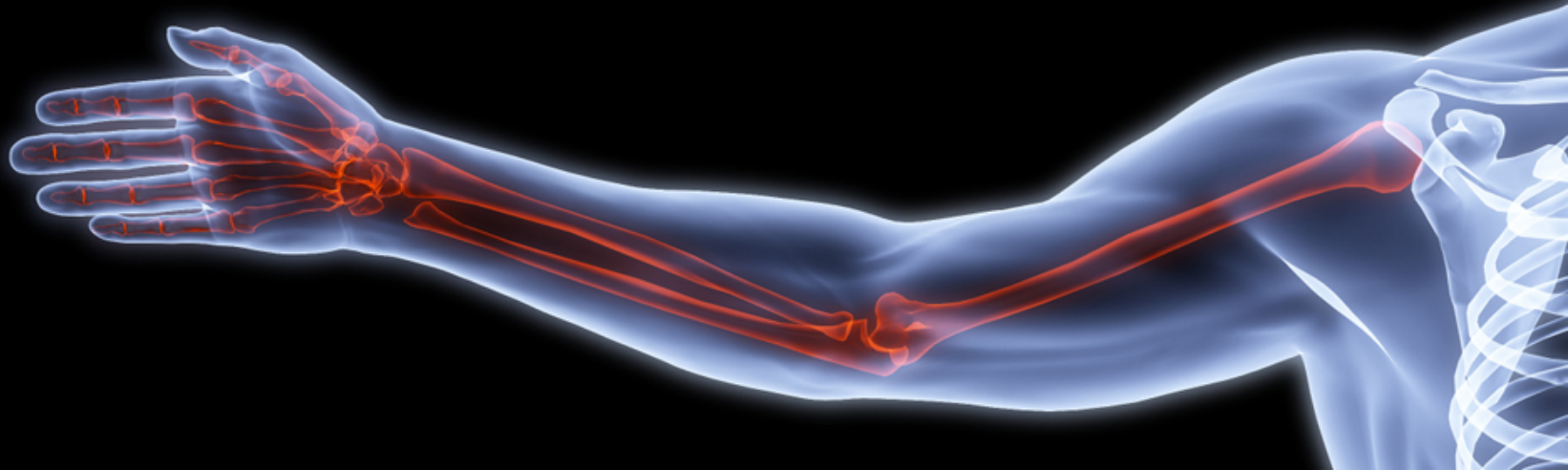


# **BONES OF THE UPPER LIMBS**



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**College of Medicine**  
**@khaleelya**

# OBJECTIVES

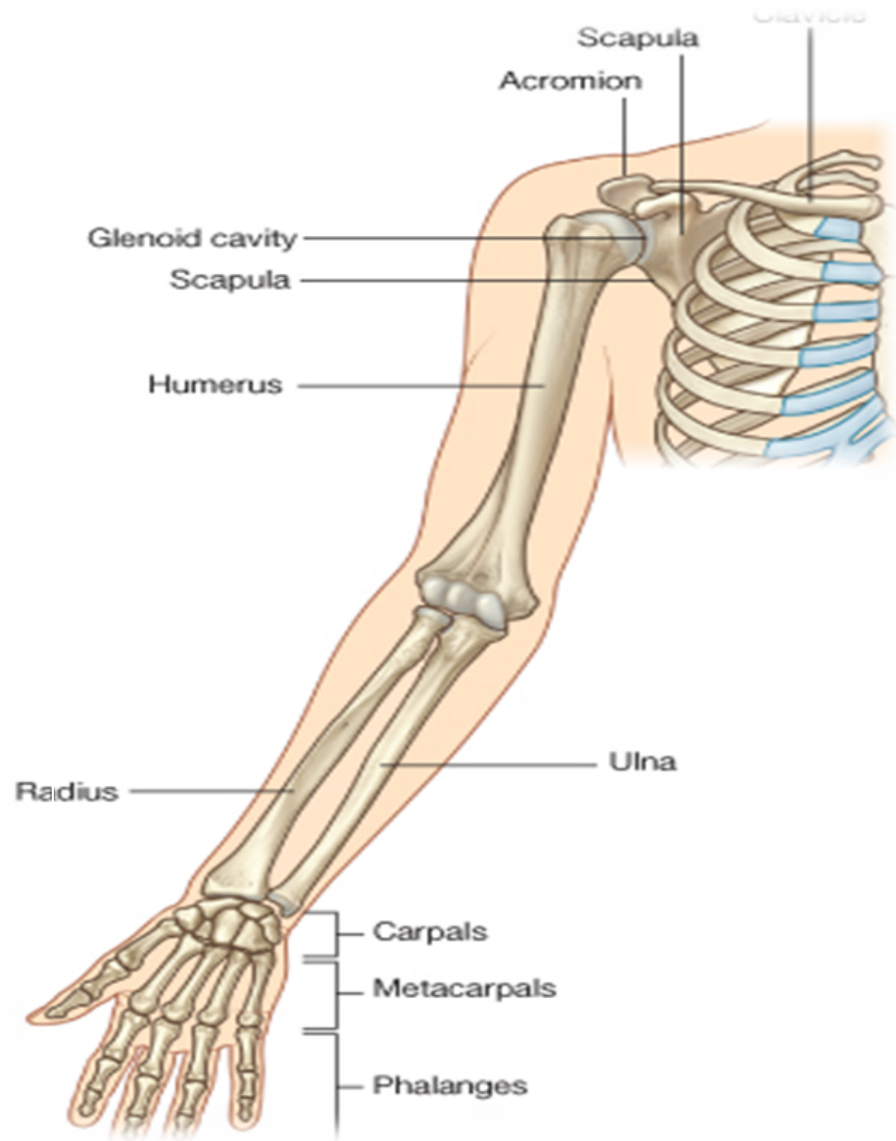
*At the end of the lecture, students should be able to:*

- **List the different bones of the Upper Limb.**
- **List the characteristic features of each bone.**
- **Differentiate between bones of right and left sides.**
- **List the articulations between the different bones.**

# BONES OF UPPER LIMB

*It consists of the following:*

- **Pectoral Girdle**
- **Arm**
  - Humerus
- **Forearm**
  - Radius & Ulna
- **Wrist**
  - Carpal bones
- **Hand**
  - Metacarpals & Phalanges

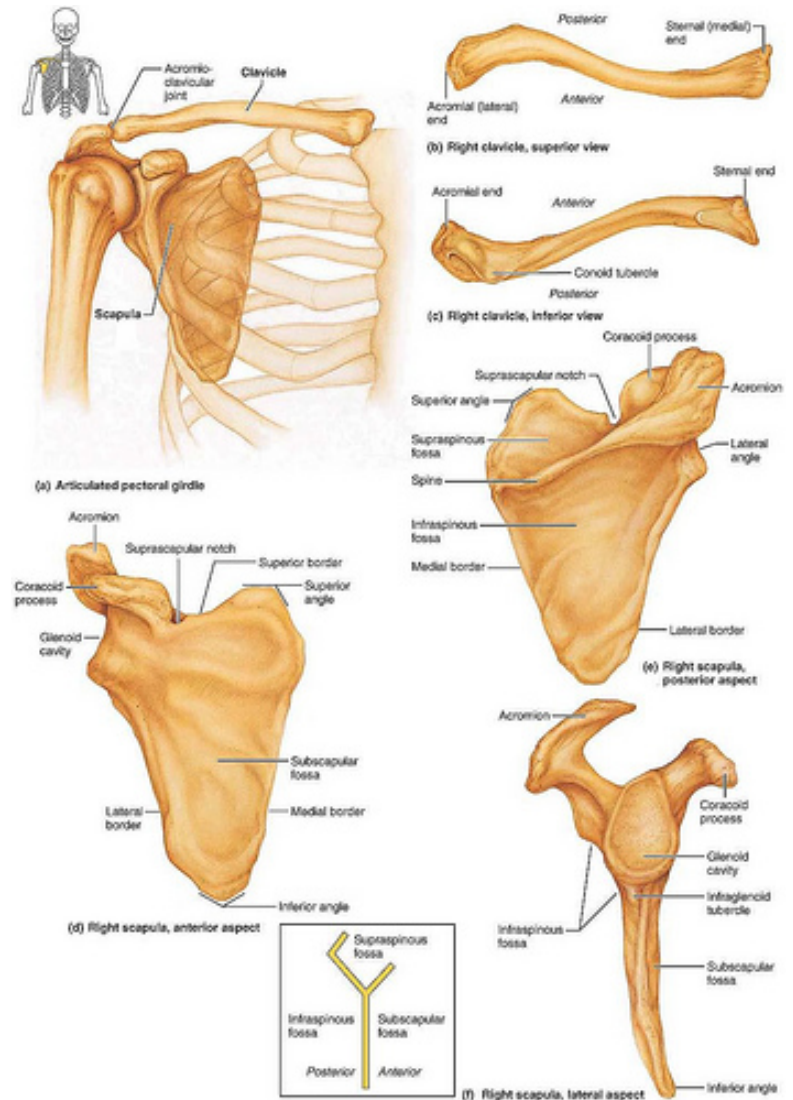


# PECTORAL GIRDLE

□ It composed of Two bones:

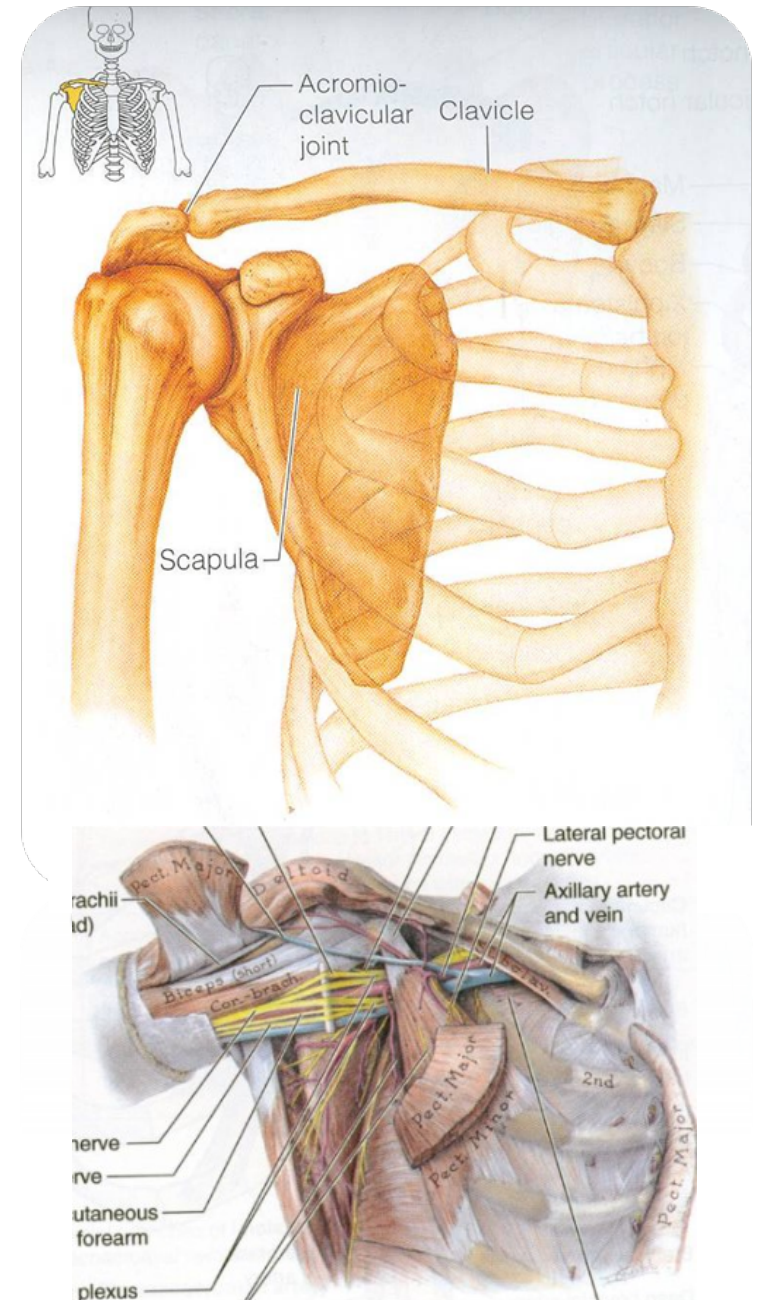
- **Clavicle**
- **Scapula**

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



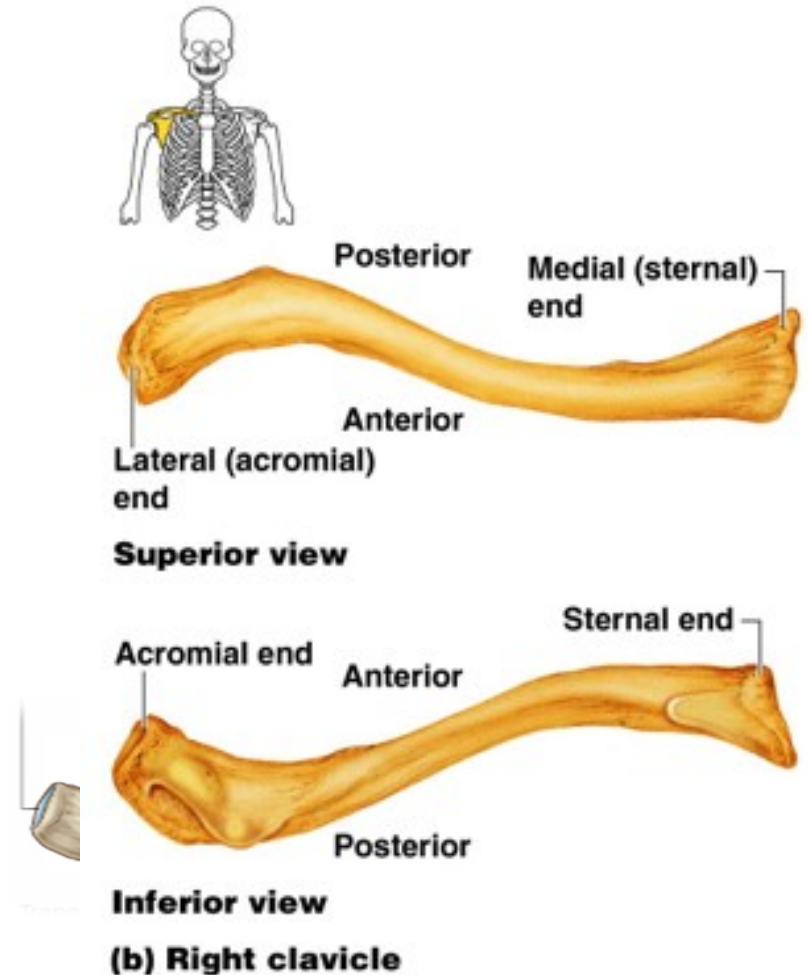
# CLAVICLE

- ❑ **It is a long bone lying horizontally across the root of the neck**
- ❑ **It is subcutaneous throughout its length.**
- ❑ **Functions:**
  - **It serves as a rigid support from which the scapula and free upper limb are suspended keeping them away from the trunk, so that the arm has maximum freedom of movement.**
  - **Transmits forces from the upper limb to the axial skeleton.**
  - **Provides attachment for muscles.**
  - **It forms a boundary of the cervicoaxillary canal for protection of the neurovascular bundle of the UL.**
- ❑ **If the clavicle is broken, the whole shoulder region caves in medially.**



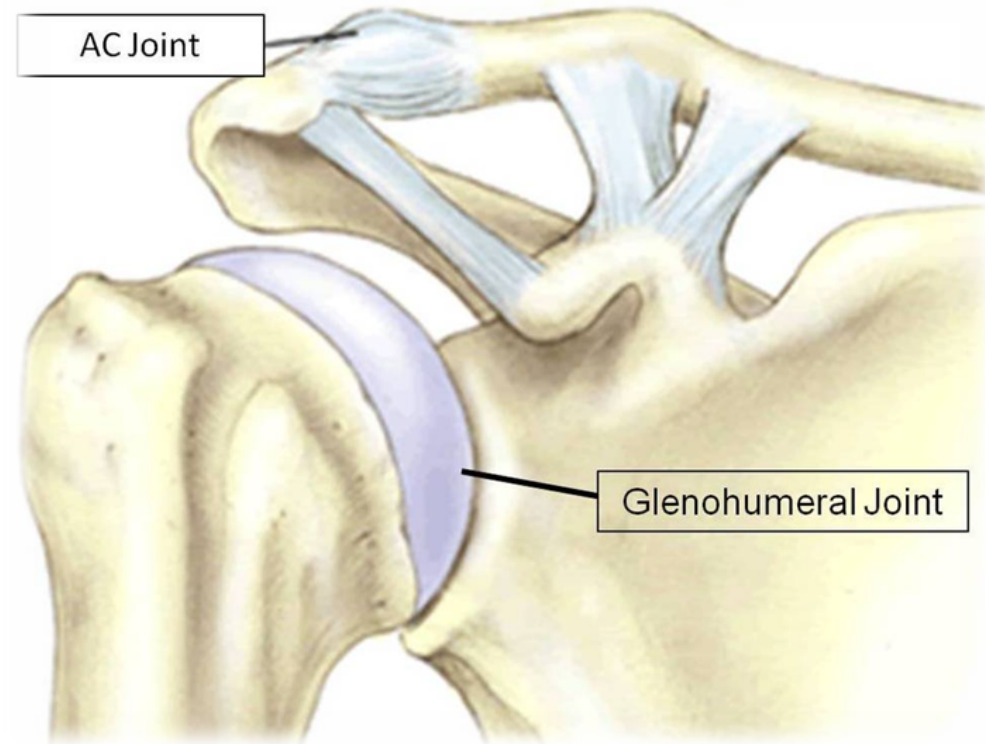
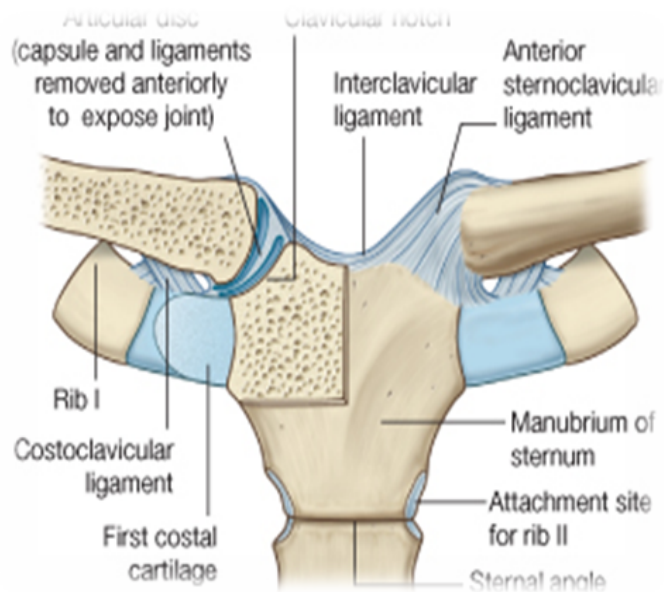
# CLAVICLE

- ❑ 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.



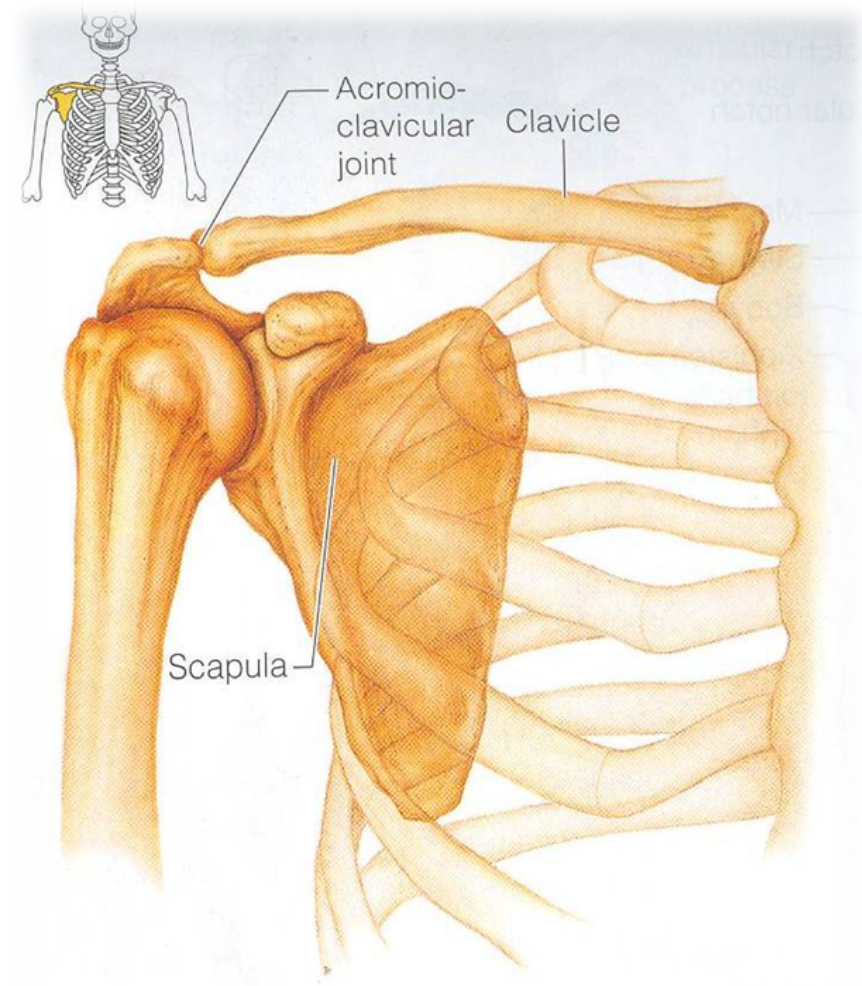
# ARTICULATIONS

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



# FRACTURES OF THE CLAVICLE

- ❑ **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.**



(a) Articulated shoulder (pectoral) girdle



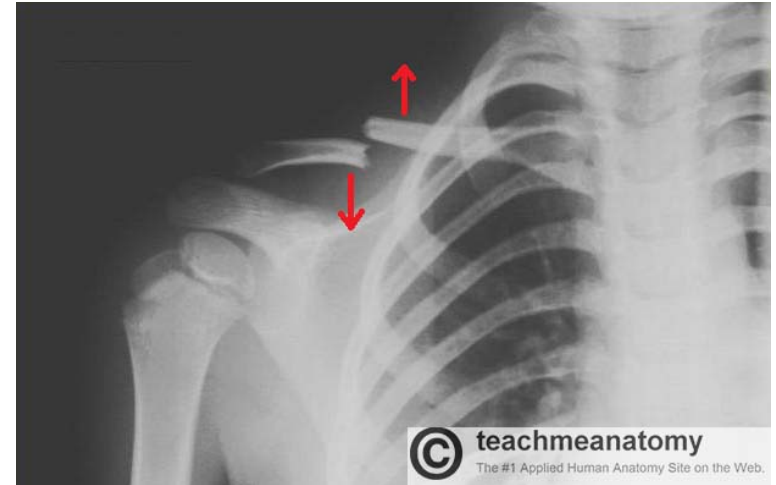
# CLINICAL SIGNIFICANCE

## Fracture 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.

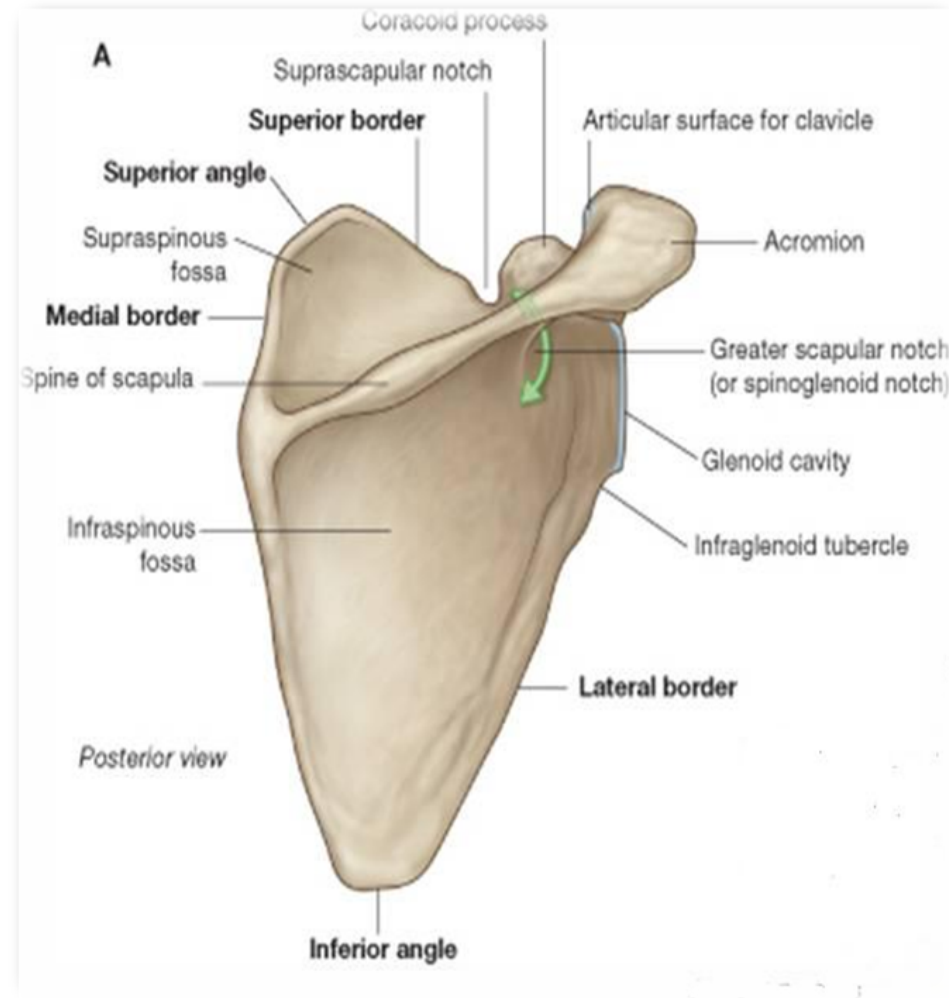
□ The most common point of fracture is the junction of the medial 2/3 and lateral 1/3.

□ After fracture, the lateral end of the clavicle is displaced inferiorly by the weight of the arm, and medially, by the pectoralis major. The medial end is pulled superiorly, by the sternocleidomastoid muscle.



# SCAPULA

- ❑ **It is a triangular flat bone.**
- ❑ **Extends between the 2nd \_ 7th ribs.**
- ❑ **It has:**
  - **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.**



# SCAPULA

## ○ **Three Angles :**

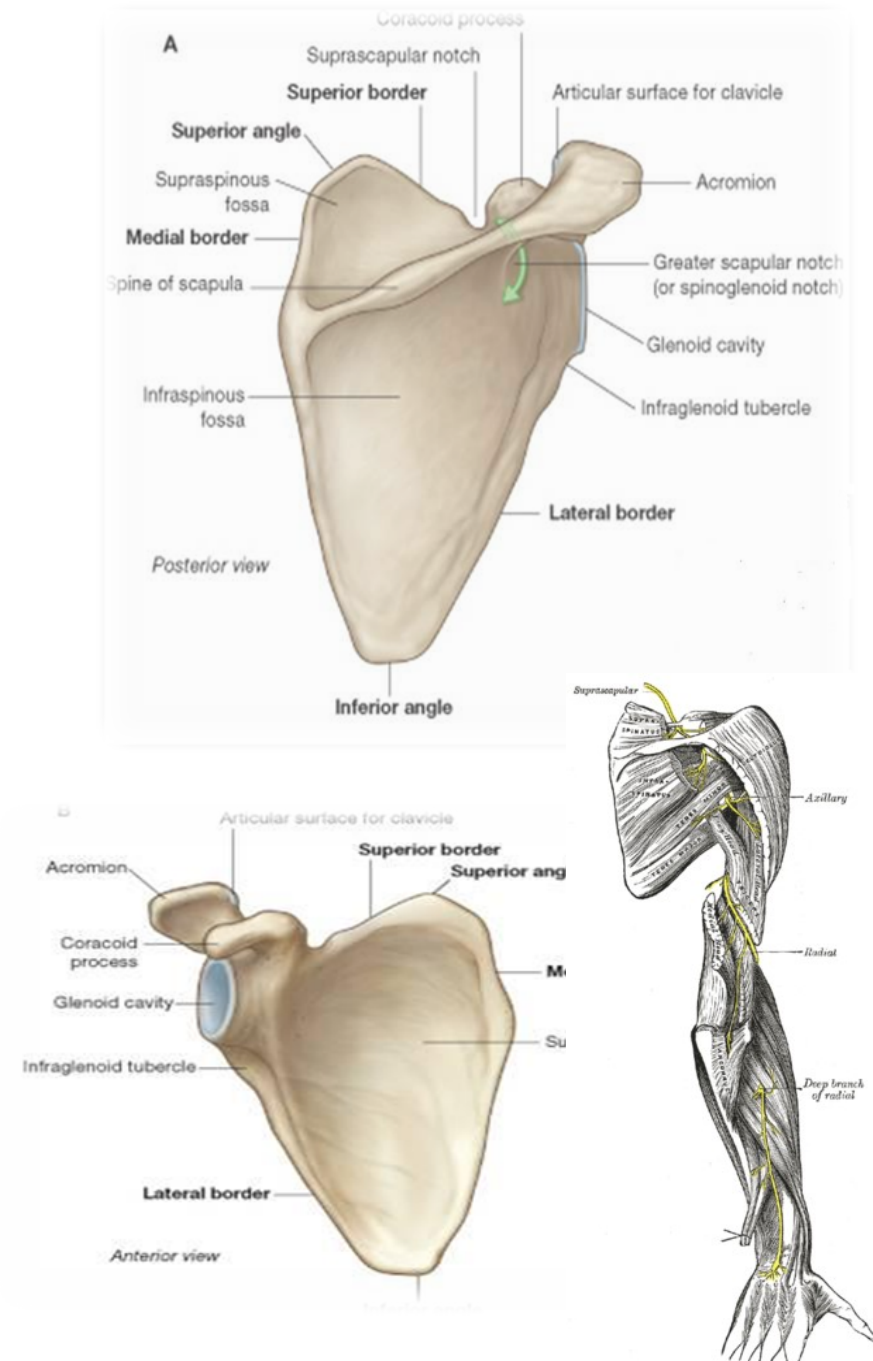
- Superior
- Inferior
- Lateral

– forms the Glenoid cavity: a shallow concave oval fossa that receives the head of the humerus.

## ○ **Two Surfaces**

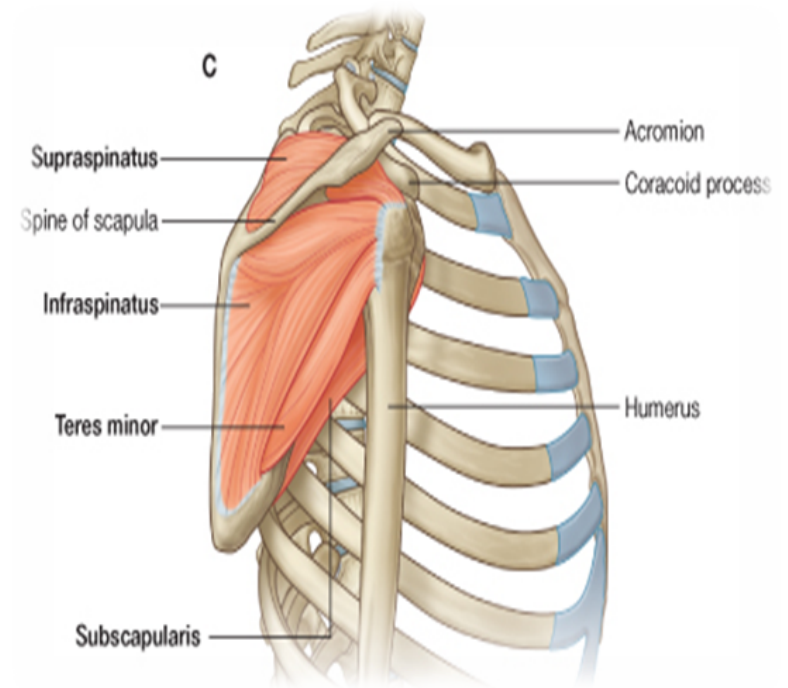
- **Convex:** posterior surface is divided by the spine of the scapula into the smaller Supraspinous Fossa - above the spine and the larger Infraspinous Fossa - below the spine.
- **Concave:** Anterior (Costal) Surface , it forms the large Subscapular Fossa.
- **Suprascapular notch:** It is a nerve passageway,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

– Suprascapular nerve



# FUNCTIONS OF SCAPULA

- ❑ **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.**

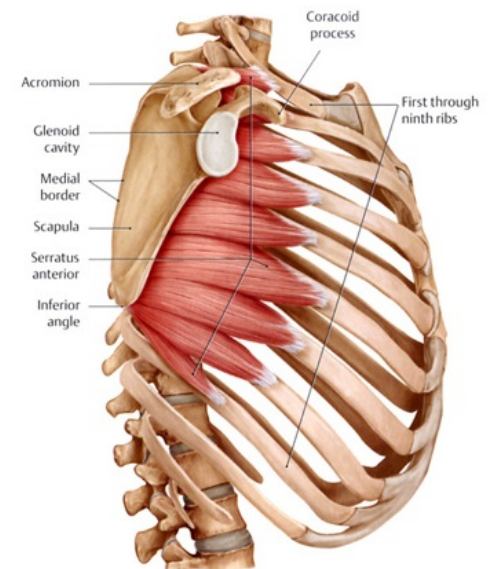


# CLINICAL SIGNIFICANCE

## 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.

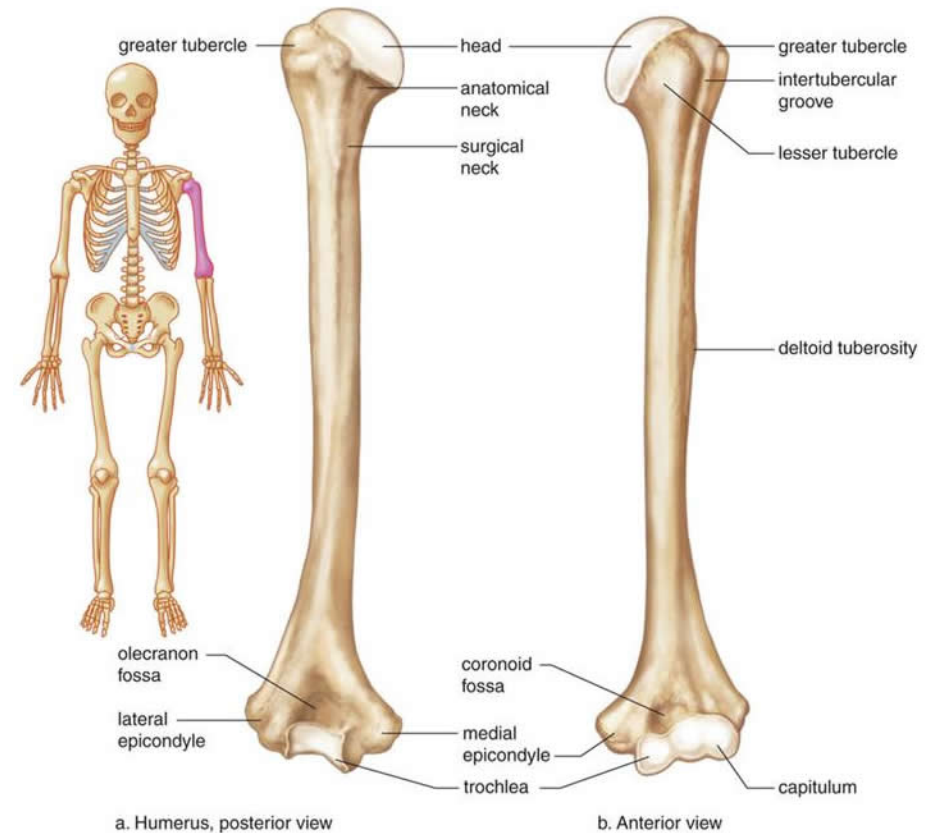


# ARM (HUMERUS)

- ❑ A typical long bone.
- ❑ It is the largest bone in the UL

- **Proximal End:**

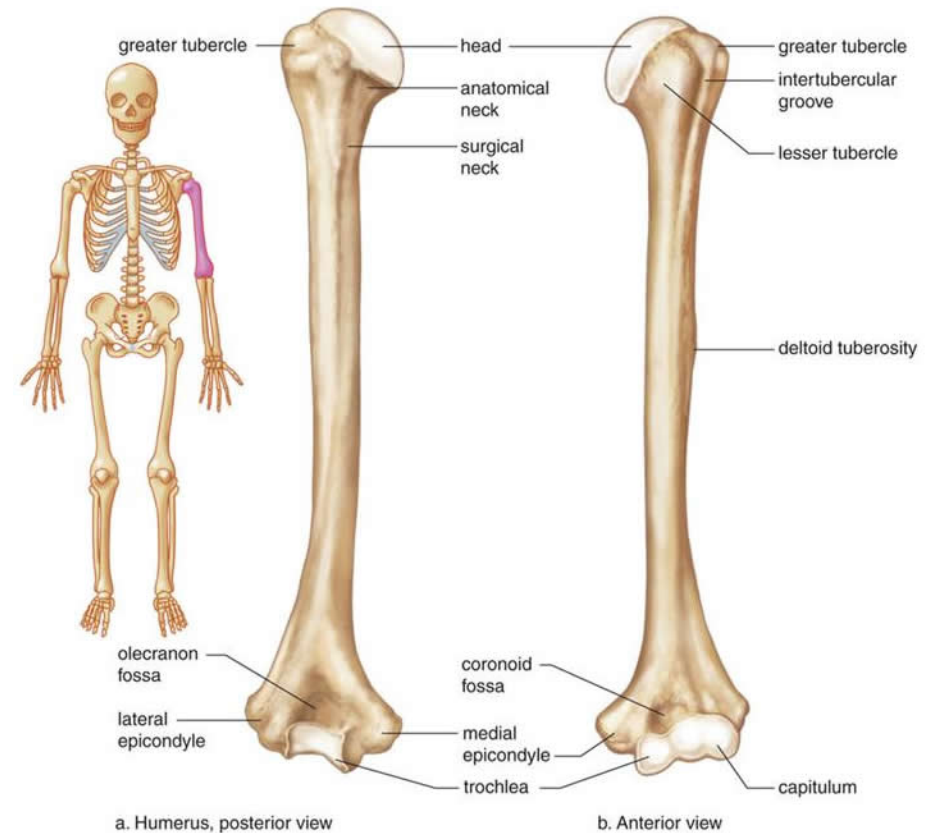
- Head, Neck, Greater & Lesser Tubercles.
- **Head:** Smooth & forms 1/3 of a sphere, it articulates with the glenoid cavity of the scapula.
- **Anatomical neck:** formed by a groove separating the head from the tubercles.
- **Greater tubercle:** at the lateral margin of the humerus.
- **Lesser tubercle:** 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.



# ARM (HUMERUS)

**Shaft (Body):** it has two prominent features:

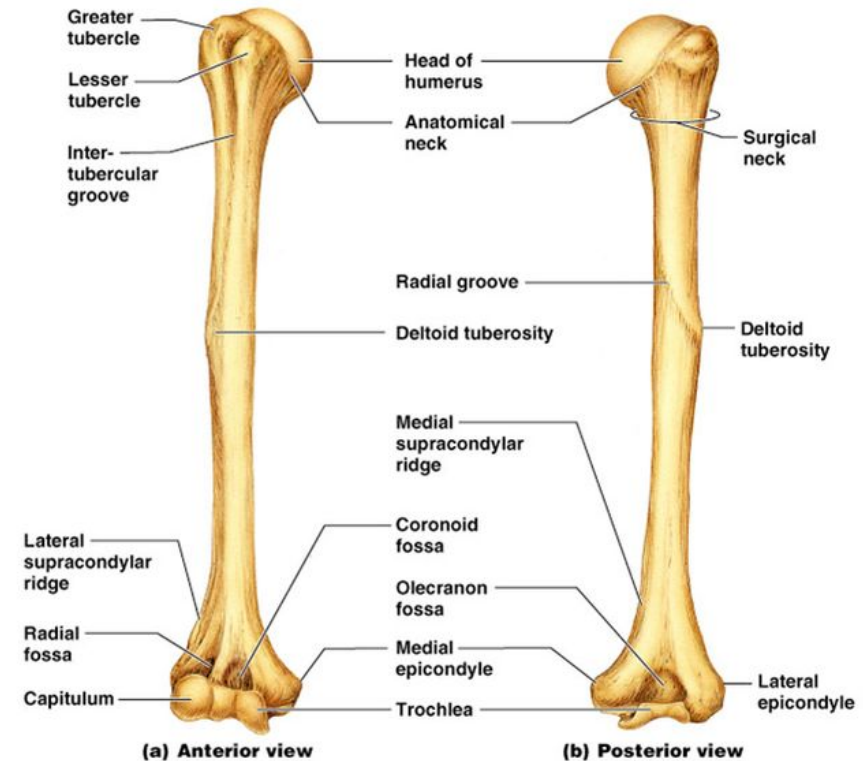
- **Deltoid tuberosity:**
  - A rough elevation laterally for the attachment of deltoid muscle.
- **Spiral (Radial) groove:**
  - Runs obliquely down the posterior aspect of the shaft.
  - It lodges the important radial nerve & vessels.



# ARM (HUMERUS)

## ○ Distal End:

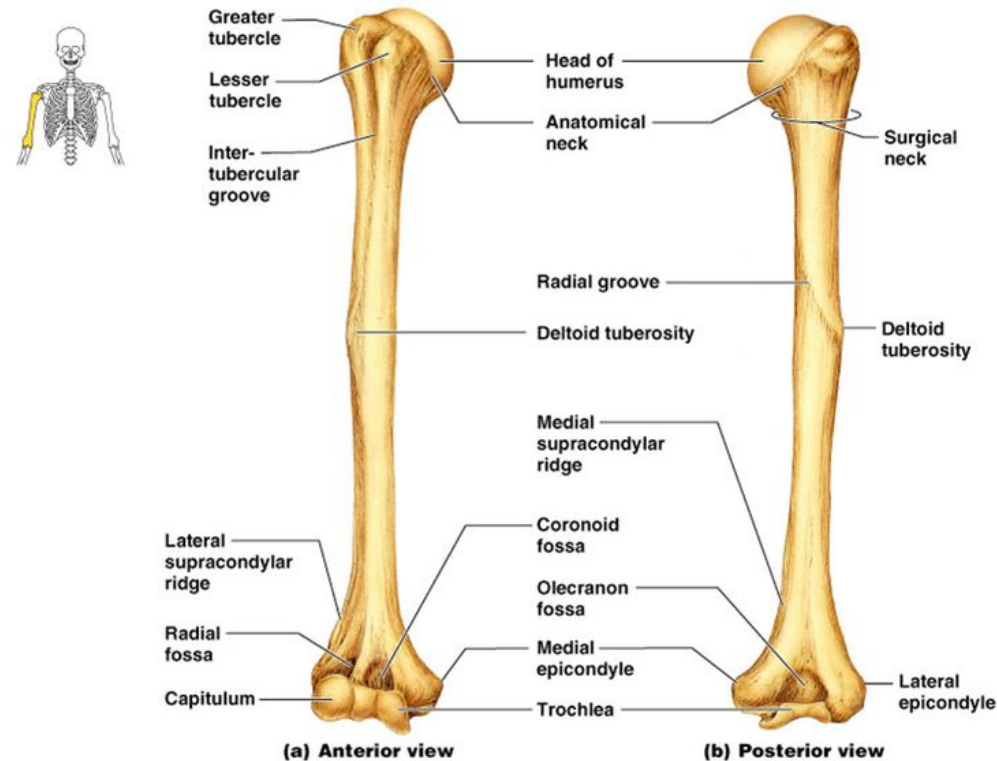
- Widens as the sharp medial and lateral supracondylar ridges form and end in the medial and lateral epicondyles providing muscular attachment.
- **Trochlea:** (medial) for articulation with the ulna
- **Capitulum:** (lateral) for articulation with the radius.
- **Coronoid fossa:** above the trochlea (anteriorly)
- **Radial fossa:** above the capitulum
- **Olecranon fossa:** above the trochlea (posteriorly).





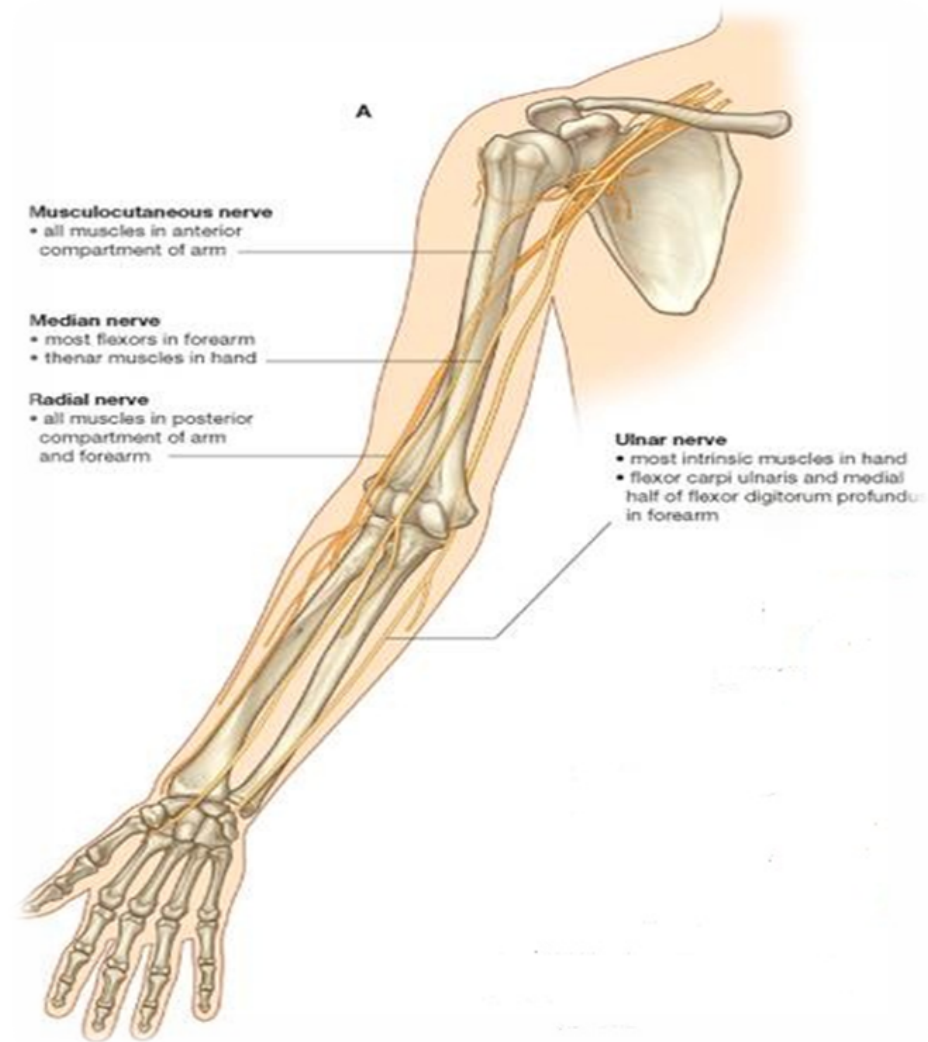
# FRACTURES OF HUMERUS

- ❑ **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.**



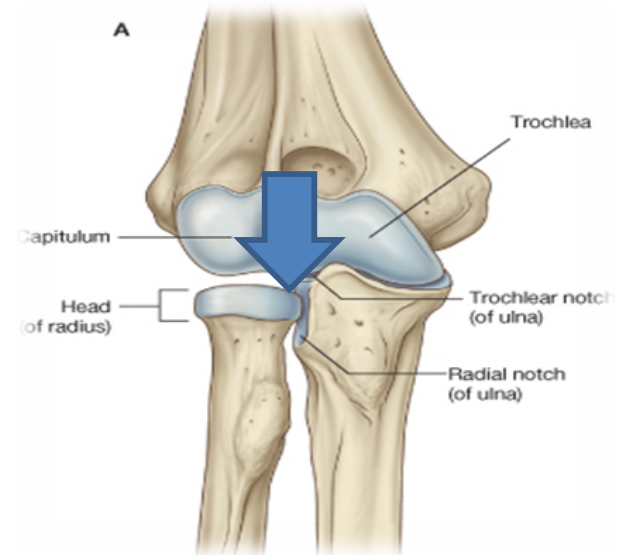
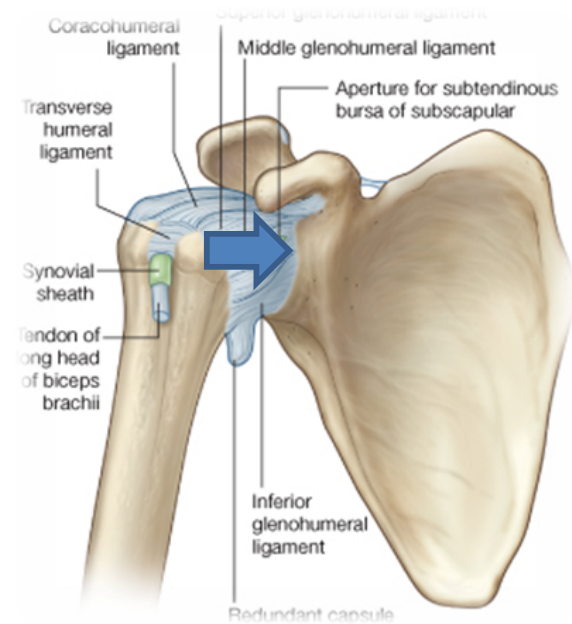
# NERVES AFFECTED IN FRACTURES OF HUMERUS

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



# ARTICULATIONS

- ❑ **Head of the humerus with the glenoid cavity of the scapula form the **Shoulder joint**.**
- ❑ **Lower end (Trochlea & Capitulum) with the upper ends of the radius & ulna form the **Elbow joint**.**



# CLINICAL SIGNIFICANCE

## Distal Humeral Fracture

□ **Medial epicondyle fractures are common fracture types of the distal humerus. A supraepicondylar fracture occurs by falling on a flexed elbow. It is a transverse fracture, spanning between the two epicondyles**

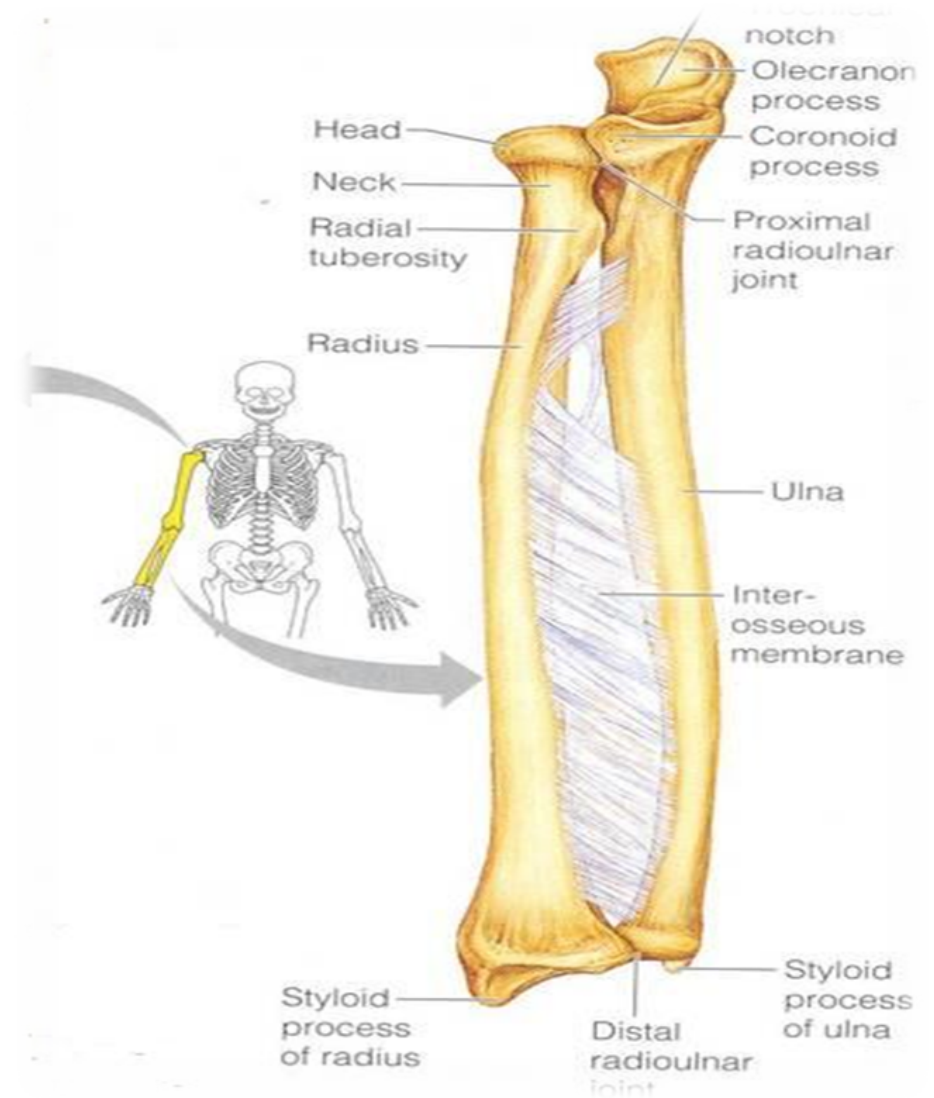
□ **Direct damage, or swelling can cause interference to the blood supply of the forearm from the brachial artery. The resulting ischaemia can cause Volkmann's ischaemic contracture – uncontrolled flexion of the hand, as flexor muscles become fibrotic and short. There also can be damage to the median, ulnar or radial nerves.**



# FOREARM

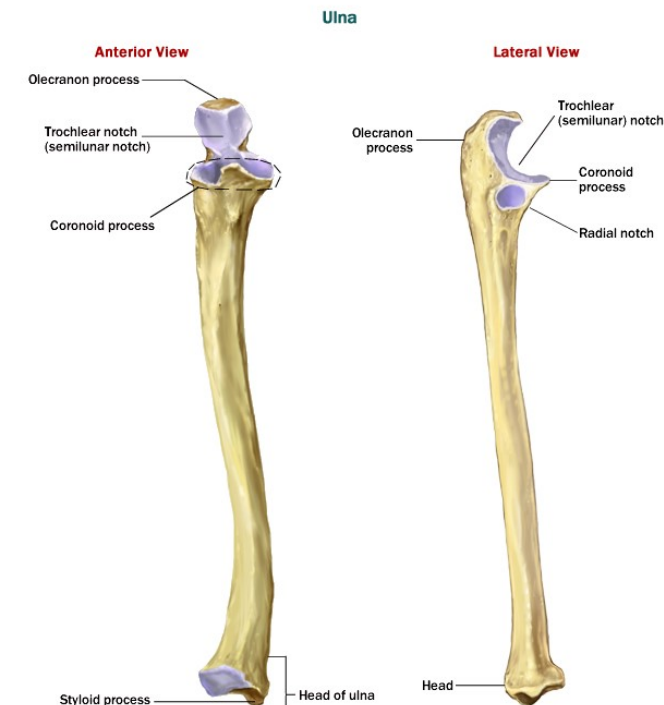
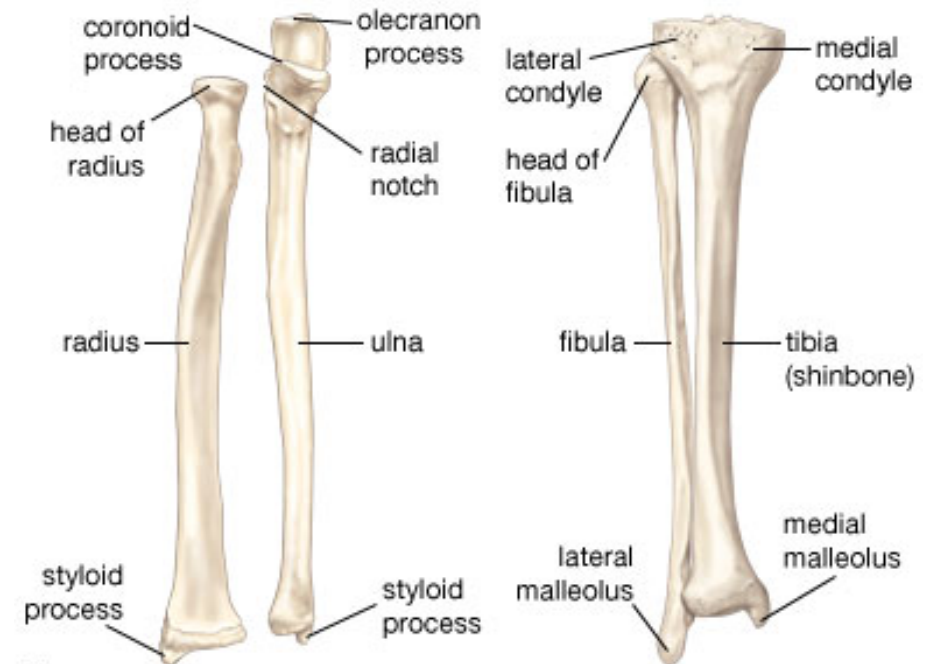
□ Formed of two bones:

- 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.



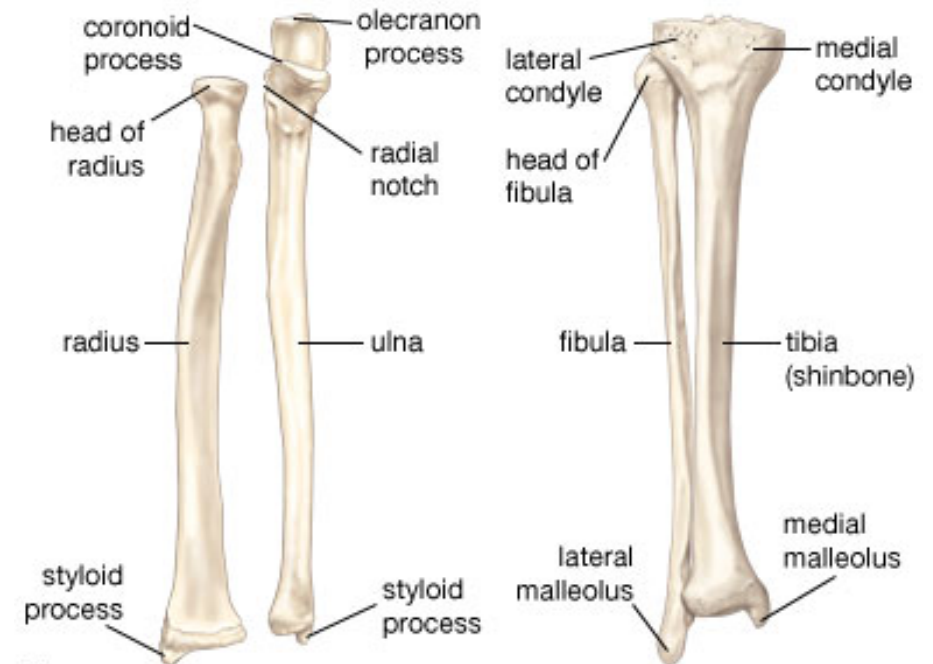
# ULNA

## ○ Shaft :

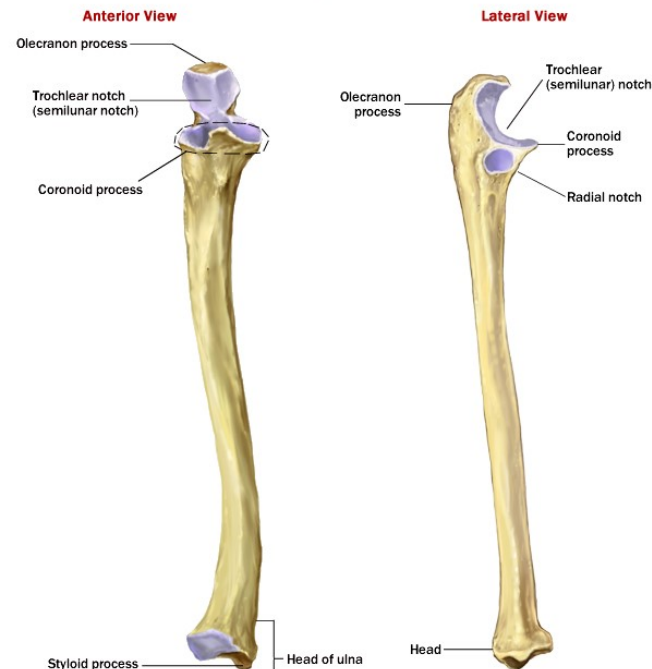
- Thick & cylindrical superiorly but diminishes in diameter inferiorly.
- Three surfaces (Anterior, Medial & Posterior).
- Sharp lateral interosseous border.

## ○ 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



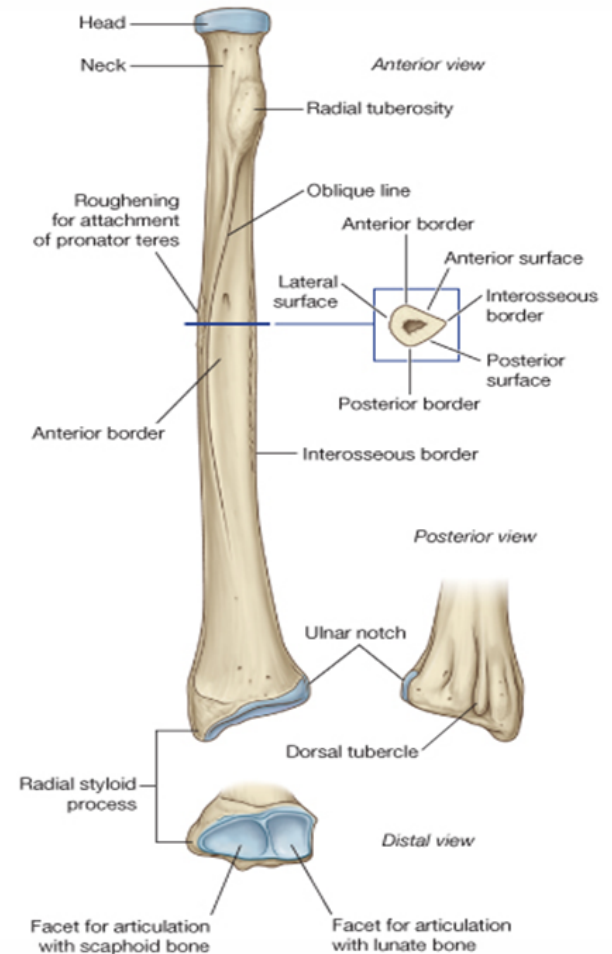
# RADIUS

□ 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.





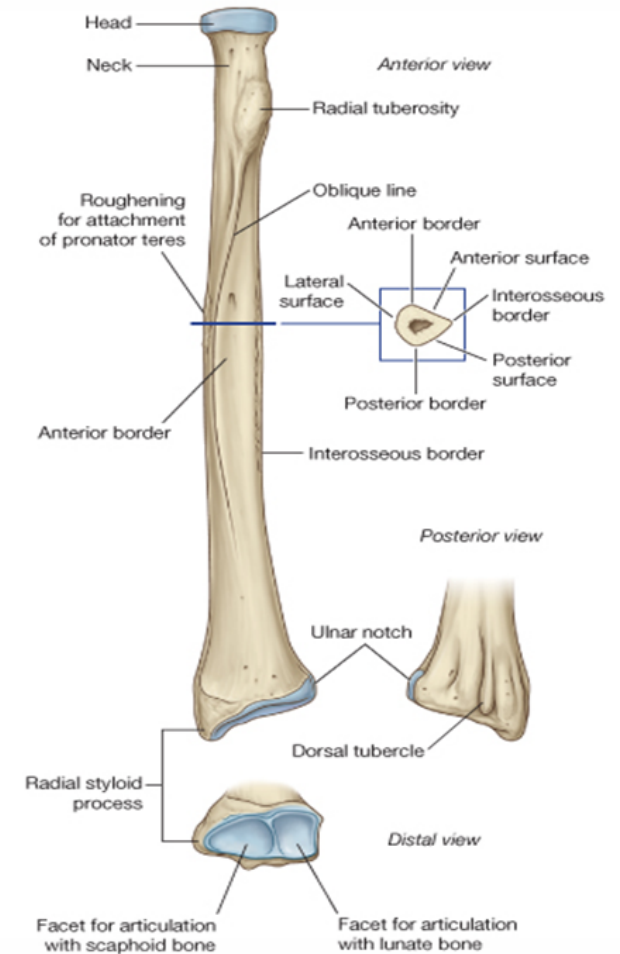
# RADIUS

## ○ Shaft:

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

## ○ Distal (Lower) End:

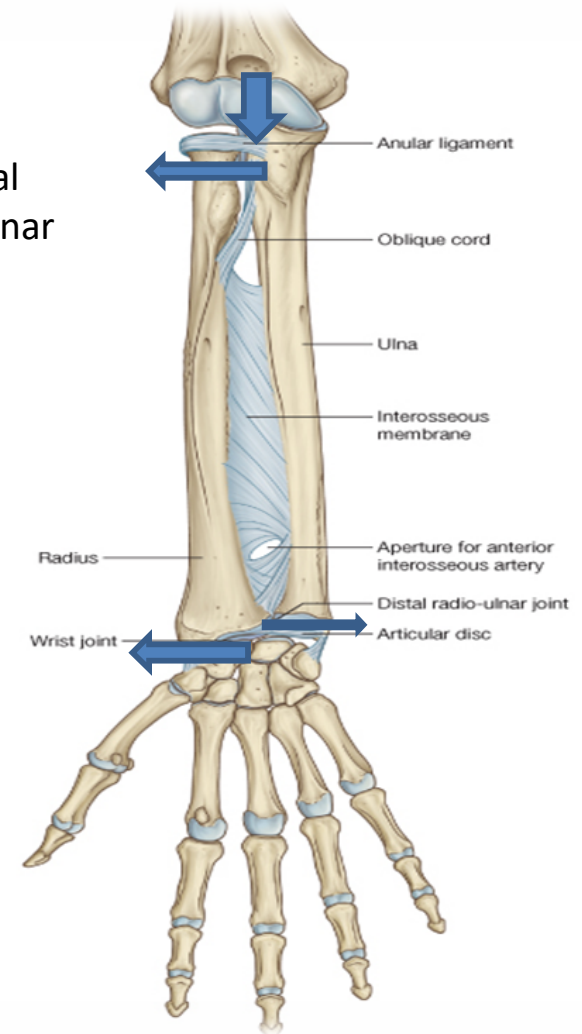
- It is rectangular.
- Its medial aspect forms a concavity : Ulnar notch to accommodate the head of the ulna.
- Radial Styloid process: extends from the lateral aspect.
- Dorsal tubercle: projects dorsally.



# ARTICULATIONS OF RADIUS & ULNA

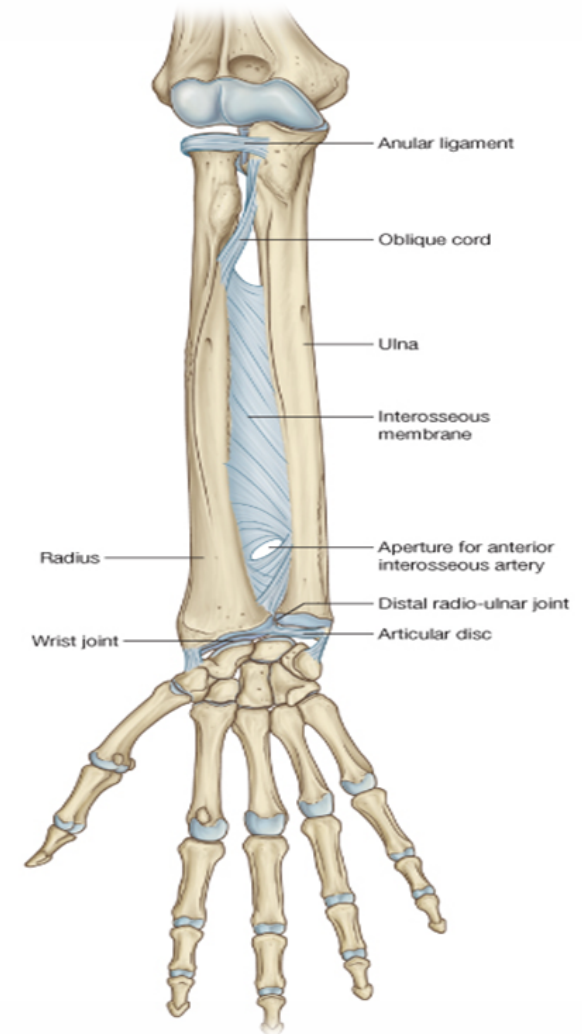
- ❑ **Distal end of Humerus with the proximal ends of Radius & Ulna**  
**Elbow joint**
- ❑ **Proximal Radioulnar joint**
- ❑ **Distal Radioulnar joint**
- ❑ **The two bones are connected by the flexible interosseous membrane**

Proximal  
Radioulnar  
joint.



# FRACTURES OF RADIUS & ULNA

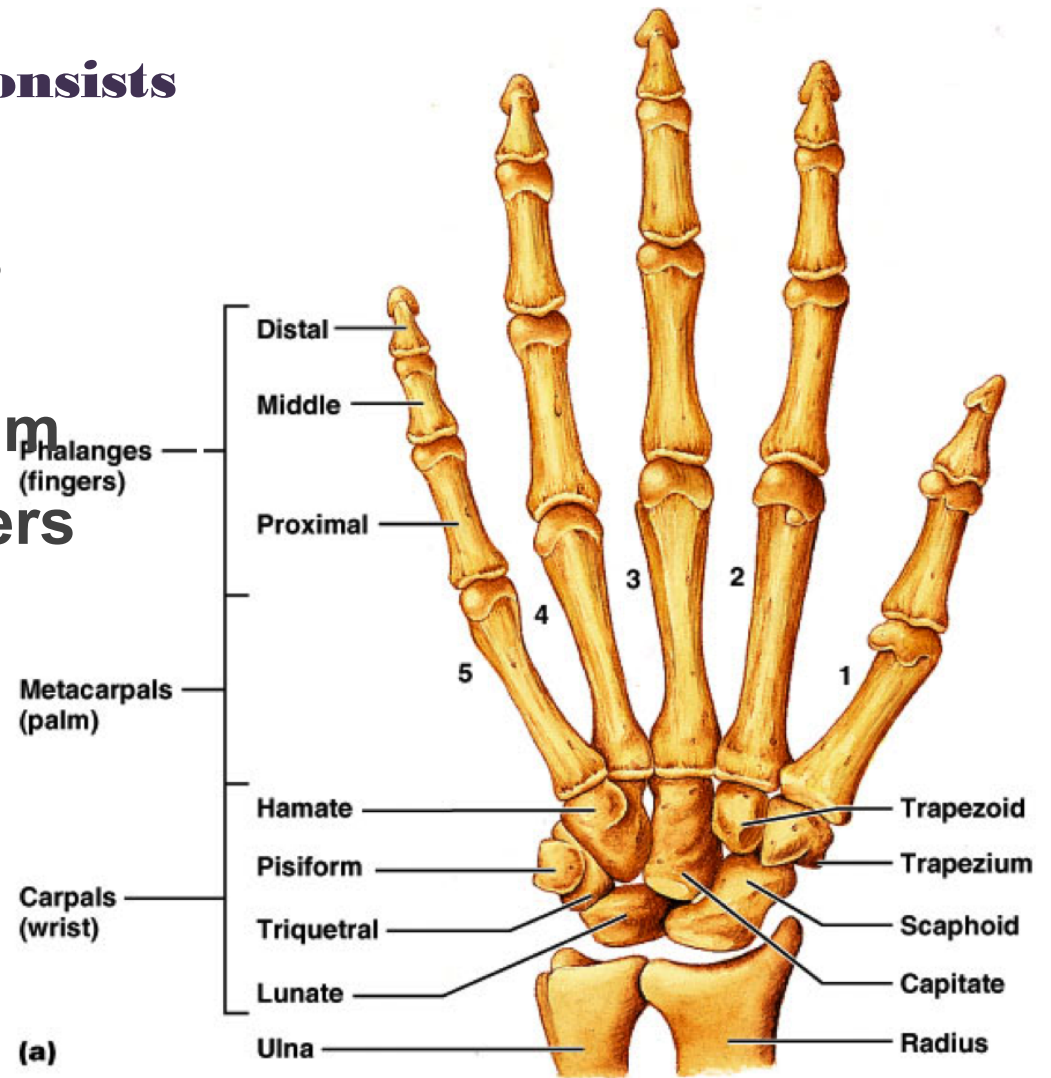
- ❑ Because the radius & ulna are firmly bound by the interosseous membrane, a fracture of one bone is commonly associated with dislocation of the nearest joint.
- ❑ Colle's fracture (fracture of the distal end of radius) is the most common fracture of the forearm.
- ❑ It is more common in women after 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

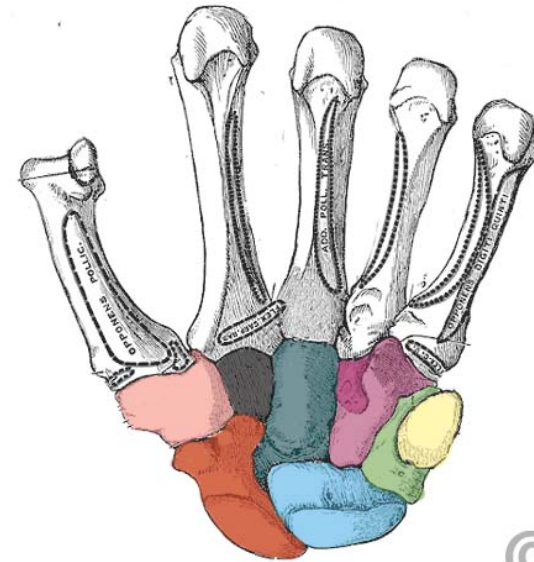
□ **The skeleton of the hand consists of the:**

- **Carpals for the carpus (wrist)**
- **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.**



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

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- **Proximal row (from lateral to medial):**

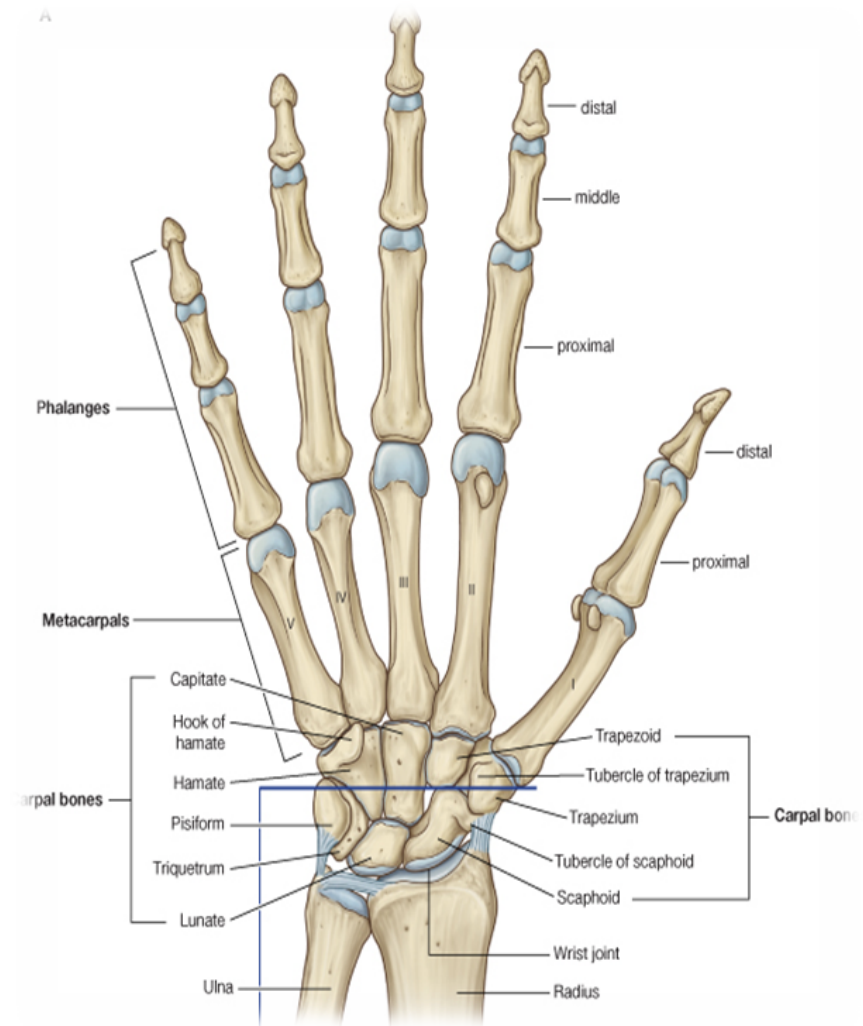
- Scaphoid
- Lunate
- Triquetrum
- Pisiform

- **Distal row (from lateral to medial):**

- Trapezium
- Trapezoid
- Capitate
- Hamate

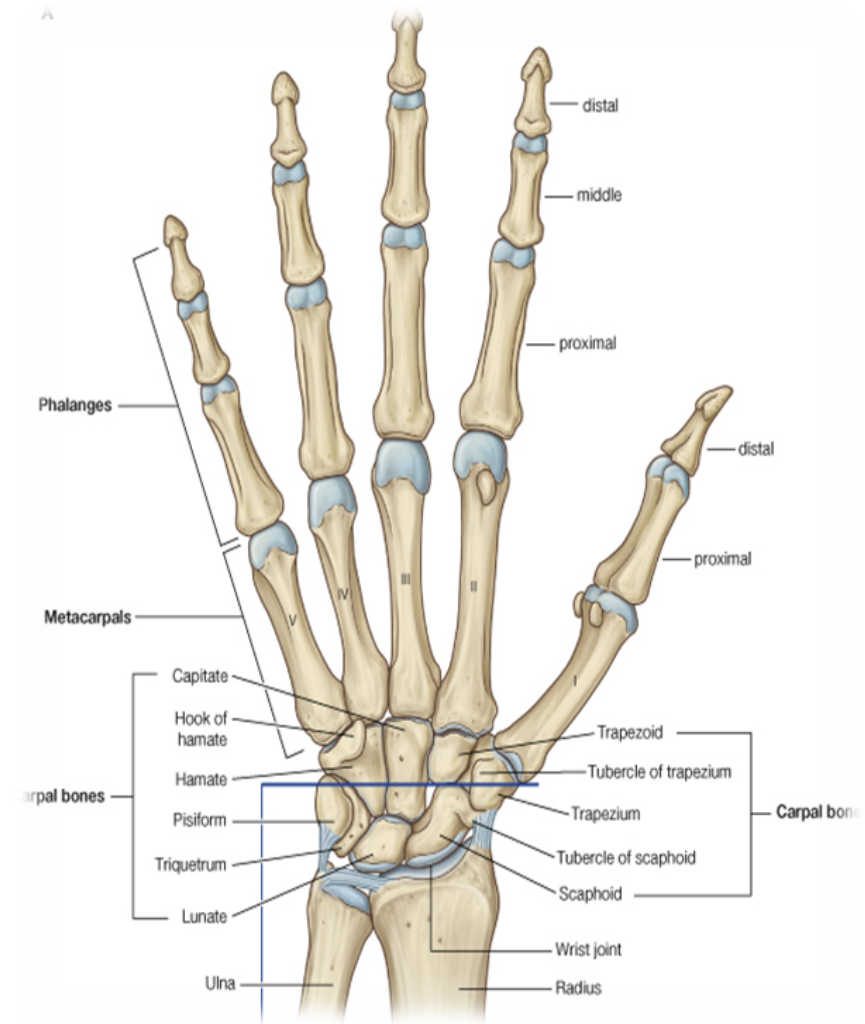
# FRACTURE OF SCAPHOID

- ❑ 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.



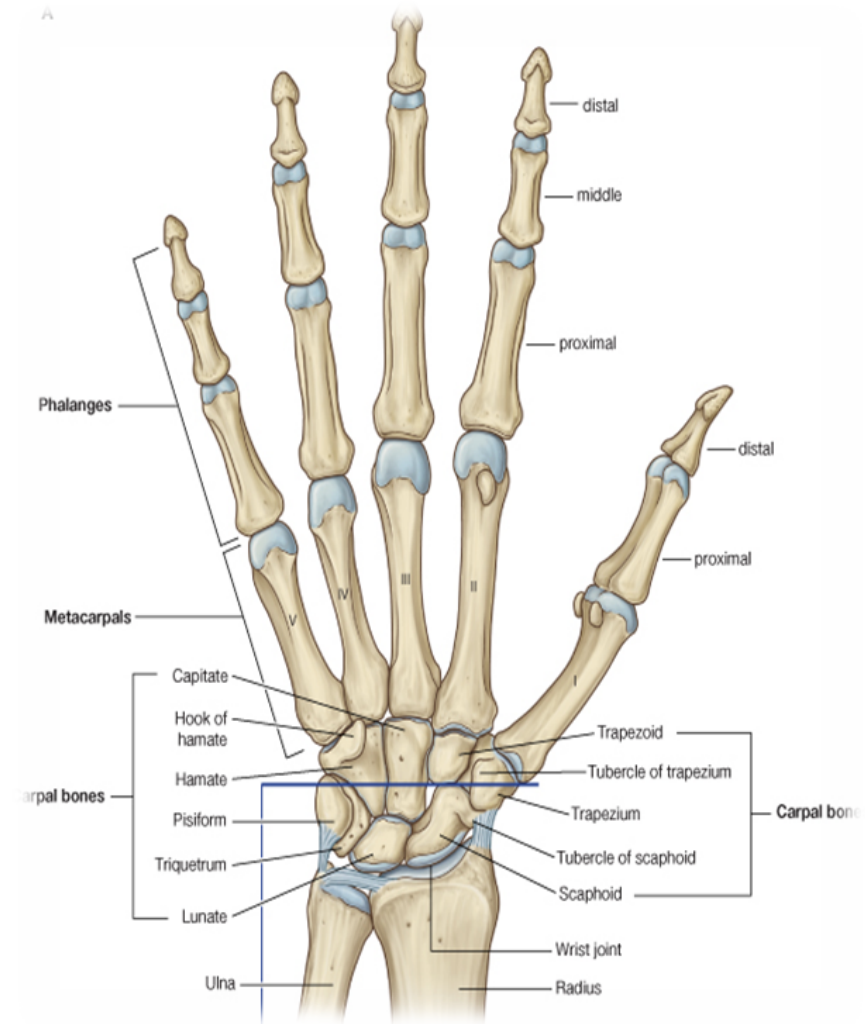
# METACARPALS

- ❑ 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)

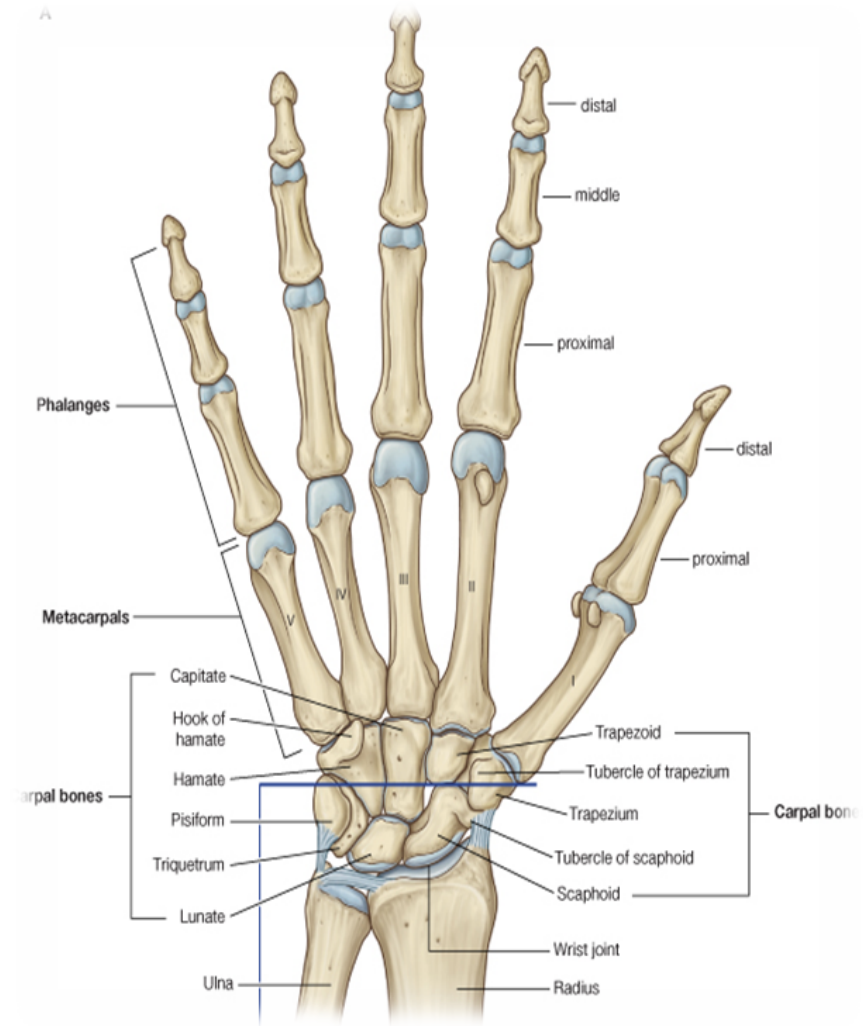
- ❑ **Each digit has Three Phalanges**
- ❑ **Except the Thumb which has only two**
- ❑ **Each phalanx has a base proximally, a head distally and a body between the base and the head.**
- ❑ **The proximal phalanx is the largest.**
- ❑ **The middle ones are intermediate in size.**
- ❑ **The distal ones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



**QUESTIONS?**