HUMAN ANATOMY AND PHYSIOLOGY- 1(BP101T)

UNIT: 2 SKELETAL SYSTEM

CLASS: 4

TOPIC: SALIENT FEATURES AND FUNCTIONS OF BONES OF APPENDICULAR SKELETAL SYSTEM

The appendicular skeleton consists of the:

- Shoulder girdle with the upper limbs.
- Pelvic girdle with the lower limbs.

DIVISION OF THE SKELETON	STRUCTURE	NUMBER OF BONES
Appendicular skeleton	**Pectoral** (*shoulder*) **girdles**	
	Clavicle	2
	Scapula	2
	Upper limbs	
	Humerus	2
	Ulna	2
	Radius	2
	Carpals	16
	Metacarpals	10
	Phalanges	28
	Pelvic (*hip*) **girdle**	
	Hip, pelvic, or coxal bone	2
	Lower limbs	
	Femur	2
	Patella	2
	Fibula	2
	Tibia	2
	Tarsals	14
	Metatarsals	10
	Phalanges	28
	Number of bones = 126	
	Total bones in an adult skeleton = 206	

❖ MAIN FUNCTIONS:

- **Voluntary movement:** The bones, muscles and joints of the limbs are involved in movement of the skeleton. This ranges from very fine finger movements needed for writing to the coordinated movement.
- **Protection of blood vessels and nerves:** These delicate structures along the length of bones of the limbs and are protected from injury by the associated muscles and skin.

❖ SHOULDER GIRDLE(PECTORAL):

The upper limb forms a joint with the trunk via the shoulder (pectoral) girdle. The shoulder girdle consists of two **clavicles** and two **scapulae**.

1.CLAVICLE (COLLAR BONE) (2): OR BEAUTY BONE: The clavicle is an **S-shaped long bone**. It articulates with the **manubrium** of the sternum at the **sternoclavicular joint** and forms the **acromioclavicular joint** with the **acromion process** of the scapula. The clavicle provides the only bony link between the upper limb and the axial skeleton.

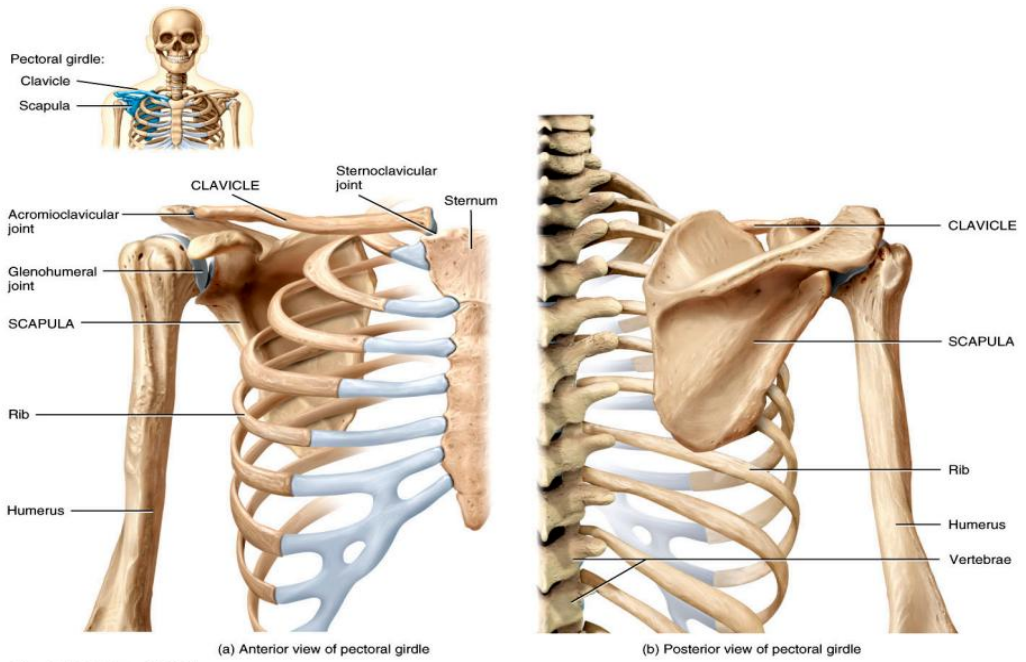
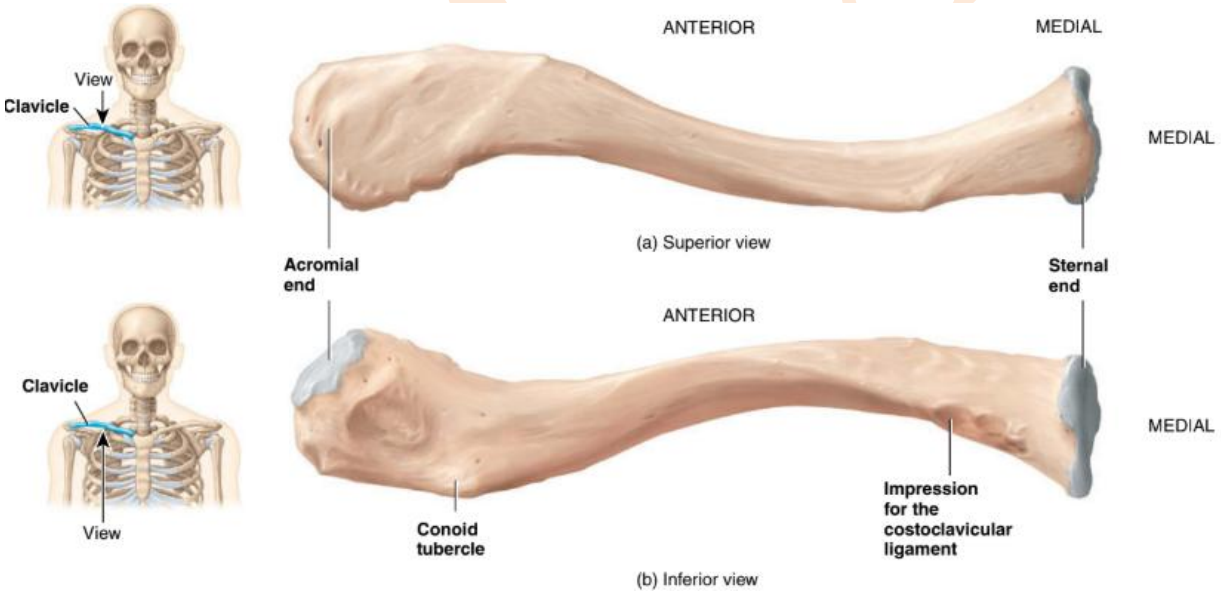


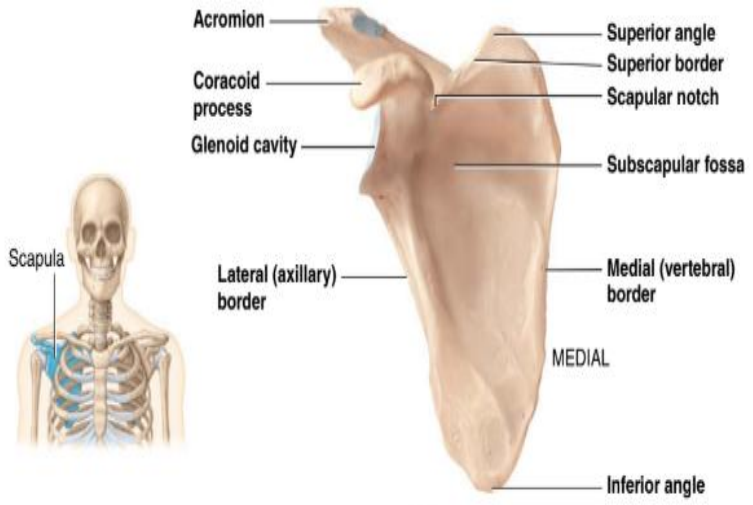
Figure 08.01 Tortora - PAP 12/e



FUNCTIONS:

- Clavicles are long bones that support upper body and play an important role in move.
- They hold shoulder in place, allowing to transfer weight from upper body to head, neck, back and chest

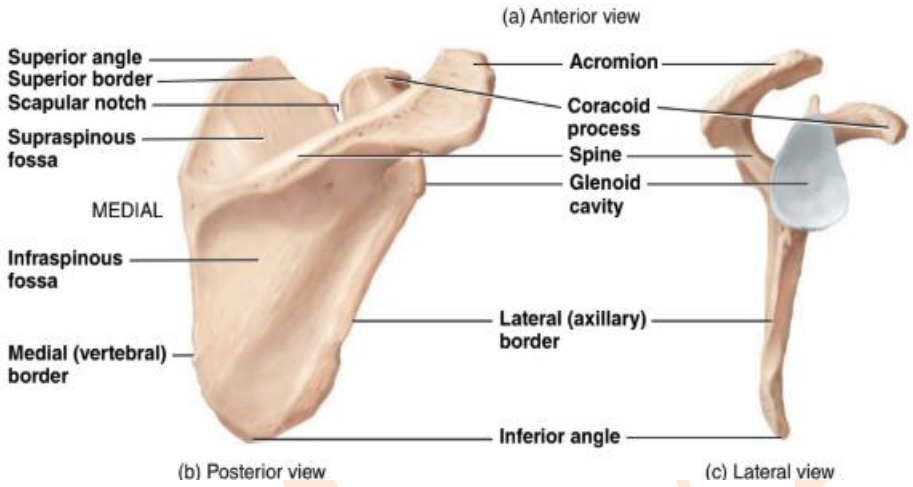
2.SCAPULA: Shoulder blade, is a large, flate bone situated in the posterior chest wall superficial to the ribs (2nd and 7th) and separated from them by muscles. The lateral angle of the scapula has a shallow surface called the **glenoid cavity**, which joins with the **humerus** to form the **shoulder joint**. A rough ridge called the spine runs across the back of the scapula and extends past its edge to form the acromion process. This bony projection, felt as the highest point of the shoulder, connects with the clavicle at the acromioclavicular joint, allowing shoulder movement. Another projection, the coracoid process, provides attachment for shoulder-moving muscles.



SCAPULA - FEATURES:

- The medial (vertebral) border - closest to the vertebral spine
- Lateral border - closest to the arm
- Superior border - superior edge
- Inferior angle - where medial and lateral borders meet inferiorly
- Superior angle - uppermost aspect of scapula where medial border meets superior border.
- Subscapular fossa - anterior concavity where the subscapularis muscle attaches

- Supraspinous fossa - posterior concavity superior to the scapular spine, attachment site for supraspinatus muscle
- Infraspinous fossa - posterior concavity inferior to the scapular spine, site of infraspinatus muscle



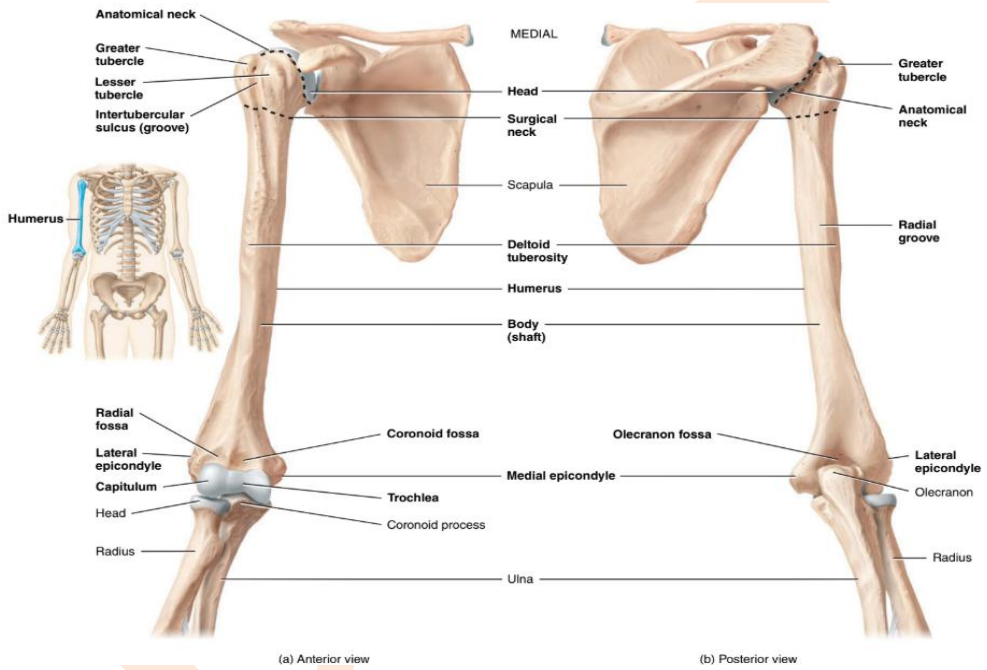
FUNCTIONS:

- Attachment points for muscles: Supporting muscle involved in pulling, lifiting and rotating the arm. Provide attachments sites for muscles that move the shoulder and arms.
- Helps in stabilize the upper limbs.
- Facilitates movement of the upper limbs in all directions.

❖ **UPPER LIMBS:** Each upper limbs have 30 bones in three locations.

- Humerus
- Ulna
- Radius
- Carpals
- Meta carpals
- Phalanges

- HUMERUS: This is the bone of the upper arm. It is the longest and largest bone of the upper limbs.
- The head sits within the glenoid cavity of the scapula, forming the shoulder joint.



Distal to the head are two roughened projections of bone, the **greater and lesser tubercles**, and between them there is a deep groove, the **bicipital groove or intertubercular sulcus**, occupied by one of the tendons of the biceps muscle.

The distal end of the bone presents two surfaces that articulate with the **radius and ulna to form the elbow joint**.

SPECIAL FEATURES:

- The capitulum is a rounded knob on the lateral aspect of the bone that articulates with the head of the radius.

- **The radial fossa** is an anterior depression above the capitulum that articulates with the head of the radius when the forearm is flexed (bent).
- **Trochlea** - medial to the capitulum, is a spool shaped projection on the distal humerus.
- **The coronoid fossa** (Crown-shaped) is an anterior depression that receives the coronoid process of the ulna when the forearm is flexed.
- **The olec-ranon fossa** (elbow) is a large posterior depression that receives the olecranon of the ulna when the forearm is extended (straightened).
- **The medial and lateral epicondyles** are bony projections to which the forearm muscles attach.

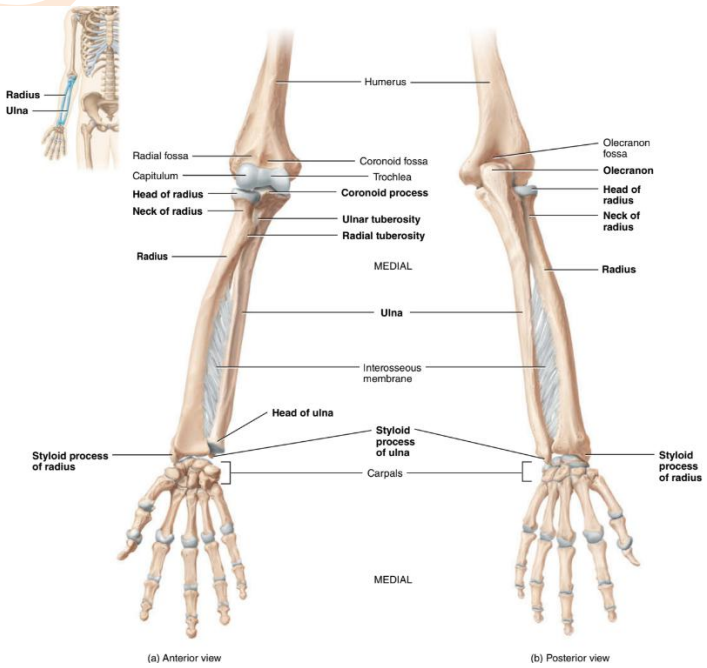
Functions: Pulling, push, lift, rotation.

SKELETON OF THE FOREARM – ULNA, RADIUS:

These are the two bones of the forearm. Each playing unique and complementary roles.

ULNA (2): It is located on the medial aspect (The little finger side) of the radius.

- At proximal end of the ulna is the olecranon, which forms the prominence of the elbow.
- **The coronoid process**, an anterior projection of the ulna, articulates with the trochlea of the humerus.
- The **trochlear notch** is a large curved area between the olecranon and coronoid process that helps form the elbow joint.
- The **radial notch** is small dip located next to and below the trochlear notch. Where it connects with the head of the radius.
- The end of the ulna has a head that is separated from the wrist by a cartilage disc.
- The styloid process at the end of the ulnas back side connects to wrist ligaments.



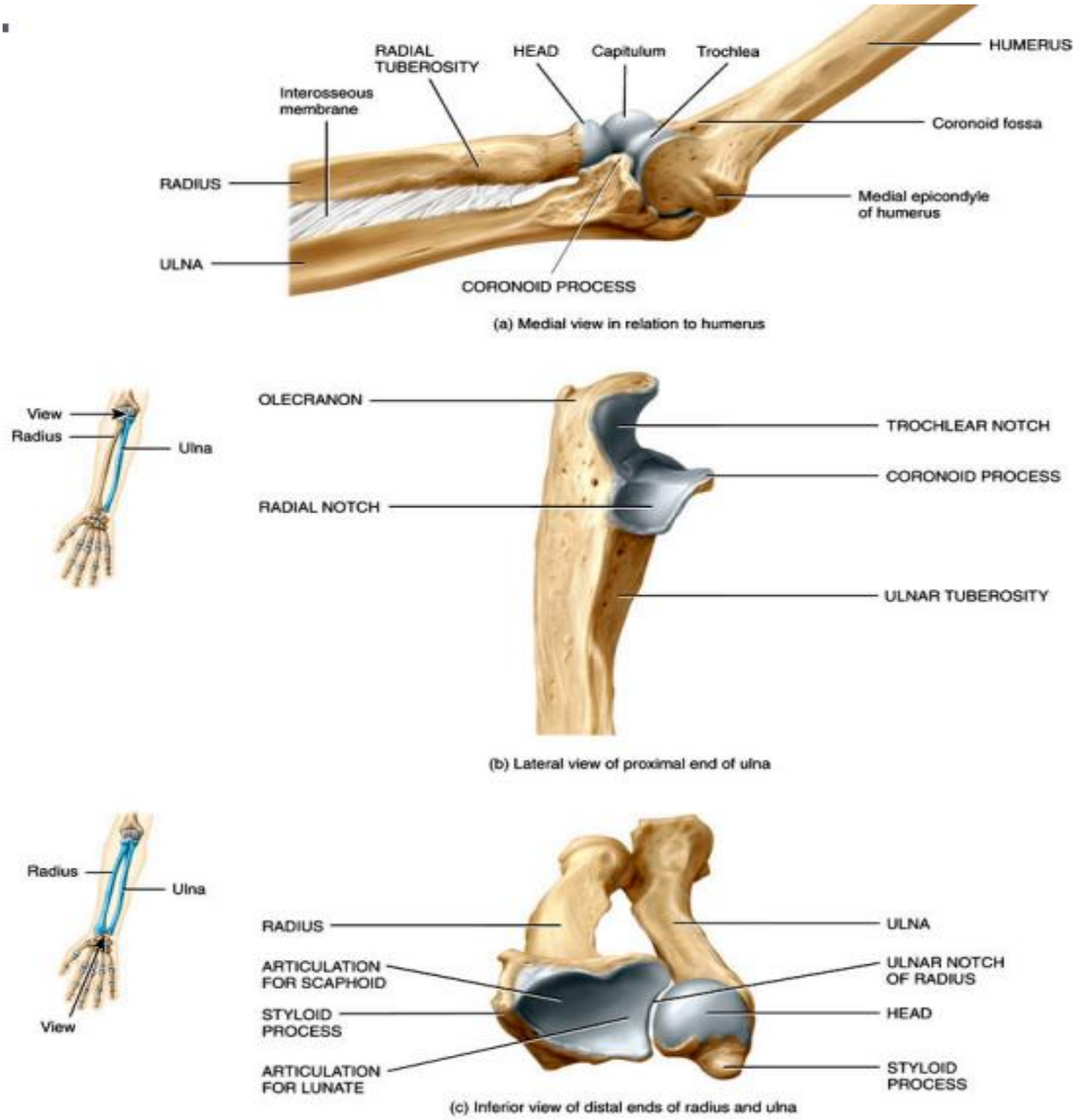


Figure 08.07 Tortora - PAP 12/e

RADIUS (2):

- Lies lateral to the ulna (thumb side of the forearm).
- The head (disc-shaped) and neck are at the proximal end.
- The head articulates with the capitulum of the humerus and the radial notch of the ulna.
- Unlike the ulna, the radius is thinner at the top and wider at the bottom.
- **Radial tuberosity** - medial and inferior to neck, attachment site for biceps brachii muscle.
- **Styloid process** - large distal projection on lateral side of radius.

The skeleton of the hand consists of the proximal carpals, the intermediate metacarpals, and the distal phalanges.

CARPAL(WRIST) BONES:

There are 8 carpal bones arranged in two rows of four.

• Proximal row: scaphoid, lunate, triquetrum, pisiform.

• Distal row: trapezium, trapezoid, capitate, hamate.

These bones are closely fitted together and held in position by ligaments that allow a limited amount of movement between them.

The bones in the row connects to the wrist, while those in the bottom row connect to the hand bones (meta carpals).

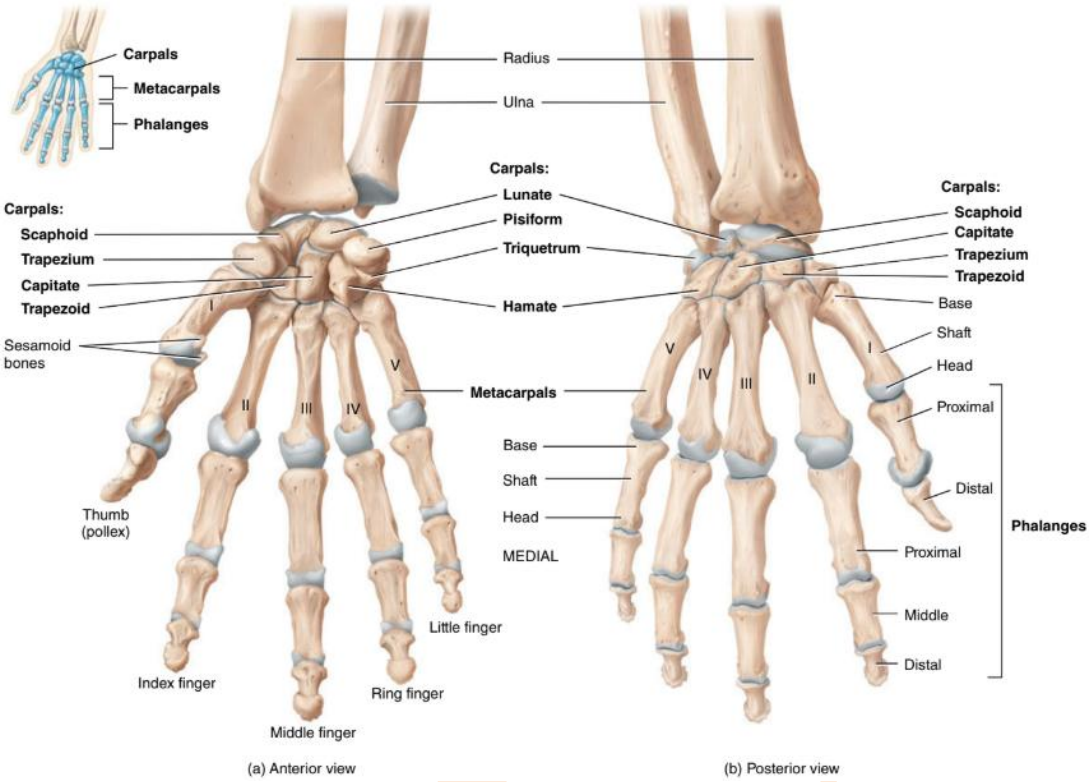
Forearm muscle tendons cross the wrist and are held close to the bones by strong fibrous bonds called **Retinacula.**

METACARPALS**:**

- The metacarpus or palm, is the intermediate region of the hand and consists of five bones called metacarpals.
- They are numbered from the thumb side inwards.
- The proximal ends articulate with the carpal bones and the distal ends with the phalanges.

PHALANGES (FINGER BONES):

- Thers are 14 phalanges, three in each finger and two in thumb. They articulate with the metacarpal bones and each other, by hinge joint.



❖ **PELVIC (HIP) GRIDLE:** The pelvic (hip) girdle consists of the two hip bones, also called coxal or pelvic bones. The pelvis is the term given to the basin-shaped structure formed by the pelvic girdle and its associated sacrum.

Innominate (hip) bones:

Each hip bone consists of three fused bones: the ilium, ischium and pubis.

On its lateral surface is a deep depression, the acetabulum, which forms the hip joint with the almost-spherical head of femur.

ILIUM: It is the upper flattened part of the bone and it presents the **iliac crest,** the anterior curve of which is called the anterior superior iliac spine.

The ilium forms a strong, flexiable joint with the sacrum called the sacroiliac joint. This joint helps absorb the stress of weight- bearing and may stiffen with age.

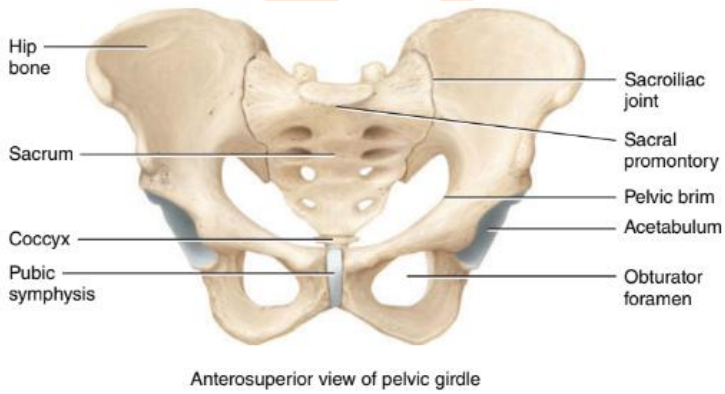
PUBIS: It is the anterior part of the bone and it articulates with the pubis of the other hip bone at a cartilaginous joint, the symphysis pubis.

ISCHIUM: The ischium is the inferior and posterior part. The rough inferior projections of the ischia, the ischial tuberosities, bear the weight of the body when seated.

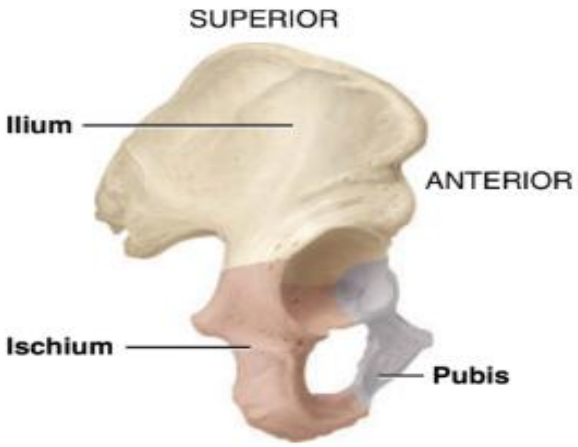
The union of the three parts takes place in the acetabulum.

PELVIS: The pelvis is formed by the hip bones, the sacrum and the coccyx. It is divided into two parts, The portion of the bony pelvis superior to the pelvic brim is referred to as the **false (greater) pelvis.** It contains superior portion of the urinary bladder (when it is full) and the lower intestines in both genders and the uterus, ovaries, and uterine tubes of the female.

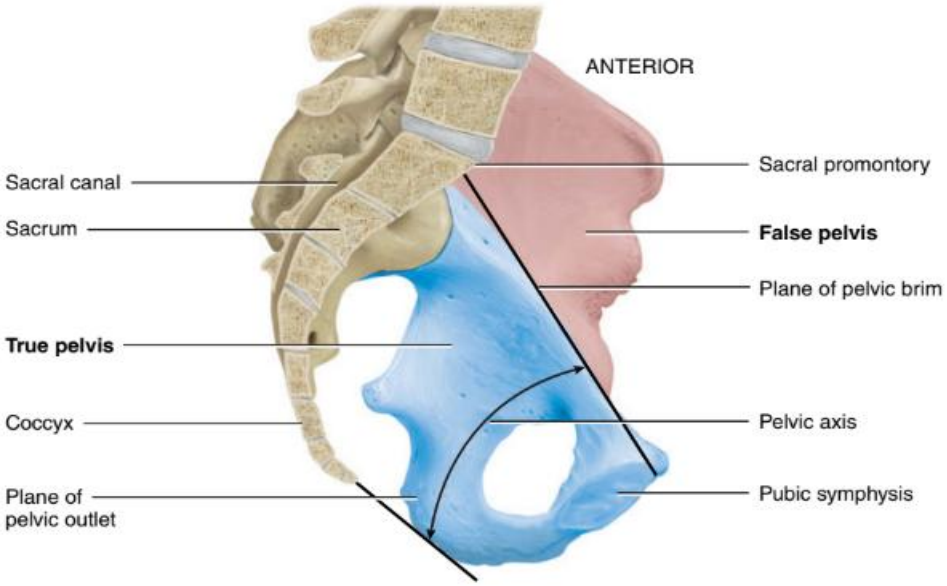
The portion of the bony pelvis inferior to the pelvic brim is the **true (lesser) pelvis.** The true pelvis contains the rectum and urinary bladder in both genders, the vagina and cervix of the uterus in females, and the prostate in males.



Anterosuperior view of pelvic girdle



(a) Anterosuperior view of pelvic girdle



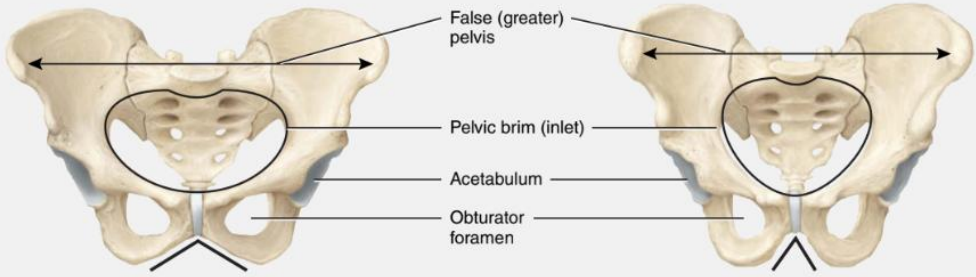
(b) Midsagittal section indicating locations of true (blue) and false (pink) pelves

(c) Anterosuperior view of false pelvis (pink)

(d) Anterosuperior view of true pelvis (blue)

COMPARISON OF FEMALE AND MALE PELVES:

POINT OF COMPARISON	FEMALE	MALE
General structure	Light and thin.	Heavy and thick.
False (greater) pelvis	Shallow.	Deep.
Pelvic brim (inlet)	Wide and more oval.	Narrow and heart-shaped.
Acetabulum	Small and faces anteriorly.	Large and faces laterally.
Obturator foramen	Oval.	Round.
Pubic arch	Greater than 90° angle.	Less than 90° angle.
Iliac crest	Less curved.	More curved.
Ilium	Less vertical.	More vertical.
Greater sciatic notch	Wide (almost 90°).	Narrow (about 70°; inverted V).
Sacrum	Shorter, wider (see anterior views), and less curved anteriorly.	Longer, narrower (see anterior views), and more curved anteriorly.



Anterior views

❖ LOWER LIMBS:

Anterior view of lower limb

FEMUR (THIGH BONE): The femur is the longest and heaviest bone of the body. The head is almost spherical and fits into the acetabulum of the hip bone to form the hip joint. The neck extends outwards and slightly downwards from the head to the shaft and most of it is within the capsule of the hip joint.

The posterior surface of the lower third forms a flat triangular area called the popliteal surface. The distal extremity has two articular condyles, which, with the tibia and patella, form the knee joint. The femur transmits the weight of the body through the bones below the knee to the foot.

TIBIA (SHIN BONE): The tibia is the medial of the two bones of the lower leg. The proximal extremity is broad and flat and presents two condyles for articulation with the femur at the knee joint. The head of the fibula articulates with the inferior aspect of the lateral condyle, forming the proximal tibiofibular joint.

The distal extremity of the tibia forms the ankle joint with the talus and the fibula. The medial malleolus is a downward projection of bone medial to the ankle joint.

FIBULA: The fibula is the long slender lateral bone in the leg. The head or upper extremity articulates with the lateral condyle of the tibia, forming the proximal tibiofibular joint, and the lower extremity articulates with the tibia, and projects beyond it to form the lateral malleolus. This helps to stabilise the ankle joint.

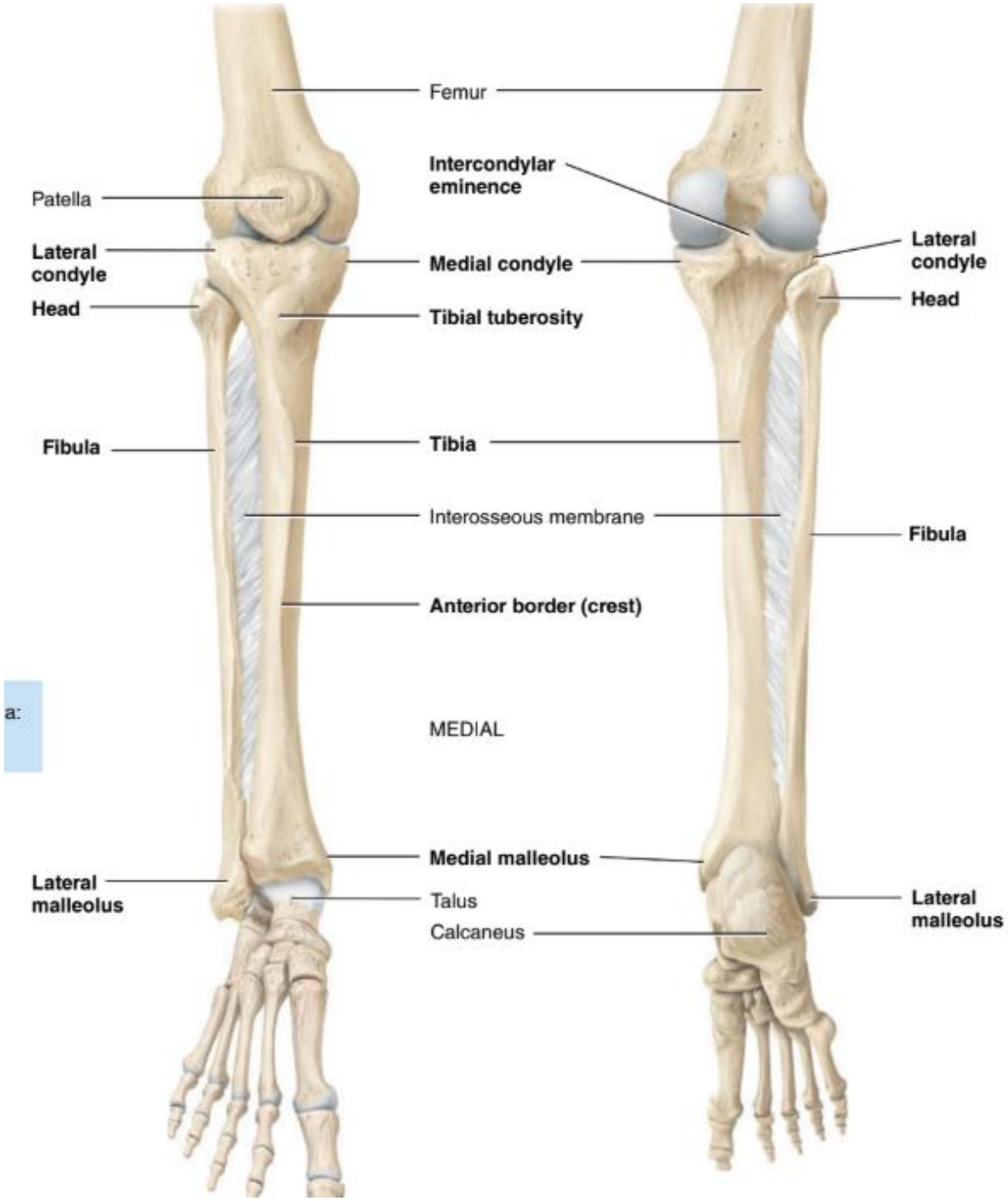
PATELLA (KNEE CAP): This is a roughly triangular-shaped sesamoid bone associated with the knee joint. Its posterior surface articulates with the patellar surface of the femur in the knee joint and its anterior surface is in the patellar tendon, i.e. the tendon of the quadriceps femoris muscle.

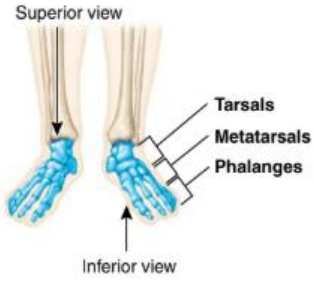
TARSAL (ANKLE) BONES:

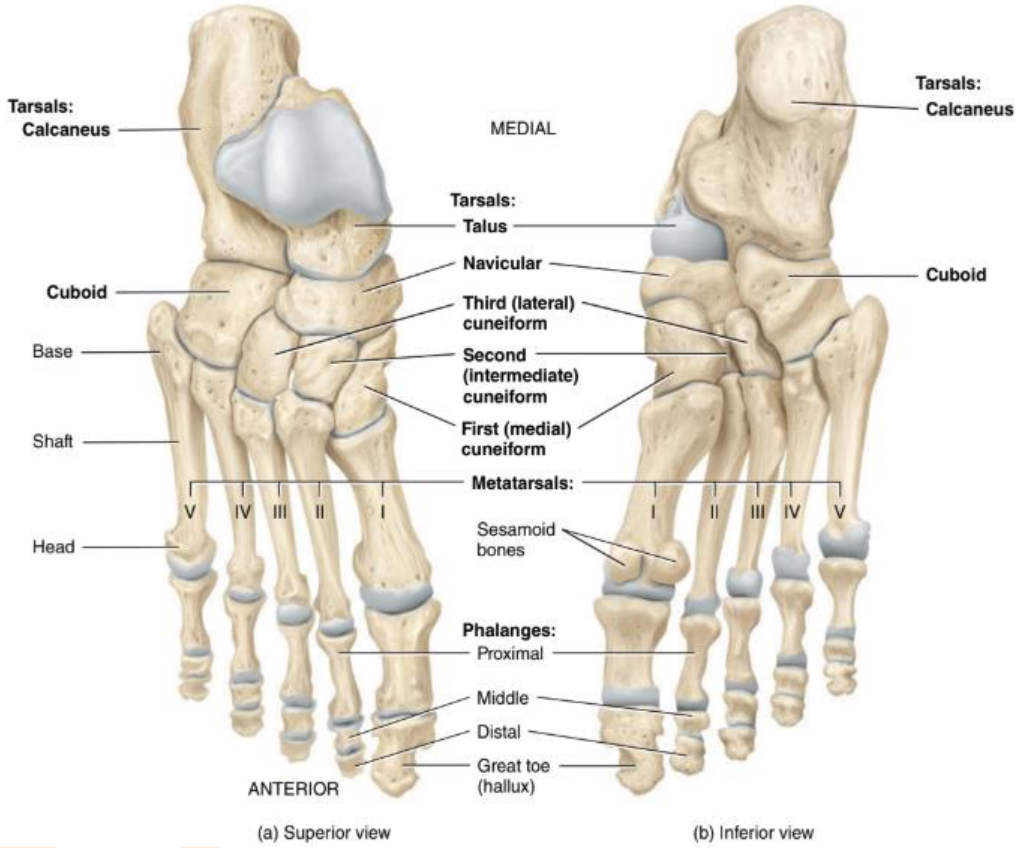
The seven tarsal bones forming the posterior part of the foot (ankle) are the talus, calcaneus, navicular, cuboid and three cuneiform bones. The talus articulates with the tibia and fibula at the ankle joint. The calcaneus forms the heel of the foot. The other bones articulate with each other and with the metatarsal bones.

METATARSALS (BONES OF THE FOOT): These are five bones, numbered from inside out, which form the greater part of the dorsum (sole) of the foot. At their proximal ends they articulate with the tarsal bones and at their distal ends, with the phalanges. The enlarged distal head of the 1st metatarsal bone forms the 'ball' of the foot.

PHALANGES (TOE BONES): There are 14 phalanges arranged in a similar manner to those in the fingers, i.e. two in the great toe (the hallux) and three in each of the other toes.


Femur
Intercondylar eminence
Patella
Lateral condyle
Medial condyle
Lateral condyle
Head
Tibial tuberosity
Head
Fibula
Tibia
Interosseous membrane
Fibula
Anterior border (crest)
a:
MEDIAL
Medial malleolus
Lateral malleolus
Talus
Calcaneus
Lateral malleolus


Superior view
Tarsals
Metatarsals
Phalanges
Inferior view


Tarsals:
Calcaneus
MEDIAL
Tarsals:
Talus
Navicular
Cuboid
Third (lateral) cuneiform
Base
Second (intermediate) cuneiform
First (medial) cuneiform
Shaft
Metatarsals:
V IV III II I
Head
Sesamoid bones
Phalanges:
Proximal
Middle
Distal
Great toe (hallux)
ANTERIOR
(a) Superior view
Tarsals:
Calcaneus
Cuboid
I II III IV V
(b) Inferior view