Anatomy of Shoulder, Elbow and Wrist

2021년 대한재활의학회 추계학술대회
Education Session 1: Imaging: Upper Extremity
2021년 10월 30일(토)

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Shoulder complex

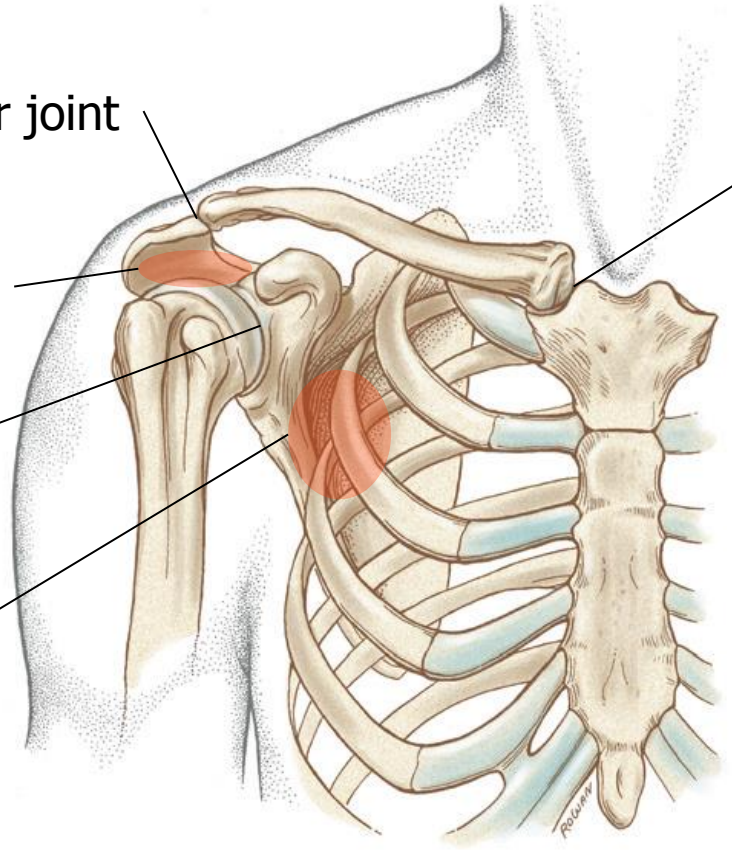
Shoulder complex

Acromioclavicular joint

Subacromial gliding mechanism (joint)

Glenohumeral joint

Scapulothoracic gliding mechanism (joint)

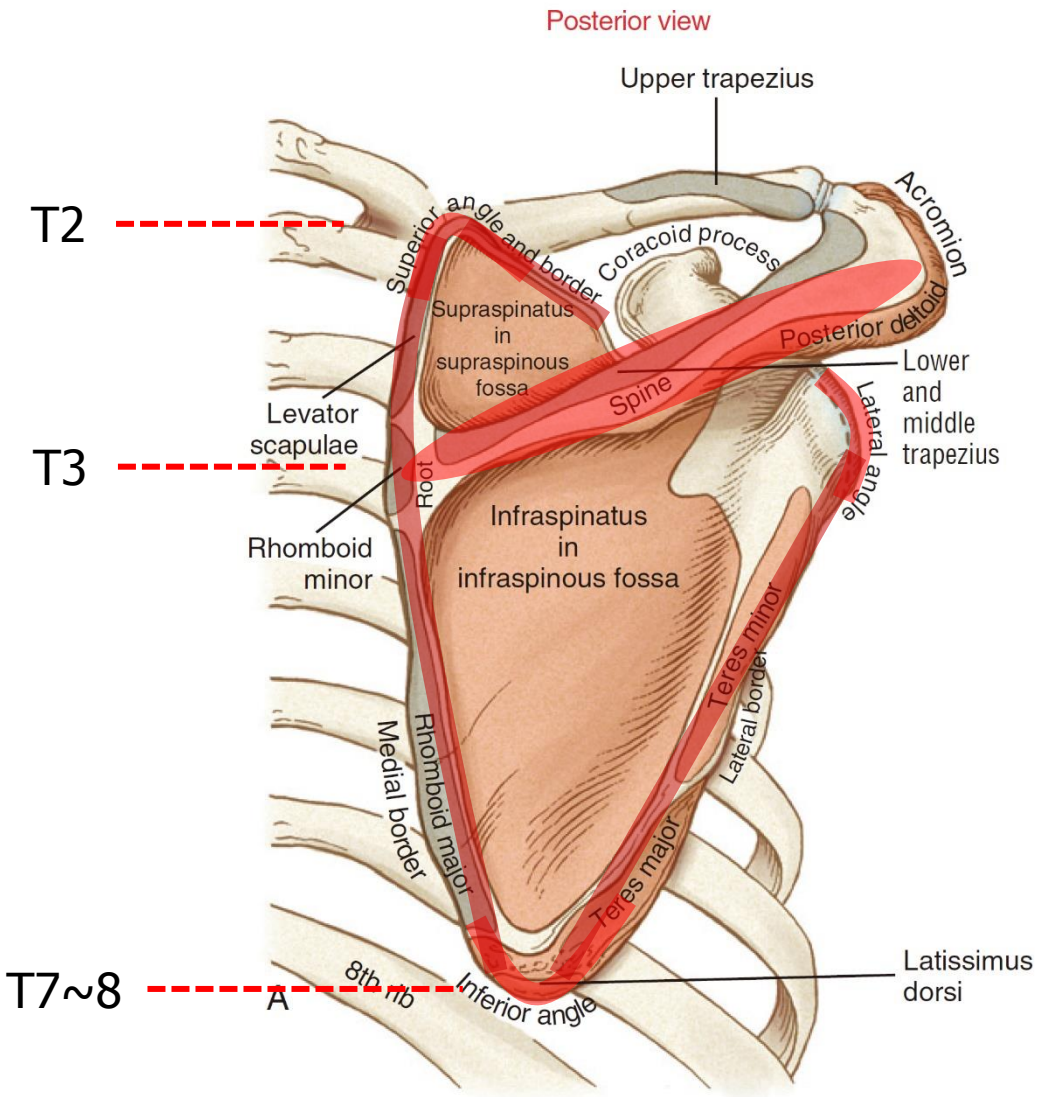


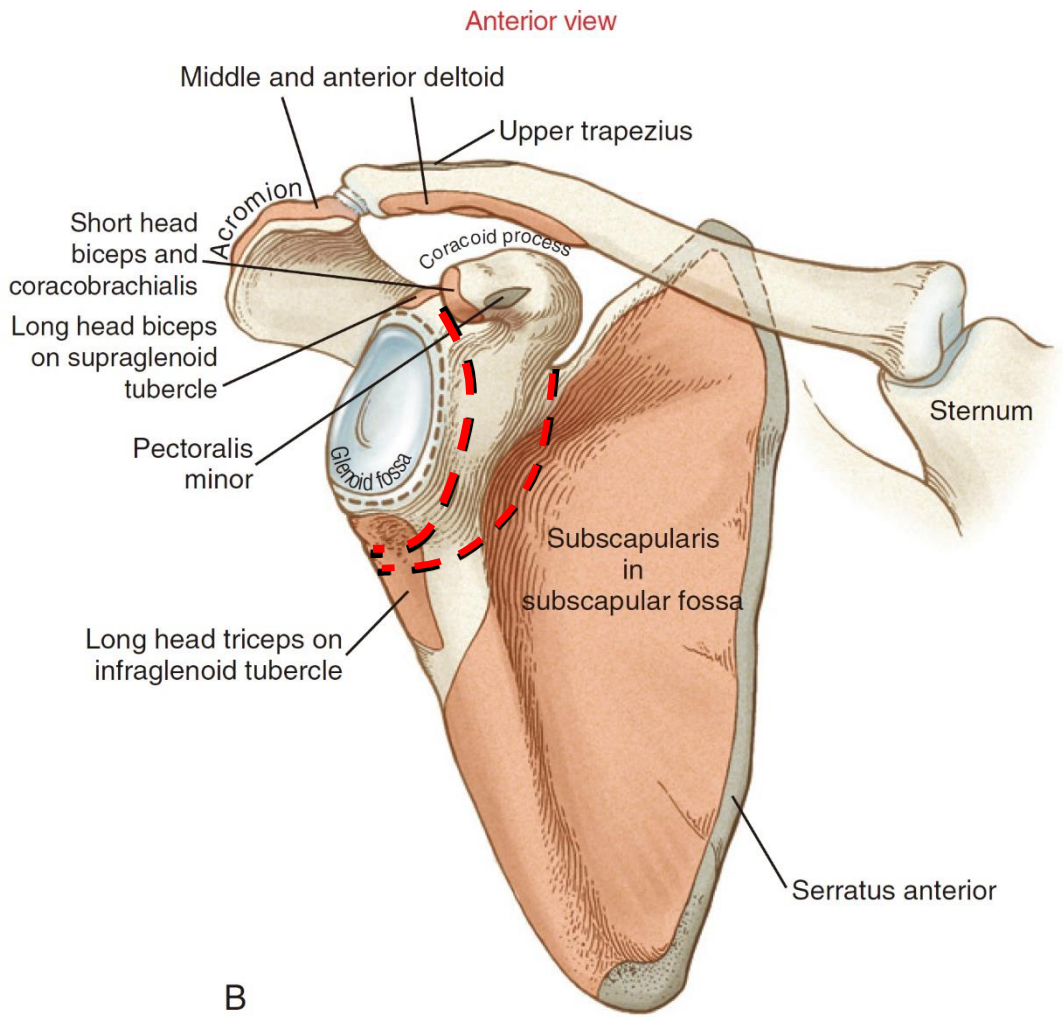
Sternoclavicular joint

Mobility

Stability

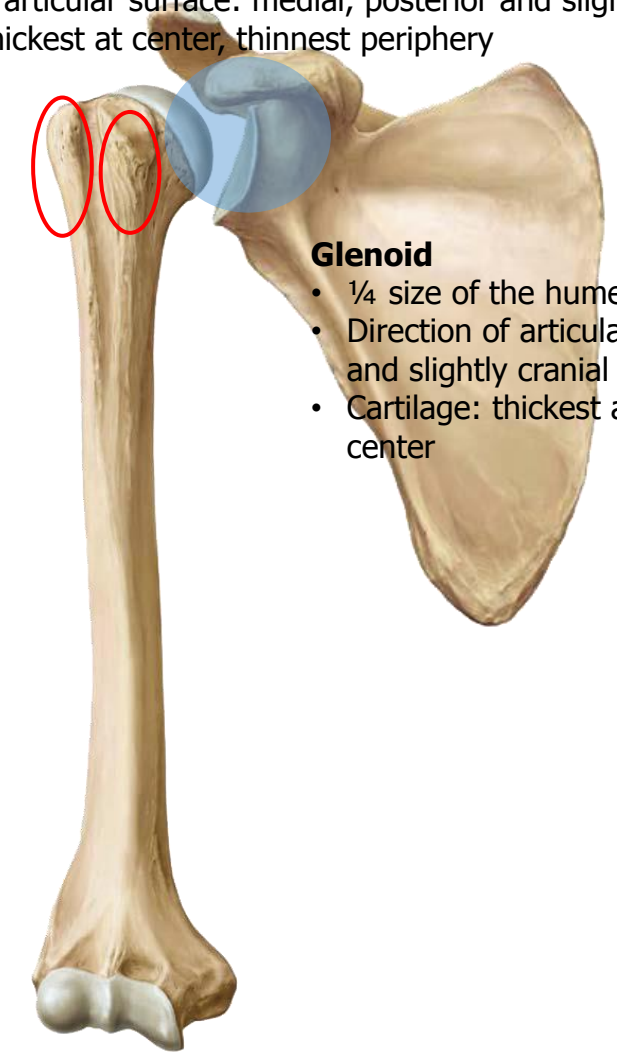
Scapula


Posterior view
T2
T3
T7~8
Upper trapezius
Acromion
Superior angle and border
Coracoid process
Supraspinatus in supraspinous fossa
Posterior deltoid
Spine
Lower and middle trapezius
Lateral angle
Levator scapulae
Rhomboid minor
Infraspinatus in infraspinous fossa
Teres minor
Lateral border
Rhomboid major
Medial border
Teres major
8th rib
Inferior angle
Latissimus dorsi
A

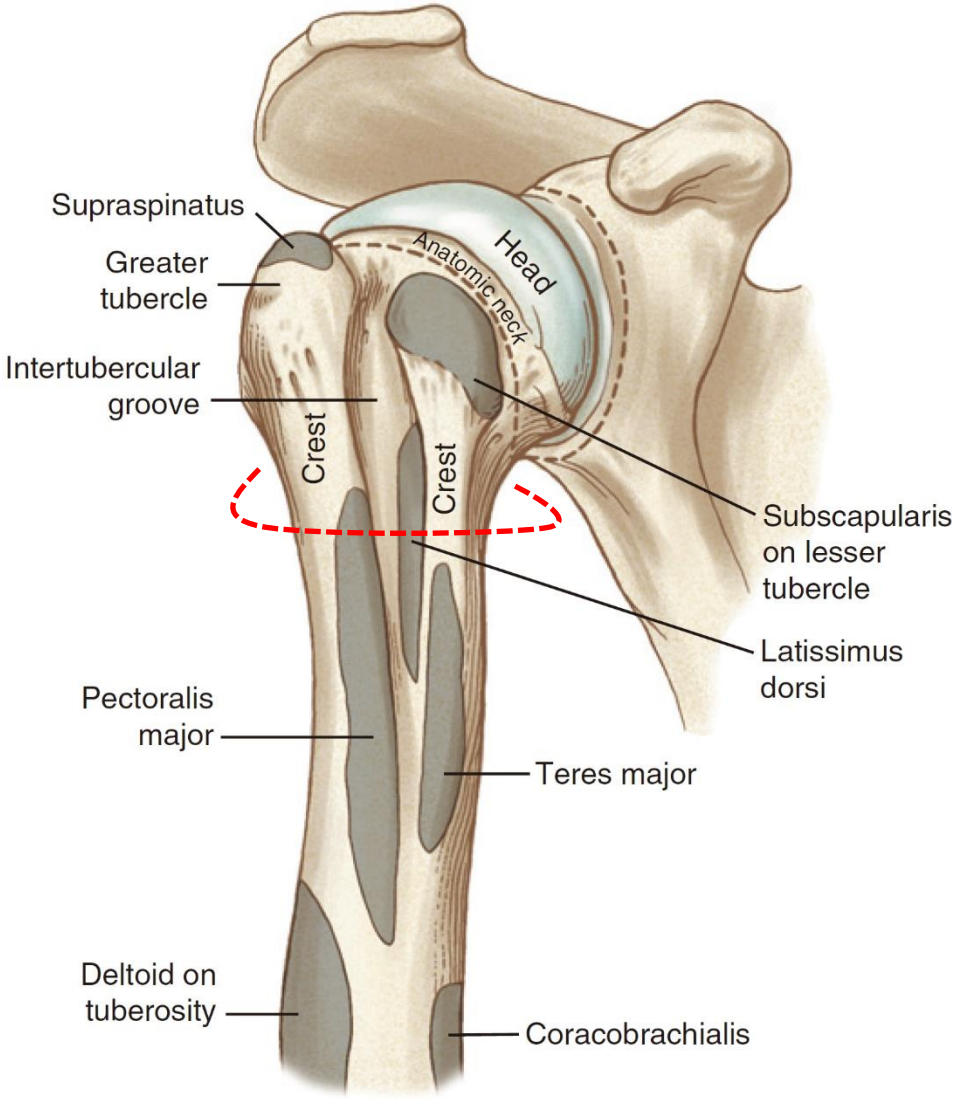

Anterior view
Middle and anterior deltoid
Upper trapezius
Acromion
Short head biceps and coracobrachialis
Coracoid process
Long head biceps on supraglenoid tubercle
Sternum
Pectoralis minor
Glenoid fossa
Subscapularis in subscapular fossa
Long head triceps on infraglenoid tubercle
Serratus anterior
B

Glenohumeral joint

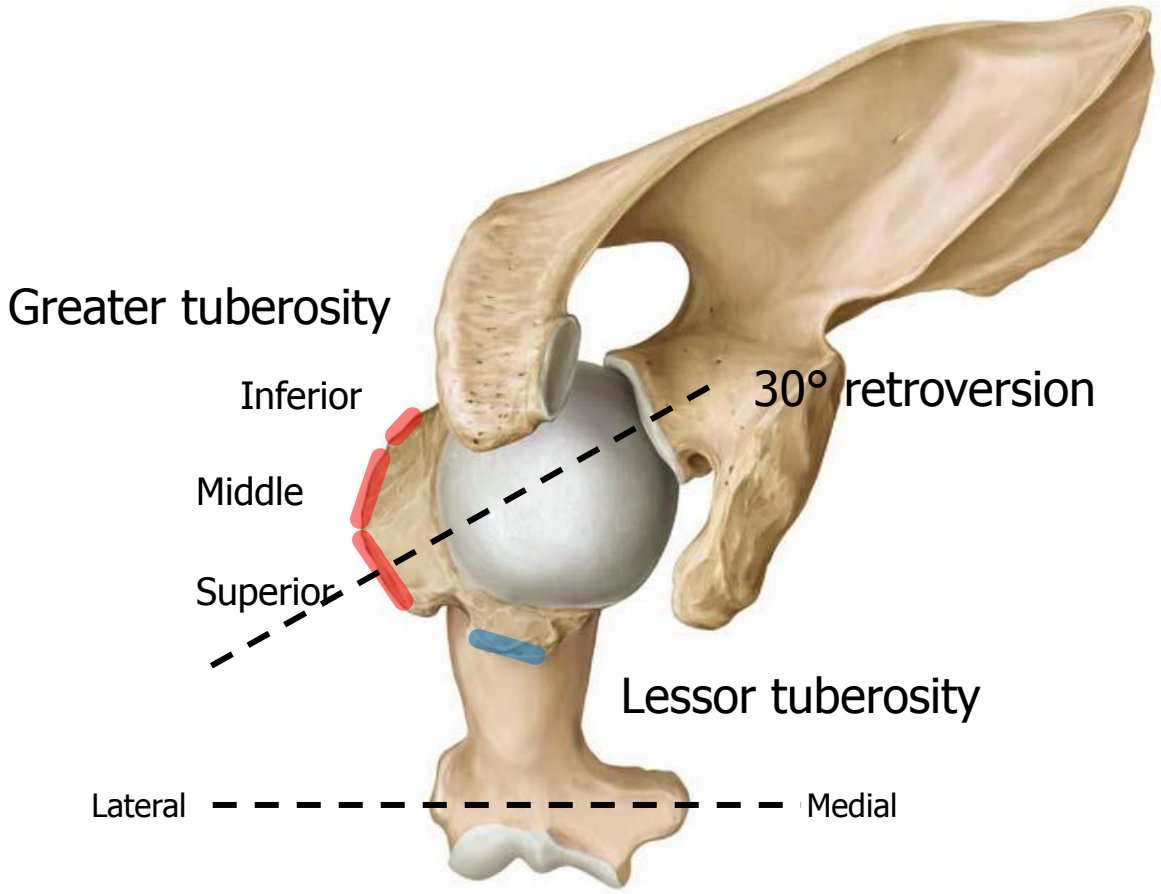
Humeral head
- One half of a full sphere (round)
- Direction of articular surface: medial, posterior and slightly caudal
- Cartilage: thickest at center, thinnest periphery

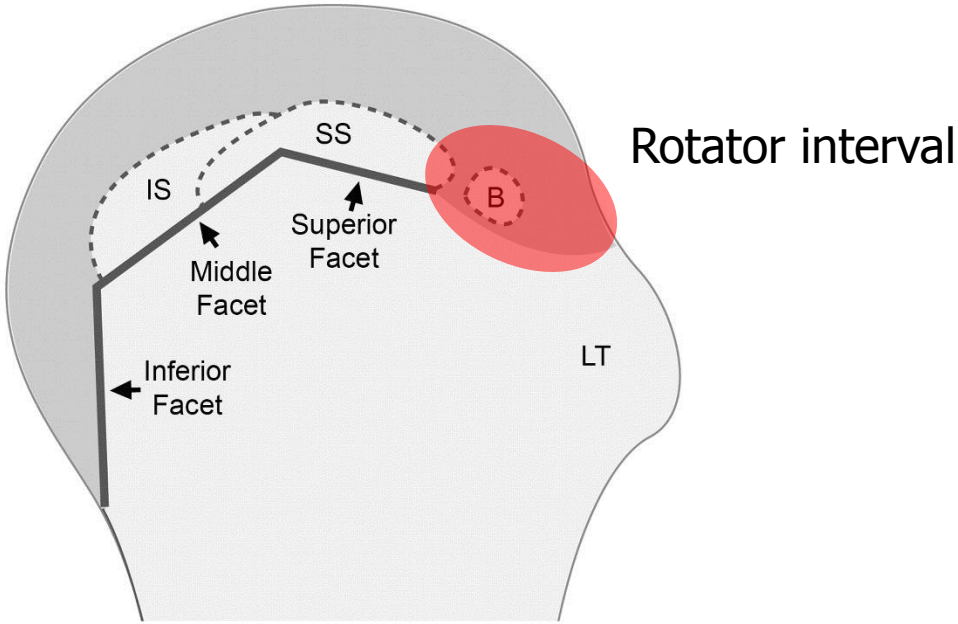


Glenoid
- ¼ size of the humeral head (flat)
- Direction of articular surface : anterior, lateral and slightly cranial
- Cartilage: thickest at periphery, thinnest at center



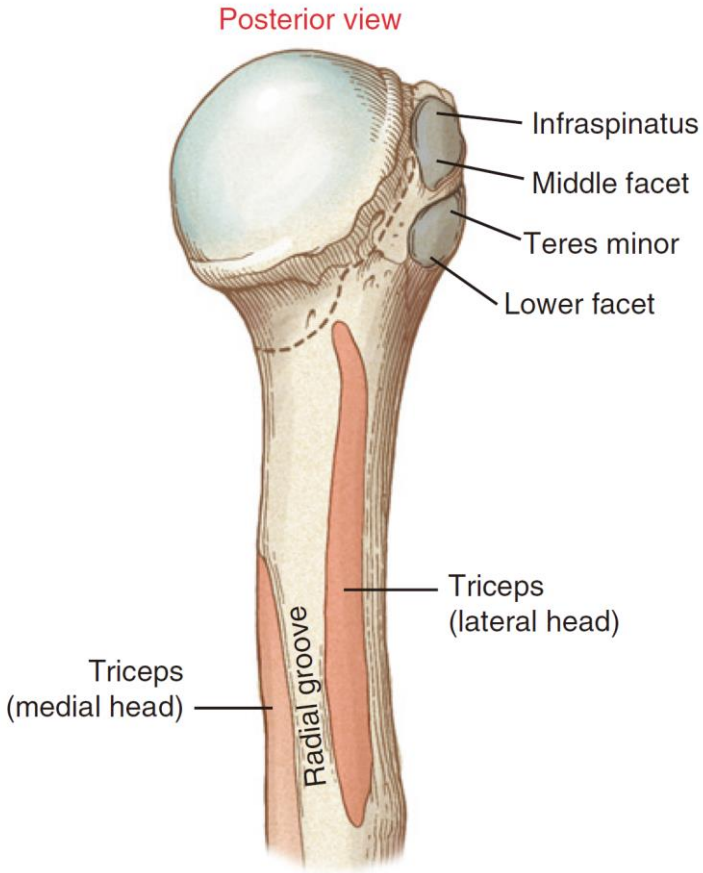
Humerus


Greater tuberosity
Inferior
Middle
Superior
30° retroversion
Lessor tuberosity
Lateral
Medial

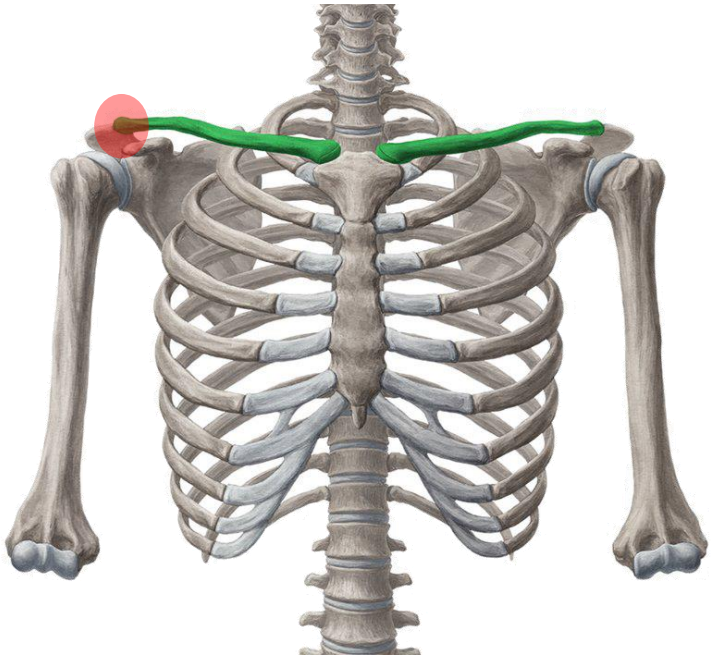

SS
IS
B
Superior Facet
Middle Facet
Inferior Facet
LT
Rotator interval

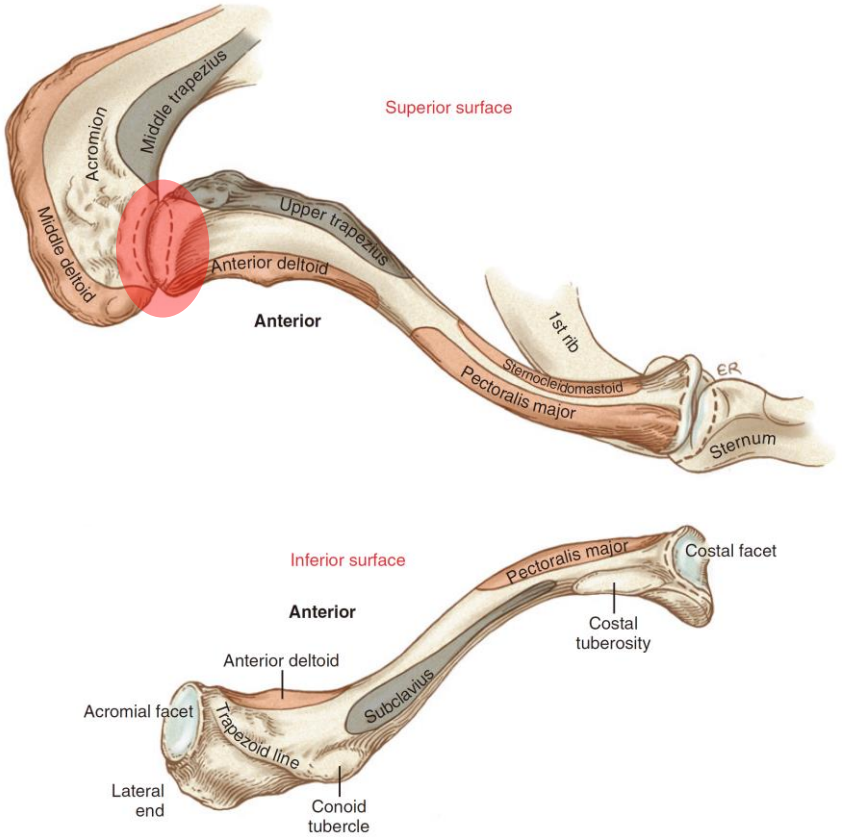
Humerus

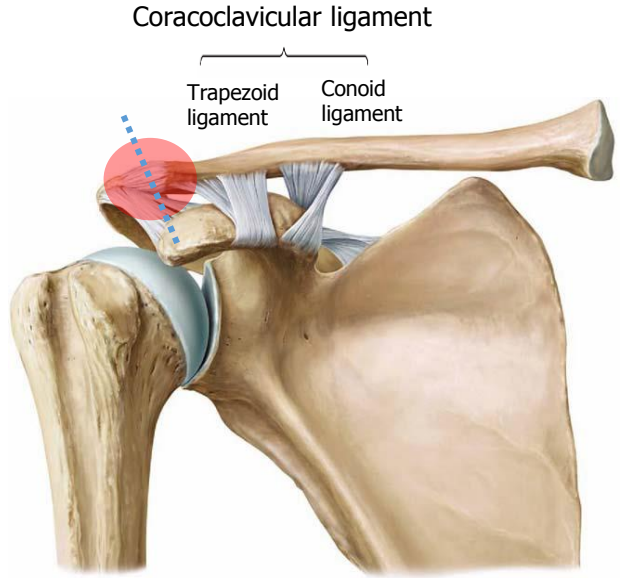

135°


Posterior view
Infraspinatus
Middle facet
Teres minor
Lower facet
Triceps
(lateral head)
Triceps
(medial head)
Radial groove

Clavicle

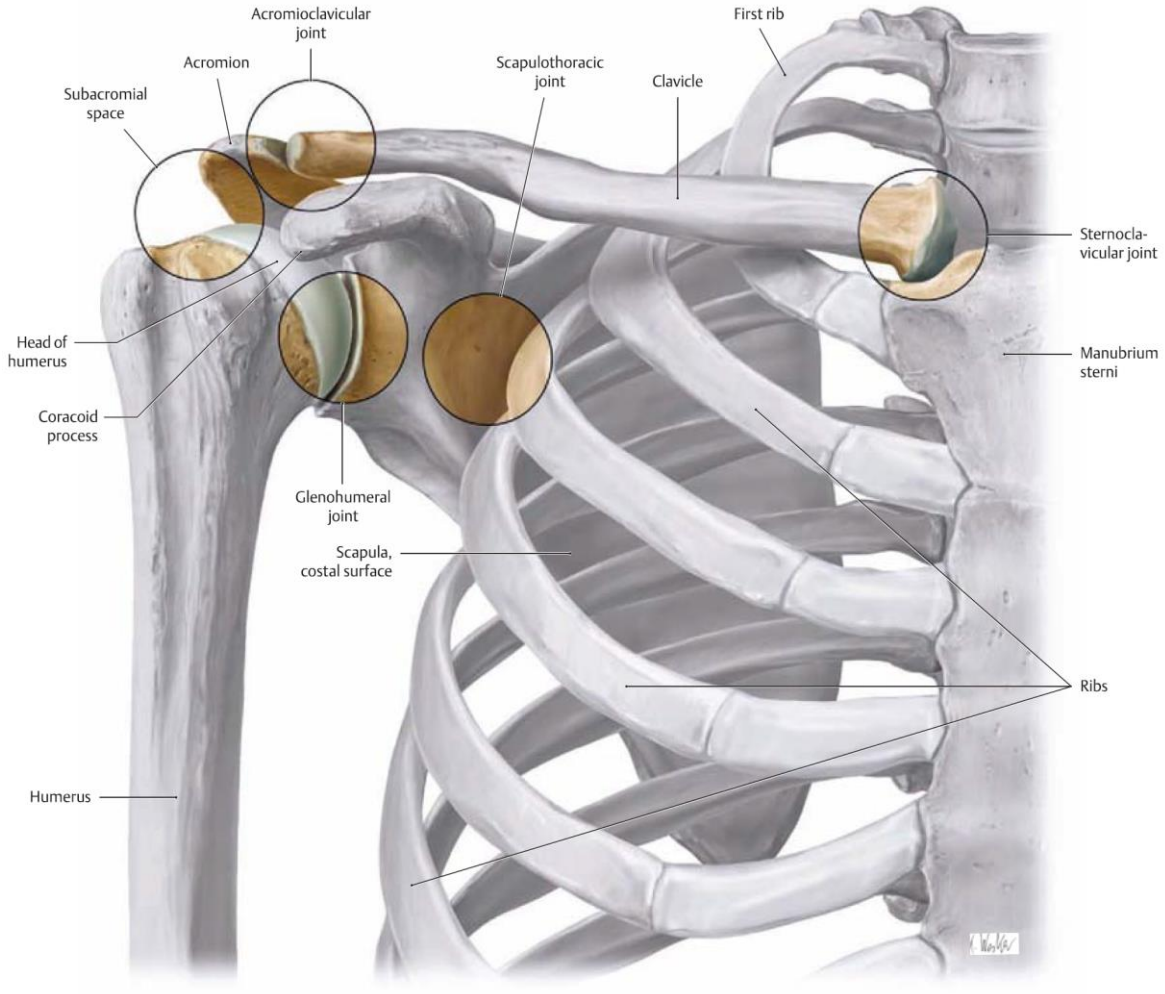



Superior surface
Acromion
Middle trapezius
Middle deltoid
Upper trapezius
Anterior deltoid
Anterior
1st rib
Sternocleidomastoid
Pectoralis major
ER
Sternum
Inferior surface
Anterior
Pectoralis major
Costal facet
Costal tuberosity
Anterior deltoid
Acromial facet
Subclavius
Trapezoid line
Lateral end
Conoid tubercle


Coracoclavicular ligament
Trapezoid ligament
Conoid ligament

Joints

- Glenohumeral joint
- Acromioclavicular joint
- Sternoclavicular joint
- Subacromial gliding mechanism (subacromial joint)
  - RC gliding
- Scapulothoracic gliding mechanism

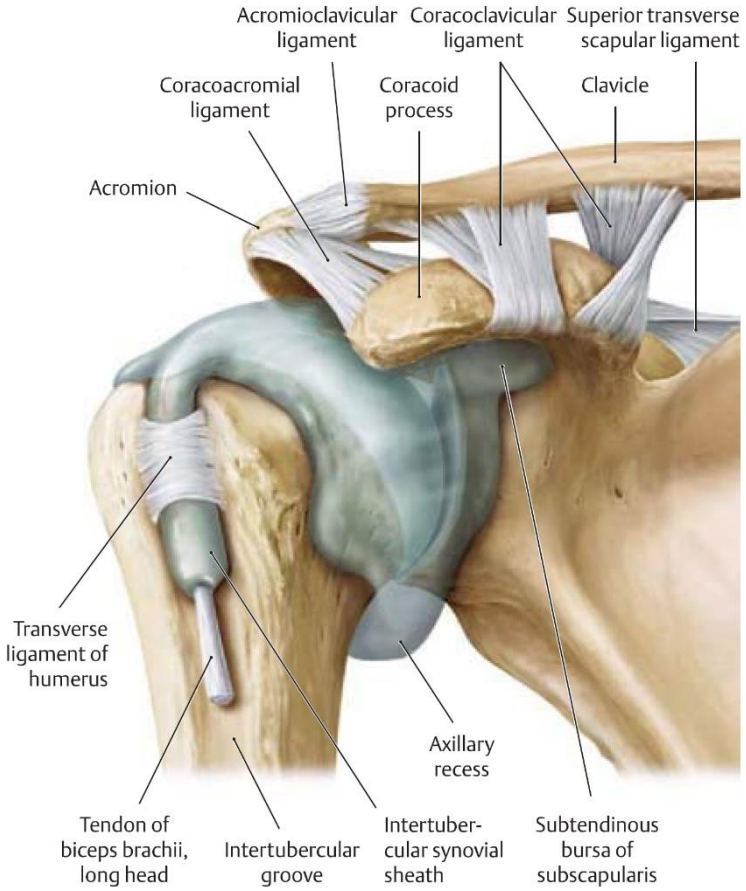


Glenohumeral joint – Labrum

- Function
  - Anchor point for capsuloligaments and biceps long head
  - Stability ↑ of GH joint
    - Depth of glenoid socket ↑
    - Surface area ↑
    - Load bearing structure for the humeral head

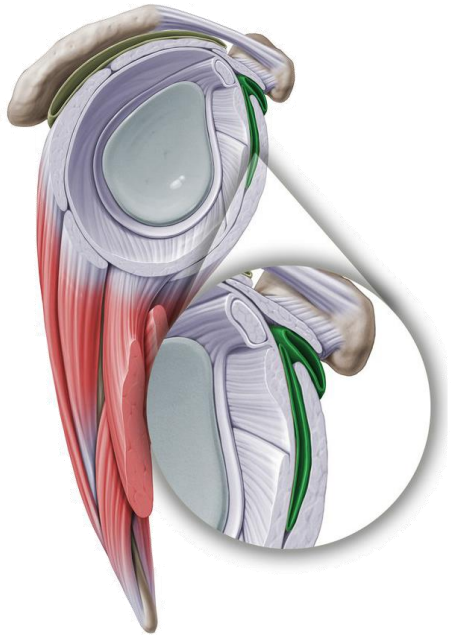
Glenohumeral joint – Joint capsule

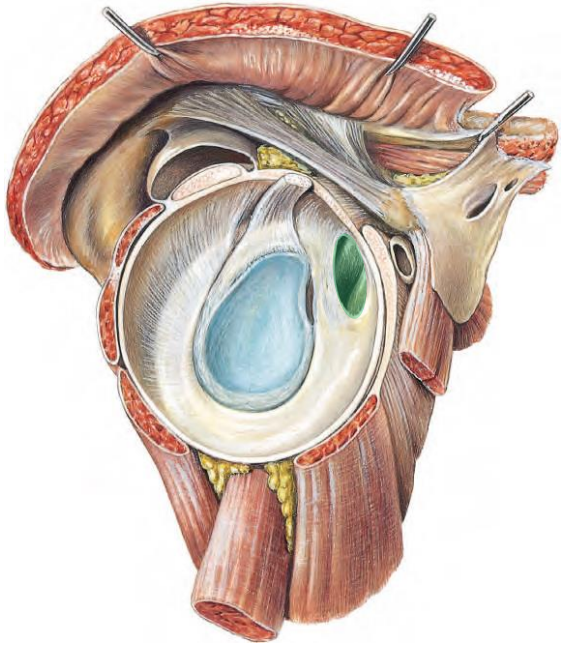
- Labrum ~ humerus anatomical neck
  - Biceps tendon sheath
    - Synovial sheath – 3~4 cm inferior to distal end of intertubercular groove
  - Axillary recess
  - Subscapularis recess (or bursa)
  - Superior sublabral recess
  - Posterior recess

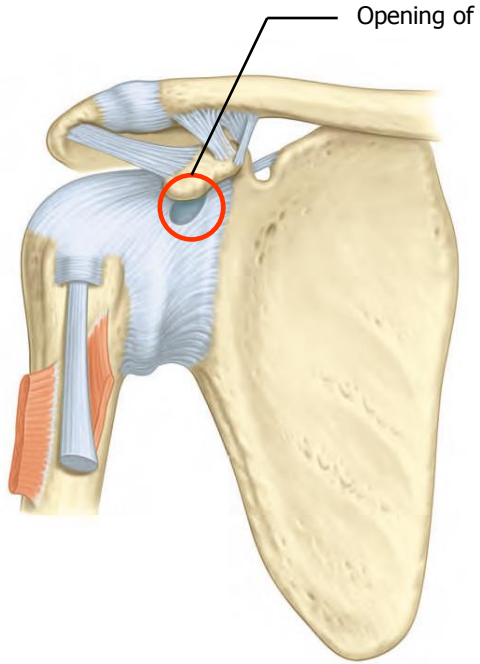


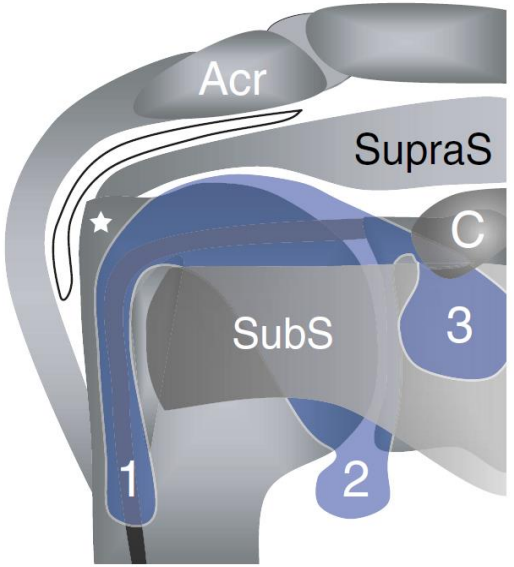
Glenohumeral joint – Joint capsule

- Labrum ~ humerus anatomical neck
  - Biceps tendon sheath
  - Axillary recess
  - Subscapularis recess (or bursa) and subtendinous bursa of subscapularis
  - Superior sublabral recess
  - Posterior recess



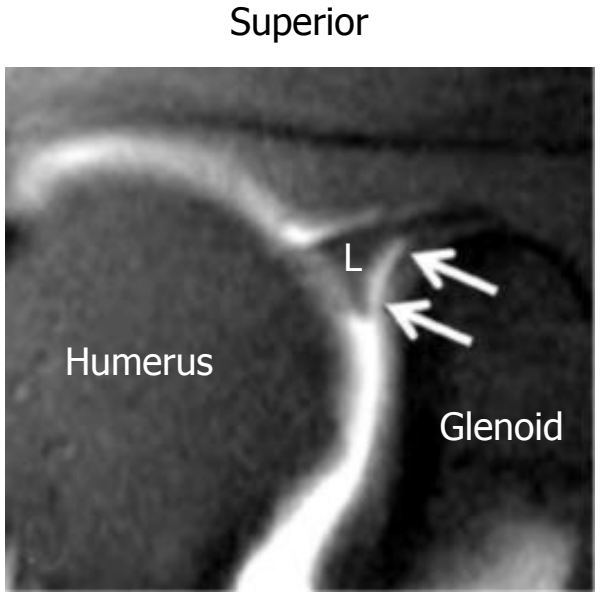


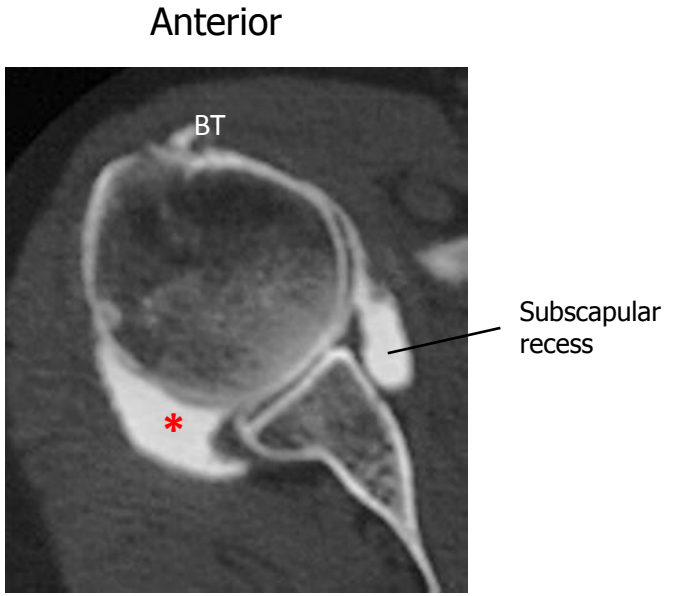




Glenohumeral joint – Joint capsule

- Labrum ~ humerus anatomical neck
  - Biceps tendon sheath
  - Axillary recess
  - Subscapularis recess (or bursa)
  - Superior sublabral recess
  - Posterior recess
    - Posterior to the glenoid
    - Deep fold of tissue posterior to the labrum

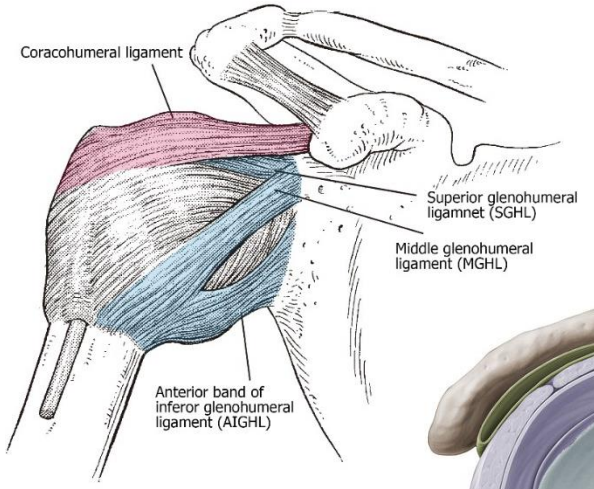


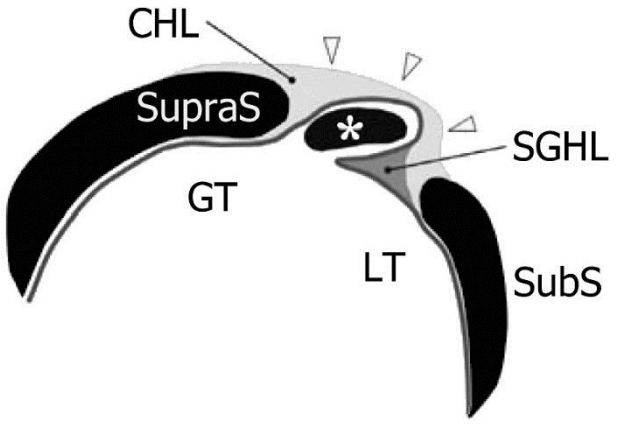


Coracohumeral and glenohumeral ligaments

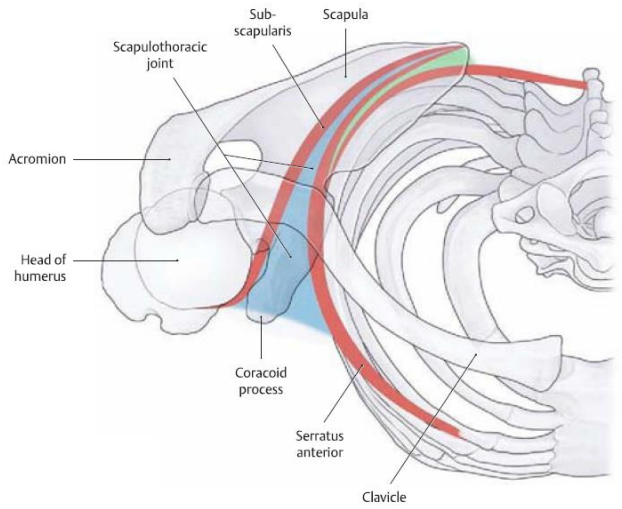
- Coracohumeral ligament
  - Lateral border of coracoid process ~ GT and LT
  - Strengthens the upper part of the GH capsule

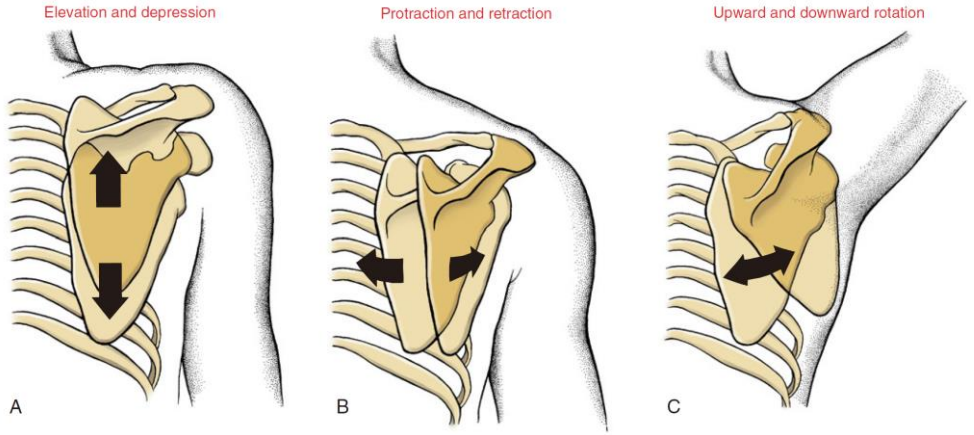
- Glenohumeral ligament
  - Superior
  - Middle
  - Inferior – Anterior and posterior bands

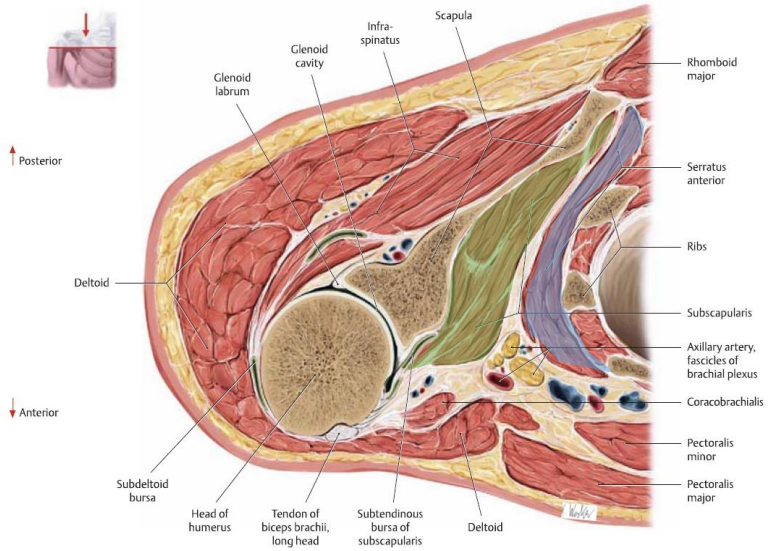


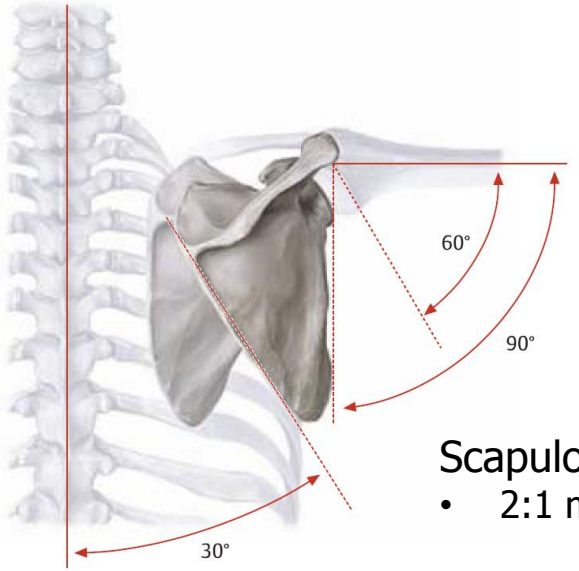


Scapulothoracic gliding mechanism





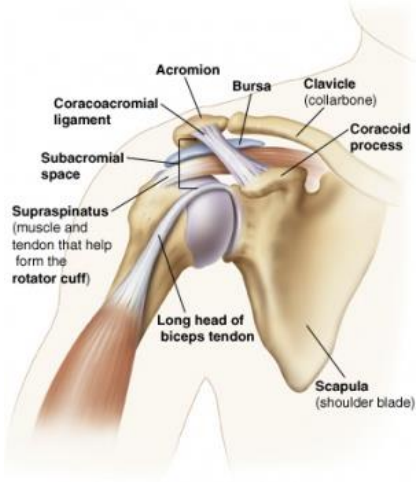




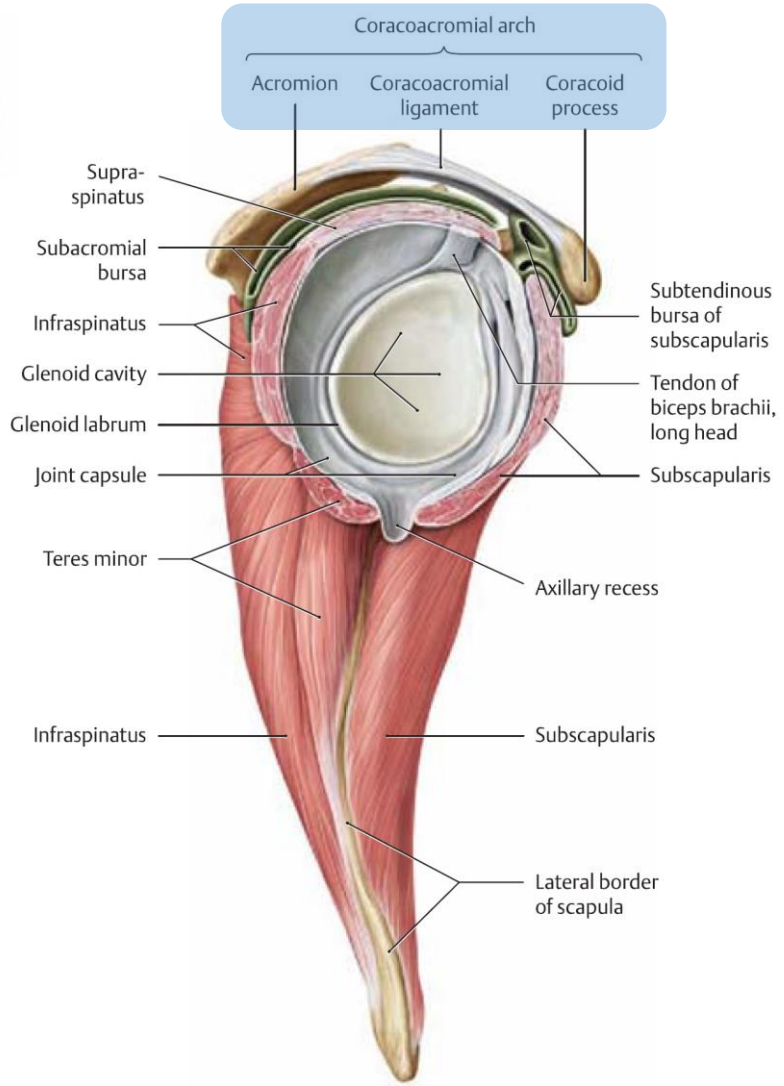
Scapulothoracic (scapulohumeral) rhythm

- 2:1 movement at GH and scapulothoracic joints

Subacromial joint

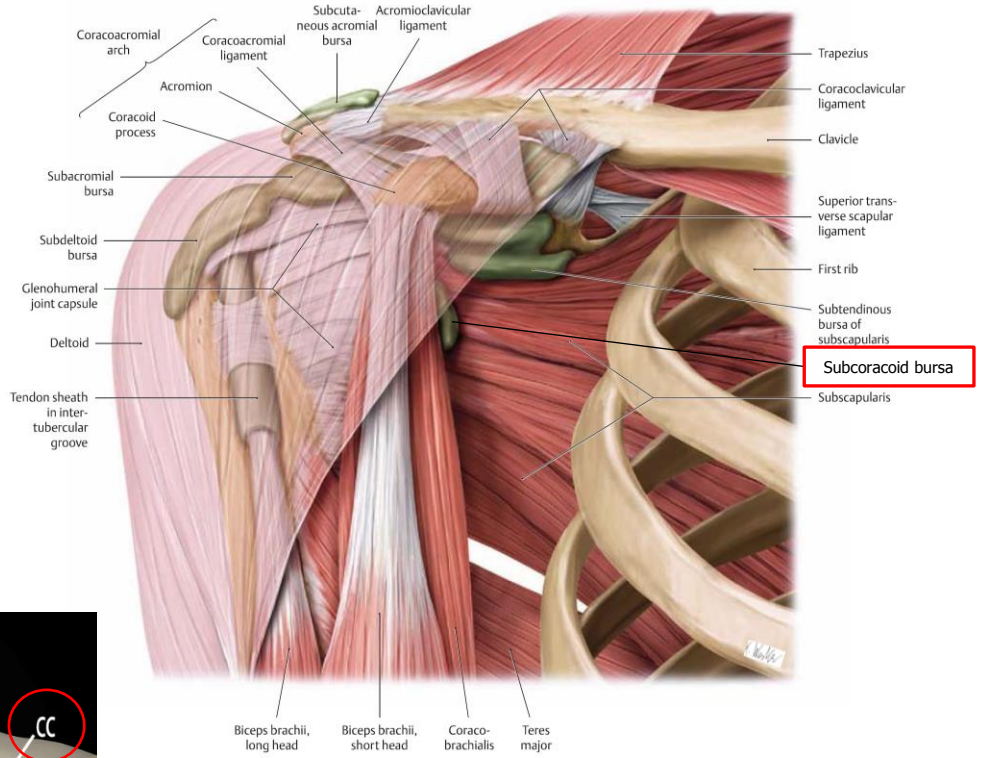


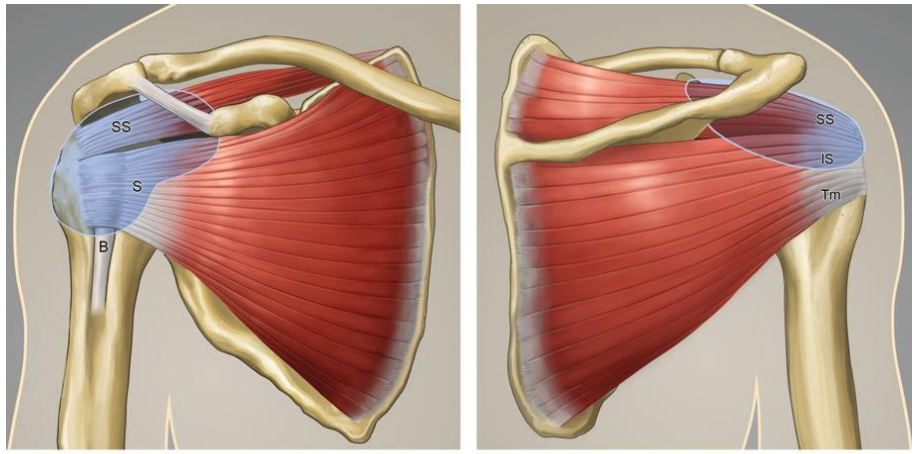
- Subacromial gliding system, subacromial space
  - Coracoacromial arch
    - Acromion
    - Coracoacromial ligament
    - Coracoid process
  - Humeral head covered by rotator cuff and biceps tendon
  - SASD bursa → synovial part of subacromial joint



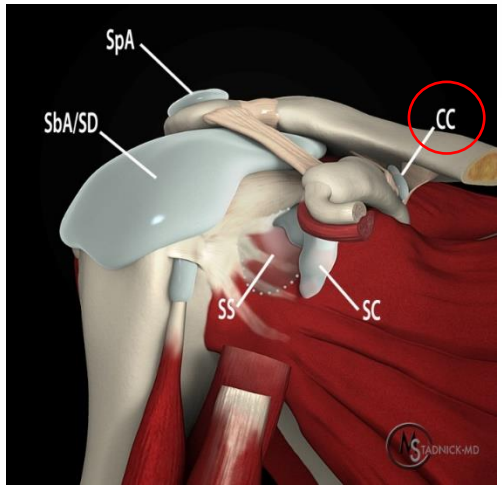
Bursae

- Subacromial-subdeltoid bursa
- Subcoracoid bursa (subcoracobrachialis bursa)
  - Between upper portion of SSc tendon, the neck of scapula and the base of the coracoid process
  - Communication with SASD bursa in 11%
- Subscapularis bursa and subtendinous bursa of subscapularis (joint capsule)
- Coracoclavicular bursa
- Supraacromial bursa (subcutaneous acromial bursa)

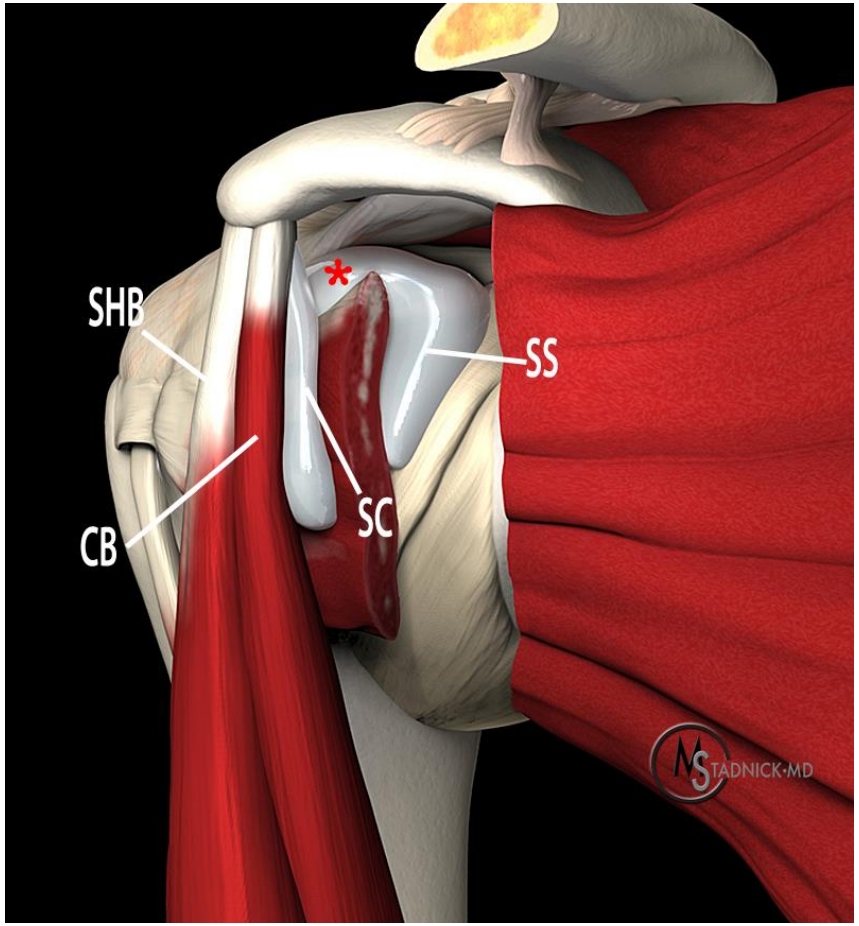


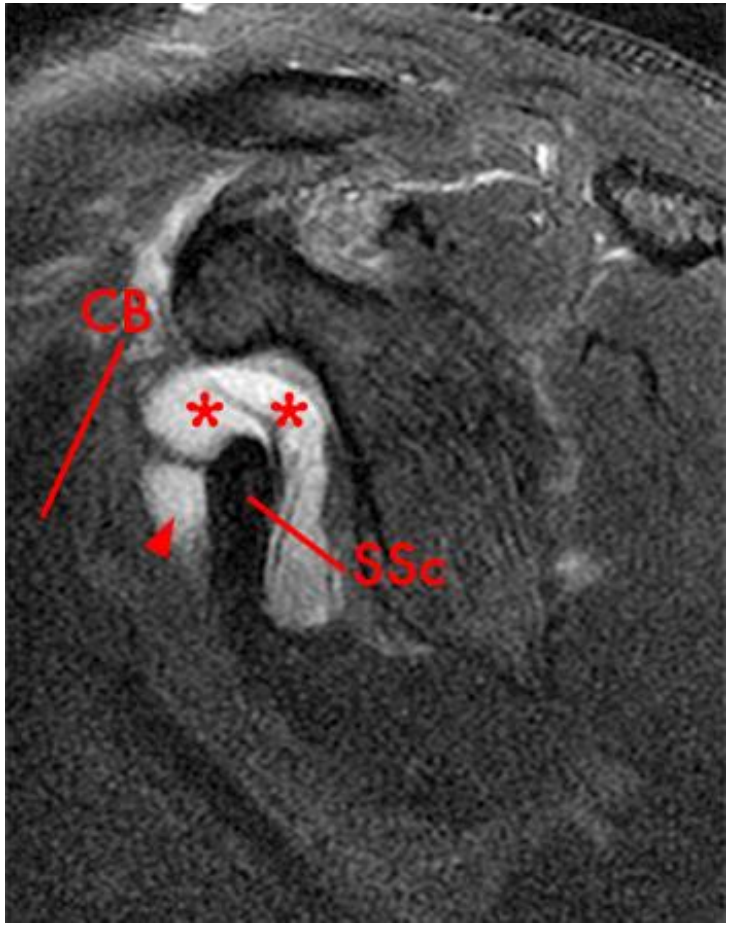


a. b.



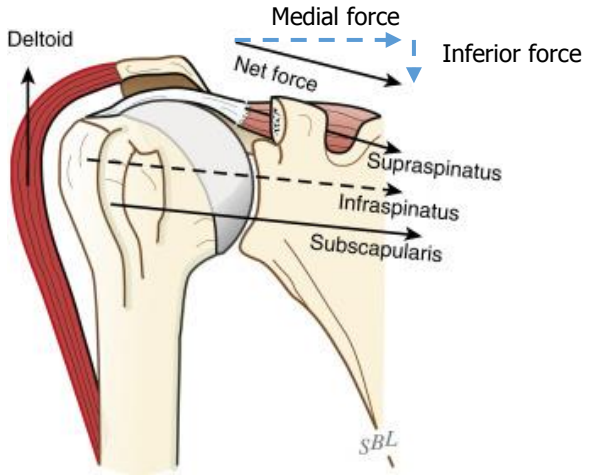
Subcoracoid bursa vs. subscapular recess

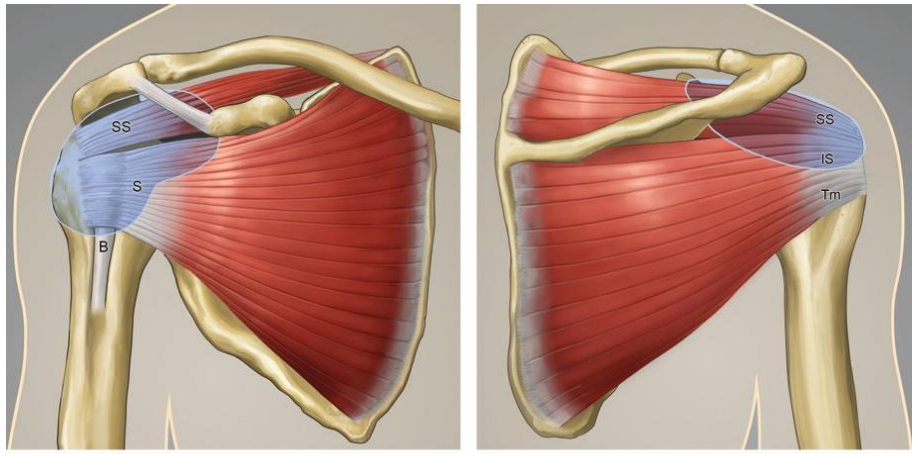


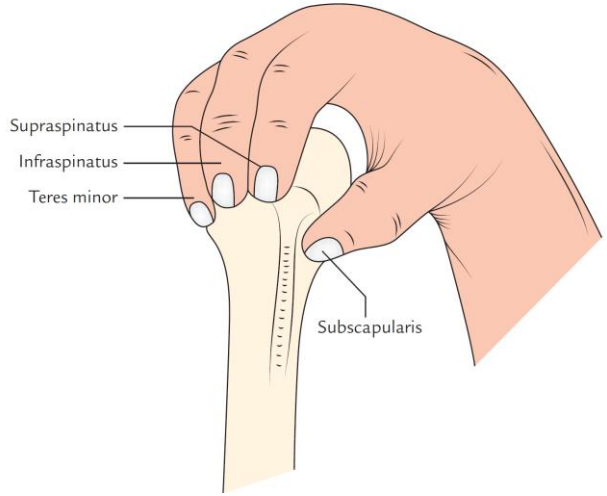


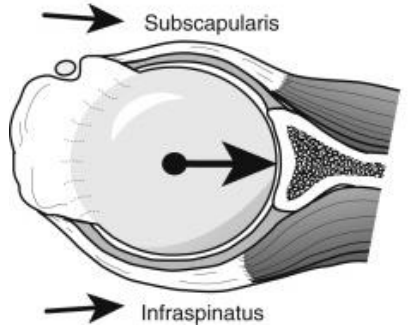
Rotator cuff

- Function
  - Rotate the humerus with respect to the scapula
  - Concavity compression by contract together
  - Provide muscle balance
    - By contracting selectively, they resist displacing forces resulting from contraction of the principal shoulder movers (deltoid, P. major, L. dorsi)
  - Dynamic ligaments – capsular stability



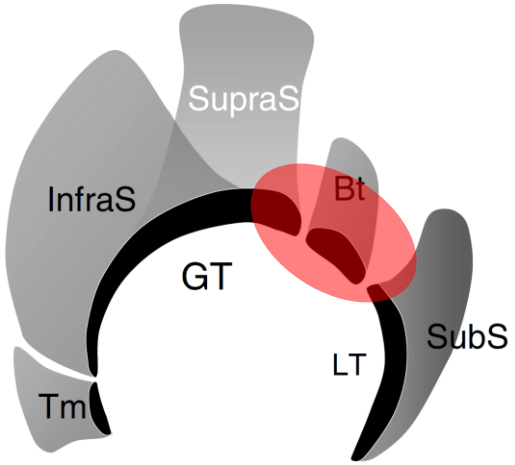


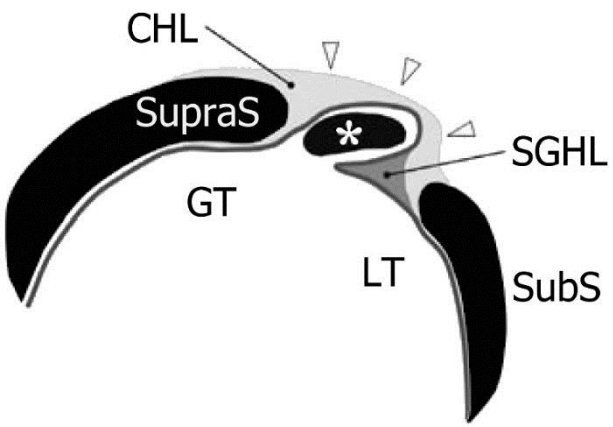


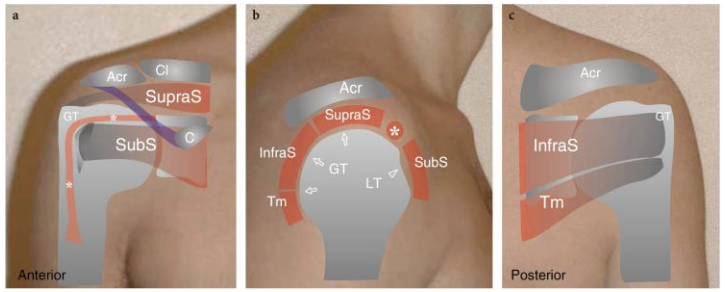


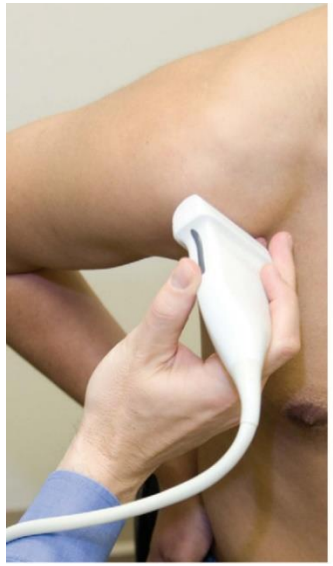
Deltoid vs. RC

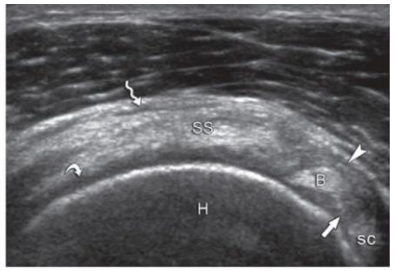
Rotator interval

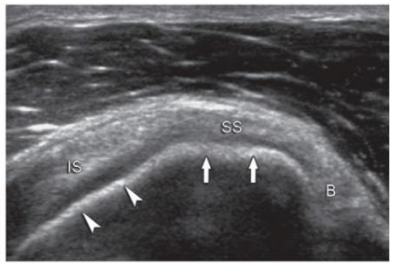






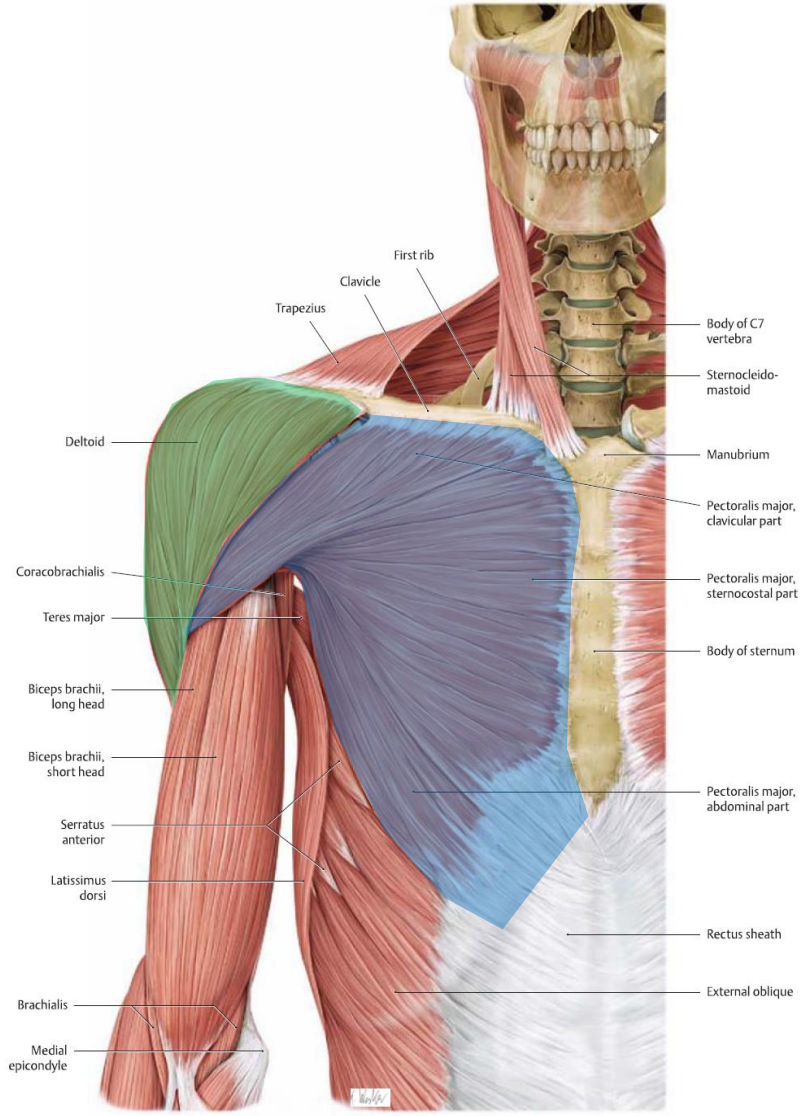


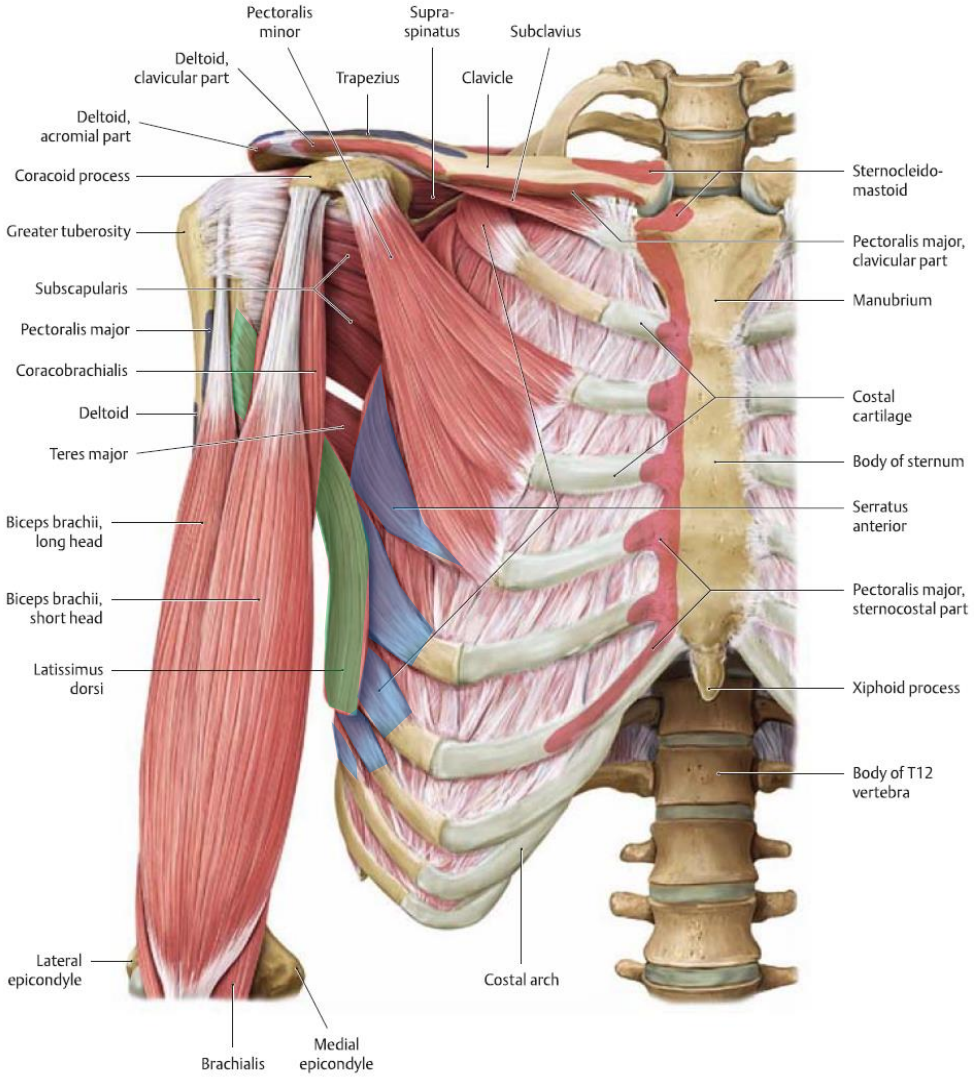




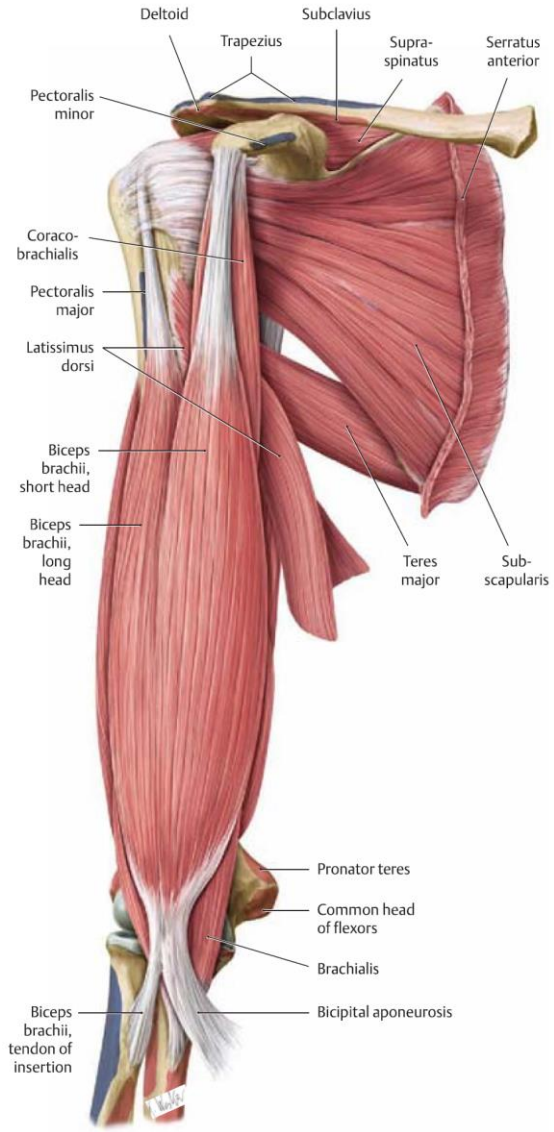
- Functions
  - Act as a **restraint against extreme** flexion, extension, adduction, and external rotation
  - **Stabilize the humeral head** against inferior translation while in adduction
  - **Stabilize the humeral head** against posterior translation while in flexion and external rotation with abduction

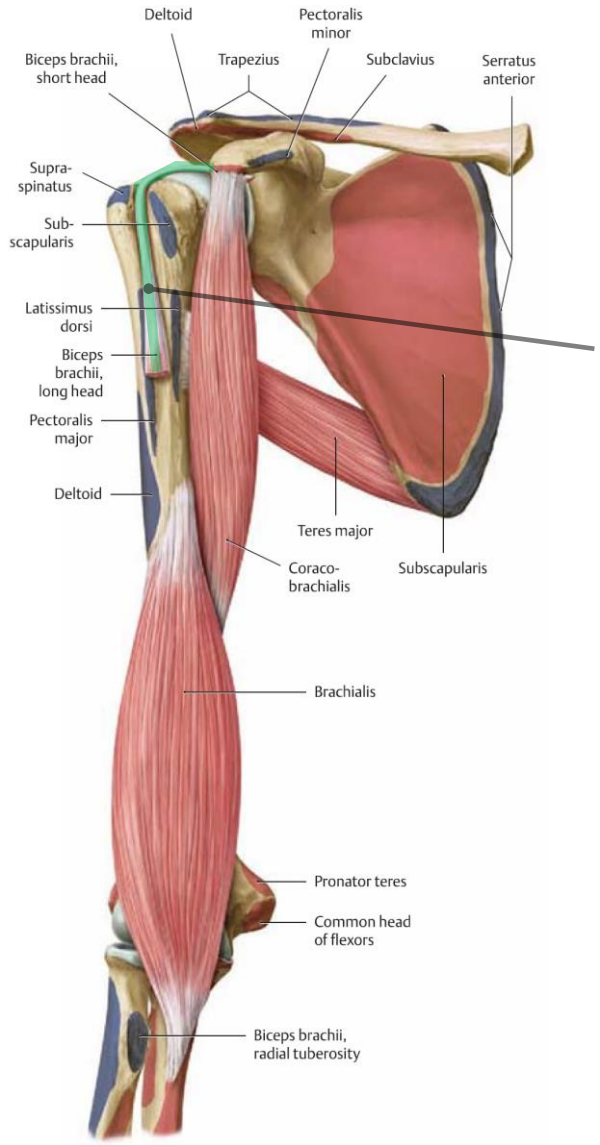
Anterior shoulder ~ upper arm





Anterior shoulder ~ upper arm

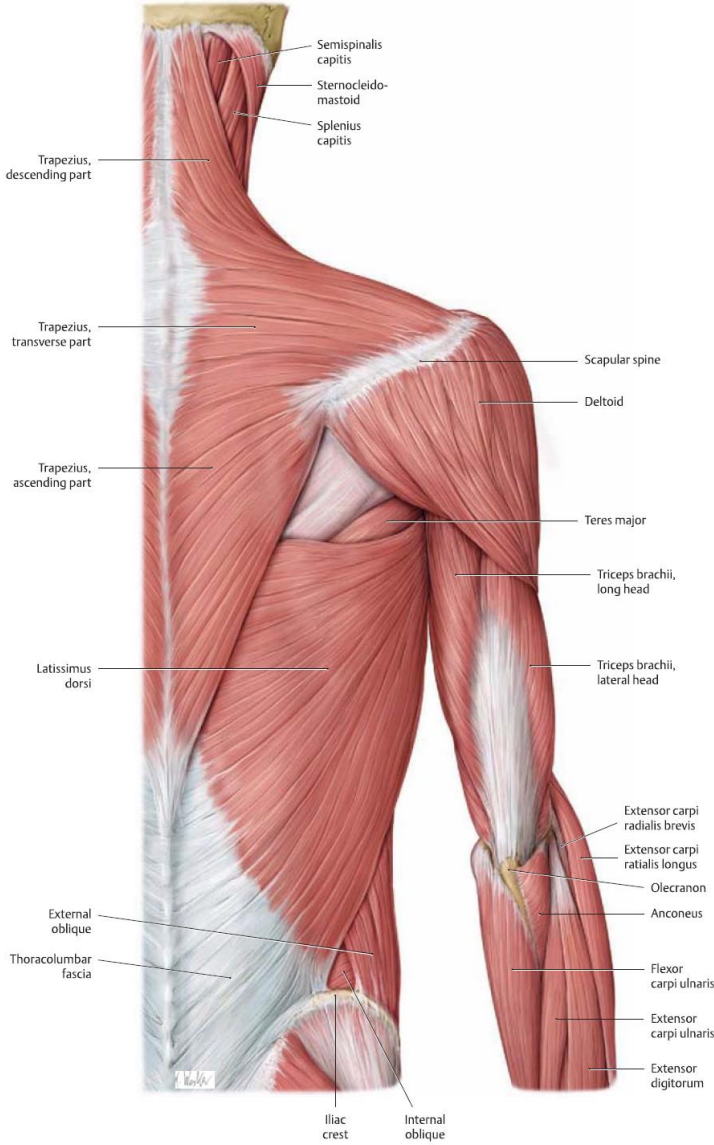


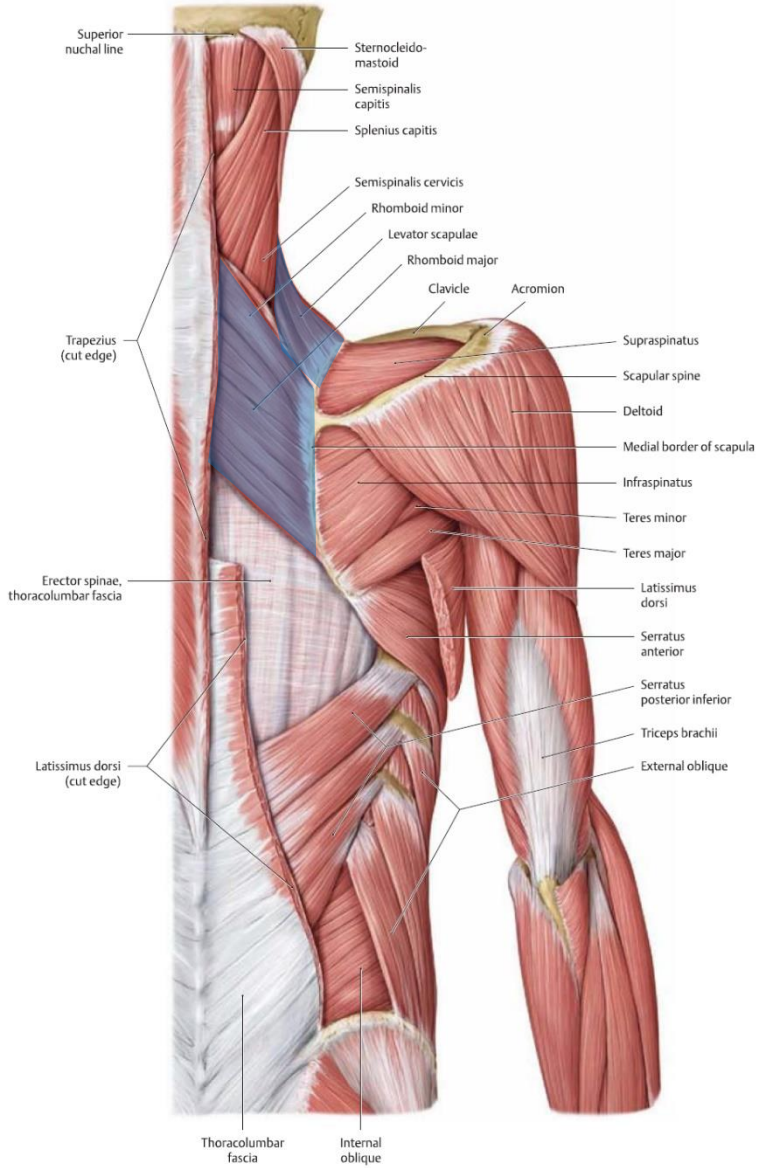


Biceps brachii, long head

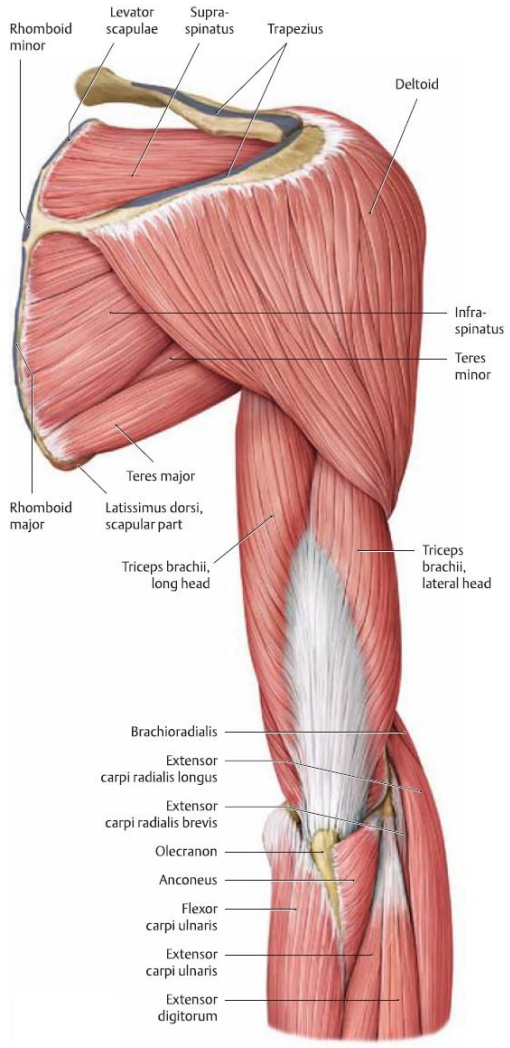
- It plays an important role in the stabilization of the humeral head in the glenoid fossa during powerful flexion of the elbow and supination of the forearm

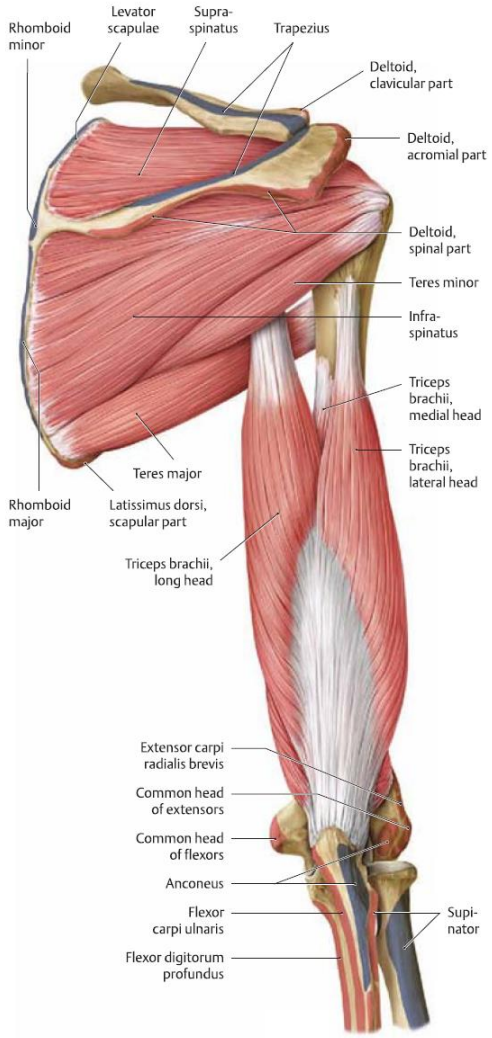
Posterior shoulder ~ upper arm



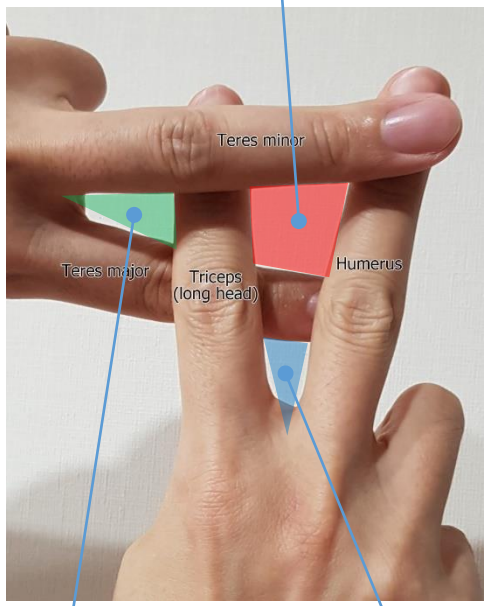


Posterior shoulder ~ upper arm



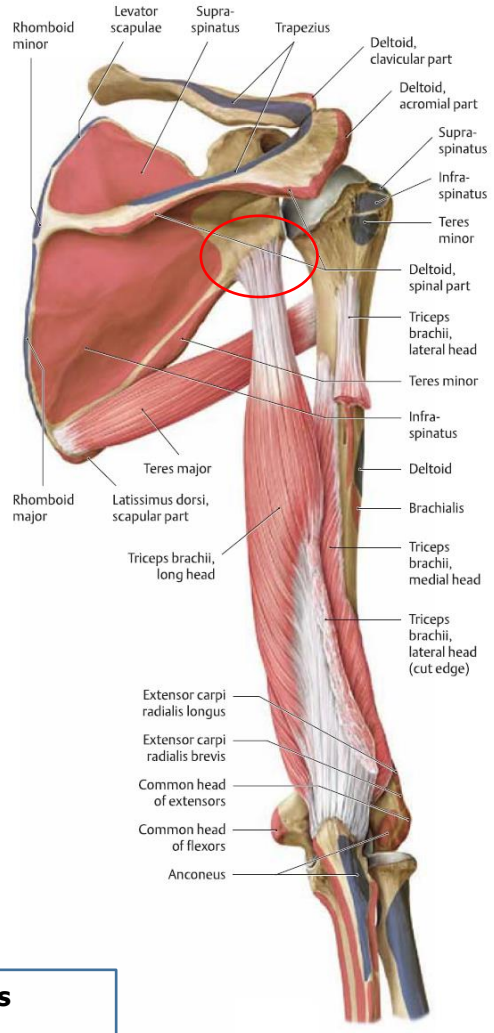


Quadrangular space
Axillary nerve
Posterior circumflex humeral artery

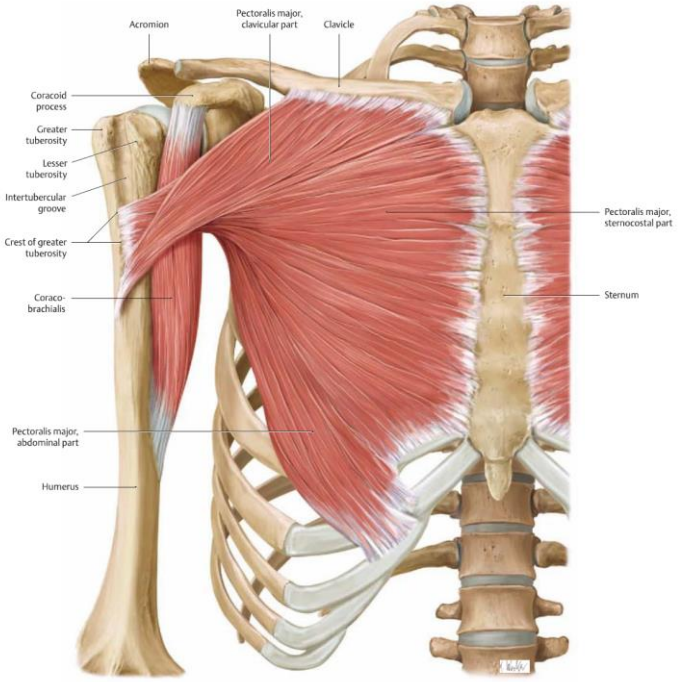


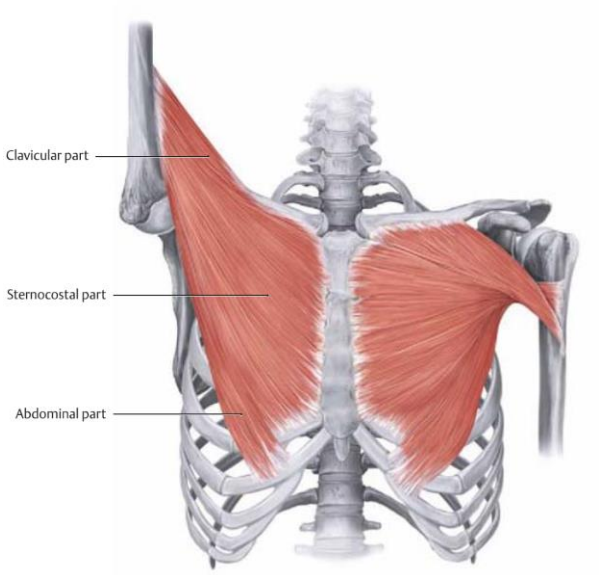
Triangular space
Circumflex scapular artery

Triceps hiatus
Radial nerve
Profunda brachii artery



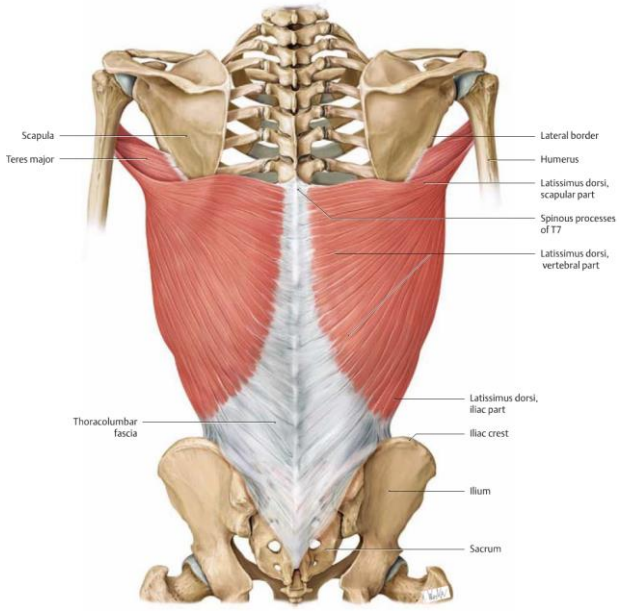
P. major and L. dorsi

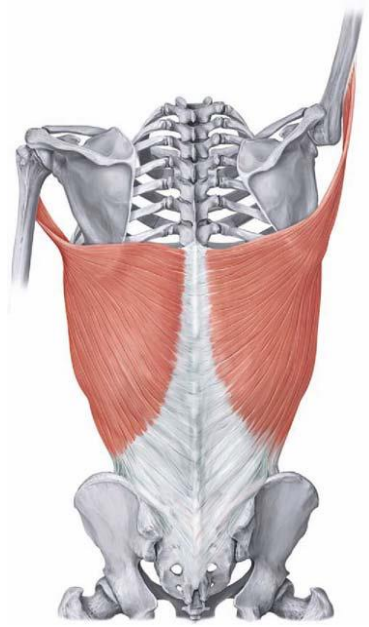




Pectoralis major

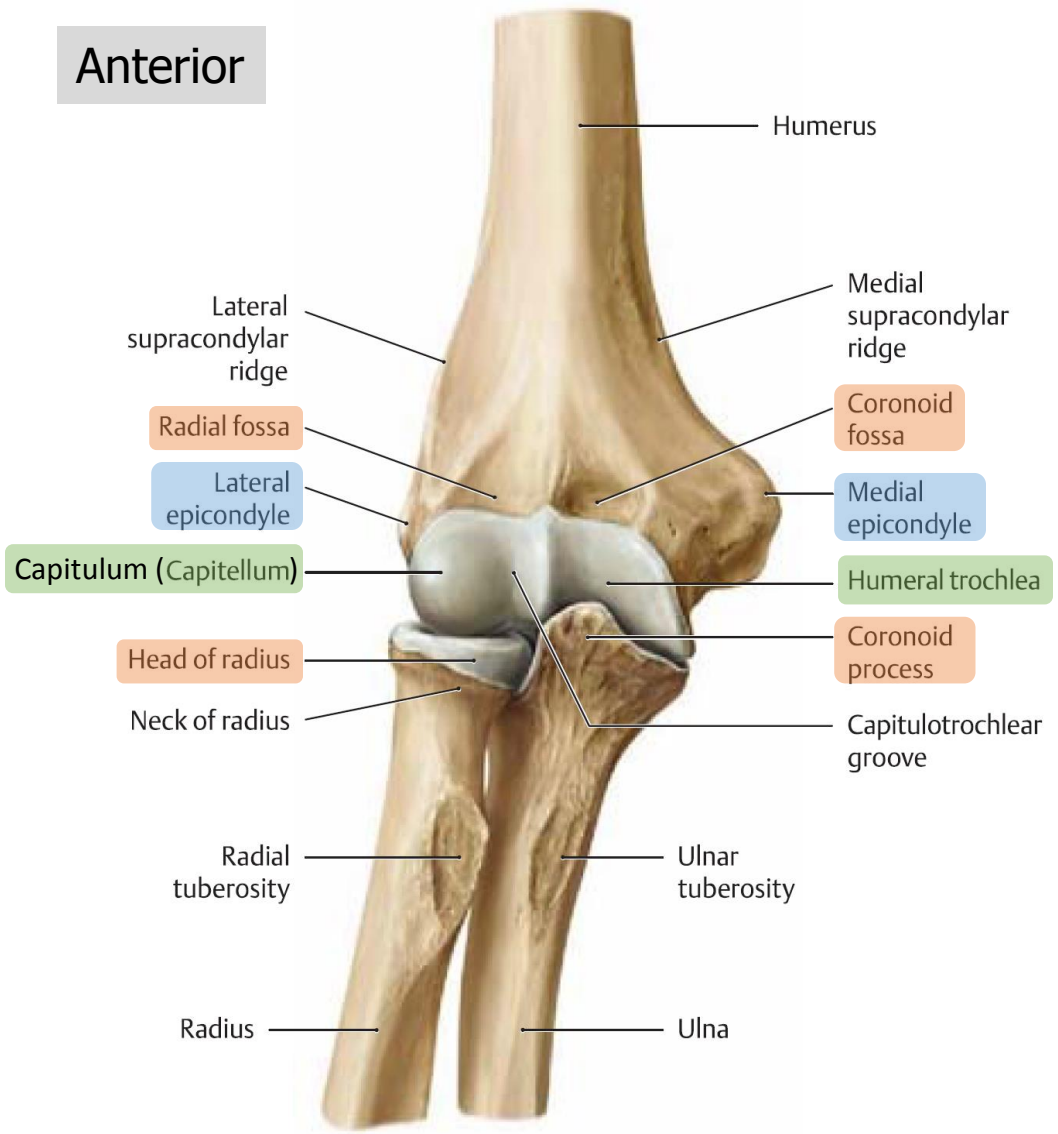
Latissimus dorsi

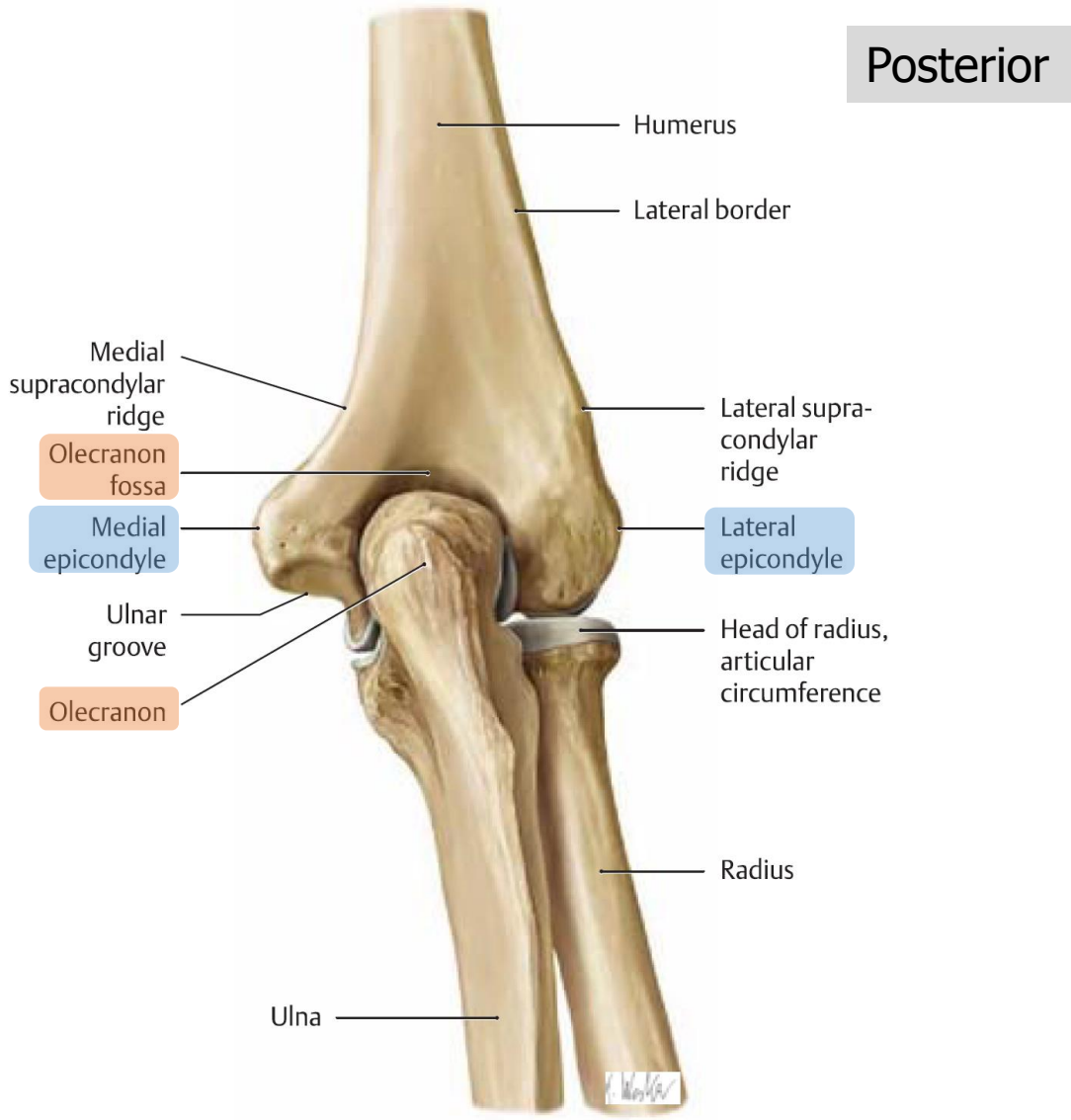




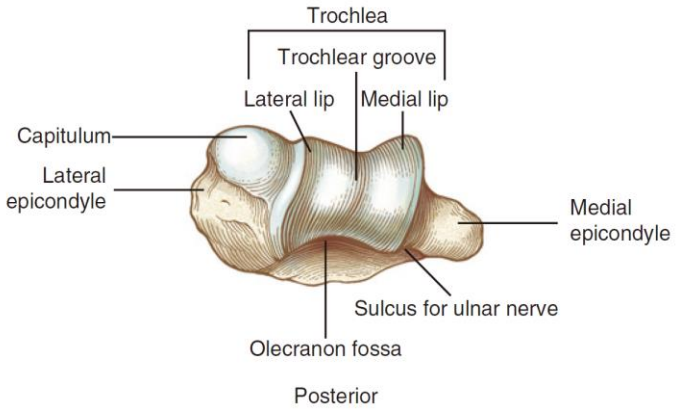
Elbow

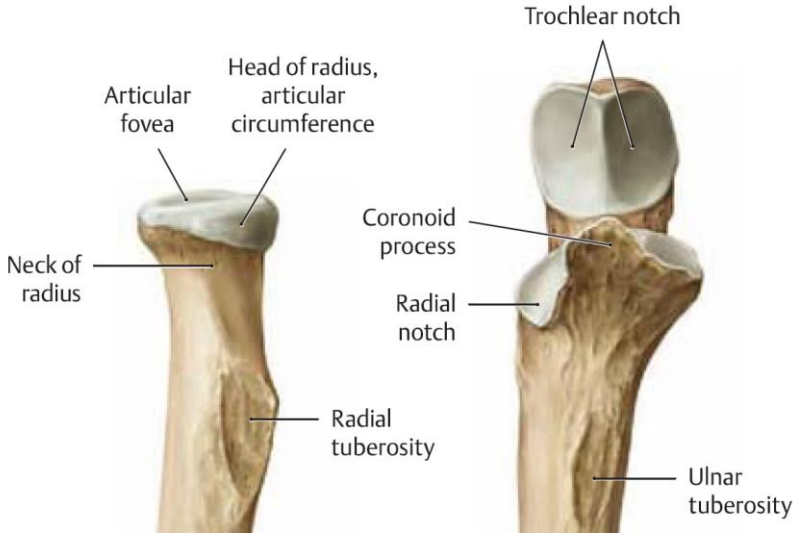
Bones & Joints

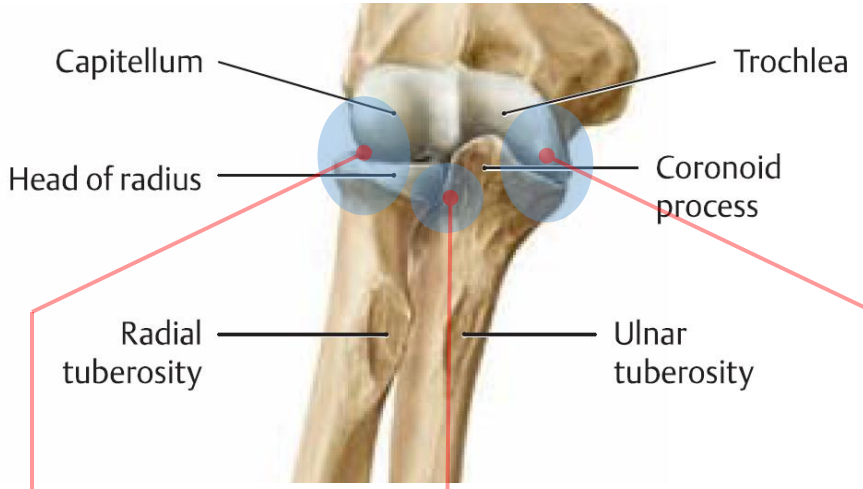


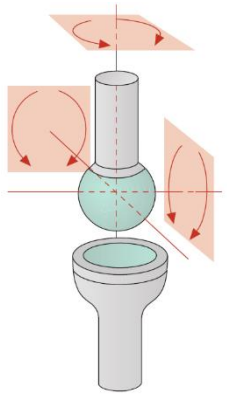


Bones & Joints

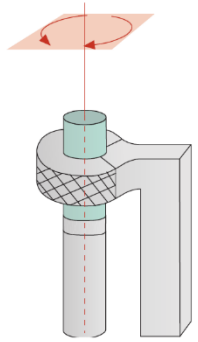




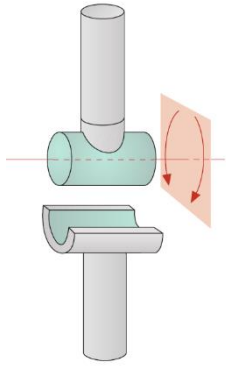




Humeroradial joint (ball & socket)



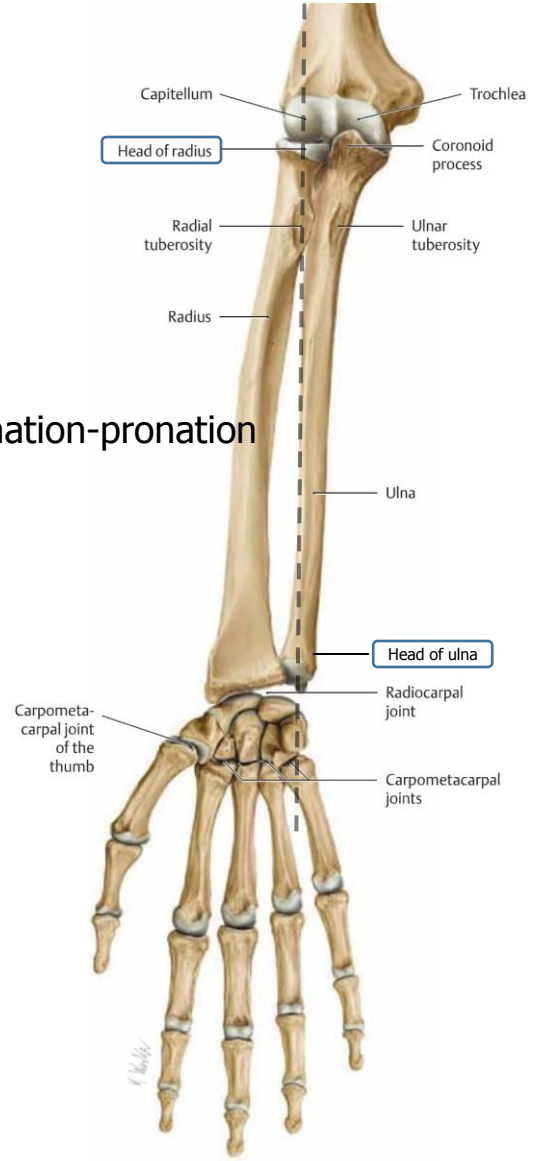
Proximal radioulnar joint (pivotal)

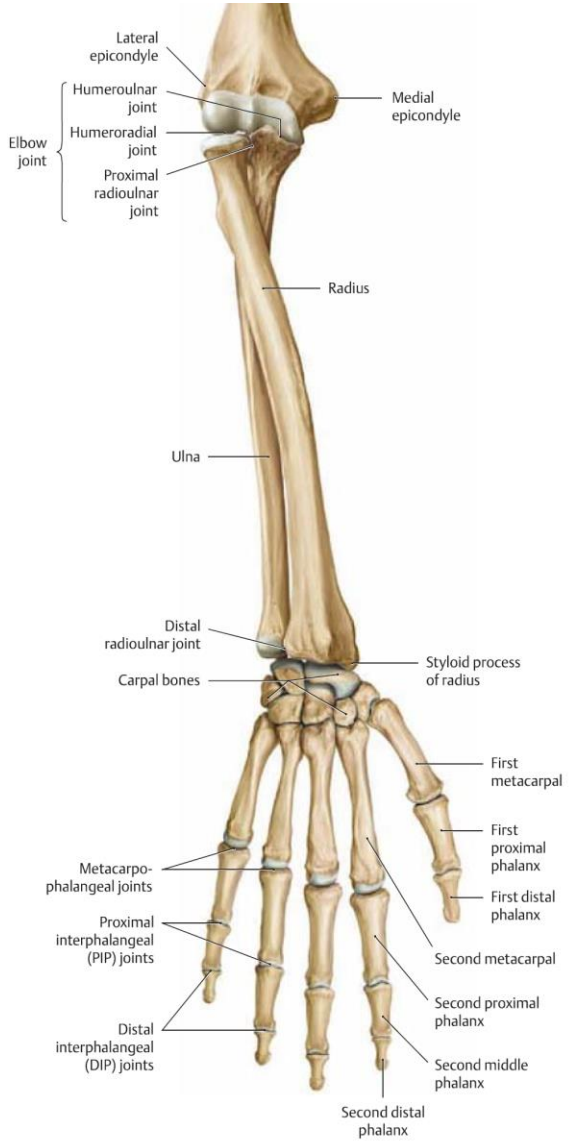


Humeroulnar joint (hinge)

Supination-pronation

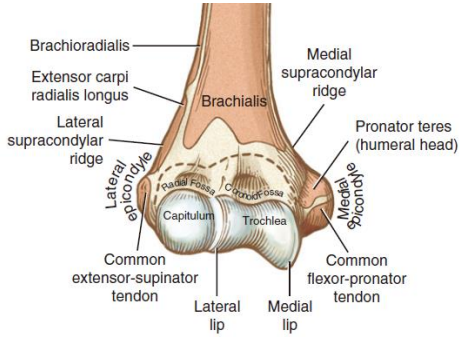
Axis of supination-pronation

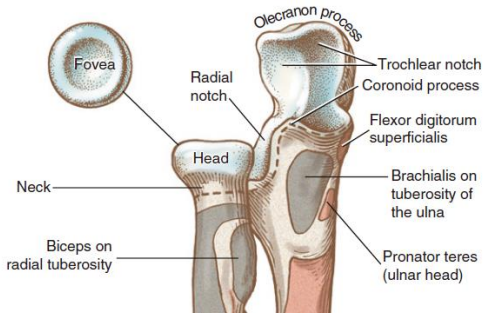




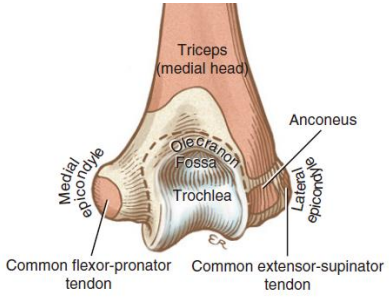
Joint capsule

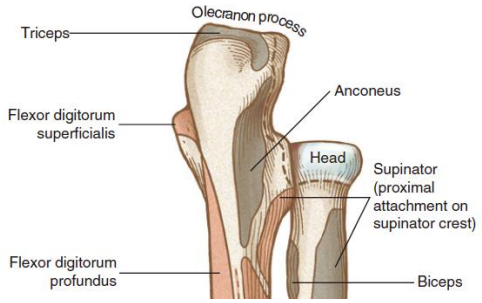
- Anterior
  - Proximal: above coronoid and radial fossa
  - Distal: coronoid medially and annular ligament laterally



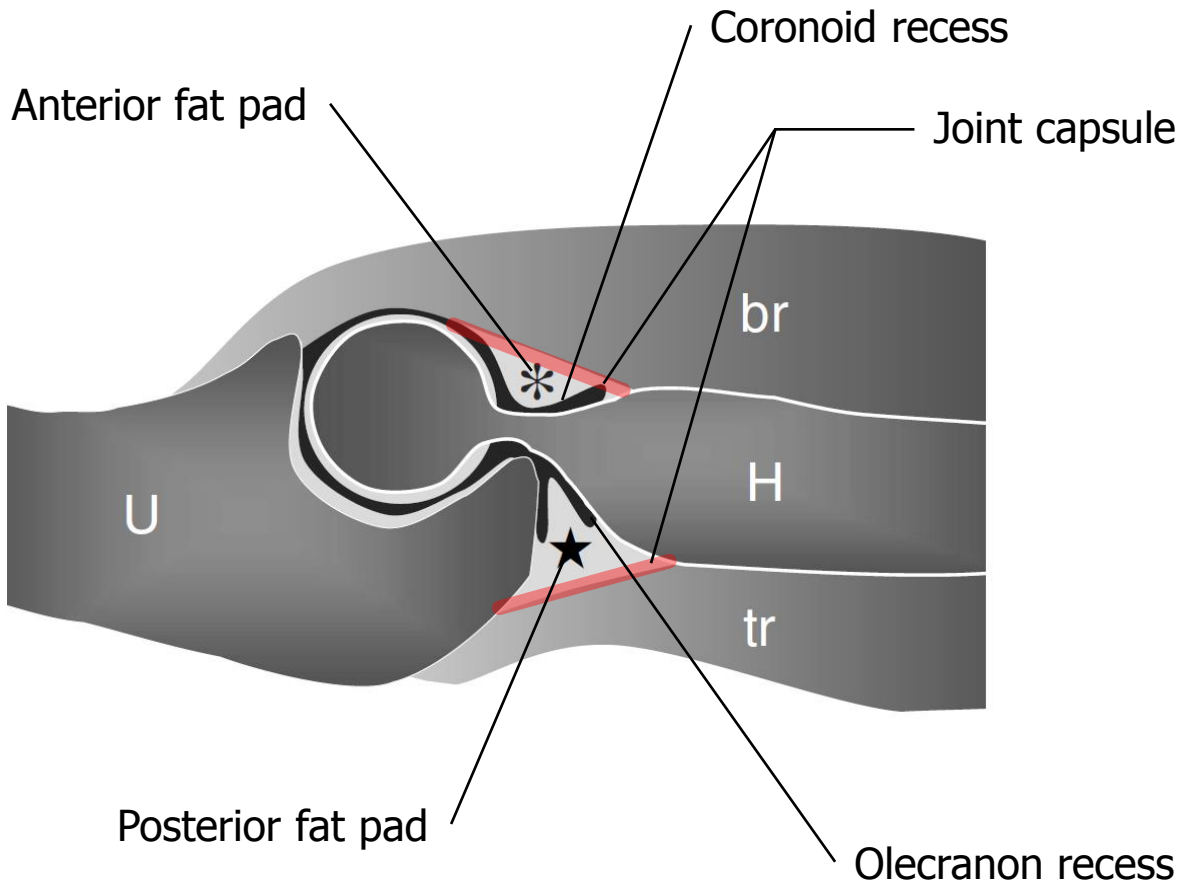


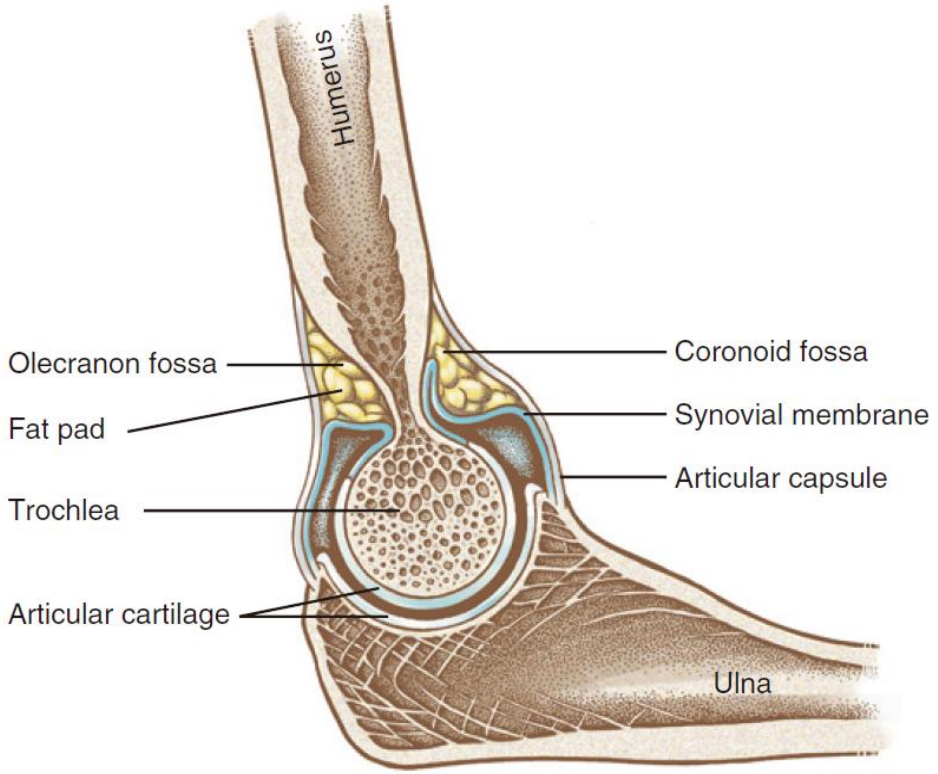
- Posterior
  - Proximal: just above olecranon fossa
  - Distal: upper margin of olecranon (medial and lateral articular margin of sigmoid notch)





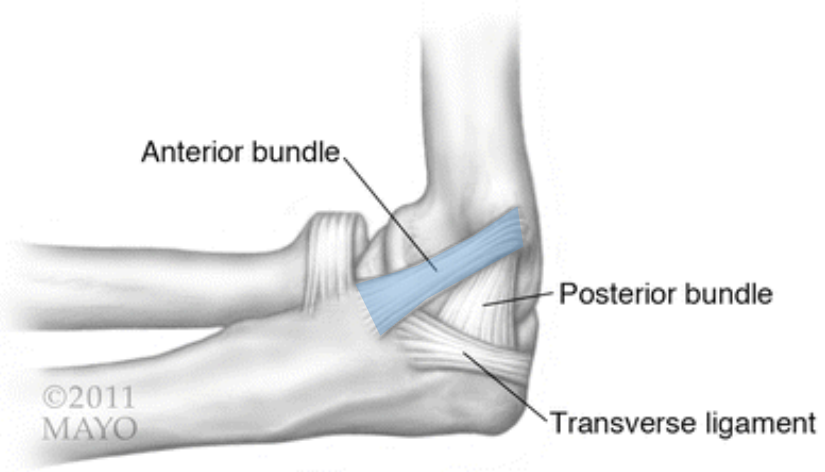
Synovial membrane and fat pad



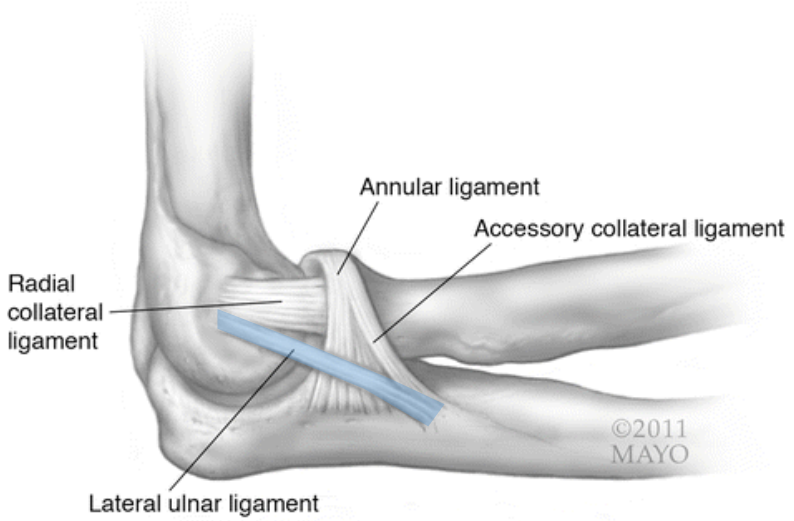


Ligament

- Medial collateral ligament (=ulnar collateral ligament)
  - Anterior band → coronoid process
  - Posterior band → olecranon
  - Oblique (or transverse) band (ligament of Cooper)



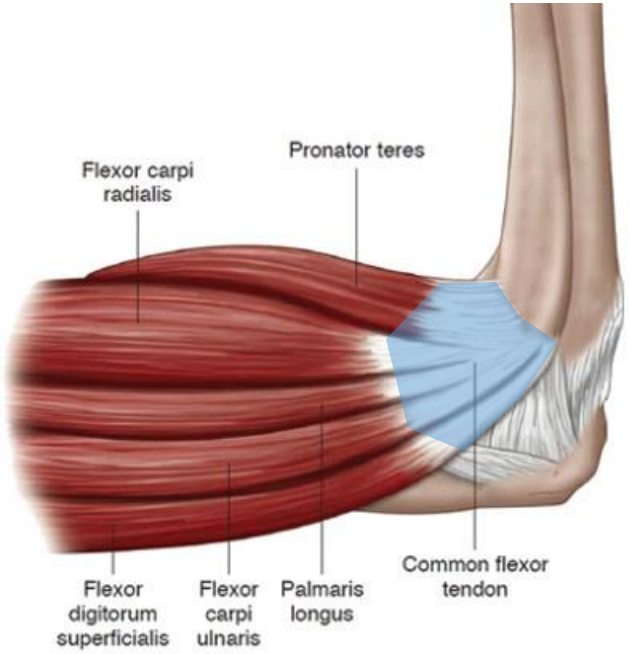
- Lateral collateral ligament
  - Radial collateral ligament
  - Lateral ulnar collateral ligament (LUCL)
  - Annular ligament
  - Accessory lateral collateral ligament

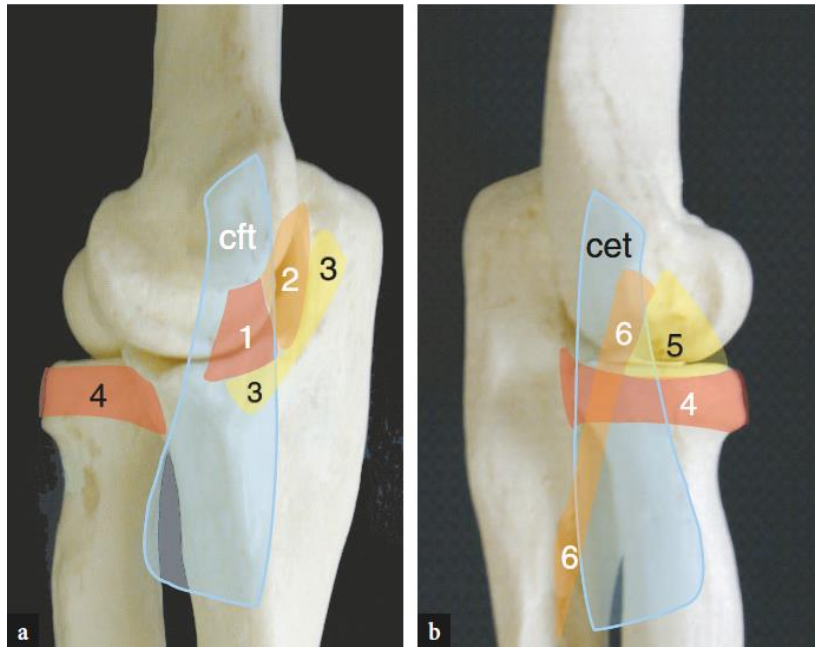


Common flexor and extensor tendons

Common flexor(-pronator) tendon

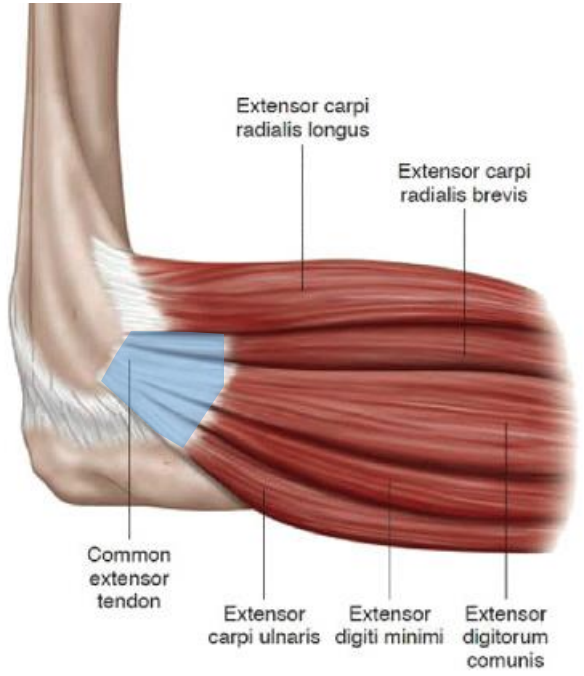
- PT
- Superficial flexors (FCR, PL, FDS, FCU)



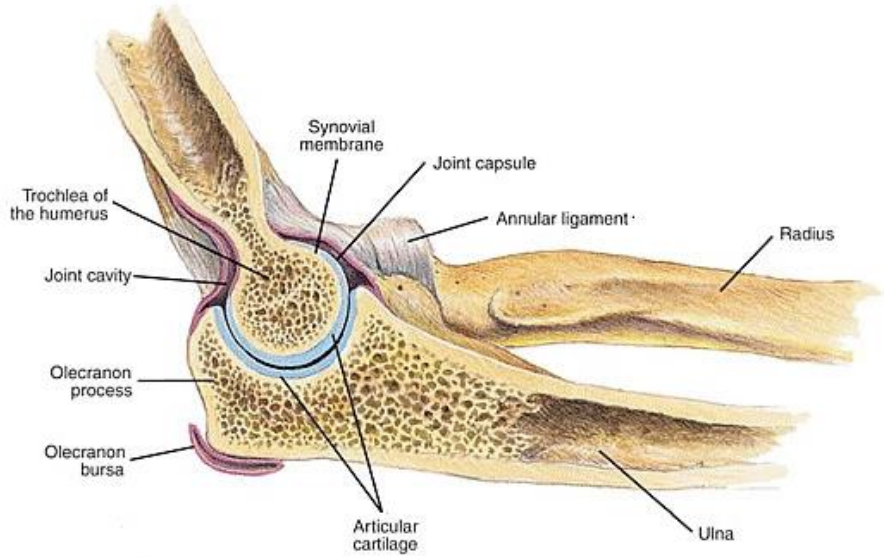


Common extensor(-supinator) tendon

- ECRB
- EDC
- EDM
- ECU

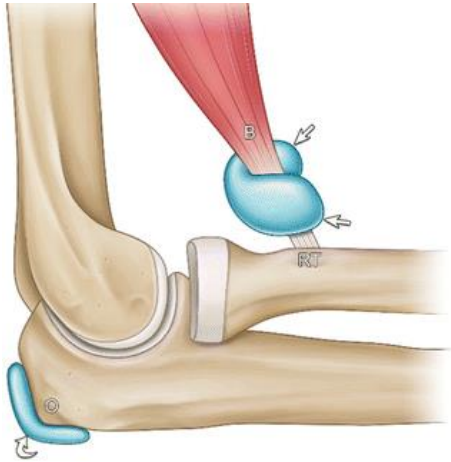


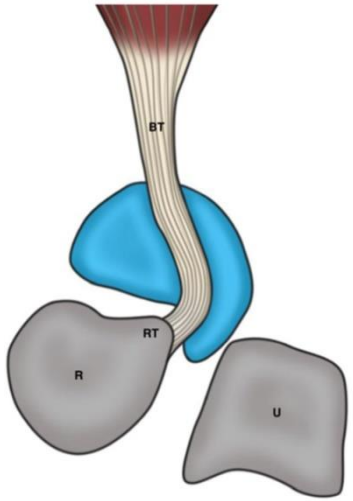
Bursae



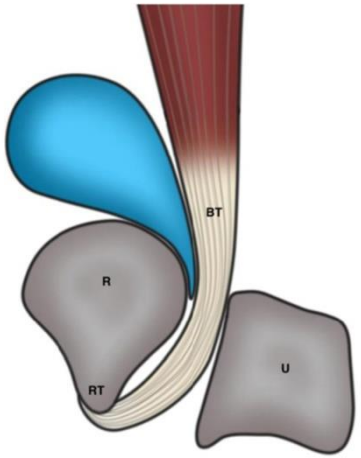
Olecranon bursa

Bicipitoradial bursa





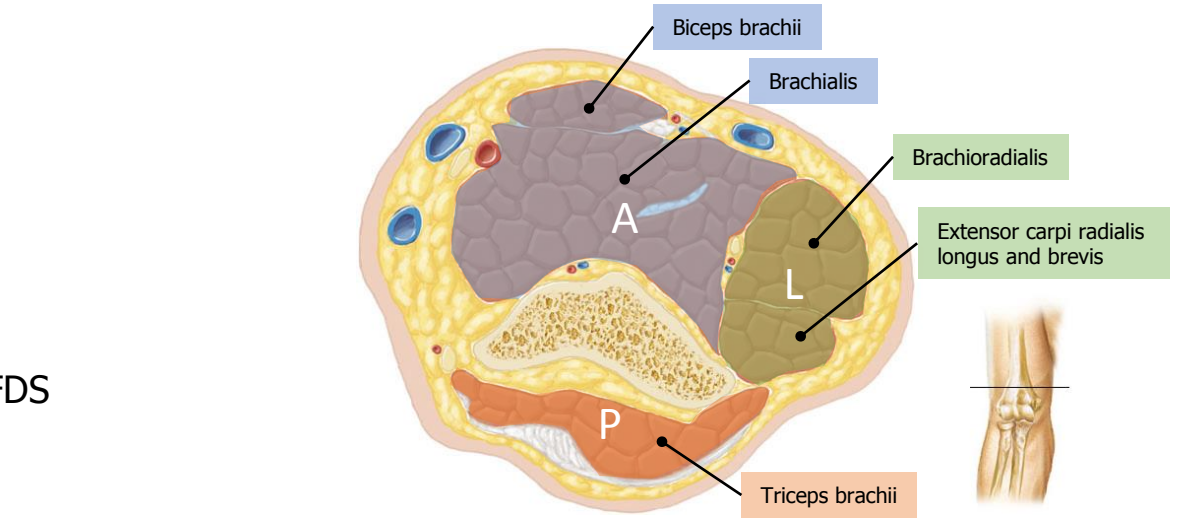
Supination

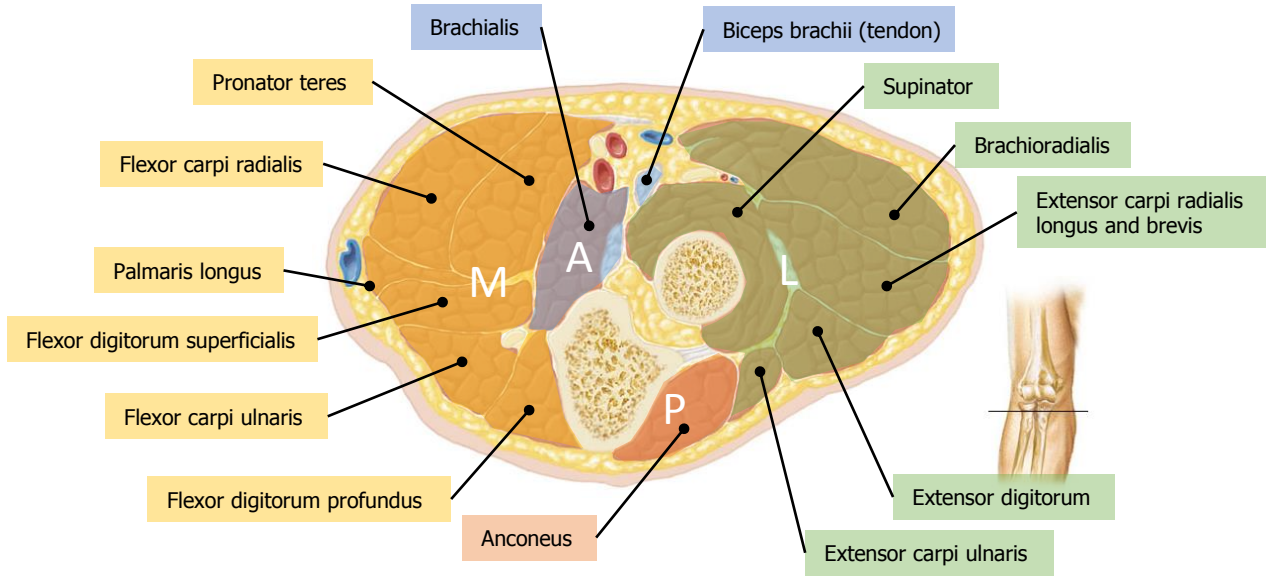


Pronation

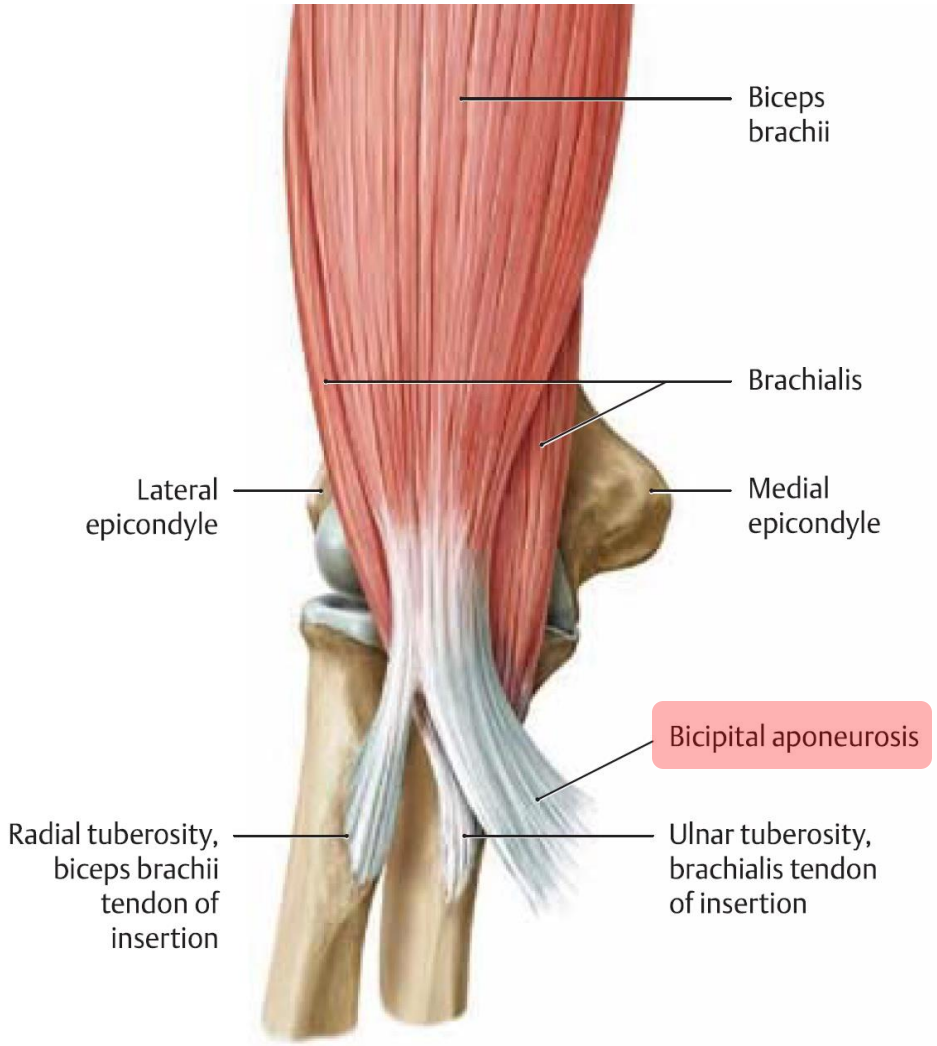
Muscles and tendons

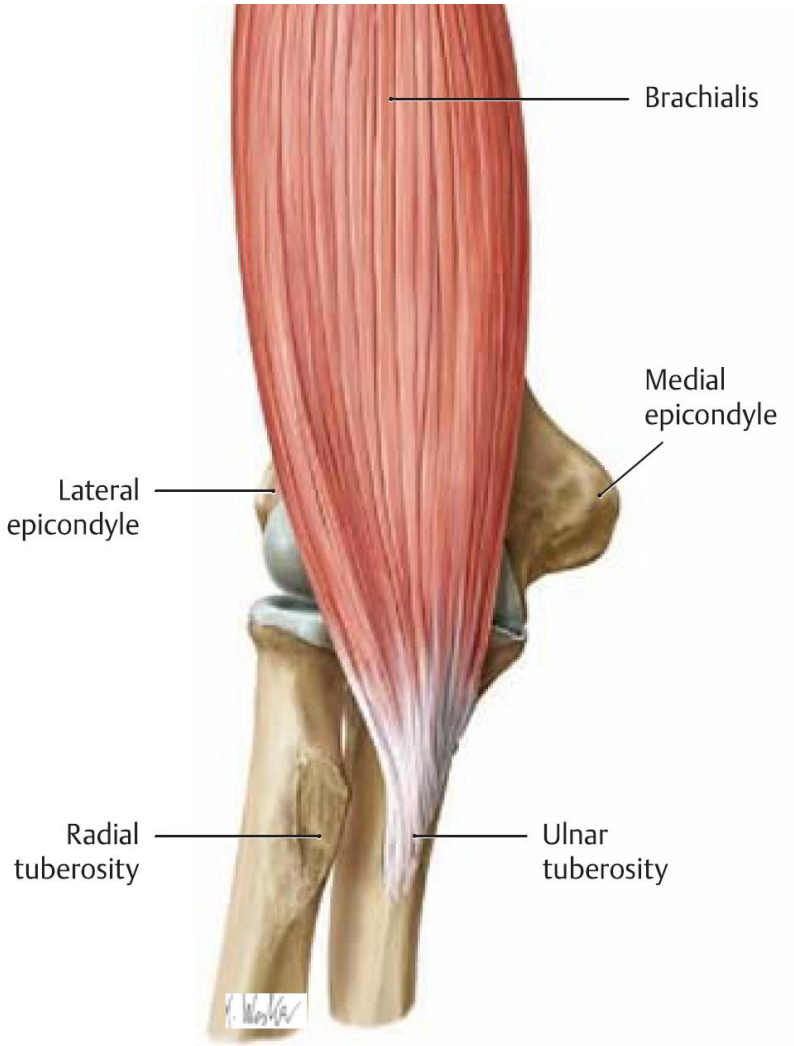
- Anterior compartment
  - Biceps brachii
  - Brachialis
- Medial compartment
  - Common flexor tendon
    - Pronator teres (humeral head)
    - Superficial flexors - FCR, PL, FCU, FDS
  - FDP
- Lateral compartment
  - Common extensor tendon
    → ECRB, EDC, EDM, ECU
  - Brachioradialis
  - ECRL
  - Supinator
- Posterior compartment
  - Triceps
  - Anconeus



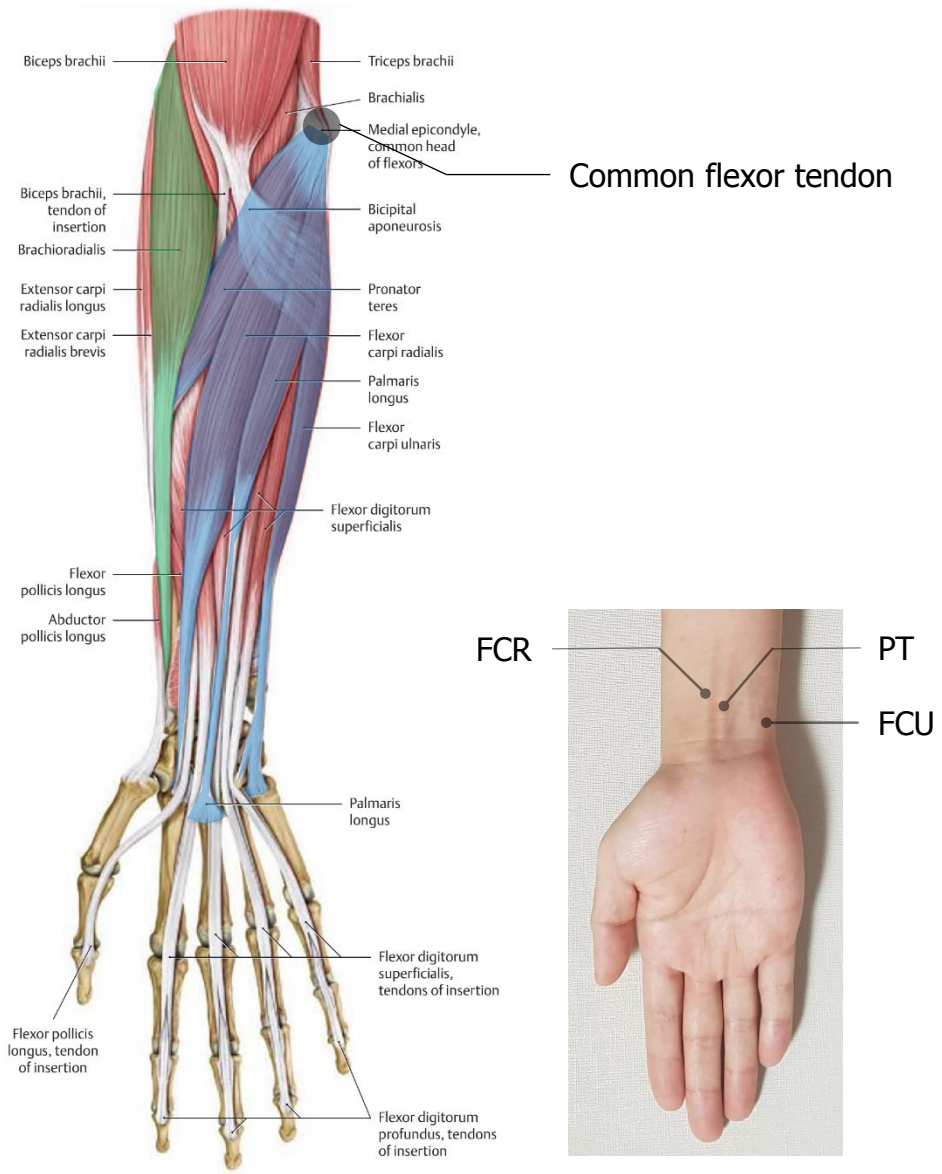


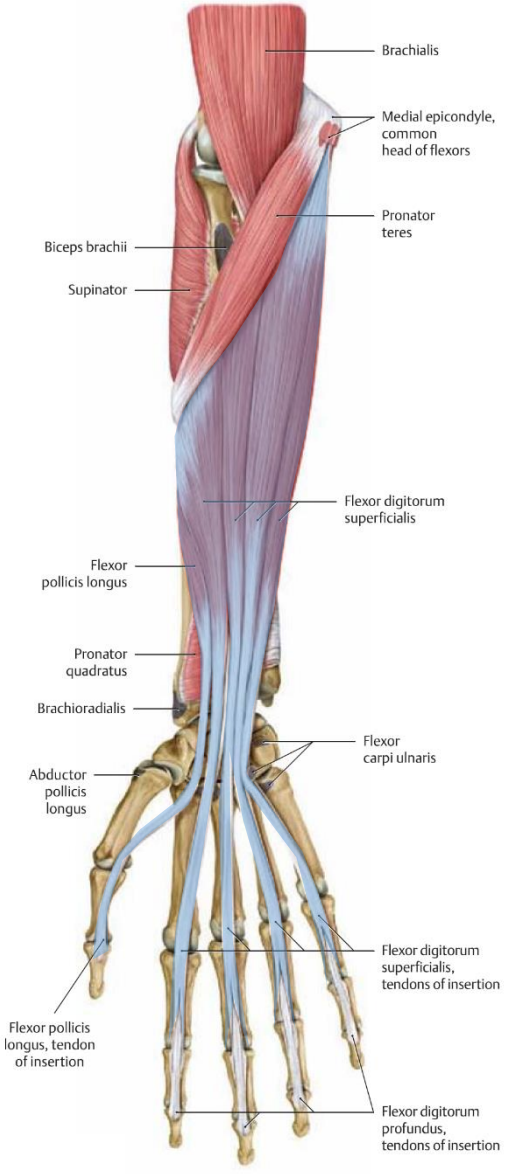
Biceps brachii and brachialis

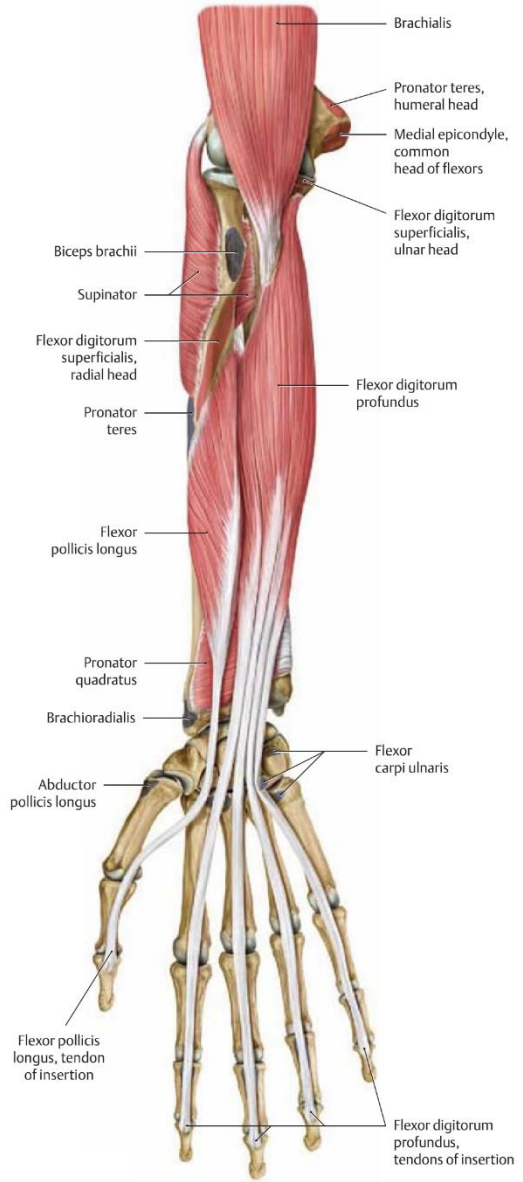




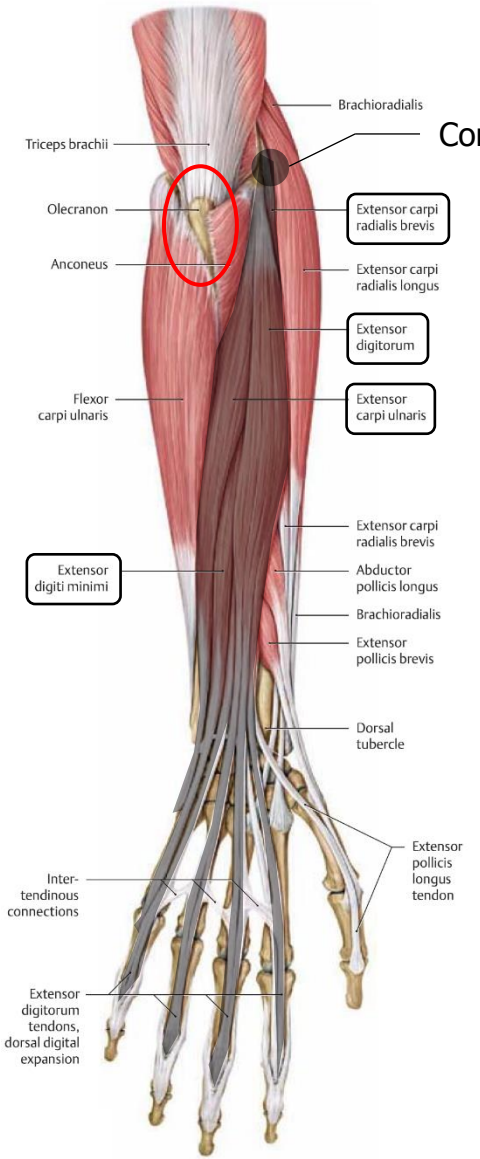
Anterior elbow ~ forearm



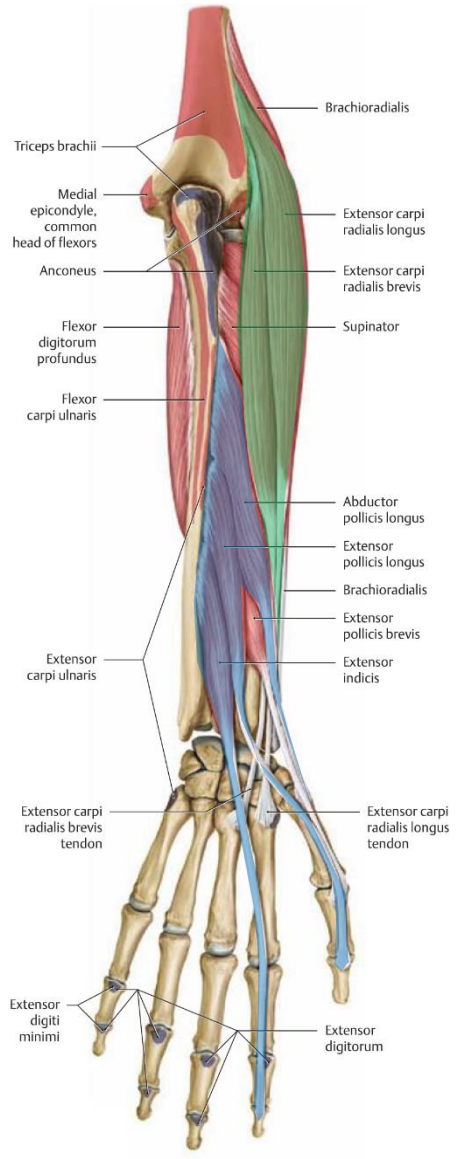


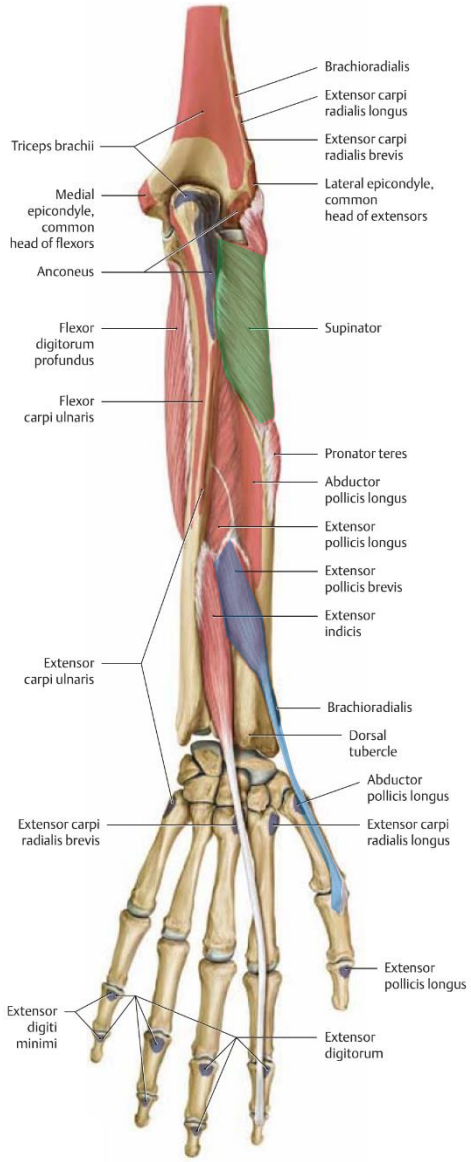


Posterior elbow ~ forearm



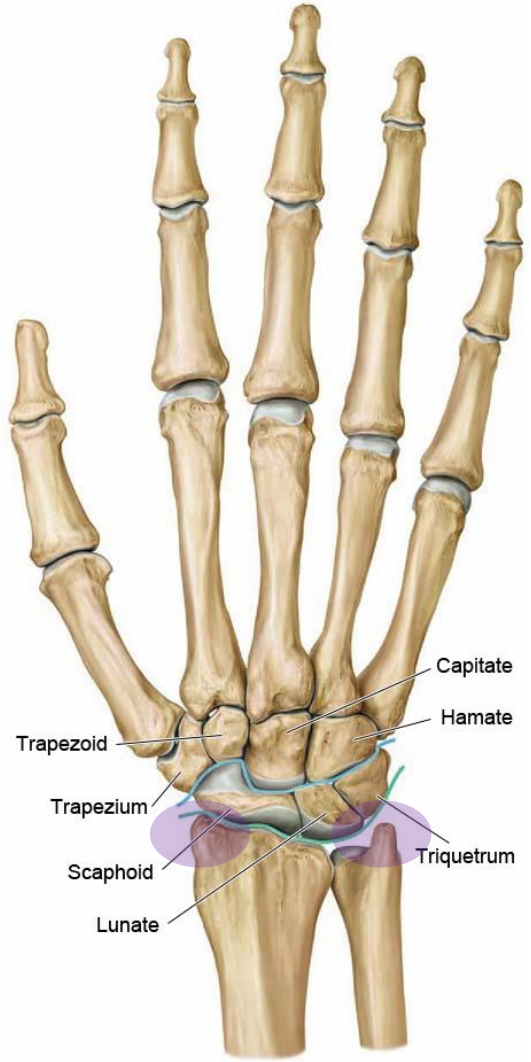
Common extensor tendon

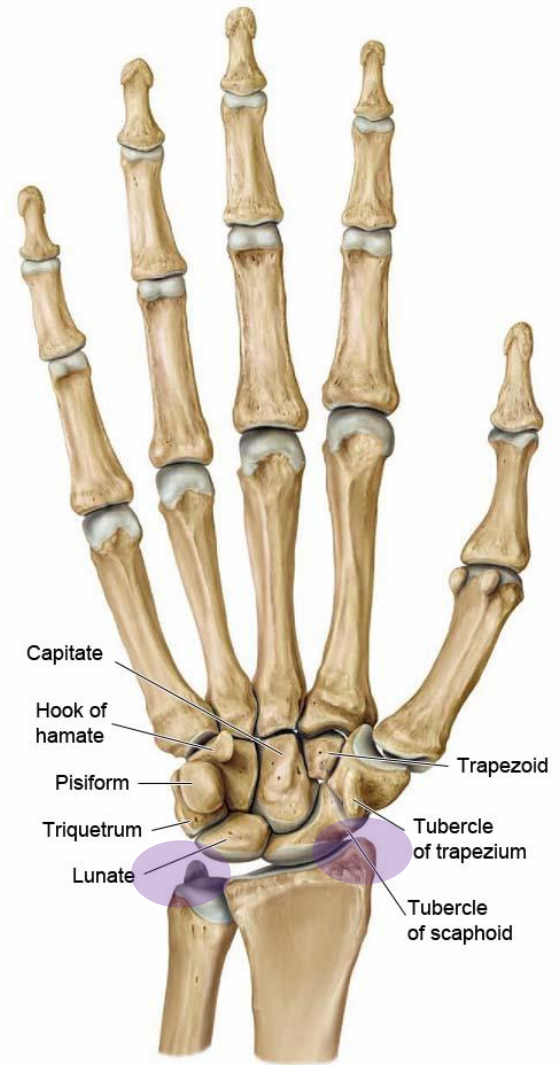




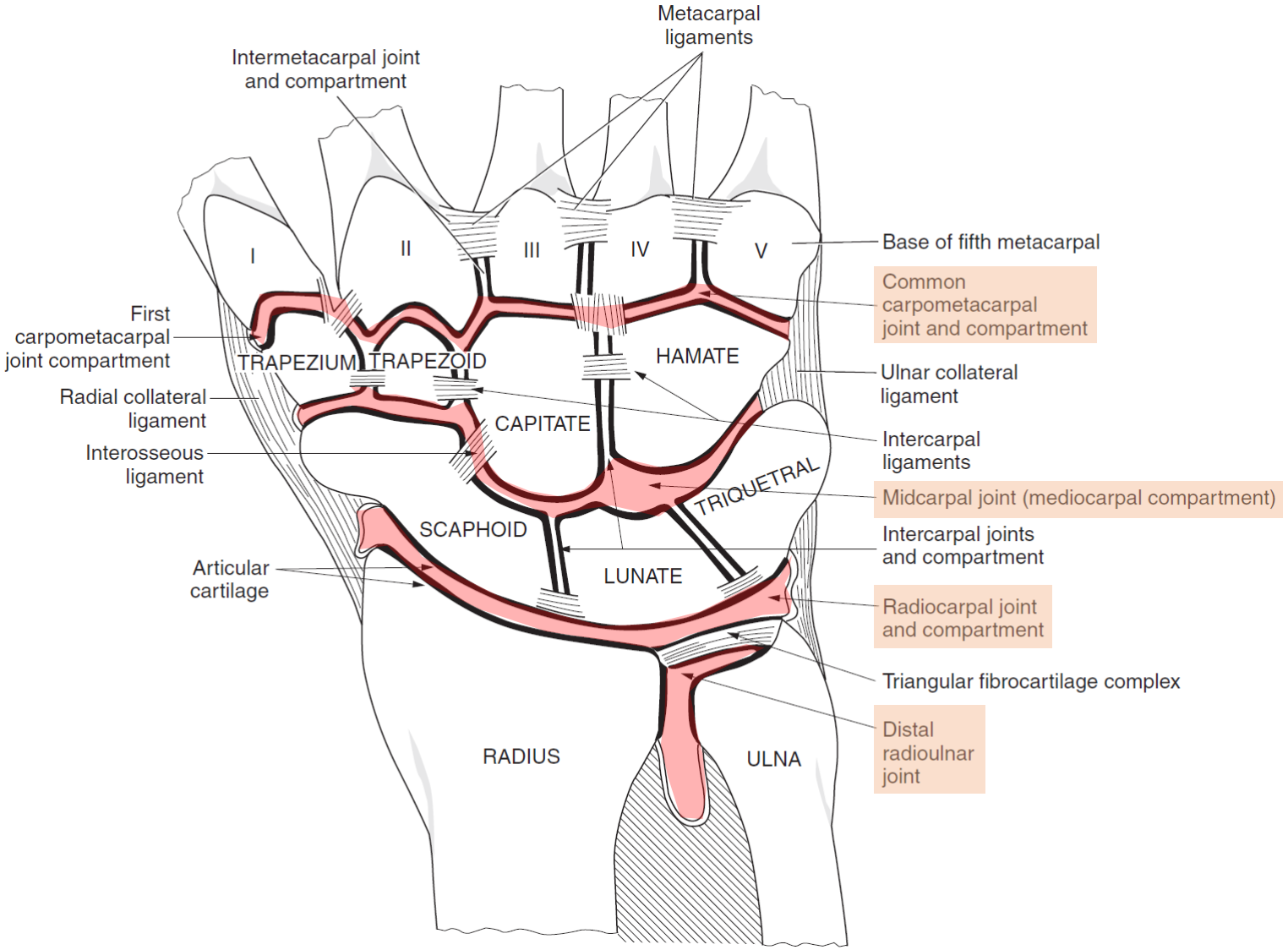
Wrist

Bony anatomy



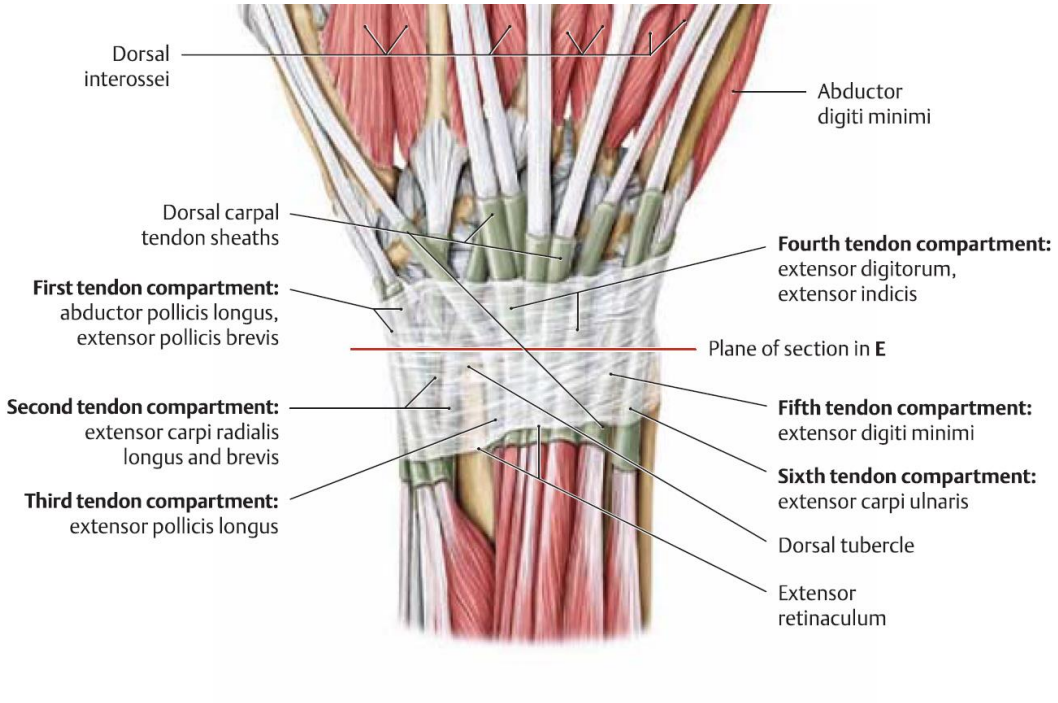


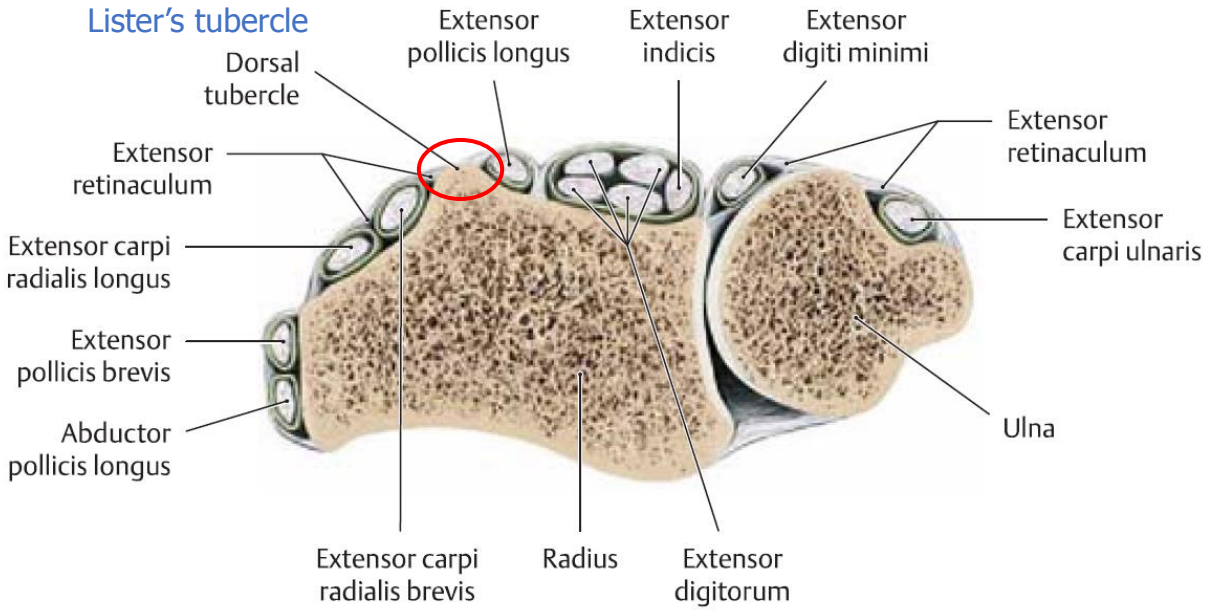
Joints



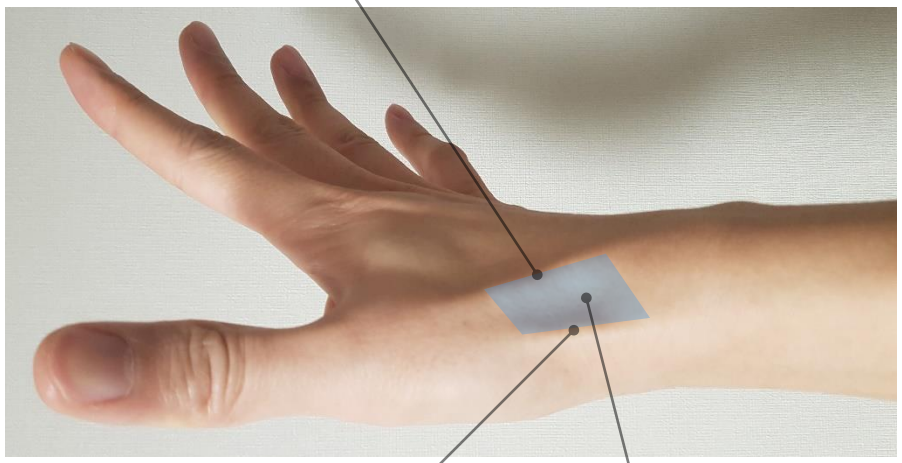
- Distal radioulnar joint
  - Uniaxial pivot joint: pronation-supination
  - L-shape
    - Short leg: between radius and ulna
    - Longer leg: between the distal ulna and the articular disc
- Radiocarpal joint
  - Formed by the articular carpal surface of the radius and the TFCC
  - Distal surface
    - Scaphoid, lunate, triquetrum, scapholunate ligament, lunotriquetral ligament

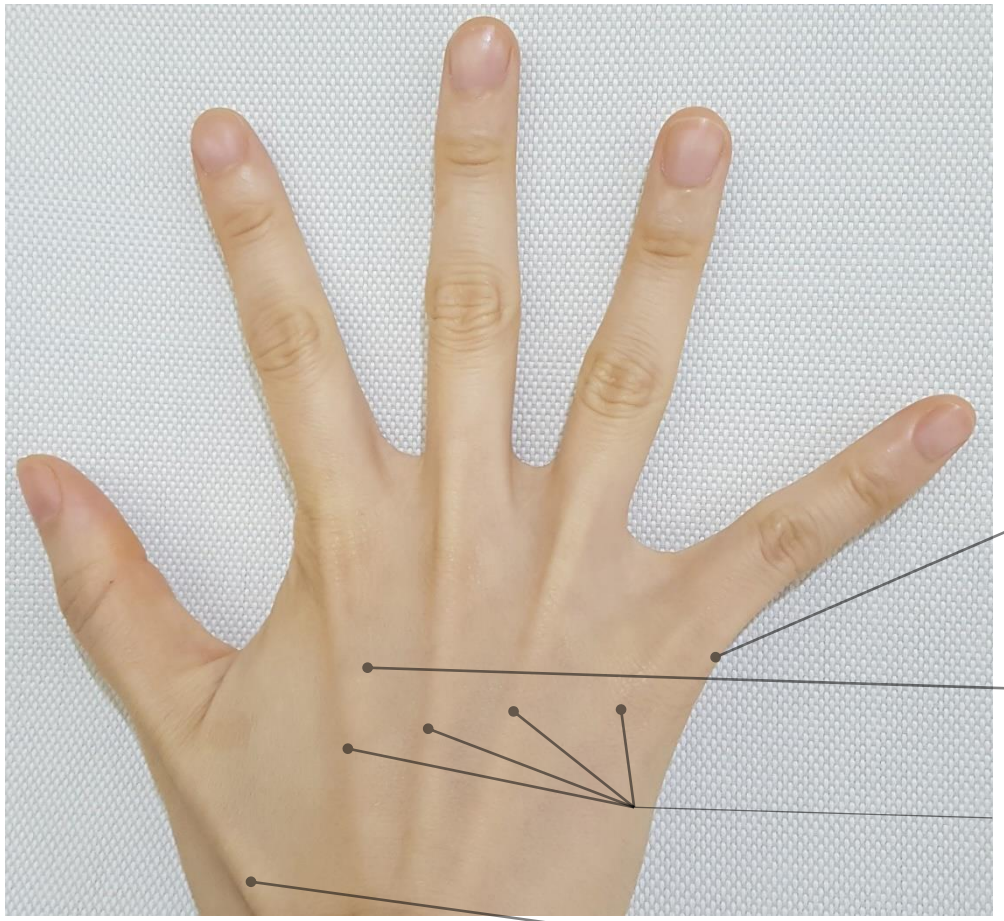
Extensor tendons

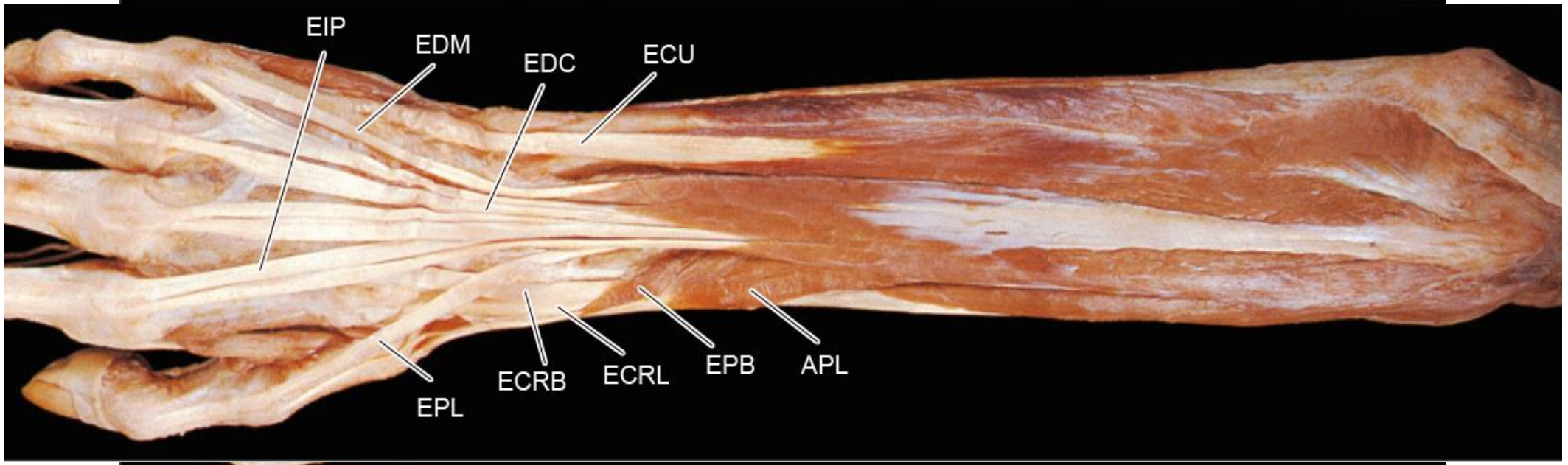


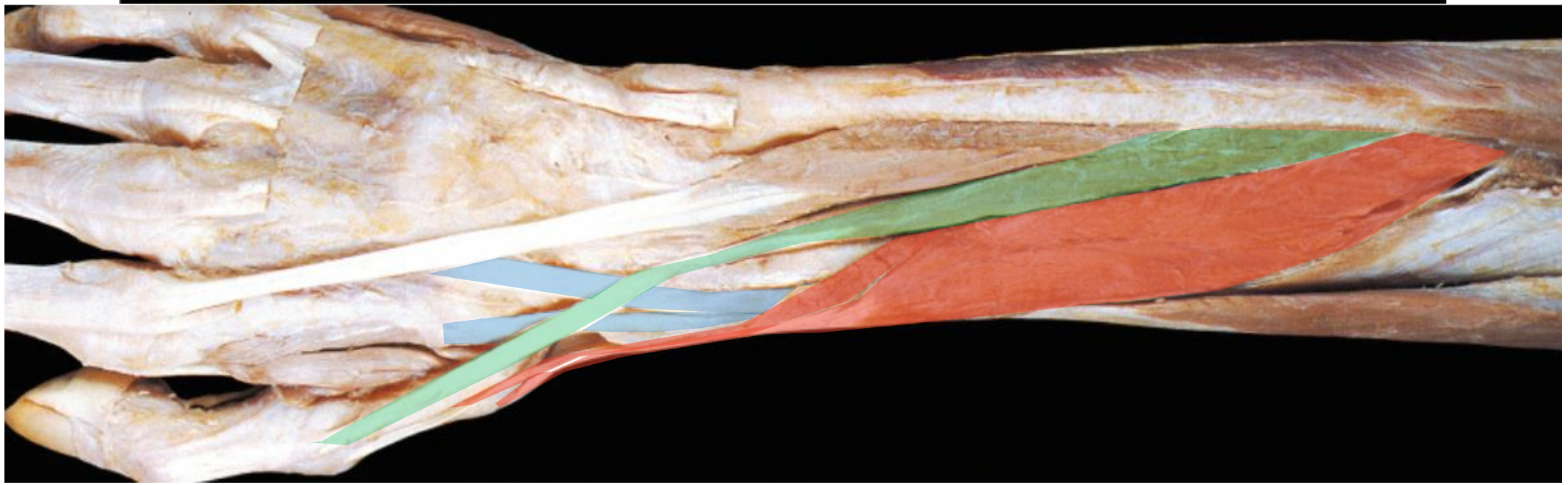


Tendons of dorsal wrist



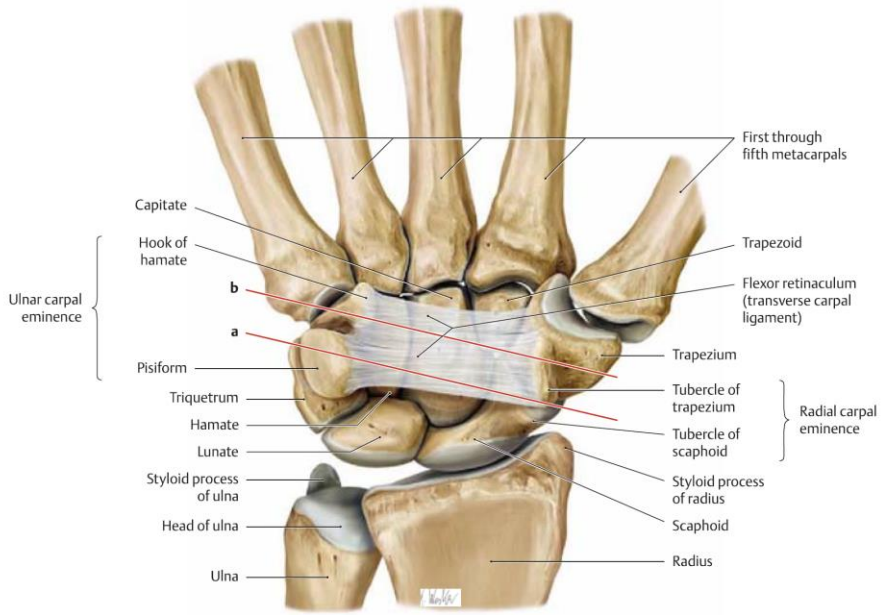


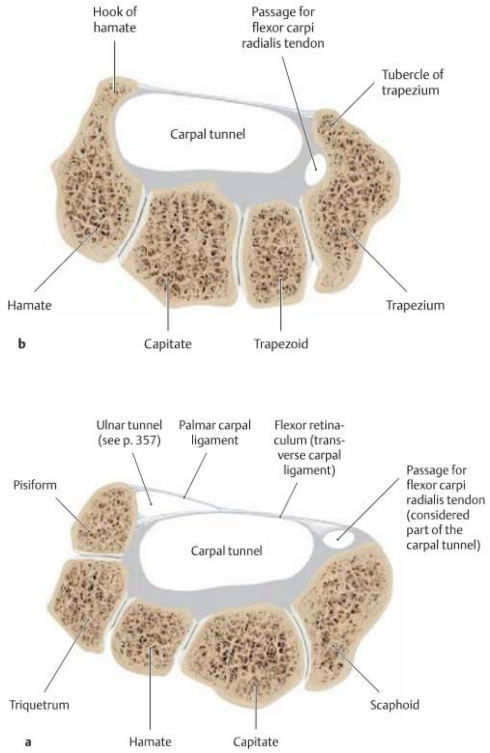

EIP
EDM
EDC
ECU
EPL
ECRB
ECRL
EPB
APL

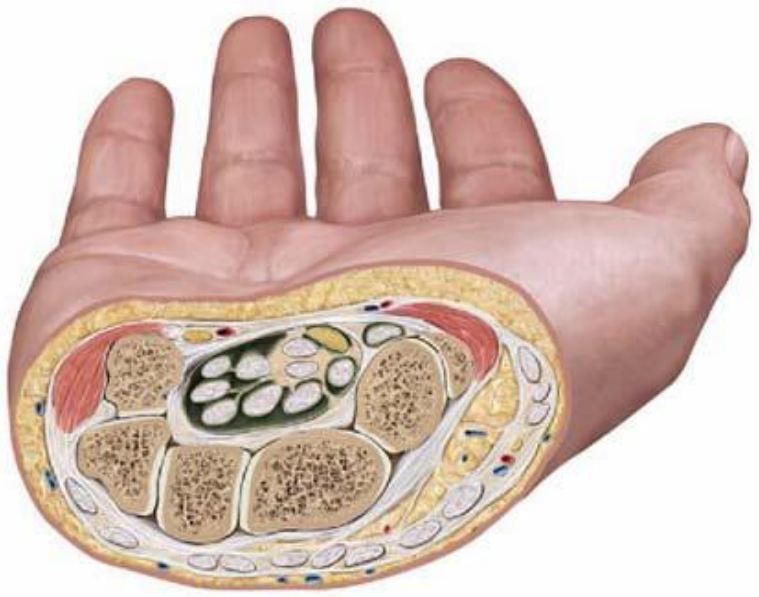


Carpal & Guyon's tunnels

- Carpal tunnel
  - Flexor retinaculum
    - Pisiform and hook of hamate (medial)
    - Scaphoid and trapezium (lateral)
- Guyon's tunnel
  - Superficial to carpal tunnel
    - Superficial palmar carpal ligament
    - Ulnar extension of flexor retinaculum
    - Lateral aspect of pisiform







TFCC (Triangular Fibrous Cartilage Complex)

- TFCC
  - Fan-shaped band of fibrous tissue that originates on the medial surface of the distal radius and transverses horizontally to insert on the ulnar styloid process
  - Separates the ulna from the carpal bones
- Components
  - Triangular fibrous cartilage
    - Central component: articular disc
  - Meniscus homologue
    - Thickened ulnar part of the TFCC
    - Inserts into the triquetral, hamate bones and base of 5th metacarpal
  - Dorsal and palmar radioulnar ligament
  - Ulnar collateral ligament
  - Sheath of the ECU tendon
  - Ulnolunate and ulnotriquetral ligament (palmar aspect)
- Function
  - Stabilizes the radioulnar and ulnocarpal joints
  - Transmits and distributes load form the carpus to the ulna
  - Facilitates complex movements to the wrist