# BONES OF THE UPPER LIMB

Khaleel Alyahya, PhD, MEd
King Saud University
College of Medicine
@khaleelya

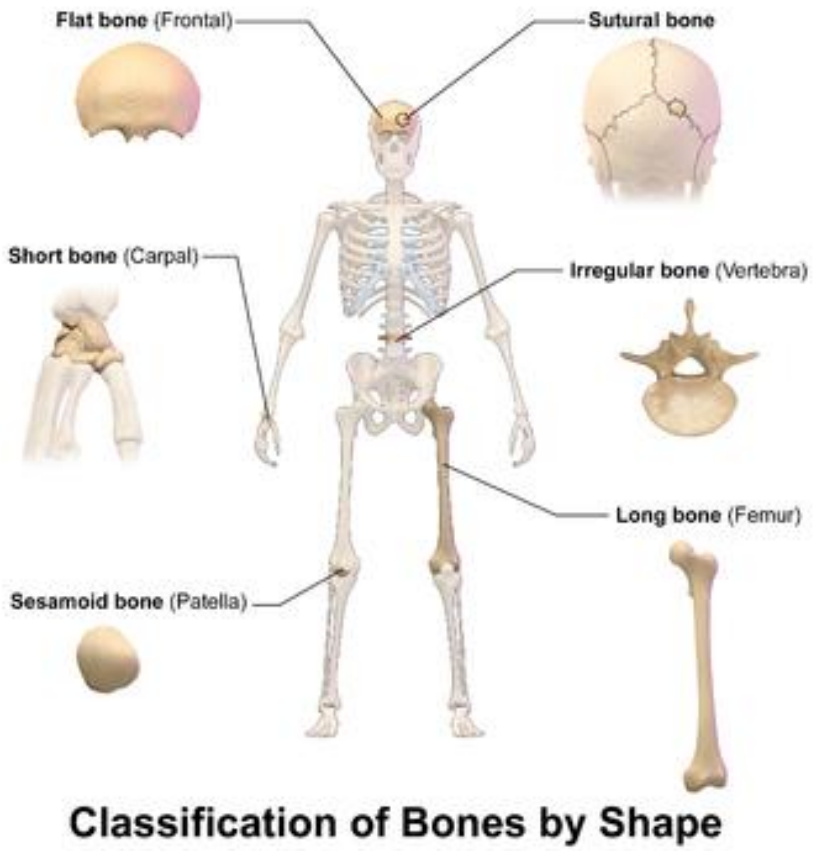
# OBJECTIVES

***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

- ***Bones support and protect the various organs of the body.***
- ***Produce red and white blood cells.***
- ***Store minerals.***
- ***Enable movement.***
- ***Provides attachment for muscles.***
- ***Come in a variety of shapes and sizes.***
- ***There are five types of bones in the human body:***
  - *Long bones (limbs and fingers)*
  - *Short bones (wrist and ankles)*
  - *Flat bones (skull and sternum)*
  - *Irregular bones (spine and pelvis)*
  - *Sesamoid bones (patella)*

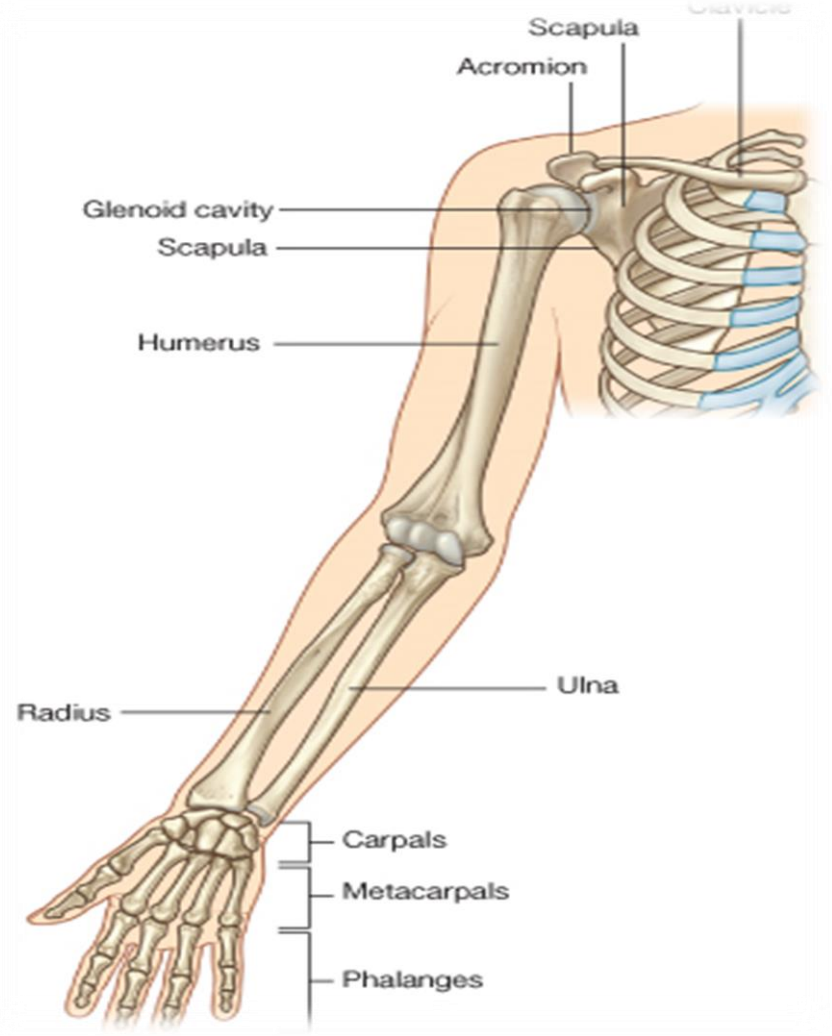


Classification of Bones by Shape

# BONES OF UPPER LIMB

*It consists of the following:*

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

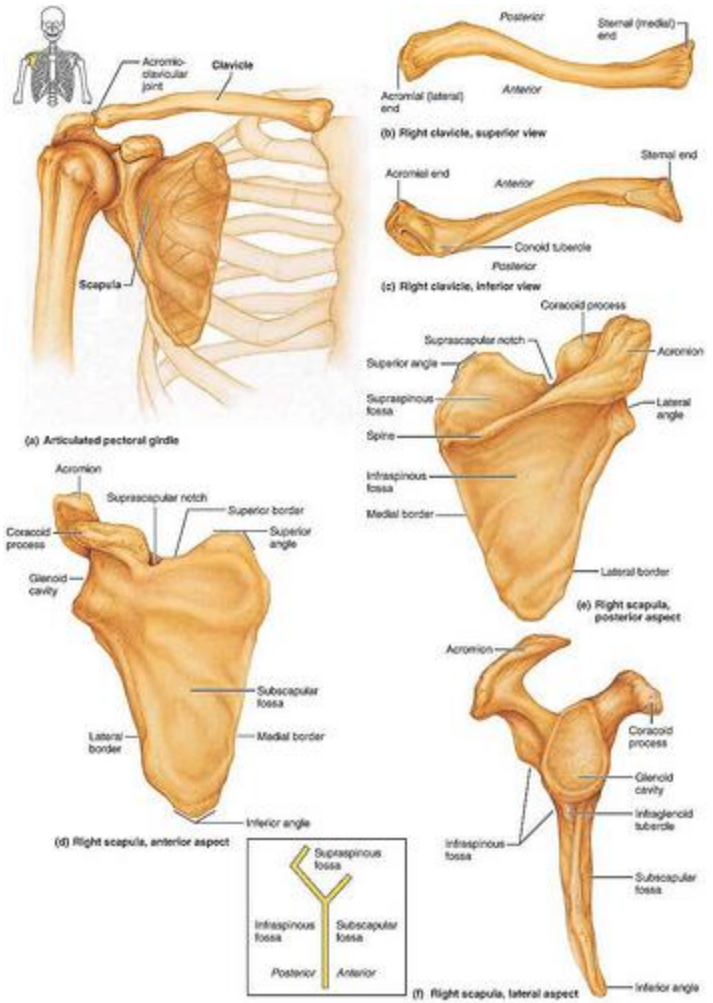


# PECTORAL GIRDLE

*It composed of Two bones:*

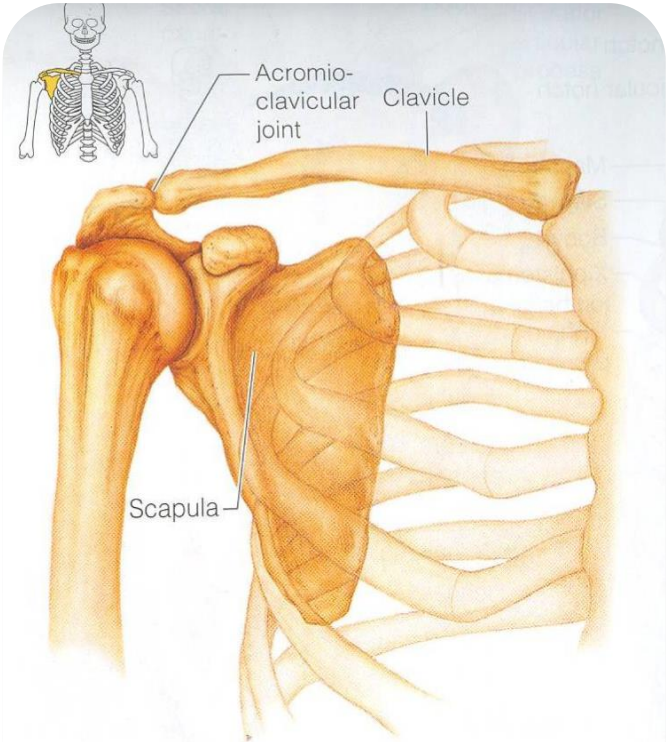
- *Clavicle*
- *Scapula*

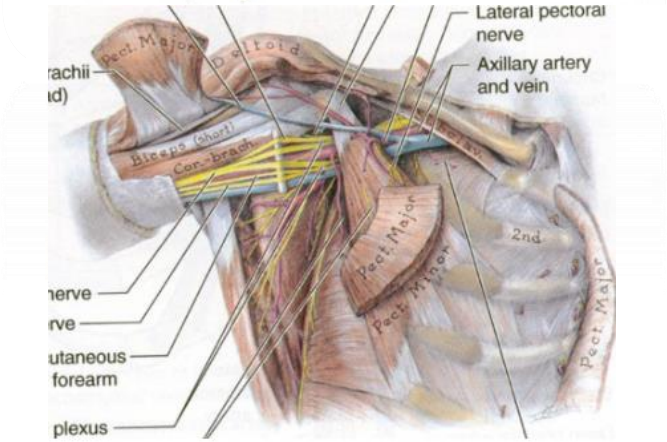
*It is very light and it allows the upper limb to have exceptionally free movement.*



# CLAVICLE

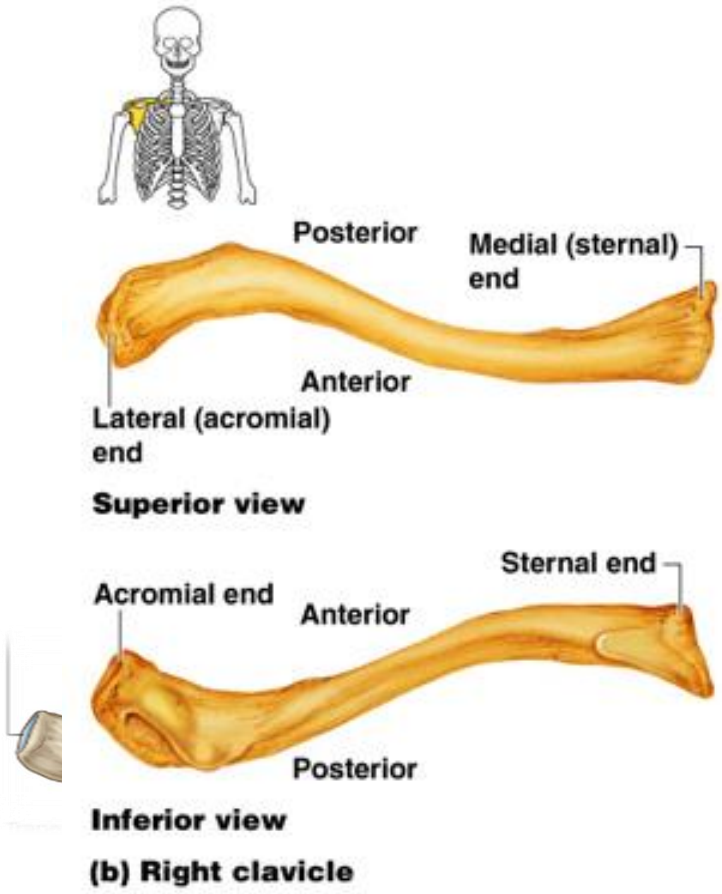
- **It is a long bone lying horizontally across the root of the neck**
- **It is subcutaneous throughout its length.**
- **Functions:**
  - It serves as a rigid support from which the scapula and free upper limb are suspended keeping them away from the trunk, so that the arm has maximum freedom of movement.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



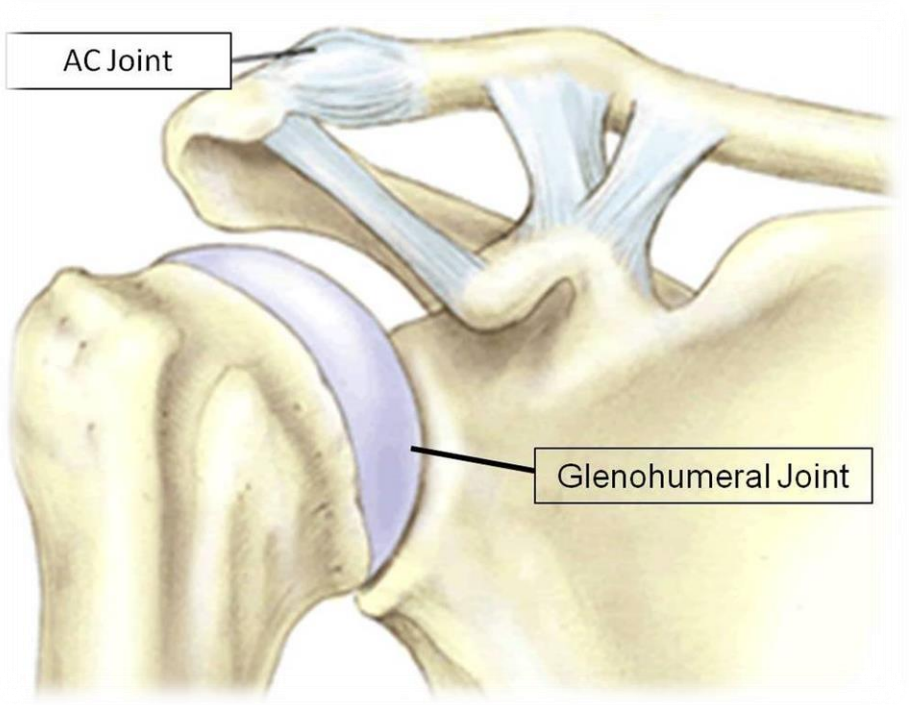
# CLAVICLE

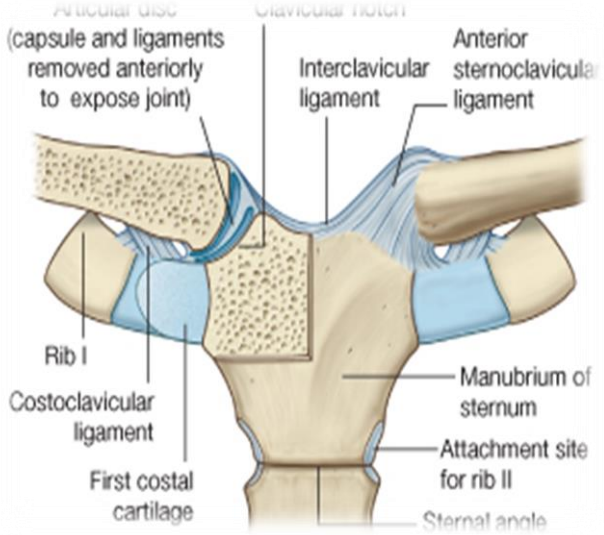
- **It is considered as a long bone but it has no medullary (bone marrow) cavity.**
- **Its medial (Sternal) end is enlarged & triangular.**
- **Its lateral (Acromial) end is flattened.**
- **The medial 2/3 of the body (shaft) is convex forward.**
- **The lateral 1/3 is concave forward.**
- **These curves 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

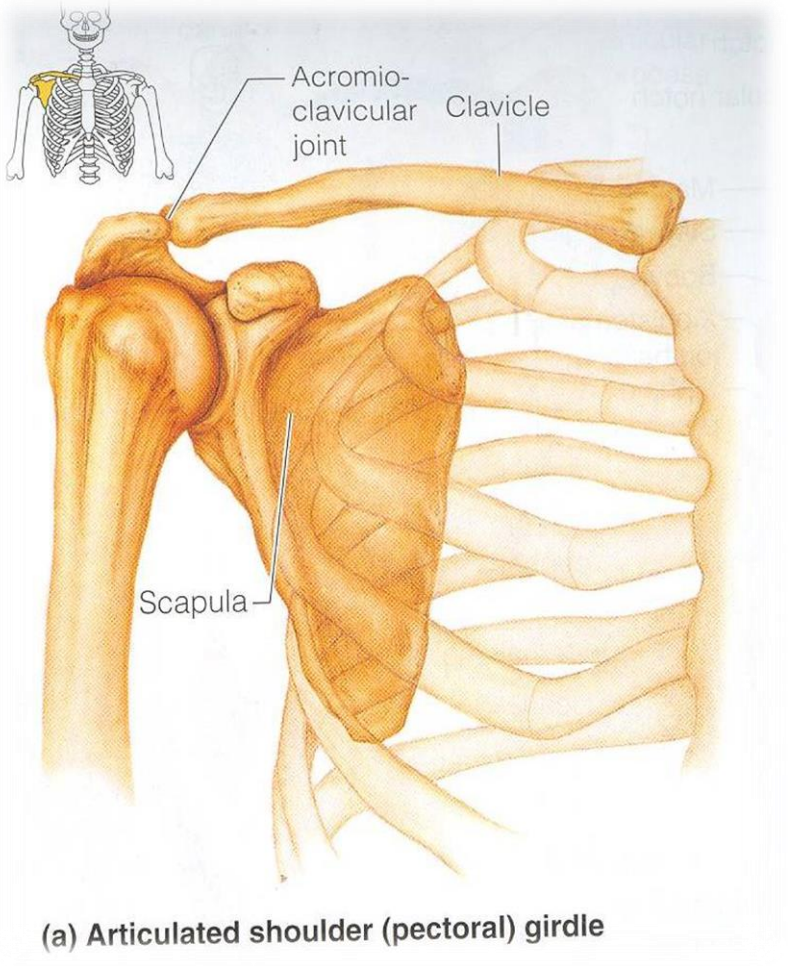
- Medially, sternoclavicular joint
  - with the Manubrium
- Laterally, Acromioclavicular joint
  - with the Acromial end of the scapula
- Inferiorly, costoclavicular Joint
  - with the 1st rib



# 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

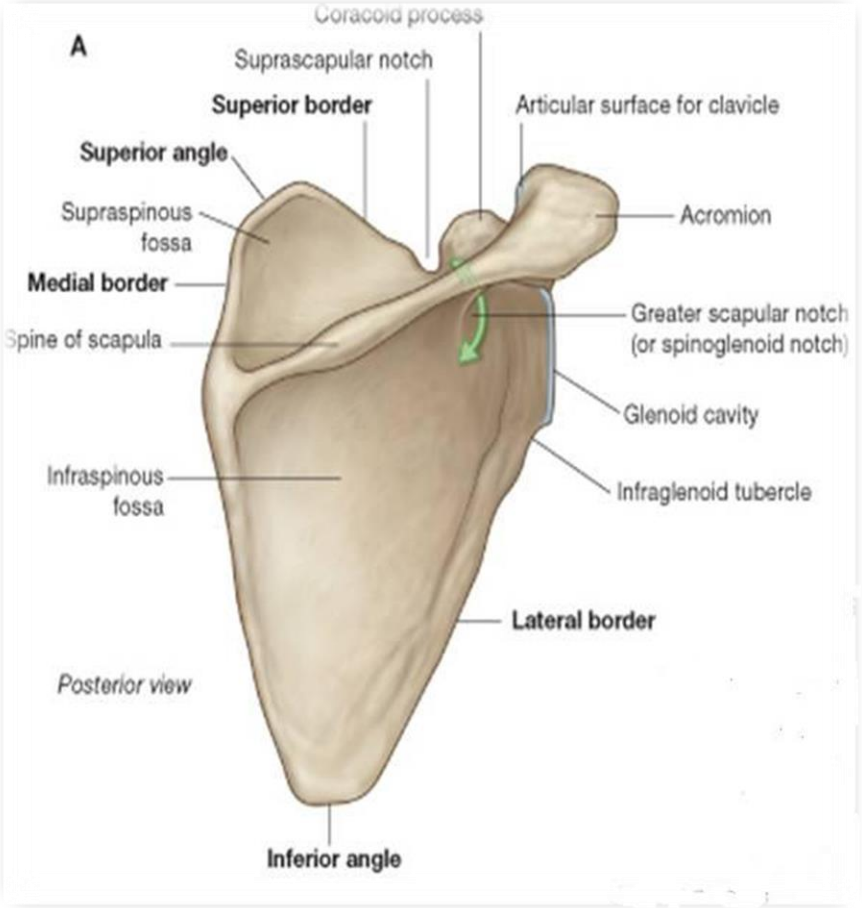
# SCAPULA

**It is a triangular flat bone.**

**Extends between the 2nd to 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.**



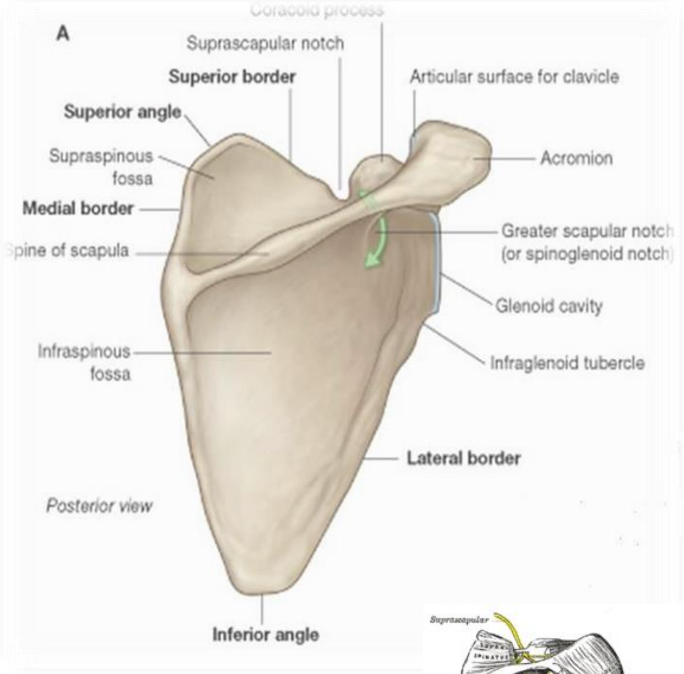
# SCAPULA

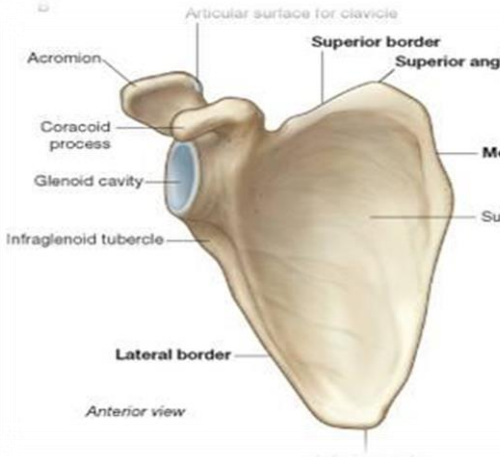
## Three Angles :

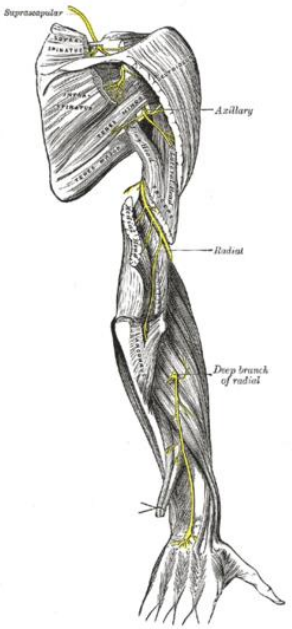
- Superior
- Inferior
- Lateral
  - forms the Glenoid cavity: a shallow concave oval fossa that receives the head of the humerus.

## 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: Anterio (Costal) Surface , it forms the large Subscapular Fossa.
- Suprascapular notch: It is a nerve passageway, medial to coracoid process.
  - Suprascapular nerve

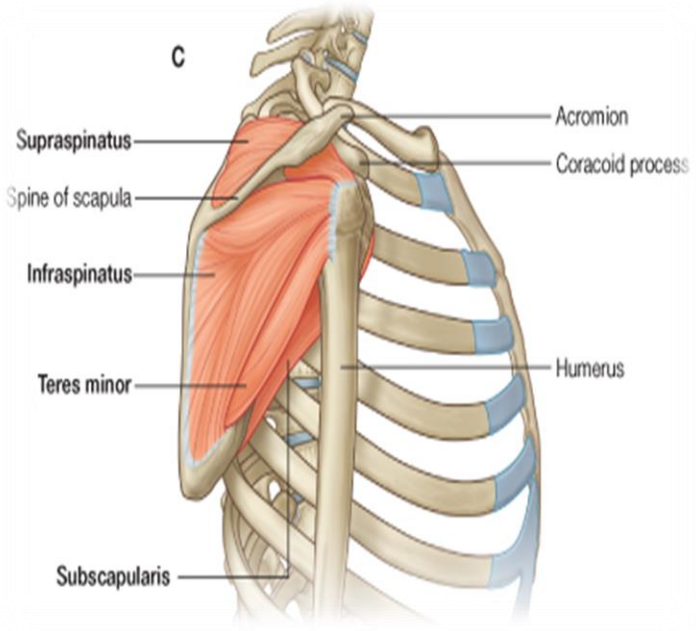


# FUNCTIONS OF SCAPULA

- **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.**

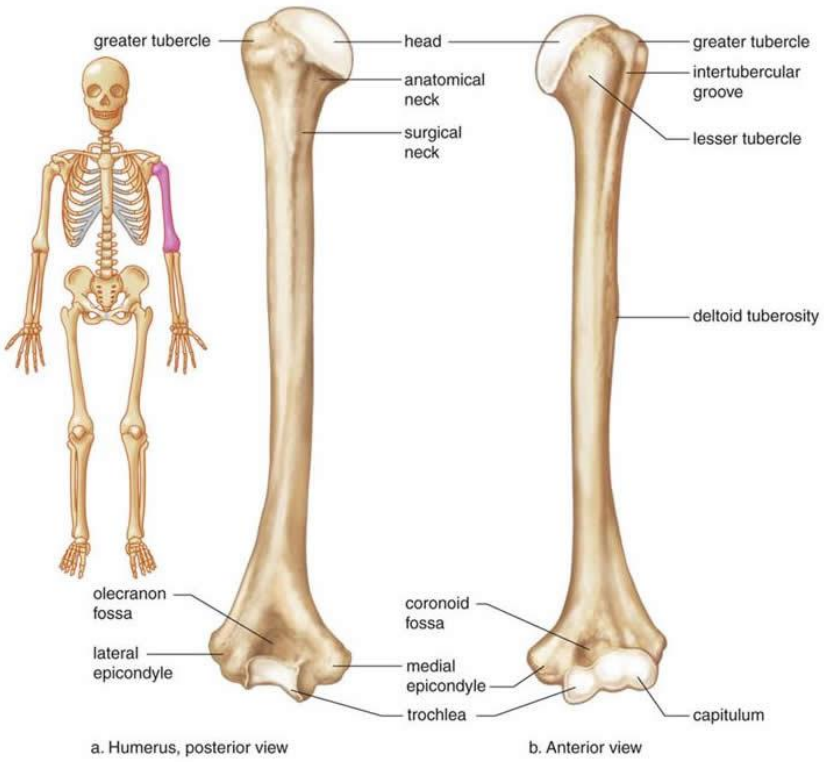


# ARM (HUMERUS)

**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.**

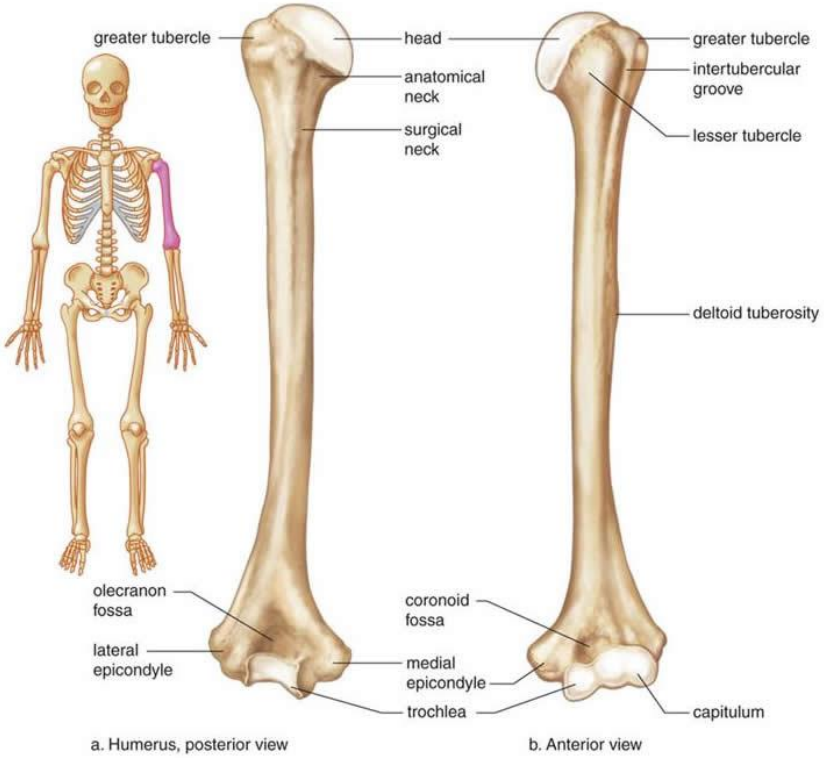


# ARM (HUMERUS)

## Shaft (Body):

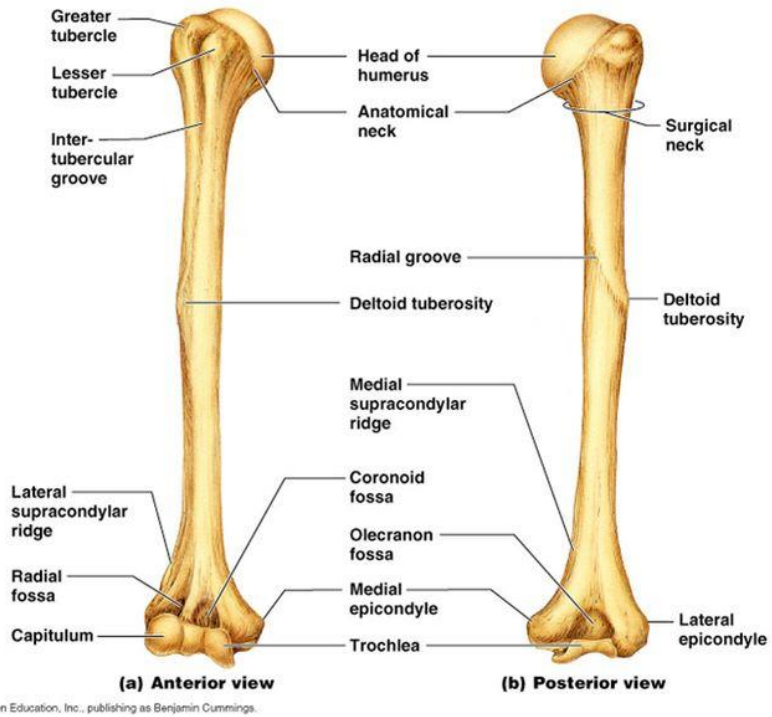
- it has two prominent features:

- **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.



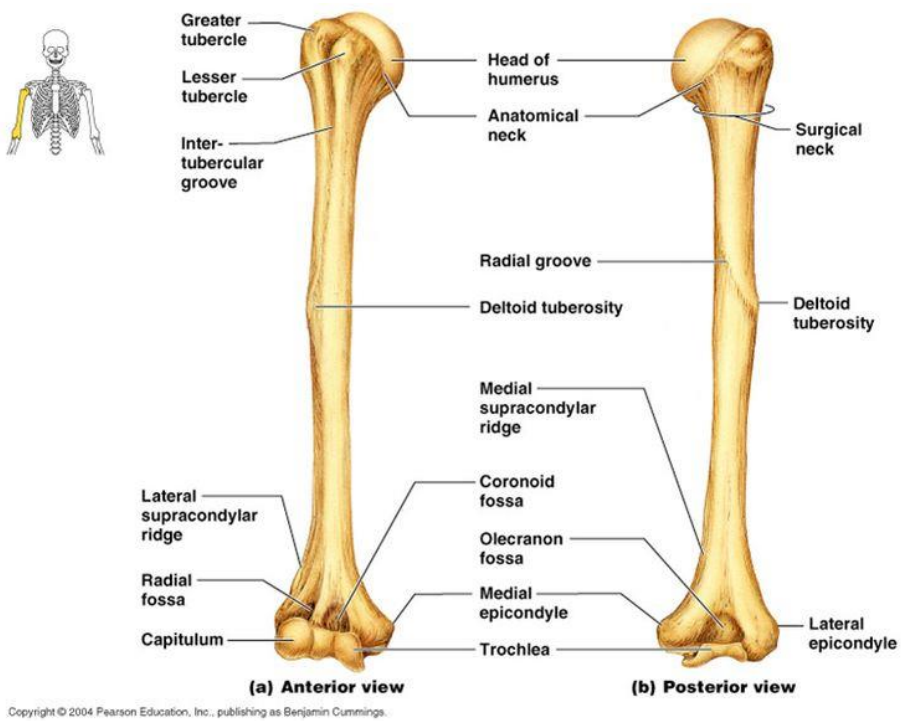
# ARM (HUMERUS)

- **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).



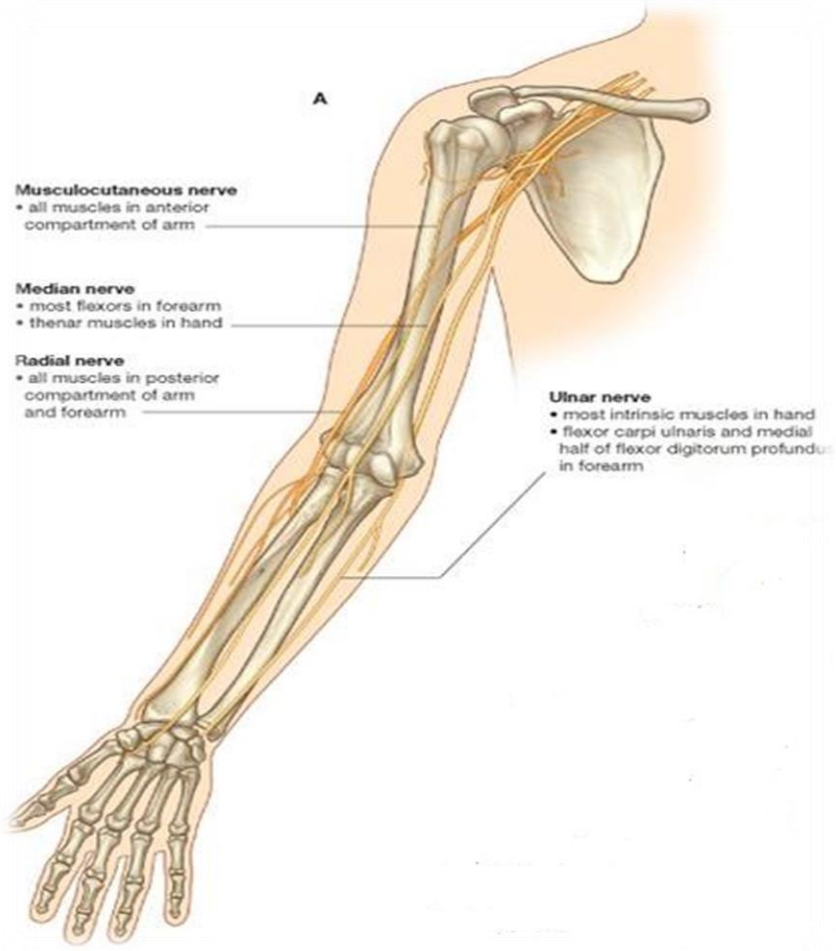
# FRACTURES OF HUMERUS

- **Most common fractures of the surgical neck especially in elder people with osteoporosis.**
- **The fracture results from falling on the hand (transmittion 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 oustretched hand.**



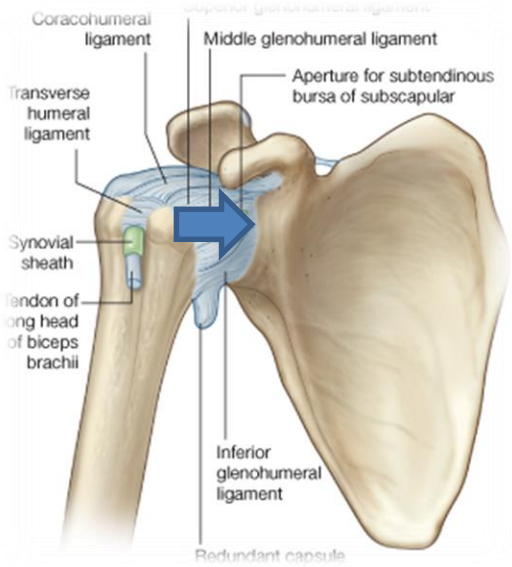
# NERVES AFFECTED IN FRACTURES OF HUMERUS

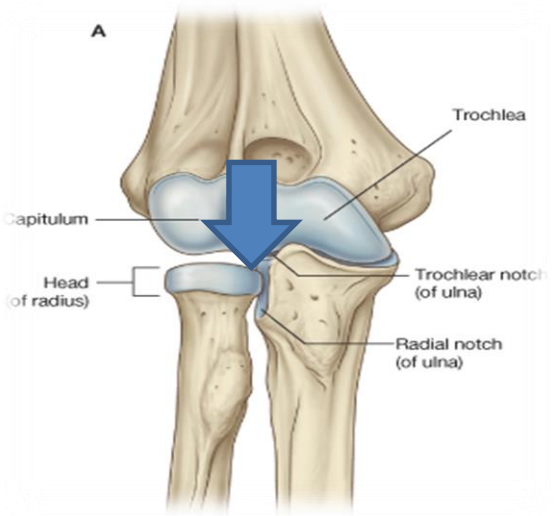
- **Surgical neck:** Axillary nerve
- **Radial groove:** Radial nerve
- **Distal end of humerus:** Median nerve
- **Medial epicondyle:** Ulnar nerve



# 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.**

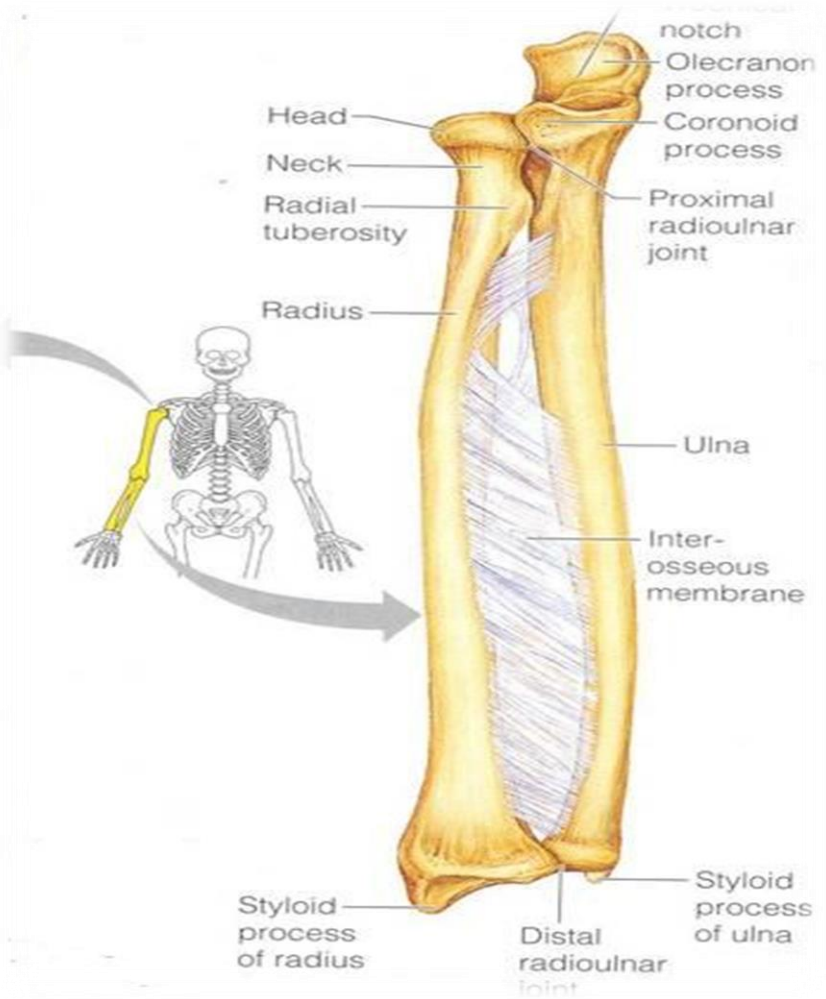


# FOREARM

**Formed of two bones:**

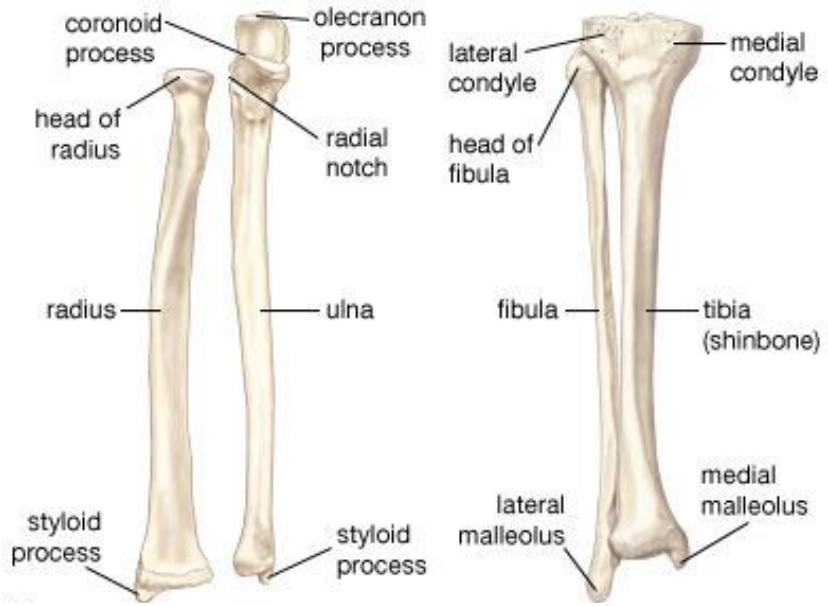
- **The Radius is the lateral bone.**
- **The Ulna is the medial bone.**

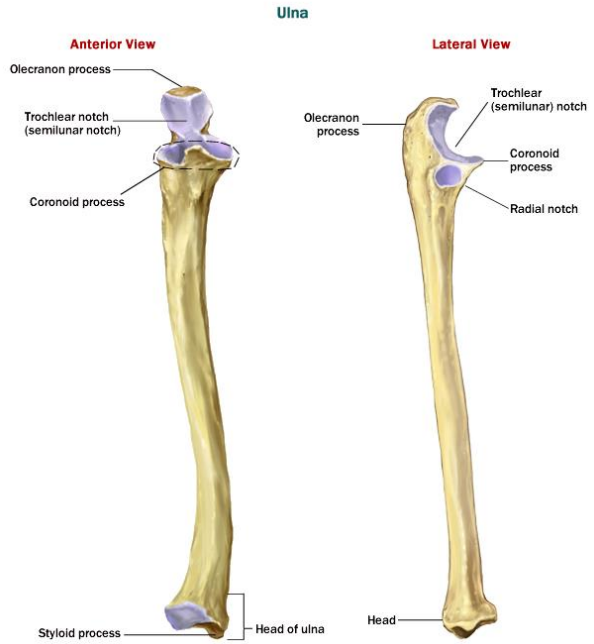


# ULNA

- 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.

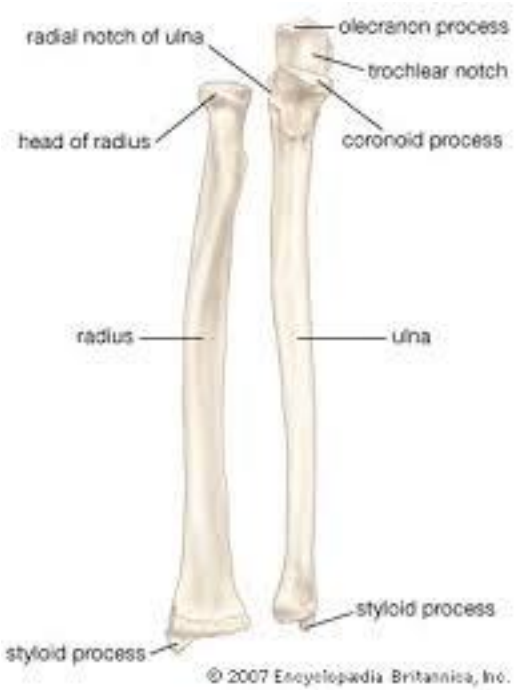


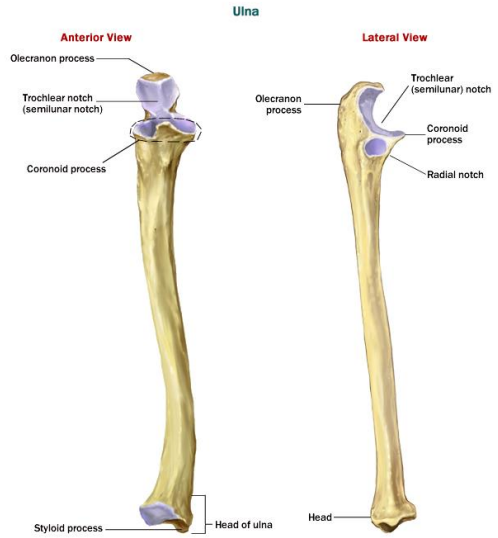



# ULNA

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

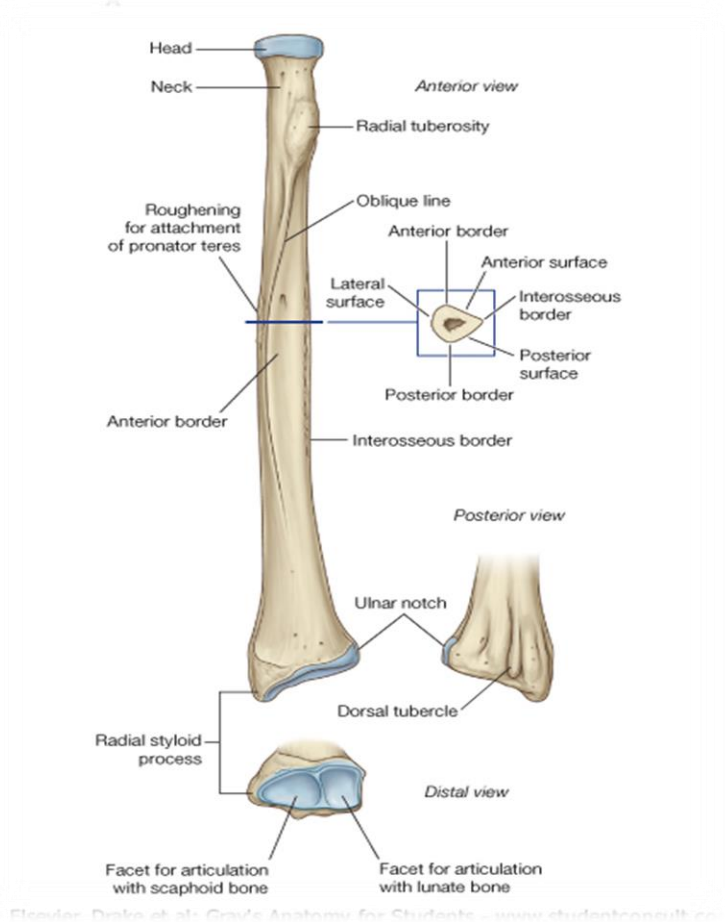
- **Distal end:**
- Small rounded Head: Styloid process
- The head lies distally at the wrist.
- The articulations between the ulna & humerus at the elbow joint allows primarily only flexion & extension (small amount of abduction & adduction occurs).



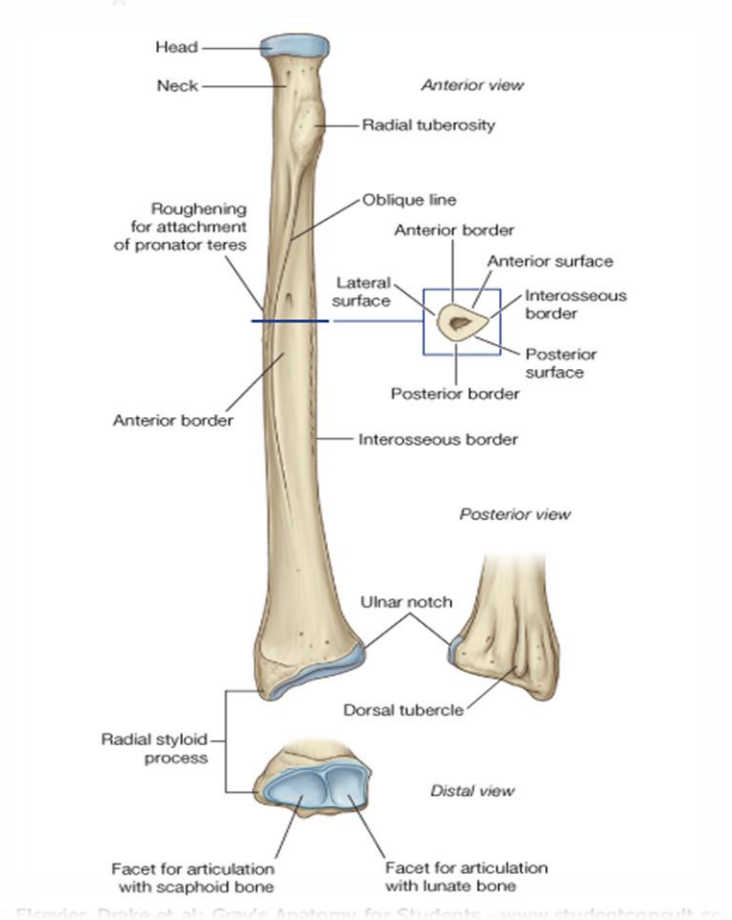
# RADIUS

- **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 (Biciptal) Tuberosity: medially directed and separates the proximal end from the body.**



# RADIUS

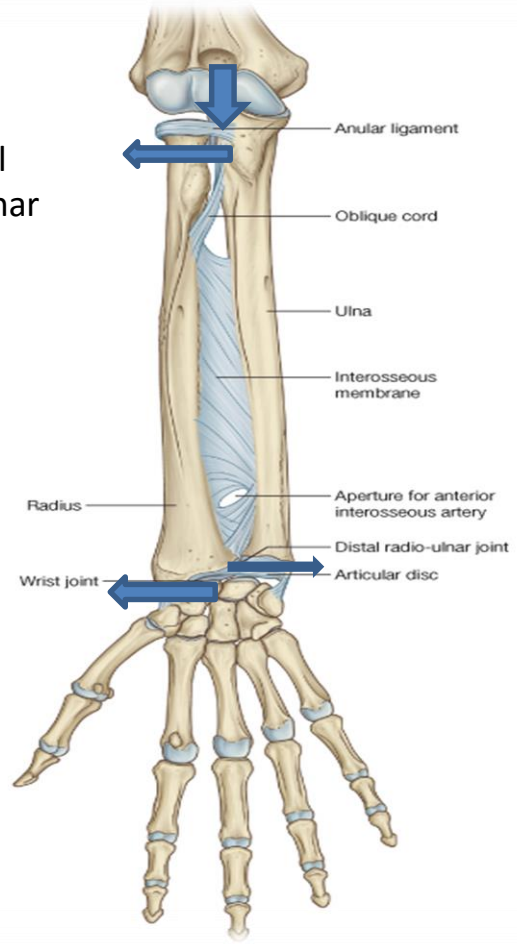
- **Shaft:**
  - **Has a lateral convexity.**
  - **It gradually enlarges as it passes distally.**
- **Distal (Lower) End:**
  - **It is rectangular.**
  - **Its medial aspect forms a concavity : Ulnar notch to accommodate the head of the ulna.**
  - **Radial Styloid process: extends from the lateral aspect.**
  - **Dorsal tubercle: projects dorsally.**



# ARTICULATIONS OF RADIUS & ULNA

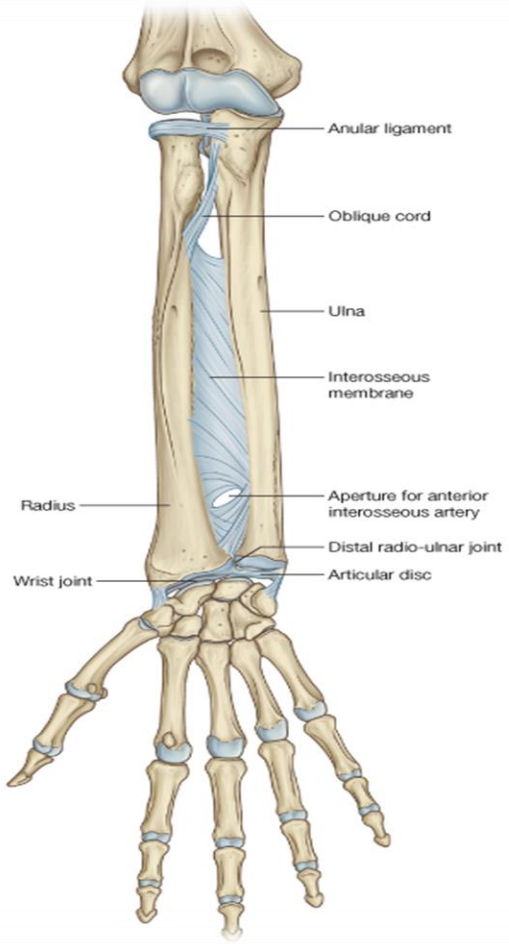
- Distal end of Humerus with the proximal ends of Radius & Ulna **Elbow joint**
- Proximal **Radioulnar joint**
- Distal **Radioulnar joint**
- The two bones are connected by the flexible **interosseous membrane**

Proximal Radioulnar joint.



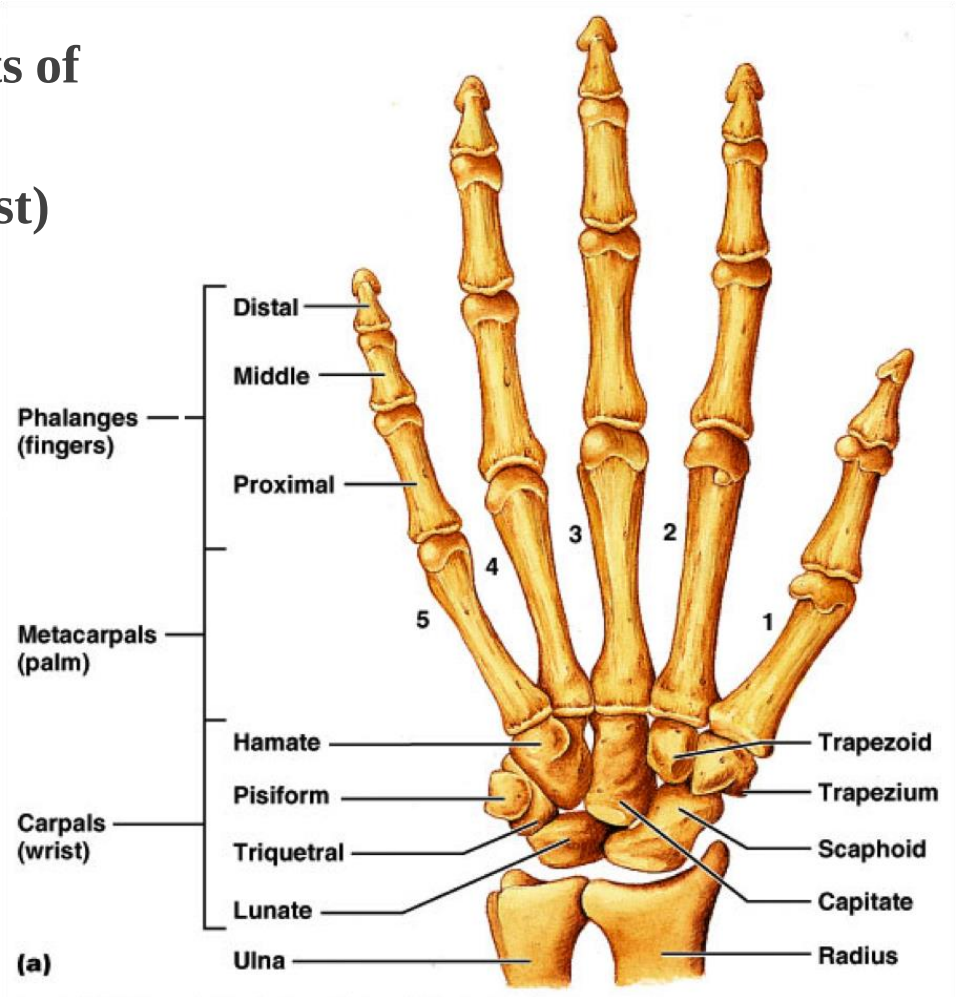
# FRACTURES OF RADIUS & ULNA

- **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.**



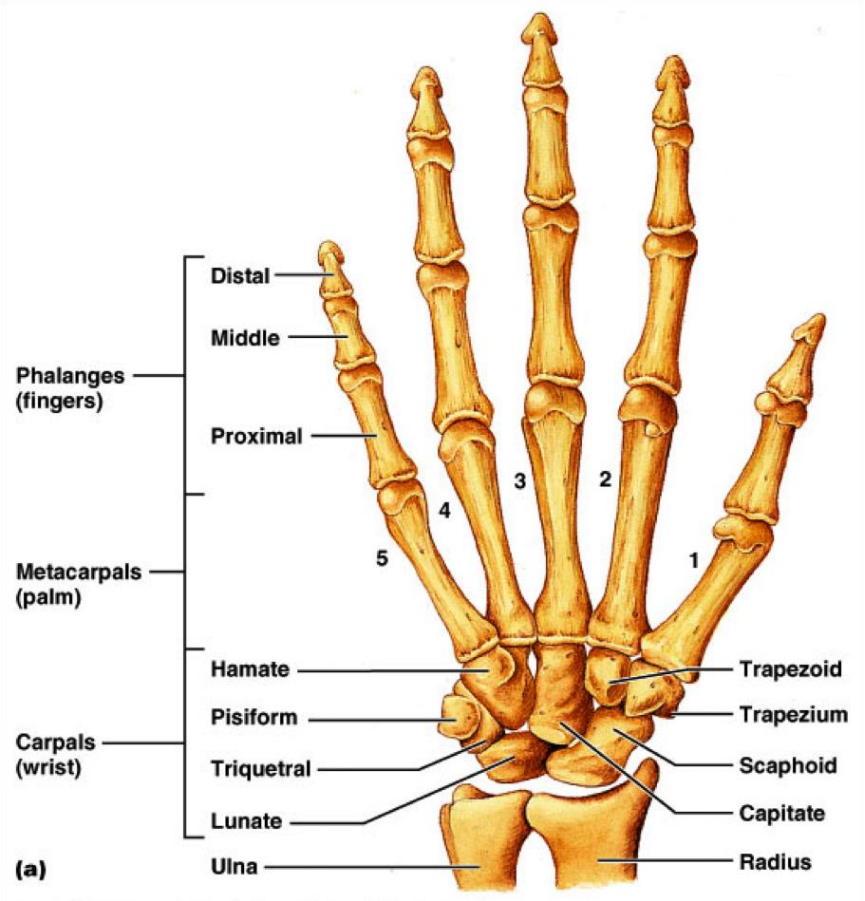
# HANDS

- **The skeleton of the hand consists of the:**
  - **Carpals  for the carpus (wrist)**
  - **Metacarpals for the palm**
  - **Phalanges for the fingers**



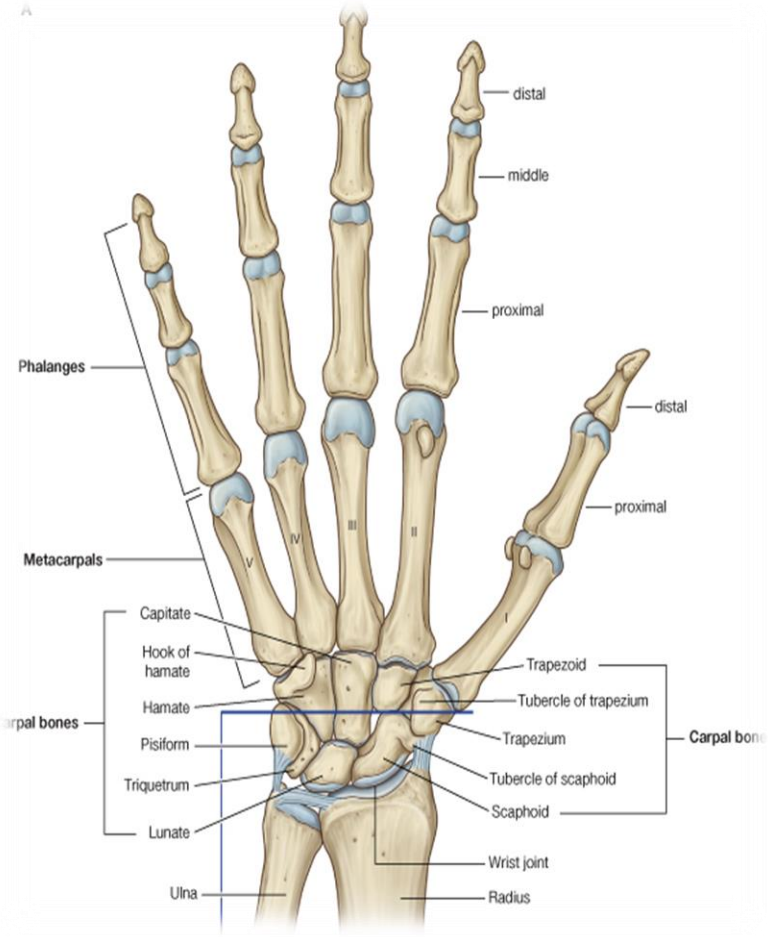
# WRIST (CARPUS)

- 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.
- **Proximal row (from lateral to medial):**
  - Scaphoid
  - Lunate
  - Triquetral
  - Pisiform
- **Distal row (from lateral to medial):**
  - Trapezium
  - Trapezoid
  - Capitate
  - Hamate



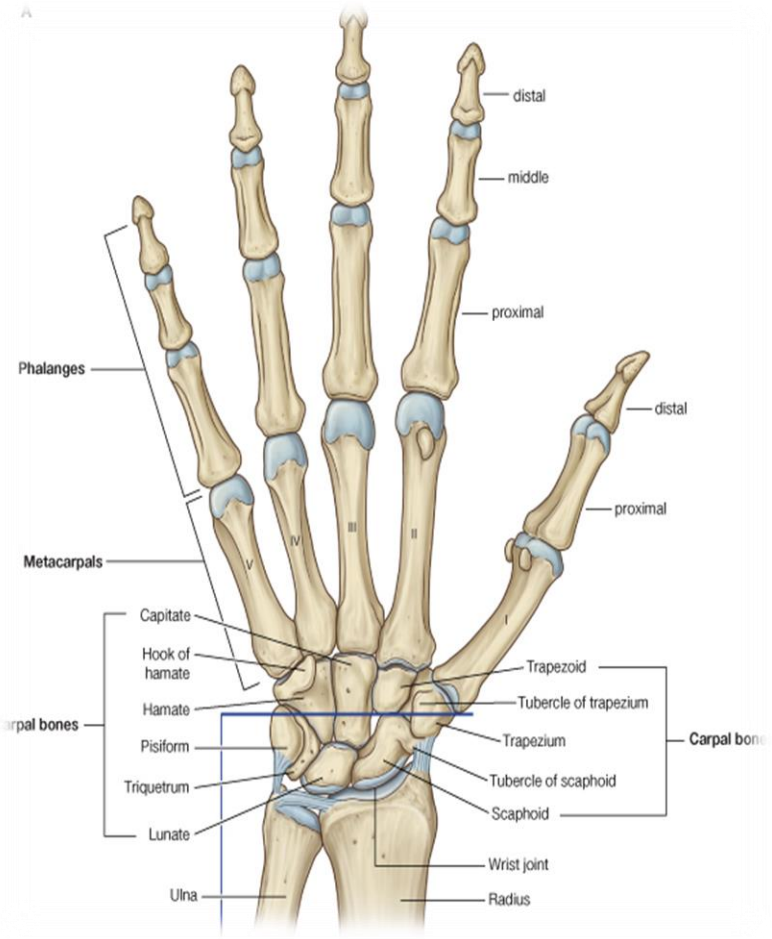
# FRACTURE OF SCAPHOID

- 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.



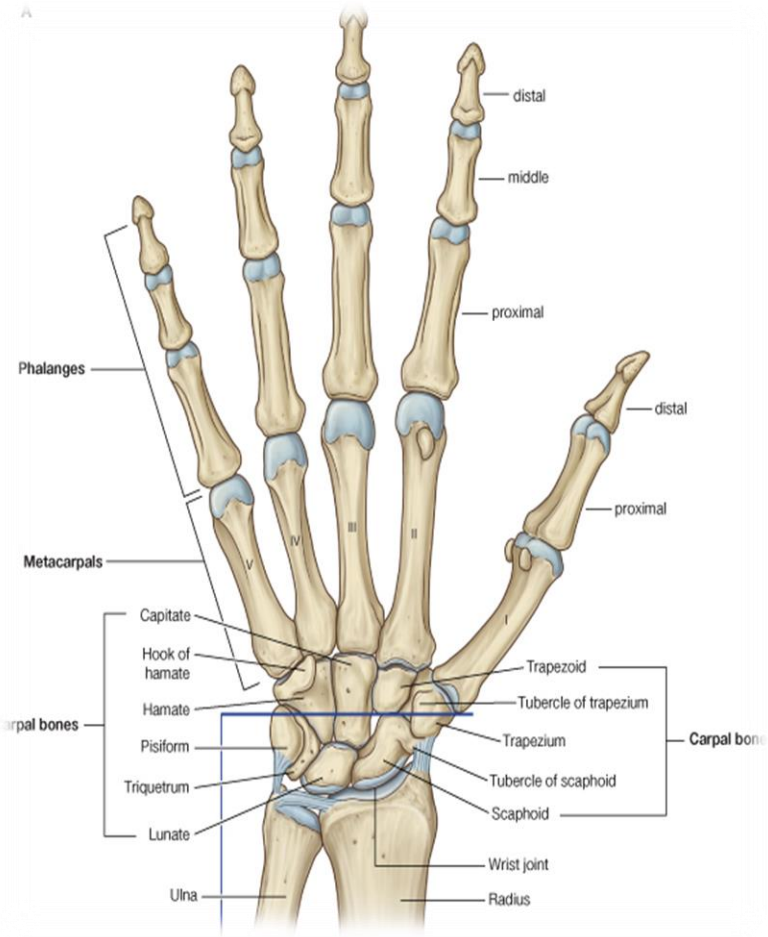
# METACARPALS

- 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.



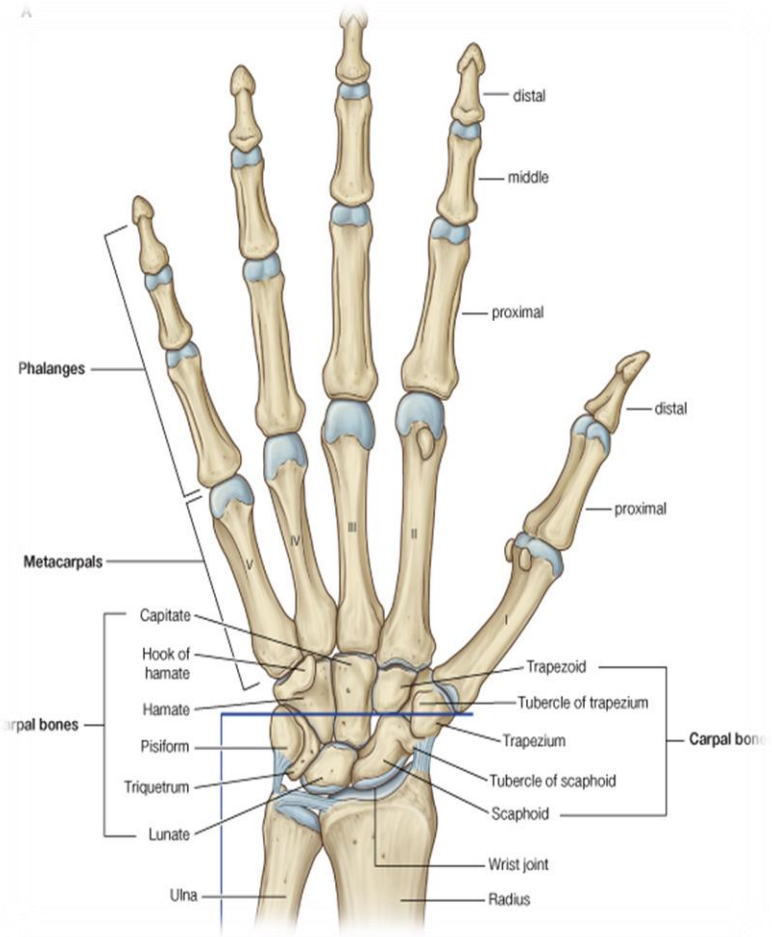
# DIGITS (PHALANGES)

- 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 Raw of Carpal bones
  - Wrist joint



# QUESTION?