

BONES OF UPPER & LOWER LIMBS



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OBJECTIVES

At the end of the lecture, students should be able to:

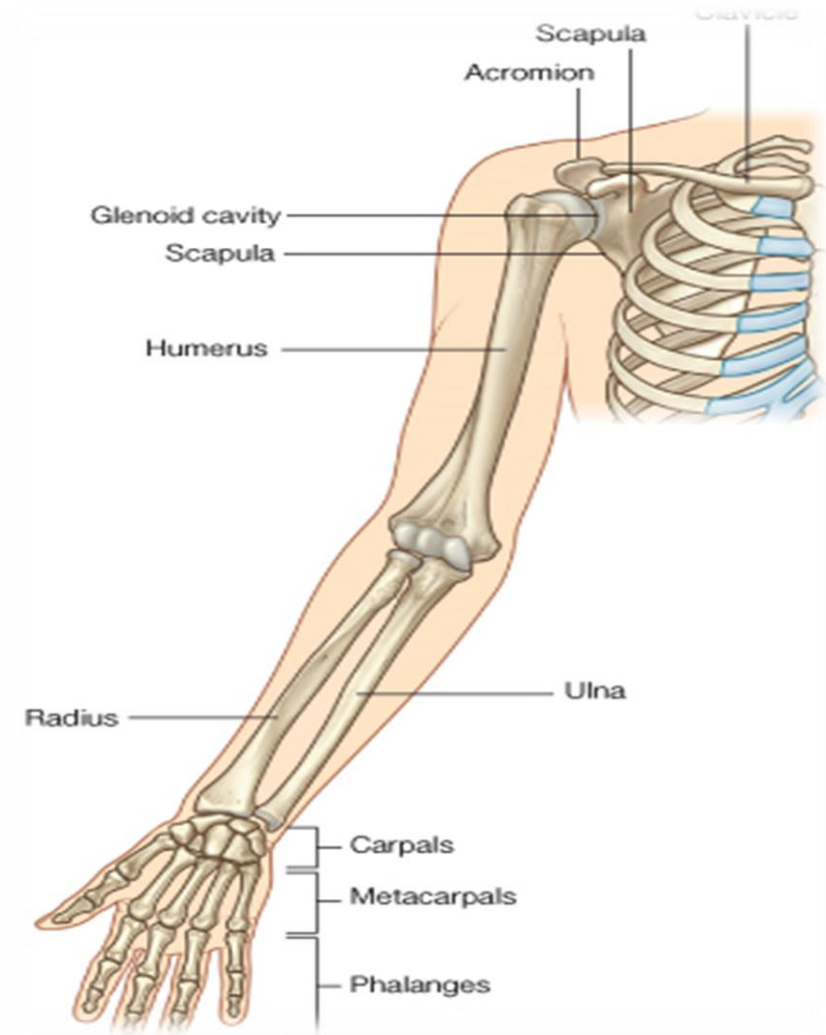
- List the different bones of the the upper and lower limbs.
- List the characteristic features of each bone in both.
- Differentiate between bones of right and left sides.
- List the articulations between the different bones.
- Learn some clinical significances associated with the upper and lower limbs.

UPPER LIMBS

BONES OF UPPER LIMB

It consists of the following:

- **Pectoral Girdle**
 - Clavicle
 - Scapula
- **Arm**
 - Humerus
- **Forearm**
 - Radius & Ulna
- **Wrist**
 - Carpals bones
- **Hand**
 - Metacarpals & Phalanges



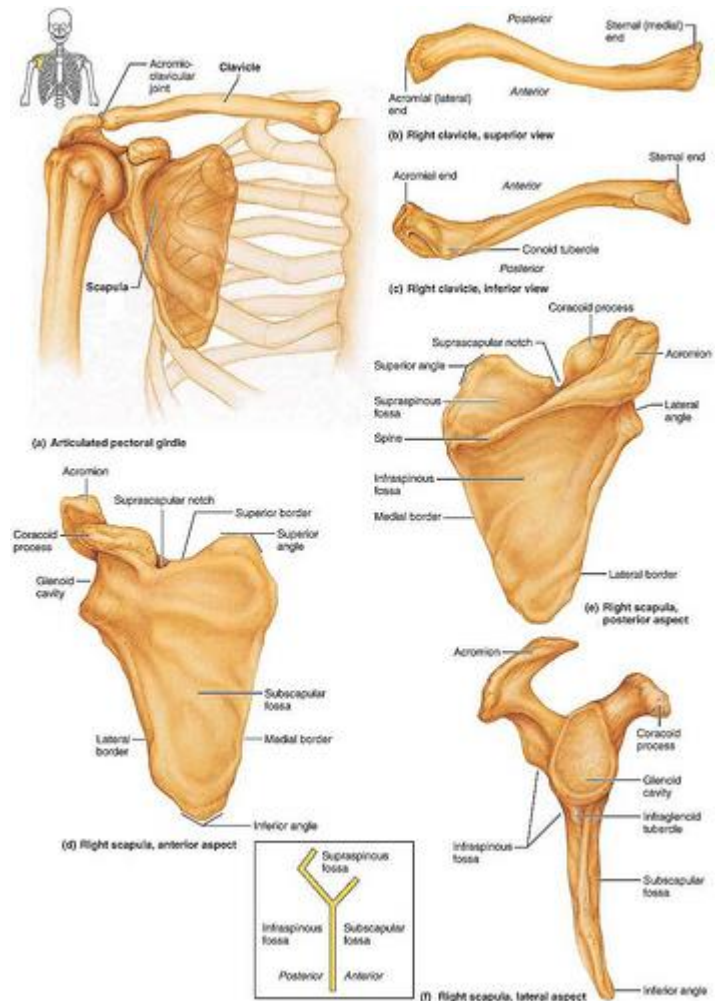
PECTORAL GIRDLE

❑ It composed of Two bones:

- Clavicle

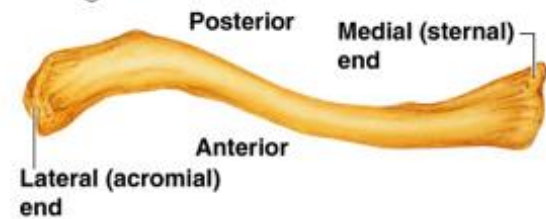
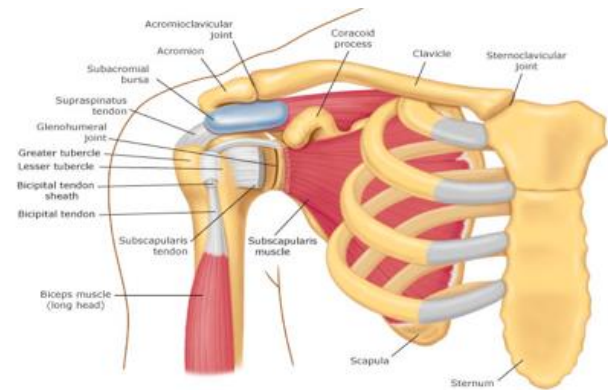
- Scapula

❑ It is very light and it allows the upper limb to have exceptionally free movement.

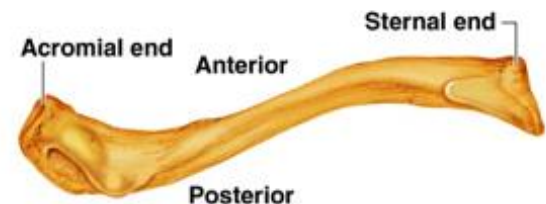


CLAVICLE

- ❑ It is considered as a long bone but it has no medullary (bone marrow) cavity.
- ❑ Its medial (**Sternal**) end is enlarged & triangular.
- ❑ Its lateral (**Acromial**) end is flattened.
- ❑ The medial 2/3 of the body (shaft) is convex forward.
- ❑ The lateral 1/3 is concave forward.
- ❑ These curves give the clavicle its appearance of an elongated capital (S)
- ❑ It has two surfaces:
 - **Superior:** smooth as it lies just deep to the skin.
 - **Inferior:** rough because strong ligaments bind it to the 1st rib.
- ❑ Functions:
 - It serves as a rigid **support** to keep upper limb suspended away from the trunk.
 - **Transmits forces** from the upper limb to the axial skeleton.
 - **Provides attachment** for muscles.
 - Forms a boundary of the **cervicoaxillary canal** for protection of the neurovascular bundle of the UL.



Superior view

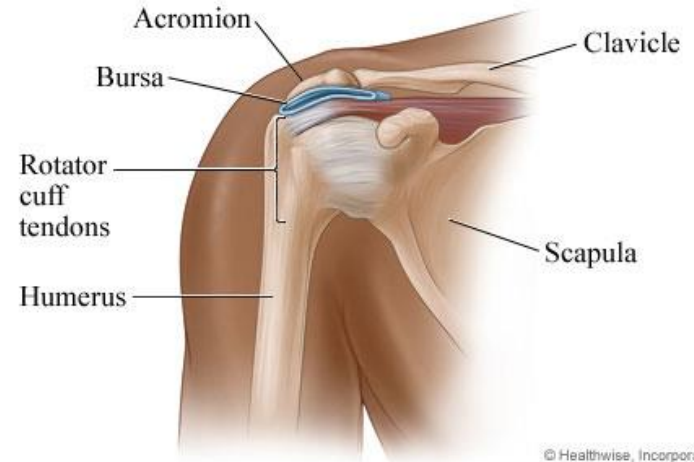
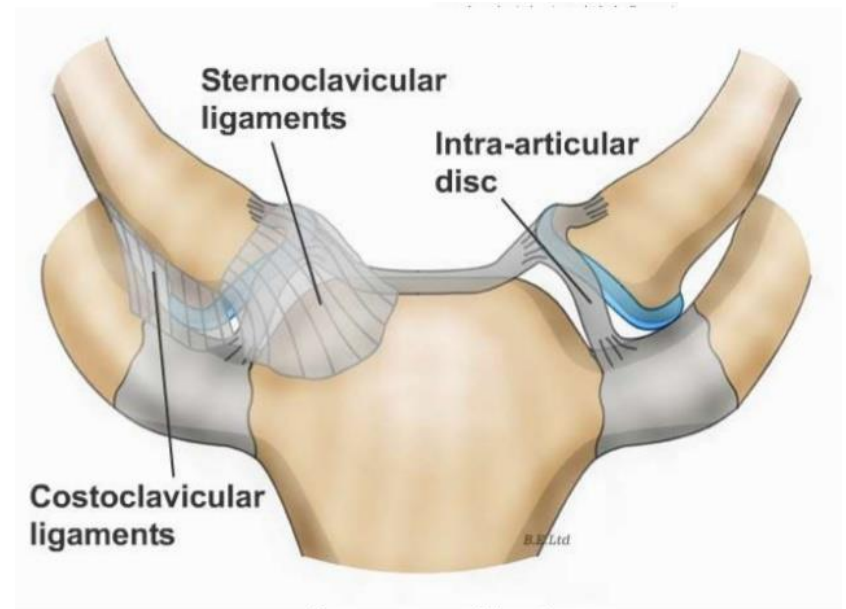


Inferior view

(b) Right clavicle

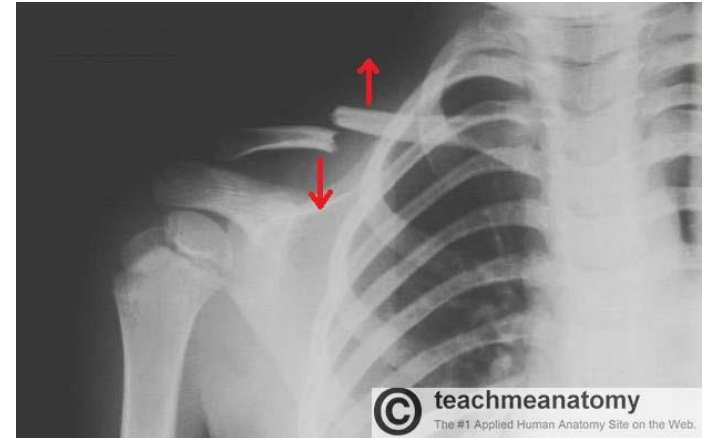
ARTICULATIONS

- ❑ Medially, **sternoclavicular joint**
 - with the Manubrium
- ❑ Inferiorly, **costoclavicular Joint**
 - with the 1st rib
- ❑ Laterally, **Acromioclavicular joint**
 - with the Acromial end of the scapula

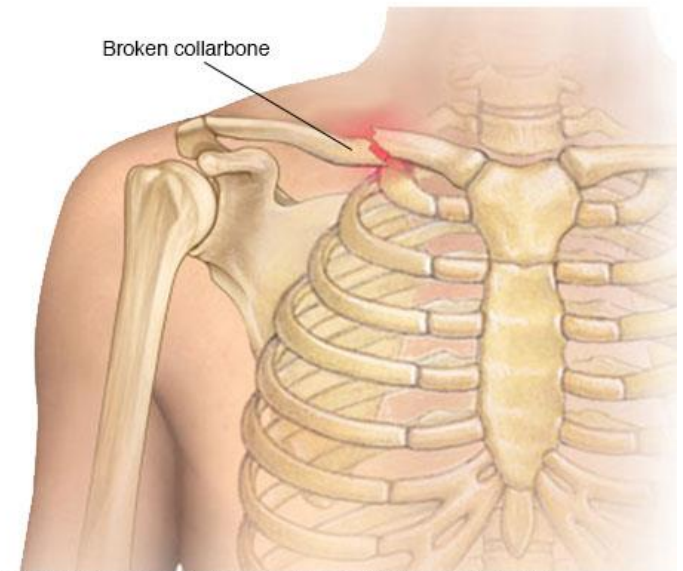


FRACTURES OF THE CLAVICLE

- ❑ A function of the clavicle is to transmit forces from the upper limb to the axial skeleton. Thus, the clavicle is the most commonly fractured bone in the body.
- ❑ Fractures commonly result from a fall onto the shoulder, or onto an outstretched hand.
- ❑ The clavicle is commonly fractured especially in children as forces are impacted to the outstretched hand during falling.
- ❑ The weakest part of the clavicle is the junction of the middle and lateral thirds.
- ❑ After fracture, the medial fragment is elevated (by the sternomastoid muscle), the lateral fragment drops because of the weight of the UL.
- ❑ It may be pulled medially by the adductors of the arm.

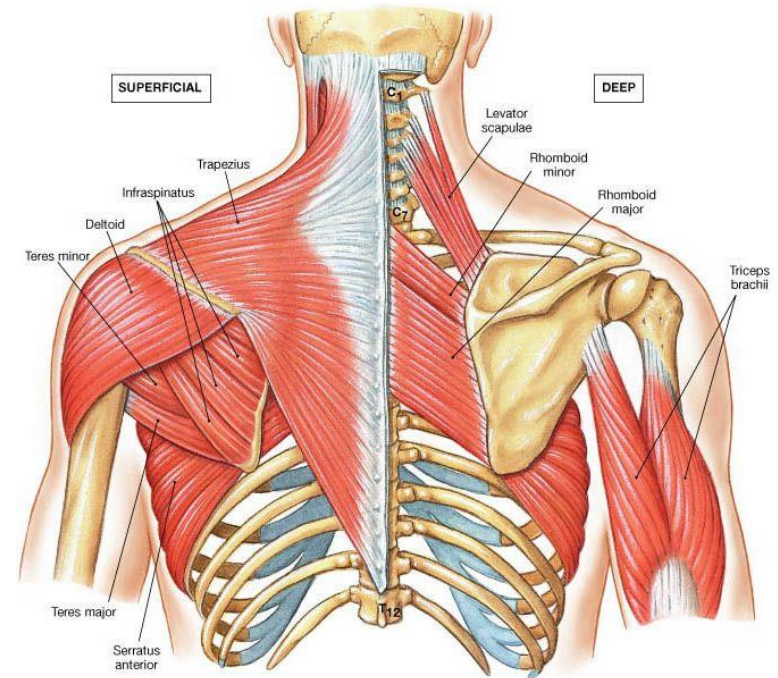


Broken collarbone



SCAPULA

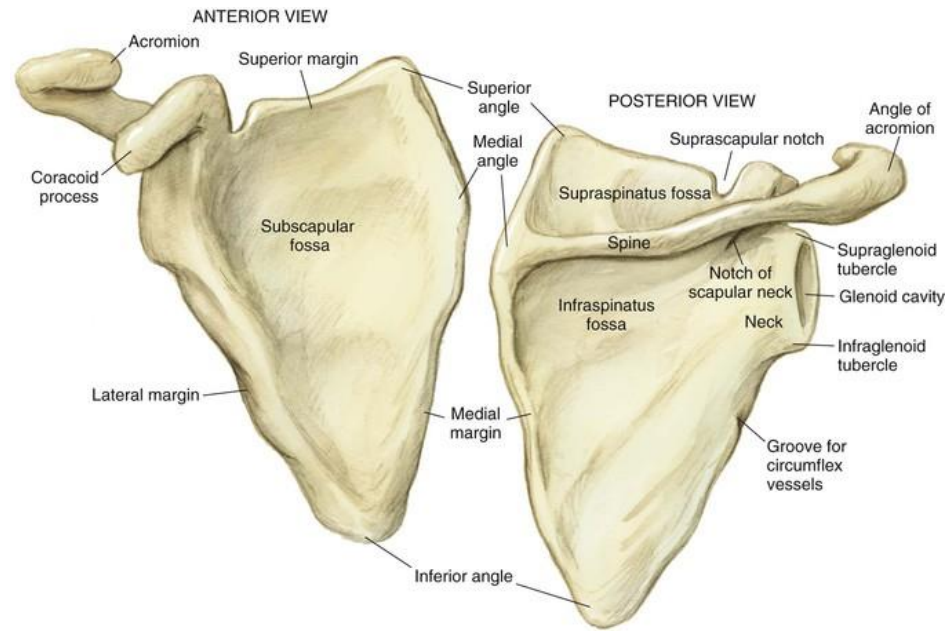
- ❑ It is a triangular flat bone.
- ❑ It extends between the 2nd and 7th ribs.
- ❑ It articulates with:
 - humerus at the **glenohumeral joint**
 - clavicle at the **acromioclavicular joint**.
- ❑ It connects the upper limb to the trunk.



PROCESSES AND BORDERS

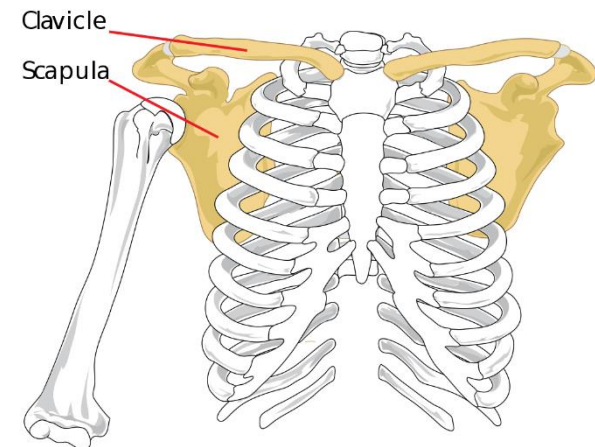
Three Processes:

- **Spine:** a thick projecting ridge of bone that continues laterally as the flat expanded
- **Acromion:** forms the subcutaneous point of the shoulder.
- **Coracoid:** a beaklike process. It resembles in size, shape and direction a bent finger pointing to the shoulder.



Three Borders:

- **Superior**
- **Medial** (Vertebral)
- **Lateral** (axillary)
 - The lateral border terminates at the lateral angle (the thickest) part of the bone.



Front view

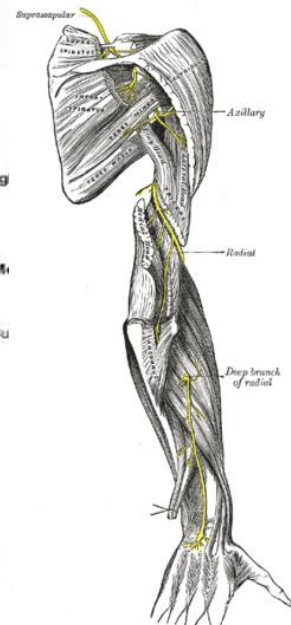
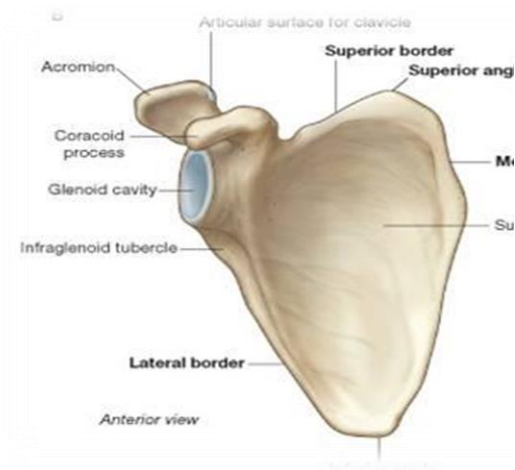
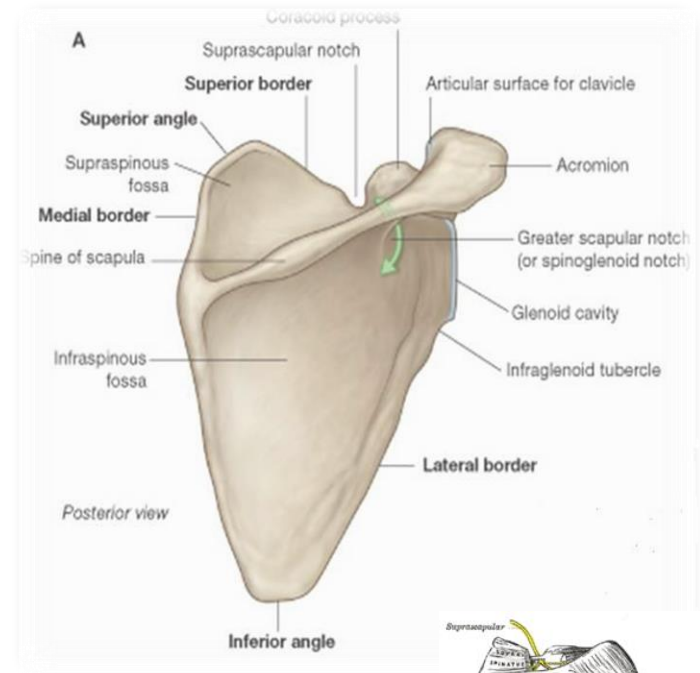
ANGLES AND SURFACES

Three Angles :

- Superior
- Inferior
- Lateral
 - forms the Glenoid cavity: a shallow concave oval fossa that receives the head of the humerus.

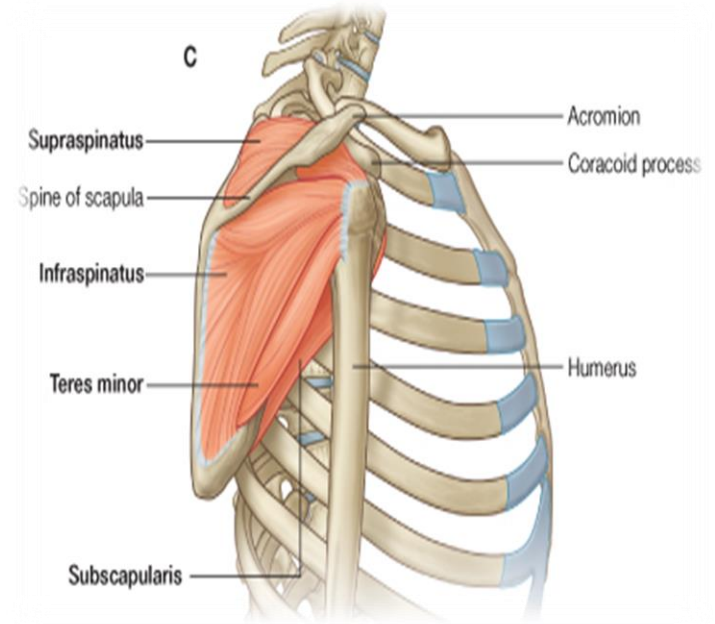
Two Surfaces

- **Convex:** posterior surface is divided by the spine of the scapula into the smaller Supraspinous Fossa - above the spine and the larger Infraspinous Fossa - below the spine.
- **Concave:** Anterior (Costal) Surface , it forms the large Subscapular Fossa.
- **Suprascapular notch:** It is a nerve passageway, medial to coracoid process.
 - Suprascapular nerve



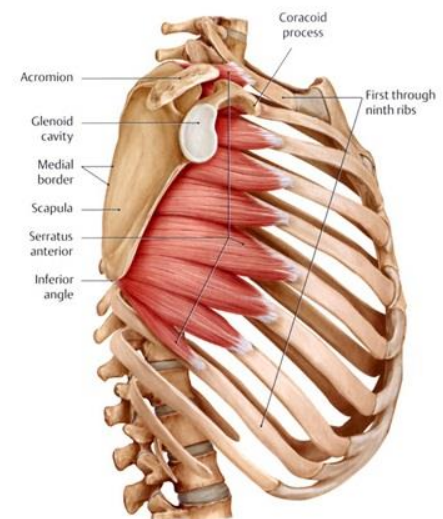
FUNCTIONS

- ❑ Gives attachment to muscles.
- ❑ Has a considerable degree of movement on the thoracic wall to enable the arm to move freely.
- ❑ The glenoid cavity forms the socket of the shoulder joint.
- ❑ Because most of the scapula is well protected by muscles and by its association with the thoracic wall , most of its fractures involve the protruding subcutaneous acromion.



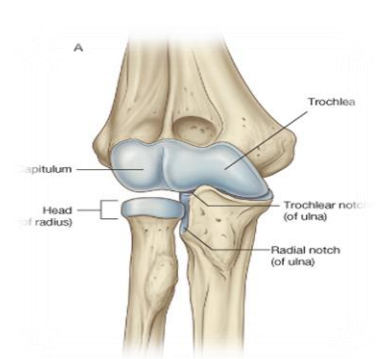
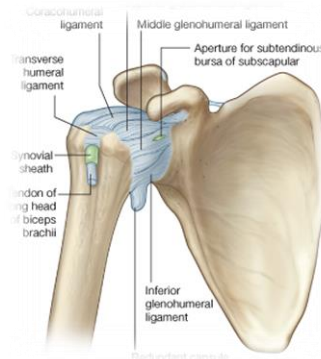
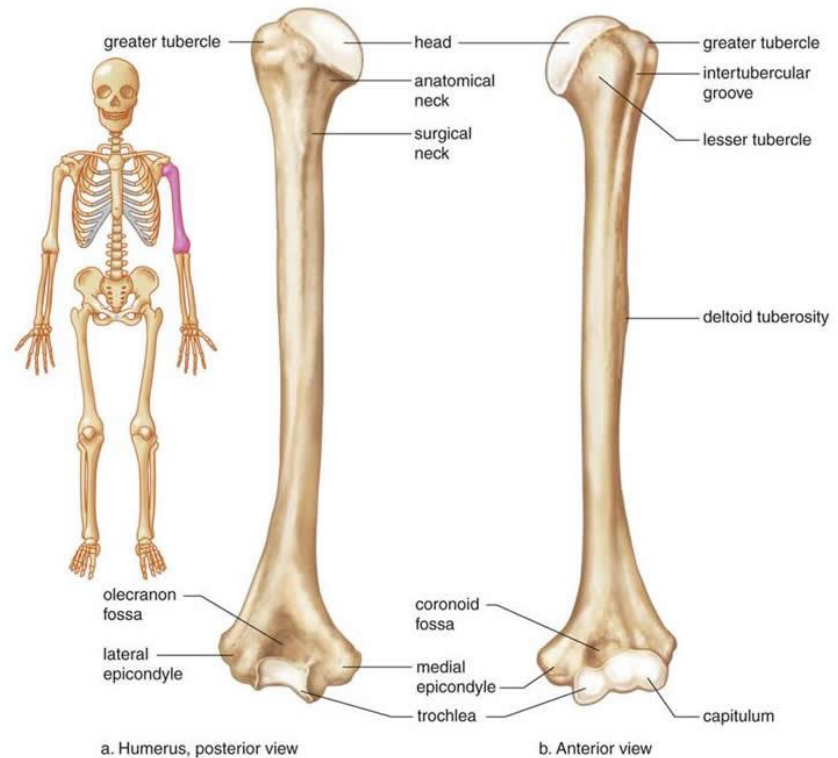
WINGING OF THE SCAPULA

- ❑ The **serratus anterior muscle** originates from ribs 2-8, and attaches the costal face of the scapula, pulling it against the ribcage.
- ❑ The **long thoracic nerve** innervates the serratus anterior.
- ❑ If this nerve becomes damaged, the scapula protrudes out of the back when pushing with the arm.
- ❑ The long thoracic nerve can become damaged by trauma to the shoulder, repetitive movements involving the shoulder or by structures becoming inflamed and pressing on the nerve.



ARMS (HUMEROUS)

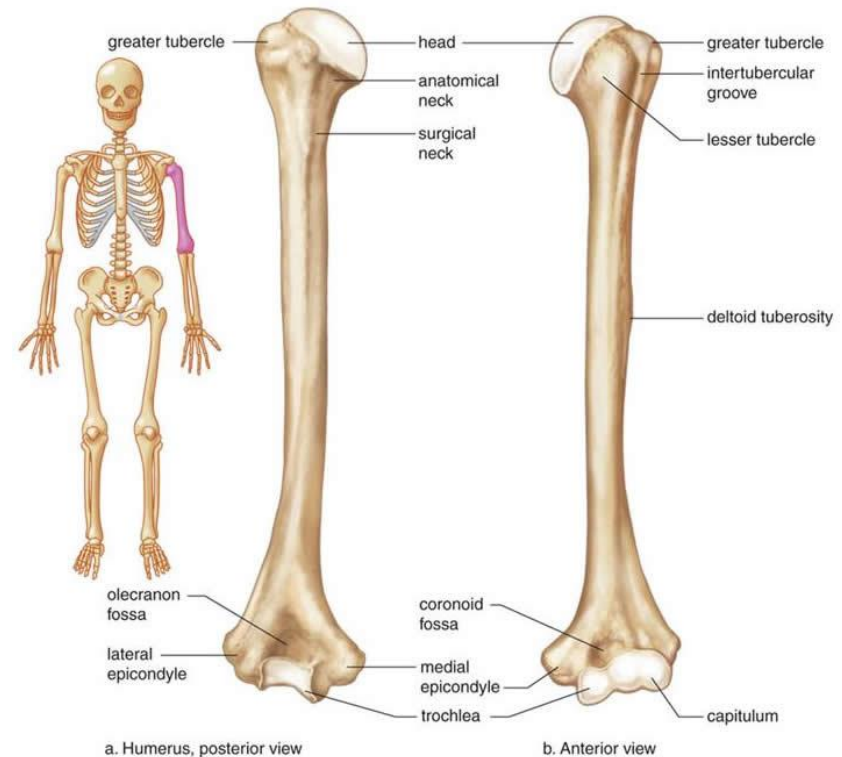
- ❑ The arm (humerus) is a long bone of the upper limb that extends from the shoulder to the elbow.
- ❑ It is the largest bone in the UL
- ❑ The proximal region of the humerus articulates with the glenoid fossa of the scapula, forming the **glenohumeral joint**.
- ❑ At the distal end, the humerus articulates with the head of the radius and trochlear notch of the ulna forming **elbow joint**.



PROXIMAL END

☐ It has the following features:

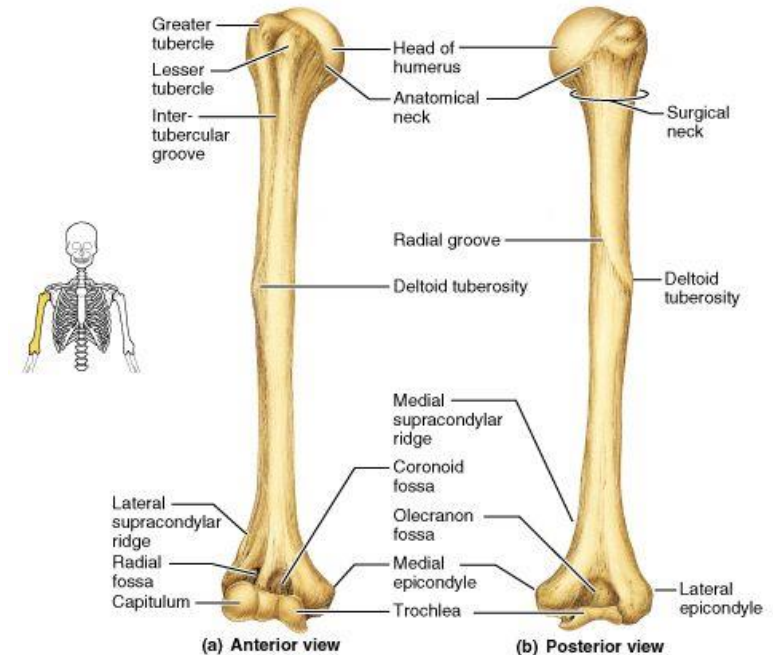
- **Head:** Smooth & forms 1/3 of a sphere, it articulates with the glenoid cavity of the scapula.
- **Anatomical neck:** formed by a groove separating the head from the tubercles.
- **Greater tubercle:** at the lateral margin of the humerus.
- **Lesser tubercle:** projects anteriorly.
- The two tubercles are separated by **intertubercular Groove**.
- **Surgical Neck:** a narrow part distal to the tubercles. It is a common fracture site of the humerus.



SHAFT (BODY)

☐ It has two prominent features:

- **Deltoid tuberosity:**
 - A rough elevation laterally for the attachment of deltoid muscle.
- **Spiral (Radial) groove:**
 - Runs obliquely down the posterior aspect of the shaft.
 - It lodges the important radial nerve & vessels.



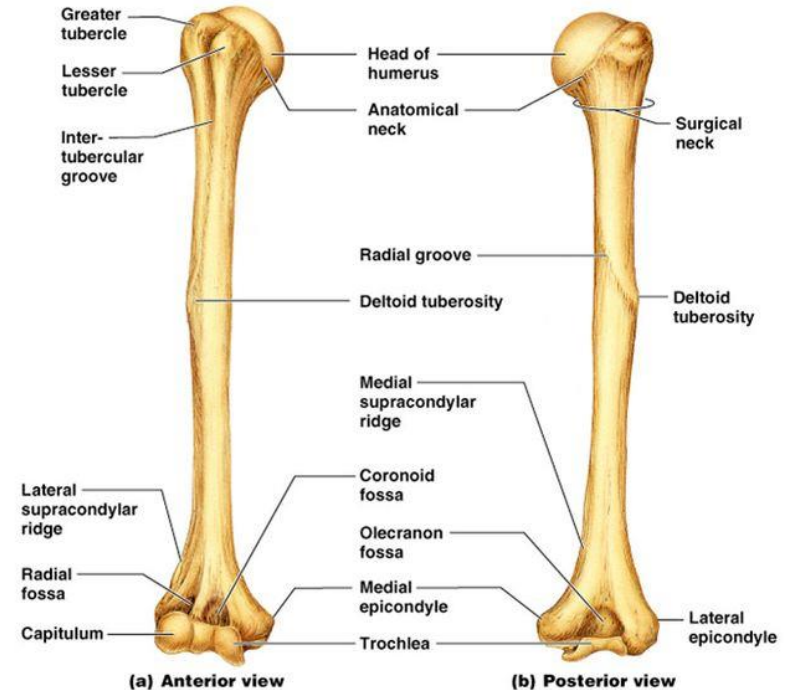
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DISTAL END

□ Widens as the sharp medial and lateral supracondylar ridges form and end in the medial and lateral Epicondyles providing muscular attachment.

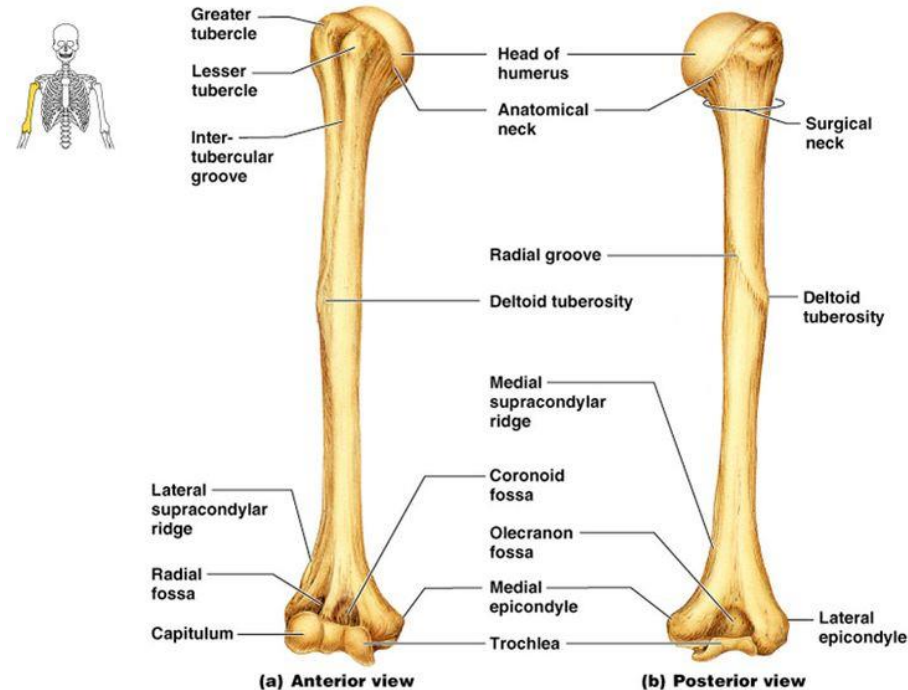


- **Trochlea:** (medial) for articulation with the ulna
- **Capitulum:** (lateral) for articulation with the radius.
- **Coronoid fossa:** above the trochlea (anteriorly)
- **Radial fossa:** above the capitulum
- **Olecranon fossa:** above the trochlea (posteriorly).



FRACTURES OF HUMERUS

- ❑ Most common fractures of the **surgical neck** especially in elder people with osteoporosis.
- ❑ The fracture results from falling on the hand (transmission of force through the bones of forearm of the extended limb).
- ❑ In younger people, fractures of the greater tubercle results from falling on the hand when the arm is abducted .
- ❑ The body of the humerus can be fractured by a direct blow to the arm or by indirect injury as falling on the outstretched hand.



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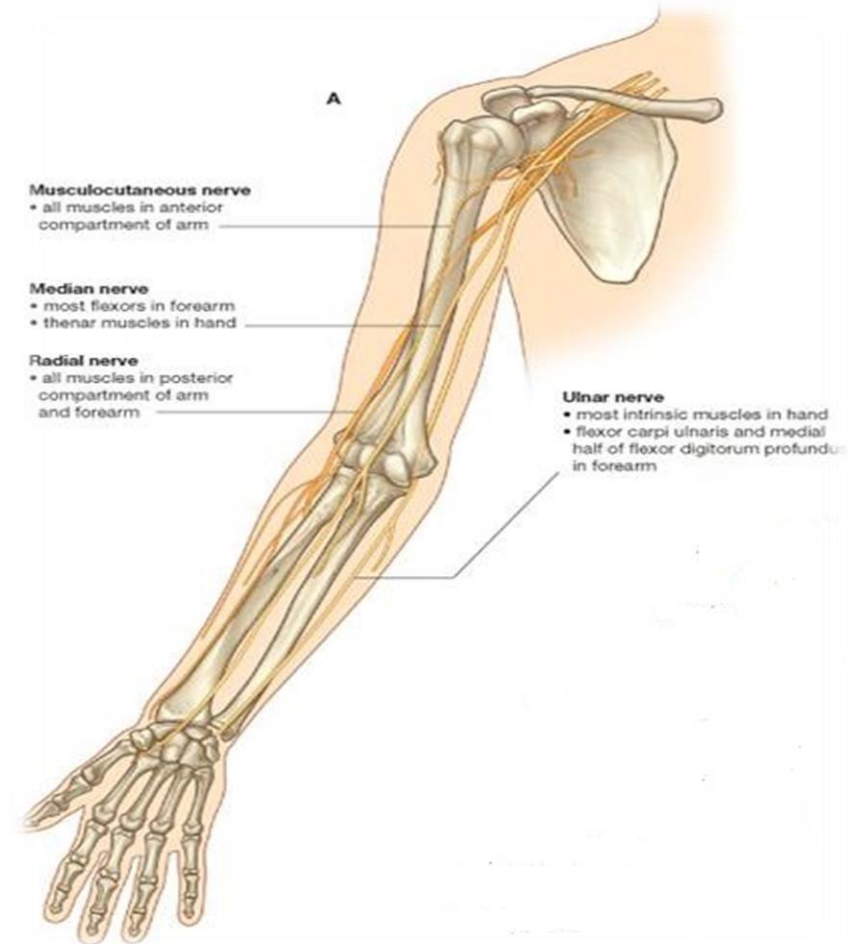
DISTAL HUMERAL FRACTURE

- ❑ **Medial epicondyle fractures** are common fracture types of the distal humerus.
- ❑ The **supraepicondylar fracture** occurs by falling on a flexed elbow. It is a transverse fracture, spanning between the two epicondyles
- ❑ Direct damage, or swelling can cause interference to the blood supply of the forearm from the brachial artery.
- ❑ The resulting ischaemia can cause **Volkman's ischaemic contracture** – uncontrolled flexion of the hand, as flexor muscles become fibrotic and short. There also can be damage to the median, ulnar or radial nerves.



FYI: NERVES AFFECTED IN FRACTURES OF HUMERUS

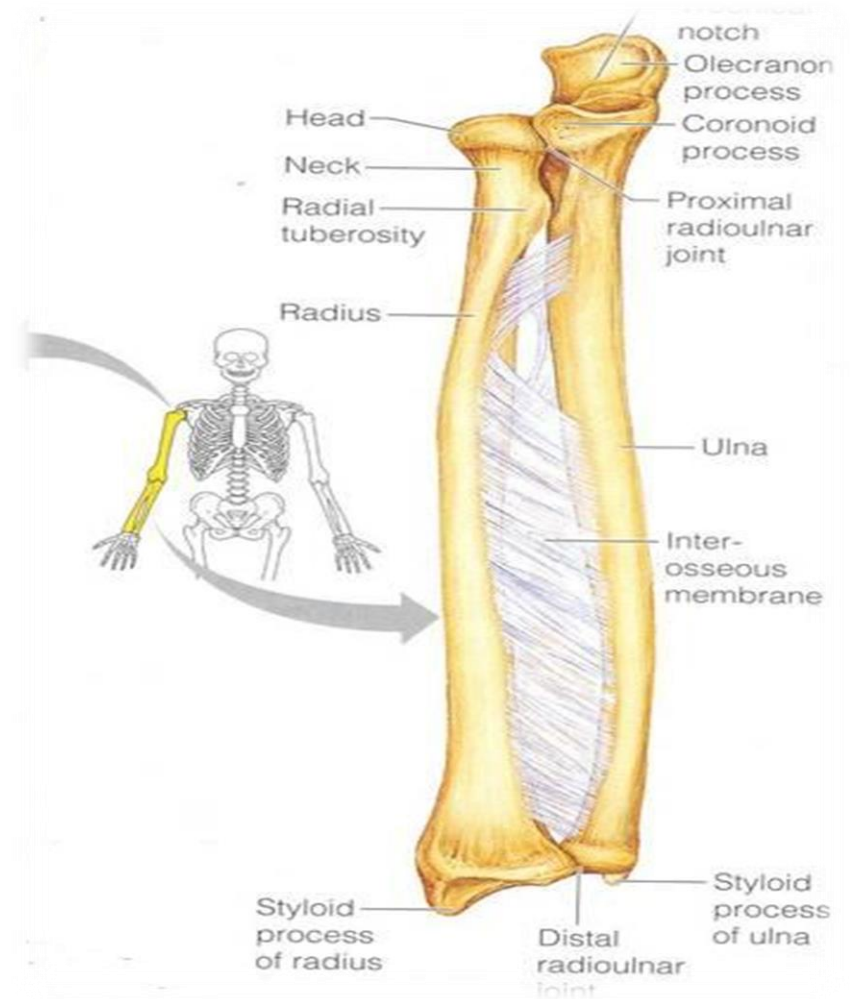
- ❑ Surgical neck: **Axillary nerve**
- ❑ Radial groove: **Radial nerve**
- ❑ Distal end of humerus: **Median nerve**
- ❑ Medial epicondyle: **Ulnar nerve**



FOREARM

❑ Formed of two bones:

- The **Radius** is the lateral bone.
- The **Ulna** is the medial bone.

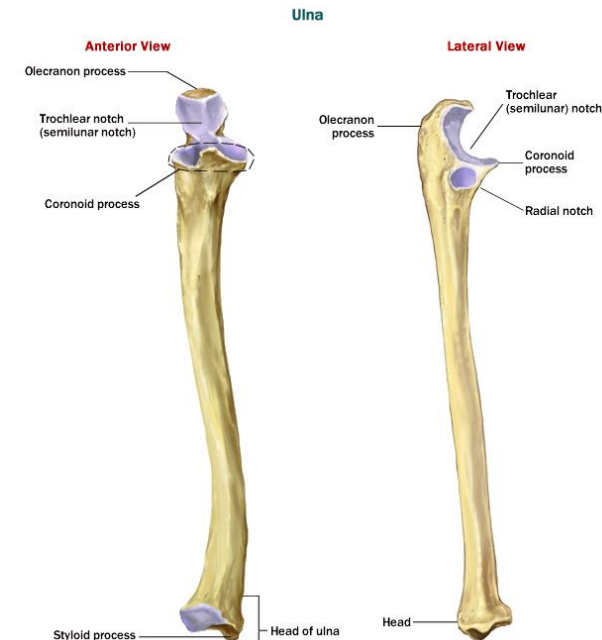
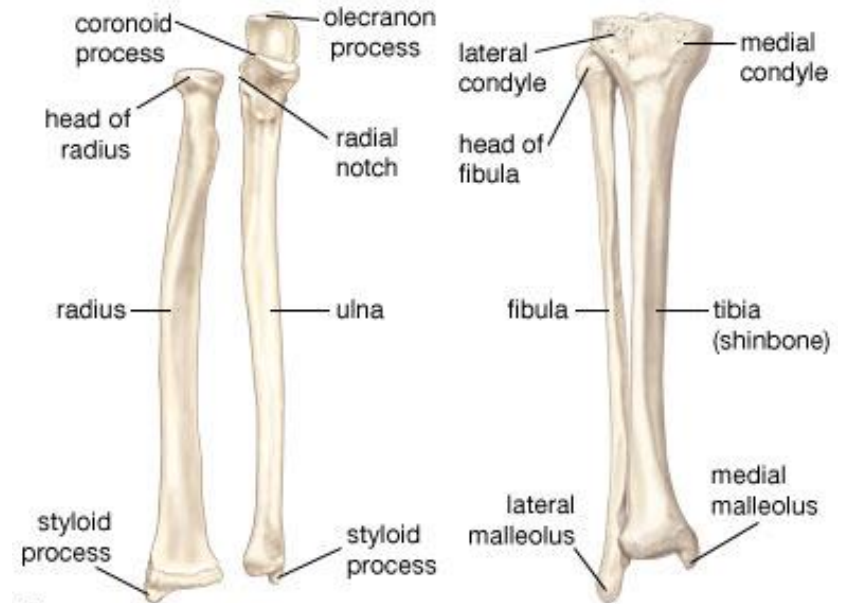


ULNA

- ❑ It is the stabilizing bone of the forearm.
- ❑ It is the medial & longer of the two bones of the forearm.

Proximal End

- It has two prominent projections:
 - **Olecranon process:** projects proximally from the posterior aspect (Forms the prominence of the elbow).
 - **Coronoid process:** projects anteriorly.
- **Trochlear notch:** articulates with trochlea of humerus.
- **Radial notch:** a smooth rounded concavity lateral to coronoid process.
- **Tuberosity of ulna:** inferior to coronoid process.



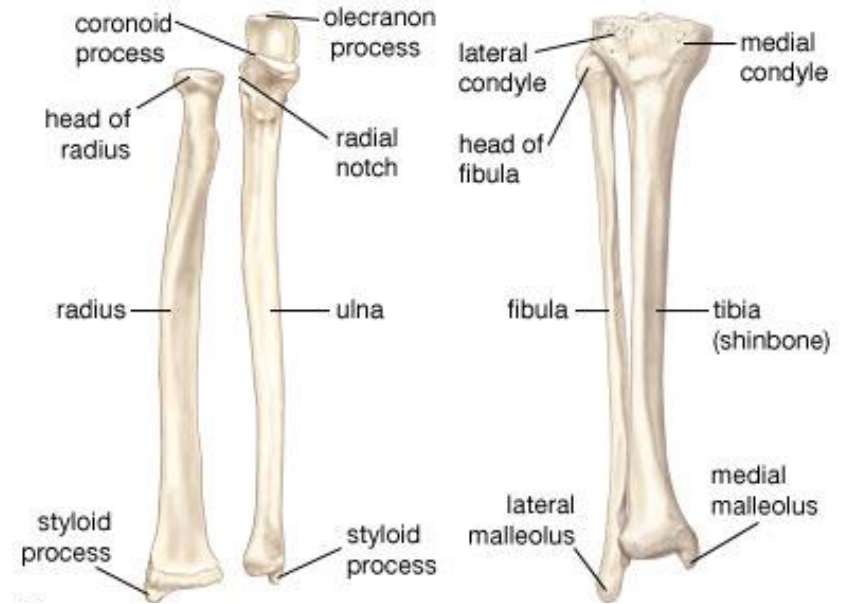
ULNA

Shaft

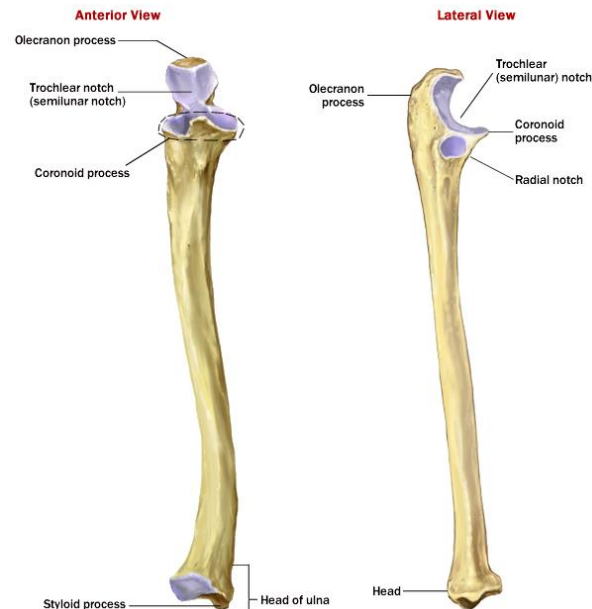
- Thick & cylindrical superiorly but diminishes in diameter inferiorly.
- **Three surfaces** (Anterior, Medial & Posterior).
- Sharp lateral interosseous border.

Distal end

- Small rounded Head: **Styloid process**
- The head lies distally at the wrist.
- The articulations between the ulna & humerus at the elbow joint allows primarily only flexion & extension (small amount of abduction & adduction occurs).



Ulna



RADIUS

☐ It is the shorter and lateral of the two forearm bones.

Proximal (Upper) End

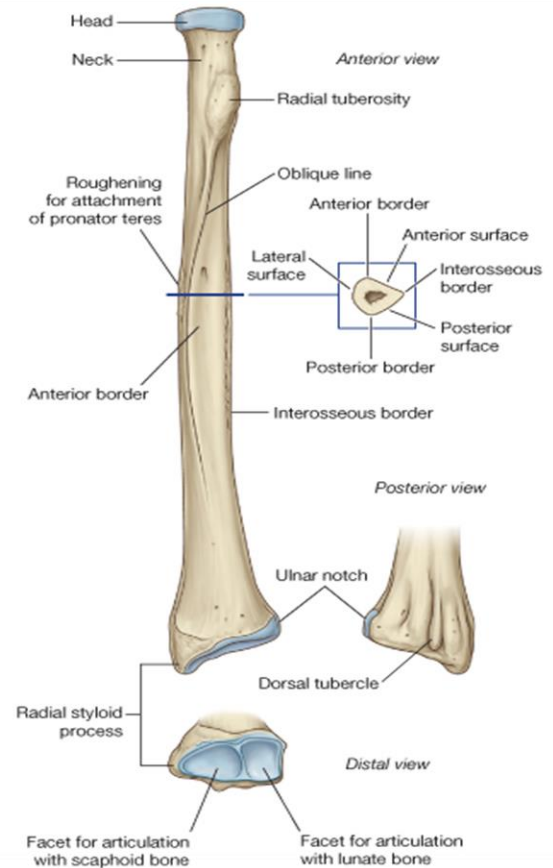
- Consists of:
 - Head:** small, circular and its upper surface is concave for articulation with the capitulum.
 - Neck**
 - Radial (Bicipital) Tuberosity:** medially directed and separates the proximal end from the body.

Shaft

- Has a lateral convexity.
- It gradually enlarges as it passes distally.

Distal (Lower) End

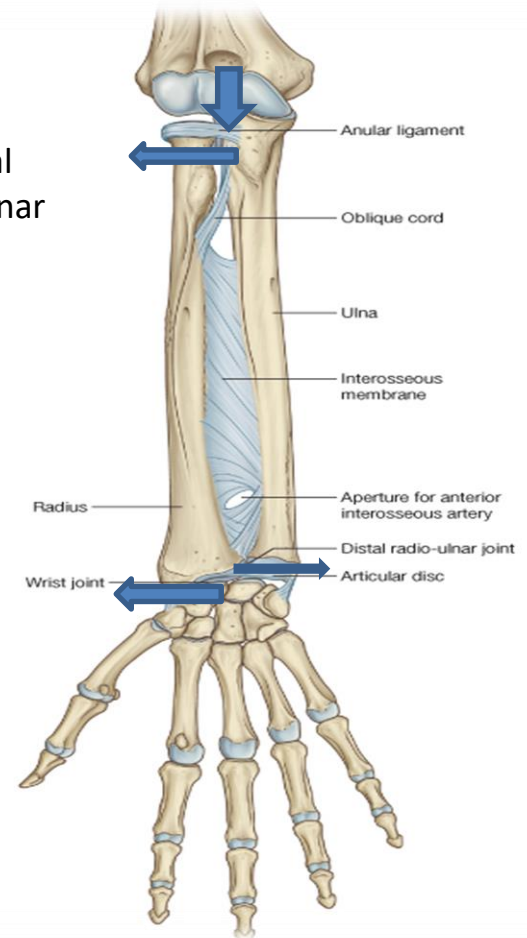
- It is rectangular.
- Its medial aspect forms a concavity : Ulnar notch to accommodate the head of the ulna.
- Radial Styloid process:** extends from the lateral aspect.
- Dorsal tubercle:** projects dorsally.



ARTICULATIONS

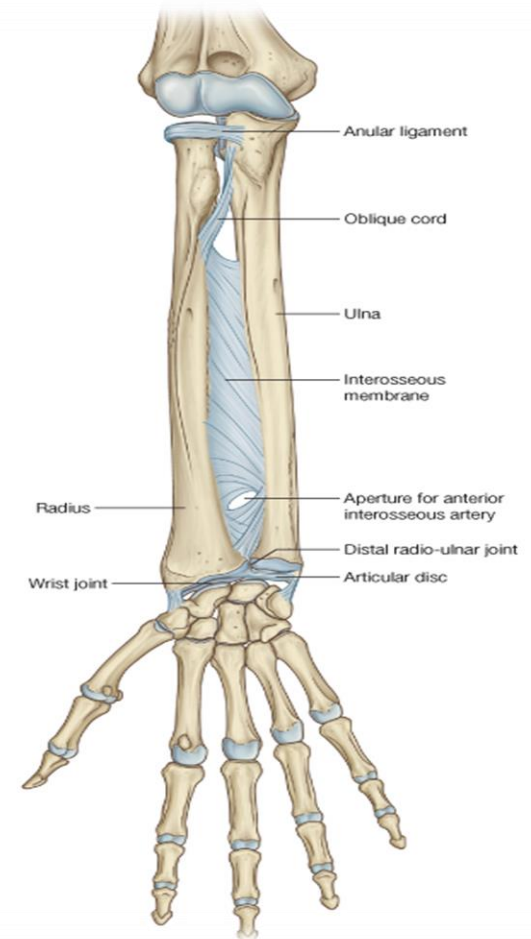
- ❑ Distal end of Humerus with the proximal ends of Radius & Ulna **Elbow joint**
- ❑ Proximal **Radioulnar joint**
- ❑ Distal **Radioulnar joint**
- ❑ The two bones are connected by the **flexible interosseous membrane**

Proximal
Radioulnar
joint.



FRACTURES OF RADIUS & ULNA

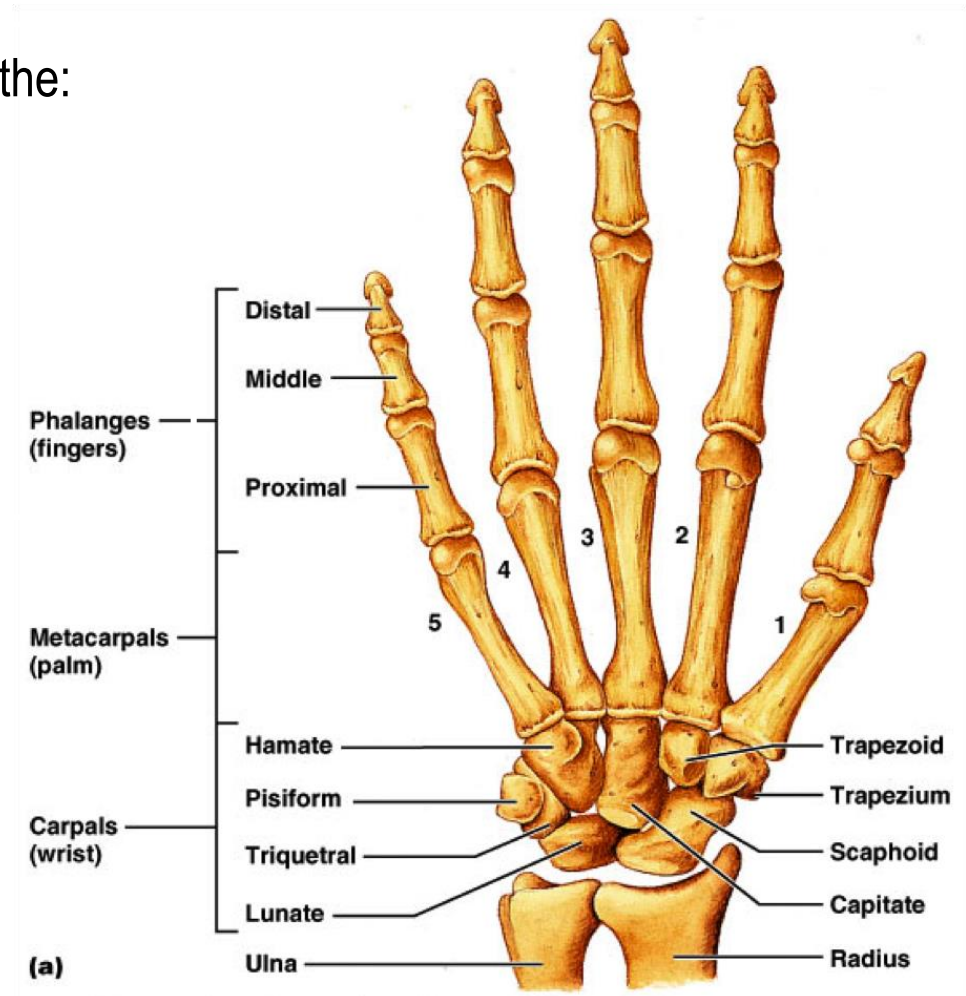
- ❑ Because the radius & ulna are firmly bound by the interosseous membrane, a fracture of one bone is commonly associated with dislocation of the nearest joint.
- ❑ **Colle' s fracture** (fracture of the distal end of radius) is the most common fracture of the forearm.
- ❑ It is more common in women after middle age because of osteoporosis.
- ❑ It results from forced dorsiflexion of the hand as a result to ease a fall by outstretching the upper limb.



HANDS

□ The skeleton of the hand consists of the:

- Carpals for the carpus (**wrist joint**)
- Metacarpals for the palm
- Phalanges for the fingers



WRIST (CARPUS)

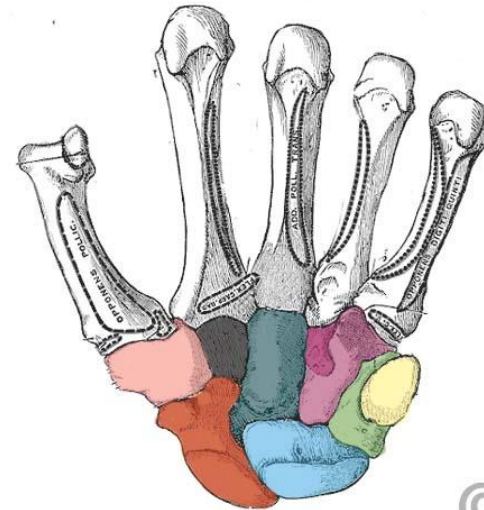
- ❑ Compose of eight carpal bones arranged in two irregular rows, each of four.
- ❑ These small bones give flexibility to the wrist.
- ❑ The Carpus presents Concavity on their Anterior surface & convex from side to side posteriorly.

Proximal row (from lateral to medial):

- Scaphoid
- Lunate
- Triquetrum
- Pisiform

Distal row (from lateral to medial):

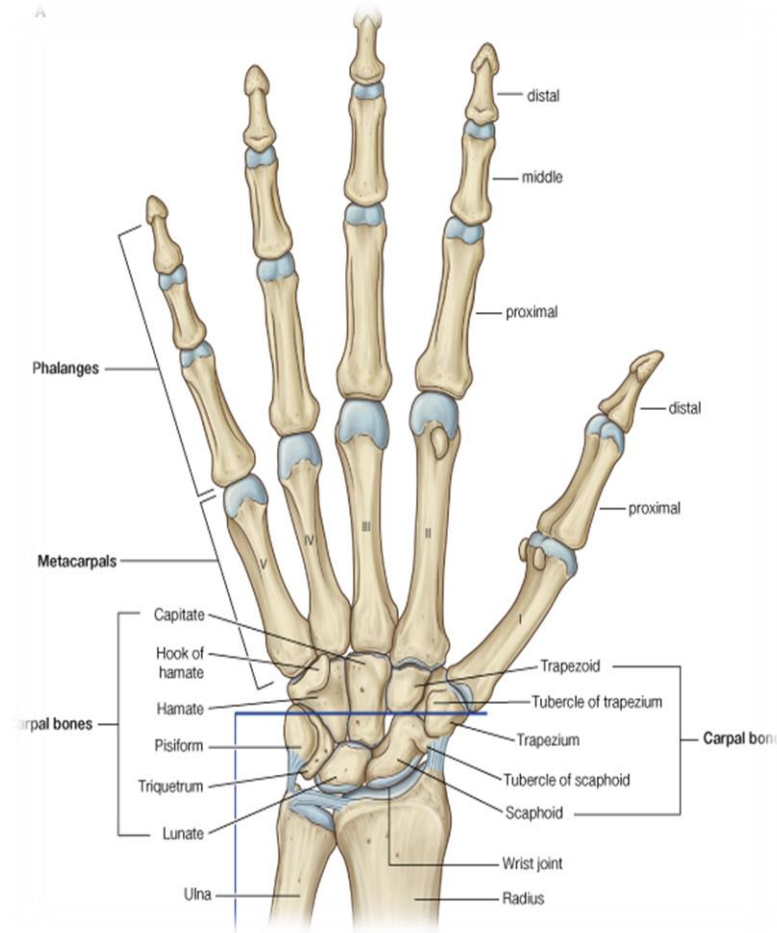
- Trapezium
- Trapezoid
- Capitate
- Hamate



- Scaphoid
- Lunate
- Triquetrum
- Pisiform
- Trapezium
- Trapezoid
- Capitate
- Hamate

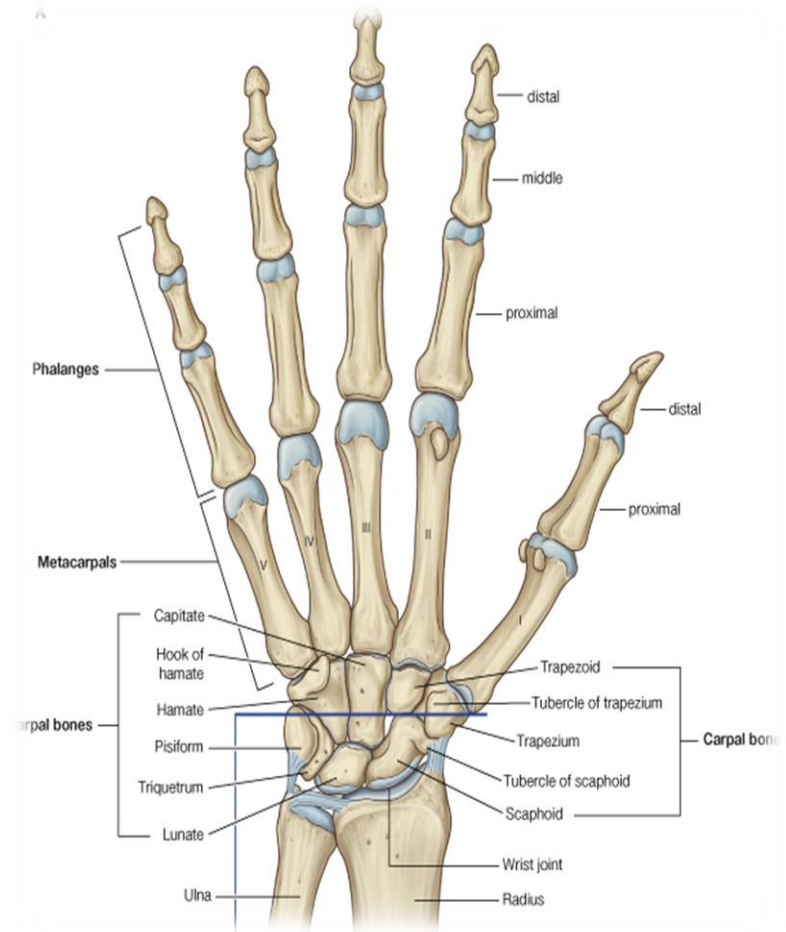
FYI: FRACTURE OF SCAPHOID

- ❑ It is the most commonly fractured carpal bone and it is the most common injury of the wrist.
- ❑ It is the result of a fall onto the palm when the hand is abducted.
- ❑ Pain occurs along the lateral side of the wrist especially during dorsiflexion and abduction of the hand.
- ❑ Union of the bone may take several months because of poor blood supply to the proximal part of the scaphoid.



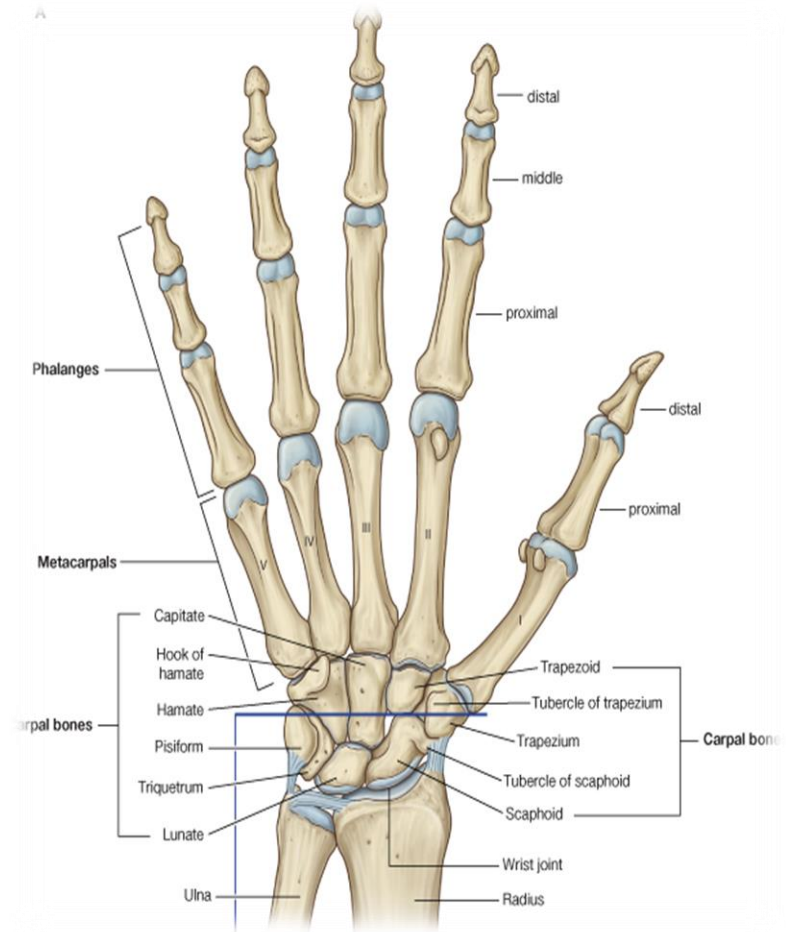
METACARPALS

- ❑ It is the skeleton of the hand between the carpus and phalanges.
- ❑ It is composed of **Five** Metacarpal bones, each has a **Base**, **Shaft**, and a **Head**.
- ❑ They are numbered 1-5 from the thumb.
- ❑ The distal ends (Heads) articulate with the proximal phalanges to form the knuckles of the fist.
- ❑ The Bases of the metacarpals articulate with the carpal bones. The 1st metacarpal is the shortest and most mobile. 3rd metacarpal has a styloid process on the lateral side of the base.



DIGITS (PHALANGES)

- ❑ Each digit has **Three** Phalanges
- ❑ Except the **Thumb** which has only two
- ❑ Each phalanx has a base proximally, a head distally and a body between the base and the head.
- ❑ The proximal phalanx is the largest.
- ❑ The middle ones are intermediate in size.
- ❑ The distal ones are the smallest, its distal ends are flattened and expanded distally to form the nail beds.



ARTICULATIONS

❑ Bases of the Metacarpal bones articulate with the distal row of the carpal bones

- **Carpometacarpal joints**

❑ Heads (knuckles) articulate with the Proximal Phalanges

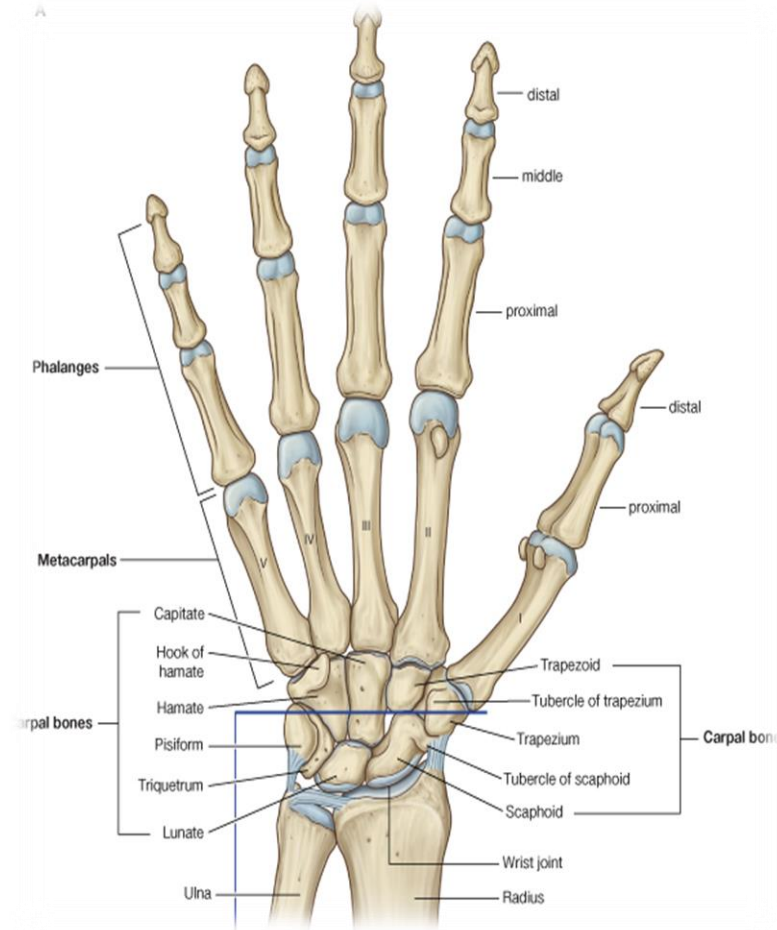
- **Metacarpophalangeal joints**

❑ The phalanges articulate with each other

- **Interphalangeal joints**

❑ Distal end of Radius with the Proximal Row of Carpal bones

- **Wrist joint**

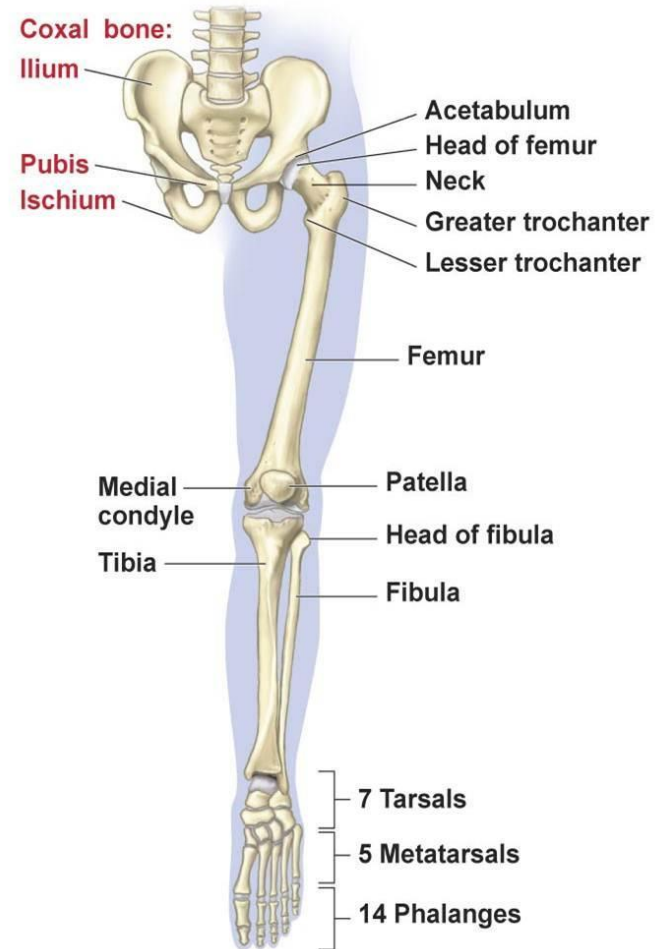


LOWER LIMBS

BONES OF LOWER LIMB

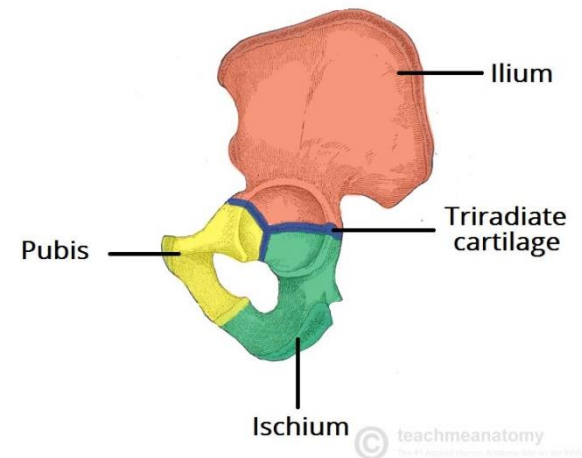
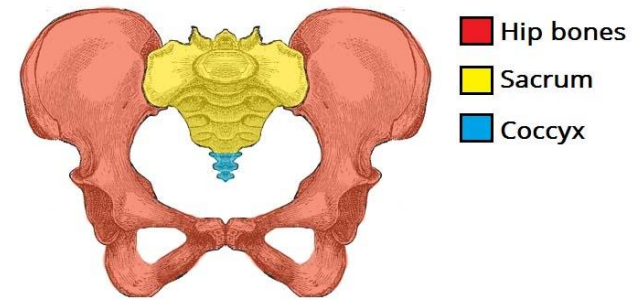
It consists of the following:

- **Pelvic Girdle**
 - Hip Bone
 - Sacrum
 - Coccyx
- **Thigh**
 - Femur
 - Patella
- **Leg**
 - Tibia & Fibula
- **Ankle**
 - Tarsal bones
- **Foot**
 - Metatarsals & Phalanges



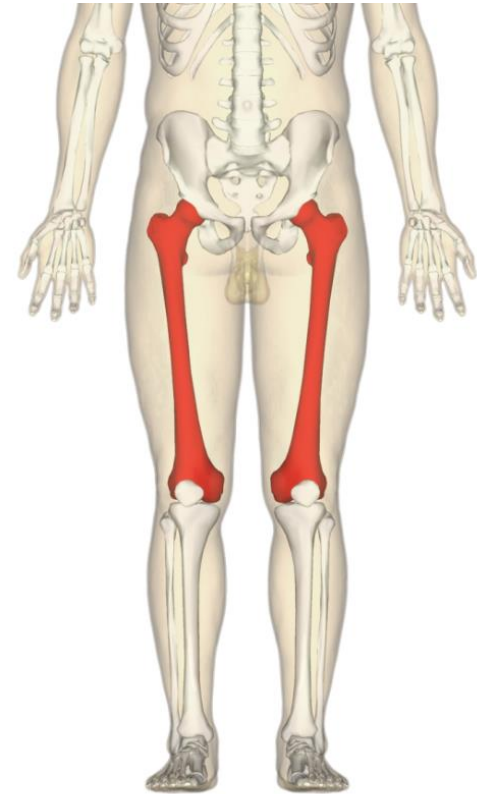
PELVIC GIRDL

- ❑ The pelvic girdle is a ring-like bony structure, located in the lower part of the trunk.
- ❑ It connects the axial skeleton to the lower limbs.
- ❑ The bony pelvis consists of the following:
 - ❑ Two hip (pelvic) bones
 - ❑ Sacrum
 - ❑ Coccyx
- ❑ The hip bone is comprised of the three parts; the **ilium**, **pubis** and **ischium**.
- ❑ The left and right hip bones are two irregularly shaped bones that form part of the pelvic girdle.
- ❑ The hip bones have three main articulations:
 - **Sacroiliac joint** – articulation with the sacrum.
 - **Pubic symphysis** – articulation between the left and right hip bones.
 - **Hip joint** – articulation with the head of femur.



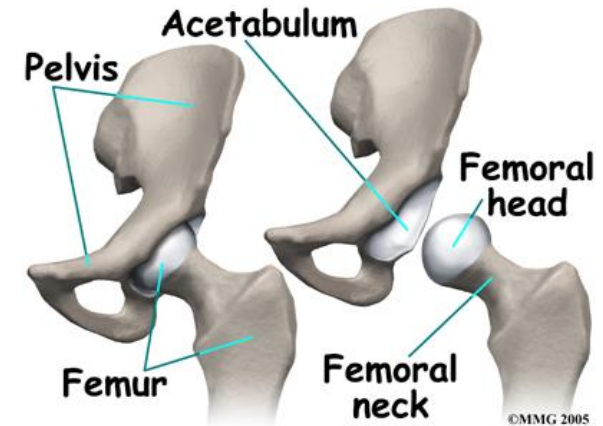
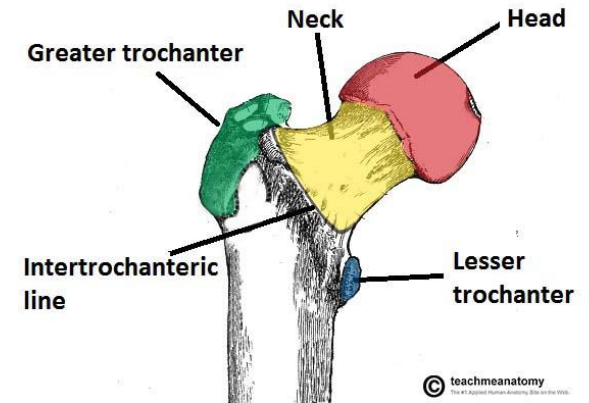
FEMUR

- ❑ It is considered a long bone and is the longest bone in the body.
- ❑ The main function of the femur is **to transmit forces from the tibia to the hip joint.**
- ❑ It acts as the site of origin and attachment of many muscles and ligaments,
- ❑ It can be divided into three areas; **proximal**, **shaft** and **distal**.



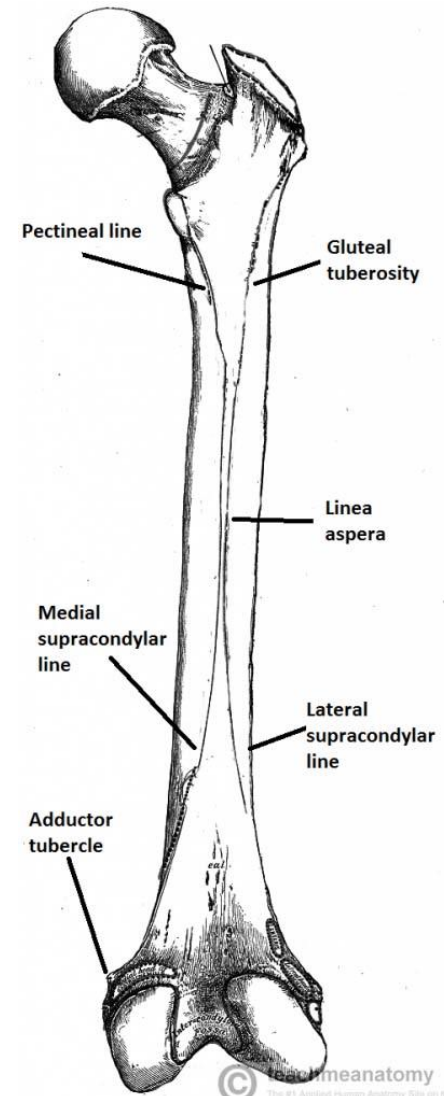
PROXIMAL END

- ❑ The proximal area of the femur forms the hip joint with the pelvis.
- ❑ **Head:** Articulates with the **acetabulum** of the pelvis to form the hip joint. It has a smooth surface with a depression on the medial aspect; for the attachment of the ligament of head of femur.
- ❑ **Neck:** Connects the head of the femur with the shaft. It is cylindrical, projecting in a superior and medial direction – this angle of projection allows for an increased range of movement at the hip joint.
- ❑ **Greater trochanter:** A projection of bone that originates from the anterior aspect and angled superiorly and posteriorly.
- ❑ **Lesser trochanter:** Smaller than the greater trochanter and projects from the posteromedial side of the femur, just inferior to the neck-shaft junction.
- ❑ **Intertrochanteric line:** A ridge of bone that runs in an inferomedial direction on the anterior surface of the femur, connecting the two trochanters together. After it passes the lesser trochanter on the posterior surface, it is known as the pectineal line.
- ❑ **Intertrochanteric crest:** A ridge of bone that connects the two trochanters together and located on the posterior surface of the femur.



SHAFT (BODY)

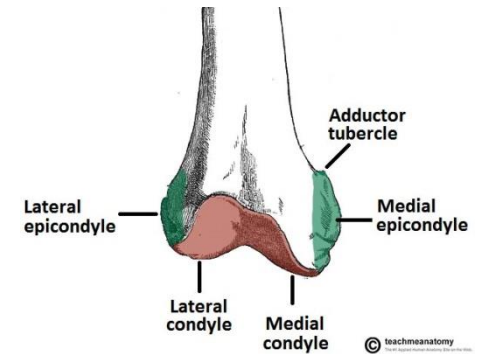
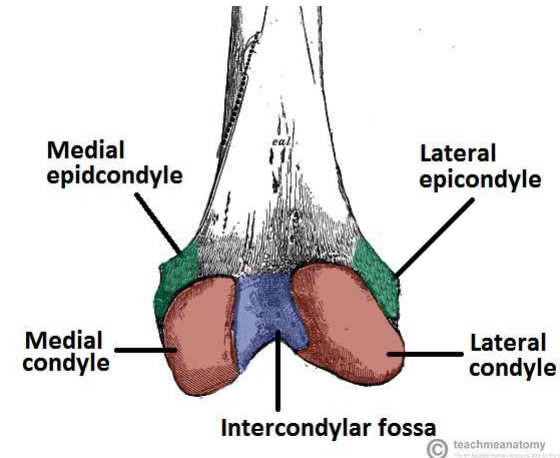
- ❑ The shaft descends in a slight medial direction.
- ❑ On the posterior surface of the femoral shaft, there are roughened ridges of bone, these are called the **linea aspera** (Latin for rough line)
- ❑ Proximally, the medial border of the linea aspera becomes the **pectineal line**. The lateral border becomes the **gluteal tuberosity**, where the **gluteus maximus** attaches.
- ❑ Distally, the linea aspera widens and forms the floor of the **popliteal fossa**, the medial and lateral borders form the medial and lateral **supracondylar lines**. The medial supracondylar line stops at the **adductor tubercle**, where the adductor magnus attaches.



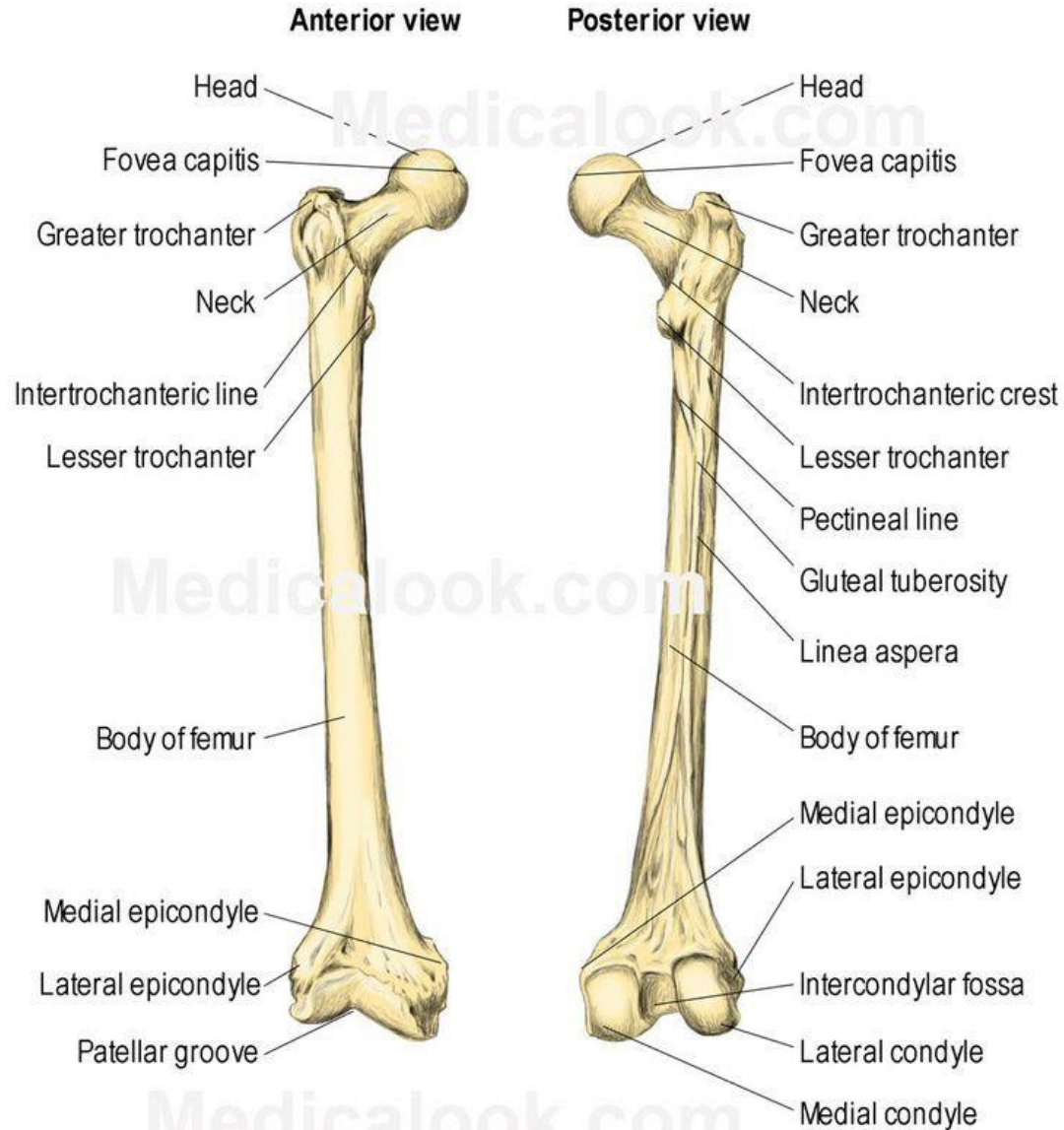
DISTAL END

□ It is characterised by the presence of the medial and lateral condyles, which articulate with the tibia and patella, forming the **knee joint**.

- **Medial and lateral condyles** – Rounded areas at the end of the femur. The posterior and inferior surfaces articulate with the tibia and menisci of the knee, while the anterior surface articulates with the patella.
- **Medial and lateral epicondyles** – They are the area of attachment of some muscles and the collateral ligaments of the knee joint.
- **Intercondylar fossa** – A depression found on the posterior surface of the femur, it lies in between the two condyles. It contains two facets for attachment of **internal knee ligaments**.
- **Facet for attachment of the posterior cruciate ligament** – Found on the medial wall of the intercondylar fossa, it is a large rounded flat face, where the **posterior cruciate ligament** of the knee attaches.
- **Facet for attachment of anterior cruciate ligament** – Found on the lateral wall of the intercondylar fossa, it is smaller than the facet on the medial wall, and is where the **anterior cruciate ligament** of the knee attaches.



THE FEMUR



FRACTURES OF FEMUR

- ❑ It is a bone fracture that involves the femur.
- ❑ They are typically sustained in high-impact trauma, such as car crashes, due to the large amount of force needed to break the bone.
- ❑ Fractures of the diaphysis, or middle of the femur, are managed differently from those at the head, neck, and trochanter.
- ❑ The fracture may be classed as open, which occurs when the bone fragments protrude through the skin, or there is an overlying wound which penetrates to the bone.
- ❑ These types of fracture cause more damage to the surrounding tissue, are less likely to heal properly, and are at much greater risk of infection.



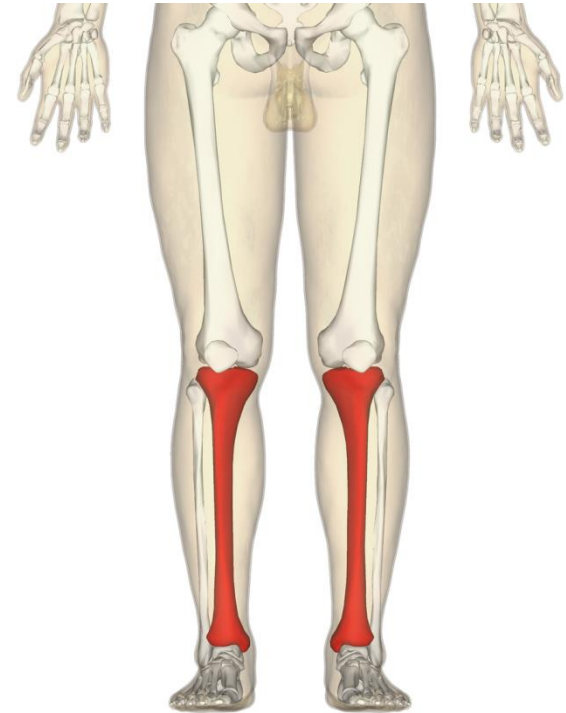
LEGS

- ❑ Formed of two bones:
 - The **Tibia** is the medial bone.
 - The **Fibula** is the lateral bone.



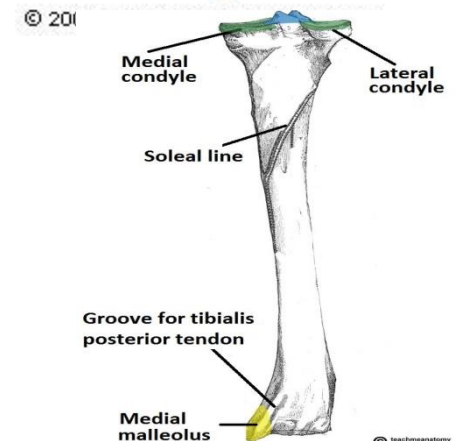
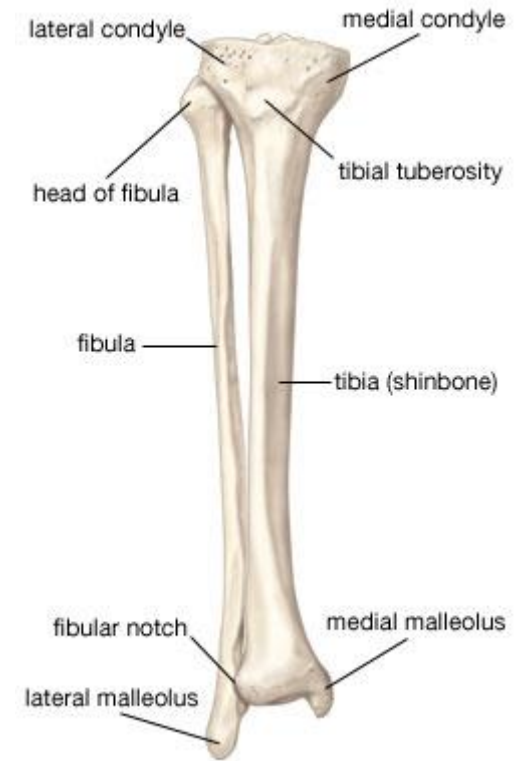
TIBIA

- ❑ The tibia is the main bone of the leg, forming what is more commonly known as the **shin**.
- ❑ It expands at the proximal and distal ends, articulating at the **knee and ankle joints** respectively.
- ❑ It is the second largest bone in the body, this is due to its function as a weight bearing structure.



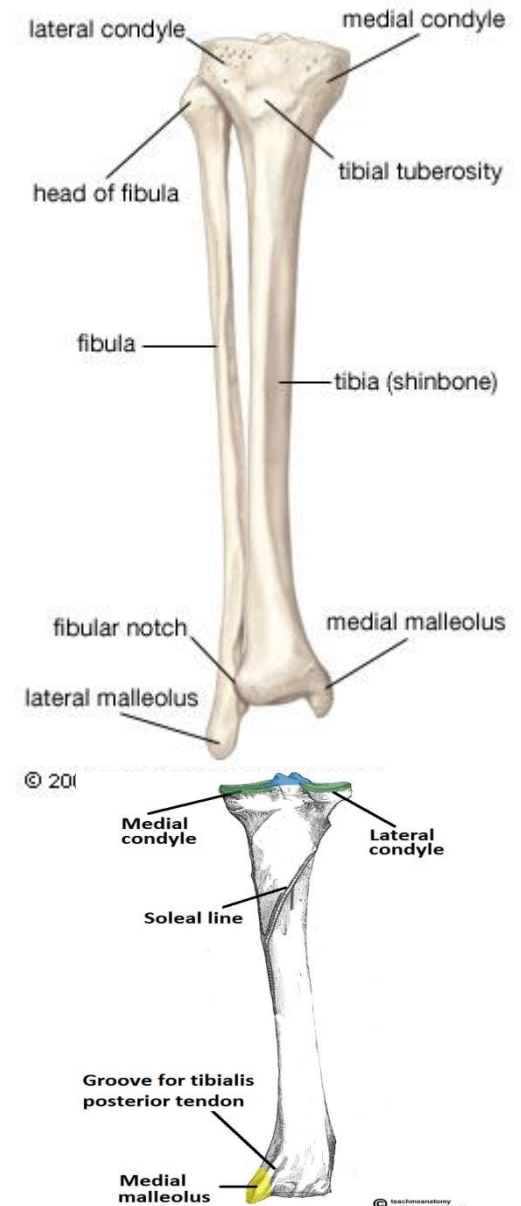
PROXIMAL END

- ❑ At the proximal end, the tibia is widened by the medial and lateral condyles, aiding in weight bearing.
- ❑ The condyles form a flat surface, known as the **tibial plateau**. This structure articulates with the femoral condyles to form the major articulation of the knee joint.
- ❑ Located between the condyles is a region called the **intercondylar eminence** – this consists of two tubercles and a roughened area. This area is the main site of attachment for the ligaments and the menisci of the knee joint.
- ❑ On the anterior surface of the proximal tibia, inferior to the condyles, the tibial tuberosity is situated. This is where the **patella ligament attaches**



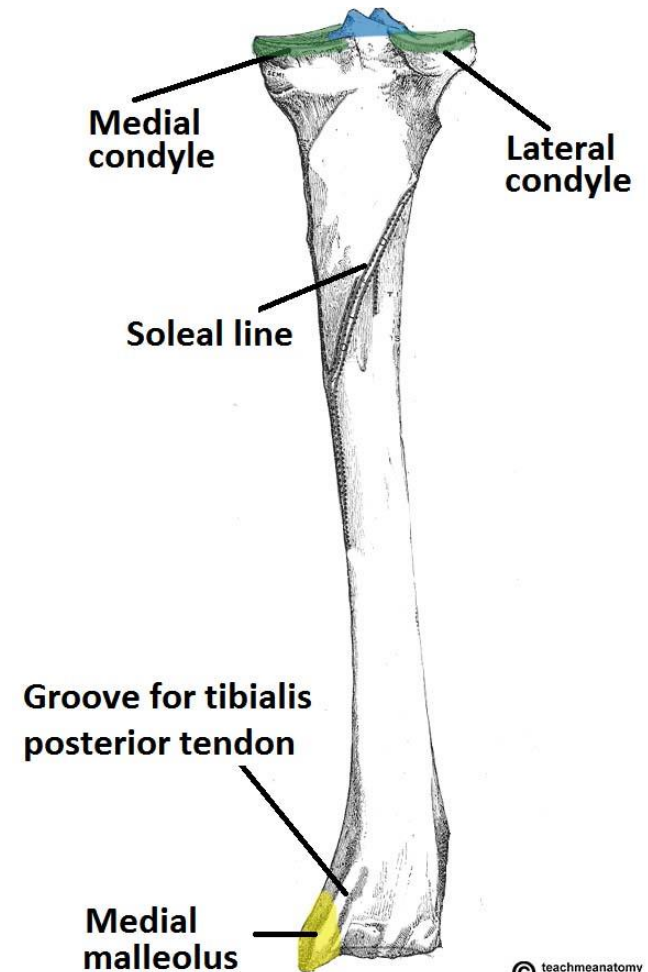
SHAFT (BODY)

- ❑ The shaft has three borders and three surfaces; anterior, posterior and lateral.
- ❑ **Anterior border** – The start of the anterior border is marked by the tibial tuberosity. It is palpable down the anterior surface of the leg as the shin.
- ❑ **Posterior surface** – This is marked by a ridge of bone called the **soleal line**. It runs inferomedially, eventually blending with the medial border of the tibia. It is here where part of the **soleus muscle** originates
- ❑ **Lateral border** – Also known as the interosseous border. This gives attachment to the **interosseous membrane** that binds the tibia and the fibula together.



DISTAL END

- ❑ The distal end of the tibia, like the proximal, widens to help with weight bearing.
- ❑ There is a bony projection continuing inferiorly on the medial side – this is called the **medial malleolus**.
- ❑ It articulates with the **tarsal bones** to form part of the ankle joint.
- ❑ On the posterior surface of the tibia, there is a groove where the **tibialis posterior muscle** attaches.

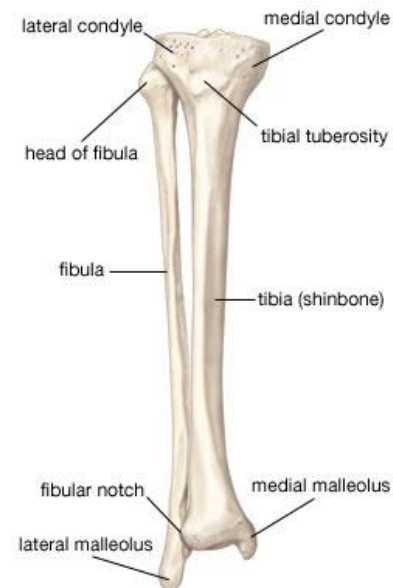
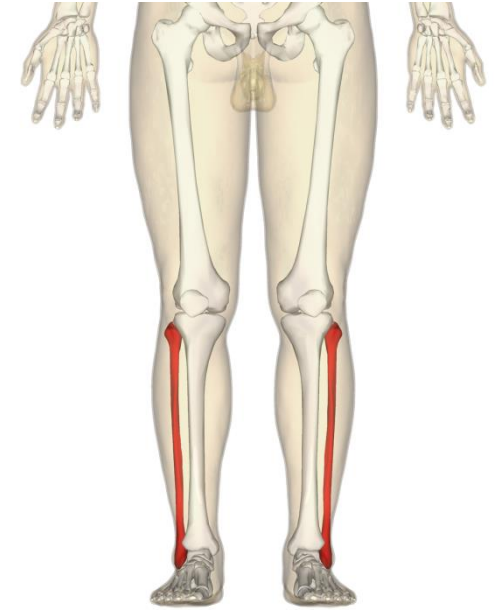


FIBULA

- ❑ The fibula is found laterally to the tibia, and is much thinner.
- ❑ Since it does not articulate with the femur at the knee joint, its main function is to act as an attachment for muscles, and not as a weight bearer.

❑ THE PROXIMAL END:

- the fibula has an enlarged head, which contains a facet for articulation with the lateral condyle of the tibia.
- On the posterior and lateral surface of the fibular neck, the **common fibular nerve** can be found.



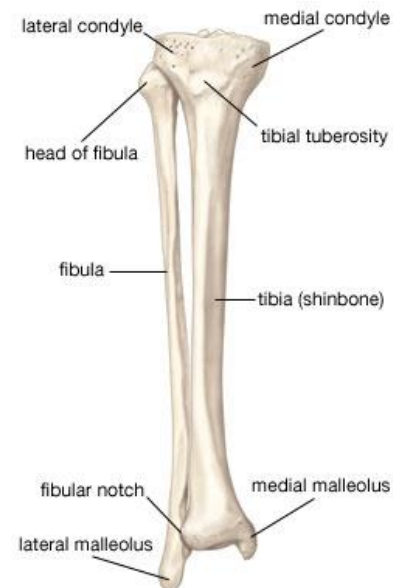
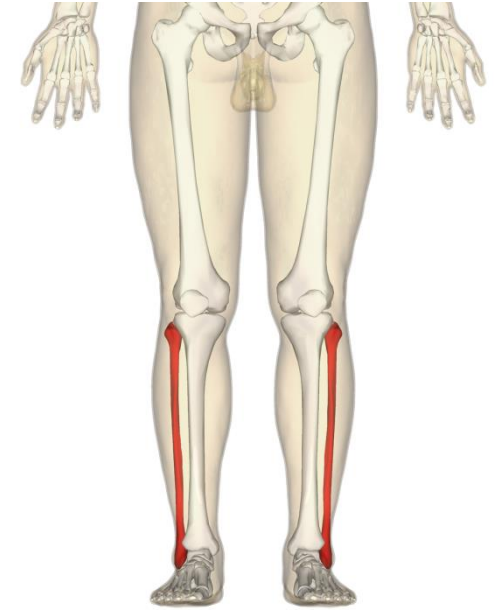
FIBULA

□ THE SHAFT:

- Has three surfaces; anterior, lateral and posterior.
- The leg is split into three compartments, and each surface faces its respective compartment.

□ THE DISTAL END:

- The lateral surface continues inferiorly, and is called the **lateral malleolus**.
- The lateral malleolus is more prominent than the medial malleolus, and can be palpated at the ankle on the lateral side of the leg



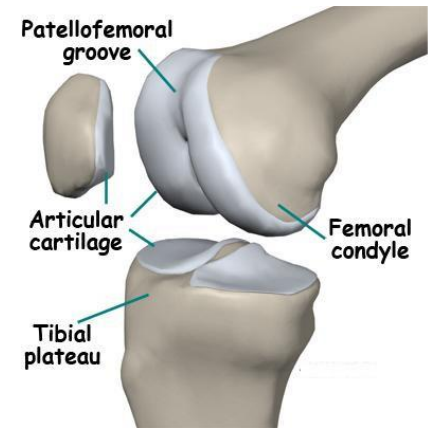
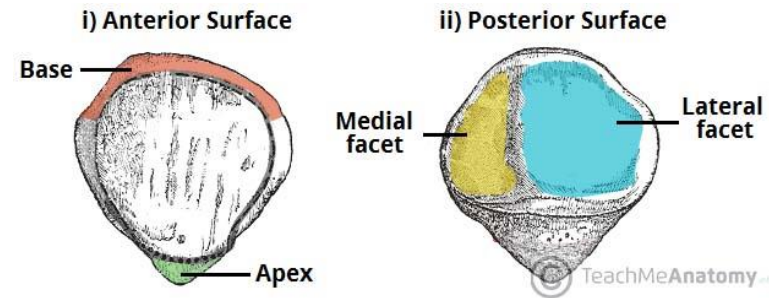
FRACTURES OF TIBIA & FIBULA

- ❑ Tibia fractures are normally caused by trauma. Whether a sporting injury, a fall at home or a fall at work, the tibia can have a variety of complex injuries that often involve the knee and ankle as well.
- ❑ Fractures include a break to the tibia (the load bearing bone) and often the fibula (the thinner lateral bone of the lower leg).
- ❑ Fractures can be proximal (upper), mid or distal (lower).
- ❑ Full recovery takes at least a year and sometimes two.

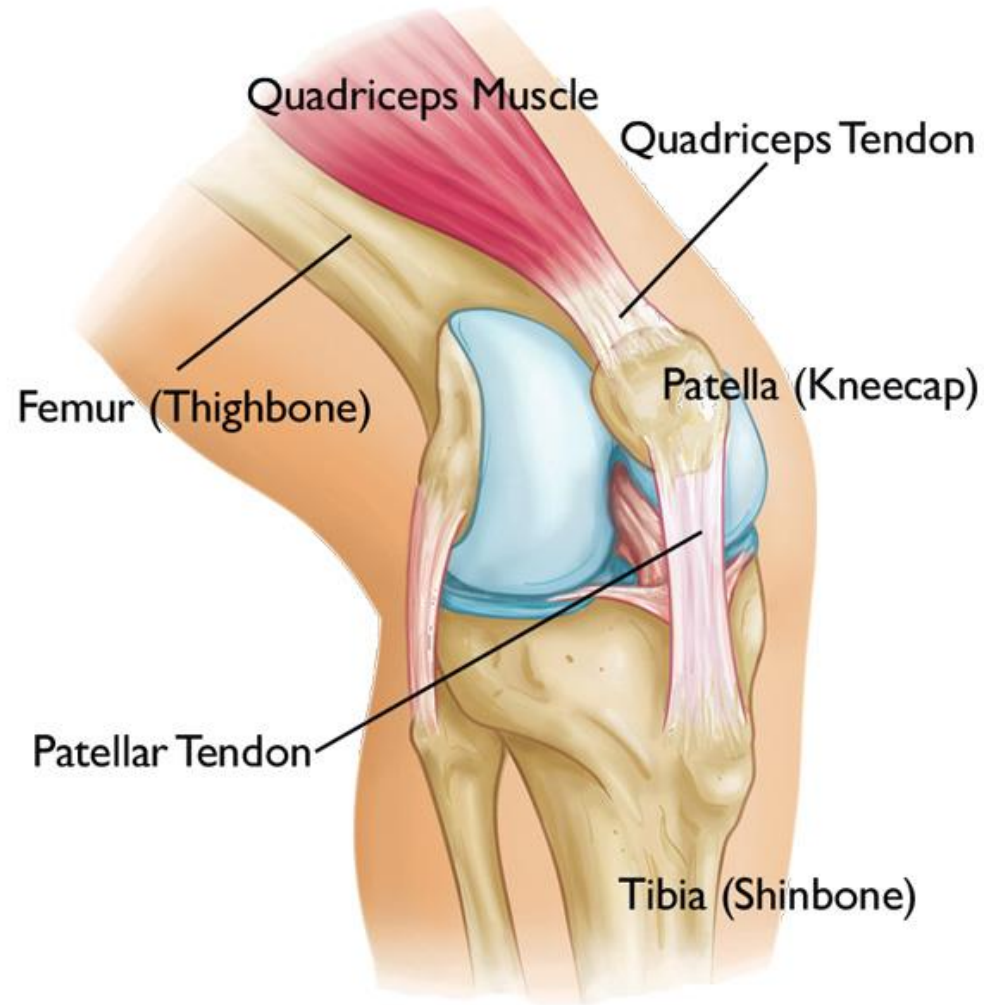


PATELLA

- ❑ The patella (**Kneecap**) is located at the front of the knee joint, within the **patellofemoral groove** of the femur.
- ❑ Its superior aspect is attached to the **quadriceps tendon**, and inferior aspect to the **patellar ligament**.
- ❑ It is classified as a **sesamoid type bone** due to its position within the quadriceps tendon, and is the largest sesamoid bone in the body.
- ❑ The apex of the patella is situated inferiorly, and is connected to the tibial tuberosity by the patella ligament.
- ❑ The base forms the superior aspect of the bone, and provides the attachment area for the quadriceps tendon.
- ❑ It has two main functions:
 - **Leg extension** – enhances the leverage that the quadriceps tendon can exert on the femur, increasing the efficiency of the muscle.
 - **Protection** – protects the anterior aspect of the knee joint from physical trauma.



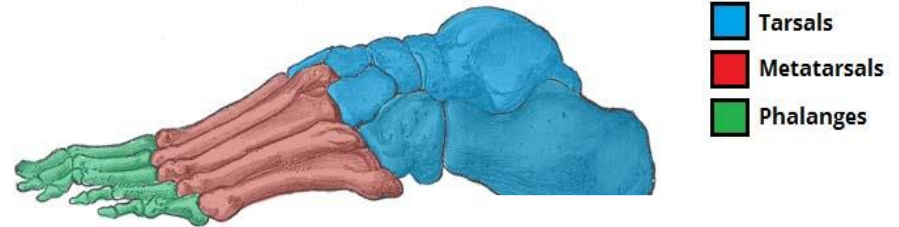
KNEE JOINT



FOOT

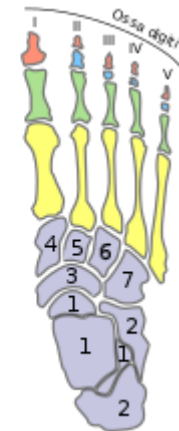
□ The skeleton of the foot consists of the:

- **Tarsals:** seven irregularly shaped bones situated proximally in the foot, in the ankle area.
- **Metatarsals:** There are five in number and they connect the phalanges to the tarsals.
- **Phalanges:** The bones of the toes. Each toe has three phalanges; a proximal, intermediate and distal.
 - except the big toe, which only has two phalanges.



Phalanges distales (3)
Phalanges mediae (2)
Phalanges proximales (1)
Metatarsalia
Ossa tarsi

1. Talus
2. Calcaneus
3. Os naviculare
4. Os cuneiforme I
5. Os cuneiforme II
6. Os cuneiforme III
7. Os cuboideum

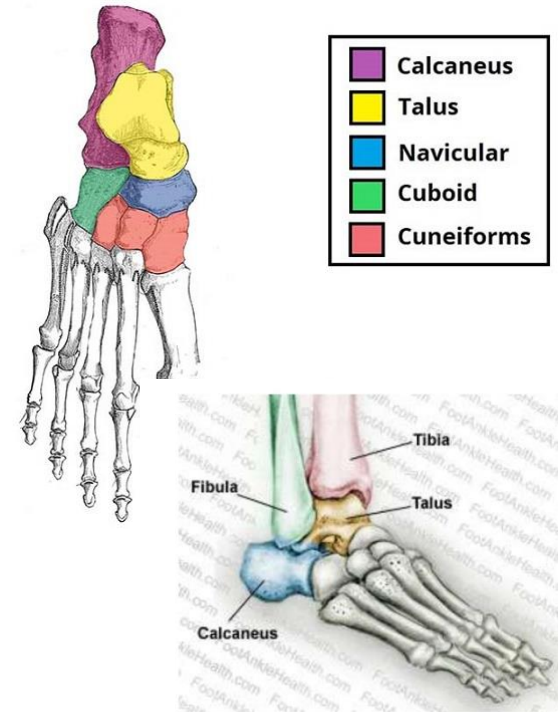


TARSALS

- ❑ The tarsal bones are organized into three rows; proximal, intermediate and distal.

PROXIMAL GROUP

- ❑ The proximal tarsal bones are the **talus** and the **calcaneus**.
- ❑ They form the bony framework around the proximal ankle and heel area.
- ❑ The **TALUS**¹ is the most superior of the tarsal bones, and it has three articulations:
 - **Superiorly:** Ankle joint – between the talus and the bones of the leg (the tibia and fibula).
 - **Inferiorly:** Subtalar joint – between the talus and calcaneus.
 - **Anteriorly:** Talonavicular joint – between the talus and the navicular.
- ❑ The main function of the talus is to transmit forces from the tibia to calcaneus (the heel bone).
- ❑ The **CALCANEUS**² lies underneath the talus, and has two articulations:
 - ❑ **Superiorly:** Subtalar joint – between the calcaneus and the talus.
 - ❑ **Anteriorly:** Calcaneocuboid joint – between the calcaneus and the cuboid.
- ❑ Calcaneus is thick and strong acting to transmit forces from the talus to the ground.
- ❑ The posterior aspect of the calcaneus is marked by calcaneal tuberosity, to which the **Achilles tendon attaches**.



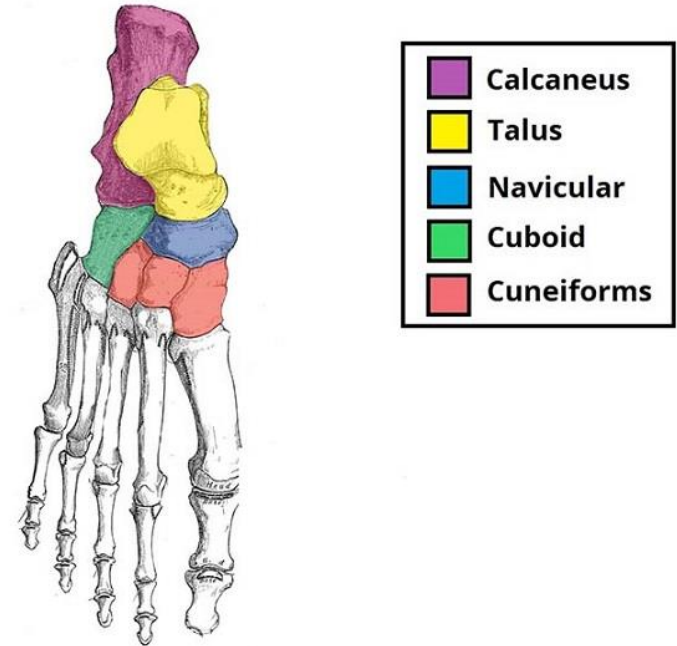
TARSALS

INTERMEDIATE GROUP

- ❑ The intermediate row of tarsal bones contains one bone, the **NAVICULAR**³ (given the name because it is shaped like a boat).
- ❑ It articulates with the **talus** posteriorly, the **cuneiform** bones anteriorly, and the **cuboid** bone laterally.
- ❑ On the plantar surface of the navicular, there is a tuberosity for the attachment of the **tibialis posterior tendon**.

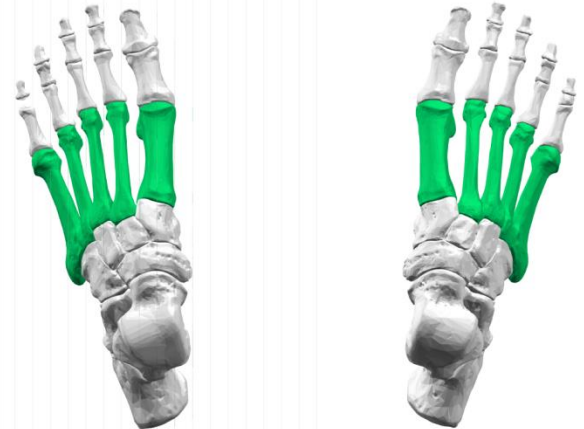
DISTAL GROUP

- ❑ There are four tarsal bones – the **cuboid** and the **three cuneiforms**. These bones articulate with the metatarsals of the foot.
- ❑ The **CUBOID**⁴ (the shape like a cube) is the most lateral bone in the distal row, articulating with the calcaneus posteriorly, and two metatarsals anteriorly.
- ❑ The inferior surface of the cuboid is marked by a groove for the **fibularis longus muscle**.
- ❑ The **THREE CUNEIFORMS**⁵⁶⁷ (lateral, intermediate and medial) are wedge shaped bones. They articulate with the navicular posteriorly, and the metatarsals anteriorly.
- ❑ The shape of the bones helps form a transverse arch across the foot.



METATARSALS

- ❑ The metatarsals are located in the midfoot, between the tarsals and phalanges.
- ❑ They are numbered I-V (medial to lateral).
- ❑ Each metatarsal has a similar structure.
- ❑ They consist of a distal head and proximal base, which are joined by a shaft of bone. They have three or four articulations:
 - **Proximally:** Tarsometatarsal joint – between the metatarsal bases and the cuneiforms or cuboid bones.
 - **Laterally:** Intermetatarsal joint(s) – between the metatarsal and the adjacent metatarsals.
 - **Distally:** Metatarsophalangeal joint – between the metatarsal head and the proximal phalanx.



PHALANGES

- ❑ The phalanges are the bones of the toes.
- ❑ Most toes have three phalanges; proximal, intermediate and distal.
- ❑ The great toe ONLY has proximal and distal phalanges.
- ❑ Each phalanx consists of a body, a proximal extremity and a distal extremity.



LIST OF JOINTS OF UPPER & LOWER LIMBS

○ Upper Limb

1. Sternoclavicular joint
2. Costoclavicular Joint
3. Acromioclavicular joint
4. Glenohumeral joint
5. Acromioclavicular joint
6. Elbow joint
7. Proximal Radioulnar joint
8. Distal Radioulnar joint
9. Wrist joint
10. Carpometacarpal joints
11. Metacarpophalangeal joints
12. Interphalangeal joints

○ Lower Limb

1. Sacroiliac joint
2. Hip joint
3. Pubic symphysis
4. Glenohumeral joint
5. Knee Joints
6. Proximal tibiofibular joint
7. Distal tibiofibular joint
8. Ankle joints
9. Subtalar joint
10. Talonavicular joint
11. Calcaneocuboid joint
12. Tarsometatarsal joint
13. Intermetatarsal joints
14. Metatarsophalangeal joint
15. Interphalangeal joints

QUESTIONS?