ANATOMY

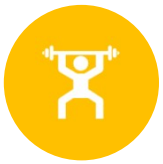
Major Topics

1. Basics
2. Head
3. Neck
4. Neuroanatomy
5. Upper Limb
6. Lower Limb
7. Thorax
8. Abdomen
9. Lower limb

Upper Limb

AREAS

BONES



MUSCLES

NERVES

JOINTS

BLOOD VESSELS & LYMPHATICS

Upper limb

AREAS	BONES	MUSCLES	NERVES	JOINTS	BLOOD VESSELS & LYMPHATICS
• Axilla • Cubital Fossa • Carpal Tunnel • Anatomical Snuffbox	• Scapula • Clavicle • Humerus • Ulna • Radius • The Hand	• Pectoral Region • Shoulder Region • Upper Arm • Anterior Forearm • Posterior Forearm • Hand	• Brachial Plexus • Axillary Nerve • Musculocutaneous Nerve • Median Nerve • Radial Nerve • Ulnar Nerve	• Acromioclavicular Joint • Sternoclavicular Joint • Shoulder Joint • Elbow Joint • Radioulnar Joints • Wrist Joint	• Arterial Supply • Venous Drainage • Lymphatics

Upper Limb

Bones

- SCAPULA
- CLAVICLE
- HUMERUS
- ULNA
- RADIUS
- THE HAND

Upper limb Bones

SCAPULA

SCAPULA

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 provides attachment to 17 Muscles.

3 Border

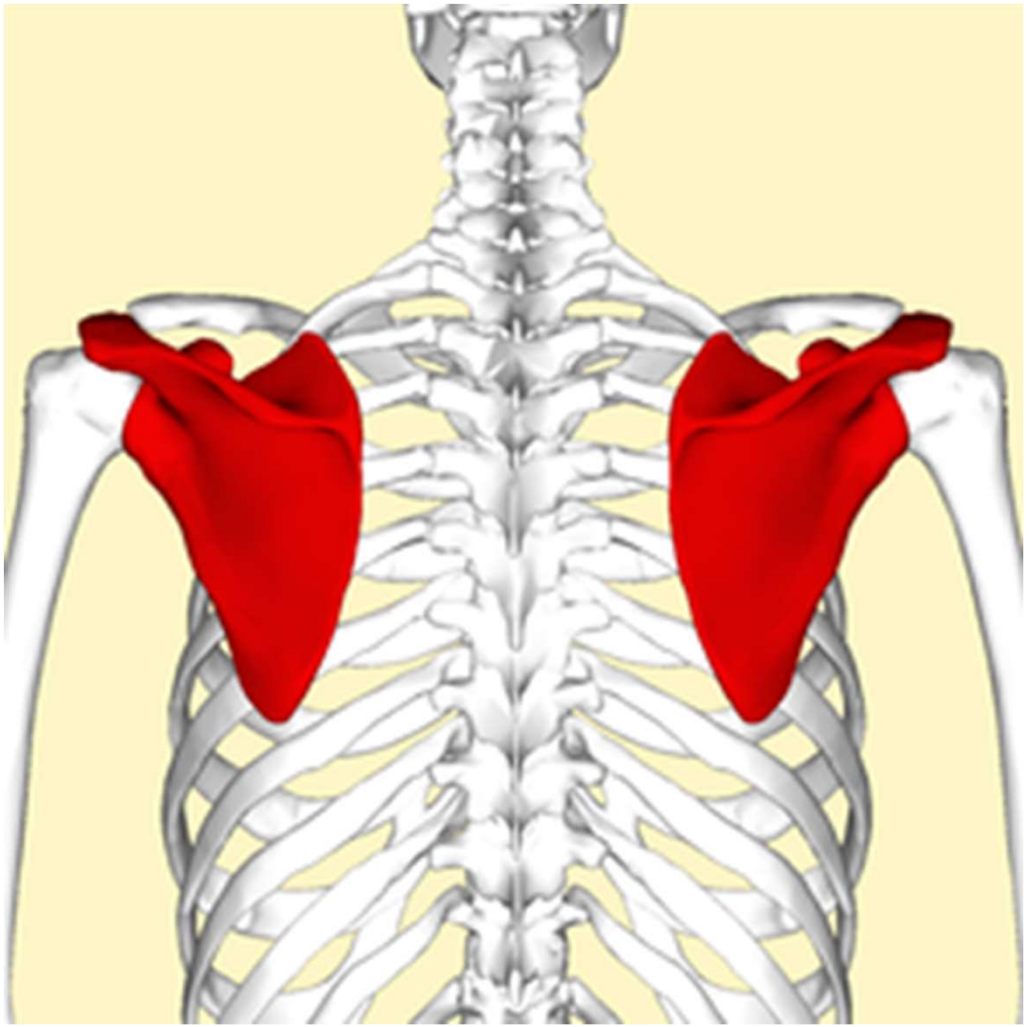
3 Angles

3 Fossa

2 Surfaces

1 Articular Surface

SCAPULA



Scapula

Surface

Costal

Dorsal

Lateral

Scapula

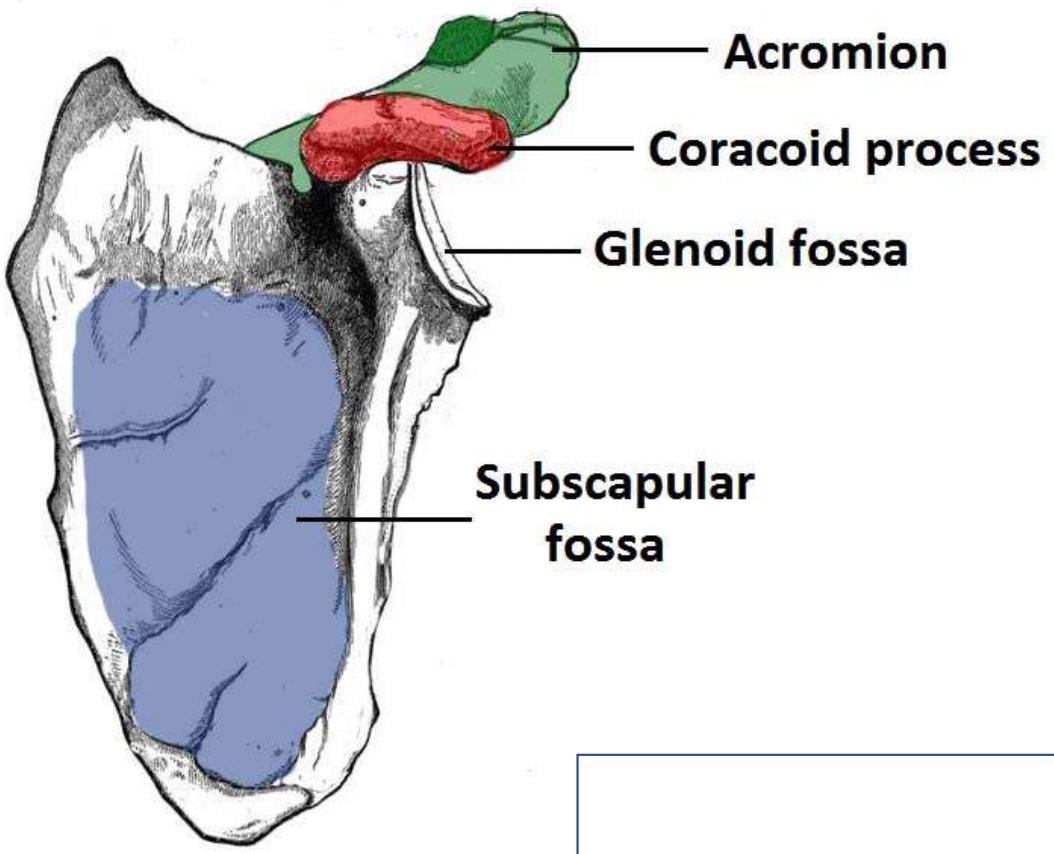
Costal Surface

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. The pectoralis minor attaches here, while the coracobrachialis and biceps brachii (short head) muscles originates from this projection

Scapula

Costal Surface



Scapula

Lateral Surface

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.

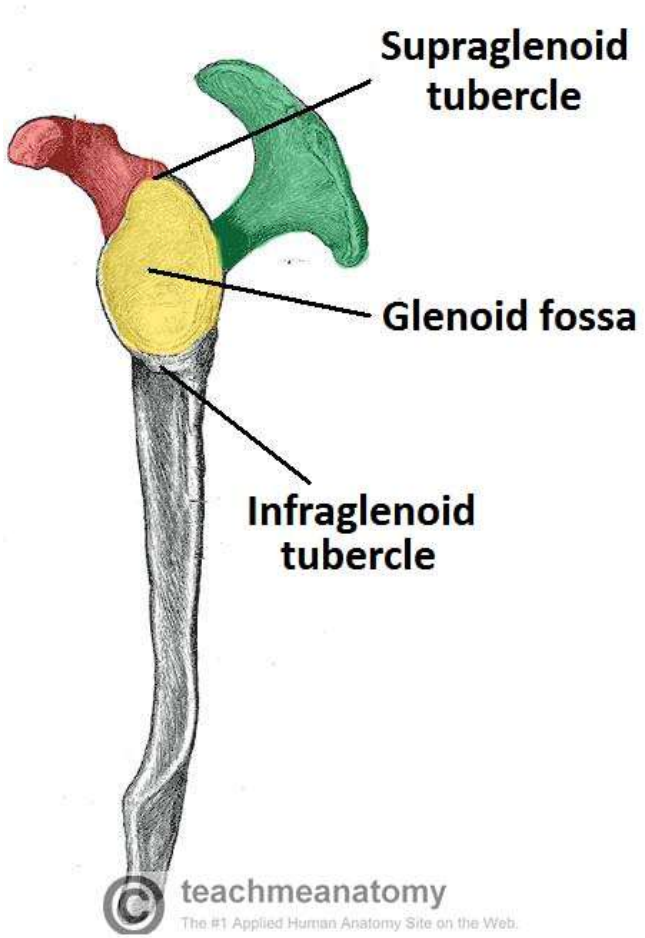
- The place of attachment of the long head of the biceps brachii.

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

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

Scapula

Lateral Surface



Scapula

Posterior Surface

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.

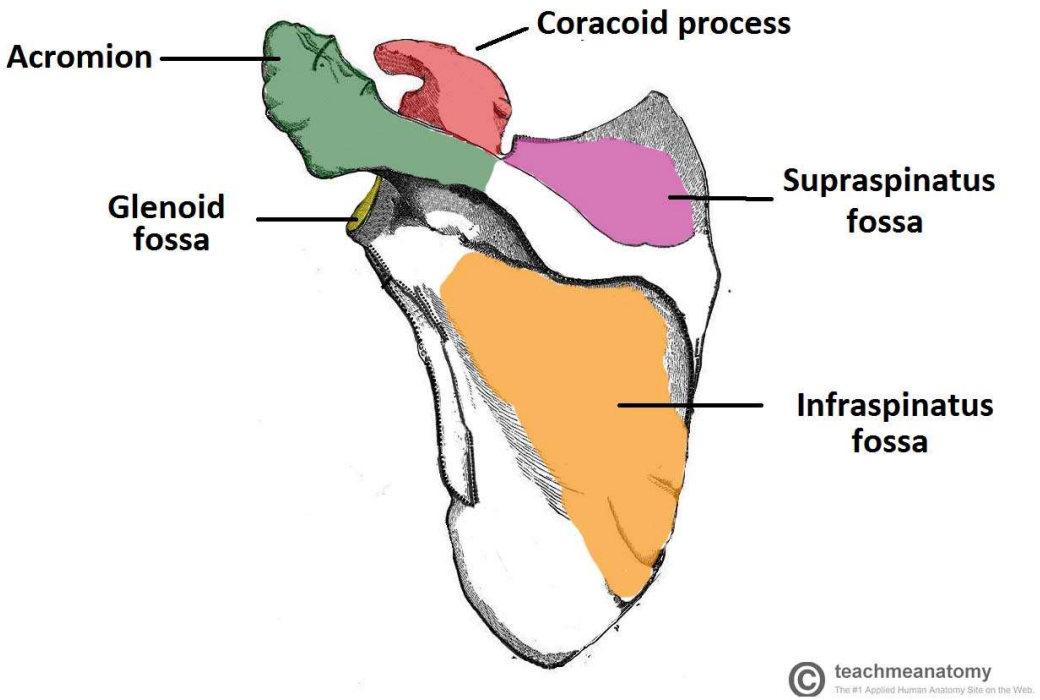
- The infraspinatus muscle originates from this area.

Supraspinous fossa – the area above the spine of the scapula, it is much smaller than the infraspinous fossa, and is more convex in shape.

- The supraspinatus muscle originates from this area.

Scapula

Posterior Surface



Scapula

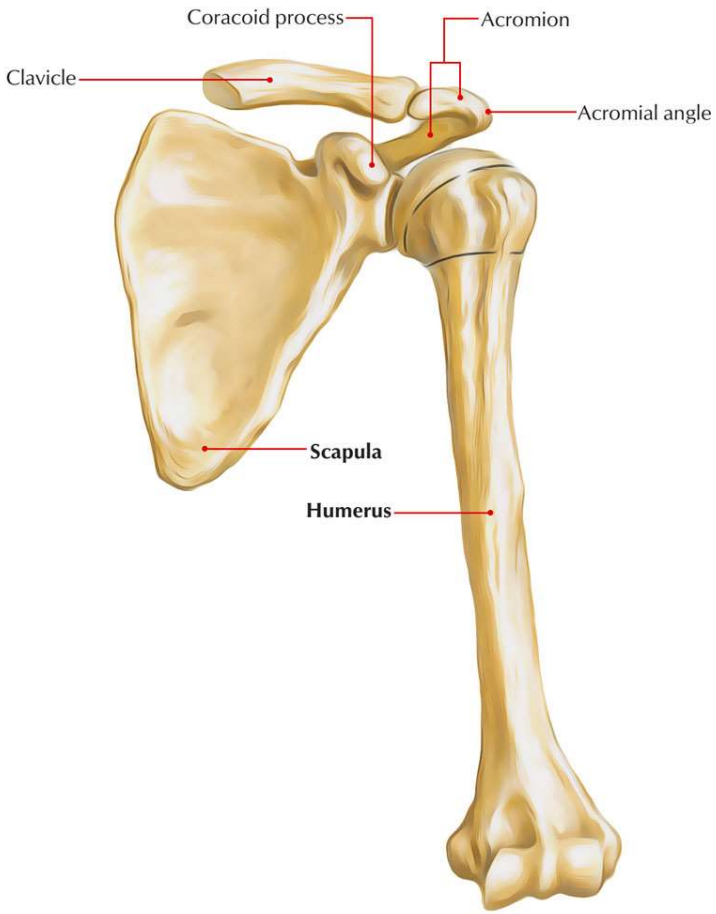
Articulations

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

Glenohumeral Joint



Scapula

Clinical Relevance

Fractures of the Scapula

- Fractures of the scapula are relatively **uncommon**, and if they do occur, it is an indication of severe chest trauma. They are frequently seen in high speed road collisions, crushing injuries, or sports injuries.
- The fractured scapula does not typically require fixation as the tone of the surrounding muscles holds the pieces in place for healing to occur.

Scapula

Clinical Relevance

Fracture

Scapula

Clinical Relevance

- **Winging of the Scapula**
- The **serratus anterior** muscle originates from ribs 1-8, 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.

Scapula

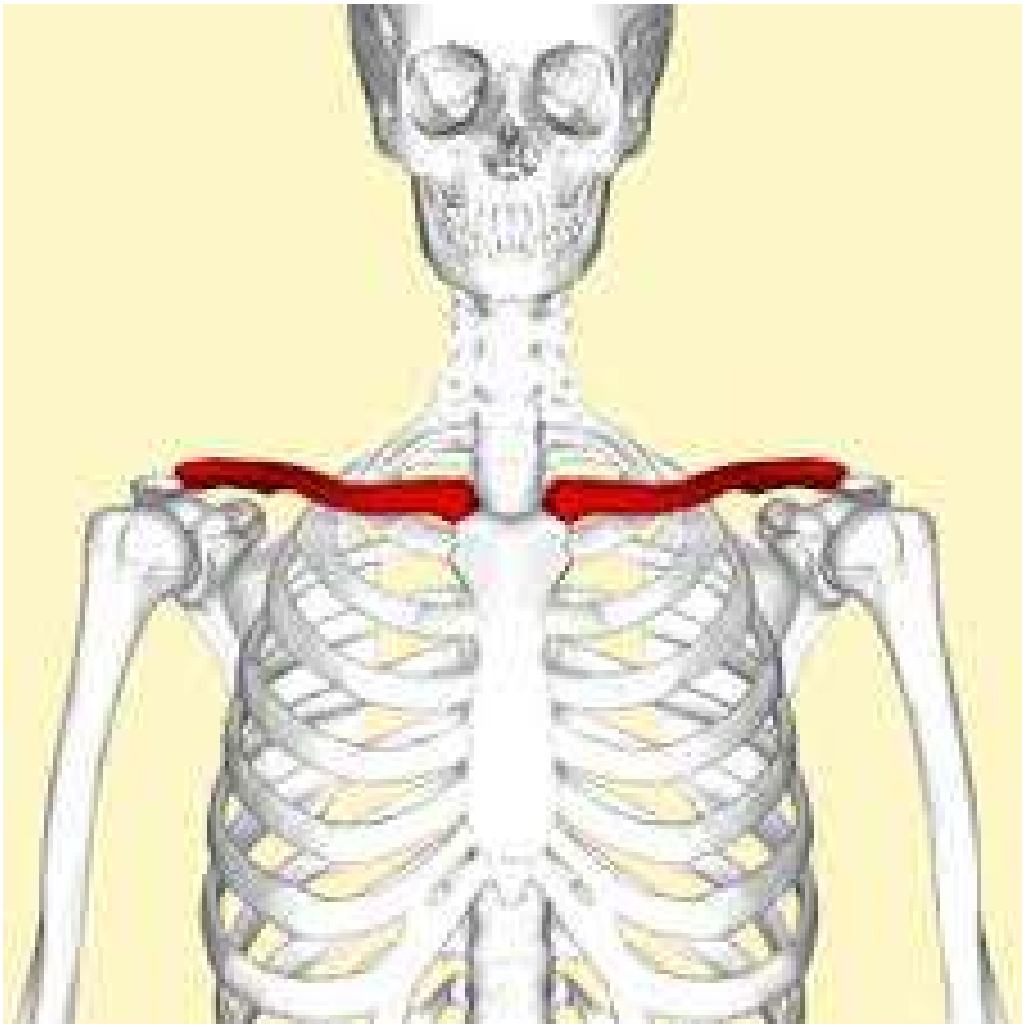
Clinical Relevance

Winging of Scapula

Upper Limb Bones

CLAVICLE

Clavicle



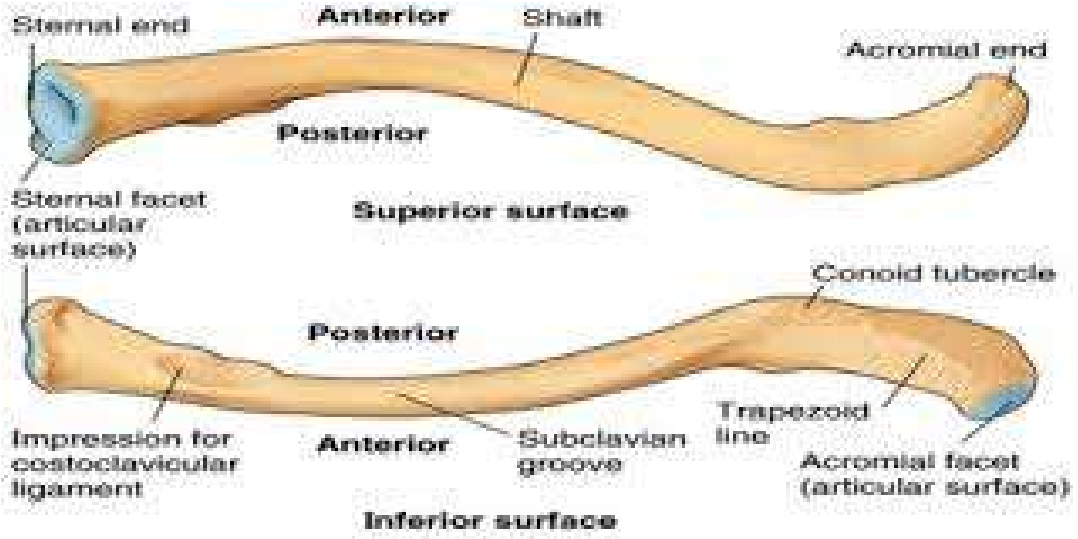
Clavicle

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.

Clavicle



Structure

Clavicle

Bony Landmarks and Articulations

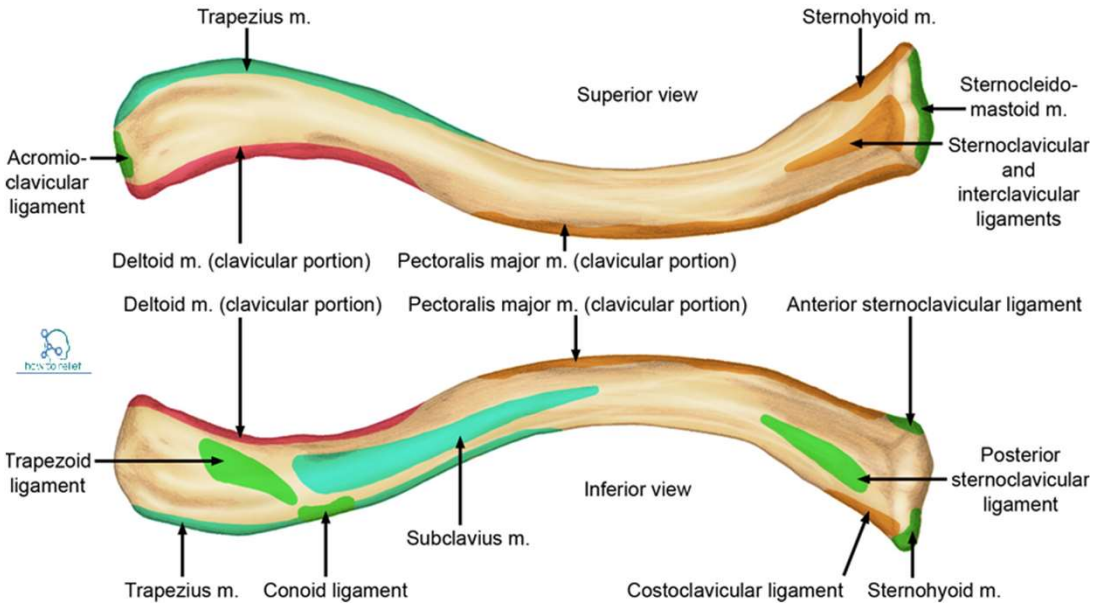
'S' shape. Facing forward, the medial aspect is convex, and the lateral aspect concave.

Sternal (medial) End

- The sternal end contains a **large facet** – for articulation with the manubrium of the sternum at the sternoclavicular joint.
- The inferior surface of the sternal end is marked by a rough oval depression for the **costoclavicular ligament** (a ligament of the SC joint).

Clavicle

Attachments



Clavicle

Shaft

The shaft of the clavicle acts a point of origin and attachment for several muscles – Deltoid, Trapezius, Subclavius, Pectoralis Major, Sternocleidomastoid and Sternohyoid

Clavicle

Acromial End

- The acromial end houses a small facet for articulation with the acromion of the scapula at the acromioclavicular joint. It also serves as an attachment point for two ligaments:
- **Conoid tubercle** – attachment point of the conoid ligament, the medial part of the coracoclavicular ligament.
- **Trapezoid line** – attachment point of the trapezoid ligament, the lateral part of the coracoclavicular ligament.
- The coracoclavicular ligament is a very strong structure, effectively suspending the weight of the upper limb from the clavicle.

Clavicle

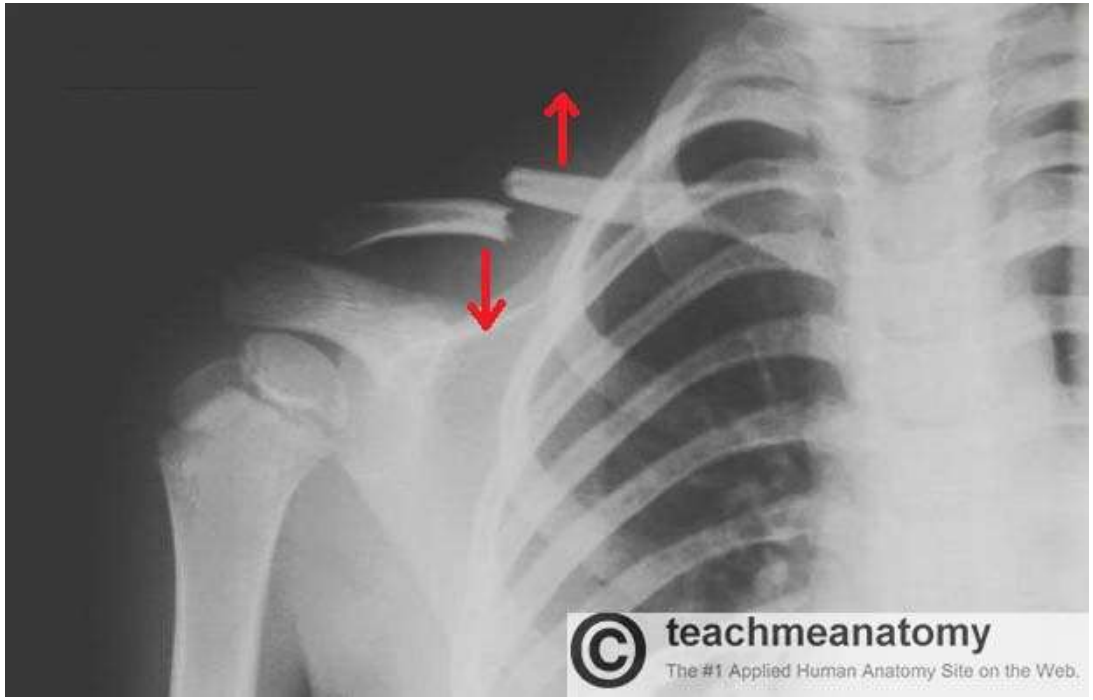
Clinical Relevance

- The clavicle acts to **transmit forces** from the upper limb to the axial skeleton. Given its relative size, this leaves it particularly susceptible to fracture. The most common mechanism of injury is a fall onto the shoulder, or onto an outstretched hand.
- With the clavicle arbitrarily divided into thirds:
- 15% of fractures occur in the lateral third
- **80% occur in the middle third**
- 5% occur in the medial third

Clavicle

Clinical Relevance

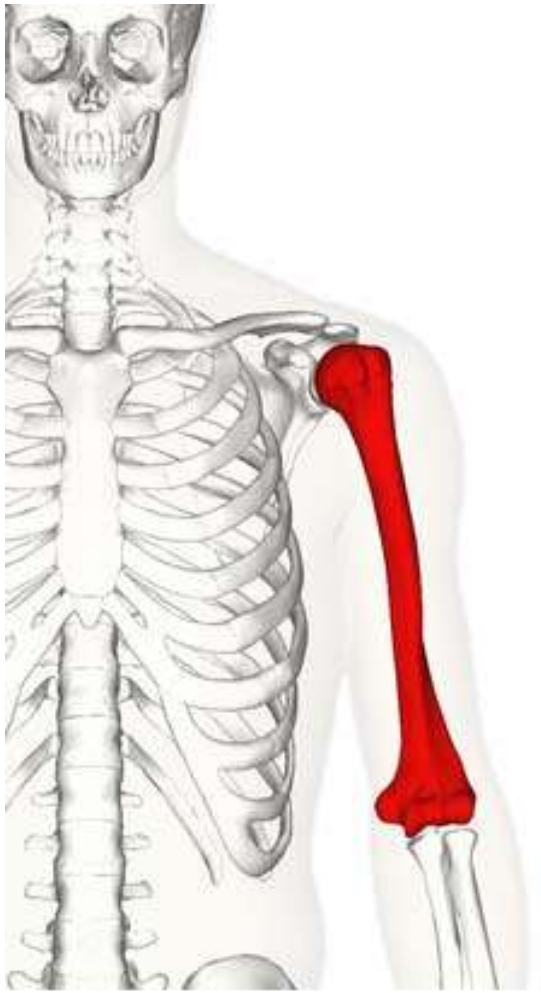
After a fracture, the lateral end of the clavicle is displaced inferiorly by the weight of the arm, and displaced medially by the pectoralis major. The medial end is pulled superiorly by the **sternocleidomastoid muscle**.



BONES OF UPEER LIMB

HUMERUS

Humerus



Humerus

Introduction

- The **humerus** is a long bone of the upper limb, which extends from the shoulder to the elbow.
- The proximal region 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

Humerus

Proximal End

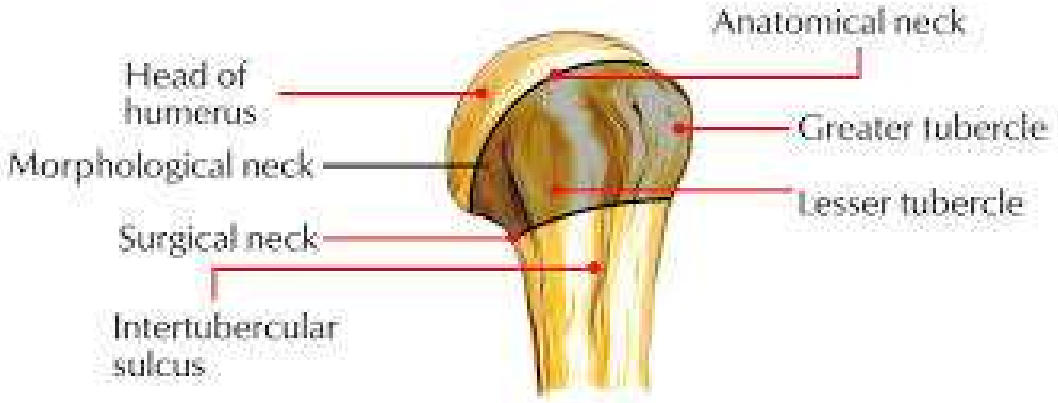
Humerus

Proximal Landmarks

Head, Anatomical neck, Surgical neck, Greater and Lesser tubercles and Intertubercular sulcus

Humerus

Proximal End



Humerus

Proximal End

Head

This faces medially, upwards and backwards and is separated from the greater and lesser tubercle by the anatomical neck.

Greater Tubercle

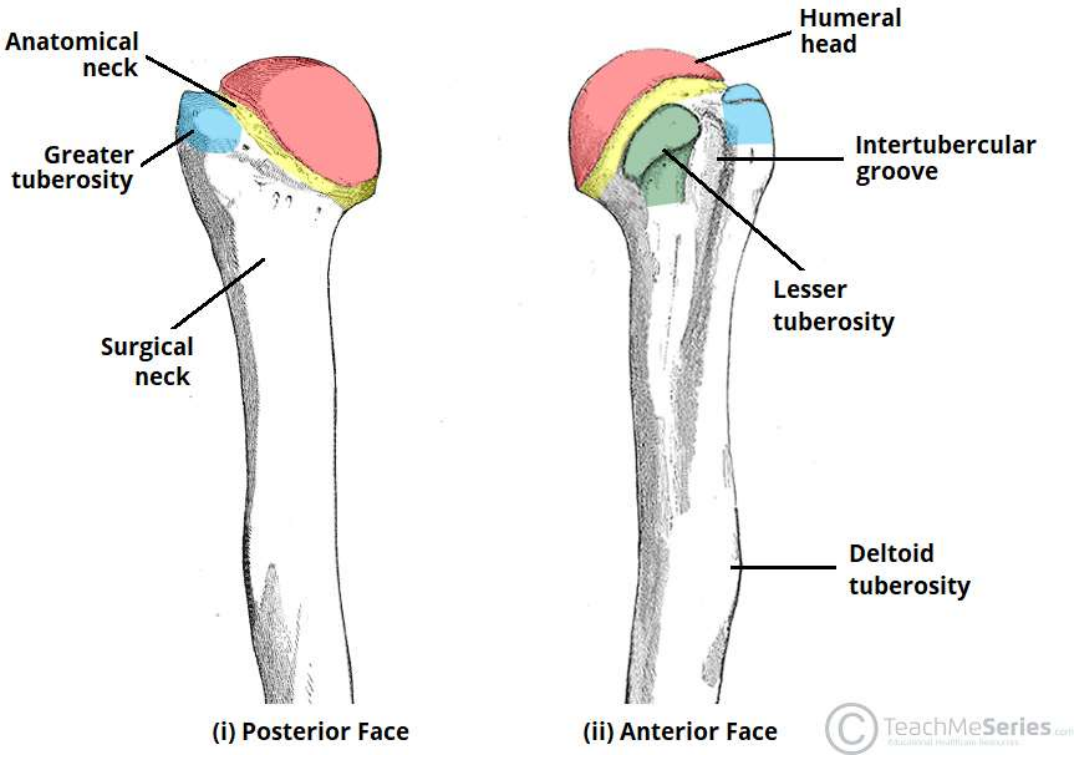
The greater tubercle serves as attachment site for three of the rotator cuff muscles – supraspinatus, infraspinatus and teres minor – they attach to superior, middle and inferior facets respectively

Lesser tubercle

It provides attachment for the last rotator cuff muscle; subscapularis.

Humerus

Proximal End



Humerus

Proximal end

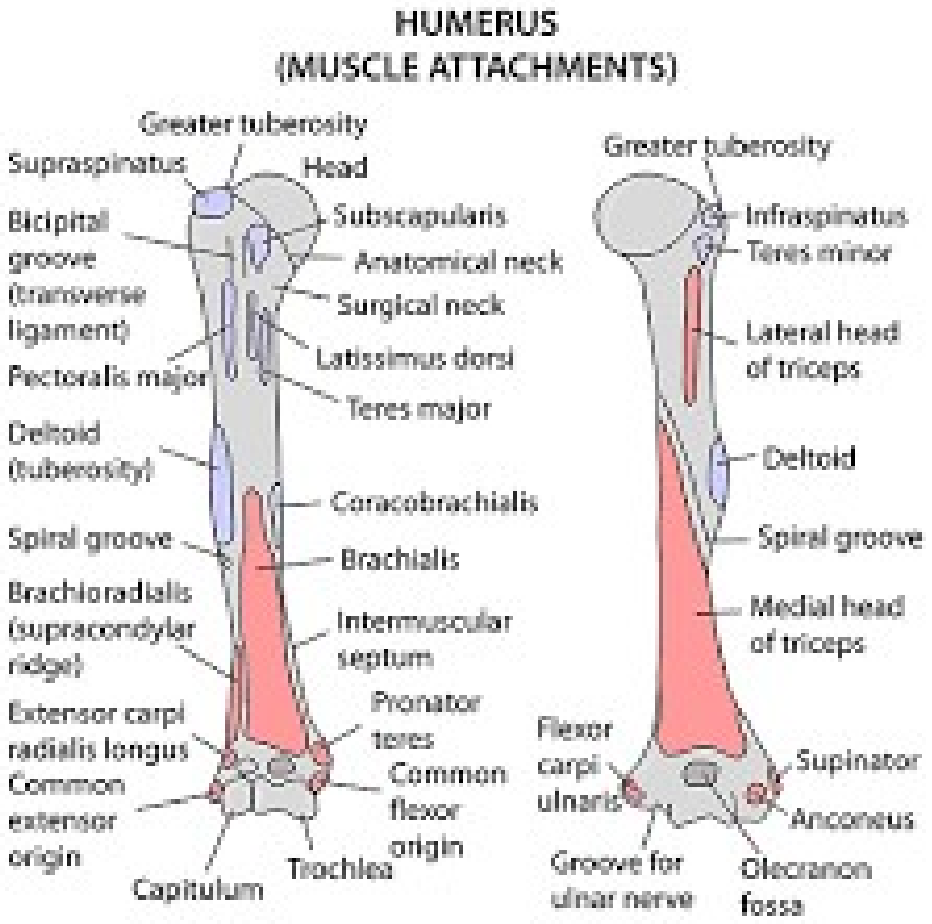
Intertubercular sulcus, or groove. The tendon of the long head of biceps brachii emerges from the shoulder joint and runs through this groove.

Pectoralis major, teres major and **latissimus dorsi** insert on the lips of the intertubercular sulcus. *This can be remembered with the mnemonic "a lady between two majors", with latissimus dorsi attaching between teres major on the medial lip and pectoralis major laterally.*

***S*urgical neck** runs from just distal to the tubercles to the shaft of the humerus. The axillary nerve and circumflex humeral vessels lie against here.

Humerus

Muscle attachment



Humerus

Shaft

Deltoid tuberosity

On the lateral side of the humeral shaft is a roughened surface where the deltoid muscle attaches.

Radial (or spiral) groove

The radial nerve and profunda brachii artery lie in this groove.

Muscle attachments

Anteriorly – Coracobrachialis, Deltoid, Brachialis, Brachioradialis.

Posteriorly – medial and lateral heads of the triceps (the spiral groove demarcates their respective origins).

Humerus

Distal Region

Lateral and **Medial epicondyles**

Supraepicondylar ridges

Trochlea

Capitulum

Coronoid fossa

Radial fossa

Olecranon fossa

Humerus

Articulations

Humerus articulates with the **glenoid fossa of the scapula** to form the glenohumeral joint (shoulder joint).

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.

Humerus

Clinical Relevance

Mid-Shaft Fracture

- A mid-shaft fracture of the humerus risk damage to the radial nerve and profunda brachii artery (as they are tightly bound in the radial groove).
- The radial nerve innervates the **extensors** of the wrist. In the event of damage to this nerve (either direct or as a consequence of swelling), the extensors will be paralysed. This results in unopposed flexion of the wrist, known as ‘wrist drop’.
- There can also be some **sensory loss** over the dorsal (posterior) surface of the hand, and the proximal ends of the lateral 3 and a half fingers dorsally.

Humerus

Clinical Relevance

Wrist Drop

Humerus

Clinical Relevance

Supracondylar Fracture

A **supracondylar fracture** is a fracture of the distal humerus just above the elbow joint. The fracture is typically transverse or oblique, and the most common mechanism of injury is falling on an outstretched hand. It is more common in children than adults.

Humerus

Clinical relevance

Supracondylar fracture

Humerus

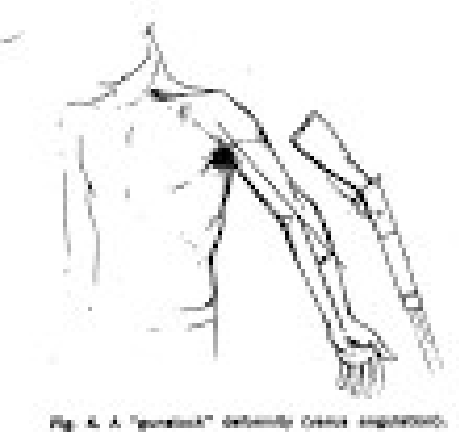
Clinical Relevance

Supracondylar Fracture

Mal Union can result in “Gun stock Deformity”

Gunstock Deformity

- Common complication of a suprachondylar fracture



Upper limb Bones

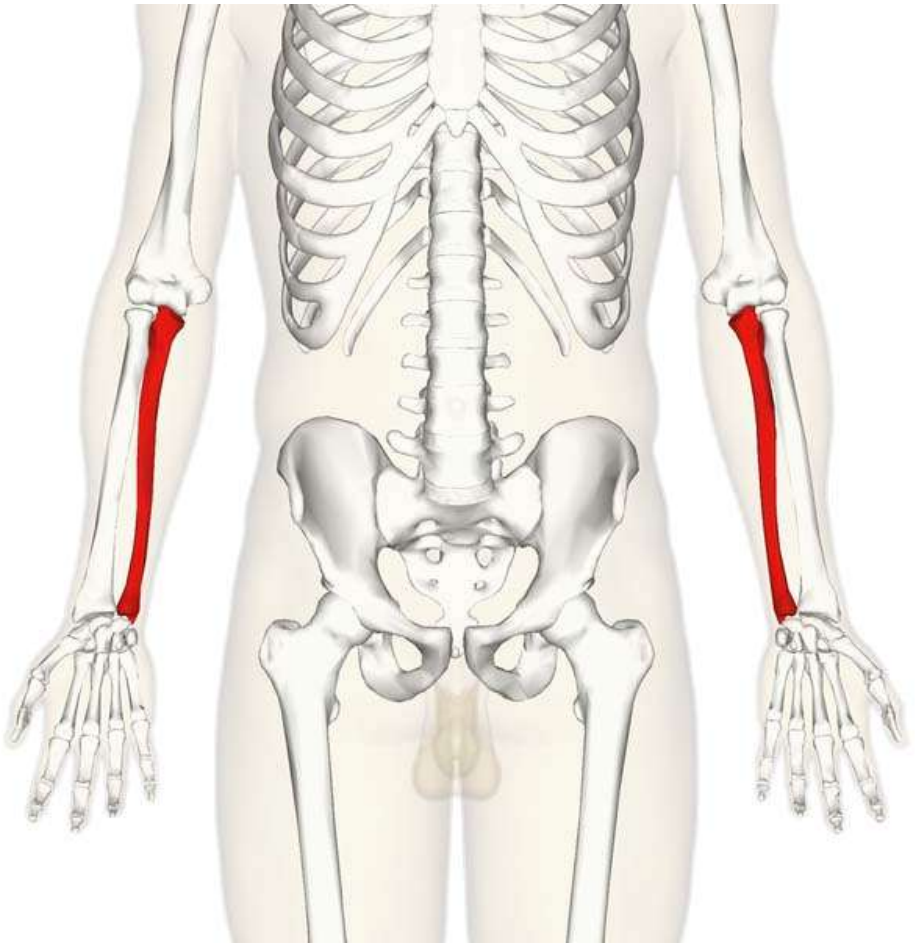
ULNA

Ulna

- 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.

Ulna

Medial bone of Forearm



Ulna

Proximal Osteology and Articulation

Olecranon – A large projection of bone that extends proximally, forming part of trochlear notch. It can be palpated as the 'tip' of the elbow. The triceps brachii muscle attaches to its superior surface.

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

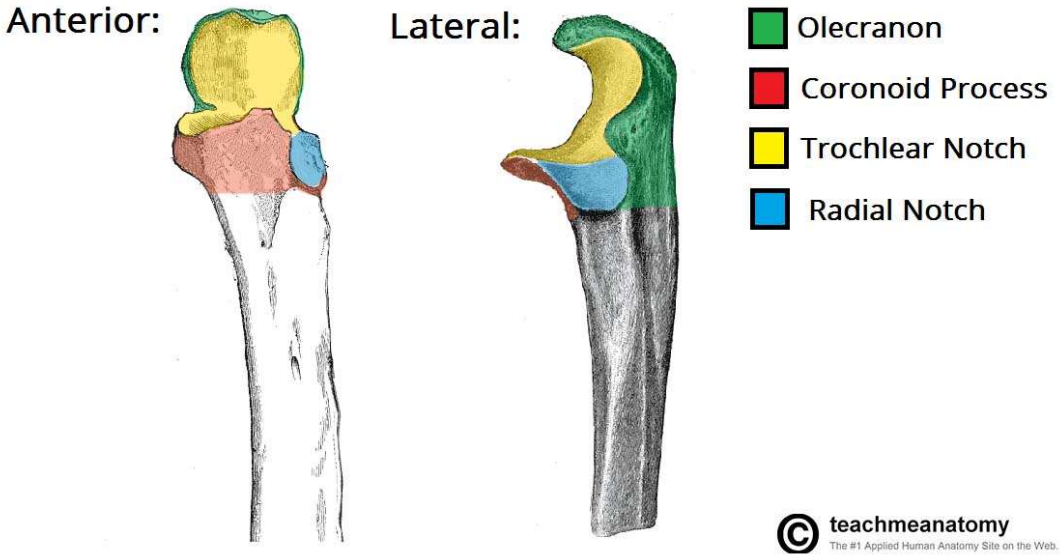
Trochlear notch – Formed by the olecranon and coronoid process. It is wrench shaped, and articulates with the trochlea of the humerus.

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 of the coronoid process. It is where the brachialis muscle attaches

Ulna

Proximal Osteology and Articulation



Ulna

Shaft of the Ulna

Triangular in shape, with three borders and three surfaces

The three surfaces:

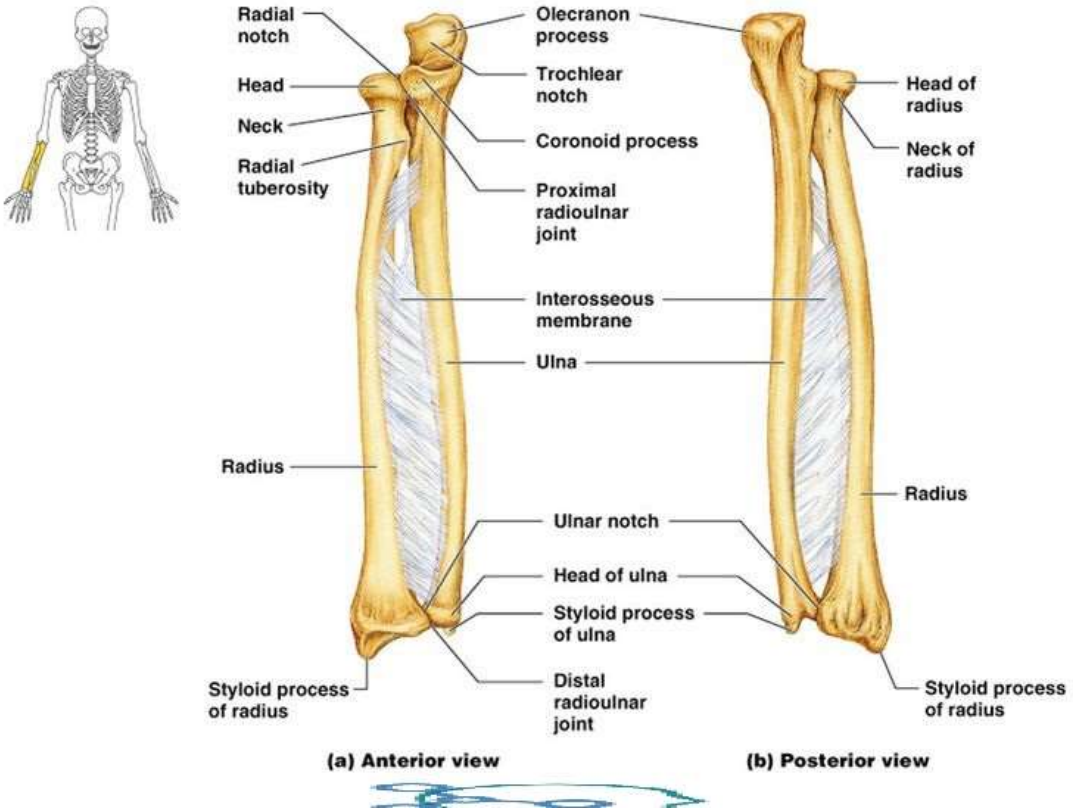
- **Anterior** – Site of attachment for the pronator quadratus muscle distally.
- **Posterior** – Site of attachment for many muscles.
- **Medial** – Unremarkable.

The three borders:

- **Posterior** – Palpable along the entire length of the forearm posteriorly
- **Interosseous** – Site of attachment for the interosseous membrane, which spans the distance between the two forearm bones.
- **Anterior –** Unremarkable.

Ulna

Shaft of Ulna



Ulna

Distal Osteology and Articulations

- 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.

Ulna

The three surfaces:

- **Anterior** – Site of attachment for the pronator quadratus muscle distally.
- **Posterior** – Site of attachment for many muscles.
- **Medial** – Unremarkable.

The three borders:

- **Posterior** – Palpable along the entire length of the forearm posteriorly
- **Interosseous** – Site of attachment for the interosseous membrane, which spans the distance between the two forearm bones.
- **Anterior –** Unremarkable.

Ulna

Digital osteology and attachment

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**.

Ulna

Clinical Relevance

A fracture of the ulna alone (not involving the radius) usually occurs as a result of the ulna being hit by an object. The **shaft** is the most likely site of fracture. In this situation, the normal muscle tone will pull the proximal ulna **posteriorly**.

Less commonly, the **olecranon process** can be fractured. This is caused by the patient falling on a flexed elbow. The triceps brachii can displace part of the fragment proximally

Ulna

There are two classical fractures:

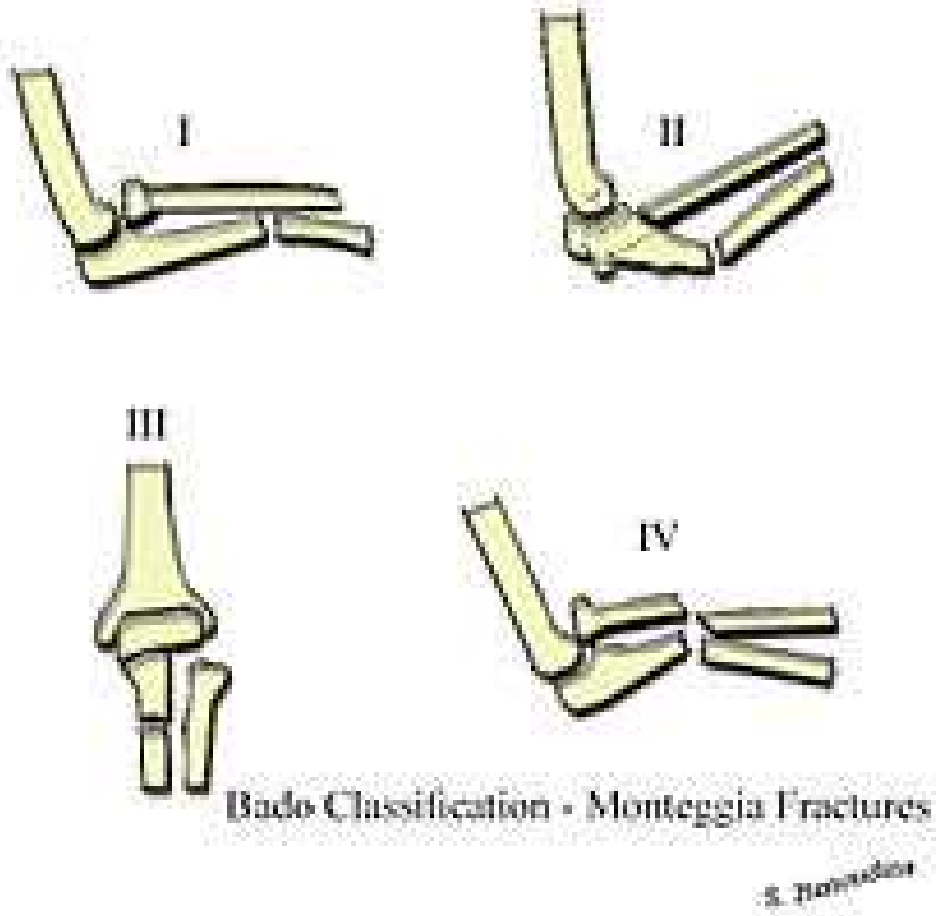
- **Monteggia's Fracture** – Usually caused by a force from behind the ulna. The proximal shaft of ulna is fractured, and the head of the radius dislocates anteriorly at the elbow.

- **Galeazzi's Fracture** – A fracture to the distal radius, with the ulna head dislocating at the distal radio-ulnar joint.

Ulna

Clinical Relevance

Monteggia's Fracture



Bado Classification - Monteggia Fractures

Ulna
Clinical Relevance

Galeazzi's Fracture

The **Galeazzi fracture** is a **fracture** of the distal third of the radius with dislocation of the distal radioulnar joint.

Upper Limb

Radius

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.

Radius

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.

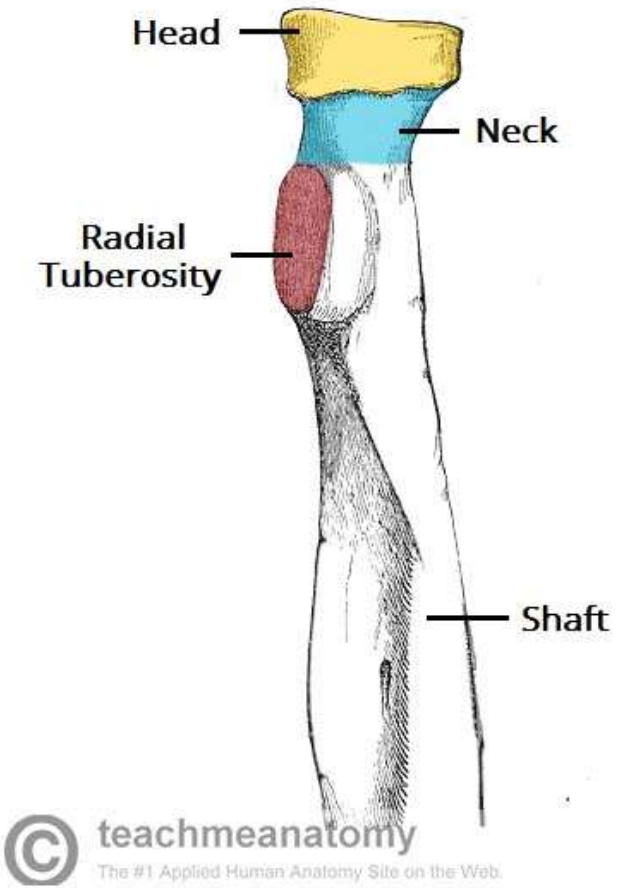
Radius

Proximal Region of the Radius

- **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.

Radius

Proximal Region of the Radius



Radius

Shaft of the Radius

- The radial shaft expands in diameter as it moves distally. Much like the ulna, it is **triangular** in shape, with three borders and three surfaces.
- In the middle of the lateral surface, there is a small roughening for the attachment of the **pronator teres** muscle

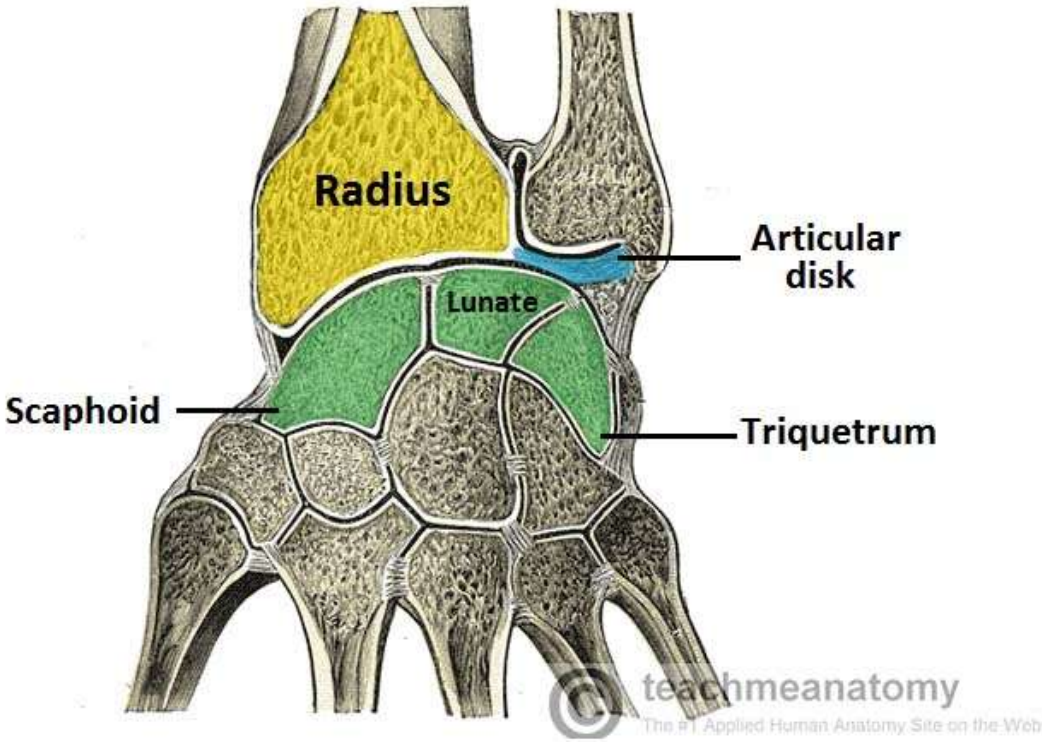
Radius

Distal Region of Radius

- Styloid Process
- Ulnar Notch
- Radio Ulnar Joint
- Wrist 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**

Radius

Wrist joint



Radius

Clinical Relevance

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'.

Radius

Clinical Relevance

Smith's Fracture – A fracture caused by falling onto the back of the hand. It is the opposite of a Colles' fracture, as the distal fragment is now placed anteriorly.

BONES OF THE HAND

Carpal bones (Most proximal) – A set of eight irregularly shaped bones. These are located in the wrist area.

Metacarpals – There are five metacarpals, each one related to a digit

Phalanges (Most distal) – The bones of the fingers. Each finger has three phalanges, except for the thumb, which has two.

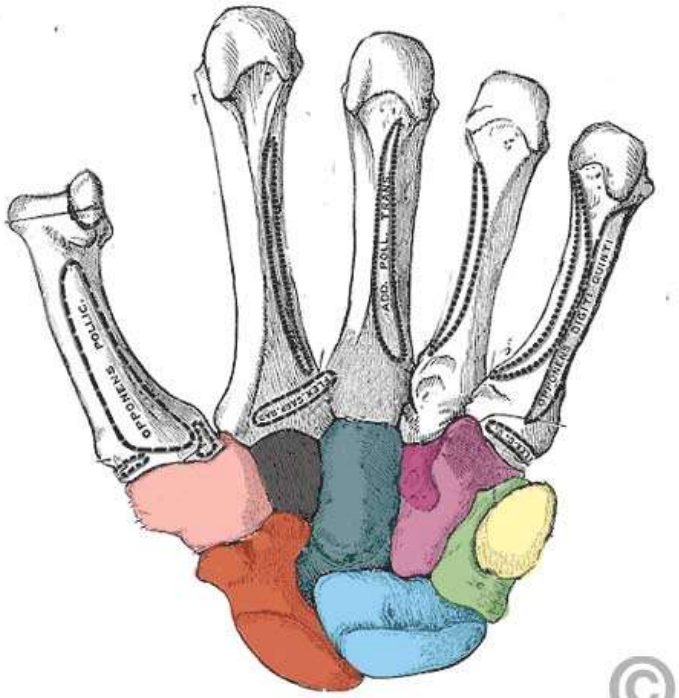
Bones of Hand

Carpel Bones

Proximal Row (lateral to medial)	Distal Row (lateral to medial)
•Scaphoid •Lunate •Triquetrum •Pisiform (a sesamoid bone, formed within the tendon of the flexor carpi ulnaris)	•Trapezium •Trapezoid •Capitate •Hamate (has a projection on its palmar surface, known as the ‘hook of hamate’

Bones of Hand

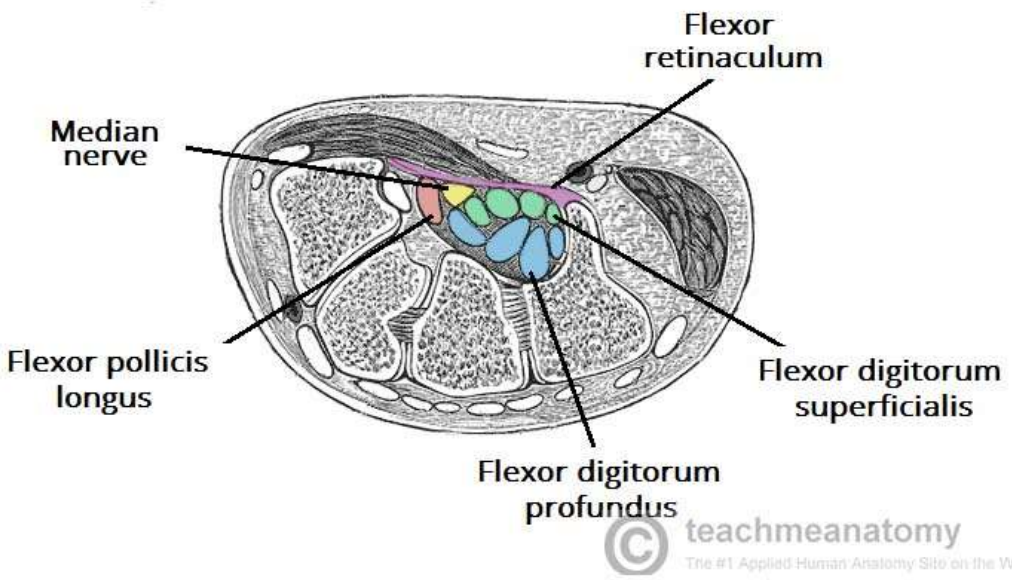
Carpal Bones



Scaphoid
Lunate
Triquetrum
Pisiform
Trapezium
Trapezoid
Capitate
Hamate

Bones of Hand

Carpel Tunnel



Clinical Relevance

Scaphoid Fracture

- Pain and tenderness in the anatomical snuffbox.
- The scaphoid is at particular risk of **avascular necrosis** after fracture because of its so-called 'retrograde blood supply' which enters at its distal end. This means that a fracture to the middle (or 'waist') of the scaphoid may interrupt the blood supply to the proximal part of the scaphoid bone rendering it avascular.
- Patients with a missed scaphoid fracture are likely to develop osteoarthritis of the wrist in later life.

Carpal Bone

Scaphoid Fracture

Bones of Hand

Metacarpal Bone

- 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

Bones of Hand

Clinical Relevance

Metacarpal Fracture

Boxer's fracture – A fracture of the 5th metacarpal neck. It is usually caused by a clenched fist striking a hard object. The distal part of the fracture is displaced anteriorly, producing shortening of the affected finger.

Bennett's fracture – A fracture of the 1st metacarpal base, caused by forced hyperabduction of the thumb. This fracture extends into the first carpometacarpal joint leading to instability and subluxation of the joint. As a result, it often needs surgical repair.

Bones of Hand

Bennette Fracture

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