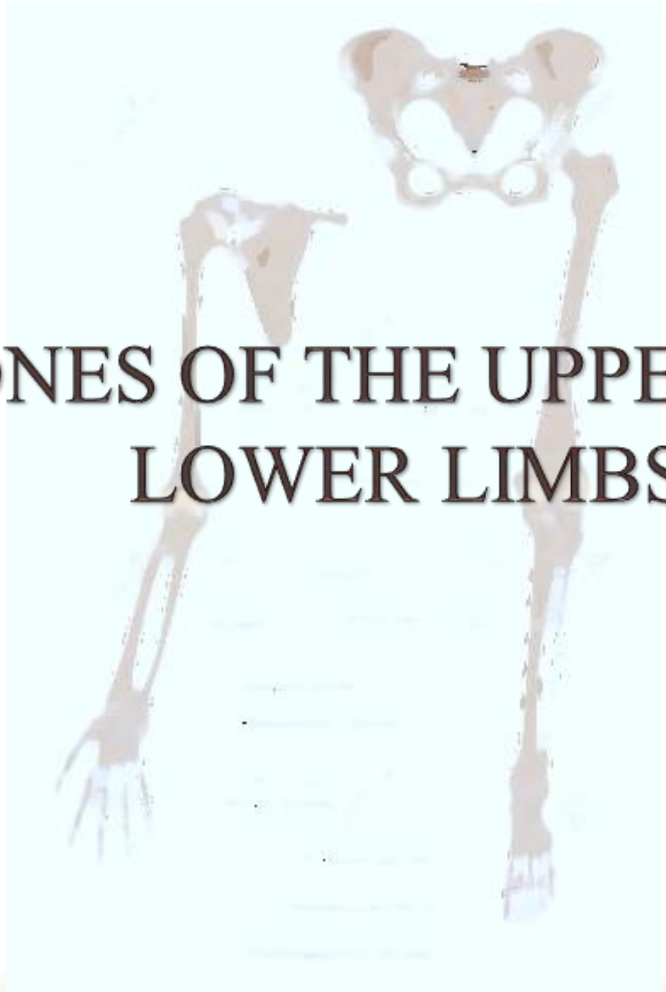


BONES OF THE UPPER AND LOWER LIMBS

DR. ZAHID KAIMKHANI
MD.M.Phil.PhD

OBJECTIVES

At the end of the discussion we should be able to:

@ List and identify the different bones of the upper and lower limbs in a skeleton/radiograph and other imaging techniques.

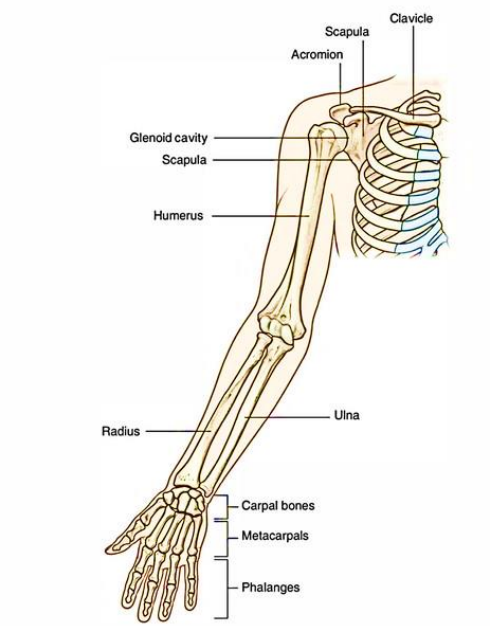
@ Identify the salient features of bones of the upper and lower limbs .

@ Differentiate between bones of right and left sides.

@ List the articulations between the different bones.

@ Clinical significances associated with the upper and lower limbs

BONES OF UPPER LIMB



Bones of upper Limb

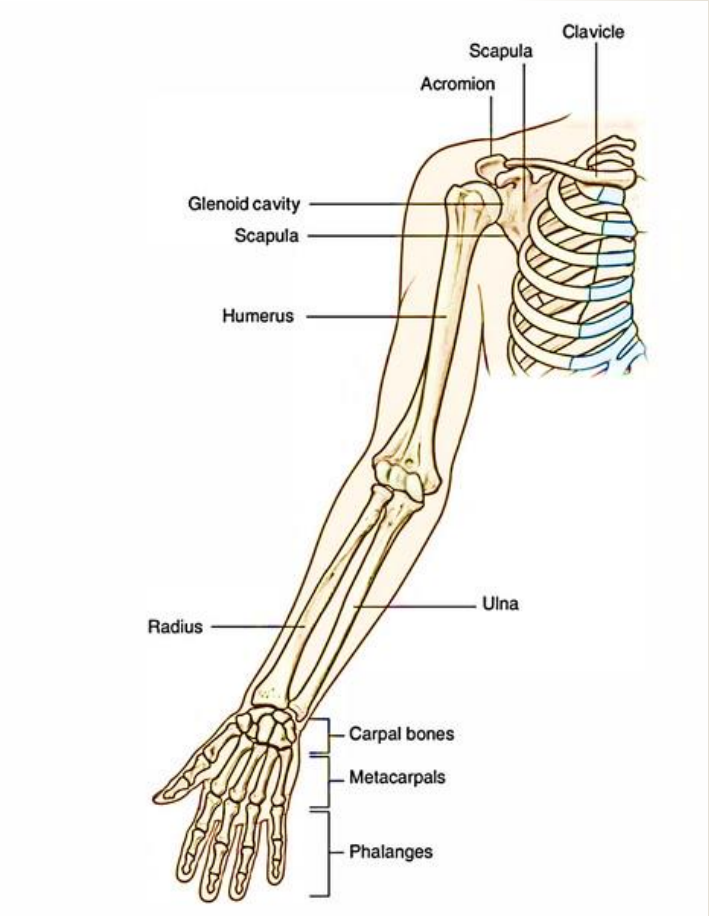
Pectoral Girdle
- •Clavicle
- •Scapula

Arm
- •Humerus

Forearm
- •Radius & Ulna

Wrist
- •Carpal bones

Hand
- •Metacarpals & Phalanges



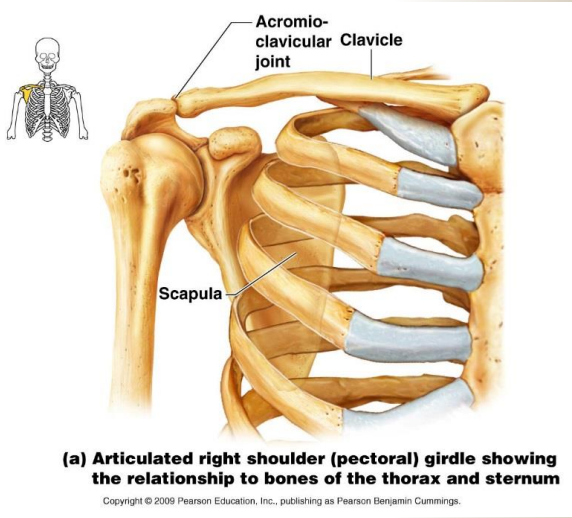
PECTORAL GIRDLE

Pectoral Girdle (Encircling)

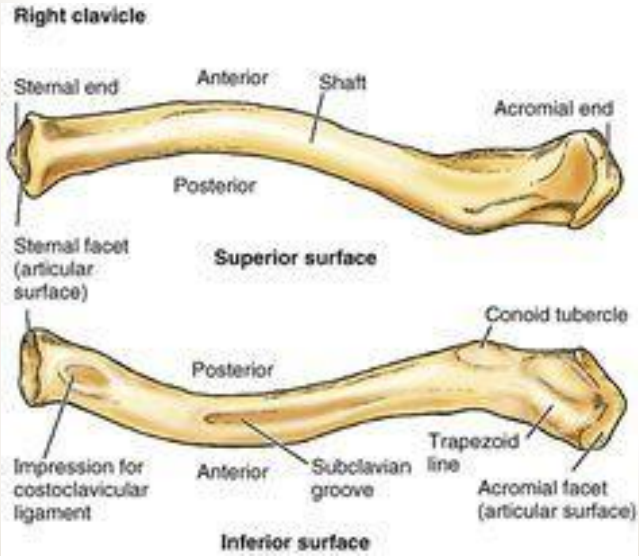
- Clavicle
- Scapula

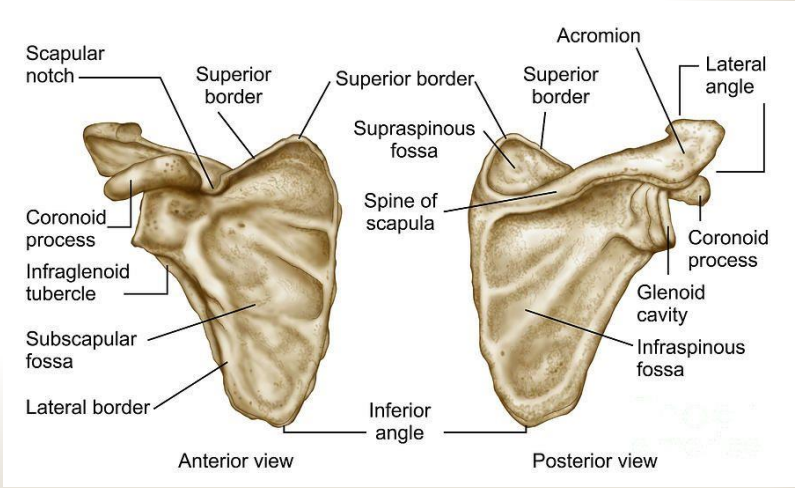
P

Allows the upper limb to have exceptionally free movement.



(a) Articulated right shoulder (pectoral) girdle showing the relationship to bones of the thorax and sternum





CLAVICLE (Collar Bone)

A long bone with some unusual features

Two Ends

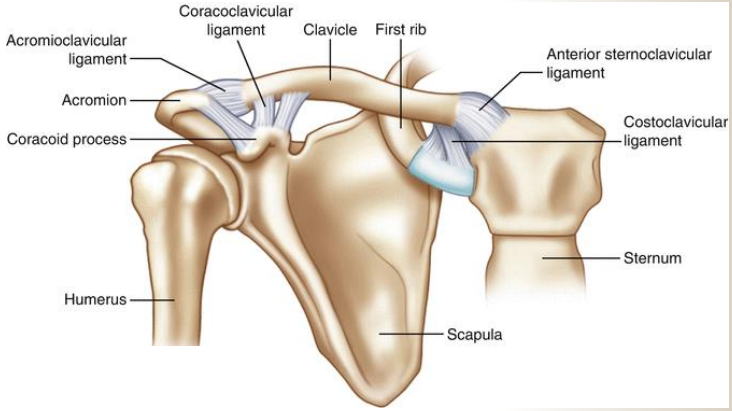
WHY the medial 2/3 of the body (shaft) is convex forward.

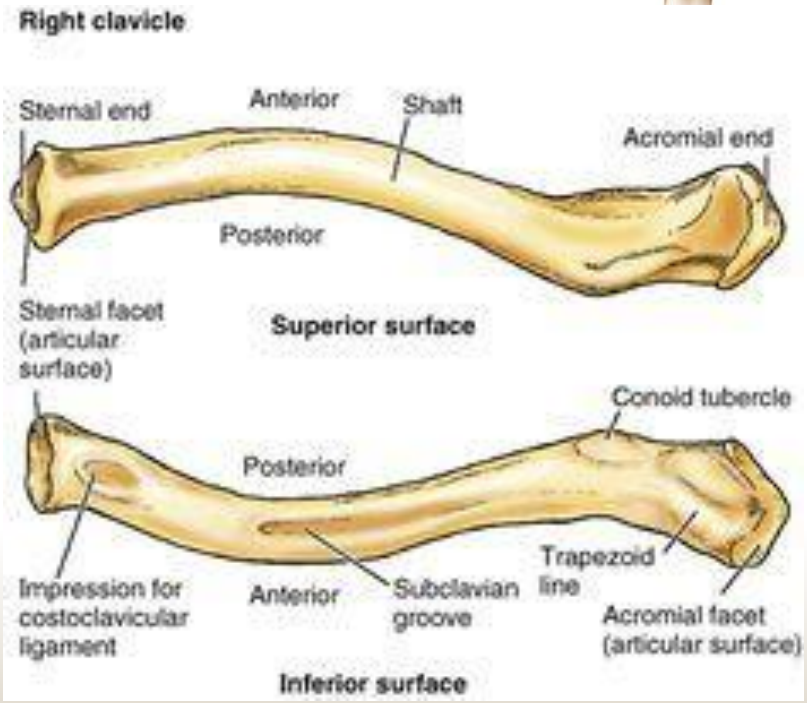
Two Surfaces

Functions:

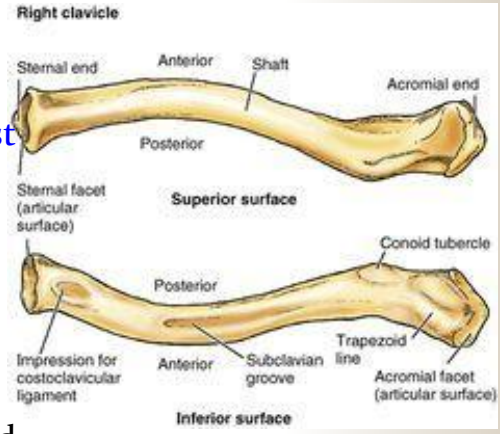
Articulations:

Weakest point





CLAVICLE (Collar Bone)



A long bone with some unusual features

- ✓ It has no medullary (bone marrow)cavity.
- ✓ It is the first one to ossify in the fetus (5^{th}-6^{th} week) and last one to complete
- ✓ It develops in membrane (not in cartilage)
- ✓ Most commonly fractures bone in the body.

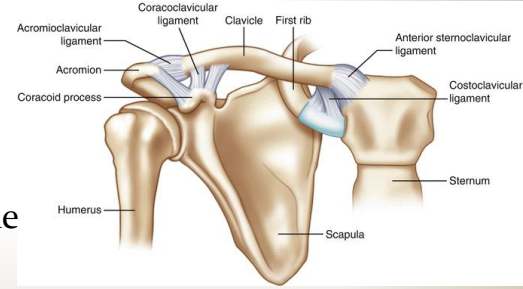
Two Ends

- Its medial(Sternal) end is enlarged & triangular.
- Its lateral (Acromial)end is flattened.

- The medial 2/3 of the body (shaft) is convex forward (**WHY?**)and the lateral 1/3 is concave forward.

Two Surfaces

Superior: smooth (Subcutaneous).
Inferior: rough because strong ligaments bind it to the 1^{st} rib.



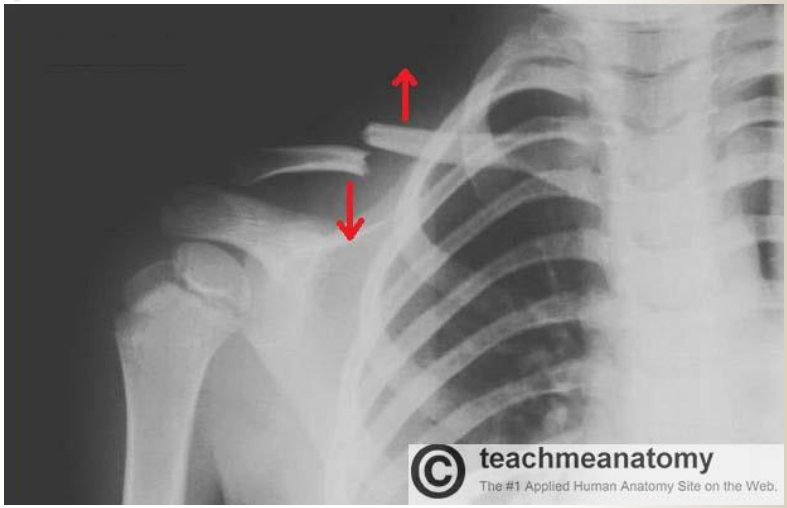
Functions:

- Transmits forces from the UL to the axial skeleton.
- Act as a strut holding the arm free from the trunk.
- Provides attachment for muscles.
- Forms a boundary of the cervicoaxillary canal for protection of the neurovascular bundle of the UL.

Articulations:

- Medially sternoclavicular joint
- Inferiorly , costoclavicular Joint and
- Laterally , Acromioclavicularjoint

CLAVICLE (Collar Bone)



CLINICAL CORRELATES

Fracture of the clavicle

Causes

- Fall on shoulder or outstretched hand .
- Birth injury (breech presentation)

Site

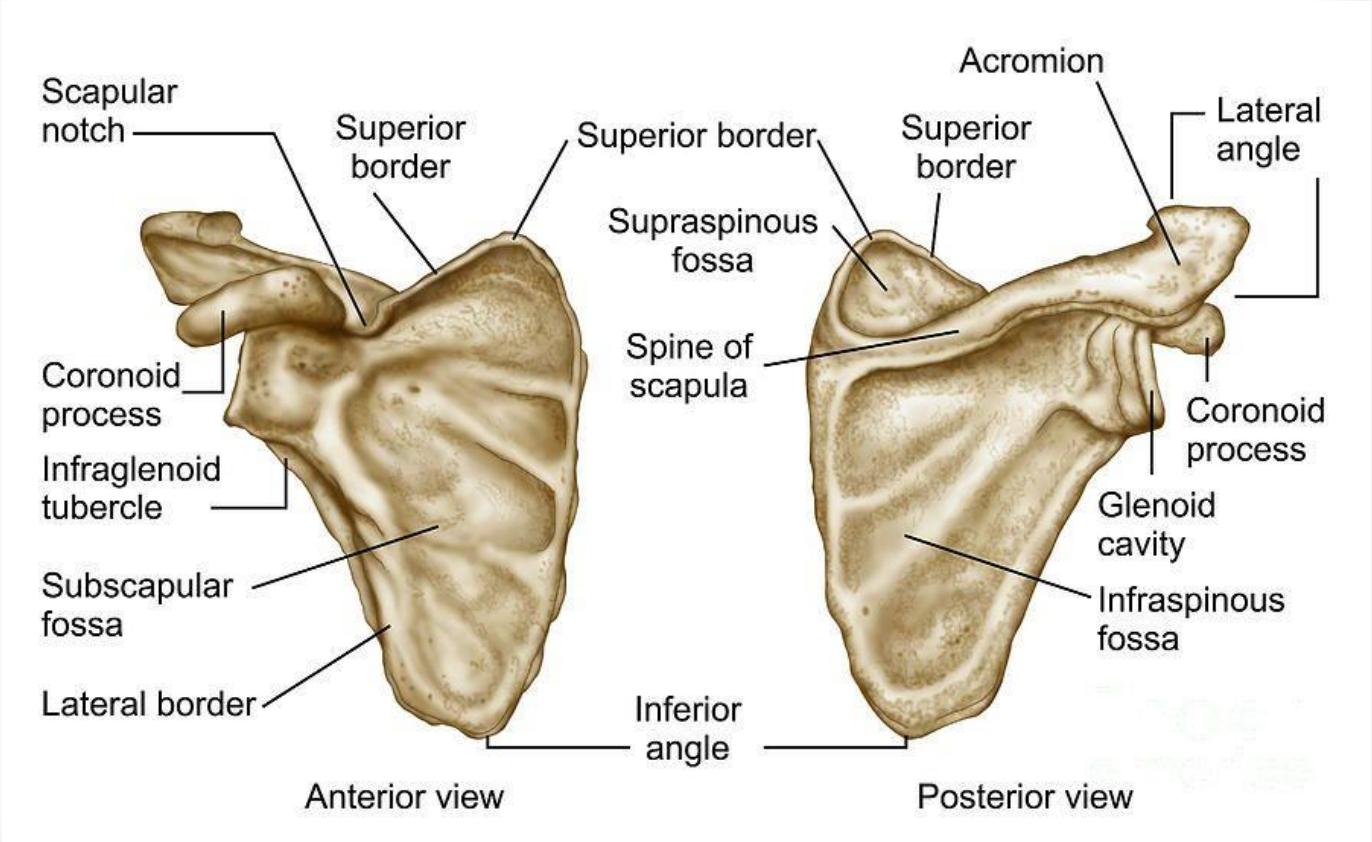
Most commonly occur at the junction of middle and lateral third, resulting in upward displacement of proximal segment and downward displacement of the distal.

Complication may occur

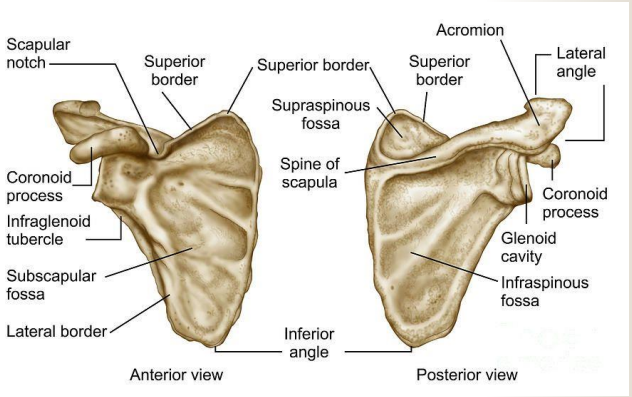
- Injury to brachial plexus (lower trunk)
- Fatal hemorrhage from subclavian artery
- Thrombosis of subclavian vein-pulmonary embolisms

.

SCAPULA (Shoulder Blade)



SCAPULA



SCAPULA

Is triangular , FLAT bone.

Extends between the 2nd to 7th ribs.

It has :

Three Processes:

(1)Spine, (2) Acromion, (3) Coracoid

Three Borders:

Superior, Medial (Vertebral) & Lateral (Axillary)

Three Angles:

Superior, Inferior. Lateral (Glenoid cavity

As hallow concave oval fossa that receives the head of the humerus).

Two Surfaces:

Convex Posterior divided into:

Supraspinous & Infraspinous Fossae

Concave Anterior (Costal) Suprascapular fossa

Functions:

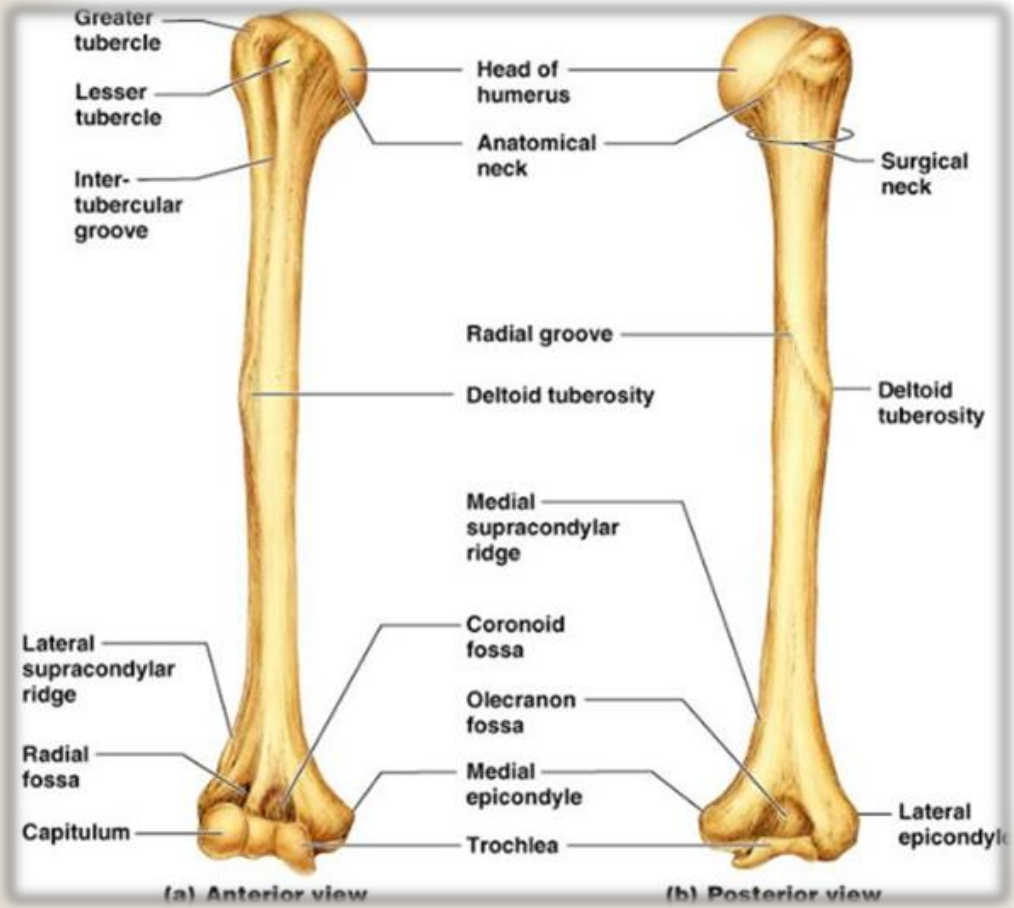
Gives attachment to muscles.

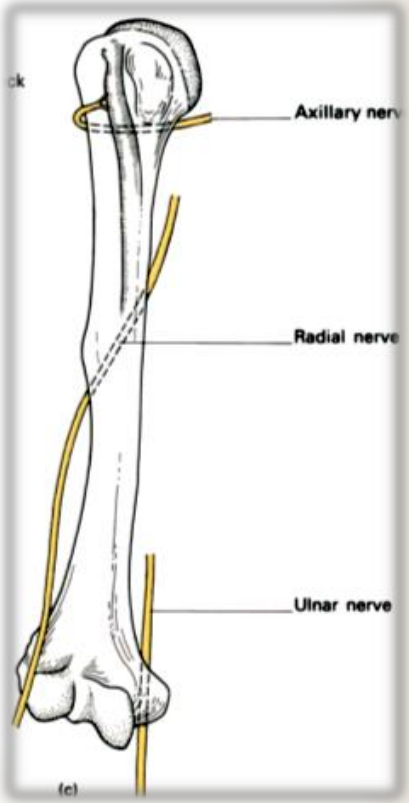
The glenoid cavity forms the socket of the shoulder joint.

Its strong muscular covering protect the scapula i.e. WHY rarely fractured ONLY by direct and severe trauma

Most of its fractures involve the protruding subcutaneous acromion

HUMERUS


Greater tubercle
Lesser tubercle
Inter-tubercular groove
Head of humerus
Anatomical neck
Surgical neck
Radial groove
Deltoid tuberosity
Deltoid tuberosity
Medial supracondylar ridge
Lateral supracondylar ridge
Coronoid fossa
Olecranon fossa
Radial fossa
Medial epicondyle
Capitulum
Trochlea
Lateral epicondyl
(a) Anterior view
(b) Posterior view


Axillary nerv
Radial nerve
Ulnar nerve
(c)

HUMERUS

HUMERUS

Typical Long bone.

Proximal End:

- Head: articulates with the scapula at the glenohumural joint
- Anatomic neck : formed by a groove separating the head from the tubercles.
- Greater & Lesser Tubercles and Intertubercular Groove.
- Surgical Neck: a narrow part distal to the tubercles, common site of fracture and in contact with axillary nerve and post circumflex H artery.

Shaft (Body): Has two prominent features:

1. Deltoid tuberosity:
2. Spiral (Radial) groove contains radial nerve

Distal End:

Medial (can be felt) and Lateral Epicondyles.

Features of the distal end:

Anteriorly:

Trochlea is medial articular surface with the ulna (trochlear notch)

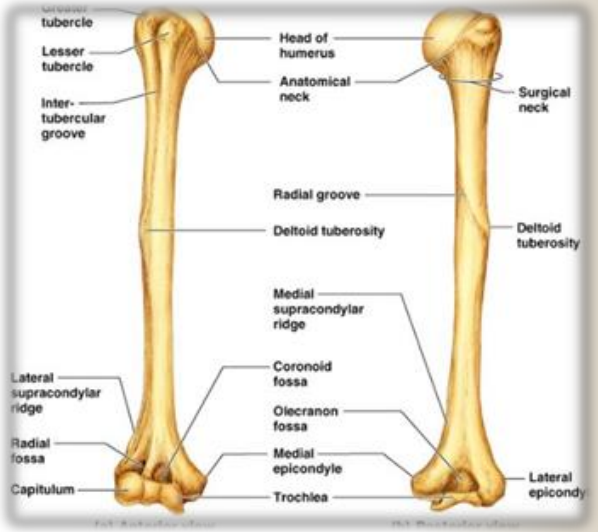
Capitulum is lateral articular surface with the head of the radius.

Coronoid fossa: depression above the trochlea.

Radial fossa: depression above the capitulum.

Posteriorly:

Olecranon fossa: above the trochlea



HUMERUS

CLINICAL CORRELATES

Fracture of greater tuberosity

- Direct trauma or by violent contraction of supraspinatus

Fracture of the surgical neck

- May injure the Axillary nerve and post CH artery

Fracture of the shaft

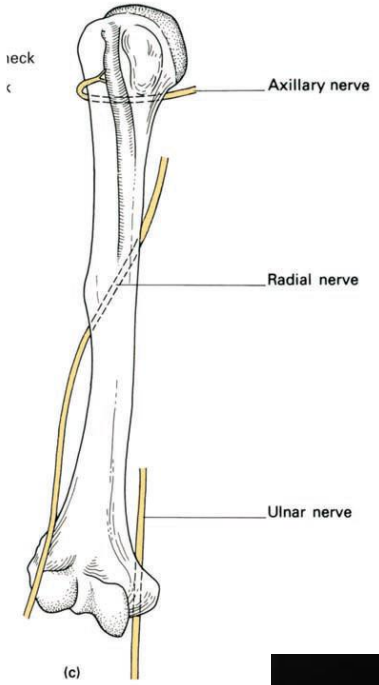
- May injure the Radial nerve and profunda BA

Supracondylar fracture

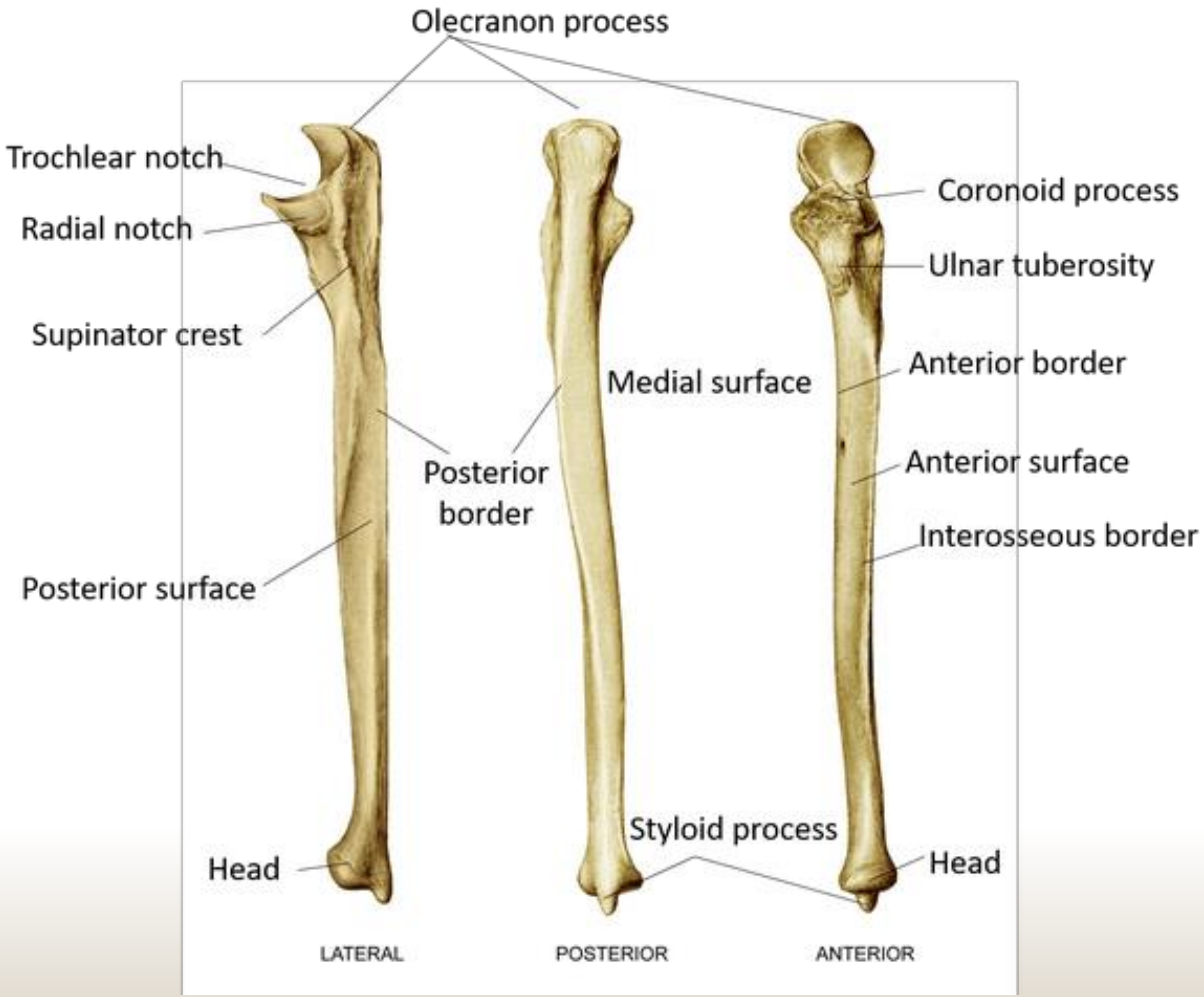
- Fracture of the distal end of the humerus, common in children, falling on outstretched hand with the elbow slightly flex. **Median nerve!** .

Fracture of the medial epicondyle (funny bone)

- May injure the Ulnar nerve



ULLNA


Olecranon process
Trochlear notch
Radial notch
Supinator crest
Posterior surface
Head
Posterior border
Medial surface
Styloid process
Coronoid process
Ulnar tuberosity
Anterior border
Anterior surface
Interosseous border
Head
LATERAL
POSTERIOR
ANTERIOR

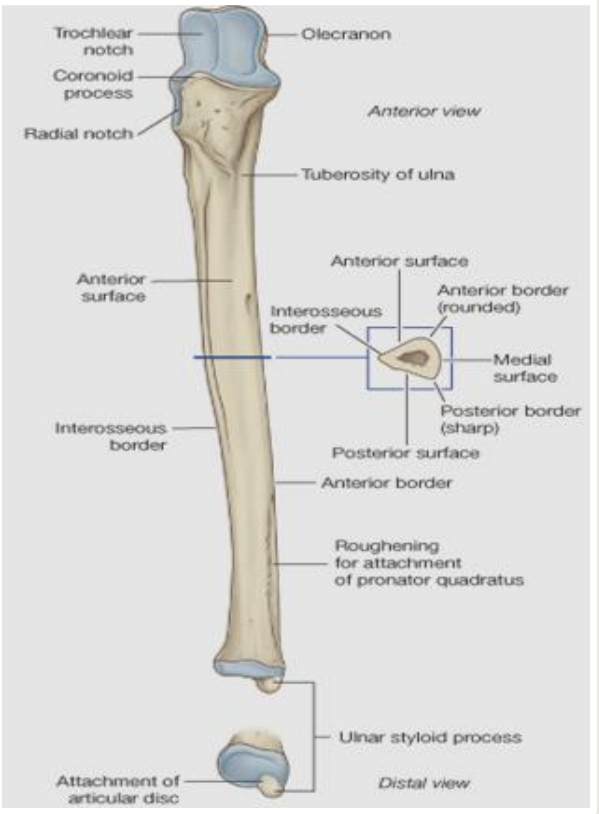
ULNA

ULNA

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

Proximal End:

1. Olecranon Process :
2. Coronoid Process :
3. Tuberosity of Ulna:
4. Trochlear Notch:
5. Radial Notch :



Shaft :

Thick & cylindrical superiorly but diminishes in diameter inferiorly

It has Three Surfaces (Anterior, Medial & Posterior).

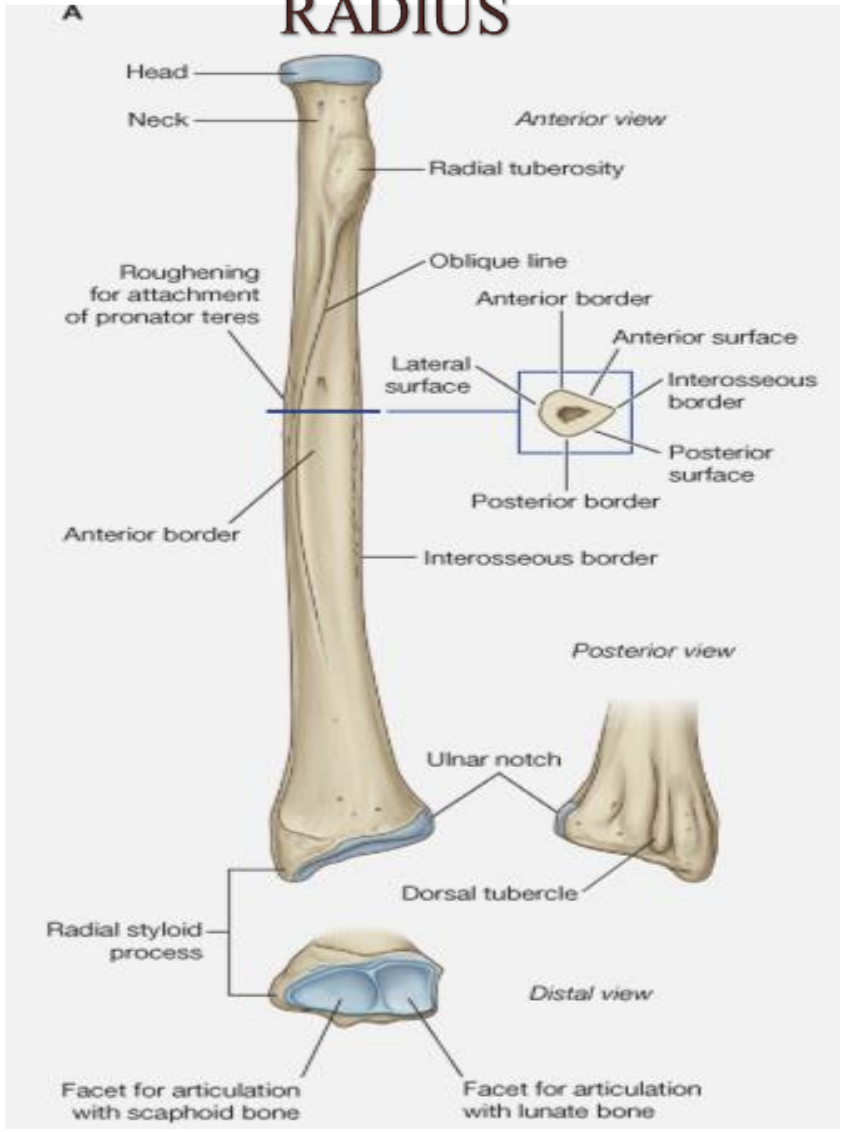
Sharp Lateral Interosseous border.

Distal End:

Small rounded

1. Head: lies distally at the wrist. .
2. Styloid process: Medial.
3. The articulations between the ulna & humerus at the elbow joint allows primarily only flexion & extension (small amount of abduction & adduction occurs).

RADIUS


A
Head
Neck
Anterior view
Radial tuberosity
Oblique line
Roughening for attachment of pronator teres
Anterior border
Anterior surface
Lateral surface
Interosseous border
Posterior surface
Posterior border
Anterior border
Interosseous border
Posterior view
Ulnar notch
Dorsal tubercle
Radial styloid process
Distal view
Facet for articulation with scaphoid bone
Facet for articulation with lunate bone

RADIUS

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.

Shaft

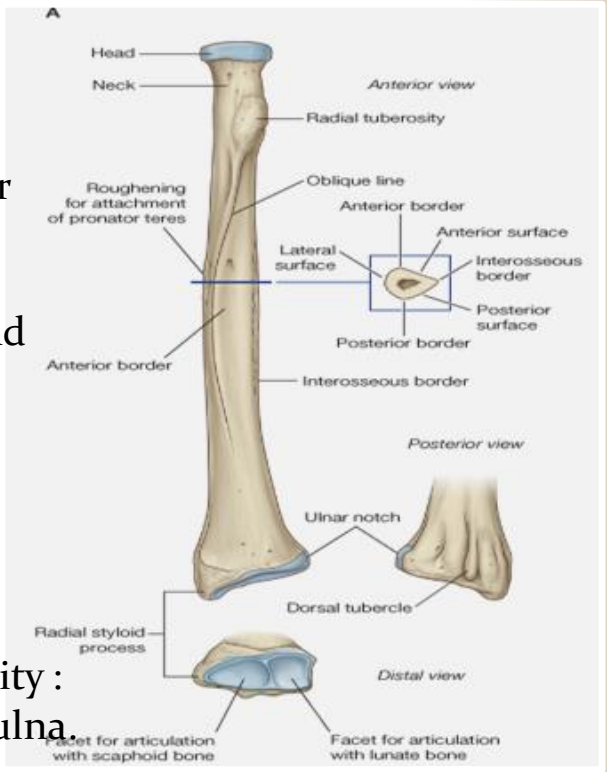
Has a lateral convexity.

It gradually enlarges as it passes distally.

Distal (Lower) End

It is rectangular. Its medial aspect forms a concavity : Ulnar notch to accommodate by the head of the ulna.

Radial Styloid process: extends from the lateral aspect. Dorsal tubercle: Projects dorsally.



RADIUS

CLINICAL CORRELATES

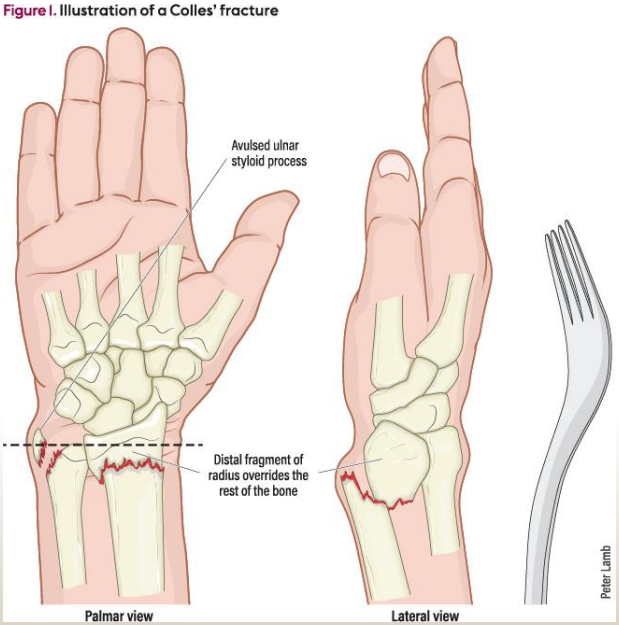
RADIUS

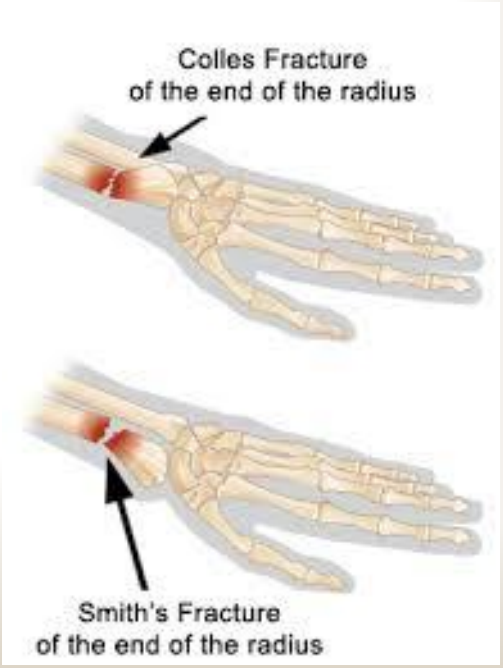
Collies fracture of the wrist is a **distal radius fracture**.

- The distal fragment id displaced posteriorly
- Produces a characteristic bump describe a **Dinner fork deformity**

- If the distal fragment displaced anteriorly it is called

Reverse Collies fracture (Smith fracture.)

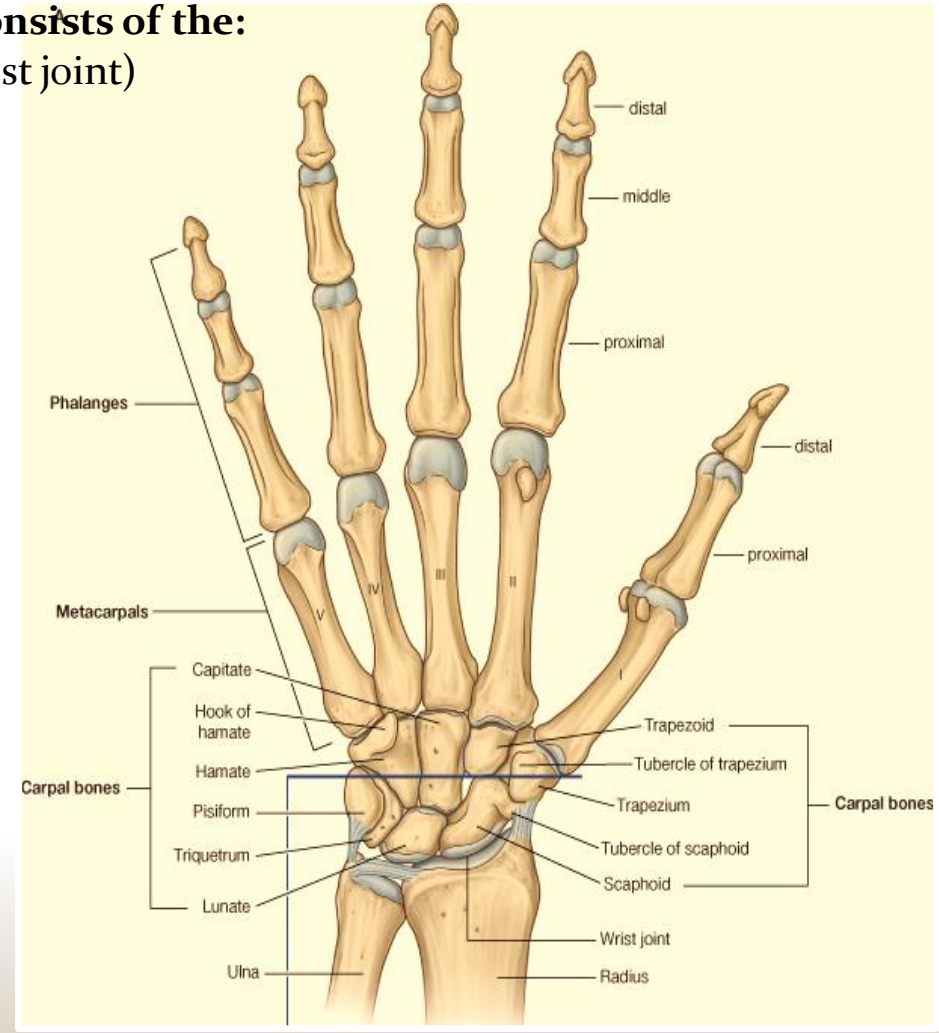




BONES of HANDS

The skeleton of the hand consists of the:

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



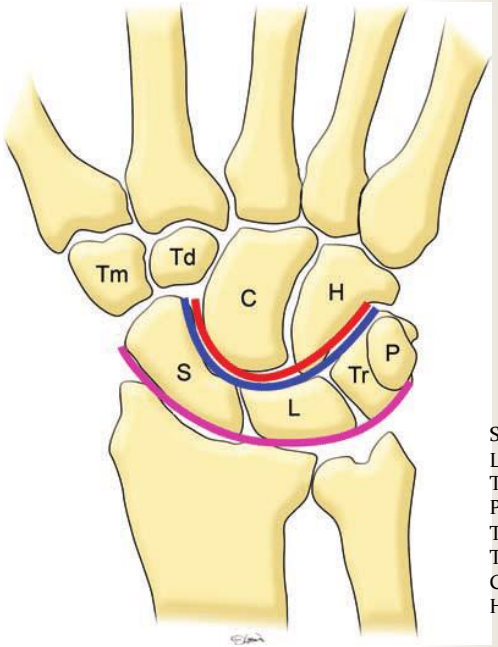
CARPAL BONES

CARPAL (WRIST)

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



She Looks To Pretty Try To Catch Her

Note:

Except for the Pisiform, articulates with radius and disc
The ulna has NO contact with carpals.

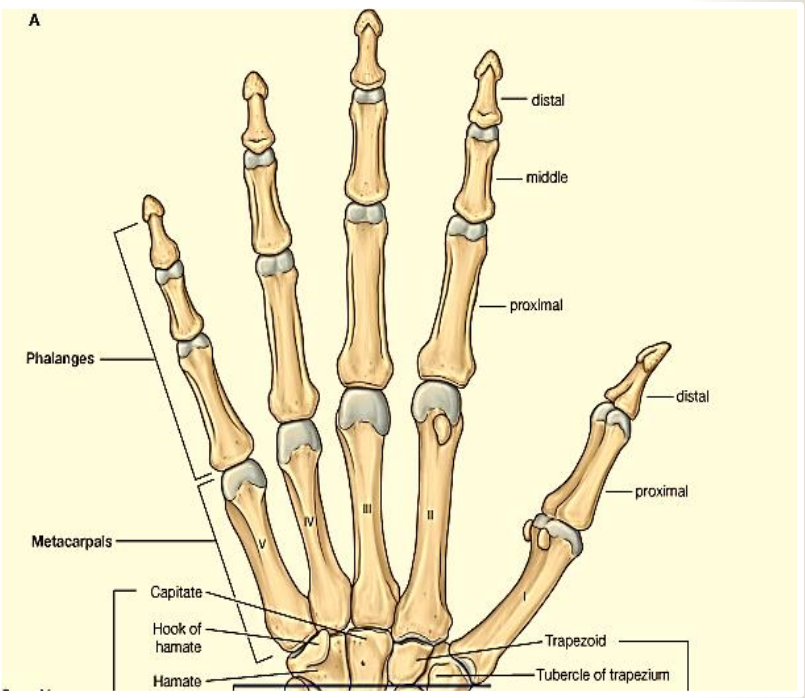
Distal row(from lateral to medial):

- Trapezium
- Trapezoid
- Capitate
- Hamate

METACARPAL & PHALANGES BONES

METACARPALS

- Are miniature long bones
- Are numbered 1-5 from the thumb
- Consisting of bases (proximal ends),shafts(bodies) and heads (distal ends)
- The 1st metacarpal is the shortest and most mobile.
- **Heads form knuckle of the fist**.



PHALANGES

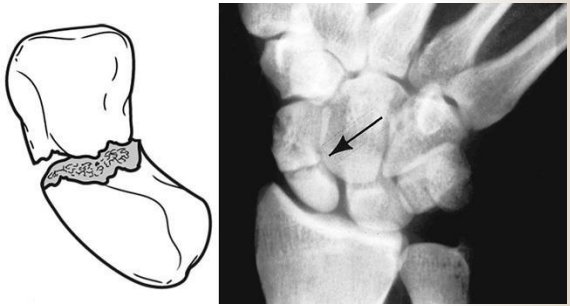
- Are miniature long bones
- Each digit has three phalange
- **Except** the Thumb which has only two
- Consisting of bases ,shafts and heads

CARPAL BONES

CLINICAL CORRELATES

Fracture of Scaphoid

- Occurs on a fall on the outstreached hand
- Shows a deep tenderness in anatomical snuffbox
- Avascular necrosis
- Damages to radial artery



Fracture of Hamate

- may injure the ulnar nerve and artery

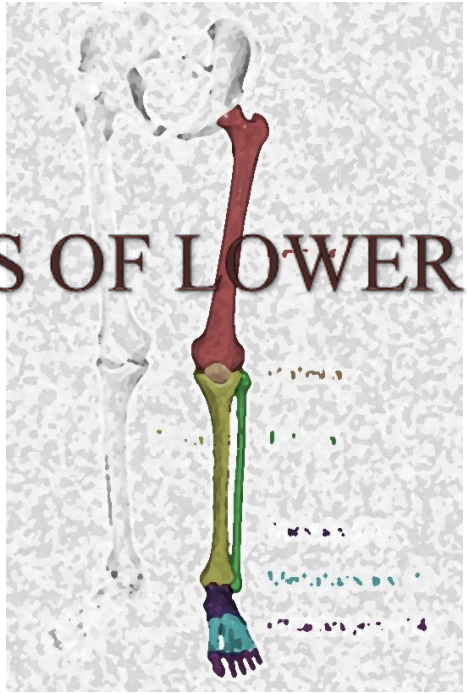
Bennett Fracture

- Fracture of the base of the metacarpal of the thumb.

Boxer's Fracture

- Fracture of the neck of the 2nd & 3rd metacarpals in professional boxers AND TYPICALLY of 5th in unskilled boxers

BONES OF LOWER LIMB



BONES OF LOWER LIMB

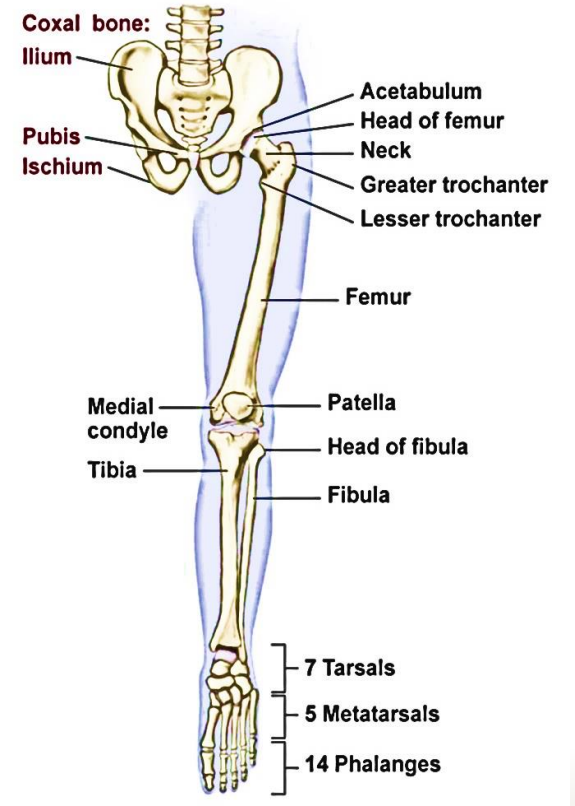
Pelvic Girdle
- Hip Bone
- Sacrum
- Coccyx

Thigh
- Femur
- Patella

Leg
- Tibia & Fibula

Ankle
- Tarsal bones

Foot
- Metatarsals & Phalanges



PELVIC GIRDLE

PELVIC GIRDLE

The bony pelvis consists of the following**:**

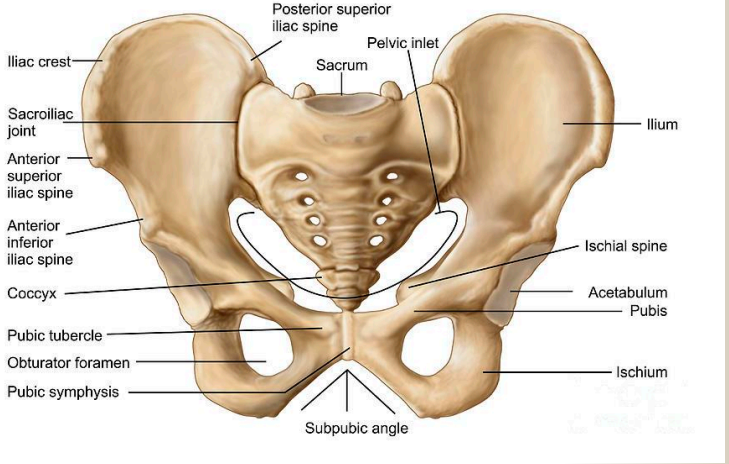
- Two hip (pelvic) bones
- Sacrum
- Coccyx

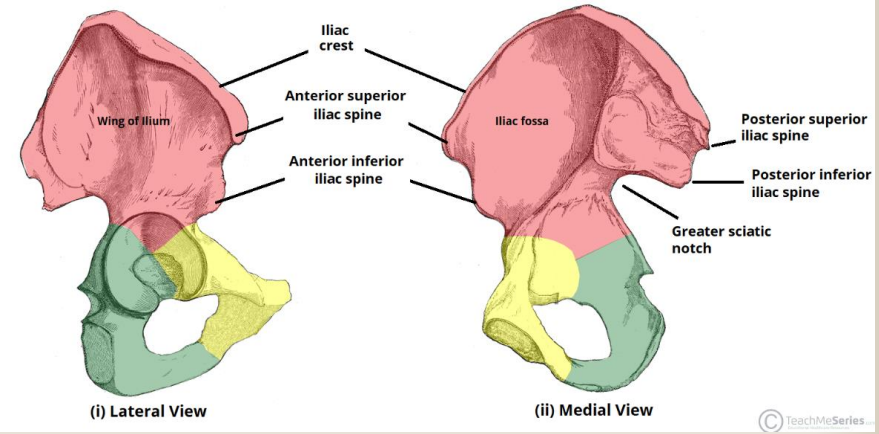
The hip bone is comprised of the three parts;

- Ilium
- Pubis &
- Ischium

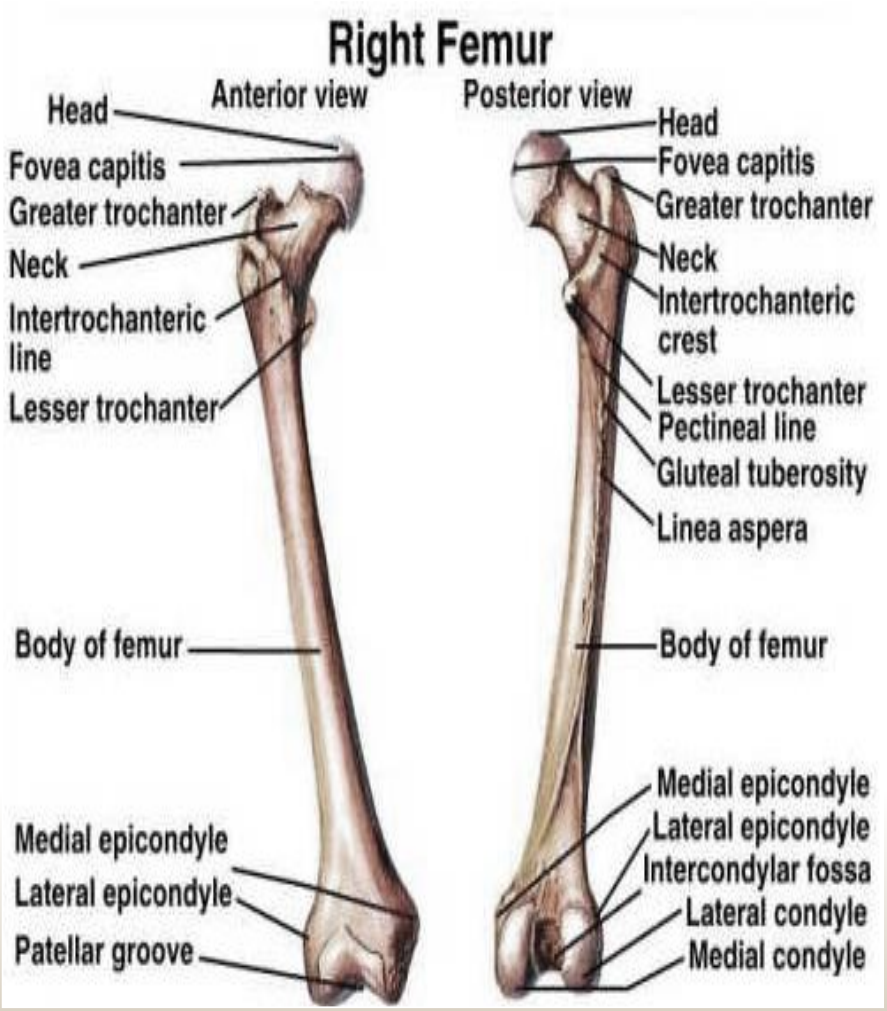
The hip bones have three main articulations**:**

- Sacroiliac joint
- Pubic symphysis
- Hip joint





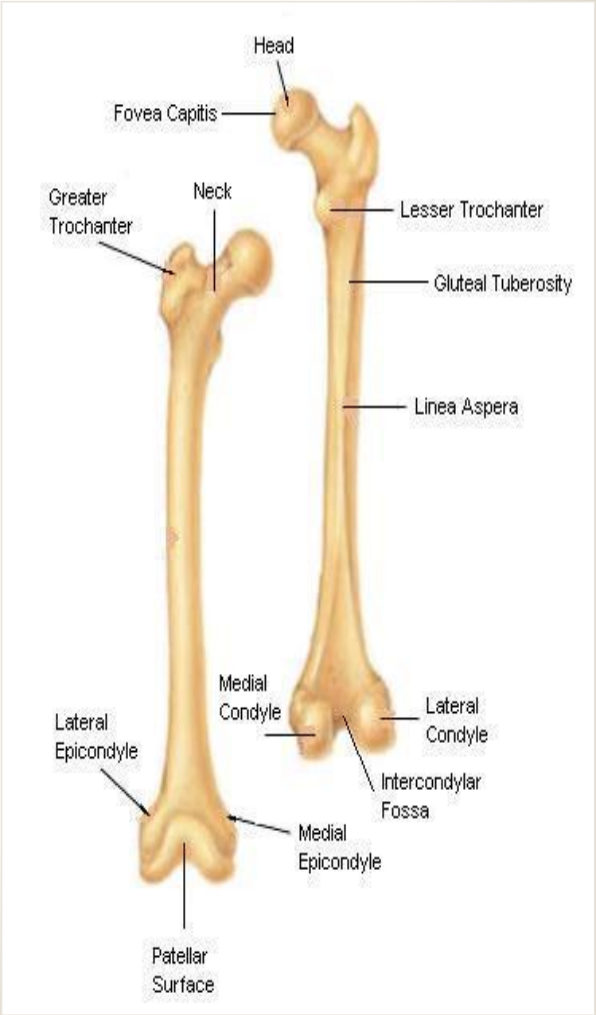
BONES of THIGH -FEMUR & PATELLA



FEMER

FEMER

- typical Long bone.
- the **longest & strongest** bone in the body.
- Articulates above with acetabulum of hip bone to form the **hip joint.**
- Articulates below with tibia and patella to form the **knee joint**.
- Consists of :
  1. Upper (Proximal) end
  2. Shaft
  3. Lower (Proximal) end



FEMER

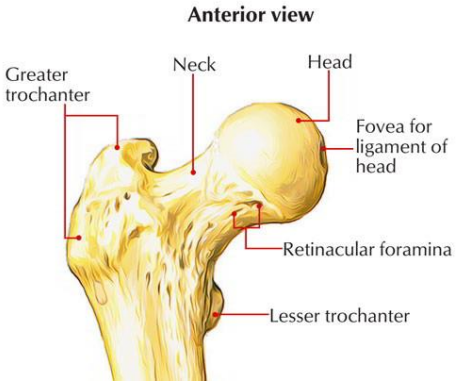
Proximal (Upper) End:

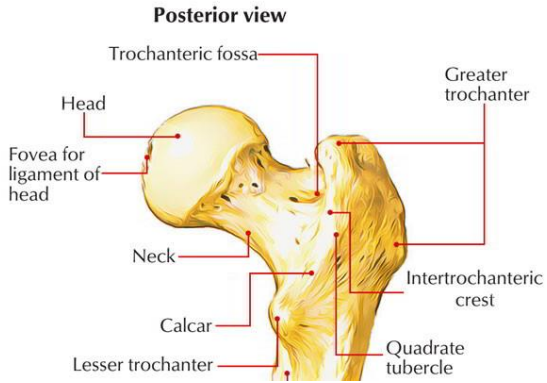
Head:

- forms 2/3rd of the a sphere
- articulates with the with acetabulum of hip bone to form **HIP JOINT**
- Has a depression in its articular surface , **the fovea capitis femoris** for the attachment of **the ligament of head of femur.**

Neck :

- connects head to the shaft.
- Forms an angle of about 125 degrees with the shaft
- Common site of fractures





Greater & lesser trochanters :

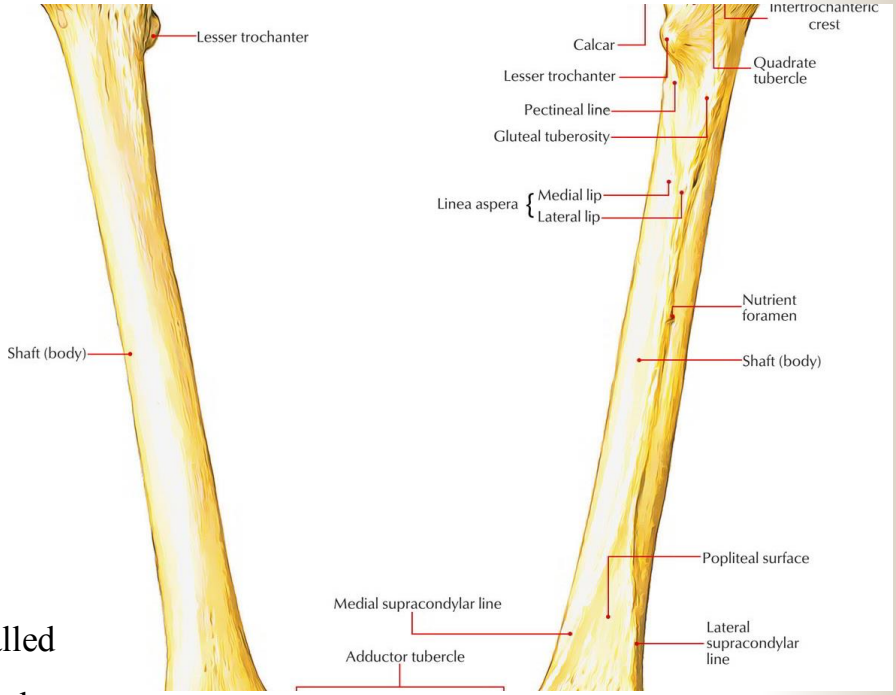
- **Anteriorly** connected by the **inter-trochanteric line**, where the iliofemoral ligament is attached.
- **Posteriorly,** connected by the **inter-trochanteric crest**, on which is the quadrate tubercle (Qudratus femoris muscle).

FEMER

Shaft (Body):

- has **3 surfaces**
  - **Medial**
  - **Anterior**
  - **Lateral**

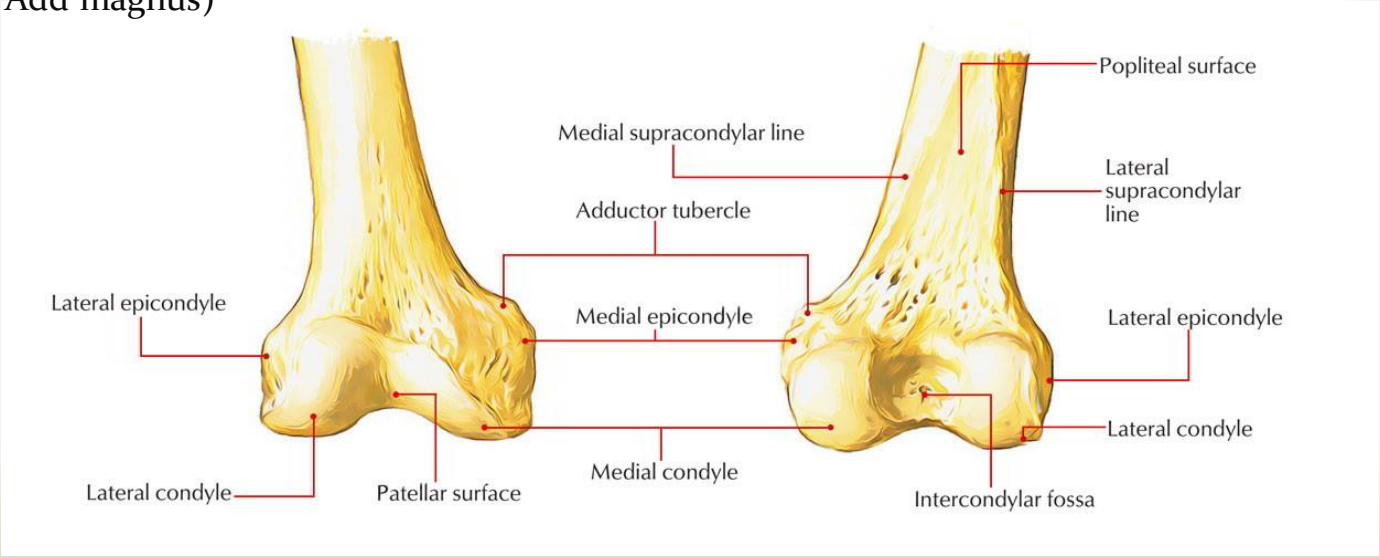
- It has **3 borders**
  - **Medial (rounded)**
  - **Lateral (rounded)**
  - **Posterior , thick** border or ridge called **LINEA ASPERA (** exhibits lateral and medial lips provides attachments to many muscles and the three I/muscular septa)



FEMER

Distal (Lower)End:

- Has **lateral and medial condyles**, separated
  - **anteriorly** by articular patellar surface, and
  - **posteriorly** by intercondylar notch or fossa.
- The 2 condyles take part in the **knee joint.**
- Above the condyles are the medial & lateral epicondyles.
- **Adductor tubercle** on the uppermost part of the medial epicondyle (for insertion of Add magnus)

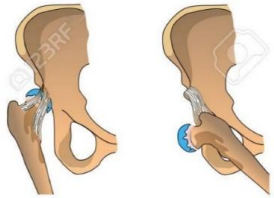


Femur

CLINICAL CORRELATES

Fracture of the head of the Femur

- Rare , caused by **post hip dislocation** in advance age
- Present as **shortened lower limb with medial rotation**



Fracture of the neck of the Femur

- results in ischemic necrosis of the neck and head (WHY?)
- Causes a pull of the distal fragment upward by quadriceps , adductors and hamstrings so that the affected **lower limb is shortened with lateral rotation**

Pertrochanteric Fracture

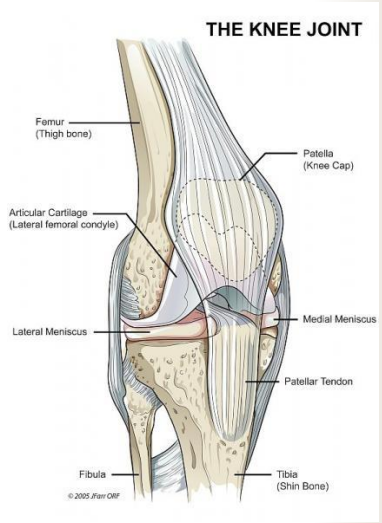
- Fracture thru the trochanters
- Common in elderly women
- The pull of quadriceps , adductors and hamstrings may produced **shortening with lateral rotation** of the leg

- **Fracture of the middle of the Femoral shaft**
- The proximal fragment is pulled by quadriceps and hamstrings , resulting in **shortening,** and the distal fragment **is rotated backward** by the gastrocnemius

PATELLA

Patella:

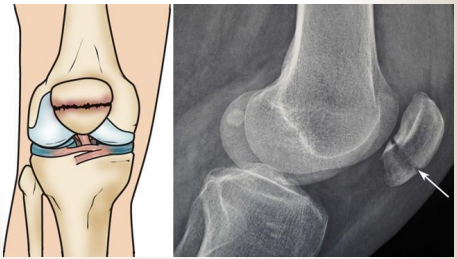
- is a **largest sesamoid bone** (lying inside the Quadriceps tendon in front of knee joint).
- Articulate with femure BUT not with the tibia
- Its apex lies inferiorly and is connected to tuberosity of tibia by ligamentum patellae.
- **Functions**:
  - to obviate wear and attrition on the quadriceps tendon
  - To increase the angle of the pullof the quadriceps femoris thereby **Magnifying its power**



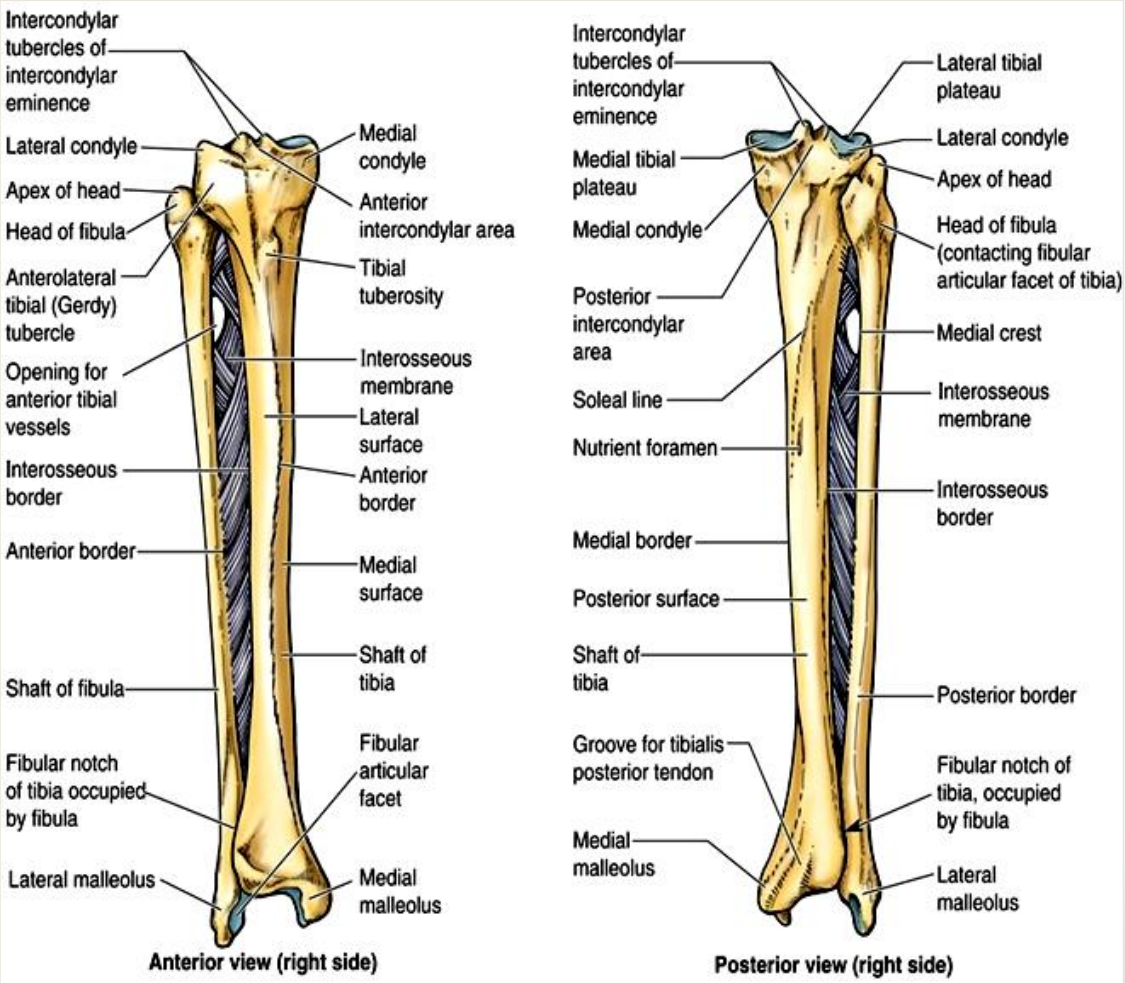
CLINICAL CORRELATES

Transverse patellar fracture results from:

- a blow to the knee **or**
- from sudden contraction of the quadriceps muscle



BONES OF LEG



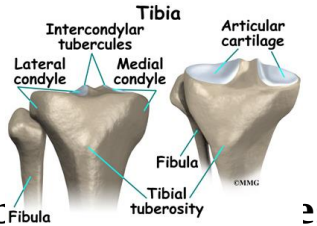
TIBIA (Medial)
&
FIBULA (Lateral)
Each has:

- Upper end
- Shaft
- Lower end

the leg

Upper End:

has two **Tibial condyles:**



Medial condyle :

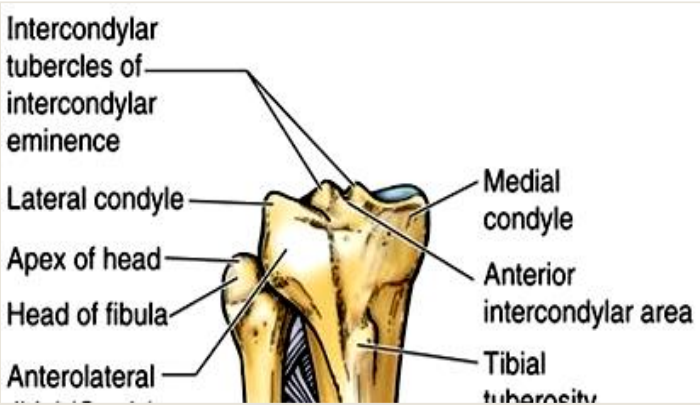
- is larger and articulate with medial condyle of femur.
- It has a groove on its posterior surface for **semimembranosus.**

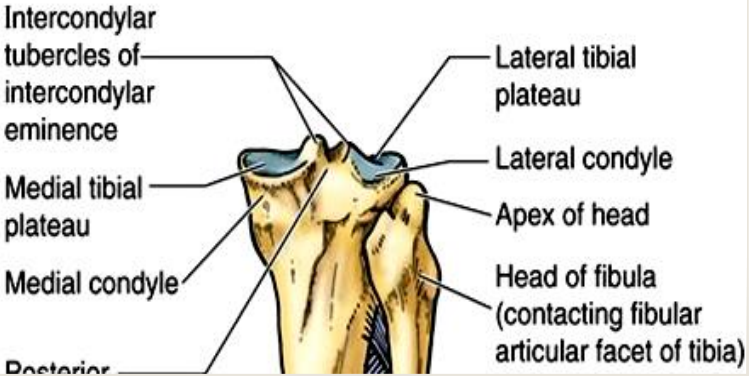
Lateral condyle :

- is smaller and articulates with lateral condyle of femur.
- It has facet on its lateral side for articulation with head of fibula to form proximal tibio-fibular joint.

Intercondylar area :

- is rough and has intercondylar eminence.





the leg

Shaft has:

Tibial tuberosity:

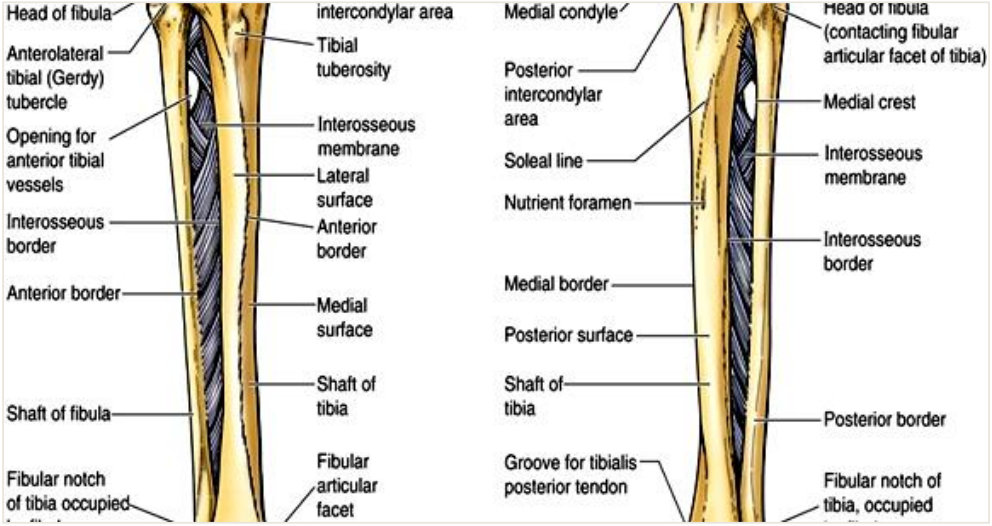
- Into which the patellar ligament inserts
- Its lower rough part is subcutaneous.

3 borders :

- **Anterior border :** sharp and subcutaneous.
- **Medial border.**
- **Lateral border** (interosseous border).

3 surfaces :

- **Lateral**
- **Medial :** subcutaneous.
- **Posterior** has oblique line, soleal line for attachment of soleus muscle



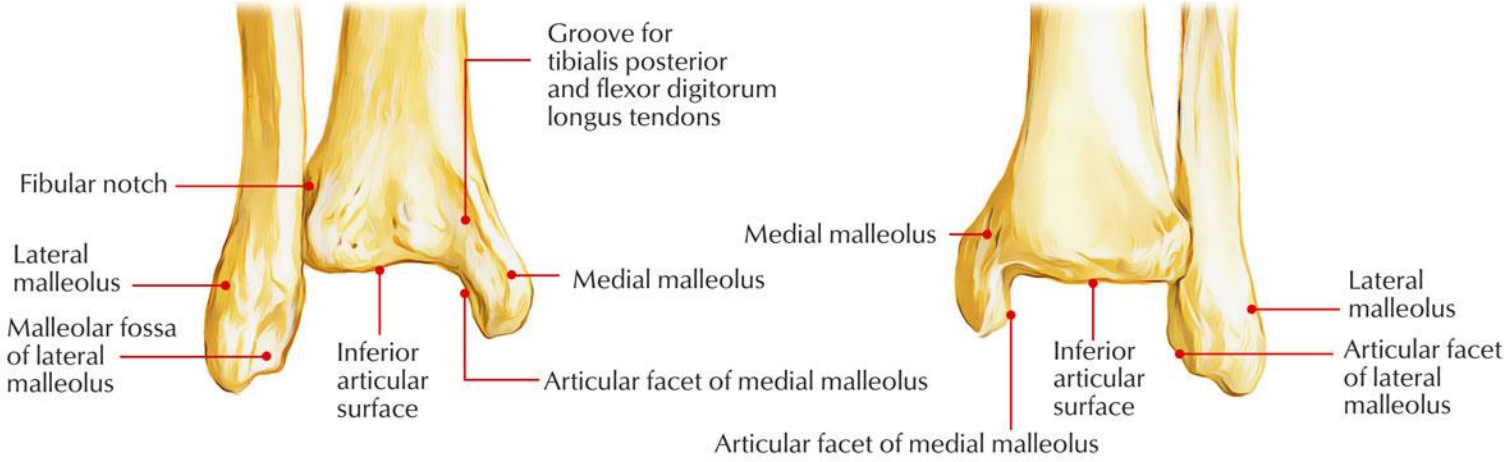
the leg

Lower End:

Articulates with talus for formation of ankle joint.

Medial malleolus:

- Its medial surface is subcutaneous.
- Its lateral surface articulate with talus.
- Fibular notch: lies on its lateral surface of lower end to form distal tibiofibular joint.
- Has malleolar groove for TP and FDL
- Groove on posterolateral surface for FHL



FIBULA has little or no function in weight bearing

Proximal (Upper) End has:

Head (apex):

- articulates with lateral condyle of tibia.

Styloid process.

Neck. Related to common peroneal nerve

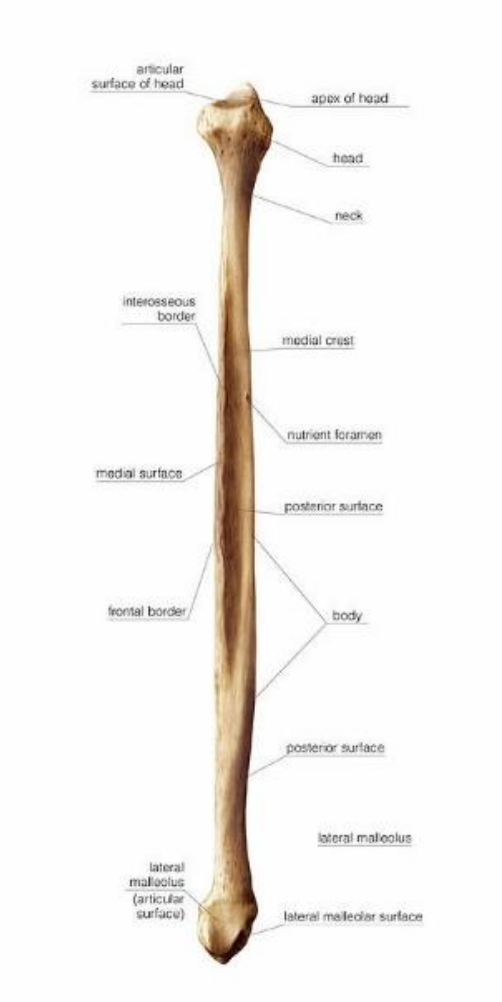
Shaft has:

4 borders : its medial 'interosseous border gives attachment to interosseous membrane.

4 surfaces.

Lower end :

- forms lateral malleolus:
- is subcutaneous,
- Its medial surface is smooth
- Articulates with the trochlea of the talus.
- More inferior and posterior than the medial



TIBIA & FIBULA

CLINICAL CORRELATES

Bumper Fracture:

- Fracture of the lateral tibial condyle (automobile bumper).
- Usually associated with common peroneal injury.

Pott Fracture

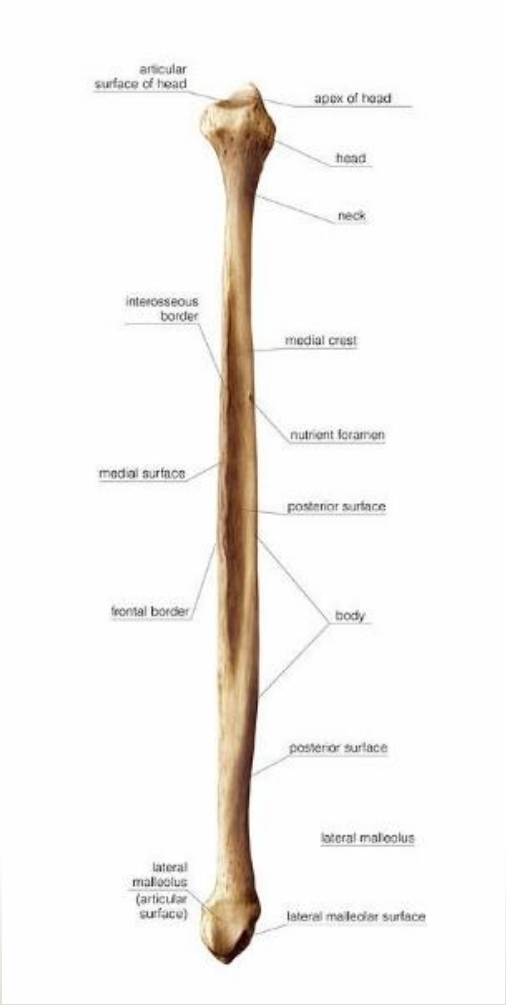
- Fracture of the lower end of fibula
- Often accompanied by fracture of the medial malleolus or rupture the deltoid ligament

Pillion Fracture

- T-shaped fracture of the distal femur with displacement of condyles.
- May be caused by a blow to the flex knee of a person riding pillion on a motorcycle

Fracture of the fibular neck

- May cause injury to common peroneal

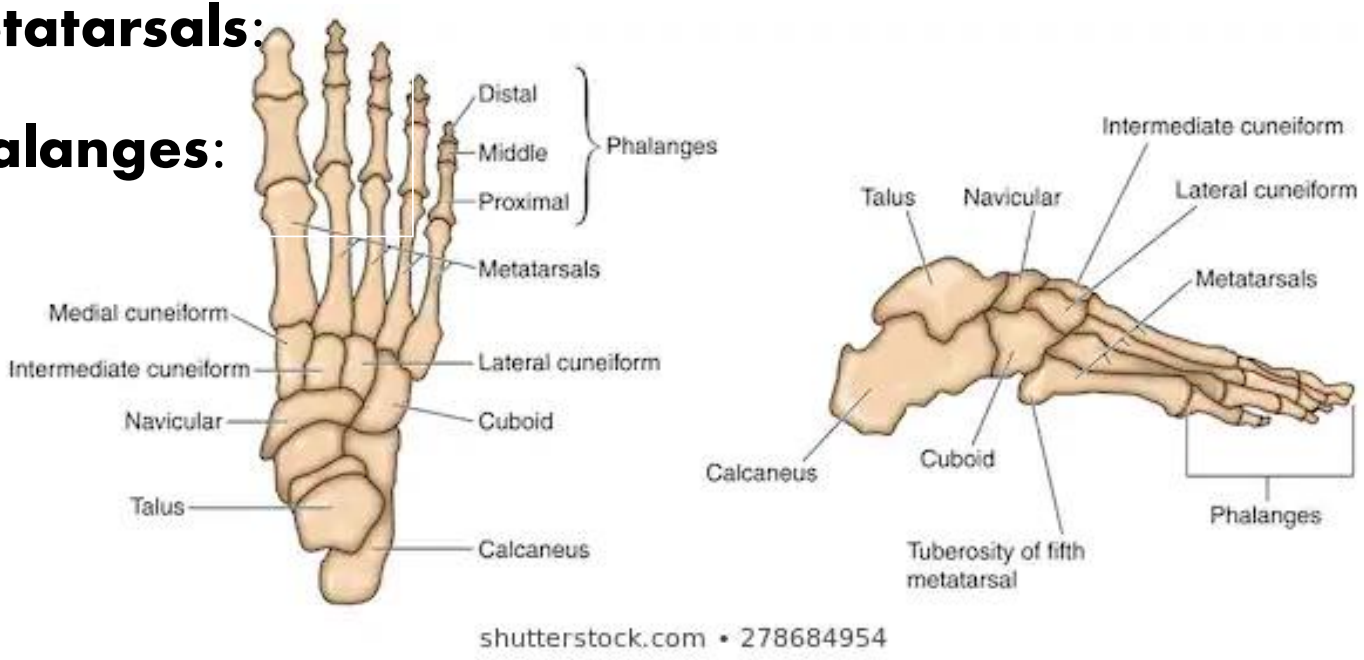


BONES OF THE FOOT

Tarsals:.

Metatarsals:

Phalanges:



BONES OF THE FOOT

The skeleton of the foot consists of the:

Tarsals: seven irregularly shaped bones situated proximally in the foot, in the ankle area.

- **Calcaneum**. the largest bone of foot, forming the heel.
- **Talus .** ONLY tarsal articulates with tibia & fibula at ankle joint
  - No muscles attachment
  - Transmit weight from tibia to the foot
  - Has head, neck and body
  - Head serves as **KEY Stone** of the medial longitudinal arch
- **Navicular.** Boat shaped between head of talus and 3 cuneiform
- **Cuboid** serves as **KEY Stone** of the lateral longitudinal arch
- **3 cuneiform bones.**

Metatarsals: There are five in number and they connect the phalanges to the tarsals. Each metatarsal bone has a **base (proximal)**' a **shaft** and a **head (distal).**

Phalanges: The bones of the toes. Each toe has three phalanges; a proximal, intermediate and distal. o except the big toe, which only has two phalanges(distal).

CLINICAL CORRELATES

March (Stress)Fracture is fatigue fracture of ONE of the metatarsal from prolong walking

Metatarsal fractures are also common in Ballet dancer (if lose balance and put whole body weight on metatarsals.

That's all guys