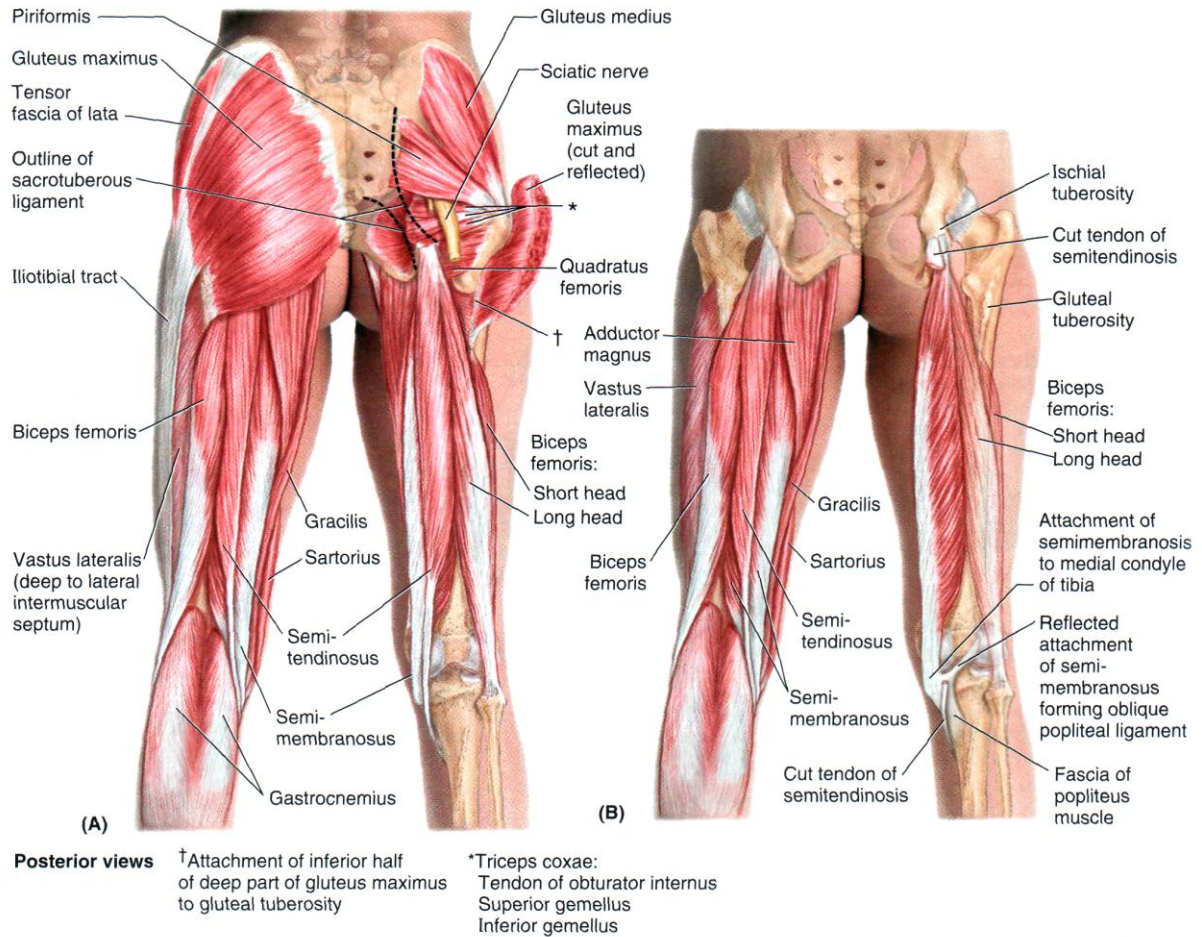
Semitendinosus muscle (*m. semitendinosus, L.*) is called so because of its long tendon, which makes up almost the entire distal half of the muscle. It arises on the ischial tuber and attaches behind the gracilis muscle to the tibial tuberosity and the fascia of the leg. At the site of attachment, the tendon of the semitendinosus muscle, together with the tendons of the gracilis and sartorius muscles, forms a triangular tendinous extension continuous with the fascia of the leg. This extension is called the "superficial goose's foot" (pes anserinus superficialis), under which a synovial bursa (bursa anserina) is lodged.

The **semimembranosus muscle** (*m. semimembranosus, L.*) lies under the semitendinosus muscle. It arises on the ischial tuber as a flat tendon which descends and forms almost the entire proximal half of the muscle, hence the name. The end tendon separates at the site of attachment into three bands, the pes anserinus profundus, one of which is attached to the medial condyle of the tibia. Another attaches to the fascia covering the popliteus muscle, and the third folds over to the posterior wall of the knee joint and is continuous with the oblique popliteal ligament.

The **biceps femoris muscle** (*m. biceps femoris, L.*) is located near the lateral border of the thigh and is separated from the vastus lateralis by the lateral intermuscular septum. The muscle consists of two heads.

The long head arises with the semitendinosus muscle from the ischial tuber; the short head arises from the middle one third of the lateral lip of the linea aspera femoris and the lateral intermuscular septum of the thigh. The heads fuse and attach to the head of the fibula.

The **popliteus muscle** (*m. popliteus muscle, L.*) is triangular and lies on the posterior surface of the knee joint. It arises from the lateral epicondyle of the femur and from the capsule of the knee joint (the oblique popliteal ligament) and is inserted into the proximal part of the posterior surface of the tibia.

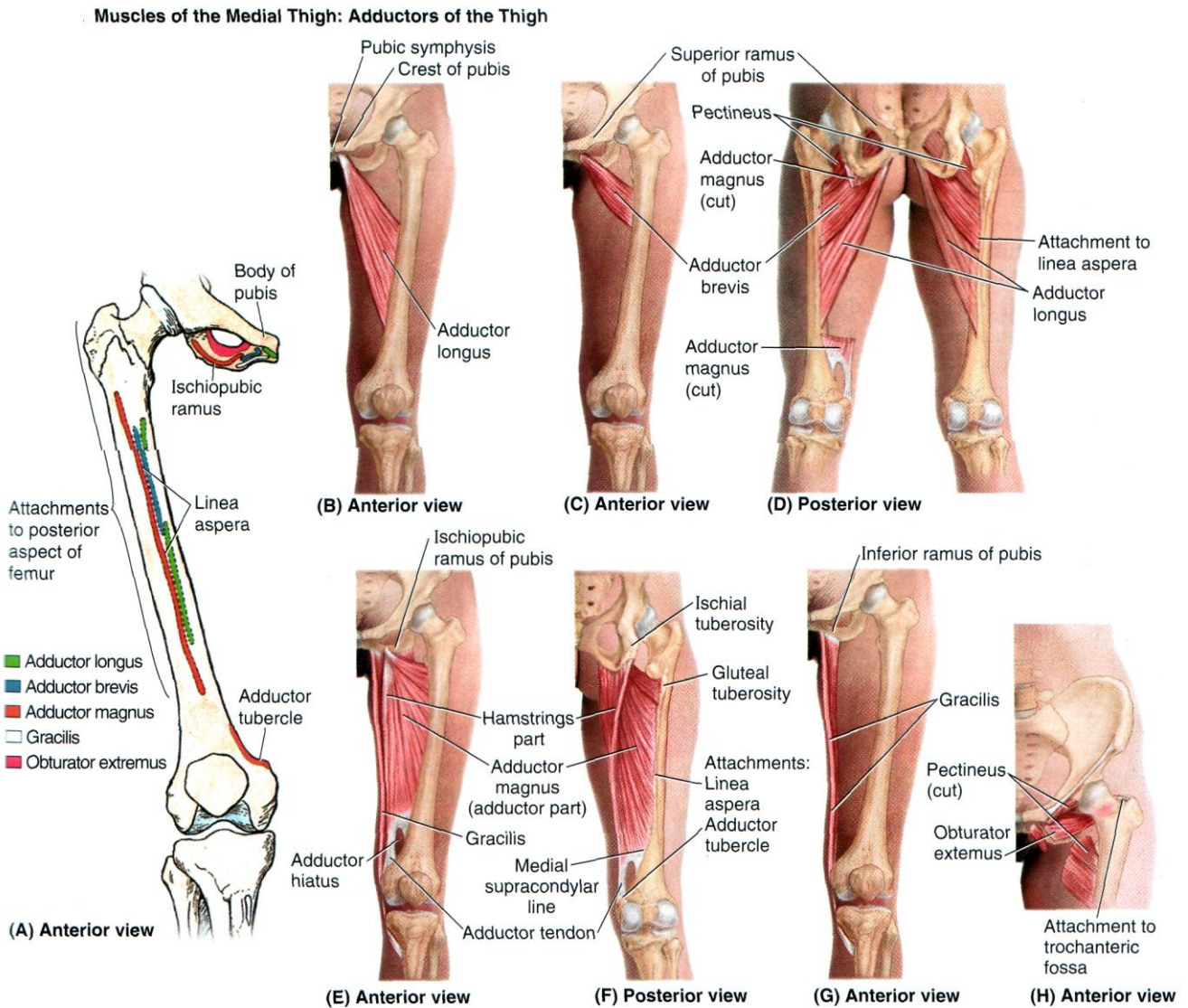


Action. Since the semitendinosus, semimembranosus, and biceps femoris muscles stretch over two joints, their simultaneous action flexes the leg at the knee joint, extends the thigh when the pelvis is steadied, and assists the gluteus maximus muscle in extension of the trunk when the leg is steadied. When the knee is flexed, these muscles rotate the leg, contracting separately on either side. The leg is rotated laterally by the biceps muscle and medially by the semitendinosus and semimembranosus muscles. The popliteus muscle acts only on the knee joint; it flexes the knee and rotates the leg medially.

C. The medial group of the thigh

Gracilis (*m. gracilis, L.*) passes down the whole length of the medial side of the thigh from the pubis and ischium to the medial side of the tibia.

Pectineus (*m. pectineus, L.*) arises from the superior ramus of the pubis and is inserted into the femur just below the lesser trochanter.

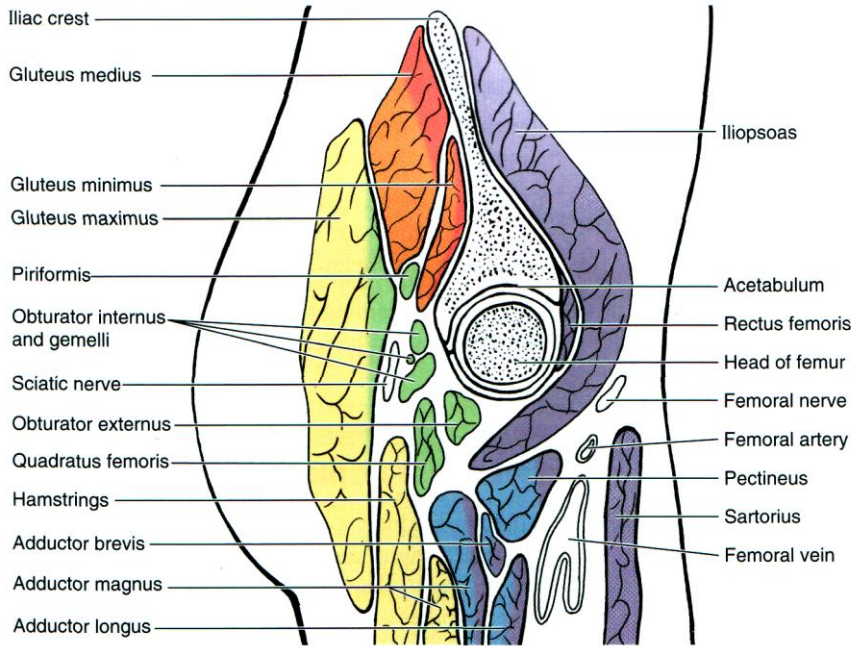


Adductor longus (*m. Adductor longus, L.*) arises by a tendon from the pubis just below the pubic tubercle and is attaches to the linea aspera.

Adductor brevis (*m. adductor brevis, L.*) extends from the inferior ramus of the pubis to the linea aspera, overlapping the insertions of pectineus and adductor longus.

Adductor magnus (*m. adductor magnus, L.*). Its origin is from the whole length of the inferior ramus of the pubis (anterior fibres), ischial tuber (oblique fibres) and the ramus of the ischium (posterior fibres). Its insertion is into the whole length of the linea aspera which is a vertical tine. Between fibres of muscles which attach to the adductor tubercle and medial epicondyle hiatus adductorius is situated. It is passage for femoral artery and popliteal vein.

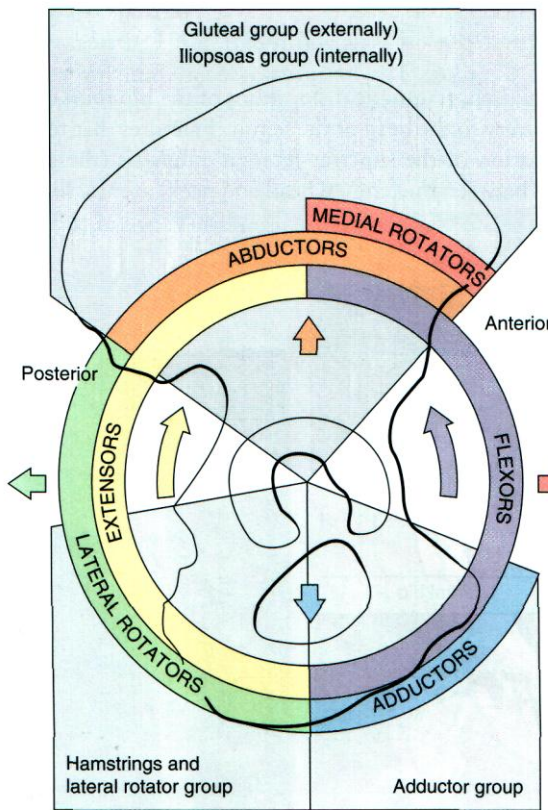
Action. As their names indicate, all the adductor muscles adduct the thigh, slightly rotating it laterally. Those lying closer to the front and crossing the transverse axis of the hip joint (the pectineus muscle and the longus and brevis adductors) can also accomplish flexion at this joint. The gracilis muscle, passing over two joints, in addition to adduction of the thigh, flexes the leg at the knee joint and rotates it medially.



(A) Lateral view of sagittal section through femoral head

Functional groups of muscles acting at hip joint

Flexors
Iliopsoas Sartorius Tensor of fascia lata Rectus femoris Pectineus Adductor longus Adductor brevis Adductor magnus—anterior part Gracilis
Adductors
Adductor longus Adductor brevis Adductor magnus Gracilis Pectineus Obturator externus
Lateral rotators
Obturator externus Obturator internus Gemelli Piriformis Quadratus femoris Gluteus maximus
Extensors
Hamstrings: Semitendinosus Semimembranosus Long head, biceps femoris Adductor magnus—posterior part Gluteus maximus
Abductors
Gluteus medius Gluteus minimus Tensor of fascia lata
Medial rotators
Gluteus medius Gluteus minimus } Anterior parts Tensor of fascia lata



(B) Diagrammatic lateral view

Circular Zones =
The zones represent the position of origin of functional groups relative to center of humeral head in acetabulum (point of rotation). Pull is applied on the femur (femoral trochanters or shaft) from these positions.

Colored Arrows =
The arrows show the direction of rotation of femoral head caused by activity of functional groups.

Muscle of internal group of the pelvis

Name of muscle	Origin	Insertion	Action
Iliacus	Upper part of iliac fossa, internal lip of iliac crest	With psoas into lesser trochanter of femur	Flexes thigh on trunk; if thigh is fixed, it flexes the trunk on the thigh as in sitting up from lying down
Psoas Major	Transverse processes, bodies, and intervertebral discs of the Th12 and all lumbal vertebrae	With iliacus into lesser trochanter of femur	Flexes thigh on trunk; if thigh is fixed, it flexes the trunk on the thigh as in sitting up from lying down
Obturator internus	Inner surface of obturator membrane and inner aspect of margin of obturator foramen	Fossa trochanterica of femur	Lateral rotator of thigh at hip joint
Gemellus superior	Spine of ischium		
Gemellus inferior	Ischial tuber		
Piriformis	Anterior surface of sacrum		
		Apex of greater trochanter of femur	

Muscle of external group of the pelvis

Name of muscle	Origin	Insertion	Action
Gluteus maximus	Outer surface of ilium, sacrum, coccyx, and sacrotuberous ligament	Iliotibial tract and gluteal tuberosity of femur	Extends and laterally rotates thigh at hip joint; through iliotibial tract, it extends knee joint
Gluteus medius	Outer surface of ilium	Greater trochanter of femur	Abducts thigh at hip joint; tilts pelvis when walking
Gluteus minimus	Outer surface of ilium	Greater trochanter of femur	Abducts thigh at hip joint; anterior fibers medially rotate thigh
Tensor fasciae lata	Outer lip of iliac crest	Iliotibial tract, lateral condyle of tibia	Assists gluteus maximus in extending the knee joint
Quadratus femoris	Ischial tuber	Intertrochanteric crest of femur	Lateral rotator of thigh at hip joint
Obturator externus	Outer surface of obturator membrane and outer aspect of margin of obturator foramen	Greater trochanter of femur	Lateral rotator of thigh at hip joint

Muscles of anterior group of the thigh

Name of muscle	Origin	Insertion	Action
Sartorius	Anterior superior iliac spine	Tuberositas of tibia	Flexes, abducts, laterally rotates thigh at hip joint; Flexes and medially rotates leg and knee joint
Quadriceps femoris Rectus femoris Vastus medialis Lateralis Intermedius	Anterior inferior iliac spine Medial lip of the line aspera Lateral lip of the line aspera Body of the femur	They unit to form pattelar ligament and attach to tuberositas of tibia	Flexes thigh at hip joint end extends leg at knee joint

Muscles of middle group of the thigh

Name of muscle	Origin	Insertion	Action
Gracilis	Inferior ramus of pubis	Upper part of shaft of tibia	Adducts thigh at hip joint, flexes leg at knee joint, hamstring part extends thigh at hip joint
Pectineus	Superior ramus of pubis	Pectineal tuberosity	Flexes, abducts thigh at hip joint
Adductor longus	External surface of superior ramus of pubis	Medial lip of aspera line of femur	Adducts thigh at hip joint, assists in lateral rotation
Adductor brevis	Inferior ramus of pubis	Medial lip of aspera line of femur	Adducts thigh at hip joint, assists in lateral rotation
Adductor magnus	Inferior ramus of pubis, ramus of ischium, ischial tuber	Medial lip of aspera line, adductor tubercle of femur	Adducts thigh at hip joint, assists in lateral rotation, hamstring part extends thigh at hip joint

Muscles of posterior group of the thigh

Name of muscle	Origin	Insertion	Action
Biceps femoris	Long head: ischial tuber; short head: lateral lip of aspera line of femur	Head of fibula	Flexes and laterally rotates leg at knee joint, long head also extends thigh at hip joint
Semitendinosus	Ischial tuber	Tuberosity of tibia	Flexes and medially rotates leg at knee joint, extends thigh at hip joint
Semimembranosus	Ischial tuber	Tuberosity of tibia	Flexes and medially rotates leg at knee joint, extends thigh at hip joint

Muscles of the Leg

A. Anterior group

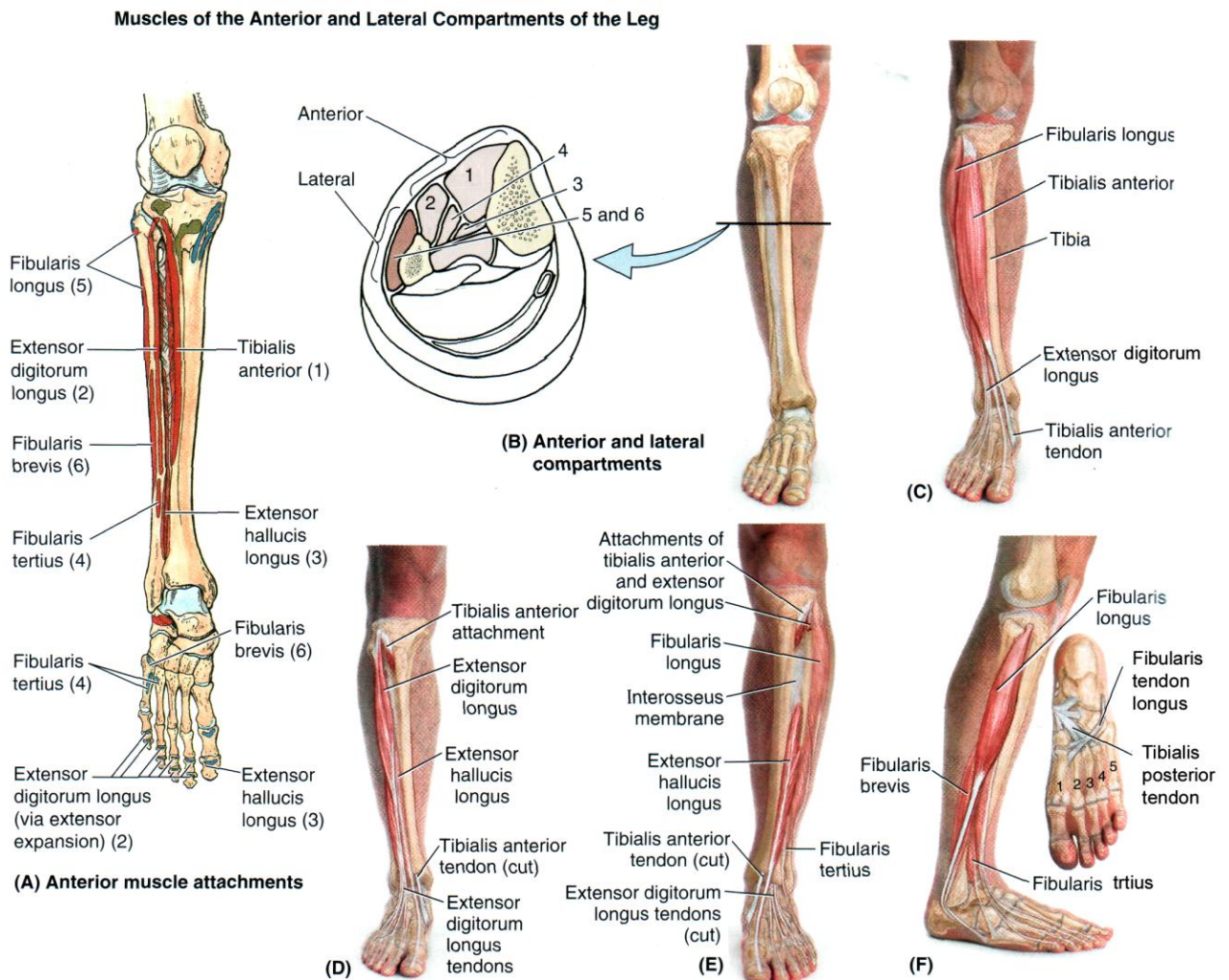
Tibial anterior (*m. tibialis anterior, L.*). Arises from the shaft of the tibia and its tendon is easily recognized on the medial side of the front of the ankle region as it passes down to the base of the first metatarsal and the medial cuneiform. As well as being a dorsiflexor it is therefore also an invertor of the foot.

Extensor digitorum longus and extensor hallucis longus (*m. extensor digitorum longus et m. extensor hallucis longus, L.*). Both arise from the very narrow anterior surface of the fibula, the digitorum from the upper three-quarters and the hallucis from the middle half, the hallucis muscle belly being between digitorum and the tibialis anterior. The tendons are inserted into the distal phalanges of the toes, extensor hallucis longus into the big toe and extensor digitorum longus into the other four toes. The latter tendons also have dorsal extensor expansions that receive lumbricals and interossei and they have additional attachments to the middle phalanges in exactly similar way to the corresponding tendons in the hand. The muscles extend the toes and dorsiflex the foot. The lower fibres of extensor digitorum longus give rise to a tendon that is attached to the base of the fifth metatarsal (*m. peroneus tertius*).

Extensor digitorum brevis (*m. extensor digitorum brevis, L.*). This is a small muscle attached to the upper surface of the calcaneus. Its four tendons join those of the main extensors to the medial four toes. That to the big toe is often called extensor hallucis brevis.

B. Lateral group of leg

These two muscles, **peroneus longus** and **brevis** (*m. peroneus longus et m. brevis, L.*), arise



from the lateral surface of the fibula, the former from the upper two-thirds and the latter from the lower two-thirds. Their tendons use the lower end of the fibula as a pulley and pass forwards on the lateral side of the foot, peroneus brevis being the uppermost. Brevis is attached to the base of the fifth metatarsal but longus turns medially, through the groove on the cuboid (converted into a tunnel by the long plantar ligament) and is attached to the lateral sides of the base of the first metatarsal and the medial cuneiform, opposite to the tibialis anterior. They are evertors of the foot and peroneus longus may a dorsiflexes.

C. Posterior group of leg

There are two groups of muscles in the calf. The most superficial group comprise the three muscles that size and are known as the triceps surae. In man, one of them, plantaris, is rudimentary.

1. Superficial muscles:

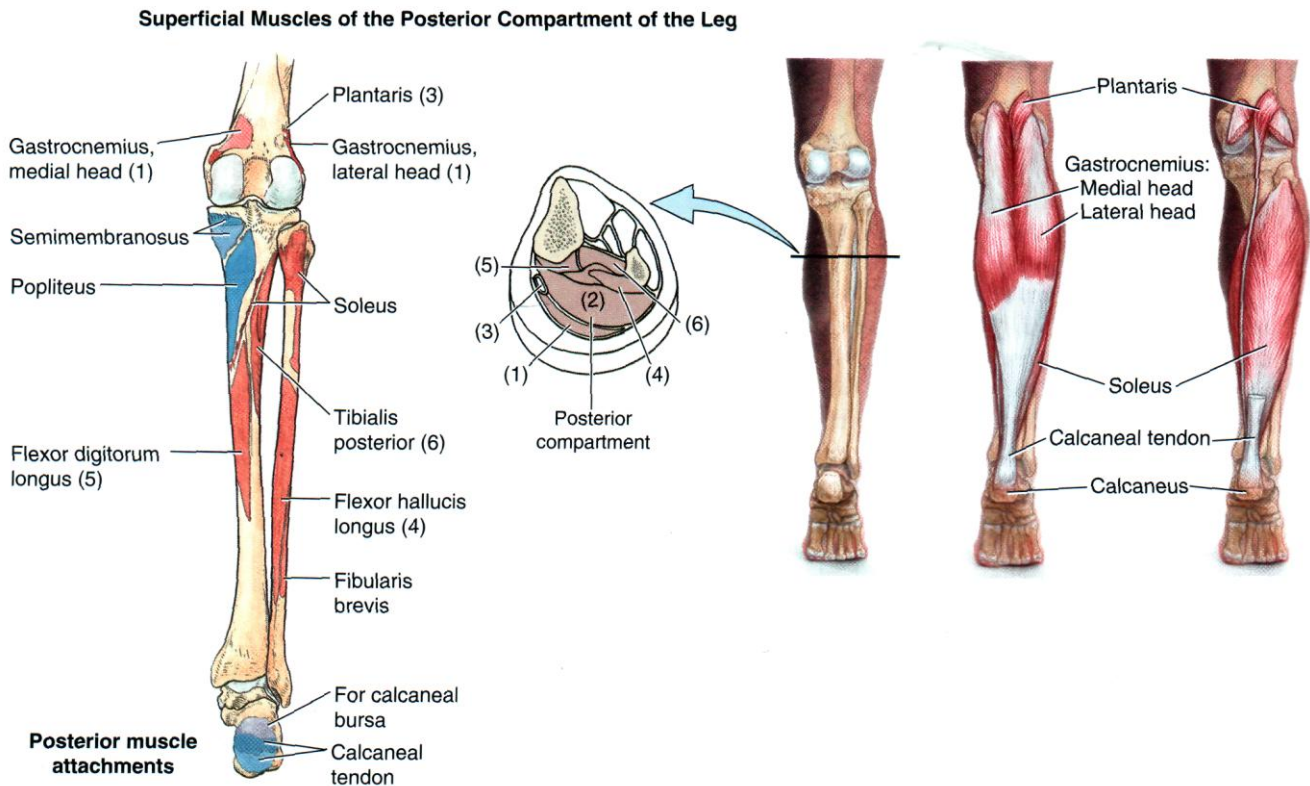
Gastrocnemius (*m. gastrocnemius, L.*). This muscle arises by two heads from medial and lateral condyles of the femur. They join to form the main belly of the muscle which is inserted in common with soleus.

Soleus (*m. soleus, L.*). This muscle has two origins, one from the solei line on the tibia and one from the upper third of the posterior surface of the fibula.

The muscle fibres on the deep surface of the muscle are arranged in a multipennate manner but superficial fibres run longitudinally. Soleus and gastrocnemius are inserted along **plantaris** (a small muscle arising with the lateral head of gastrocnemius) into the tendon calcaneus (or Achilles tendon). The tendon calcaneus is attached to the middle third of the posterior surface of calcaneus.

2. Deep muscles:

Tibialis posterior (*m. tibialis posterior, L.*). Arising from the posterior surfaces of the tibia and fibula and the interosseous membrane, its tendon runs in a groove behind the medial malleolus, turns forward across the deltoid ligament and is inserted into the tubercle of the. It

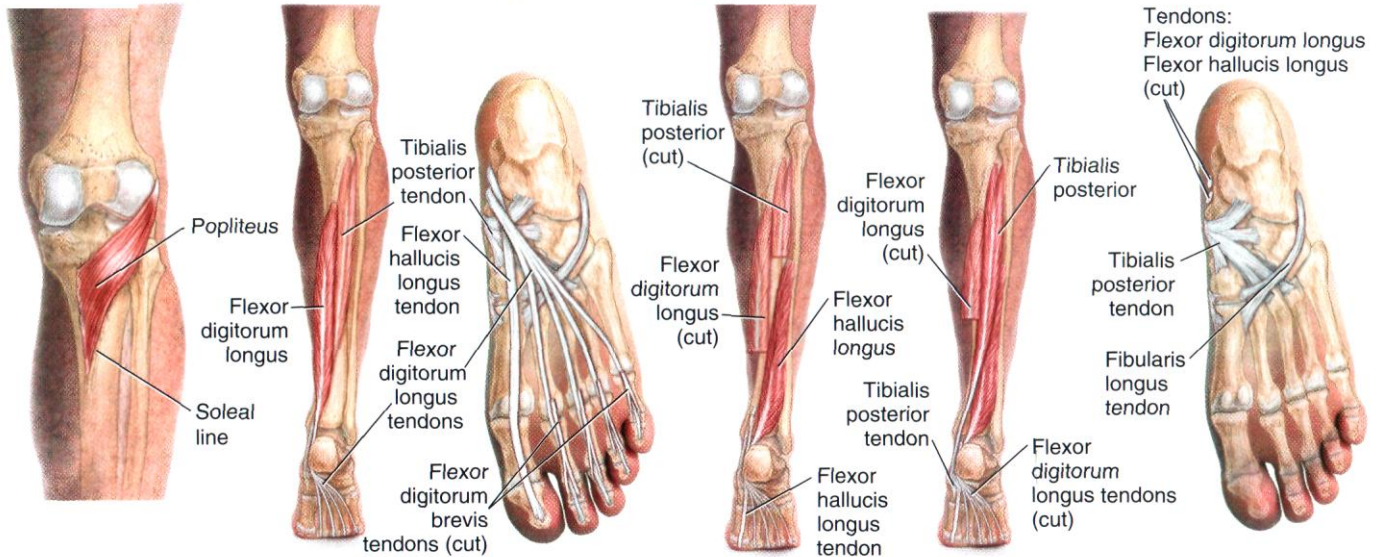


is an invertor and plantar flexor of the foot and helps to hold up the medial arch.

Flexor digitorum longus (*m. flexor digitorum longus, L.*). Arises from the posterior surface of the tibia. its tendon crosses that of tibialis posterior behind the medial malleolus, turns forwards across the sustentaculum tali, receives the attachment of flexor digitorum accessories and breaks up into four tendons for each of the four lesser toes and are inserted into the terminal phalanx.

Flexor hallucis longus (*m. flexor hallucis longus, L.*). Arising from the posterior surface of the fibula behind tibialis posterior, its tendon passes in a groove behind the talus and another below the sustentaculum tali. In the sole of the foot it is crossed superficially by the tendon of flexor digitorum longus and it is inserted into the distal phalanx of the big toe. The flexors digitorum and hallucis longus flex the toes and help in plantar flexion of the foot. It helps to remember that the tendon of flexor digitorum longus is superficial twice; it crosses superficial to tibialis posterior behind the medial malleolus and crosses superficial to flexor hallucis longus in the sole of the foot.

Deep Muscles of the Posterior Compartment of the Leg



Muscles of the leg. Anterior group

Name of muscle	Origin	Insertion	Action
Tibialis anterior	Lateral condyle and lateral surface of shaft of tibia and interosseal membrane	Medial cuneiform and base of first metatarsal bone	Extends the foot and ankle joint, inverts foot at subtalar and transverse tarsal joints, holds up medial longitudinal arch of foot
Extensor digitorum longus	Lateral condyle, head of fibula, interosseal membrane	Base of distal phalanx of four toes	Extends toes, dorsiflexes foot at ankle joint
Extensor hallucis longus	Shaft of fibula and interosseal membrane	Base of distal phalanx of great toe	Dorsiflexes foot at ankle joint, evens foot at subtalar and transverse tarsal joints
Peroneus tertius	Branch of extensor digitorum longus	Base of fifth metatarsal bone	Extends the 5th toe, dorsiflexes foot and everts foot

Muscles of the leg. Lateral group

Name of muscle	Origin	Insertion	Action
Peroneus longus	Head and lateral surface of shaft of fibula, lateral condyle of tibia	Plantar surface of base of first metatarsal and medial cuneiform bone	Plantar flexes the foot at ankle joint, everts foot at subtalar and transverse tarsal joints, holds up lateral longitudinal arch of foot
Peroneus brevis	Lateral surface of shaft of fibula	Tuberosity of fifth metatarsal bone	Plantar flexes foot at ankle joint, everts foot at subtalar and transverse tarsal joints, holds up lateral longitudinal arch

Muscles of the leg. Posterior group

Name of muscle	Origin	Insertion	Action
Superficial muscles Gastrocnemius	Medial and lateral condyles of femur	Via tendon calcaneus (Achilles tendon) into calcaneum	Plantar flexes foot at ankle joint, flexes knee joint
Plantaris	Popliteal surface of lateral condyle of femur		Plantar flexes foot at ankle joint, flexes knee joint
Soleus	Head and posterior surface of shaft of fibula, line of soleus muscle of tibia		Together with gastrocnemius and plantaris is powerful plantar flexor of ankle main propulsive force in walking and running
Deep muscles Popliteus	Lateral condyle of femur	Shaft of tibia	Flexes leg at knee joint, unlocks knee joint by lateral rotation of femur on tibia and thus slackens ligaments of joint
Flexor digitorum longus	Posterior surface of shaft of tibia	Distal phalanges of lateral four toes	Flexes distal phalanges of lateral four toes, plantar flexes foot, supports medial and lateral longitudinal arches of foot
Flexor hallucis longus	Posterior surface of shaft of fibula, interosseous membrane	Base of distal phalanx of big toe	Flexes distal phalanx of big toe, plantar flexes foot at ankle joint, supports medial longitudinal arch of foot
Tibialis posterior	Posterior surface of lateral condyle and shaft of tibia, interosseous membrane	Tuberosity of navicular bone, plantar surface of cuneiform bones, bases of 2-4 th metatarsal bones	Plantar flexes foot at ankle joint, inverts foot at subtalar and transverse tarsal joints, supports medial longitudinal arch of foot

Muscles of the foot divide on plantar and dorsal muscles.

A. Plantar muscles

1. Medial group

The **abductor hallucis** (*m. abductor hallucis, L.*) extends from the plantar surface of the calcaneus to the medial side of the first phalanx of the big toe. It can abduct the first metatarsophalangeal joint.

The adduction is the **adductor hallucis** (*m. adductor hallucis, L.*) has an oblique head some of the tarsal bones. Its transverse head is small, from metatarsal heads. It is inserted into the lateral side of the base of the first phalanx of the big toe.

The **flexor hallucis brevis** (*m. flexor hallucis brevis, L.*) arises from tarsal bones, splits into two and is inserted into both sides of the proximal phalanx in company with the adductor (medially) and the abductor (laterally). The conjoined tendon each contain a sesamoid bone.

2. Middle group.

The **flexor digitorum brevis** (*m. flexor digitorum brevis, L.*) is attached to the calcaneus and divides into four tendons, one for each of the lesser toes. It is then attached to the sides of the middle phalanx.

Quadratus plantae has two heads (medial and lateral) (*m. quadratus plantae, L.*) extends from the lateral and medial surfaces of the calcaneus to the tendon of flexor digitorum longus. Assists in flexing of the distal phalanx of each toe.

Dorsal interossei (4 muscles) (*mm. interossei dorsales, L.*) arise from metatarsal bones to the base of proximal phalanx and to the tendon of flexor digitorum longus. Action: abduct toes II-IV.

Lumbricals (*m. lumbricales, L.*) flex the metatarsophalangeal joints while extending the interphalangeal joints.

Plantar interossei (3 muscles) (*m. interossei plantares, L.*) extends from the medial surface of the II-IV metatarsal bones to the medial surface of the base of proximal phalanx 3rd-4th toes. Action: adduct toes 3rd-4th and take place in reference to the second toe (the middle finger in the hand). There is no plantar interosseous in the first space.

3. Lateral group

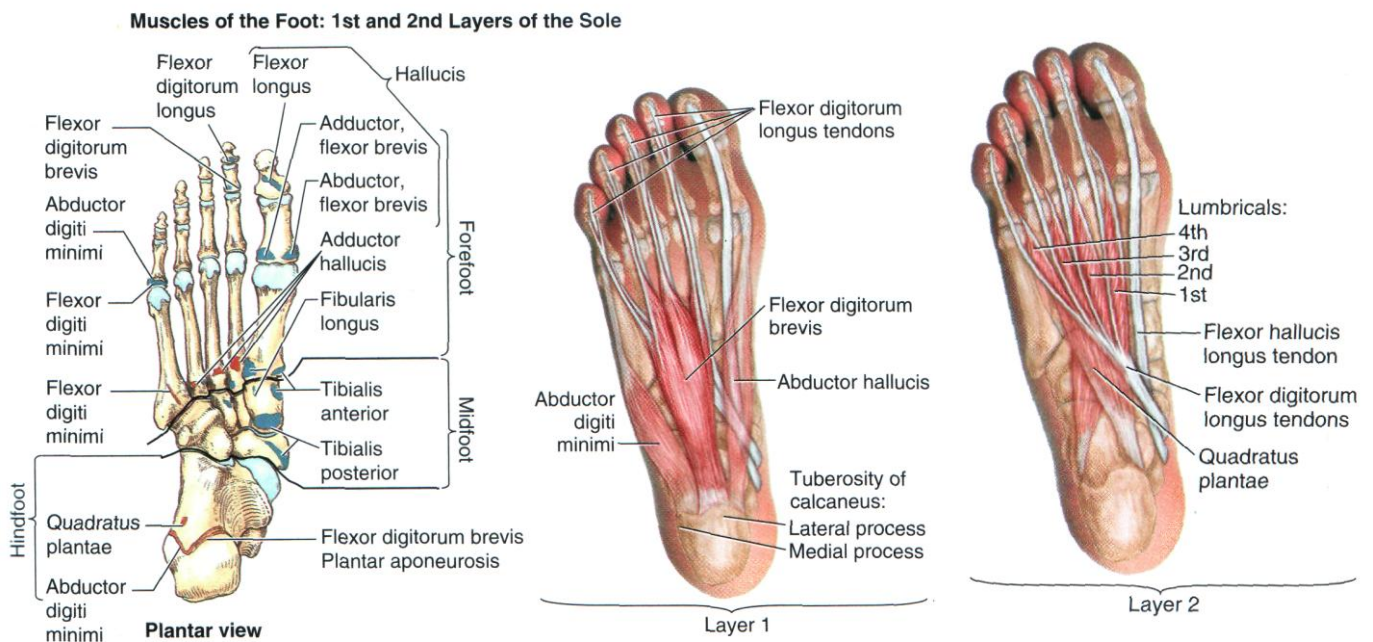
The **flexor digiti minimi brevis** (*m. flexor digiti minimi brevis, L.*) (no one seems to know why 'brevis' is used since there is no longus) is inserted into the lateral side of the proximal phalanx, while flexor hallucis brevis splits into two and is inserted into both sides of the proximal phalanx in company with the adductor (medially) and the abductor (laterally).

The **abductor digiti minimi** (*m. abductor digiti minimi, L.*) arise from calcaneus and has similar attachments (to the little toe) on the lateral side.

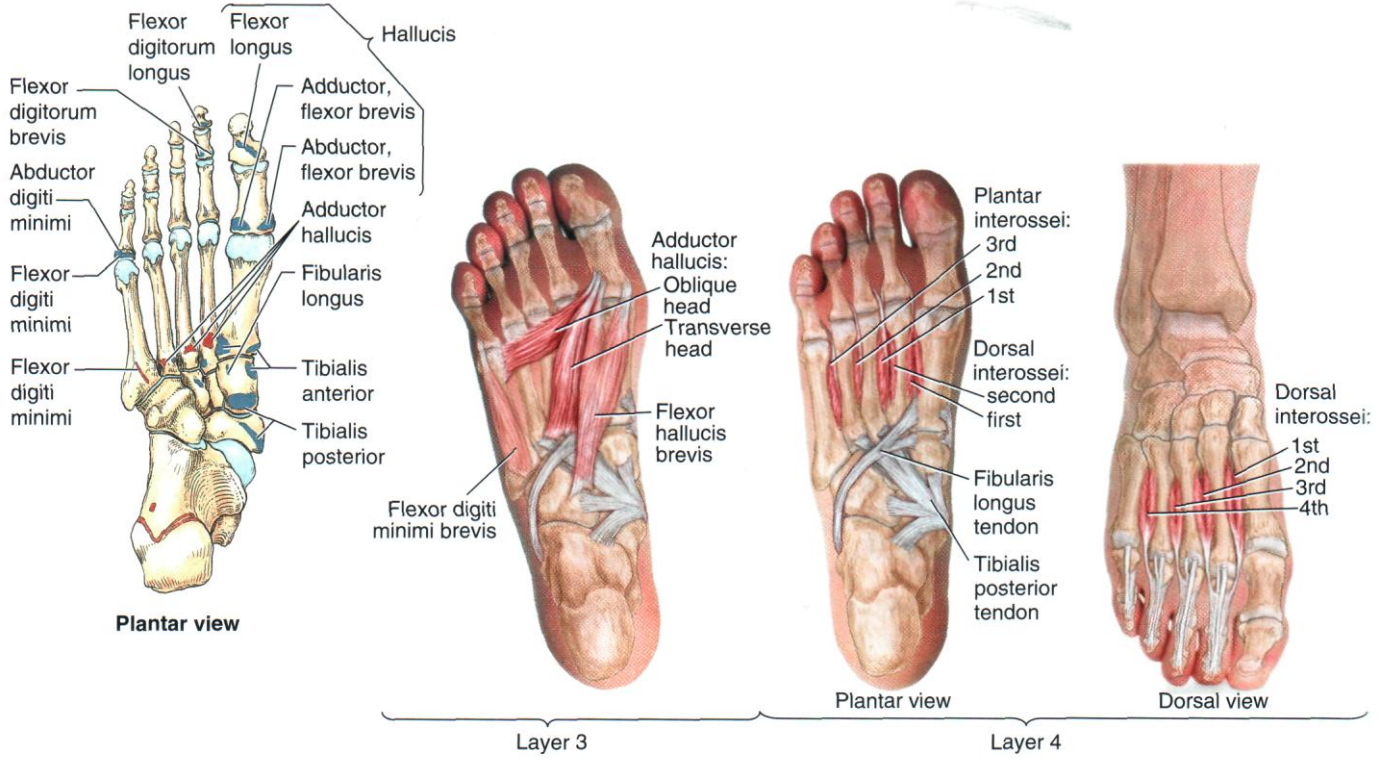
B. Dorsal muscles of the foot are situated under dorsal fascia and tendons of long extensor of toes.

Extensor digitorum brevis muscle (*m. extensor digitorum brevis, L.*) lies on the dorsal surface of the foot under the extensor digitorum longus tendons. It originates on the superolateral surface of the calcaneus just before the entrance into the sinus tarsi, extends forward, and divides into four thin tendons. These tendons stretch to the medial four toes and fuse with the lateral margin of the extensor digitorum longus and extensor hallucis longus tendons with which they form the dorsal tendinous expansion of the toes. The medial belly passing obliquely together with its tendon to the great toe is also designated separately, the **extensor hallucis brevis muscle** (*m. extensor hallucis brevis muscle, L.*).

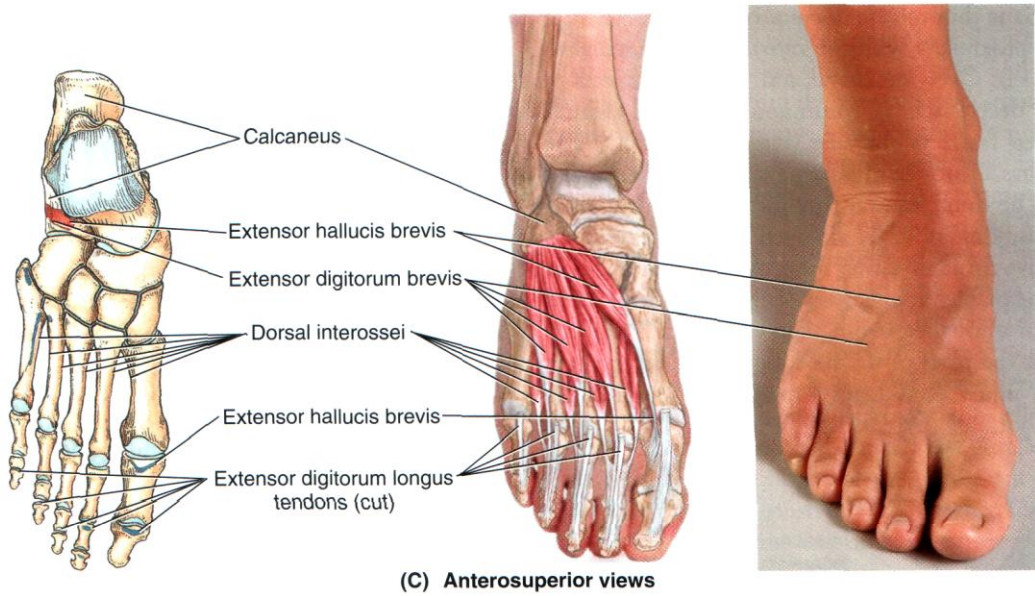
Action. Extends the medial four toes and at the same time abducts them slightly laterally.



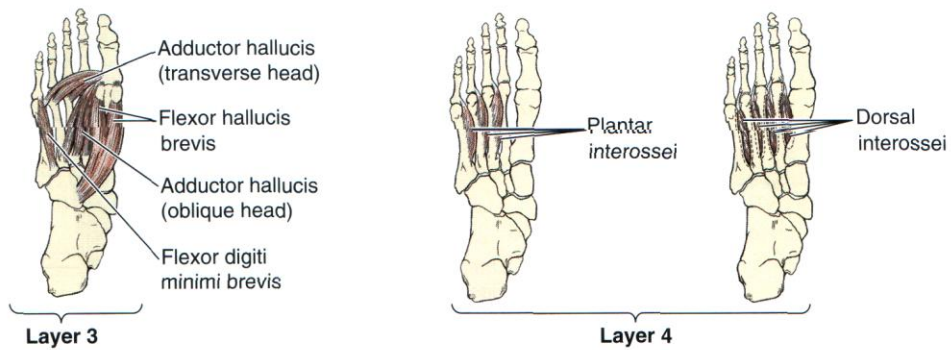
Muscles of the Foot: 3rd and 4th layers of the Sole



Muscles of the Foot: Dorsum of the Foot



(C) Anterosuperior views



Plantar muscles of the foot

Name of muscle	Origin	Insertion	Action
Medial group Abductor hallucis	Medial tubercle of calcaneum, plantar surface of navicular bone, flexor retinaculum, plantar aponeurosis	Medial side of base of proximal phalanx of hallucis	Flexes and abducts big toe, supports medial longitudinal arch
Flexor hallucis brevis	Plantar surface of navicular bone, medial cuneiform bone	Base of distal phalanx of big toe	Flexes distal phalanx of big toe
Adductor hallucis Oblique head Transverse head	Plantar surface of cuboid and lateral cuneiform bones, bases 2-4 th metatarsal bones; long plantar ligaments Plantar surface of capsules of 2-4 th metatarsophalangeal joints, deep transverse metatarsal ligament, distal end of metatarsal bones	 Common tendon attaches to lateral side of base of proximal phalanx of big toe	Adducts and flexes big toe
Middle group Flexor digitorum brevis	Plantar surface of tubercle of calcaneum, plantar aponeurosis	Both sides of plantar surface of bases of middle phalanges of 2-5 th toes	Flexes middle phalanx of 2-5 th toes
Quadratus plantae	Plantar surface of calcaneum, long plantar ligament	Tendons of flexor digitorum longus	Flexes 2-5 th toes
Lumbricals	Tendons of flexor digitorum longus	Dorsomedial side proximal phalanges of 2-5 th toes	Flex proximal phalanx and extend middle and distal phalanx of 2-5 th toes
Plantar interossei (3 muscles)	Medial aspect of 3 rd -5 th metatarsal bones	Medial aspect of base of proximal phalanx of the same ray (of 3 rd -5 th rays)	Abduct and flex 3-5 toes
Dorsal interossei (4 muscles)	From both metatarsal bones between which they lie	Base of proximal phalanges closest to the axis of the foot (2 nd ray)	Abduct and flex 2-4 th toes
Lateral group Abductor digiti minimi	Plantar surface of tubercles of calcaneum, tuberosity of 5 th metatarsal bone	Lateral side of base of proximal phalanx of fifth toe	Flexes and abducts fifth toe
Flexor digiti minimi brevis	Plantar surface of base of fifth metatarsal bone, long plantar ligament	Base of distal phalanx of proximal phalanx of little toe	Flexes little toe

Dorsal muscles of the foot

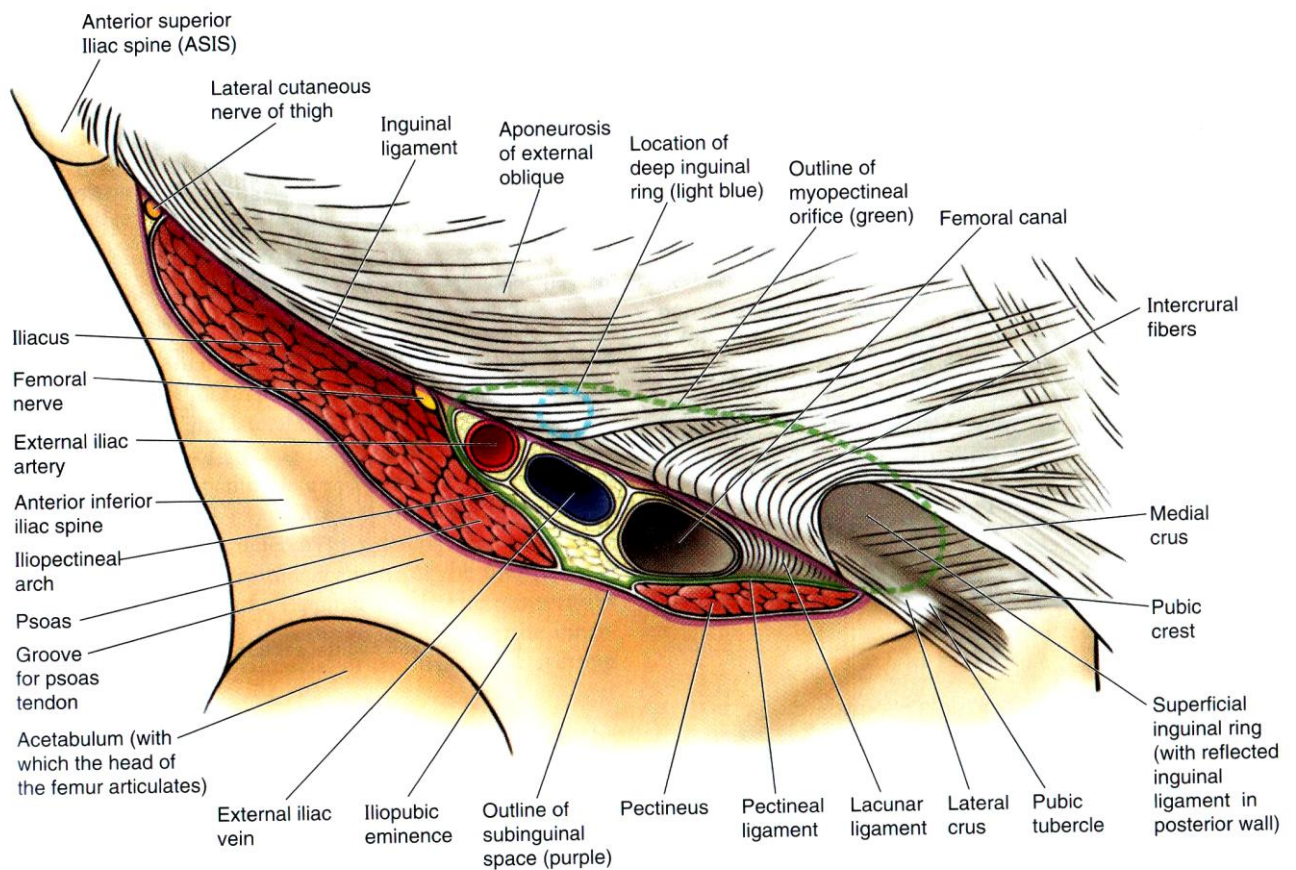
Name of muscle	Origin	Insertion	Action
extensor digitorum brevis	Upper anterolateral calcaneus, inferior extensor retinaculum	Middle and distal phalanges of 2-4 th toes	Extends 2-4 th rays
extensor hallucis brevis	Upper anterolateral calcaneus, inferior extensor retinaculum	Base of proximal phalanx of hallucis	Extends hallucis

Topography and fascia of the lower limb.

Gluteal Region. The gluteal region is bounded superiorly by the iliac crest and inferiorly by the fold of the buttock. The region is largely made up of the gluteal muscles and a thick layer of superficial fascia.

Iliac Fascia. The iliac muscle and poses major are enclosed by the iliac fascia, which make one fascia lata in thigh.

In the subinguinal region its attaches to the iliopubic eminence and to form **iliopectineal arch**. The iliopectineal arch divides the subinguinal space on vascular and muscular spaces or lacunas.



Anteroinferior view

Through **Vascular lacuna** the femoral artery and vein pass to the anterior surface of the thigh.

It's bordered by the:

Anteriorly: Inguinal ligament;

Posteriorly: Superior ramus of the pubis and the pectineal ligament;

Laterally: Iliopectineal arch.

Through the **muscular lacuna** iliopsoas muscle and femoral nerve pass. It's bordered by the:
 Anteriorly: Inguinal ligament;
 Posteriorly: Body of iliac bone;
 Medially: Iliopectineal arch.

Gluteal Fascia. This is continuous below with the fascia lata of the thigh. It splits to enclose the gluteus maximus muscle.

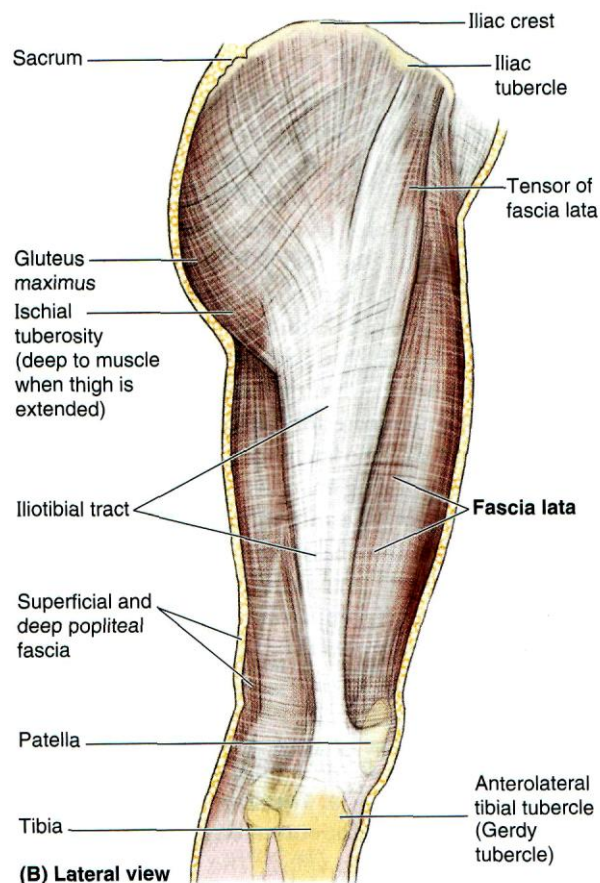
The piriformis muscle passes through the **greater ischiatic foramen** and to divides it on **suprapiriform** and **infaipiriform** foramens for vessels and artery.

Fascia of the thigh. Fascia Lata. The fascia encloses the thigh like a trouser leg.

Its upper end is attached to the pelvis and its associated ligaments. Iliotibial tract. The iliotibial tract is a thickening of the fascia lata on its lateral side. It is attached above to the iliac tubercle and below to the lateral condyle of the tibia. It receives the insertion of the greater part of the gluteus maximus muscle and the tensor fasciae lata muscles.

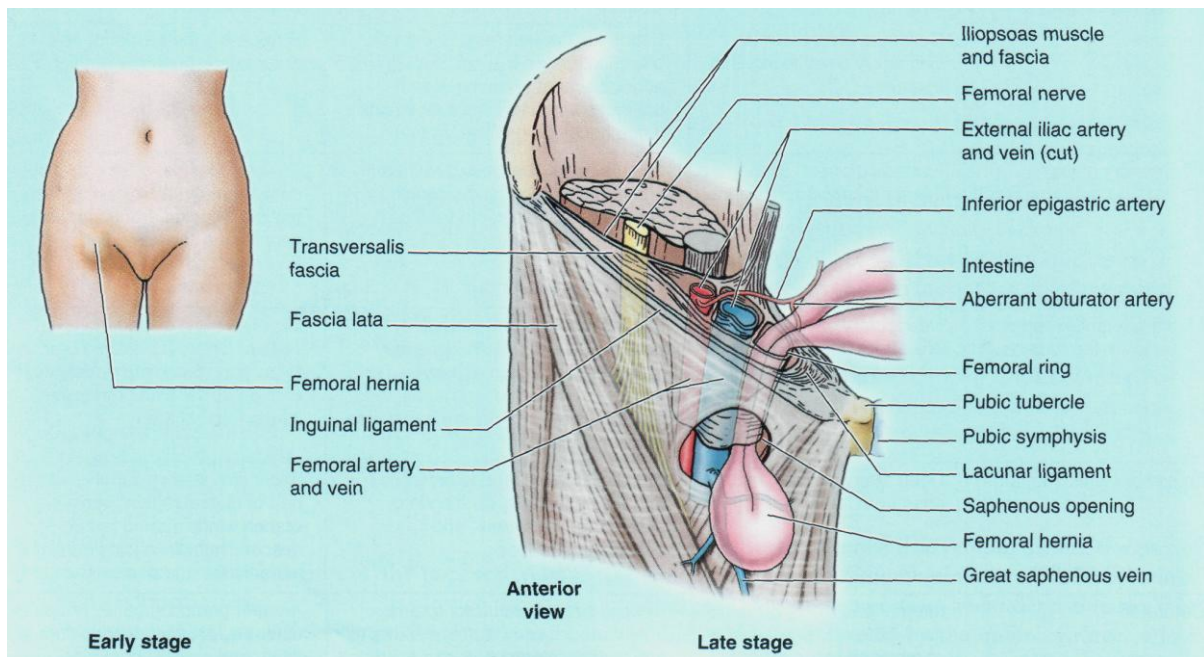
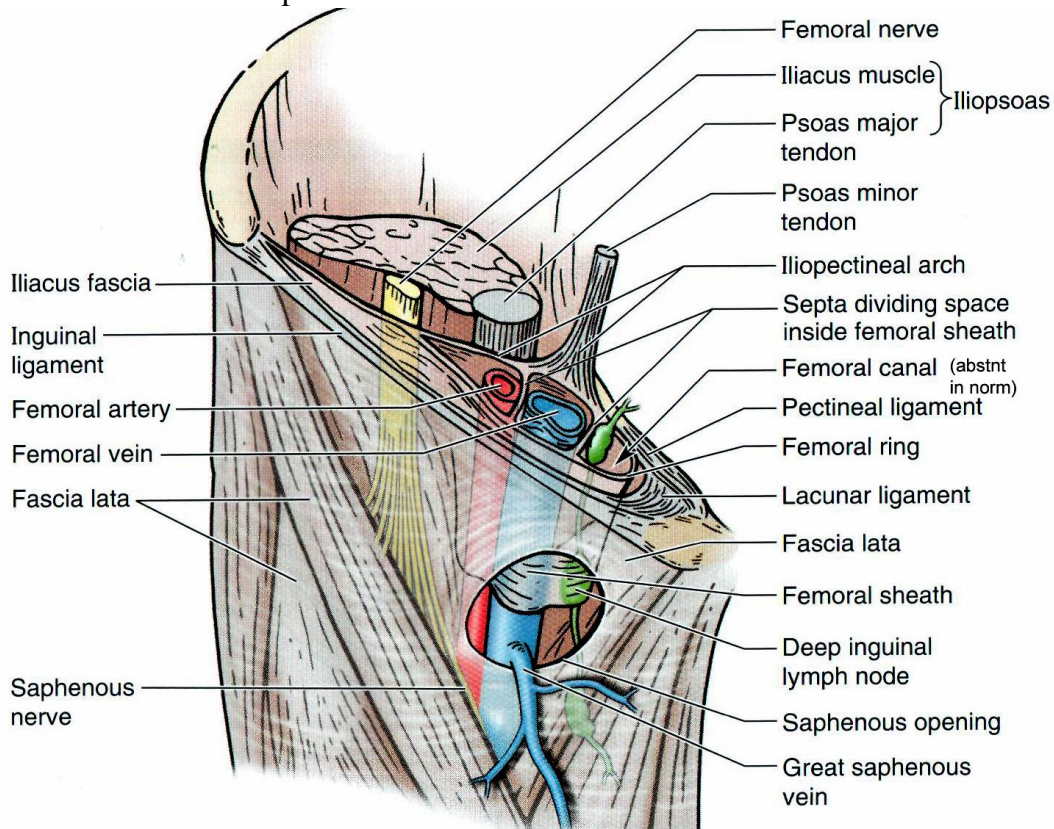
In the femoral triangle the fascia lata splits on superficial lair, which passes anteriorlly to the femoral vessels, and deep lair, which passes posteriorlly to the femoral vessels.

Obturator canal is boundaries by obturator groove of pubic bone and obturator membrane.



Saphenous opening. The saphenous opening is a gap in the superficial layer at the front of the thigh just below the inguinal ligament. It allows passage of the great saphenous vein, some small branches of the femoral artery, and lymph vessels. The opening is filled with loose connective tissue called the cribriform fascia. The edge of the saphenous opening is called the falciform margin. It has superior and inferior horn. The superior horn attaches to the inguinal ligament and joins with lacunar ligament, the inferior horn attaches to deep layer of the fascia lata behind great saphenous vein.

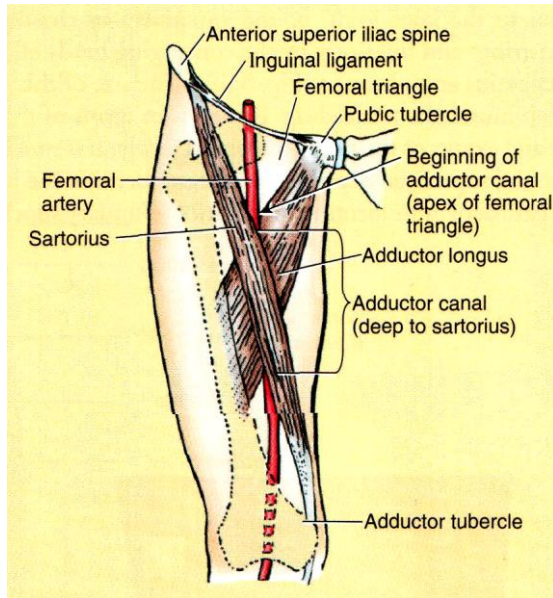
The **femoral canal** is absent in normal.



Boundaries of the femoral canal: anterior is the inguinal ligament and superior horn of the falciform margin, lateral is the femoral vein, posterior is the deep layer of fascia lata.

The upper opening of the femoral canal is called the **femoral ring** and its boundaries: are medially the lacunar ligament, laterally the vein, anteriorly the inguinal ligament and posteriorly the pectineus and its fascia. The femoral ring is a potentially weak area in the wall of the abdomen.

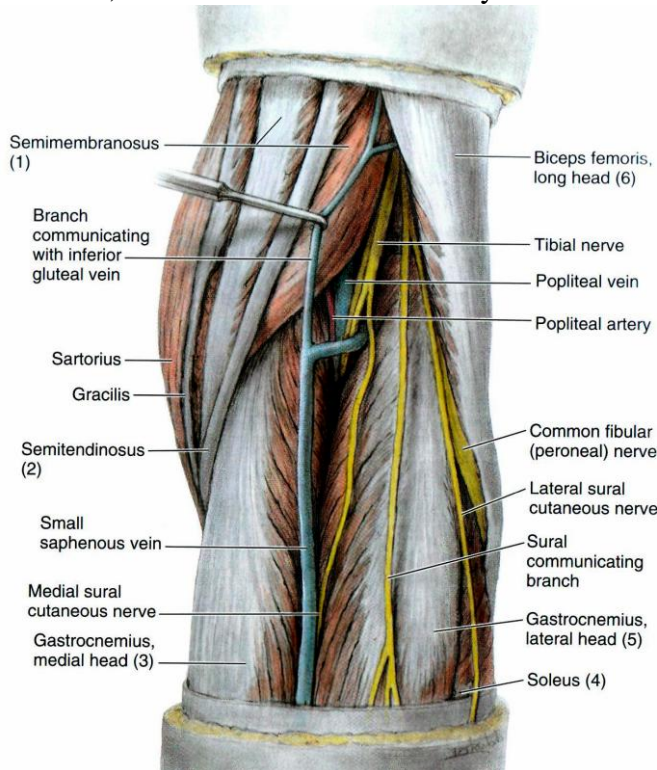
The lower opening of the femoral canal is the saphenous opening.



The femoral triangle

The boundaries are the inguinal ligament, the lateral border of sartorius and the medial adductor longus. The latter muscle, therefore, lies in the floor of the triangle. The other muscles of the floor are (from medial to lateral) pectineus, psoas and iliacus. The femoral triangle contains femoral artery, femoral nerve, saphenous vein and lymphatic vessels and nodes. The femoral artery and vein pass through the lacuna vasorum into iliopectineus sulcus (between iliacus and pectineus muscles). Then femoral vessels positioned in anterior femoral sulcus which located between adductor magnus medially and medial vastus muscle laterally. Femoral triangle by its lower angle passes into adductor canal.

Adductor canal (Hunter's canal). The adductor canal is intermuscular canal, which situated on the medial aspect of the middle third of the thigh, in lower angle of femoral triangle. The posterior wall is formed by the adductor magnus muscle, the lateral wall by the vastus medialis, and the anteromedial wall by the vastoadductorial sept. It contains the femoral artery and vein, the deep lymph vessels and nerves, which pass through the hiatus adductorius to the popliteal fossa.



The adductor canal contains the femoral artery and vein, the deep lymph vessels and nerves, which pass through the hiatus adductorius to the popliteal fossa.

Popliteal fossa. The popliteal fossa is a diamond-shaped intermuscular space, situated at the back of the knee. It contains the popliteal vessels, nerves, connective tissue, and lymph nodes.

Boundaries

Laterally. The biceps femoris above and the lateral head of the gastrocnemius and plantaris below.

Medially. The semimembranosus and semitendinosus above and the medial head of the gastrocnemius below.

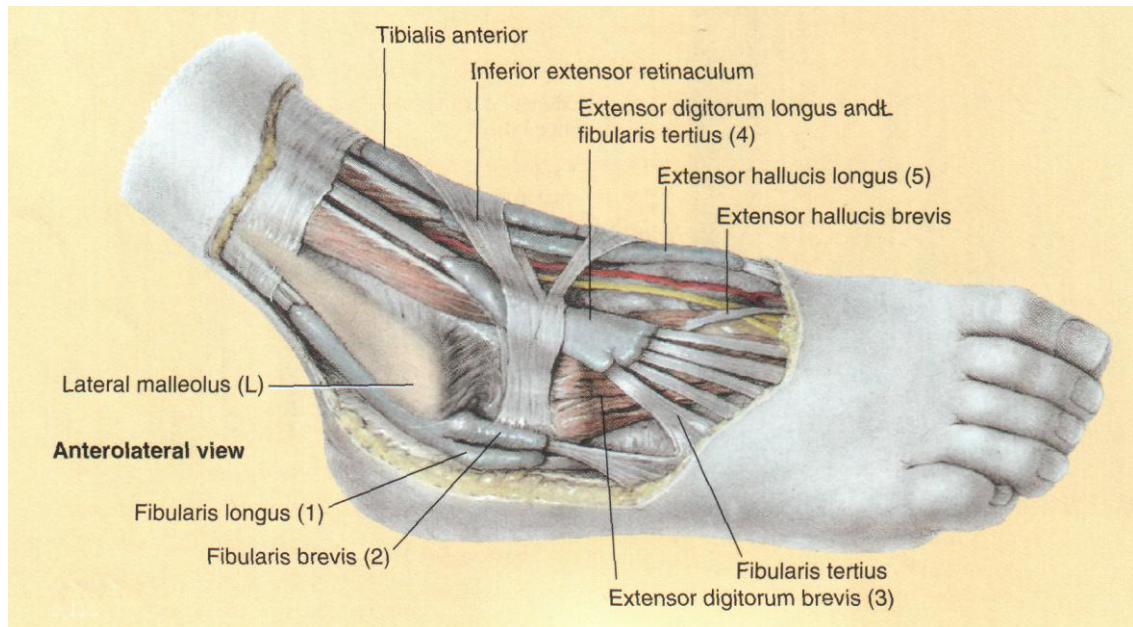
Fascia lata passes into leg as crural fascia.

The **crural fascia** surrounds the leg and is continuous above with the fascia of the thigh. It is attached to the anterior and medial borders of the tibia. Two intermuscular septa pass from its deep aspect to be attached to the fibula. The septa, together with the interosseous membrane, divide the leg into three compartments each having its own muscles, blood supply, and nerve supply.

Retinacula. The retinacula are thickenings of the crural fascia to keep the long tendons around the ankle joint in position and to act as pulleys.

Superior Extensor Retinaculum. This is attached to the distal ends of the anterior borders of the fibula and the tibia.

Inferior Extensor Retinaculum. This is a Y-shaped band located in front of the ankle



Together they form fibrous canals and synovial sheaths for tendons of tibialis anterior, extensor of hallucis longus, and long extensor digitorum.

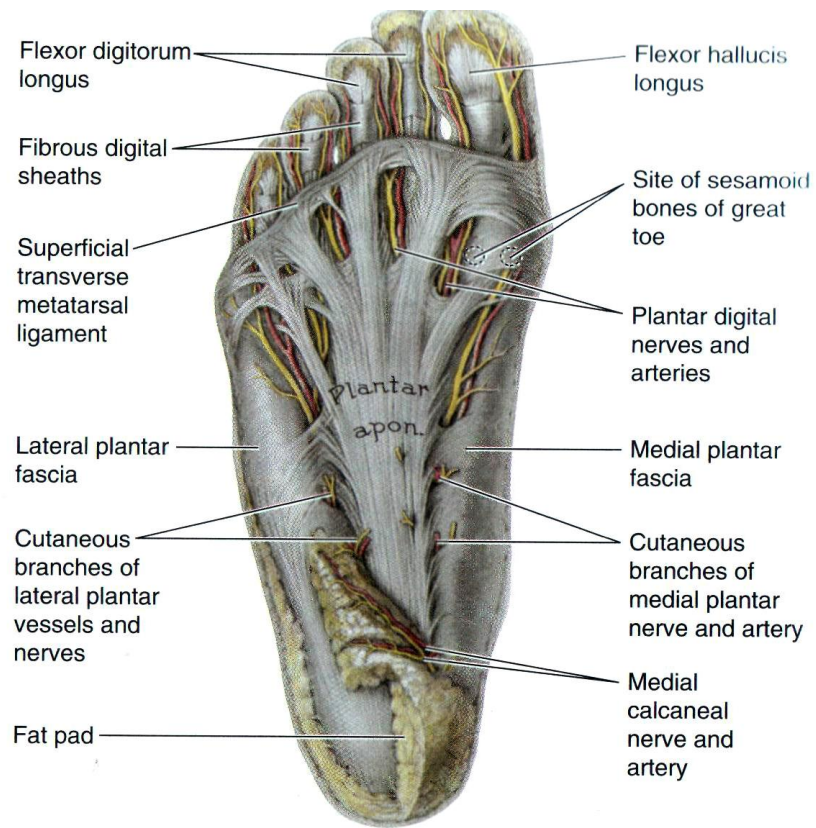
Flexor Retinaculum. This extends from the medial malleolus to the medial surface of the calcaneum. It binds in fibrous canals the synovial sheaths for tendons of tibialis posterior, flexor of hallucis longus, and long flexor digitorum muscles to the back of the medial malleolus as they pass forward to enter the sole.

Superior Peroneal Retinaculum. This connects the lateral malleolus to the lateral surface of the calcaneum. It binds the synovial sheaths of tendons of the peroneus longus and brevis to the back of the lateral malleolus.

Inferior Peroneal Retinaculum. Binds the synovial sheaths of tendons of the peroneus longus and brevis to the lateral side of the calcaneum.

Fascia cruris passes into front and forms dorsal and plantar fascia pedis. **Plantar fascia** of the foot has superficial and deep laminae. Deep lamina forms synovial vaginae for plantar muscles, also lateral and medial intermuscular septa, that separate muscle groups of foot. Superficial lamina of plantar fascia forms plantar aponeurosis.

Plantar aponeurosis. This is a triangular thickening of fascia that protects the underlying nerves, blood vessels, and muscles. Its apex is attached to the medial and lateral tubercles of the calcaneum. The base of the aponeurosis divides into five slips that pass into the toes.



**Plantar aspect or sole of foot
(inferior view)**