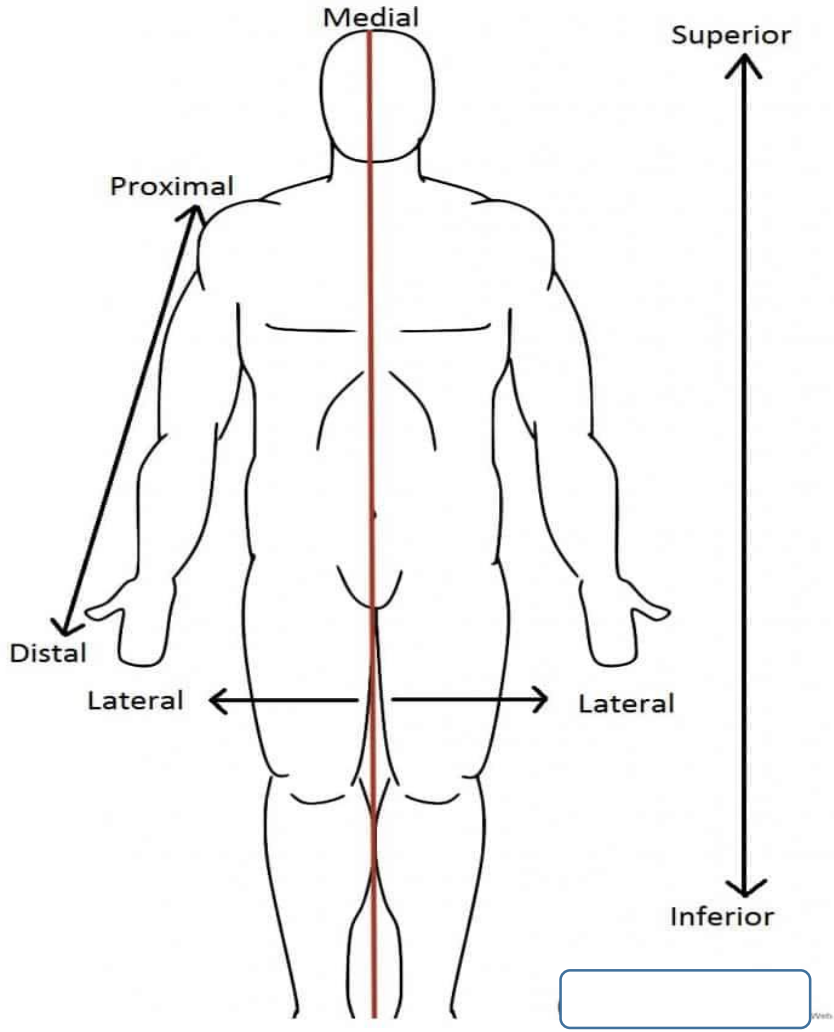
AL MUSTAQBAL UNIVERSITY

College of Medicine / First Year



ANATOMY

(L2) Bones &Osteology of Upper Limbs

Assist Prof. Dr. Abdulhusein Mizhir Almaamuri

Directional Term	Definition	Example
Superior	Towards the head or **upper** part of the body.	Pharynx is superior to larynx.
Inferior	Away from the head or **lower** part of the body.	Small intestine is inferior to stomach
Anterior	Nearer to or at the **front** of the body	Sternum is anterior to the heart.
Posterior	Nearer to or at the **back** of the body	Oesophagus is posterior to trachea.
Medial	**Nearer to the midline** of the body.	Ulna is medial to the radius.
Lateral	**Away from the midline** of the body.	The arms are lateral to the chest.
Intermediate	**Between** the two structures.	Transverse colon is intermediate to ascending colon and descending colon.
Proximal	situated **nearer to the point of attachment**.	Humerus is proximal to the radius.
Distal	situated **away from the point of attachment**.	Phalanges are distal to the carpels.
Superficial	**Toward** or on the **surface of the body.**	Ribs are superficial to lungs.
Deep	**Away** from the **surface of the bod**y.	Ribs are deep to the skin.

Body Cavities

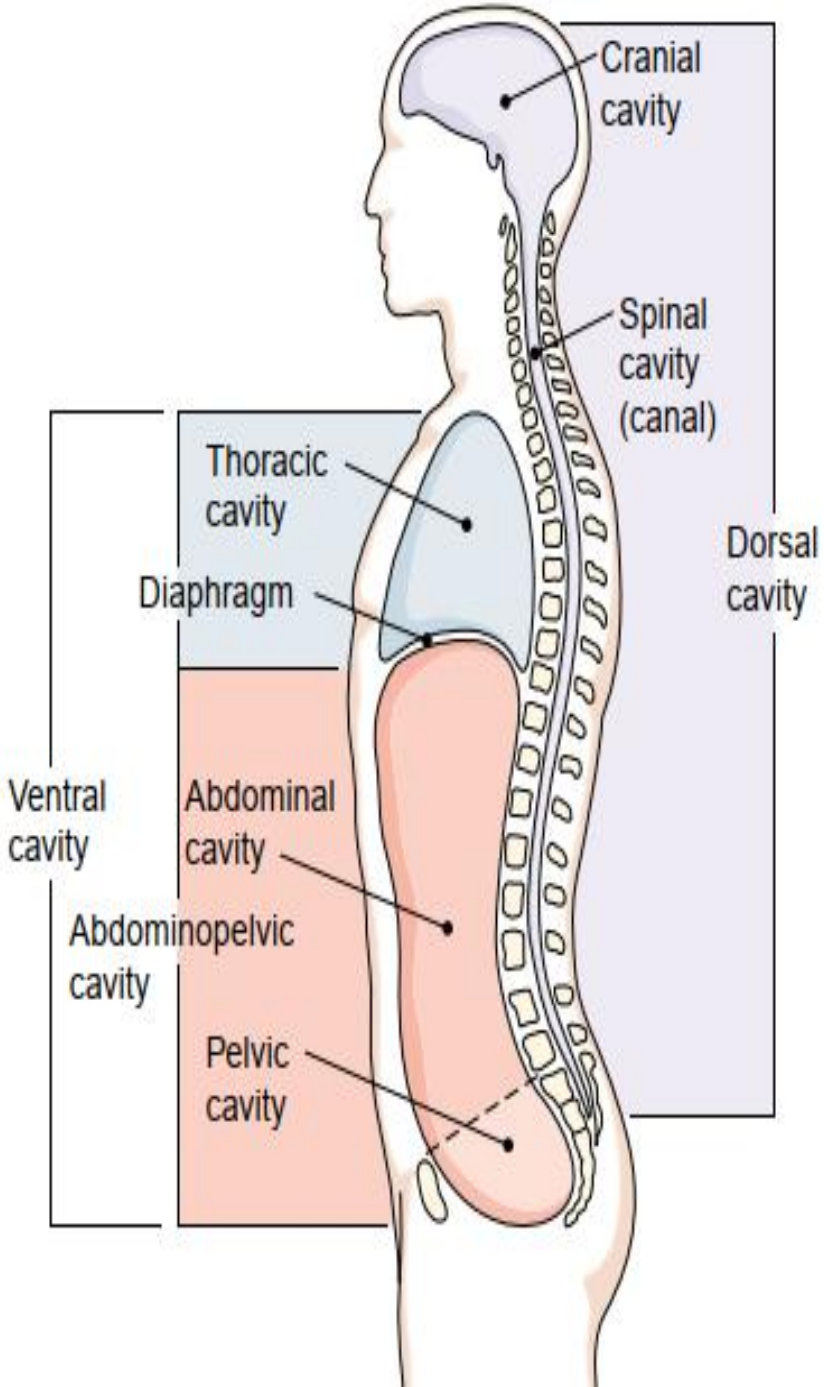
Internal organs are located within dorsal and ventral cavities.

The dorsal cavity contains the brain in the cranial cavity and the spinal cord in the spinal cavity (canal).

The uppermost ventral cavity, **the thoracic cavity**, is separated from the **abdominal cavity** by the diaphragm.

There is no anatomical separation between the **abdominal cavity** and **the pelvic cavity**, which together make up the **abdominopelvic** cavity.

The large membrane that lines the abdominopelvic cavity and covers the organs within it is the peritoneum



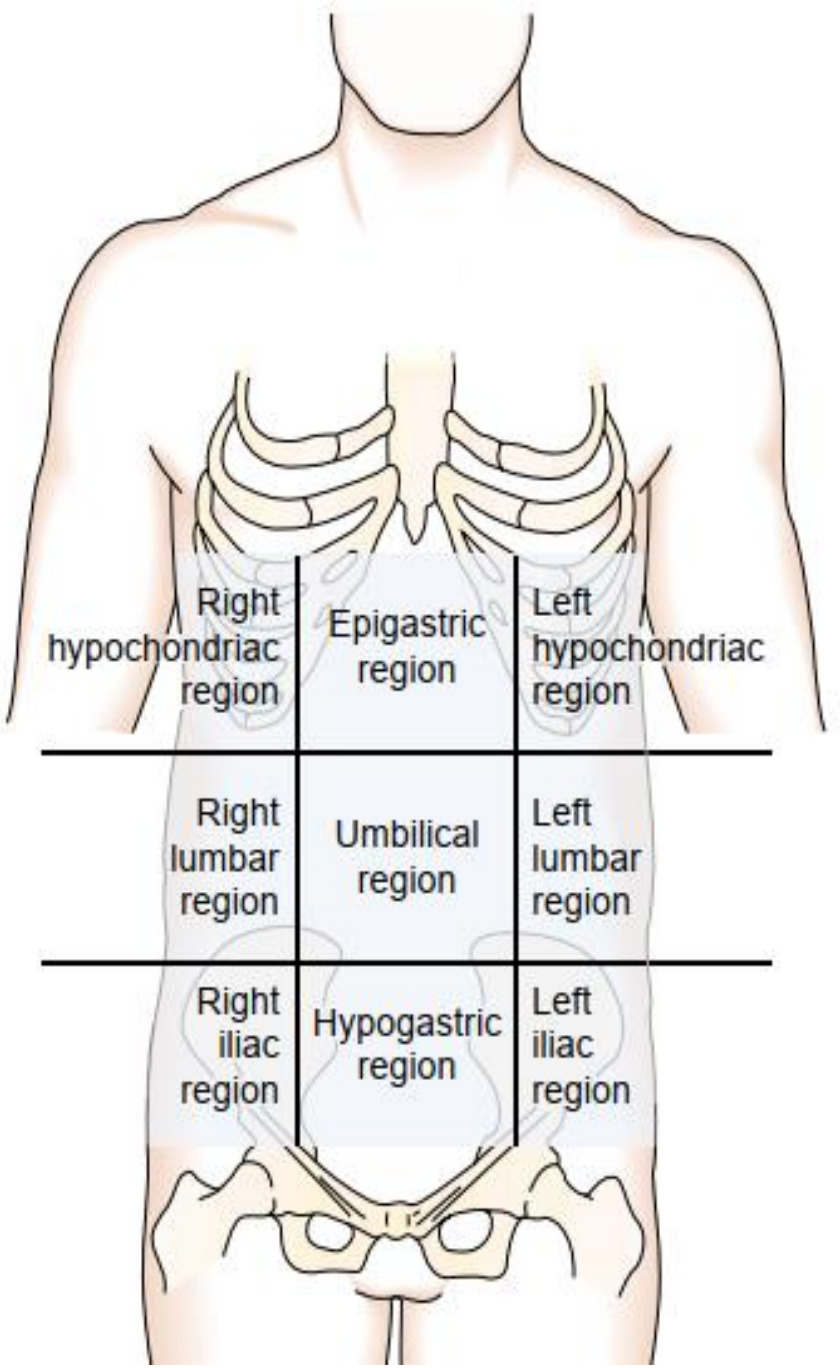
Body Regions

For orientation, the abdomen can be divided by imaginary lines into nine regions. The sections down the midline are the:

- **epigastric region,** located above the stomach
- **umbilical region**, named for the umbilicus, or navel
- **hypogastric region**, located below the stomach

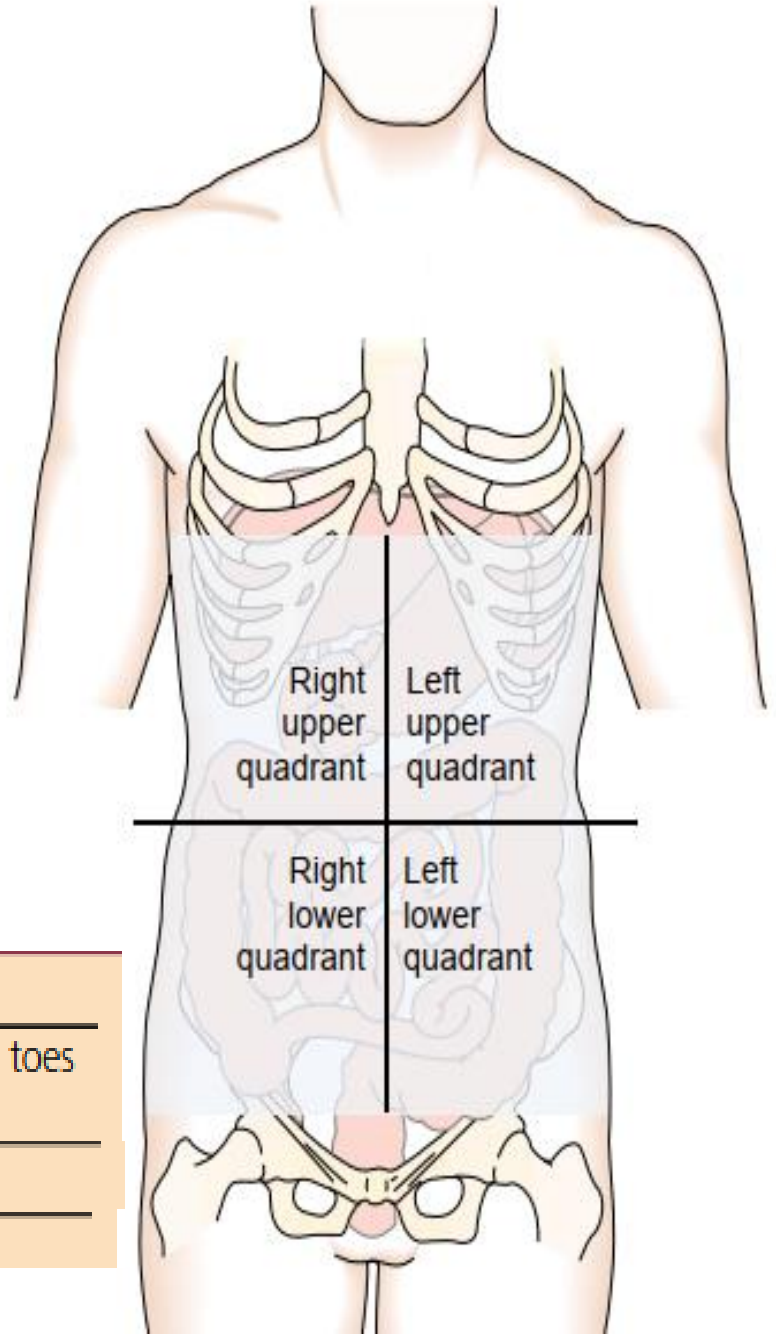
The lateral regions are the:

- right and left **hypochondriac regions**, named for their position near the ribs, near the cartilages (root chondr/o) of the ribs,
- right and left **lumbar regions**, which are located near the small of the back (lumbar region of the spine)
- right and **left iliac regions**, named for the upper bone of the hip, the ilium.



More simply, but less precisely, the abdomen can be divided by a single vertical line and a single horizontal line into four sections, designated:

the right upper quadrant **(RUQ),**
left upper quadrant **(LUQ**),
right lower quadrant **(RLQ),**
and left lower quadrant **(LLQ).**



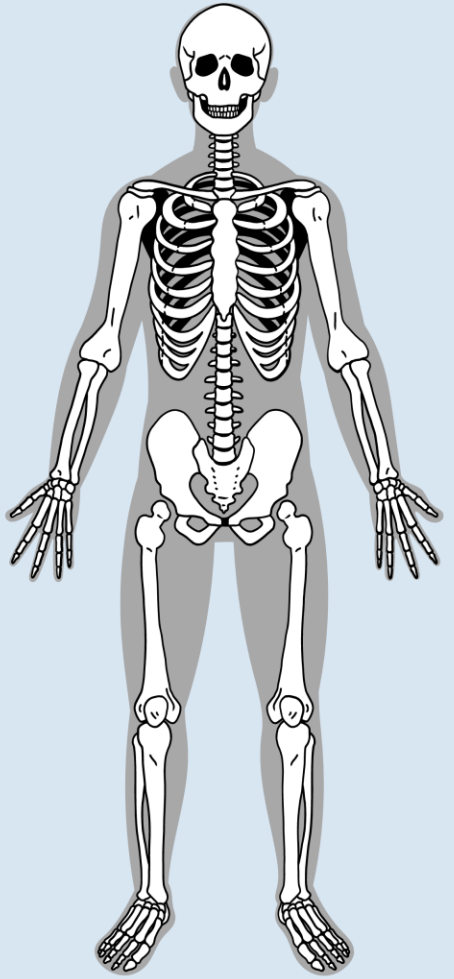
Positions: In addition to the anatomical position, there are other standard positions in which the body is placed for examination or medical procedures. Like:

POSITION	DESCRIPTION
anatomical position	standing erect, facing forward, arms at sides, palms forward, legs parallel, toes pointed forward
supine*	lying face up
prone	lying face down

General Anatomy of Bones, (Skeletal System)

Has five main functions:

- Provides us with a basic structure/shape
- Allows movement
- Protects vital organs
- Produces blood cells
- Storage of fats and minerals

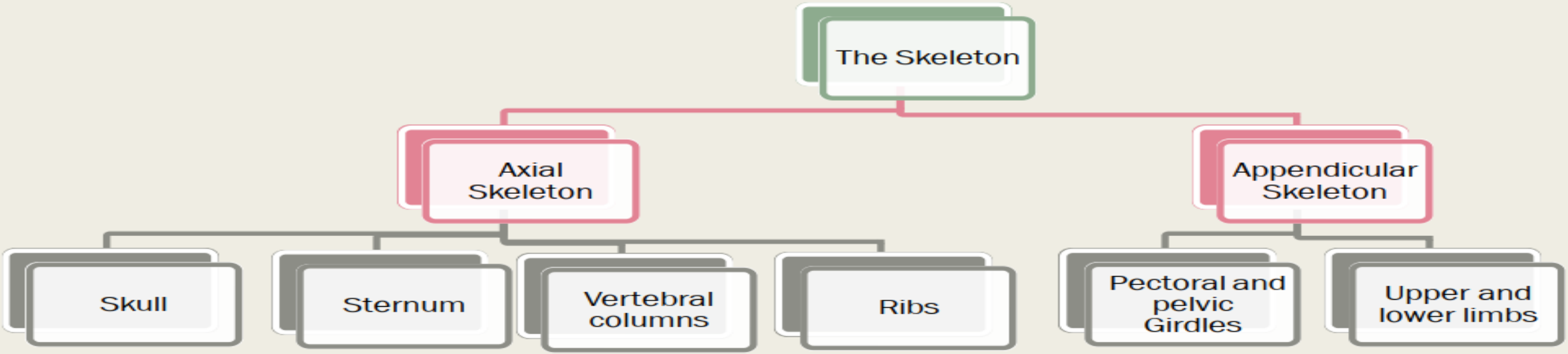



· 206 BONES
· CARTILAGE
· LIGAMENTS
THE HUMAN SKELETON


SKULL: 22
SHOULDER GIRDLE and
UPPER LIMBS: 64
VERTEBRAL
COLUMN: 33
THORACIC
CAGE: 25
PELVIC GIRDLE and
LOWER LIMBS: 62
206 BONES

The Skeleton

The skeleton is formed from 206 Bones



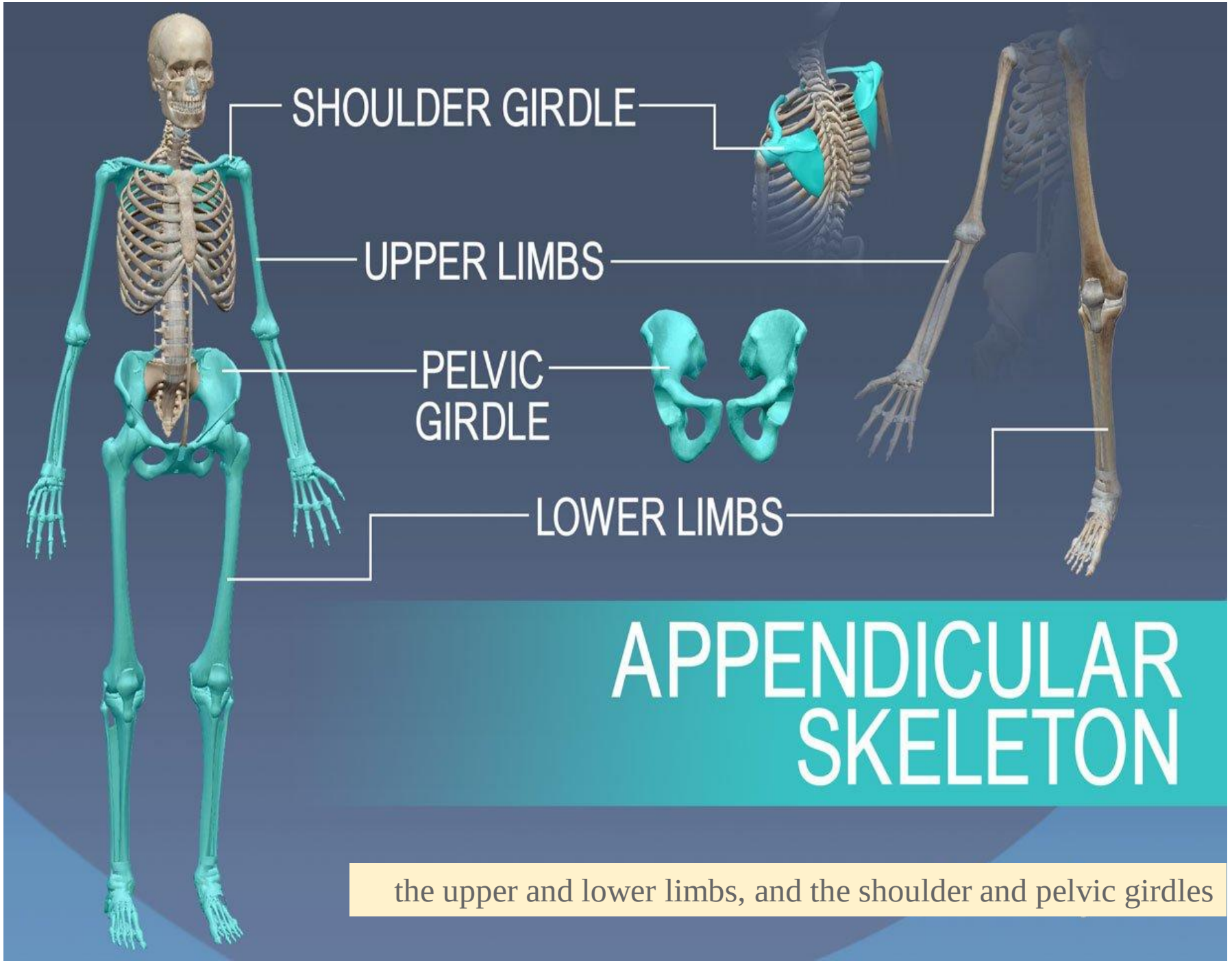
When you look at the human skeleton the 206 bones and 32 teeth stand out. But look closer and you'll see even more structures. The human skeleton also includes **ligaments and cartilage**. Ligaments are bands of dense and fibrous connective tissue that are key to the function of joints. Cartilage is more flexible than bone but stiffer than muscle. Cartilage helps give structure to the larynx and nose. It is also found between the vertebrae and at the ends of bones like the femur.


APPENDICULAR
SKELETON
AXIAL
SKELETON
THE HUMAN SKELETON

The bones of the human skeleton are divided into two groups. The **appendicular skeleton** includes all the bones that form the upper and lower limbs, and the shoulder and pelvic girdles.

The **axial skeleton** includes all the bones along the body's long axis .

The **axial skeleton** includes the bones that form the skull, laryngeal skeleton, vertebral column, and thoracic cage. The bones of the appendicular skeleton (the limbs and girdles) "append" to the axial skeleton.



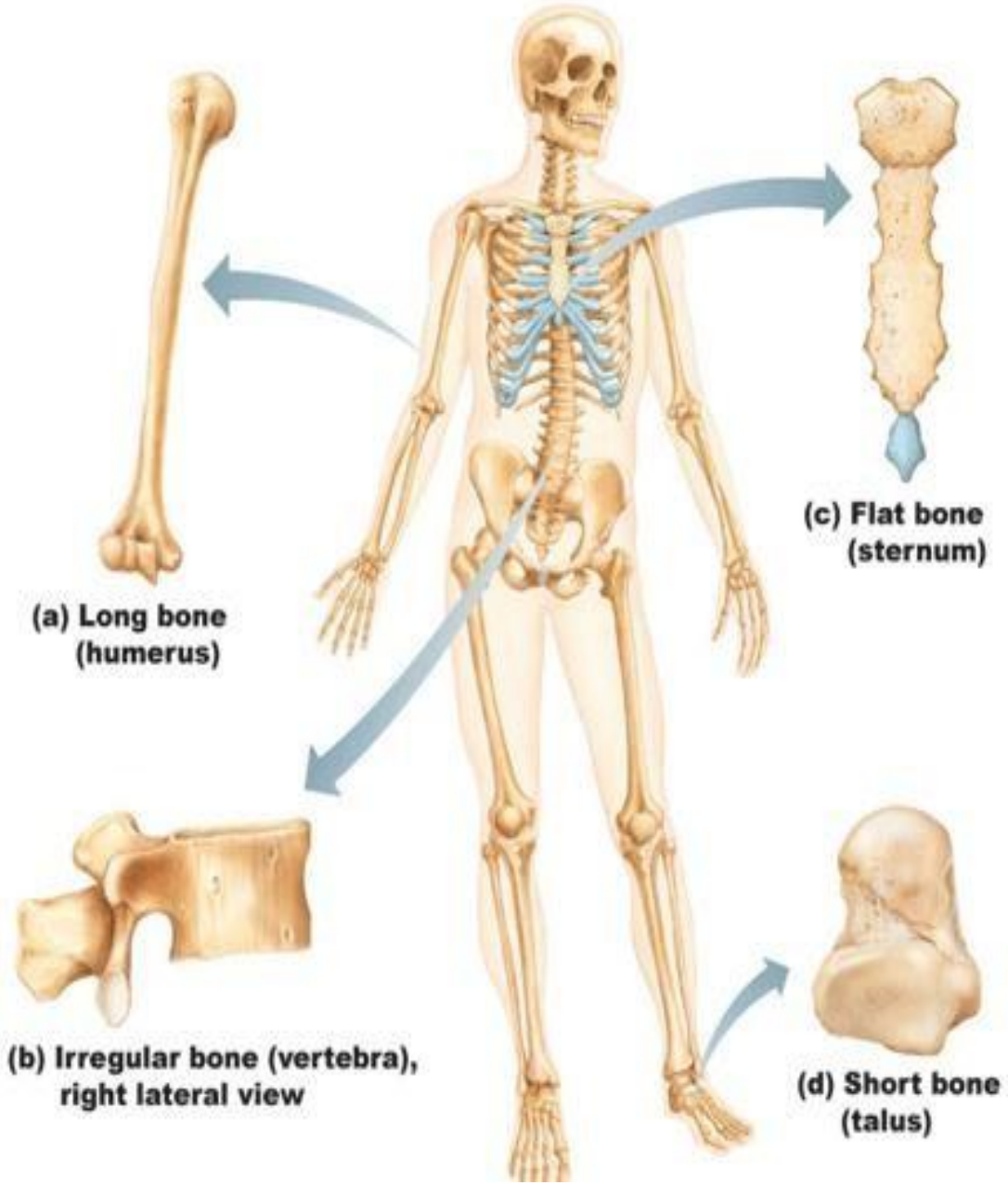
the upper and lower limbs, and the shoulder and pelvic girdles

- *Bones are classified based on three things*:

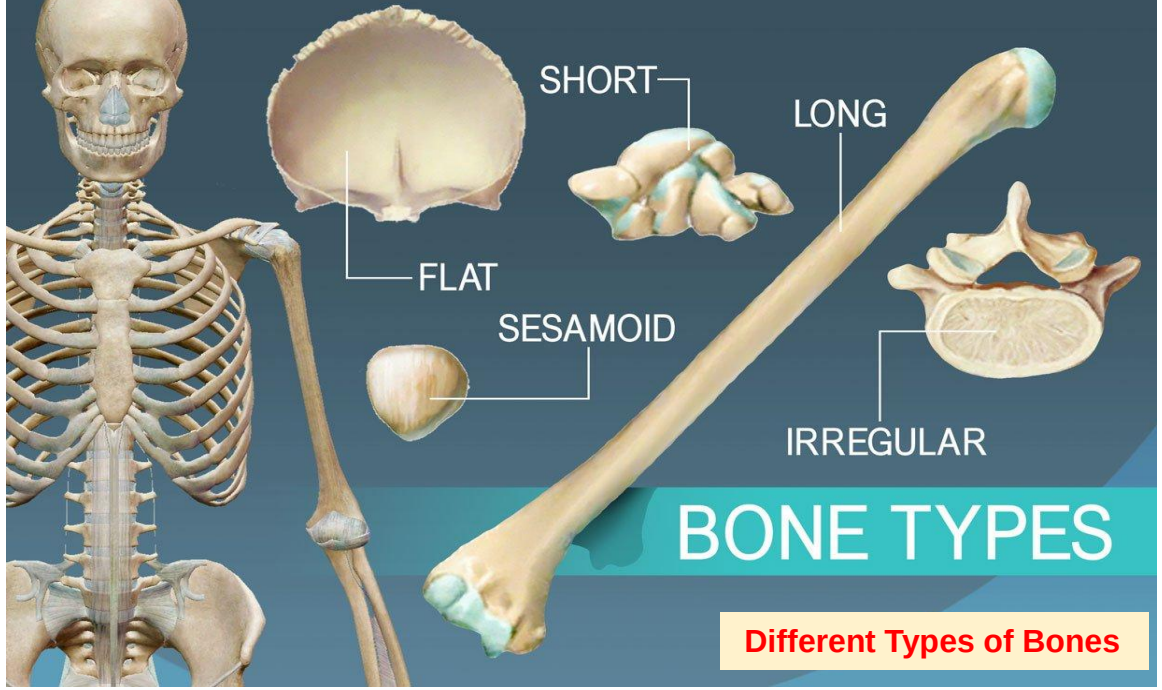
1 Shape: Long, Short, Irregular , flat

2 Structure: Compact, Spongy

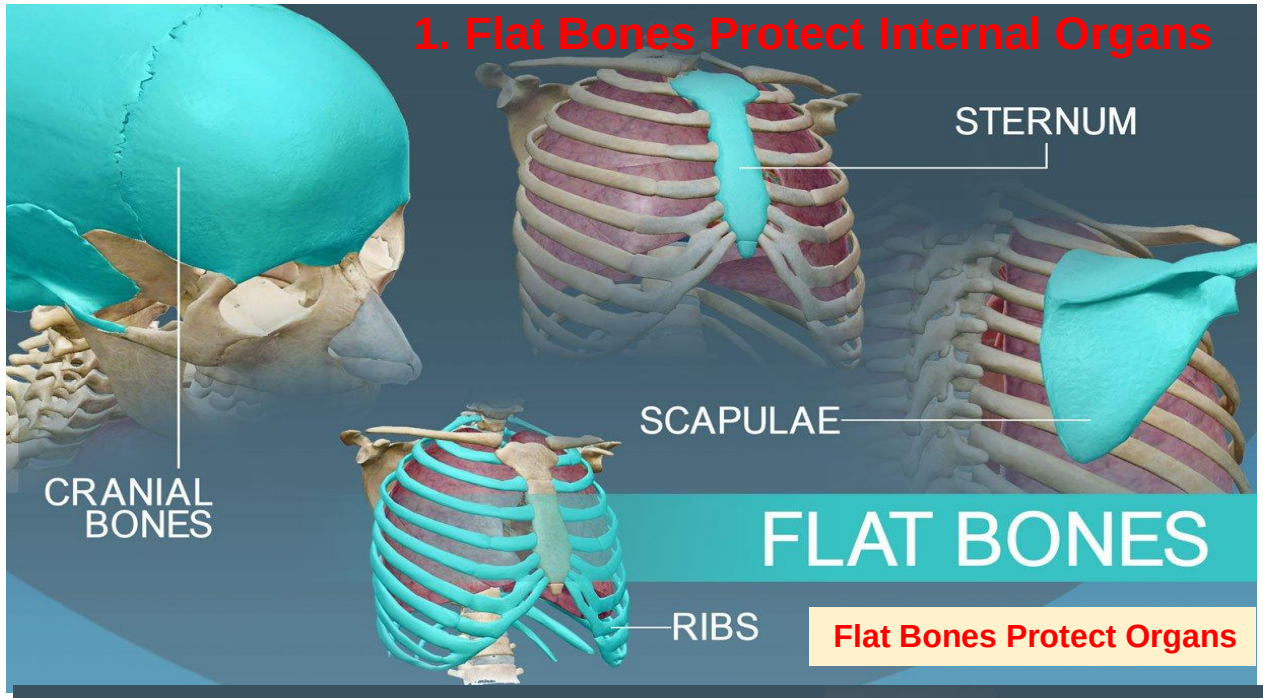
3 Development: Membrane, Cartilage



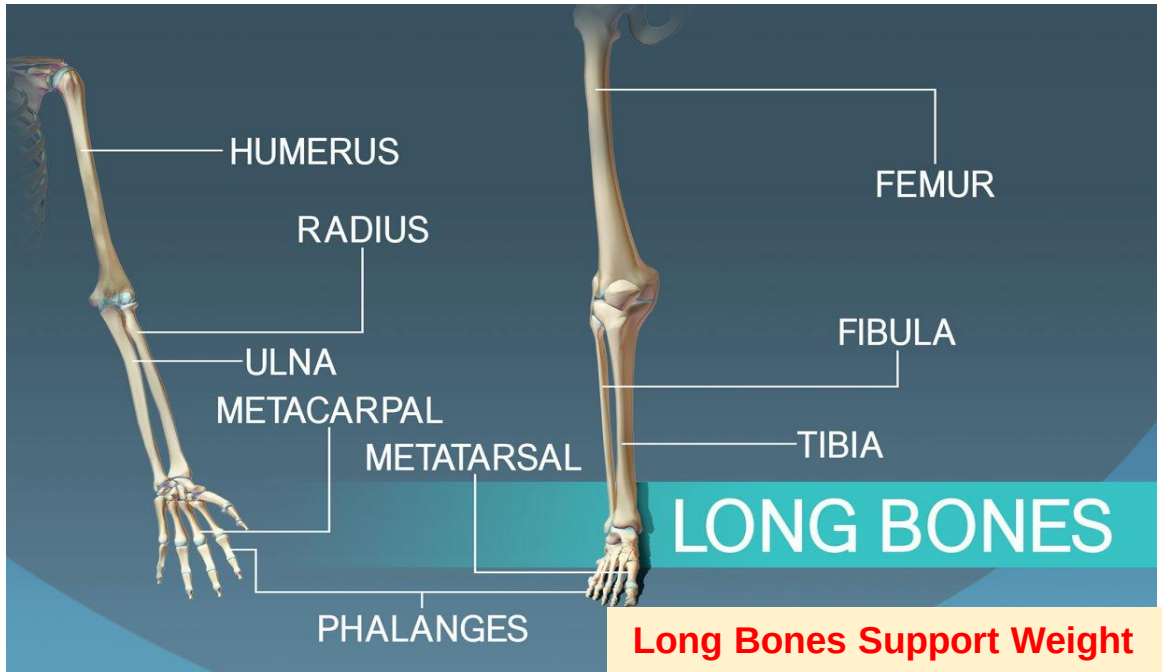
An infant skeleton has almost a hundred more bones than the skeleton of an adult.



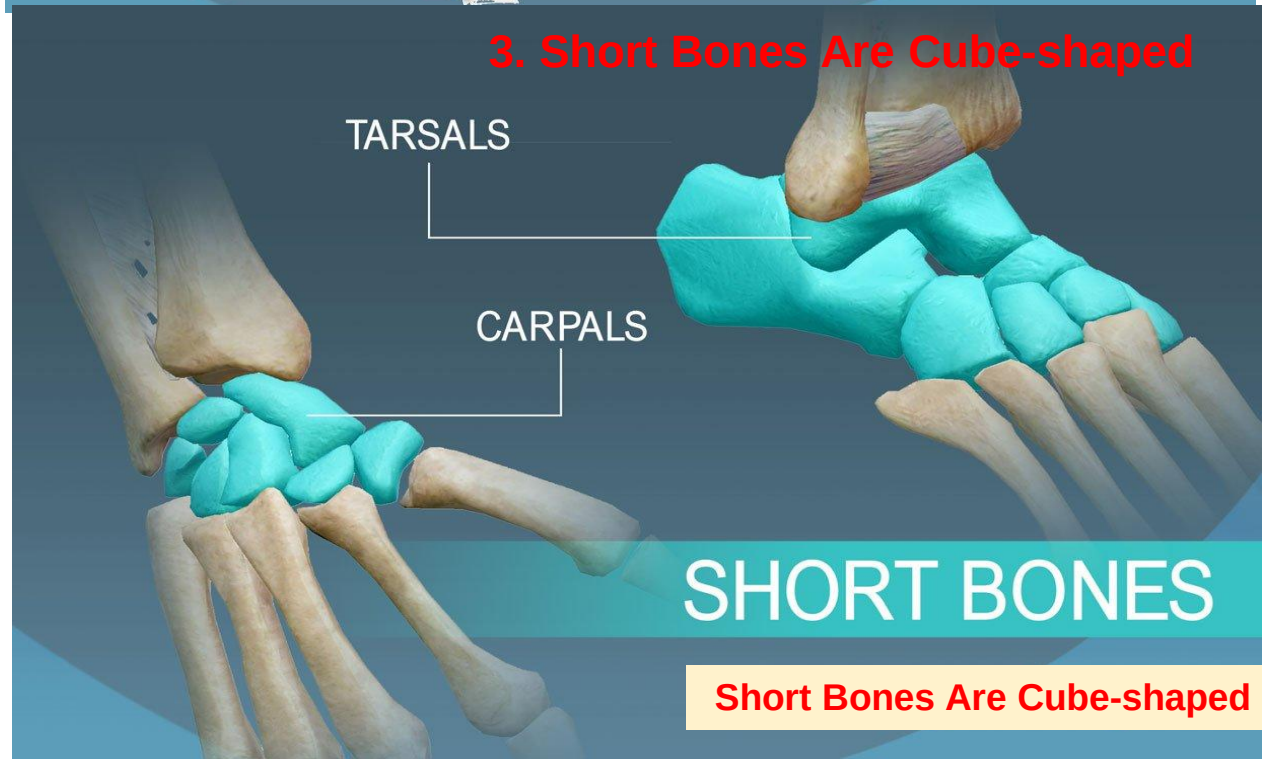
1. Flat Bones Protect Internal Organs



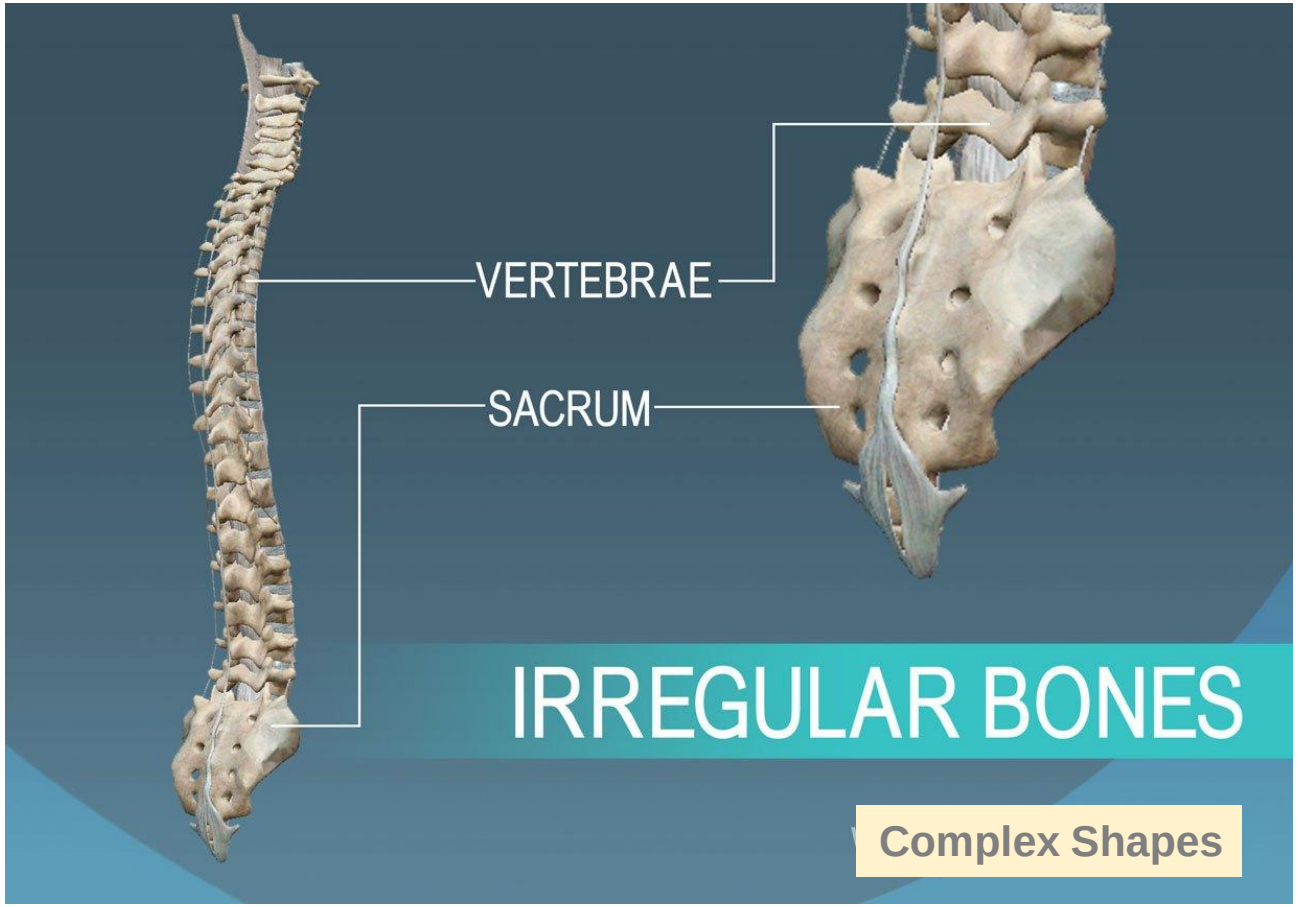
2. Long Bones Support Weight and Facilitate Movement



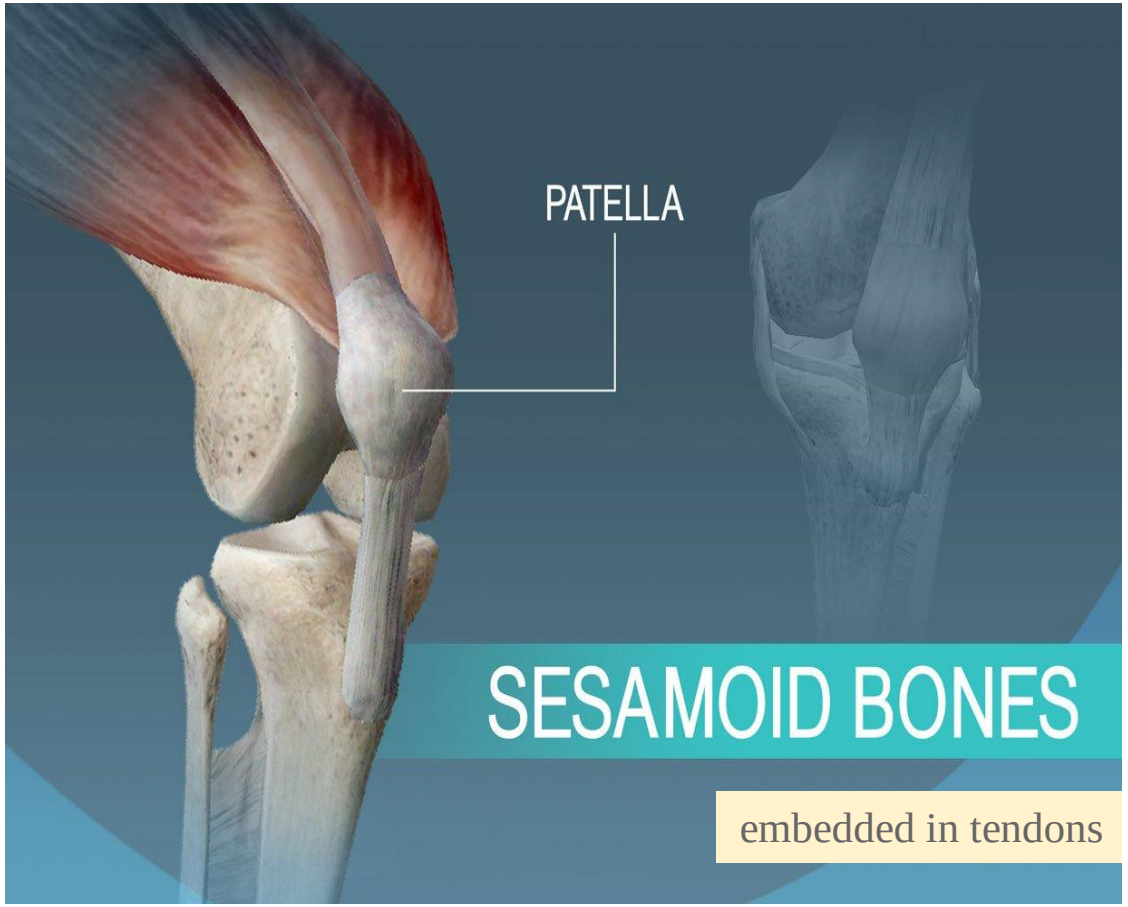
3. Short Bones Are Cube-shaped



4. Irregular Bones Have Complex Shapes



5. Sesamoid Bones Reinforce Tendons



There are **flat bones** in the skull (occipital, parietal, frontal, nasal, lacrimal, and vomer), the thoracic cage (sternum and ribs), and the pelvis (ilium, ischium, and pubis). The function of flat bones is to protect internal organs such as the brain, heart, and pelvic organs.

Sesamoid bones are bones embedded in tendons. These small, round bones are commonly found in the tendons of the hands, knees, and feet. Sesamoid bones function to protect tendons from stress and wear. The patella, commonly referred to as the kneecap, is an example of a sesamoid bone.

Parts of an Adult Long Bone

Parts of an adult long bone: Adult long bone has two ends and an intervening shaft.

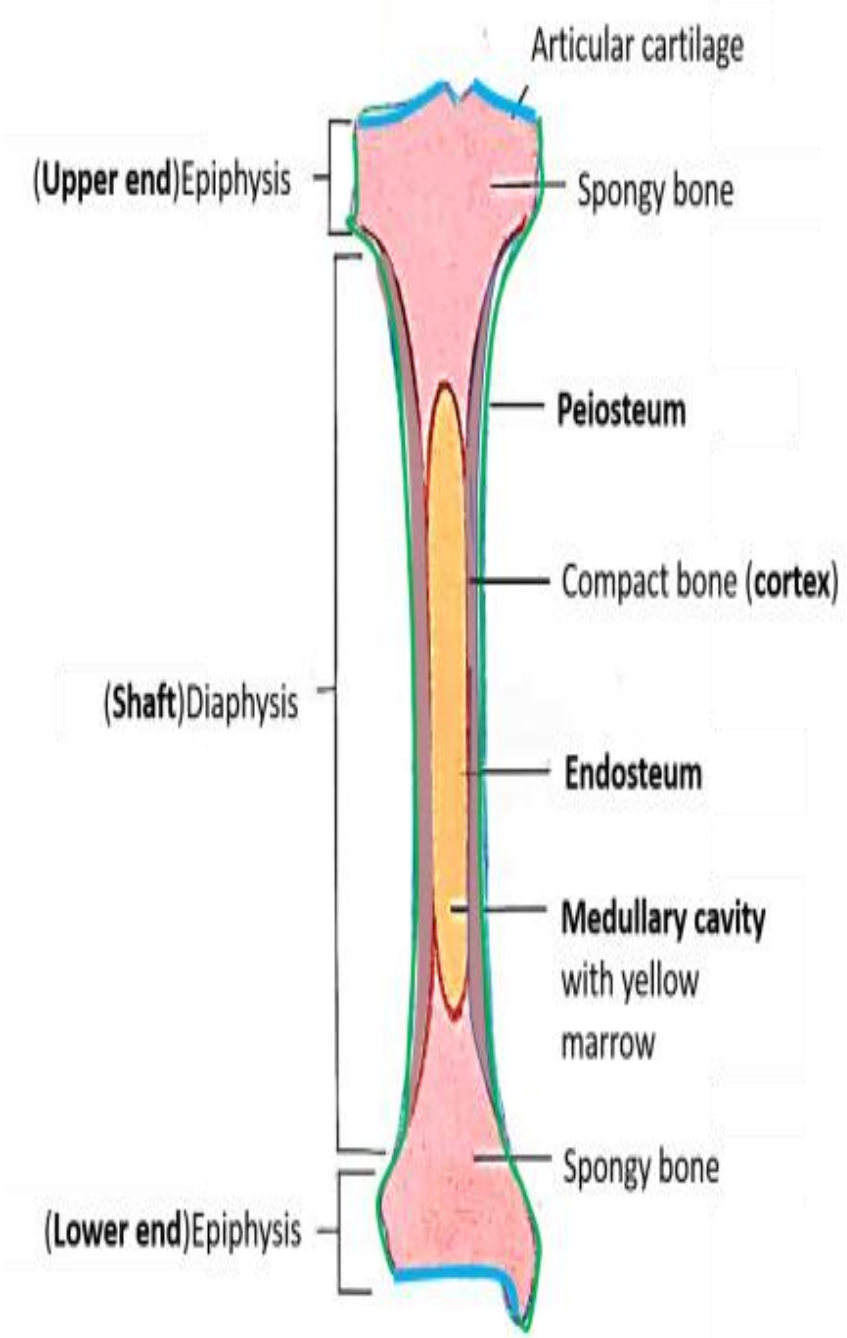
• **Shaft (diaphysis):**The shaft of the long bone is composed of the following from outside to inside:

Periosteum: It is a thick fibro-cellular layer that covers the outer surface of bone except the articular surfaces which are covered by articular cartilage (hyaline cartilage). It has very rich nerve supply and therefore it is the most pain sensitive part of bone.

Cortex (cortical bone): It is made up of dense compact/cortical bone.

Marrow cavity: Deep to the cortex is the **medullary cavity**. It is lined by endosteum and is filled with bone marrow (depending upon age of the individual it can be red or yellow marrow).

• **Ends of long bone (Epiphysis):** Are made up of cancellous bone (having bony trabeculae and marrow spaces (filled with red bone marrow)). The articular surfaces at the ends are covered by articular (hyaline) cartilage).



Osteology of Upper Limbs

32 bones in all

Shoulder Girdle: • Clavicle (Collar Bone)

• Scapula (Shoulder Blade)

Arm: • Humerus

Forearm:

• Radius (Lateral bone of forearm)

• Ulna (Medial bone of forearm)

Hand:

• Carpal Bones (8)

• Metacarpals (5) • Phalanges (14)

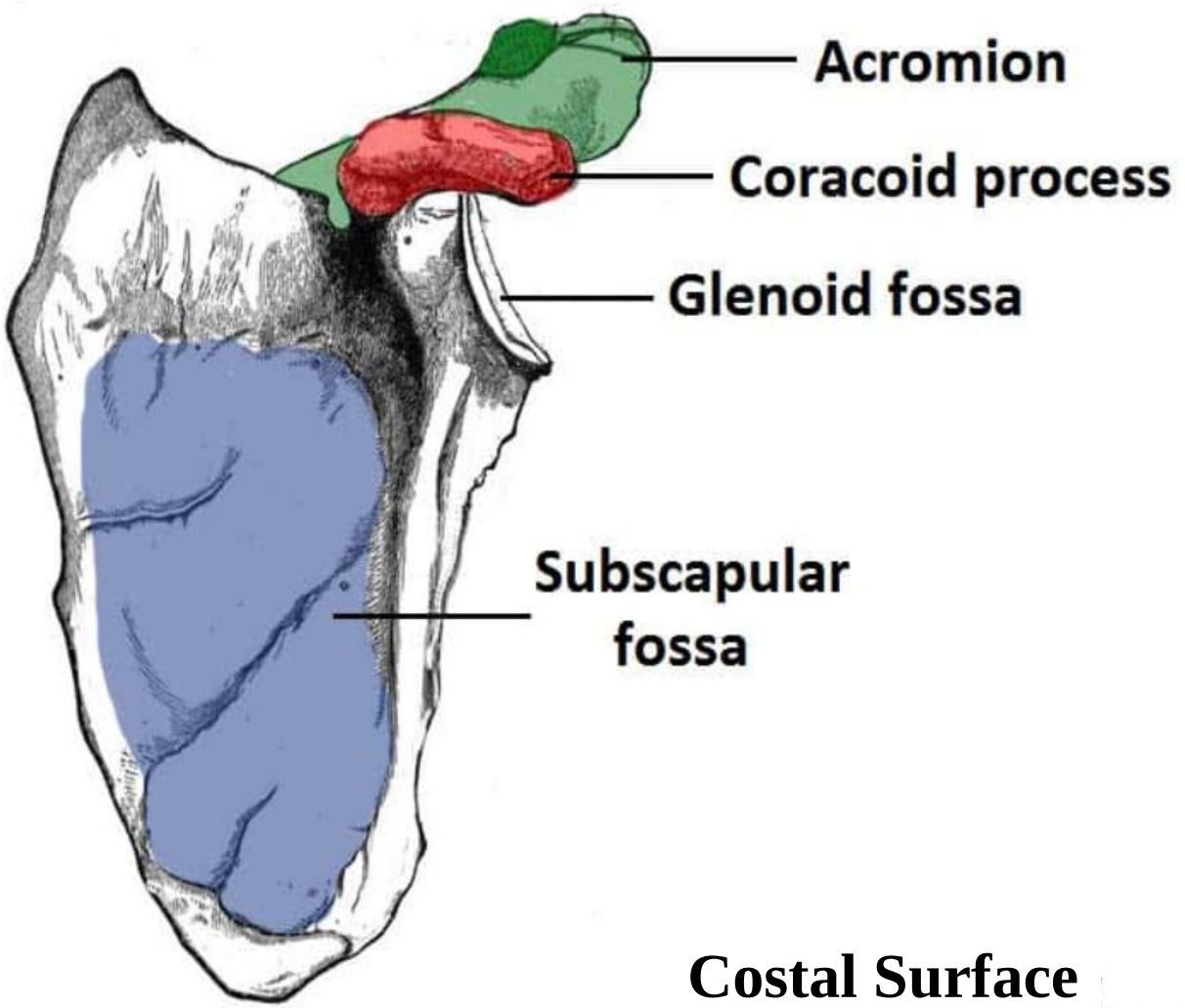
The **scapula** is also known as the shoulder blade. It articulates with the humerus at the **glenohumeral joint**, and with the clavicle at the **acromioclavicular joint**. In doing so, the scapula connects the upper limb to the trunk. It is a **triangular**, flat bone, which serves as a site for attachment for many (17!) muscles.

Costal Surface

The costal (anterior) surface of the scapula faces the **ribcage**.

It contains a large concave depression over most of its surface, known as the **subscapular fossa**. The subscapularis (rotator cuff muscle) originates from this fossa.

Originating from the superolateral surface of the costal scapula is the **coracoid process**. It is a hook-like projection, which lies just underneath the clavicle. Three muscles attach to the coracoid process: the pectoralis minor, coracobrachialis, and the short head of the biceps brachii.



Costal Surface

Lateral Surface

The lateral surface of the scapula faces the humerus. It is the site of the glenohumeral joint, and of various muscle attachments. Its important bony landmarks include:

Glenoid fossa – a shallow cavity, located superiorly on the lateral border.

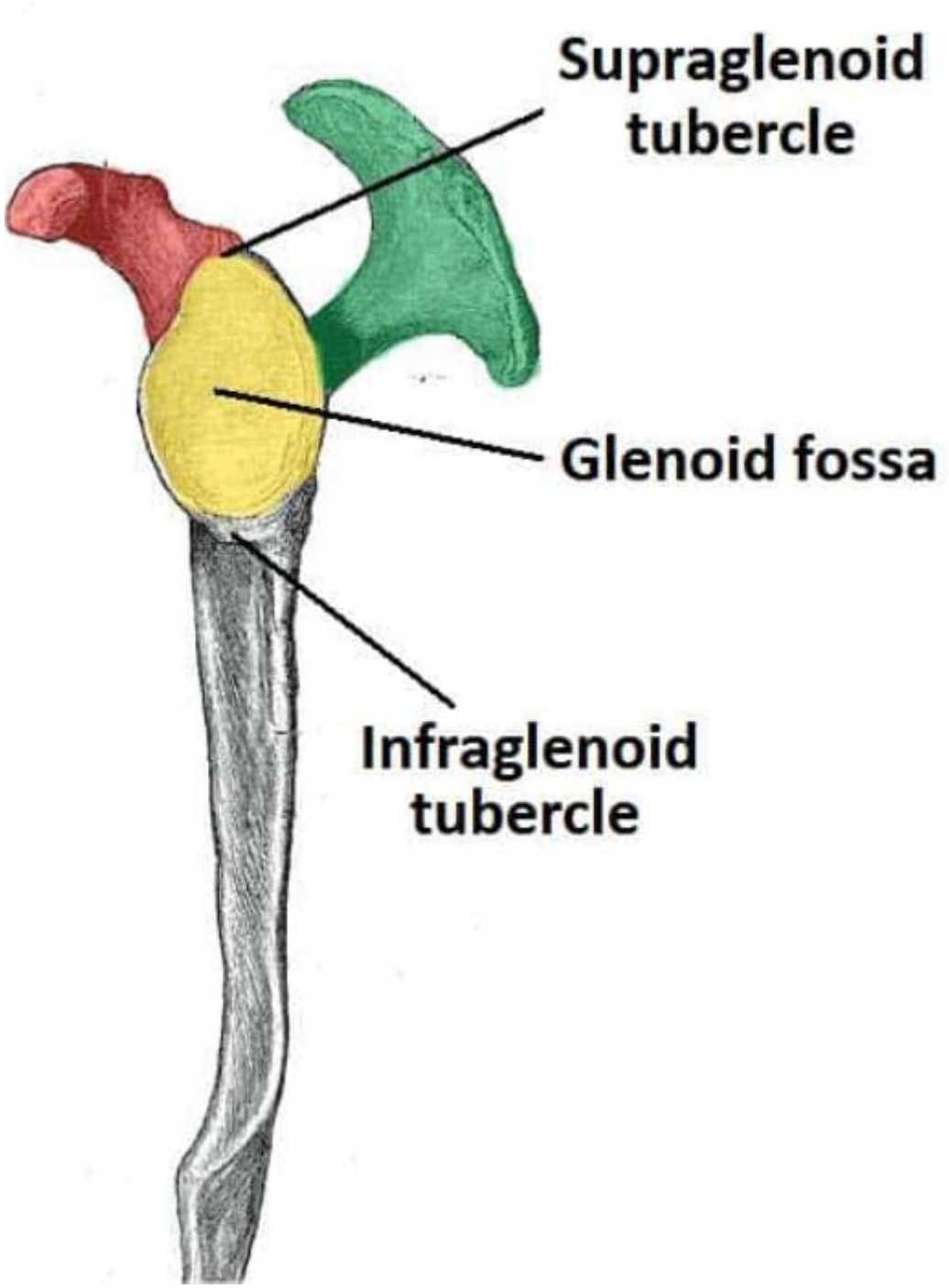
It articulates with the head of the humerus to form the glenohumeral (shoulder) joint.

Supraglenoid tubercle – a roughening immediately superior to the glenoid fossa.

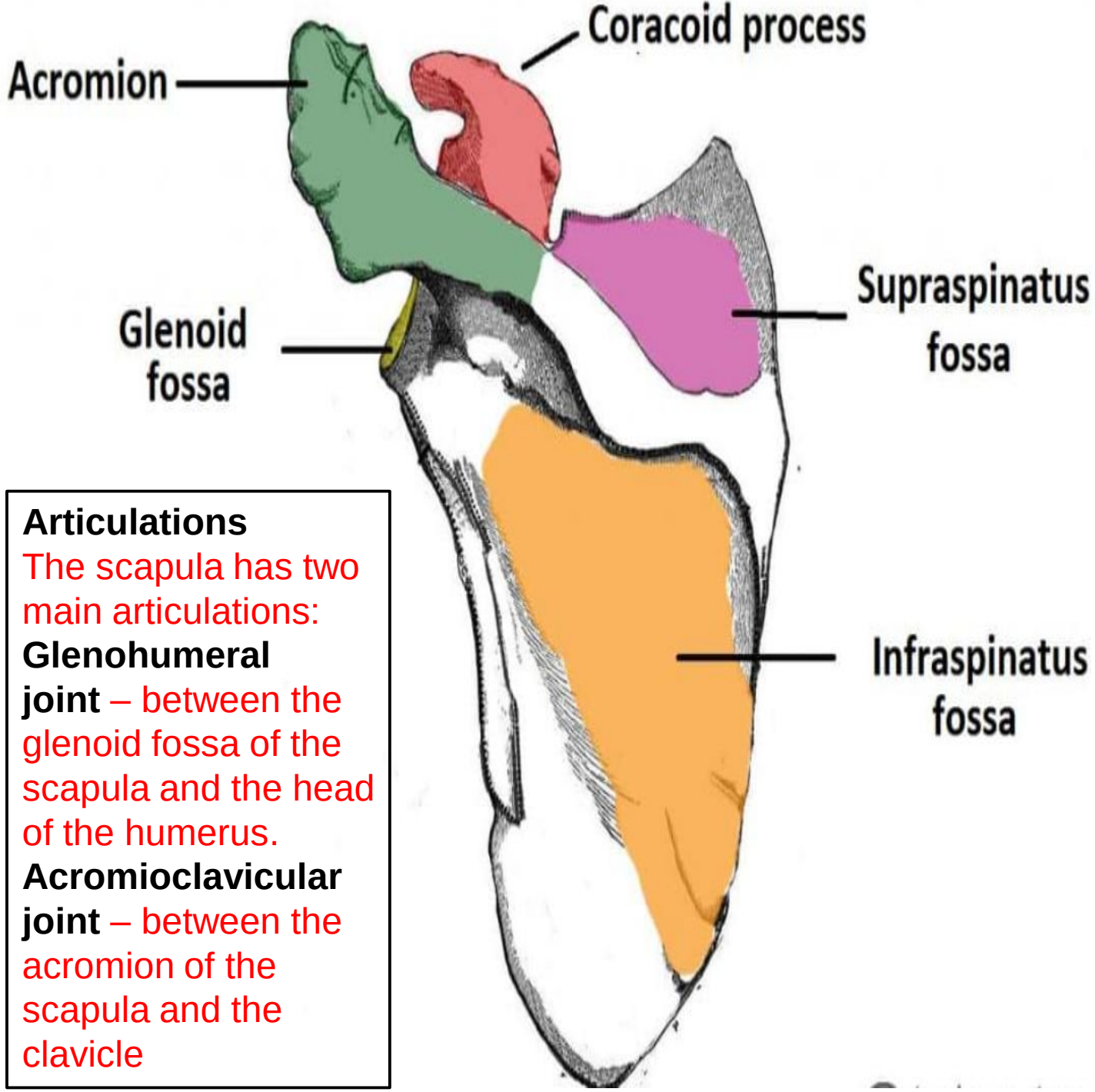
The place of attachment of the long head of the biceps brachii.

Infraglenoid tubercle – a roughening immediately inferior to the glenoid fossa.

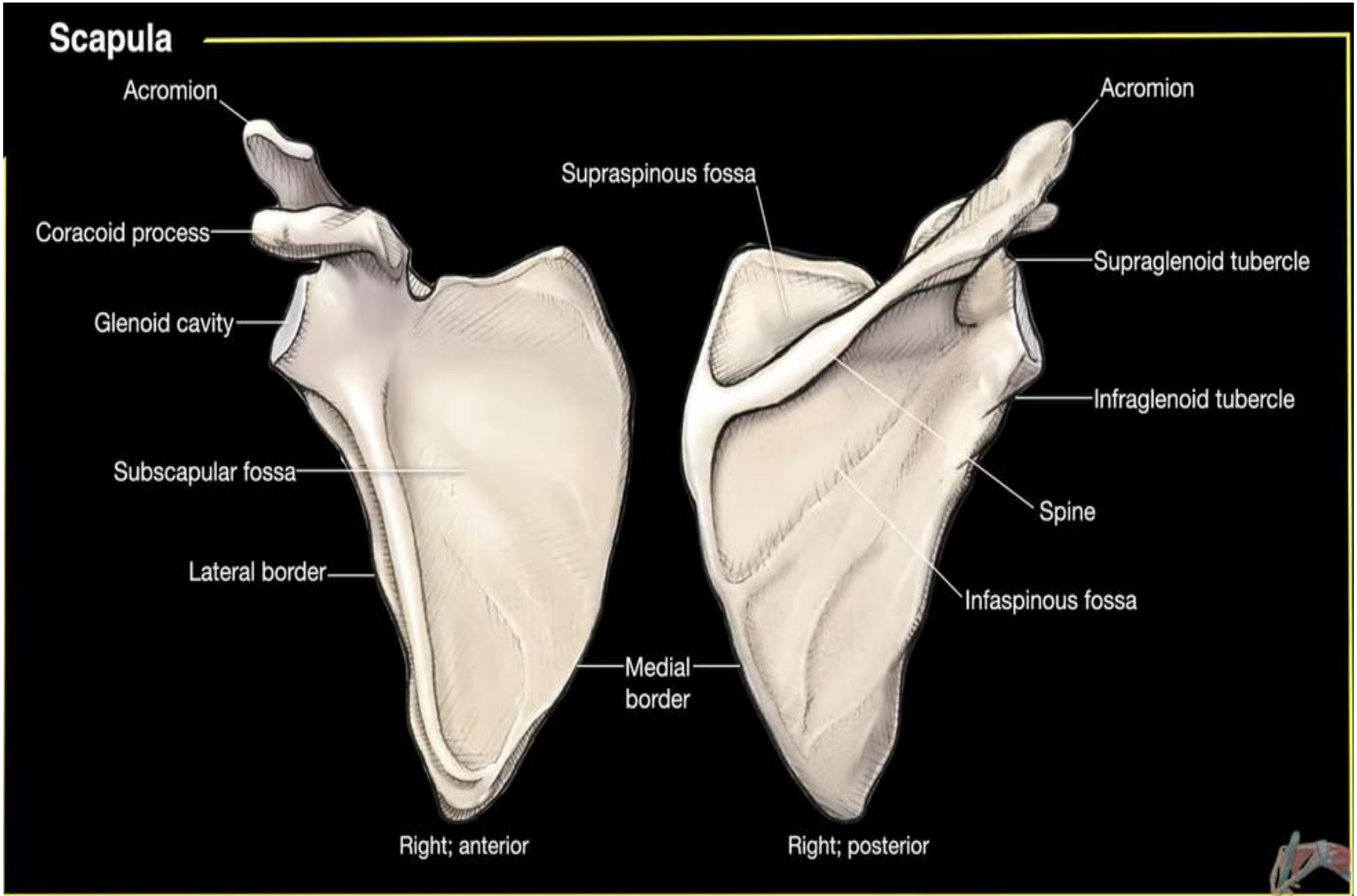
The place of attachment of the long head of the triceps brachii.



The **posterior surface** of the scapula faces outwards. It is a site of origin for the majority of the rotator cuff muscles of the shoulder.
It is marked by:
Spine – the most prominent feature of the posterior scapula. It runs transversely across the scapula, dividing the surface into two.
Acromion – projection of the spine that arches over the glenohumeral joint and articulates with the clavicle at the acromioclavicular joint.
Infraspinous fossa – the area below the spine of the scapula, it displays a convex shape.
The infraspinatus muscle originates from this area.
Supraspinous fossa – the area above the spine of the scapula, it is much smaller than the infraspinous fossa.
The supraspinatus muscle originates from this area.



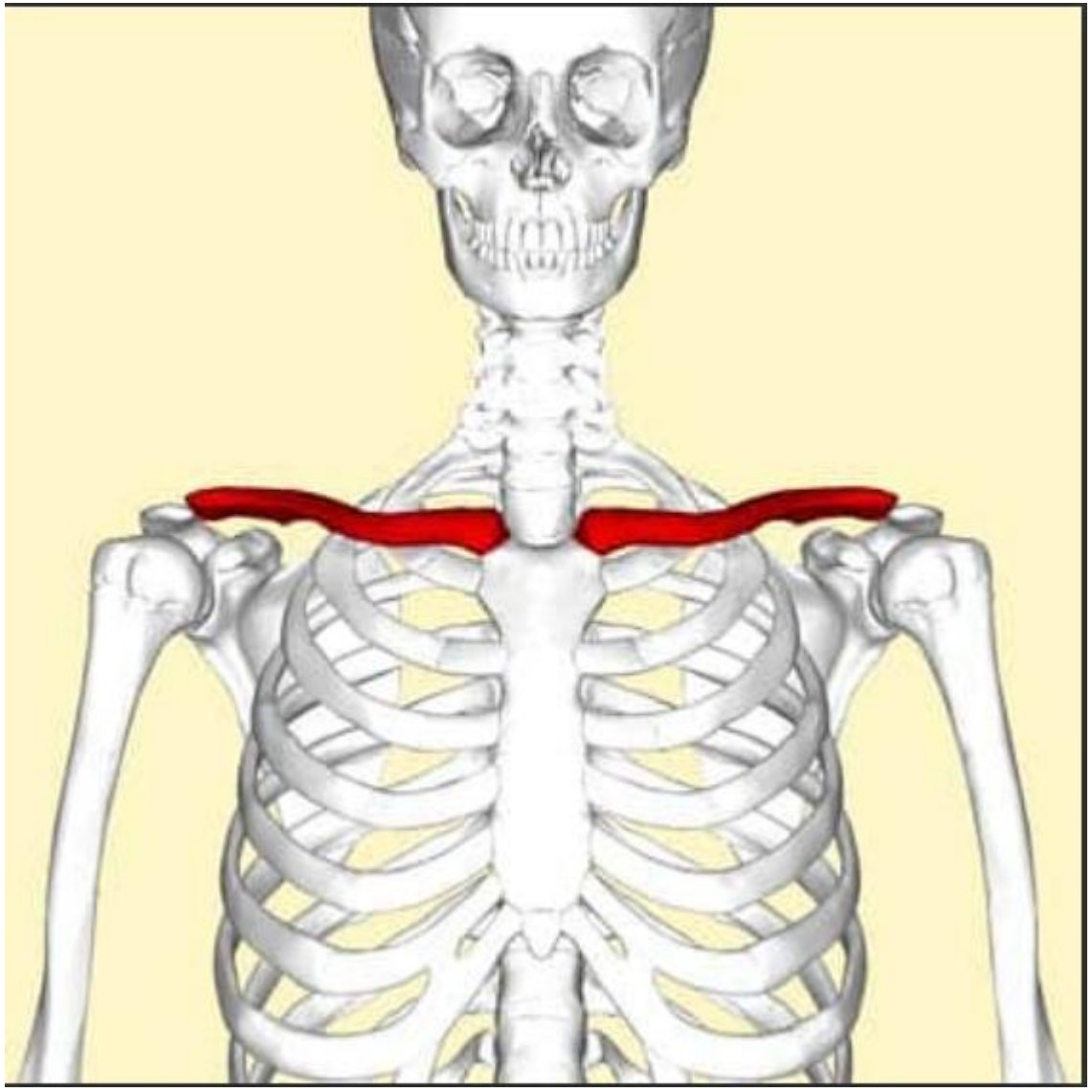
Articulations
The scapula has two main articulations:
Glenohumeral joint – between the glenoid fossa of the scapula and the head of the humerus.
Acromioclavicular joint – between the acromion of the scapula and the clavicle


Scapula
Acromion
Coracoid process
Glenoid cavity
Subscapular fossa
Lateral border
Medial border
Right; anterior
Supraspinous fossa
Acromion
Supraglenoid tubercle
Infraglenoid tubercle
Spine
Infaspinous fossa
Right; posterior

The clavicle (collarbone)
extends between the manubrium of the sternum and the acromion of the scapula.

It is classed as a **long bone** and can be palpated along its length. In thin individuals, it is visible under the skin. The clavicle has three main functions:

Attaches the upper limb to the trunk as part of the ‘shoulder girdle’.
Protects the underlying neurovascular structures supplying the upper limb.
Transmits force from the upper limb to the axial skeleton



Bony Landmarks and Articulations

The **clavicle** is a slender bone with an ‘S’ shape. Facing forward, the medial aspect is convex, and the lateral aspect concave. It can be divided into a sternal end, a shaft and an acromial end.

Sternal (medial) End

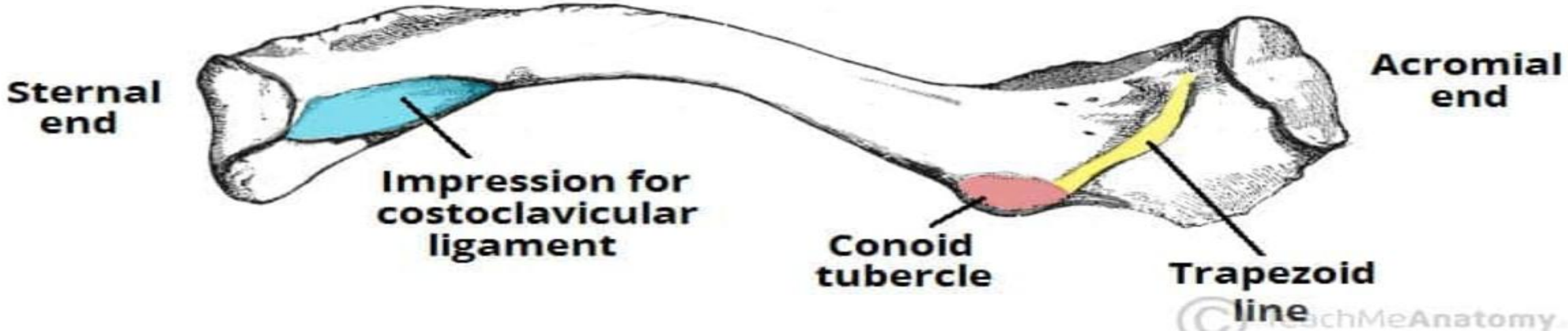
for articulation with the manubrium of the sternum at the sternoclavicular joint.

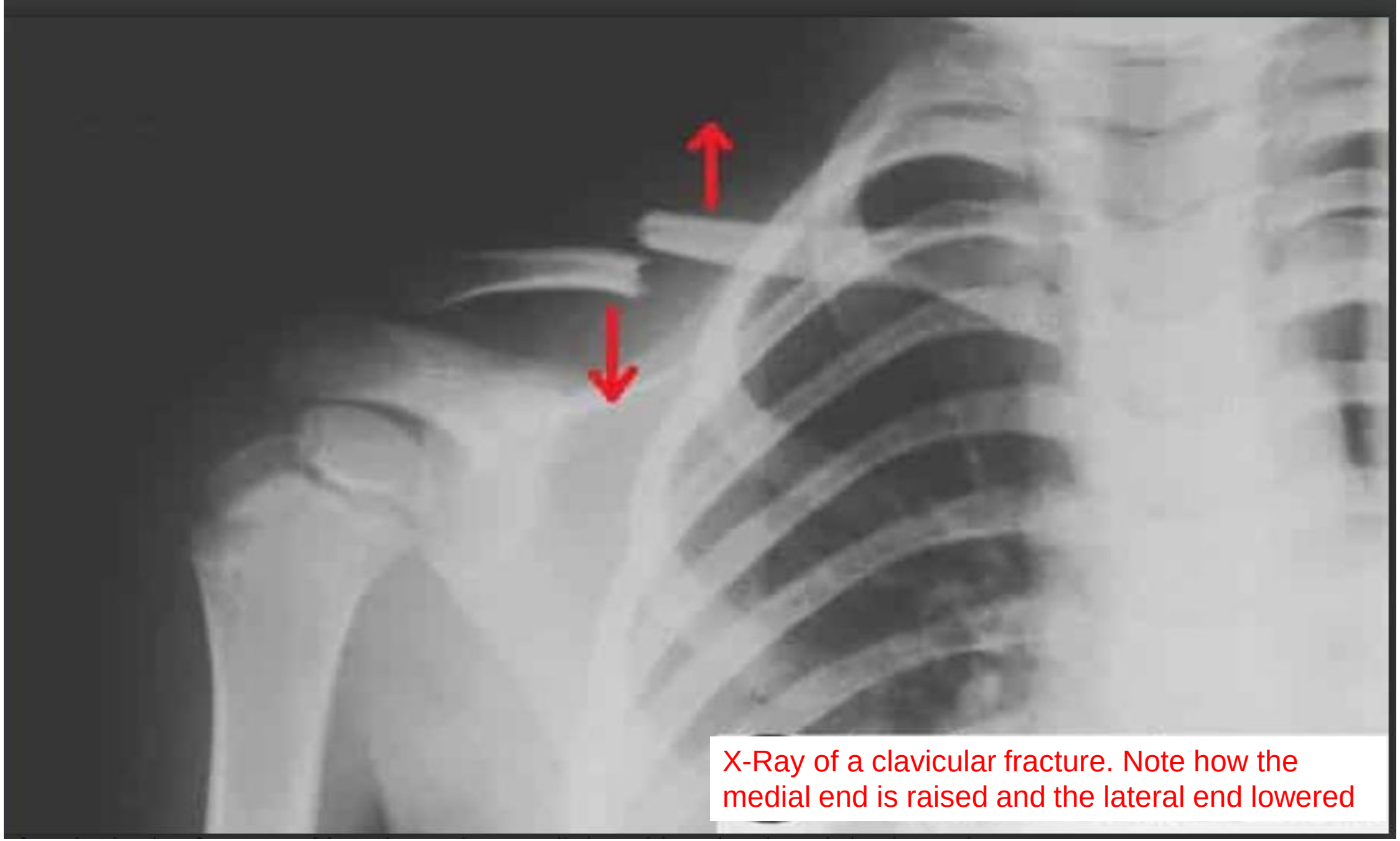
Shaft

The shaft of the clavicle acts a point of origin and attachment for several muscles – deltoid, trapezius, subclavius, pectoralis major, sternocleidomastoid and sternohyoid

Acromial (lateral) End

The acromial end houses a small facet for articulation with the acromion of the scapula at the acromioclavicular joint.





X-Ray of a clavicular fracture. Note how the medial end is raised and the lateral end lowered

The humerus

is a long bone of the upper limb, which extends from the shoulder to the elbow.

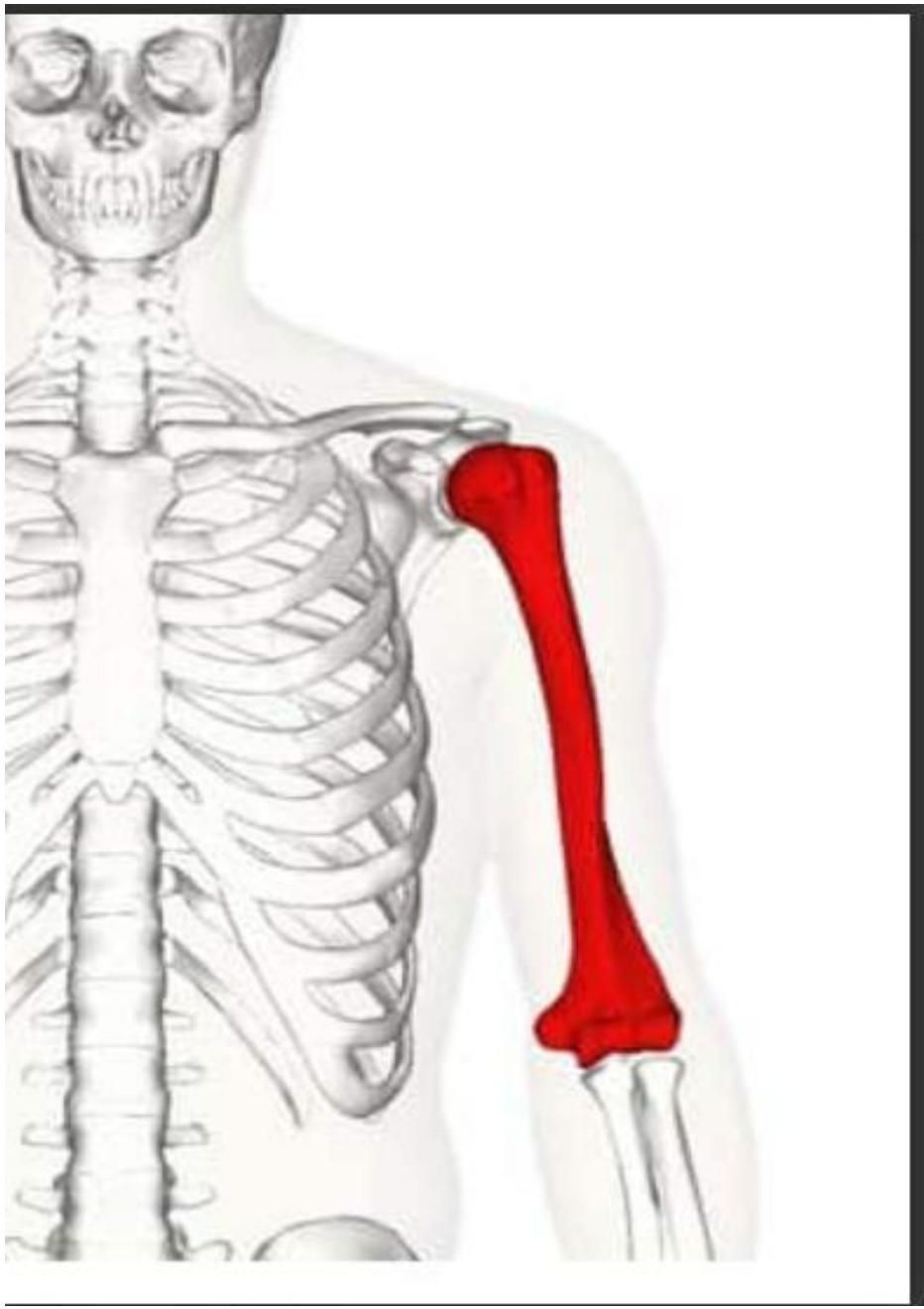
The proximal aspect of the humerus articulates with the **glenoid fossa** of the scapula, forming the glenohumeral joint. Distally, at the elbow joint, the humerus articulates with the **head of the radius** and **trochlear notch** of the ulna.

Proximal Landmarks

The proximal humerus is marked by a **head**, **anatomical neck, surgical neck, greater and lesser tuberosity and intertubercular sulcus**.

The upper end of the humerus consists of the head. This is separated from the greater and lesser tuberosities by the anatomical neck.

The greater tuberosity is located laterally on the humerus and has anterior and posterior surfaces. It serves as an attachment site for three of the rotator cuff muscles – **supraspinatus, infraspinatus and teres minor** – they attach to superior, middle and inferior facets (respectively) on the greater tuberosity.

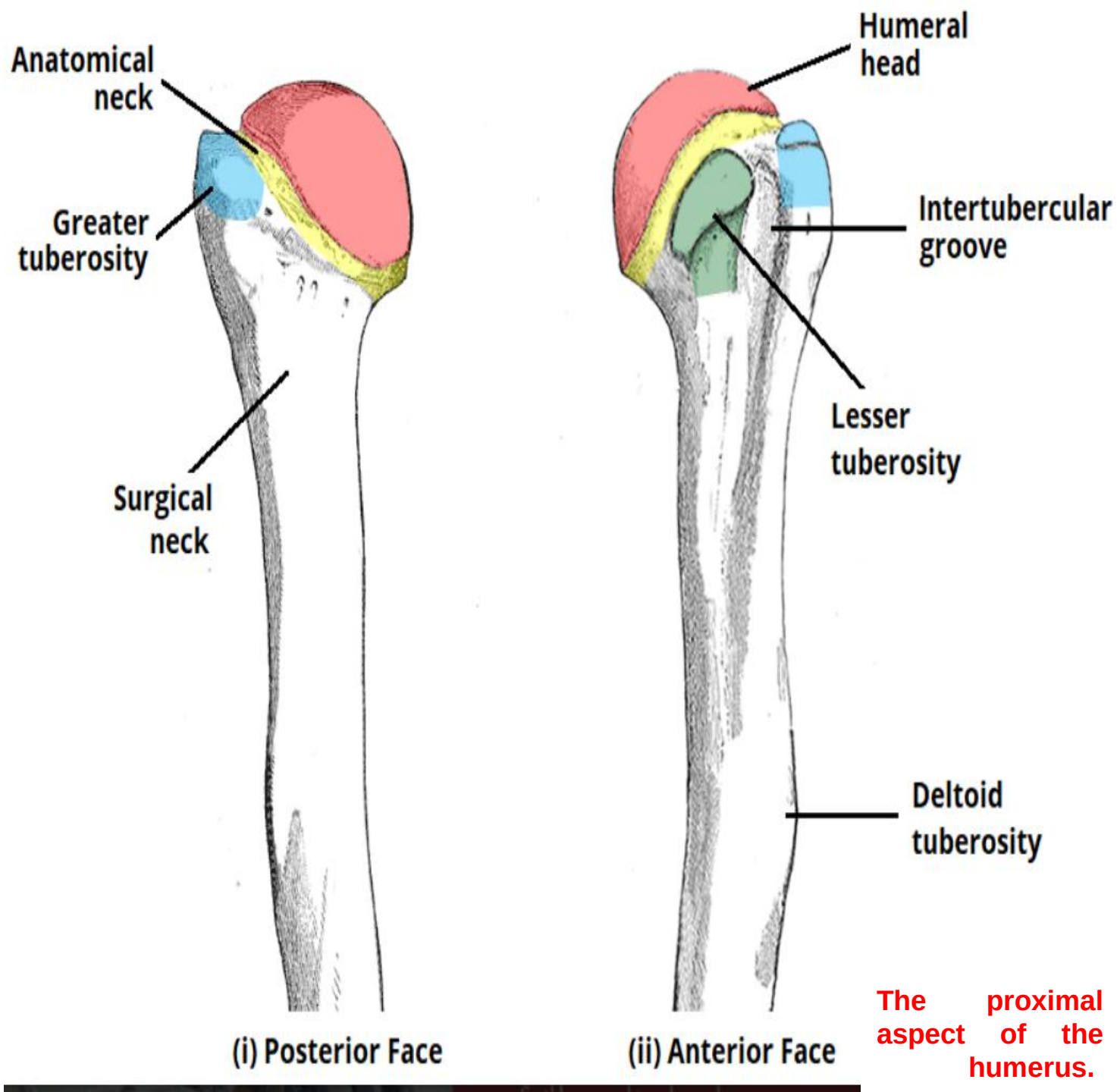


The lesser tuberosity is much smaller, and more medially located on the bone. It provides attachment for the last rotator cuff muscle – the subscapularis.

Separating the two tuberosities is a deep groove, known as the **intertubercular sulcus**. The tendon of the long head of the **biceps brachii** emerges from the shoulder joint and runs through this groove.

The edges of the intertubercular sulcus are known as lips. **Pectoralis major, teres major and latissimus dorsi** insert on the lips of the intertubercular sulcus.

The surgical neck extends from just distal to the tuberosities to the shaft of the humerus. **The axillary nerve** and **circumflex humeral vessels** lie against the bone here.



The proximal aspect of the humerus.

Surgical Neck Fracture

The **surgical neck** of the humerus is a frequent site of fracture – usually by a direct blow to the area, or falling on an outstretched hand.

The key neurovascular structures at risk here are the **axillary nerve** and **posterior circumflex artery**.

Axillary nerve damage will result in paralysis to the **deltoid and teres minor muscles**. The patient will have difficulty performing abduction of the affected limb. The nerve also innervates the skin over the lower deltoid and therefore sensation in this region may be impaired.

Shaft

The **shaft** of the humerus is the site of attachment for various muscles.
On the lateral side of the humeral shaft is a roughened surface where the deltoid muscle attaches. This is known is as the **deltoid tuberosity**.

The **radial (or spiral) groove** is a shallow depression that runs diagonally down the posterior surface of the humerus, parallel to the deltoid tuberosity. The radial nerve and profunda brachii artery lie in this groove.

The following muscles attach to the humerus along its shaft:
Anteriorly – coracobrachialis, deltoid, brachialis, brachioradialis.
Posteriorly – medial and lateral heads of the triceps (the spiral groove demarcates their respective origins).

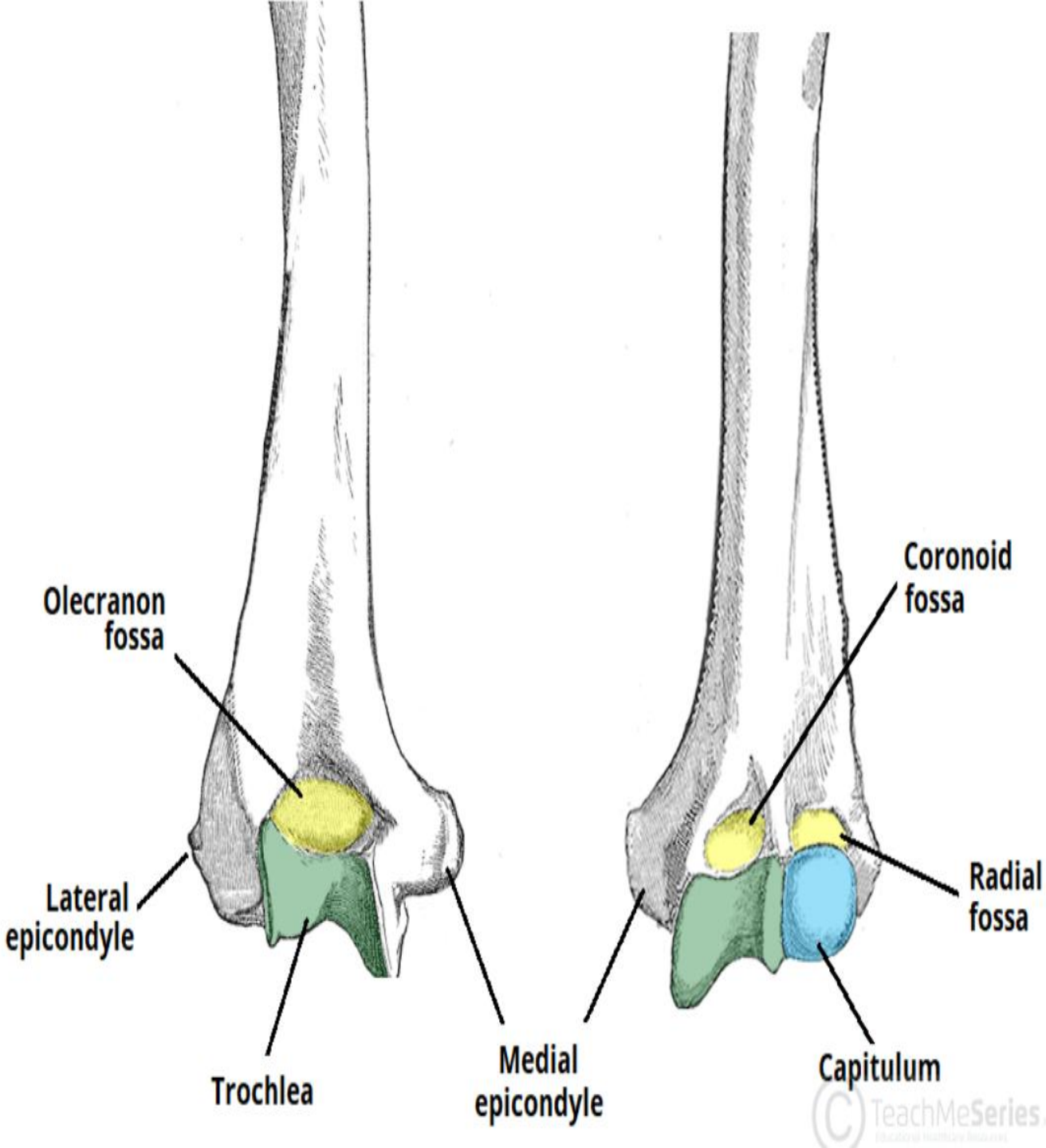
Distal Region

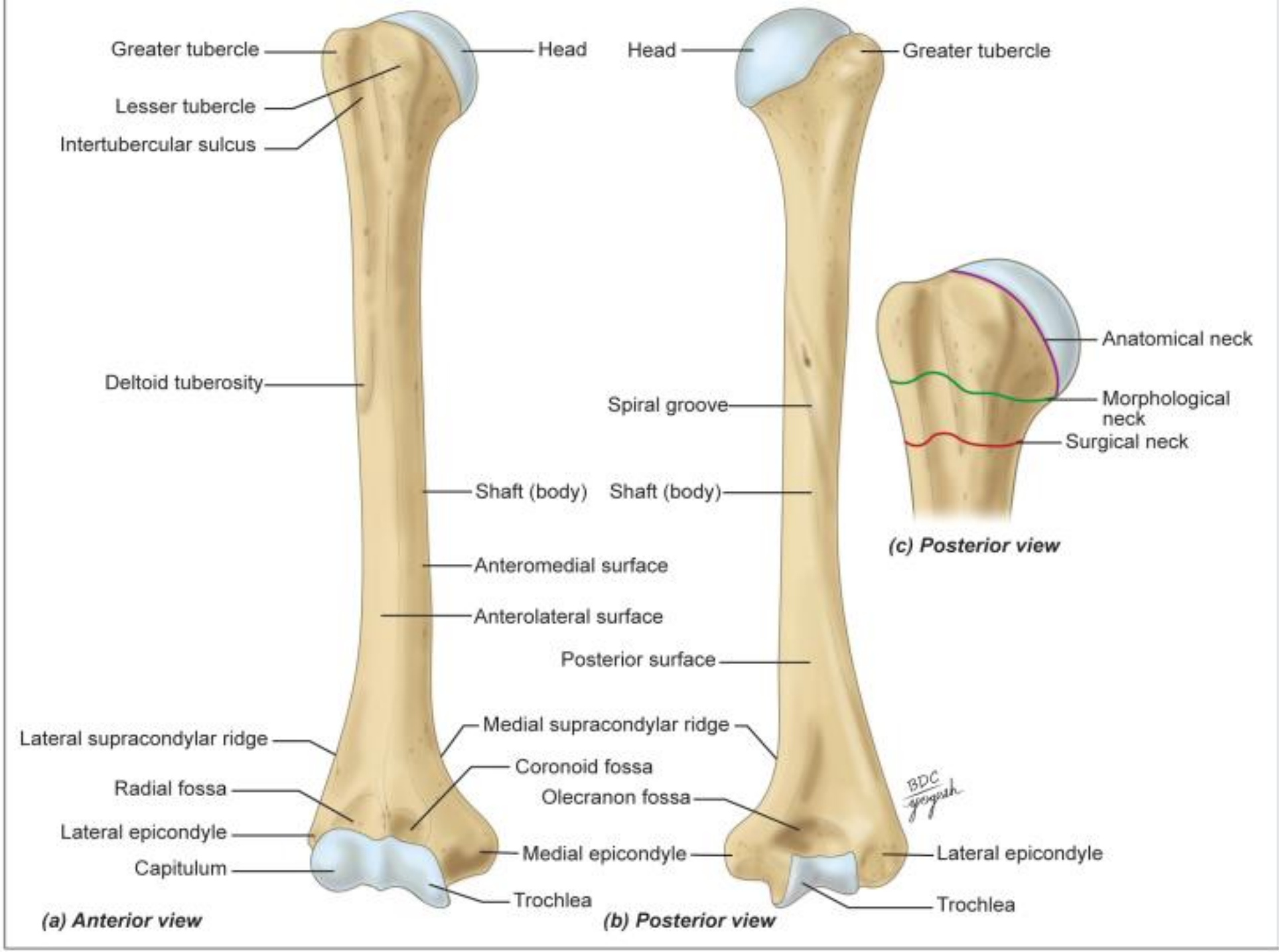
The lateral and medial borders of the distal humerus form the **lateral** and **medial epicondyles.** Both can be palpated at the elbow. The medial is the larger of the two and extends more distally. The **ulnar nerve** passes in a groove on the posterior aspect of the medial epicondyle where it is palpable.

Distally, the **trochlea** is located medially, and extends onto the posterior aspect of the bone. Lateral to the trochlea is the **capitulum,** which articulates with the radius.

Also located on the distal portion of the humerus are three depressions, known as the **coronoid**, **radial** and **olecranon fossae**.

They accommodate the forearm bones during flexion or extension at the elbow.

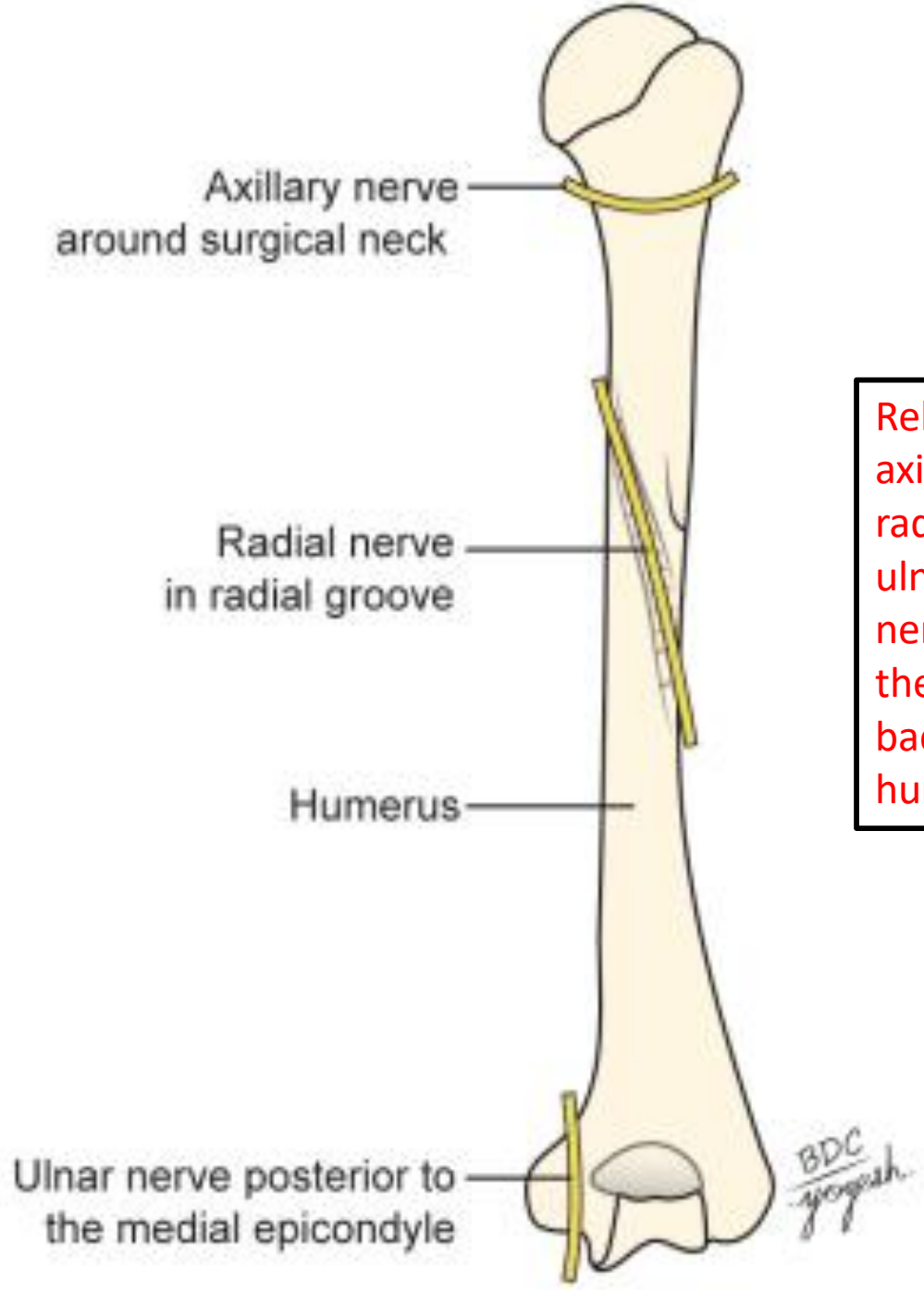



Greater tubercle
Head
Lesser tubercle
Intertubercular sulcus
Deltoid tuberosity
Shaft (body)
Anteromedial surface
Anterolateral surface
Lateral supracondylar ridge
Radial fossa
Lateral epicondyle
Capitulum
Trochlea
(a) Anterior view
Head
Greater tubercle
Spiral groove
Shaft (body)
Posterior surface
Medial supracondylar ridge
Coronoid fossa
Olecranon fossa
Medial epicondyle
Lateral epicondyle
Trochlea
(b) Posterior view
Anatomical neck
Morphological neck
Surgical neck
(c) Posterior view

Articulations

The proximal region of the humerus articulates with the **glenoid fossa of the scapula** to form the glenohumeral joint (shoulder joint).

Distally, at the **elbow joint**, the capitulum of the humerus articulates with the head of the radius and the trochlea of the humerus articulates with the trochlear notch of the ulna

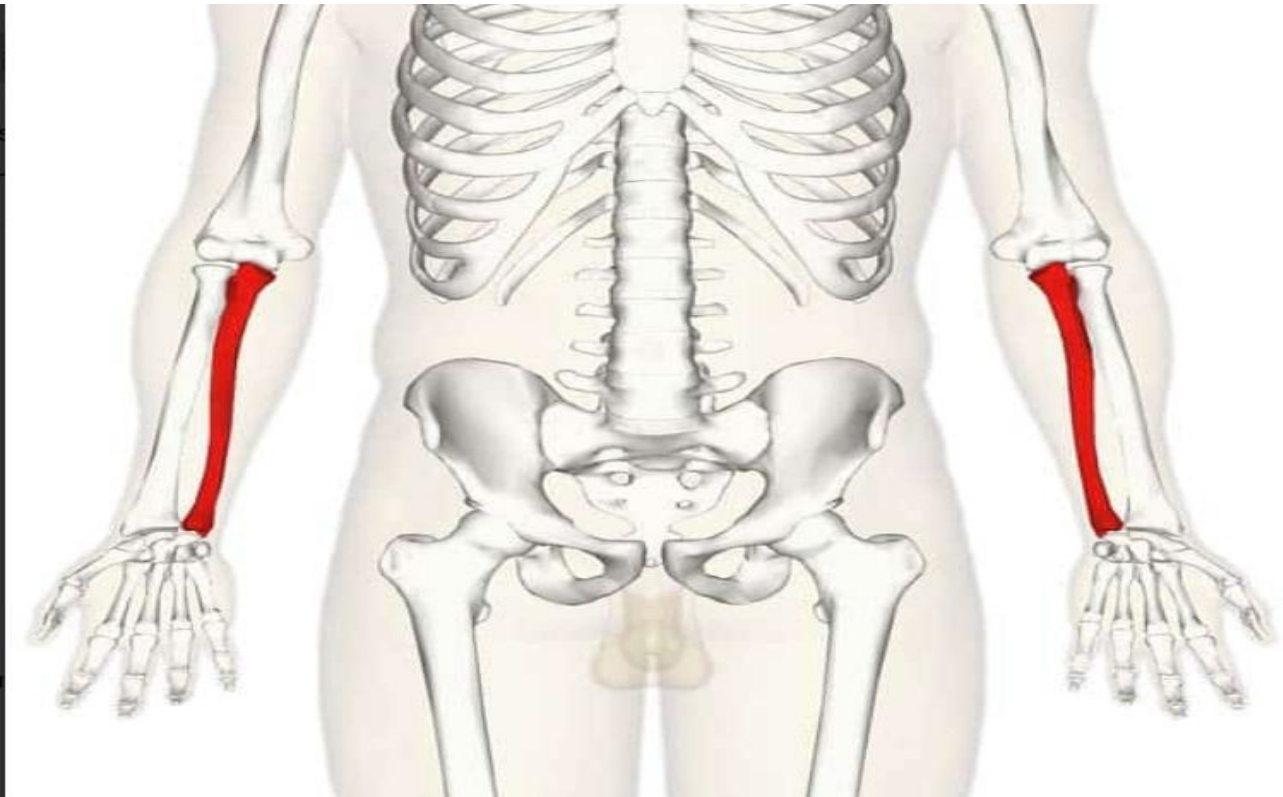


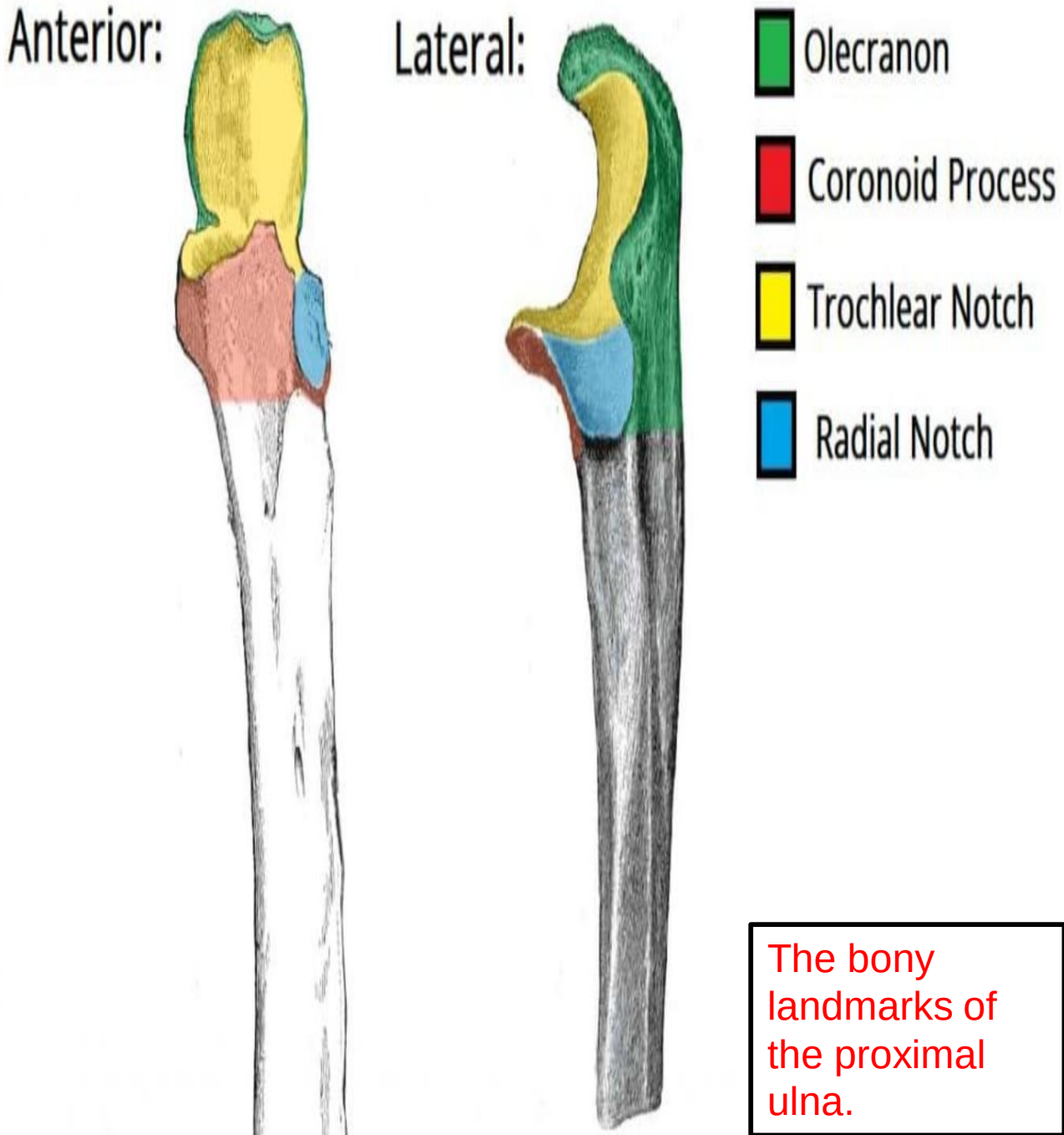
Relation of axillary, radial and ulnar nerves to the back of humerus

The ulna

is a long bone in the forearm. It lies medially and parallel to the radius, the second of the forearm bones..

Proximally, the ulna articulates with the **humerus** at the elbow joint. Distally, the ulna articulates with the **radius**, forming the distal radio-ulnar joint.





The bony landmarks of the proximal ulna.

Proximal Osteology and Articulation

The proximal end of the ulna articulates with the **trochlea** of the humerus.

Important landmarks of the proximal ulna are the olecranon, coronoid process, trochlear notch, radial notch and the tuberosity of ulna:

Olecranon – a large projection of bone that extends proximally, forming part of trochlear notch. It can be palpated as the 'tip' of the elbow.

Coronoid process – this ridge of bone projects outwards anteriorly, forming part of the trochlear notch.

Trochlear notch – formed by the olecranon and coronoid process. It articulates with the trochlea of the humerus.

Radial notch – located on the lateral surface of the trochlear notch, this area articulates with the head of the radius.

Tuberosity of ulna – a roughening immediately distal to the coronoid process. It is where the brachialis muscle attaches.

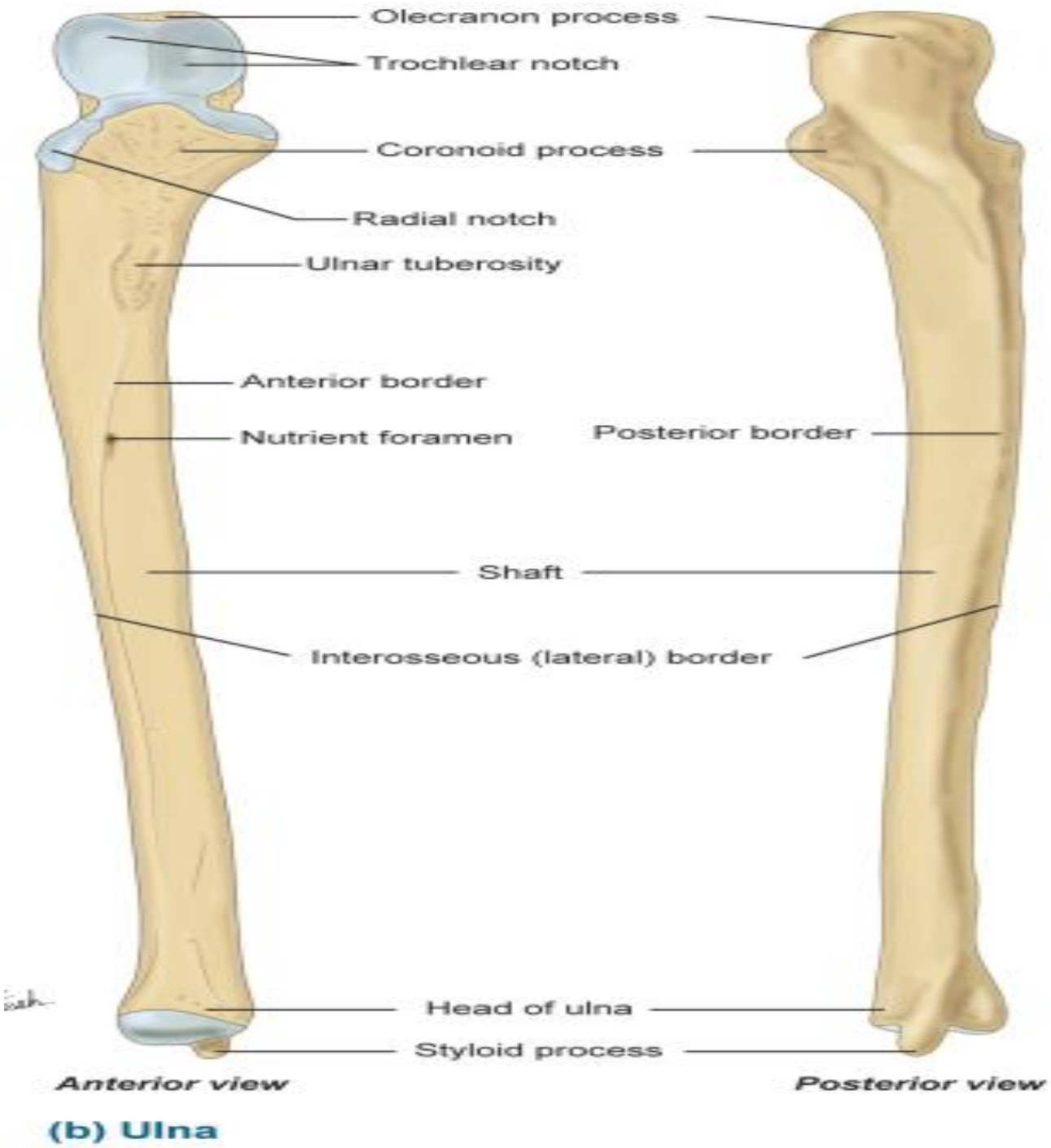
Shaft of the Ulna

The ulnar shaft is **triangular** in shape, with three borders and three surfaces. As it moves distally, it decreases in width.The three surfaces: **Anterior, Posterior** and **Medial**. The three borders:**Posterior, Interosseous** and **Anterior.**

Distal Osteology and Articulations

The distal end of the ulna is much smaller in diameter than the proximal end. It is mostly unremarkable, terminating in a rounded head, with distal projection – the ulnar **styloid process**.

The head articulates with the **ulnar notch** of the radius to form the distal radio-ulnar joint.



The radius
is a long bone in the forearm. It lies laterally and parallel to ulna, the second of the forearm bones. The radius pivots around the ulna to produce **movement** at the proximal and distal radio-ulnar joints.
The **radius** articulates in four places:
Elbow joint – Partly formed by an articulation between the head of the radius, and the capitulum of the humerus.
Proximal radioulnar joint – An articulation between the radial head, and the radial notch of the ulna.
Wrist joint – An articulation between the distal end of the radius and the carpal bones.
Distal radioulnar joint – An articulation between the ulnar notch and the head of the ulna

Proximal End

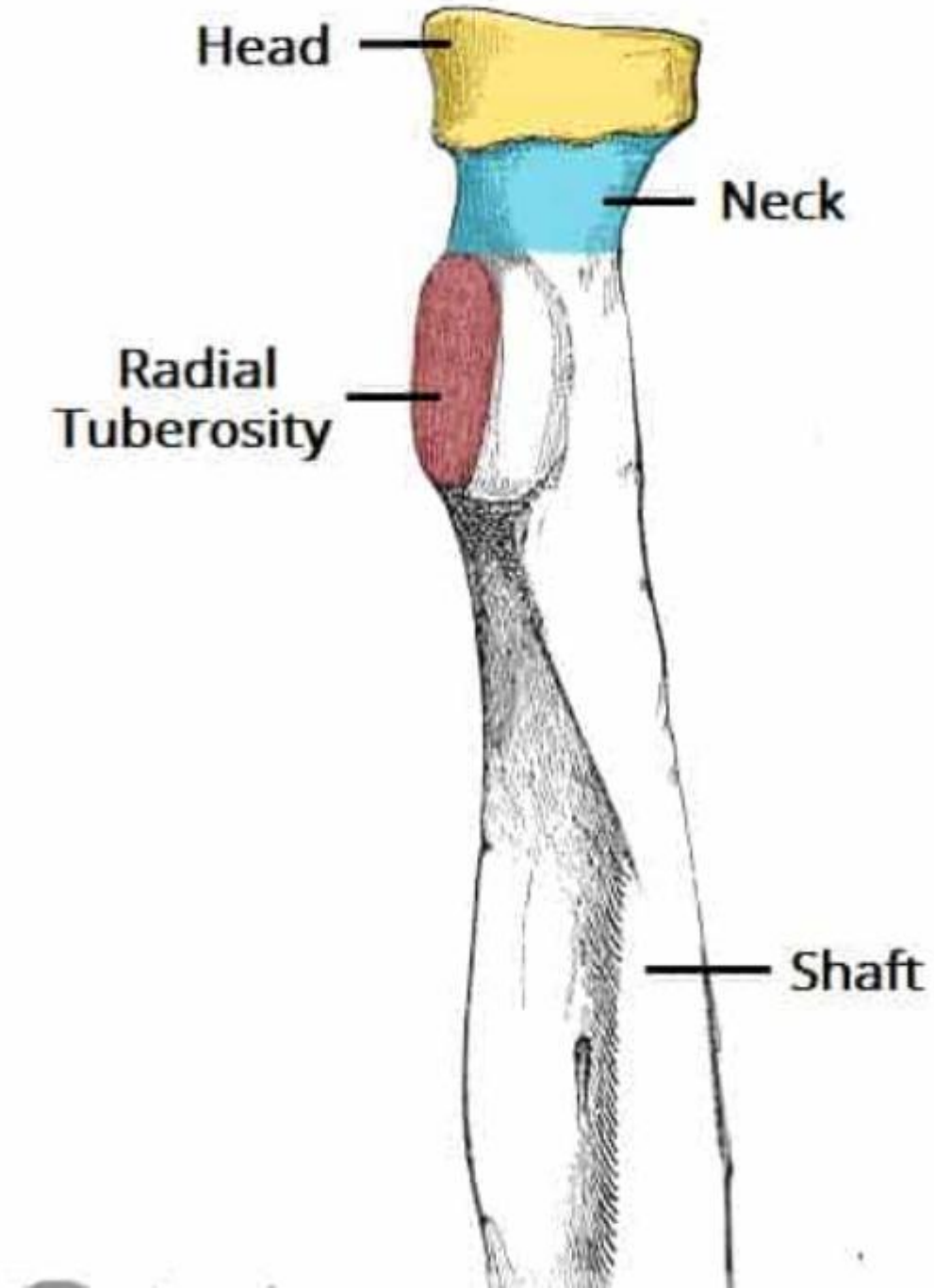
The proximal end of the radius articulates in both the elbow and proximal radioulnar joints.

Important bony landmarks include the **head**, **neck** and **radial tuberosity**:

Head of radius – A disk shaped structure, with a concave articulating surface. It is thicker medially, where it takes part in the proximal radioulnar joint.

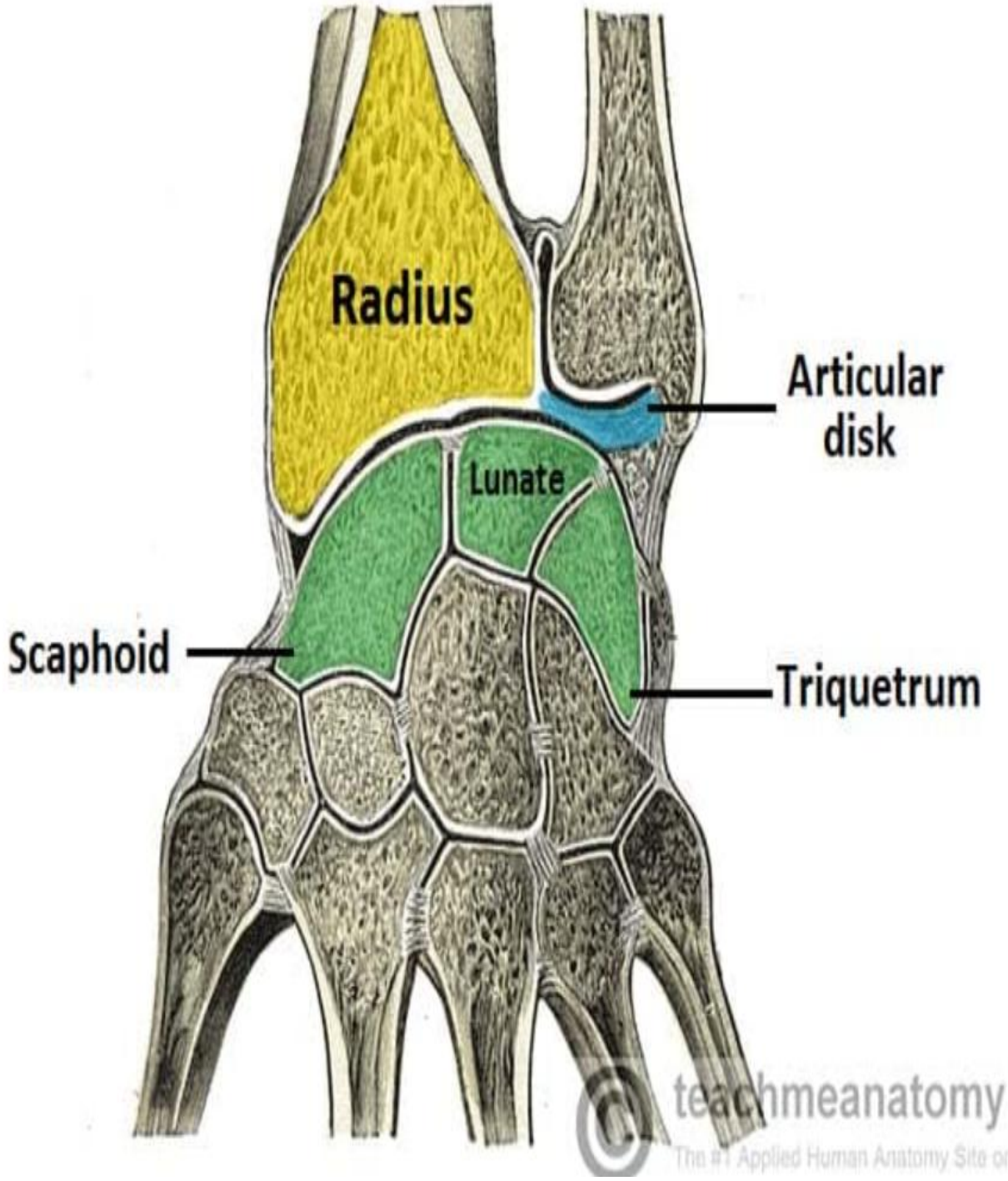
Neck – A narrow area of bone, which lies between the radial head and radial tuberosity.

Radial tuberosity – A bony projection, which serves as the place of attachment of the biceps brachii muscle.



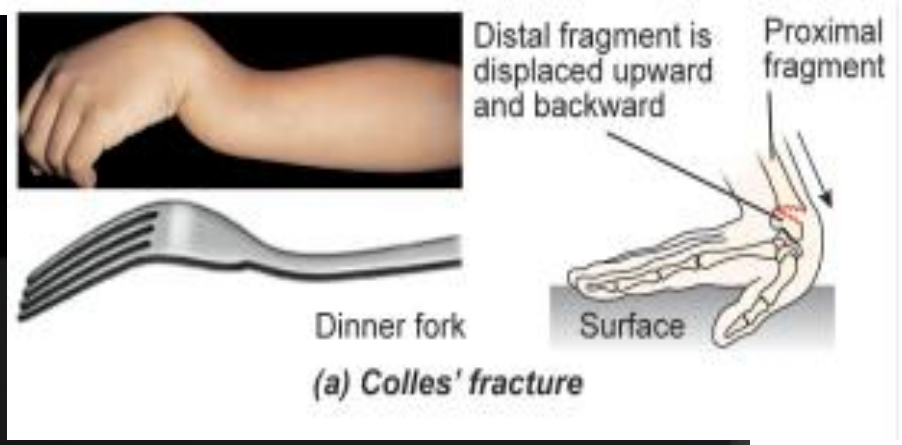
Distal End

In the distal region, the radial shaft expands to form a rectangular end. The lateral side projects distally as the **styloid process**. In the medial surface, there is a concavity, called the **ulnar notch**, which articulates with the head of ulna, forming the distal **radioulnar joint**.The distal surface of the radius has two facets, for articulation with the **scaphoid** and **lunate** carpal bones. This makes up the **wrist joint.**



The forearm is a common site for bone fractures.

Colles' fracture – The most common type of radial fracture. A fall onto an outstretched hand causing a fracture of the distal radius. The structures distal to the fracture (wrist and hand) are displaced posteriorly. It produces what is known as the 'dinner fork deformity.



Colles’ fracture of the wrist. Note the ‘dinner fork’ deformity, produced by the posterior displacement of the radius.

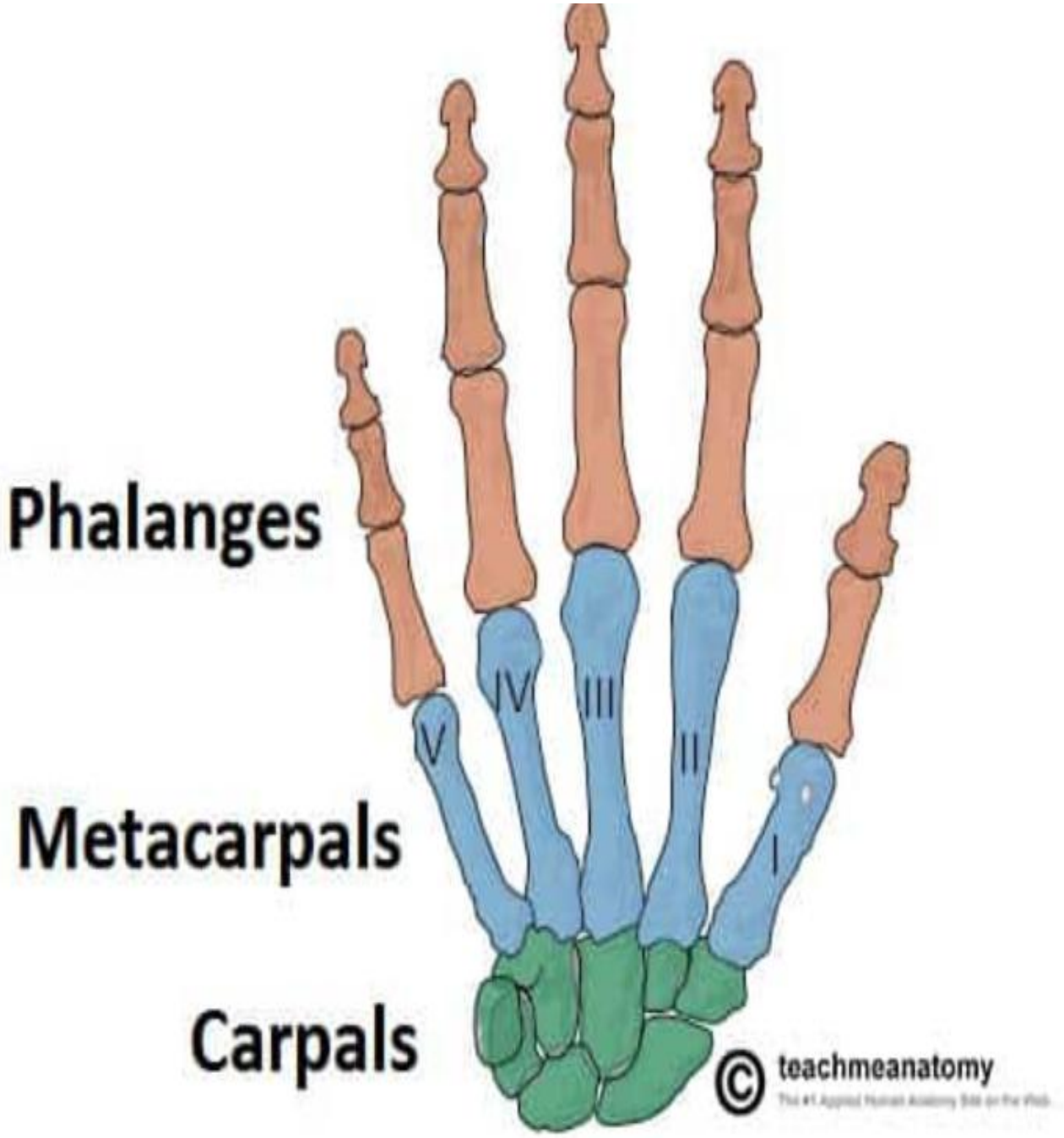
The Bones of the Hand: Carpals, Metacarpals and Phalanges

The bones of the hand provide support and movement to the soft tissues. They can be categorised into three different types:

Carpal bones (proximal) – a set of eight irregularly shaped bones. They are located in the area of the wrist.

Metacarpals – a set of five bones, each one related to a digit. They are located in the area of the palm.

Phalanges (distal) – the bones of the digits. The thumb has two phalanges, whilst the rest of the fingers have three



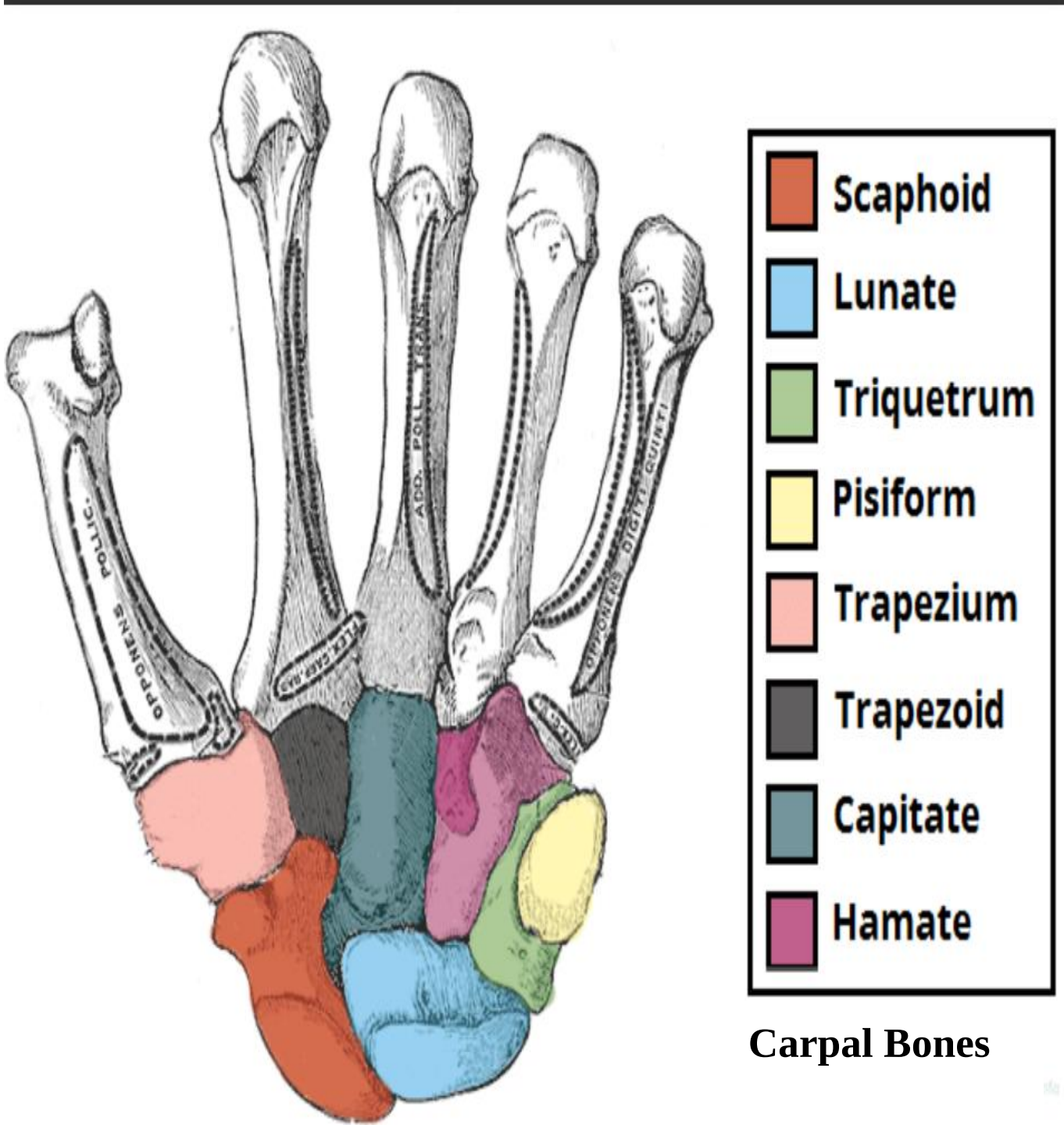
Carpal Bones

The carpal bones are a group of eight irregularly shaped bones. They are organised into two rows – proximal and distal:

Proximal row: Scaphoid, Lunate, Triquetrum, Pisiform (a sesamoid bone, formed within the tendon of the flexor carpi ulnaris)
Distal row: Trapezium, Trapezoid, Capitate, Hamate'

In the proximal row, the scaphoid and lunate articulate with the radius to form the wrist joint (radiocarpal joint). The distal row of carpal bones articulate with the metacarpals at the carpometacarpal joints.

The carpal bones collectively form an arch in the coronal plane. A membranous band, the flexor retinaculum, spans between the medial and lateral edges of the arch, forming the carpal tunnel. Structures pass through the carpal tunnel to enter and exit the volar (anterior) aspect of the hand



Carpal Bones

Metacarpal Bones

The **metacarpal bones** articulate proximally with the carpals, and distally with the proximal phalanges. They are numbered, and each is associated with a digit:

Metacarpal I – thumb.
Metacarpal II – index finger.
Metacarpal III – middle finger
Metacarpal IV – ring finger.
Metacarpal V – little finger.

Each metacarpal consists of a base, shaft and a head. The medial and lateral surfaces of the metacarpals are **concave**, allowing attachment of the **interossei** muscles.

Phalanges

The phalanges are the bones of the fingers. Each phalanx consists of a base, a shaft and a head.

The thumb has a proximal and distal phalanx, while the rest of the digits have proximal, middle and distal phalanges.

THANK YOU!