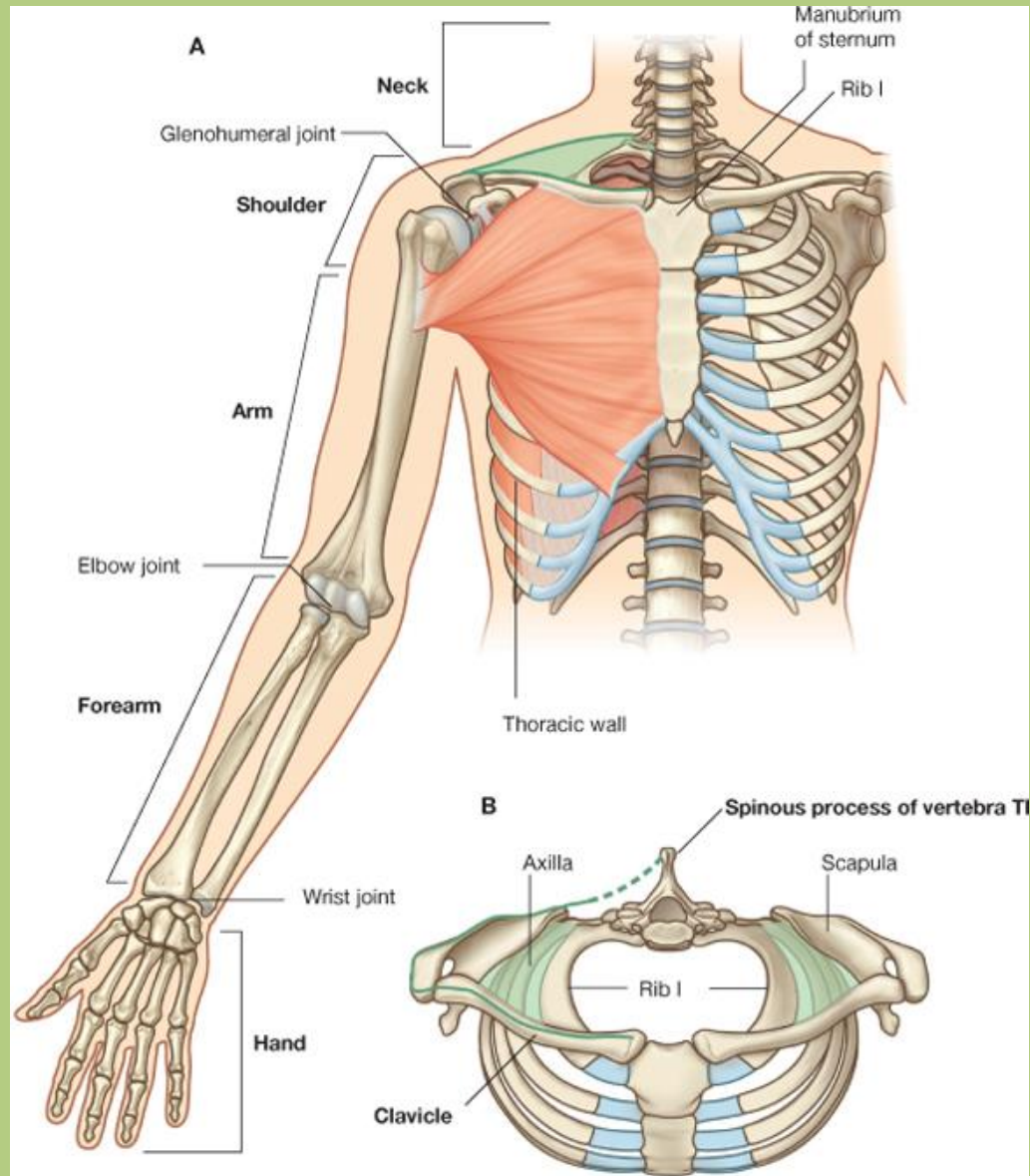




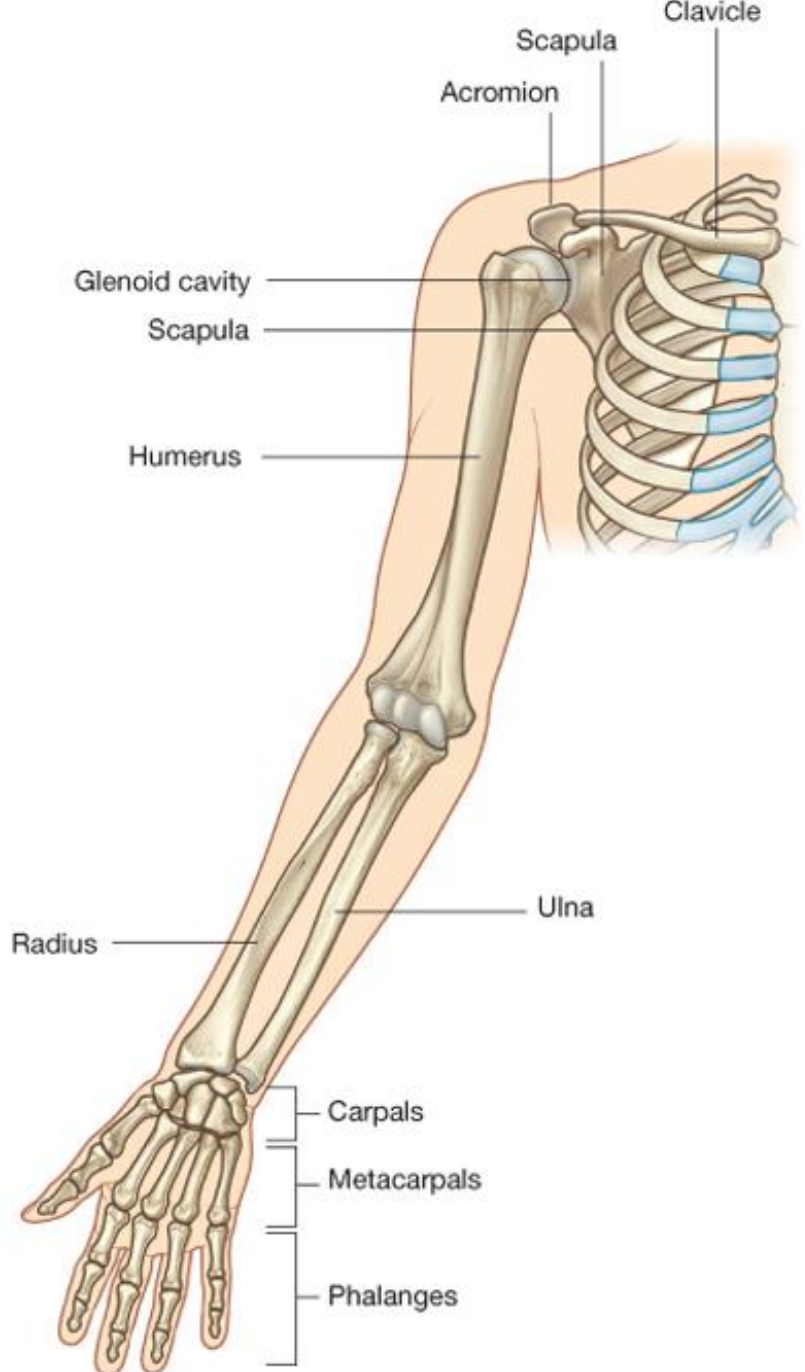
# Bones and joints of the upper limb

Sándor Katz M.D., Ph.D.

# Upper limb



# Upper limb

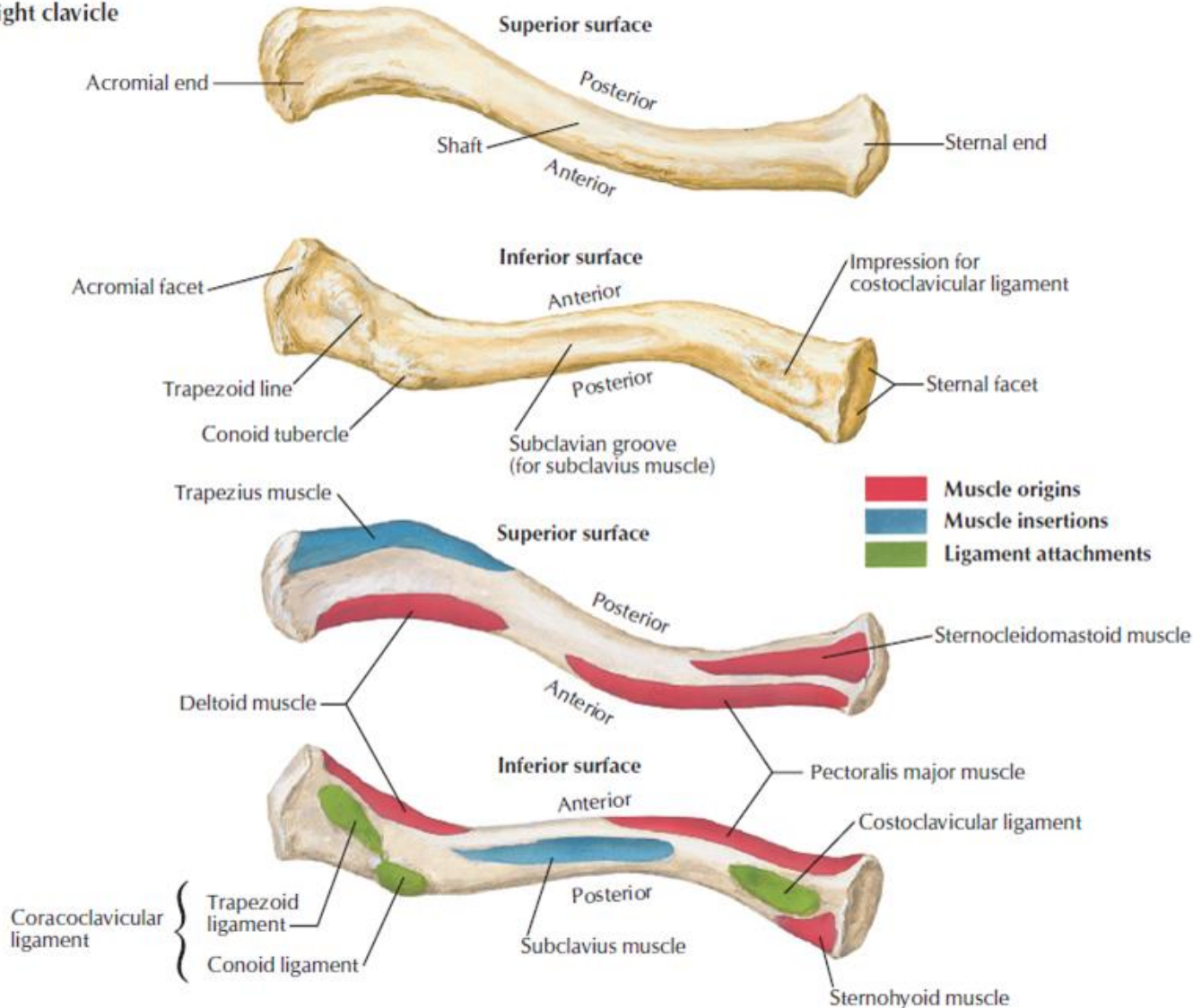


**1. Shoulder girdle:**  
clavicle and scapula

**2. Free upper extremity:**  
humerus,  
ulna, radius,  
carpal bones,  
metacarpals,  
and phalanges.

# Clavicle

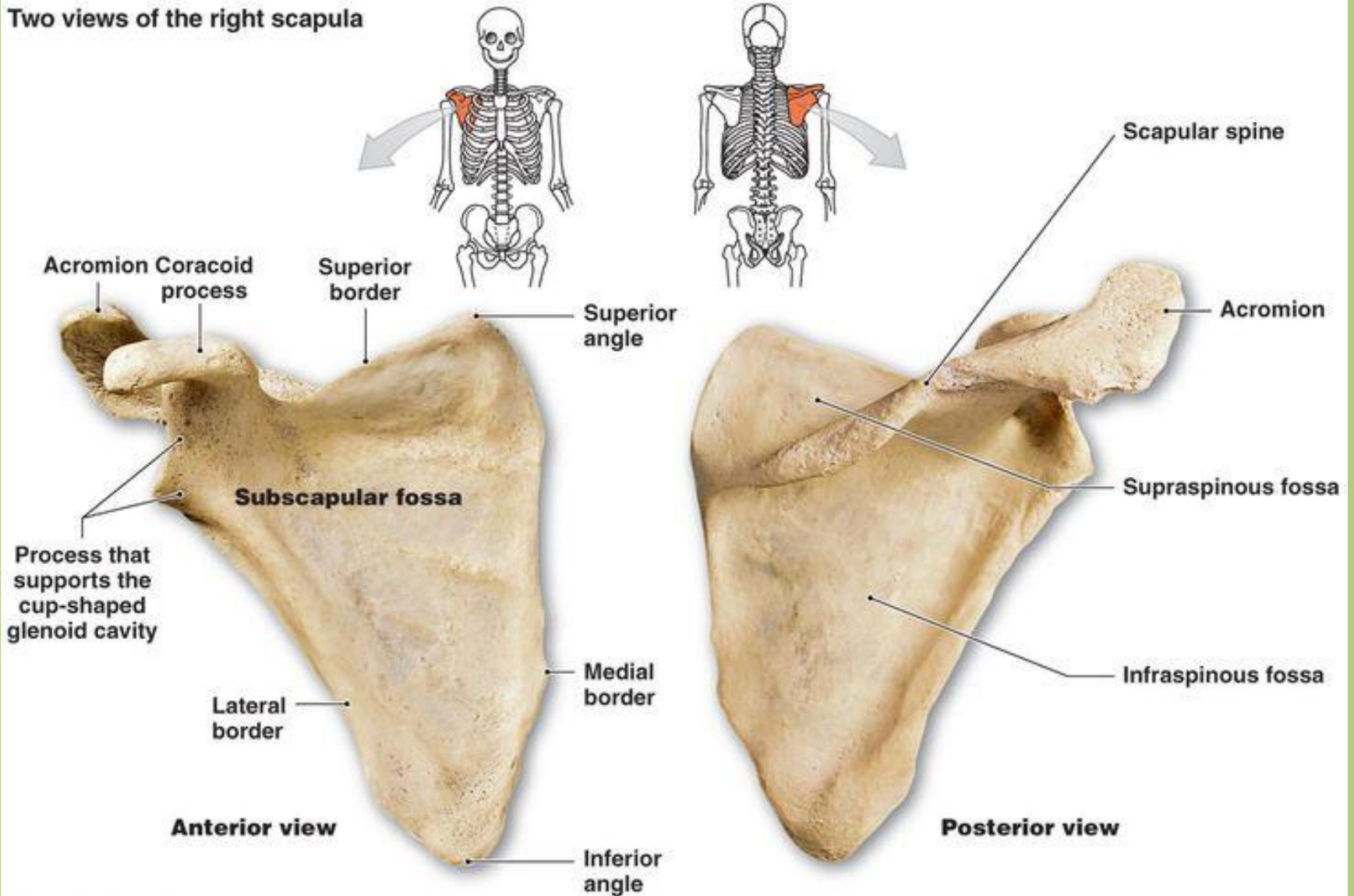
Right clavicle



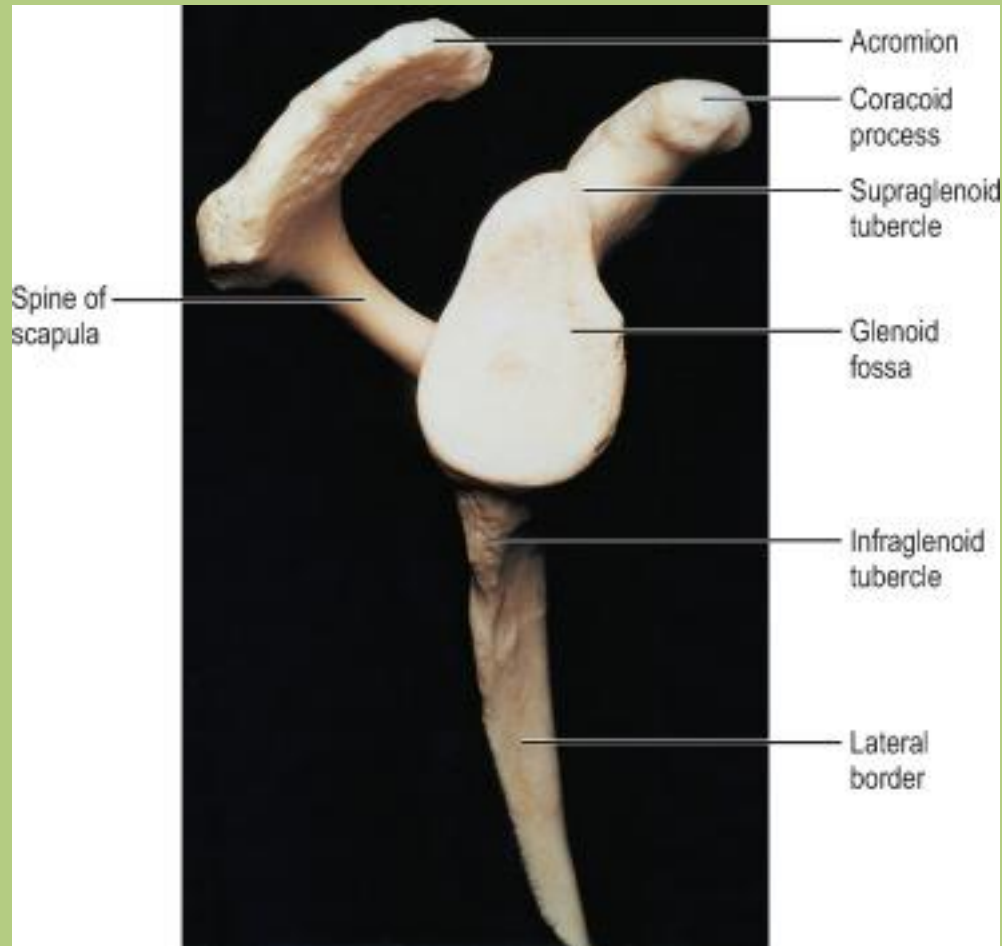
- sternal end
- acromial end
- impression for costoclavicular ligament

# Scapula

Two views of the right scapula



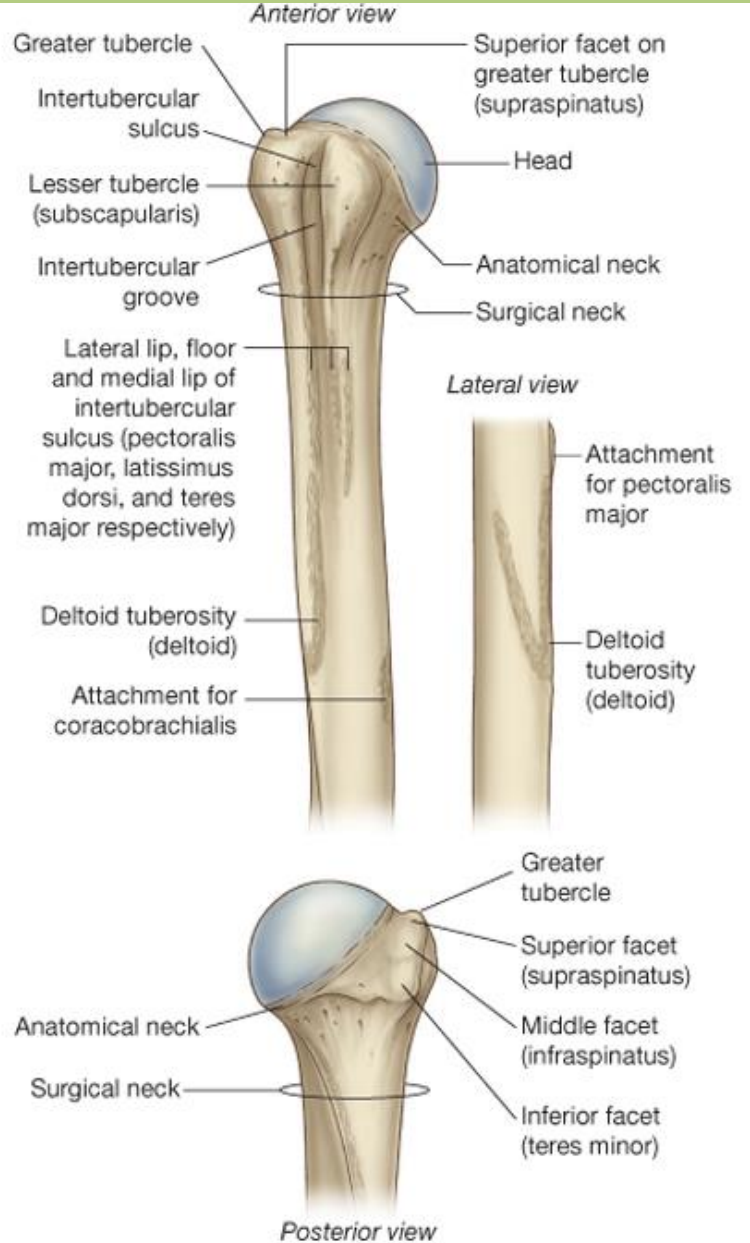
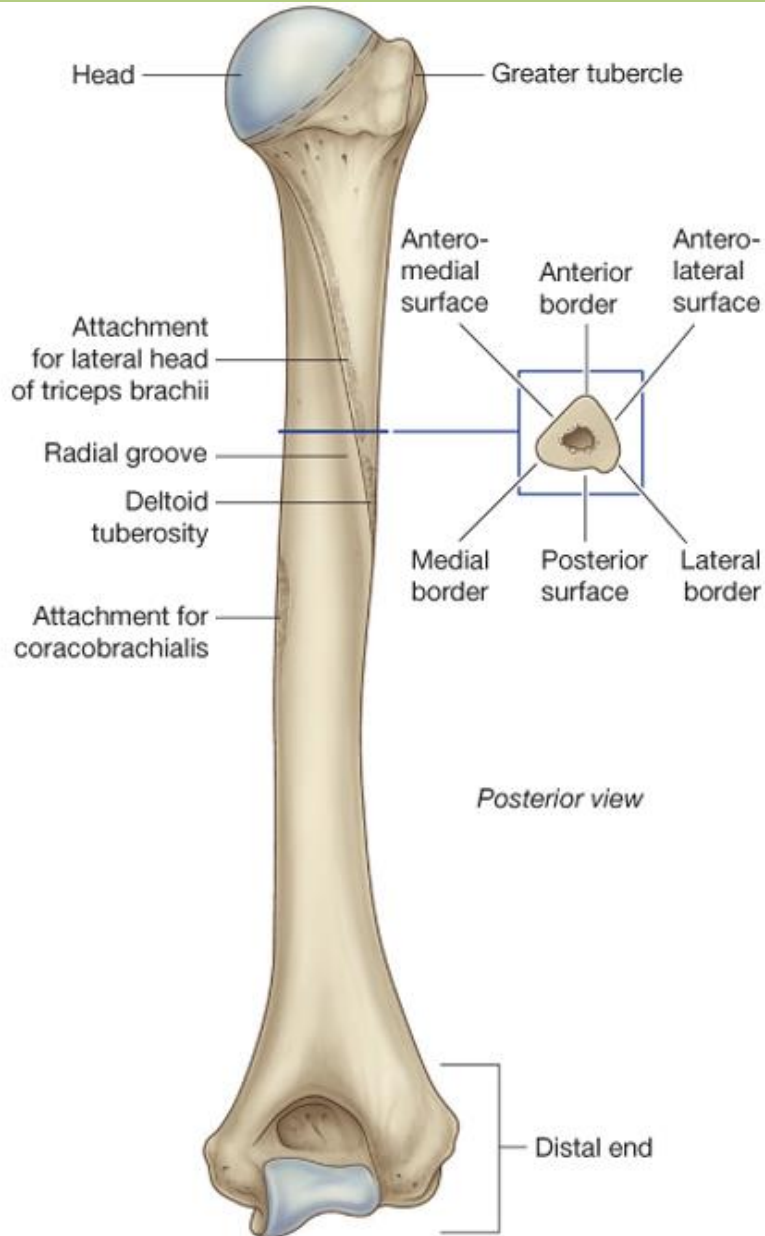
# Scapula



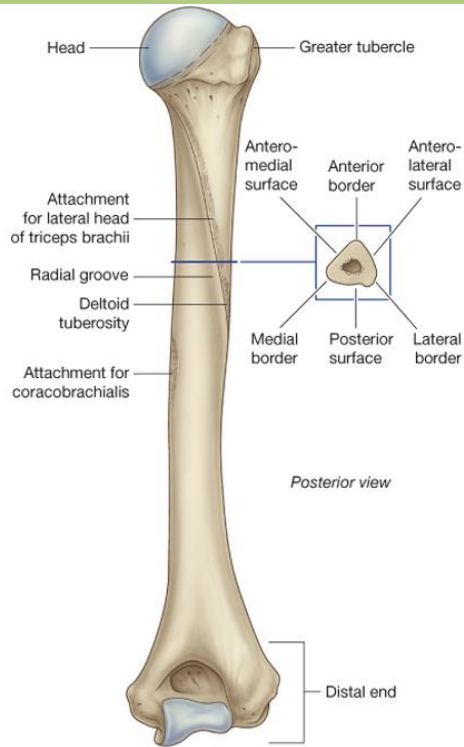
- acromion
- spine
- supraspinous fossa
- infraspinous fossa
- subscapular fossa
- glenoid cavity
- coracoid process
- medial, lateral and superior borders
- superior and inferior angles
- supraglenoid and infraglenoid tubercles

lateral view

# Humerus

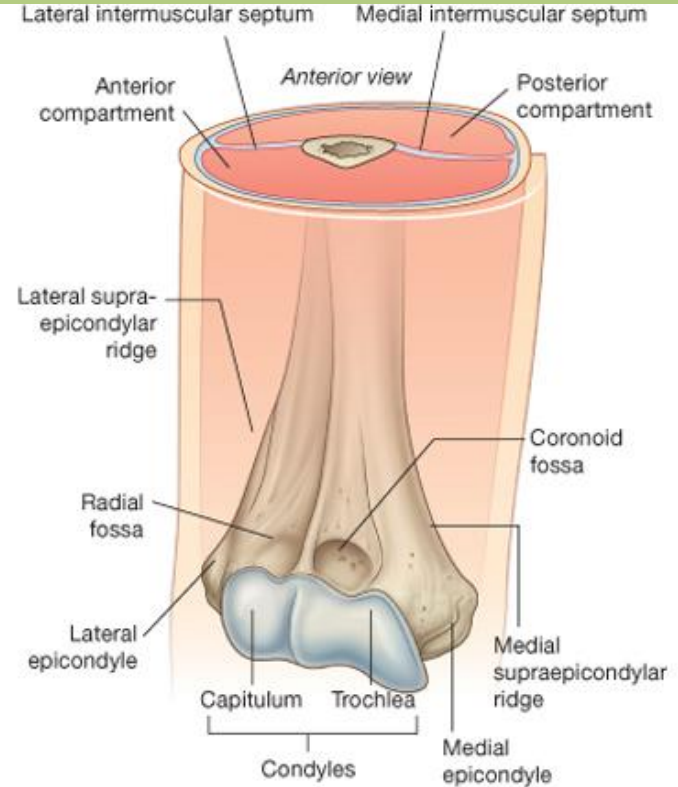


# Humerus



Drake: Gray's Anatomy for Students, 2nd Edition.  
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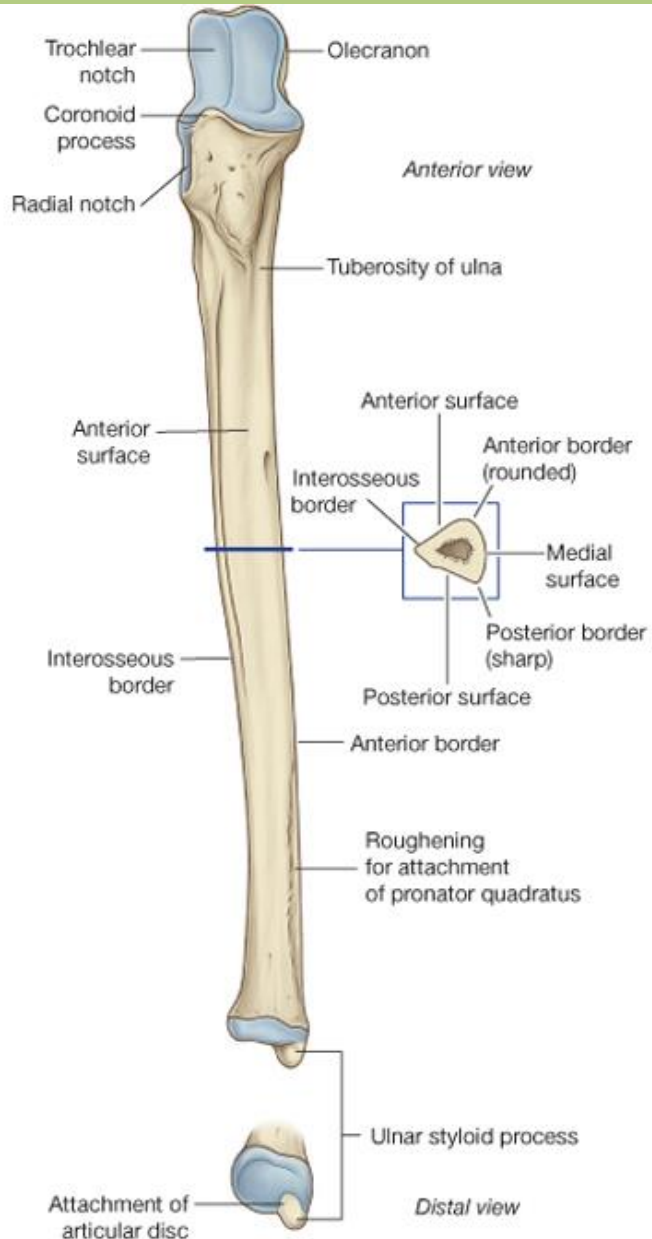
- head
- anatomical neck
- surgical neck
- body
- greater tubercle
- lesser tubercle
- intertubercular groove
- epicondyles
- capitulum
- trochlea
- olecranon fossa
- crests of lesser and greater tubercles



Drake: Gray's Anatomy for Students, 2nd Edition.  
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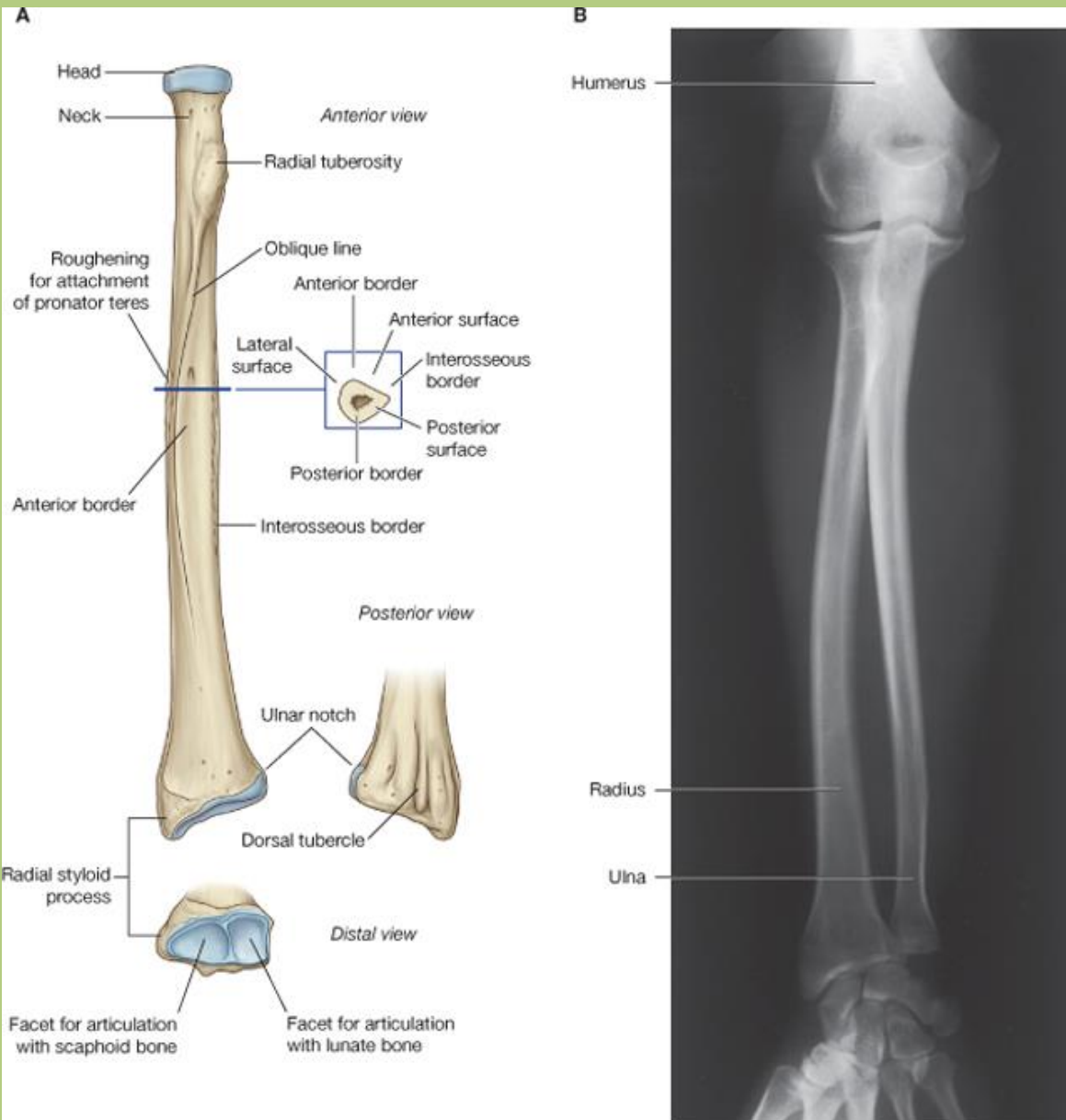


# Ulna



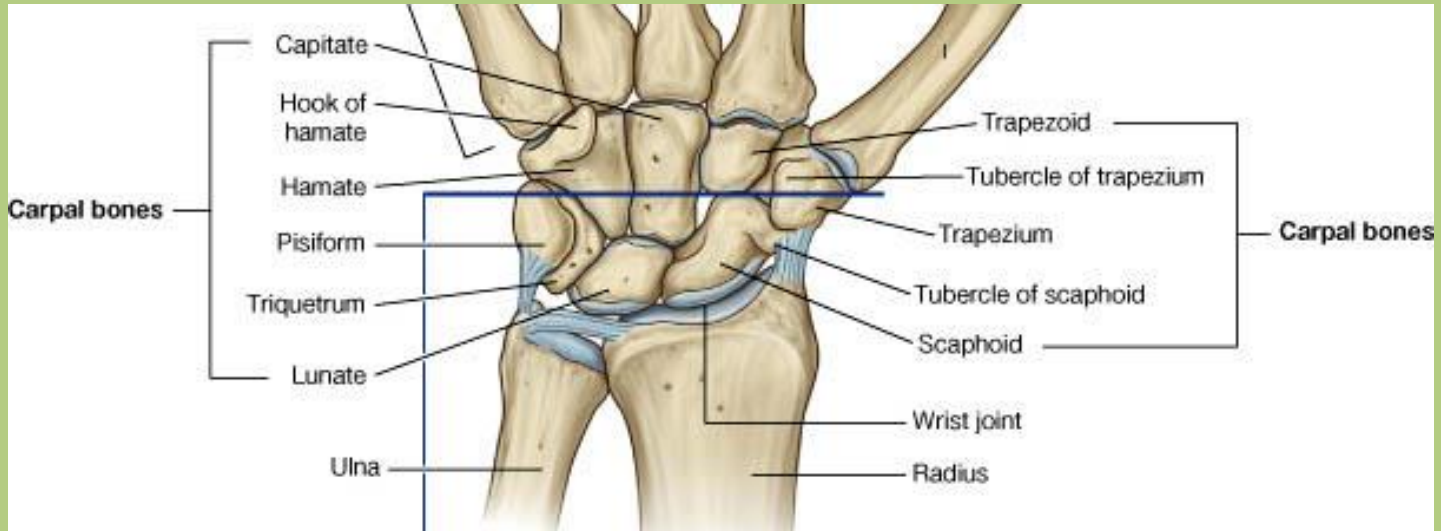
- olecranon
- trochlear notch
- ulnar tuberosity
- radial notch
- body
- ulnar head

# Radius



- head
- articular circumference
- radial tuberosity
- body
- carpal articular surface
- ulnar notch
- styloid process

# Carpal bones

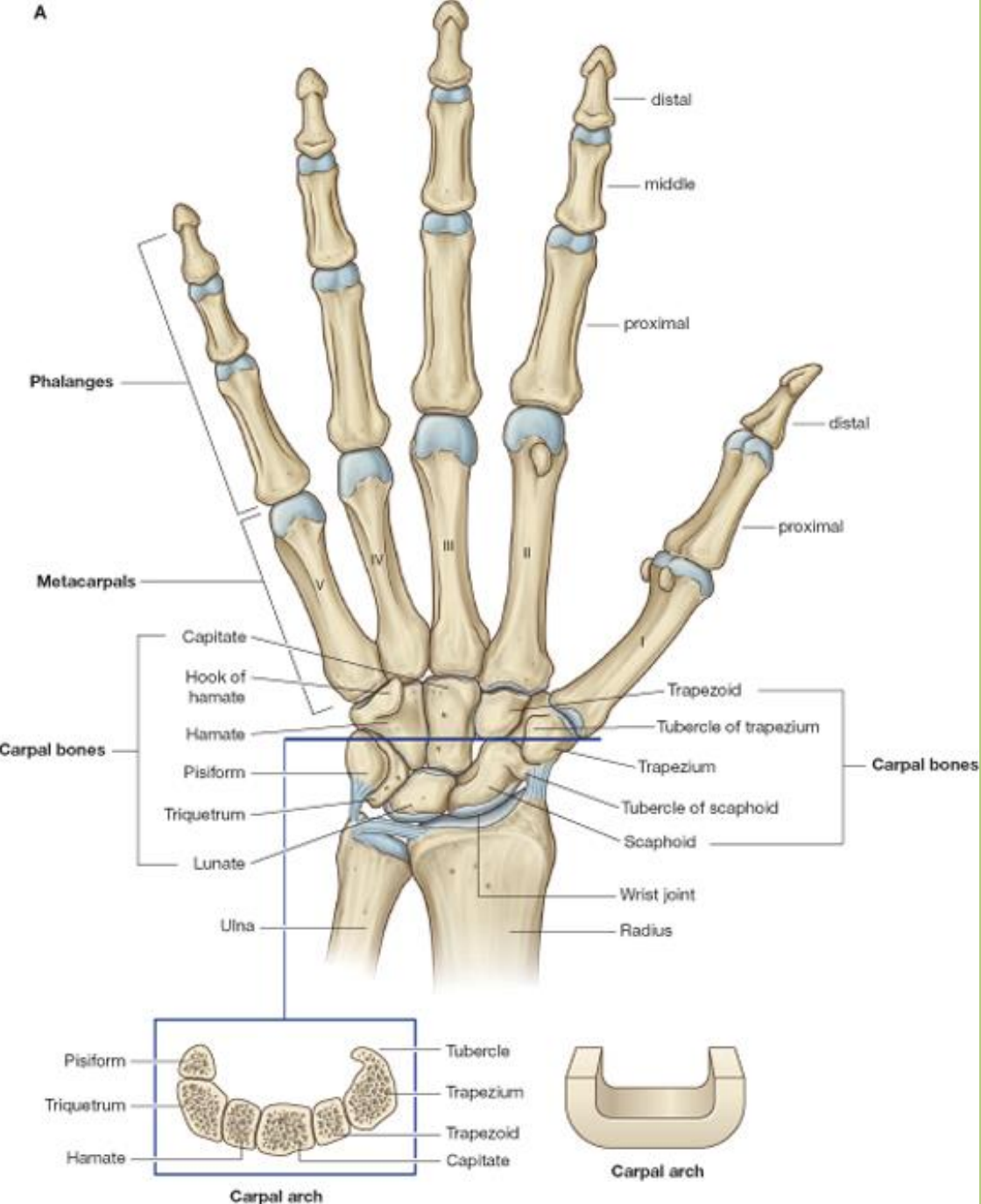


They appear in two rows.

**proximal row:** 1. scaphoid, 2. lunate, 3. triquetrum, 4. pisiform

**distal row:** 1. trapezium, 2. trapezoid, 3. capitate, 4. hamate

A



# Carpal tunnel, metacarpals and phalanges

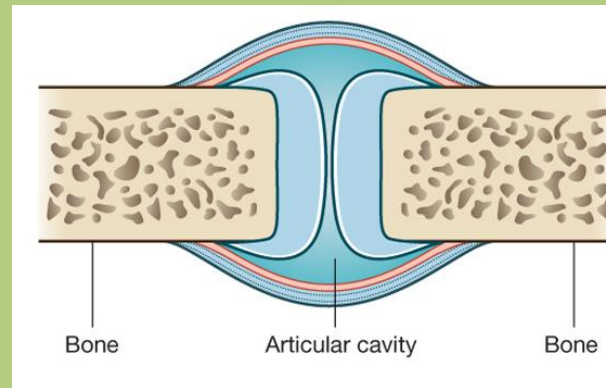
They appear in two rows.

**proximal row:** 1. scaphoid, 2. lunate, 3. triquetrum, 4. pisiform

**distal row:** 1. trapezium, 2. trapezoid, 3. capitate, 4. hamate

# Discontinuous bony connections: Joints

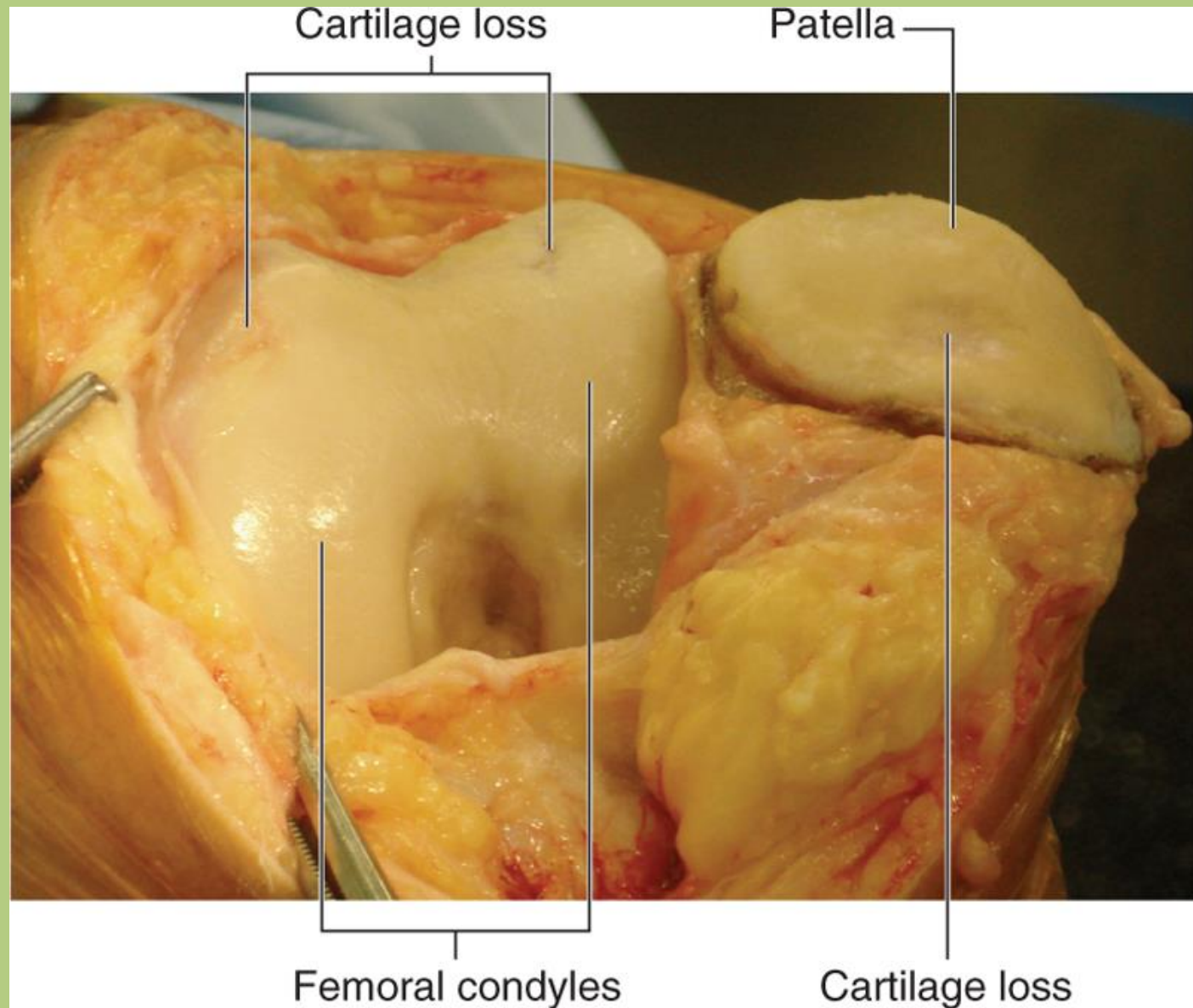
(A gap is presented between the articular surfaces.)



- **Compulsory components** (articular surfaces, cartilage, capsule and ligaments)
- **Optional components** (discs, menisci, articular lips, bursae, tendon sheaths and articular muscles)

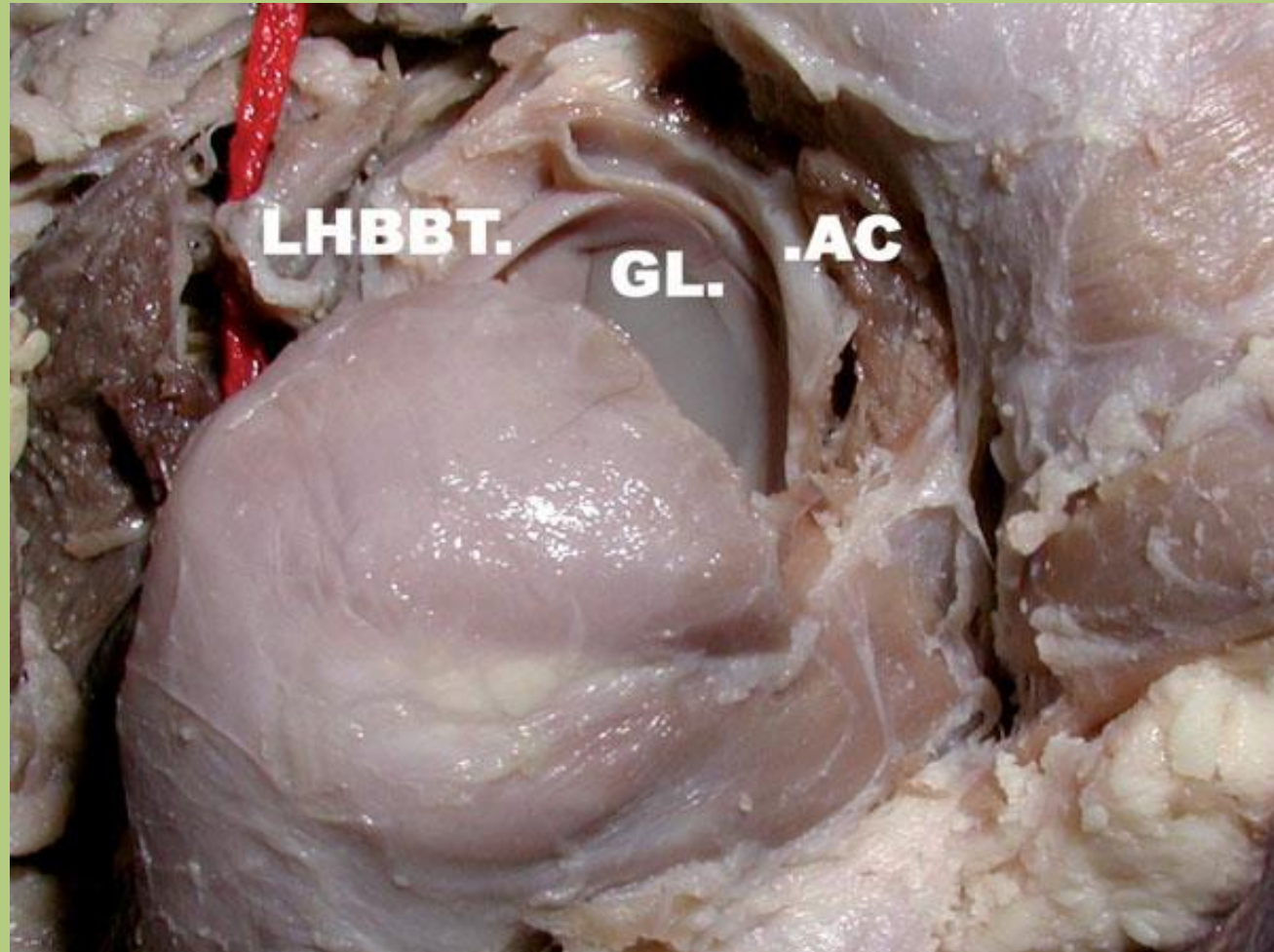
# Compulsory components - overview

- articular head
- articular cavity
- cartilage (hyaline cartilage)



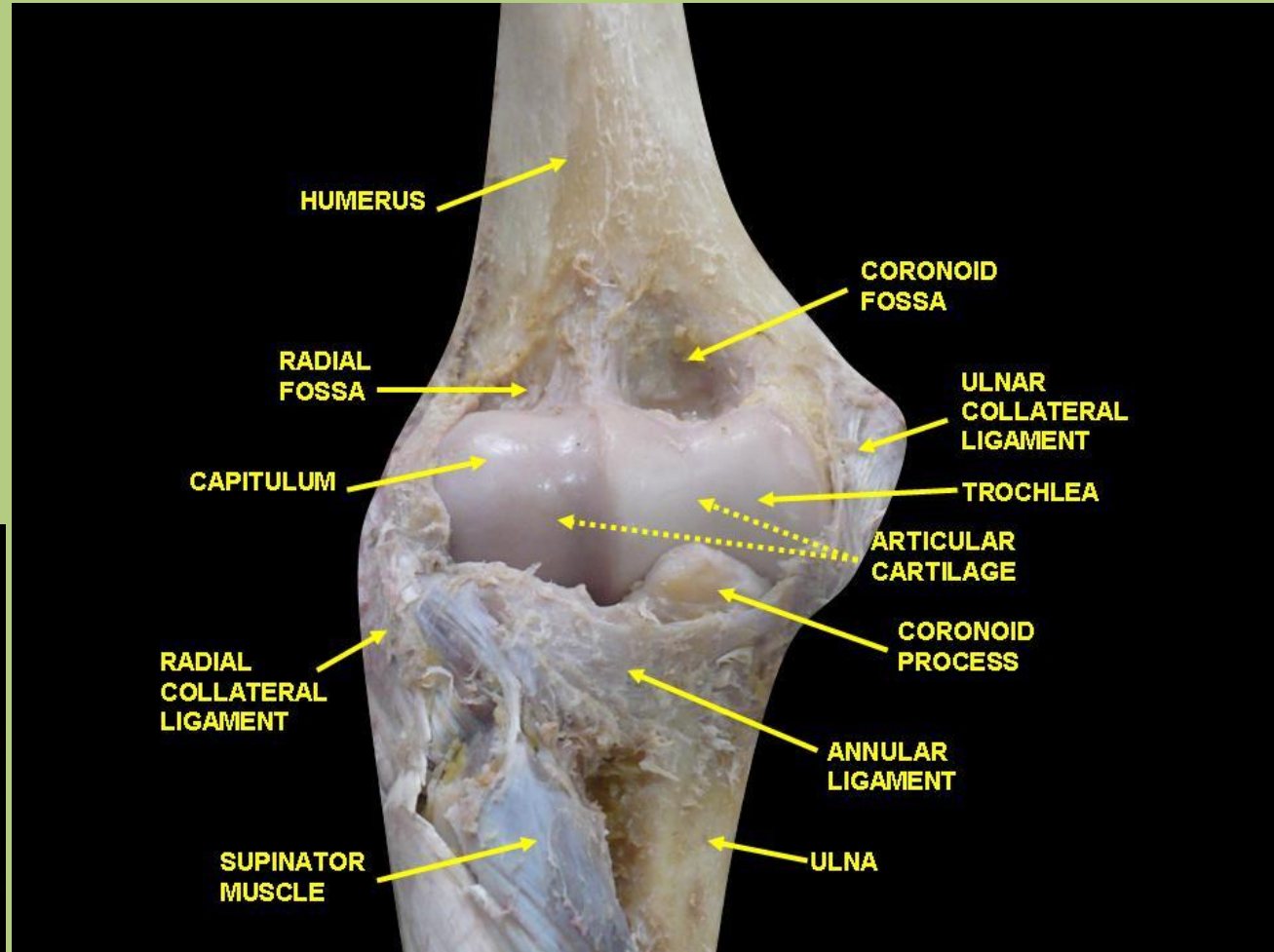
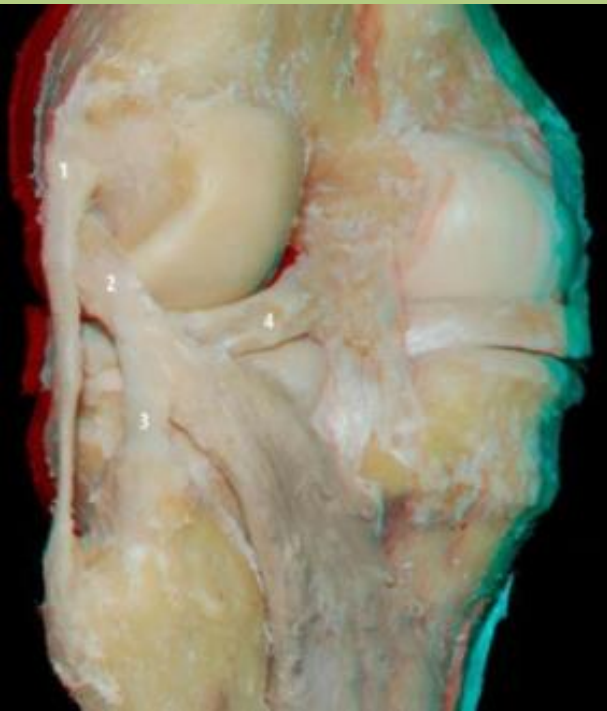
# Compulsory components

- **articular capsule:**
  - outer fibrous layer**  
(dense irregular connective tissue; rich in vessels and nerves)
  - inner synovial layer**  
(synoviocytes secrete synovia)



# Compulsory components

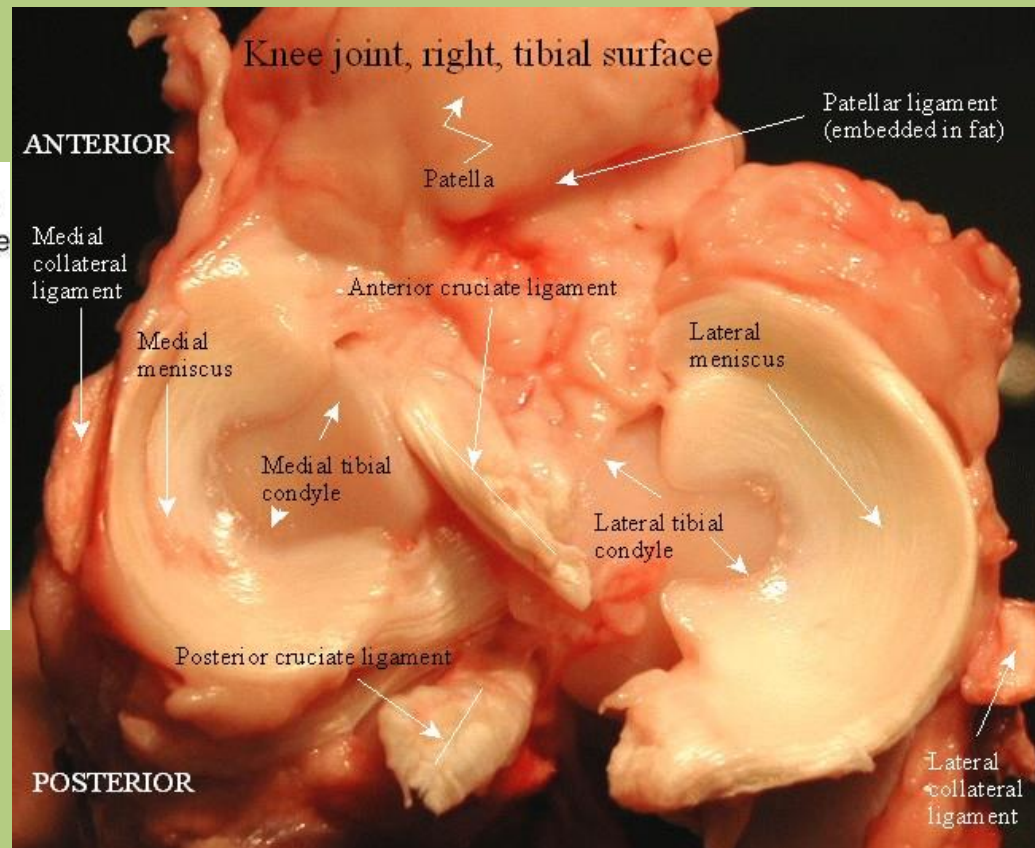
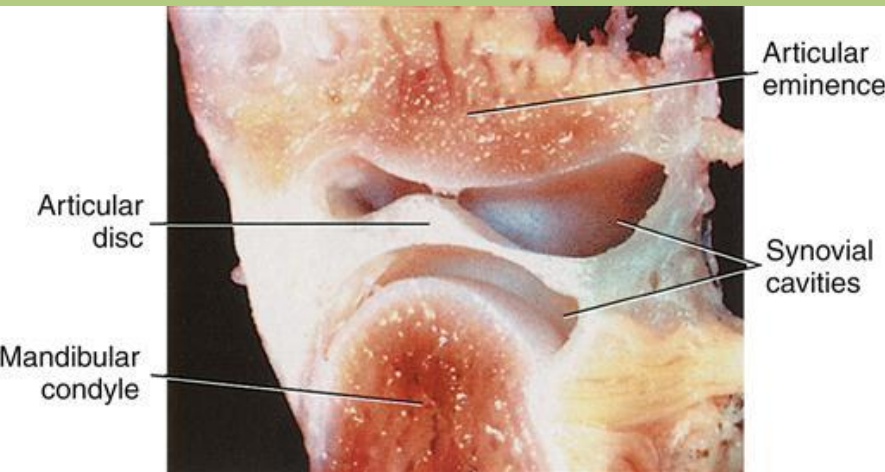
- ligaments





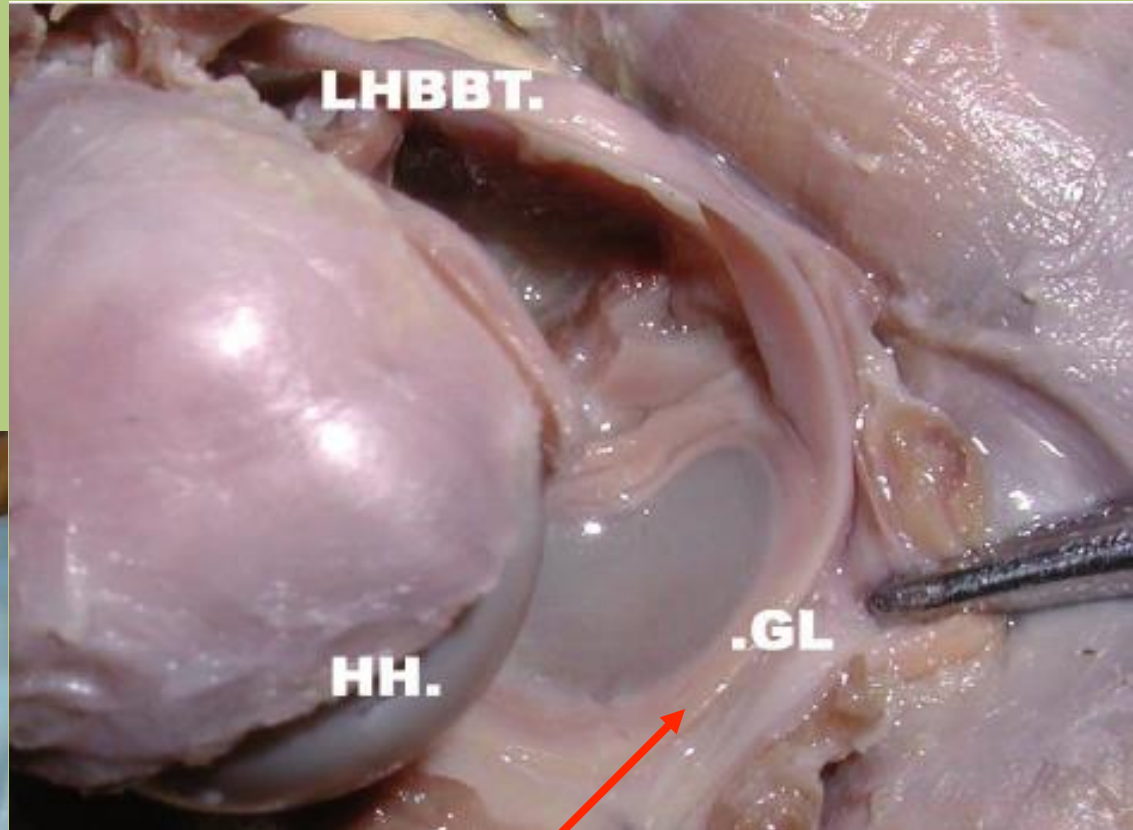
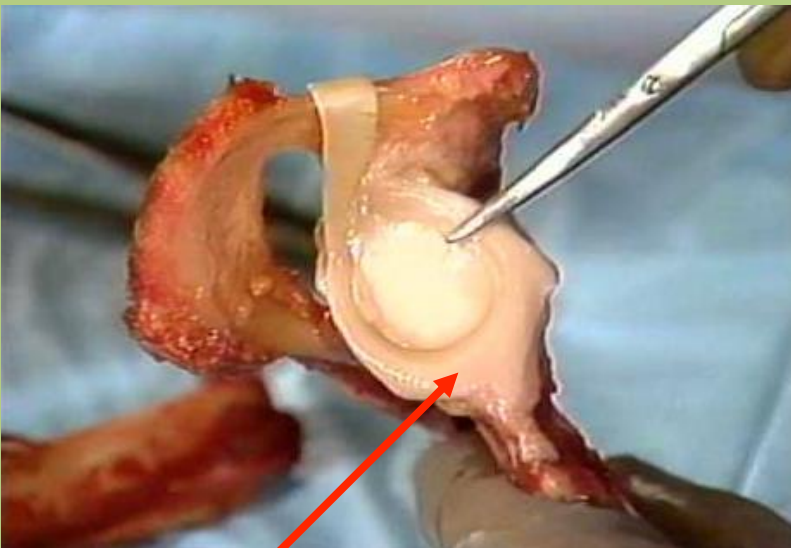
# Optional components

- **menisci and discs:** separates the articular cavity into two parts.

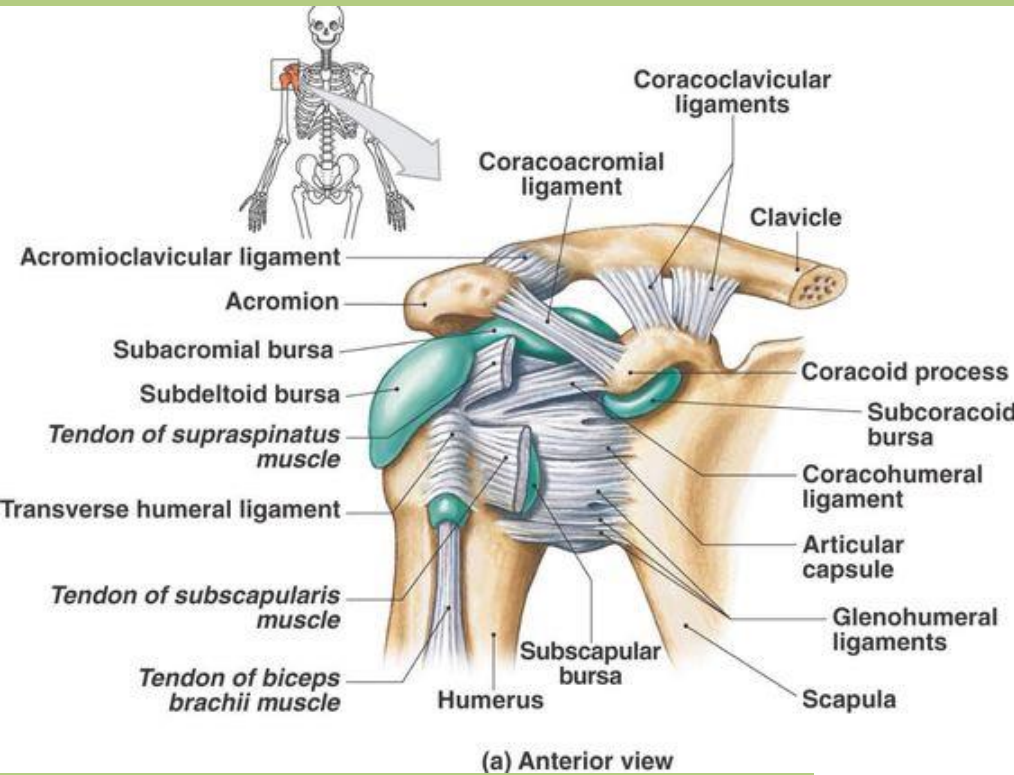


# Optional components

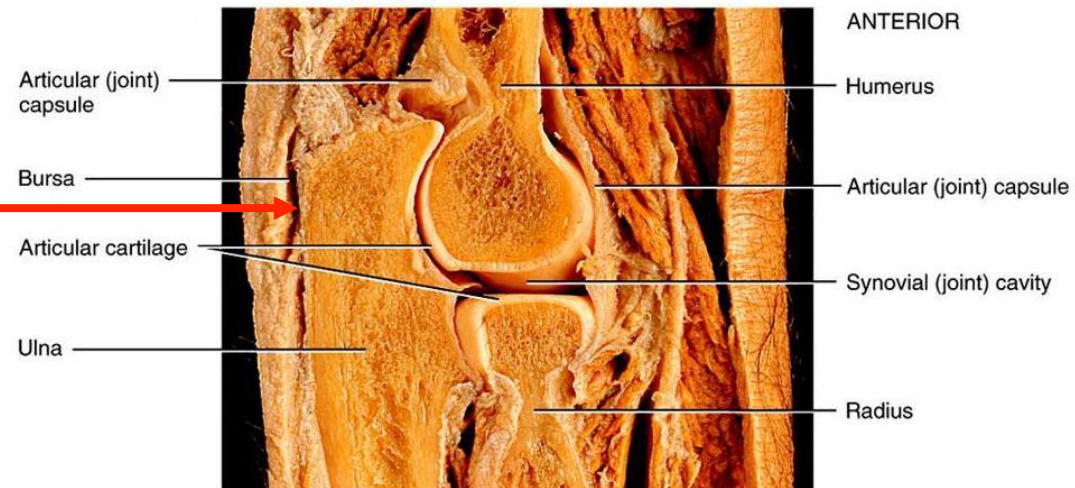
- **articular lips:** extend the articular cavities.



# Optional components



- **Bursae and tendon sheaths:** reduce friction between surfaces.



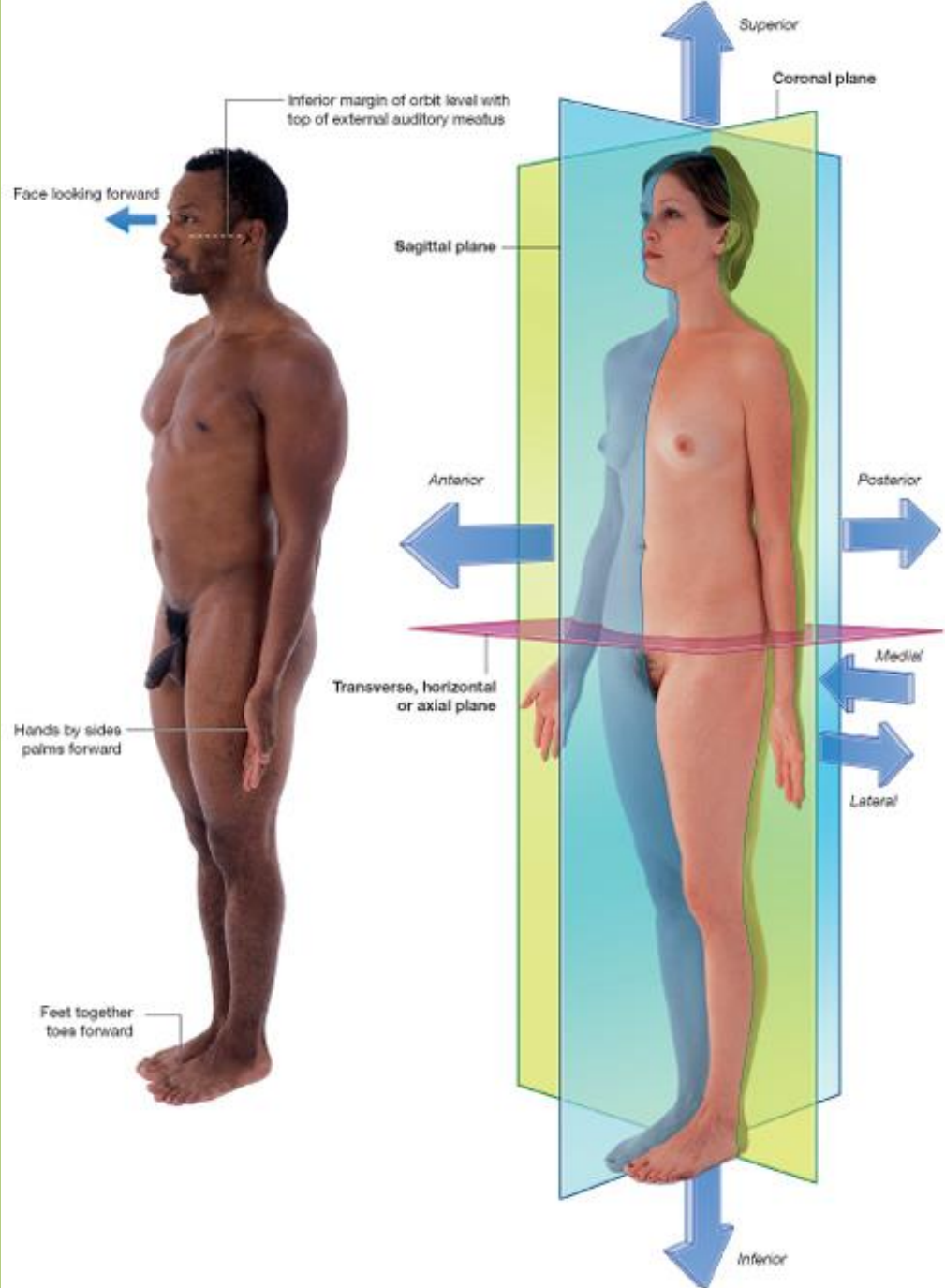
(b) Sagittal section of right elbow joint

# Optional components

- **articular muscles:** delicate fibers from the surrounding muscles, tensing the articular capsule.

- **Normal position of the body:** standing body, face looking forward and hands face forward.

- **Midposition of joints:** capsule and ligaments on each side are collectively loose.

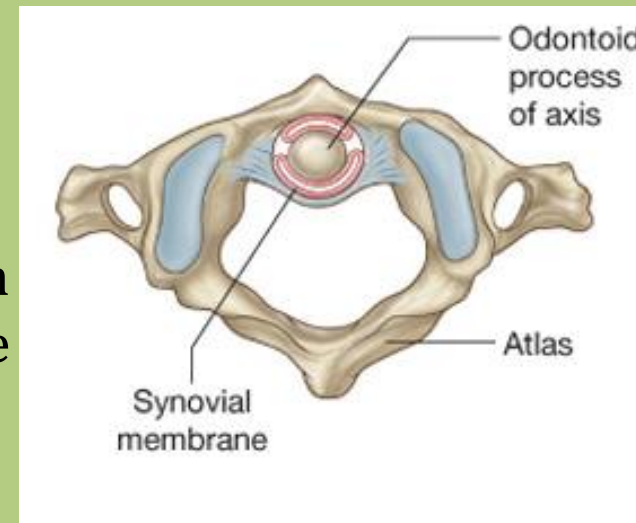
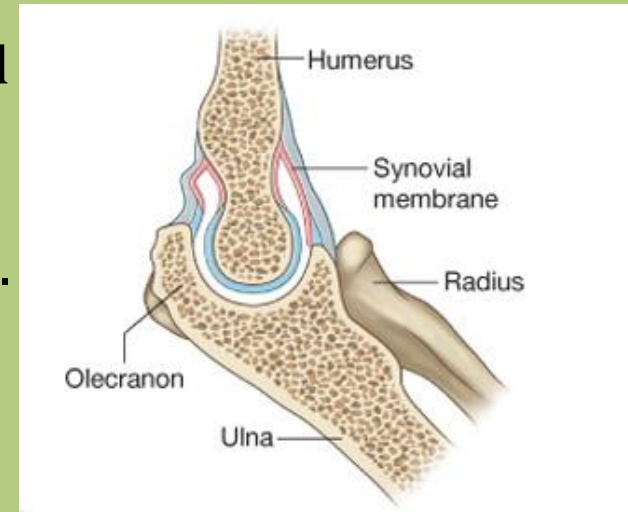


# Stabilizers of joints

- **ligaments**
- **capsule**
- **pressure**
- **adhesion between the surfaces**
- **muscles**

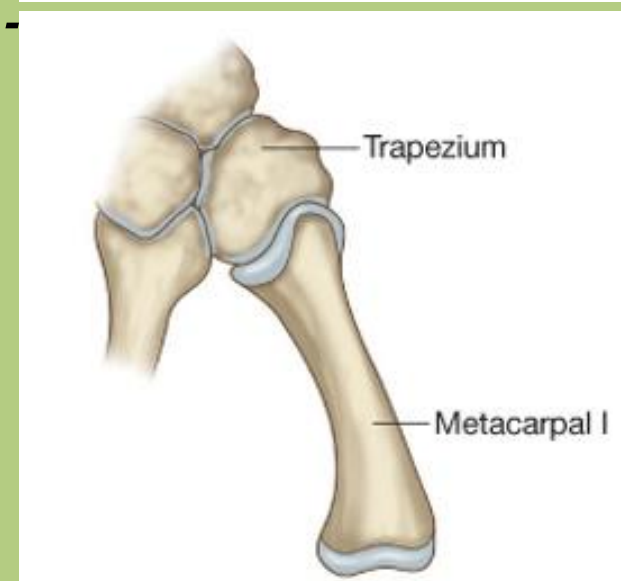
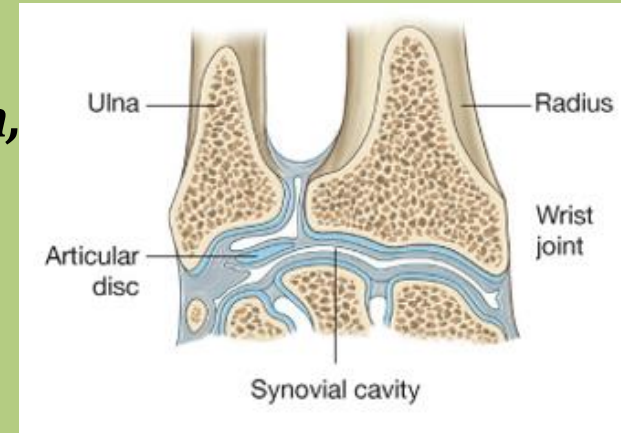
# Classification of joints - Uniaxial joints

- **Hinge:** e.g. humeroulnar and interphalangeal joints. *Flexion-extension.*
- **Pivot:** e.g. atlantoaxial and radioulnar joints. *Rotation.*
- **Trochoginglimus** (hinge and pivot): combination of the two uniaxial joints. e.g. elbow and knee joints. *Flexion-extension, rotation.*



# Classification of joints - Biaxial joints

- **Ellipsoid:** e.g. wrist joint. *Flexion-extension, adduction-abduction.*
- **Saddle:** e.g. I. carpometacarpal joint. *Adduction-abduction, opposition-reposition.*



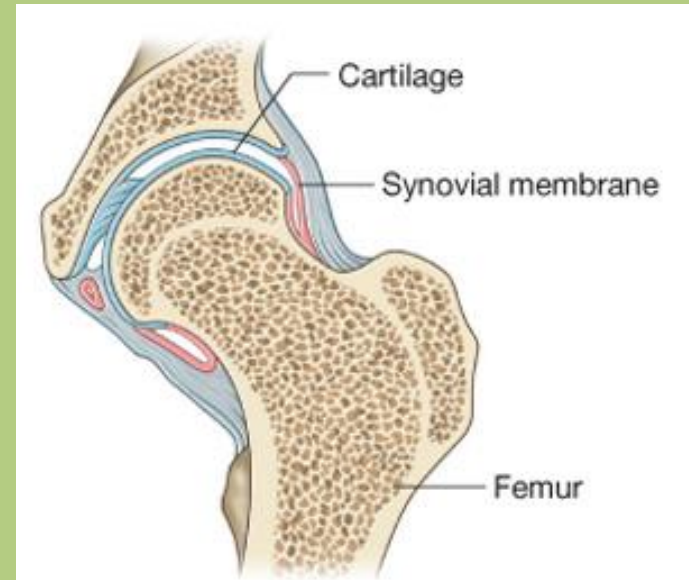


# Classification of joints - Multiaxial joints

- **Ball-and-socket:** e.g. shoulder and hip joints.  
*Flexion-extension, adduction-abduction, rotation*



**circumduction.**

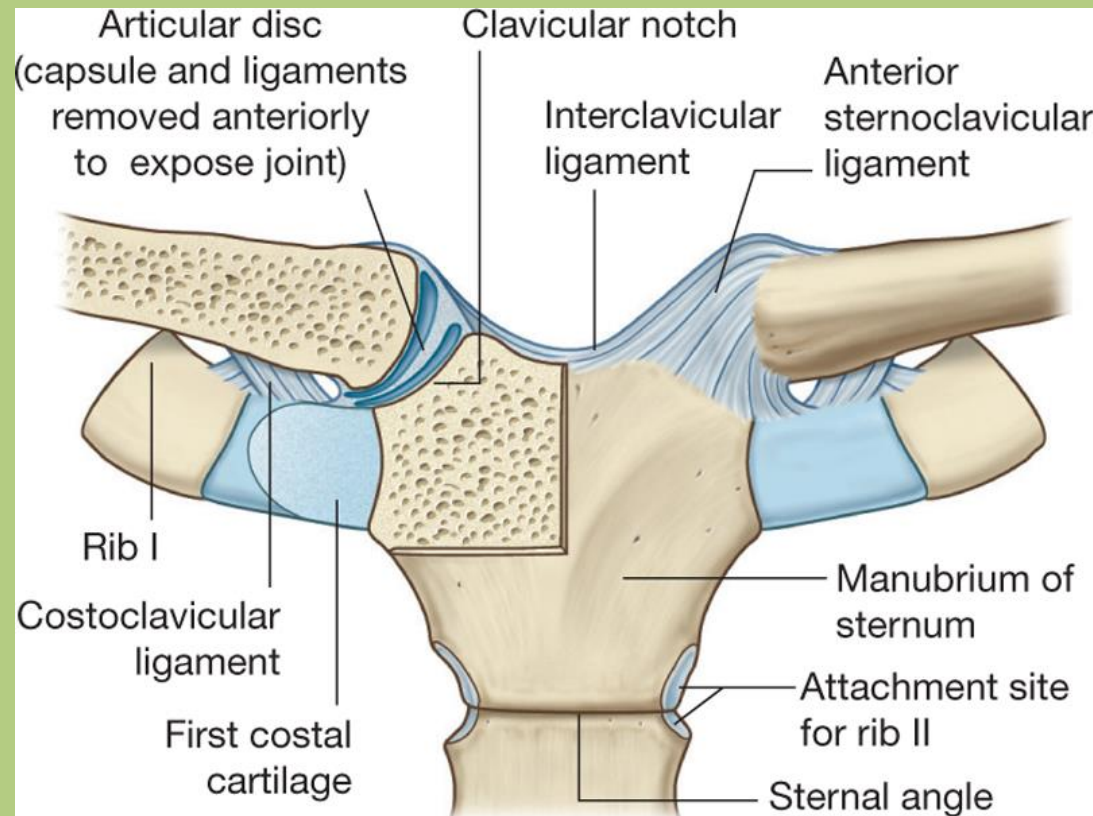


# Special joint types

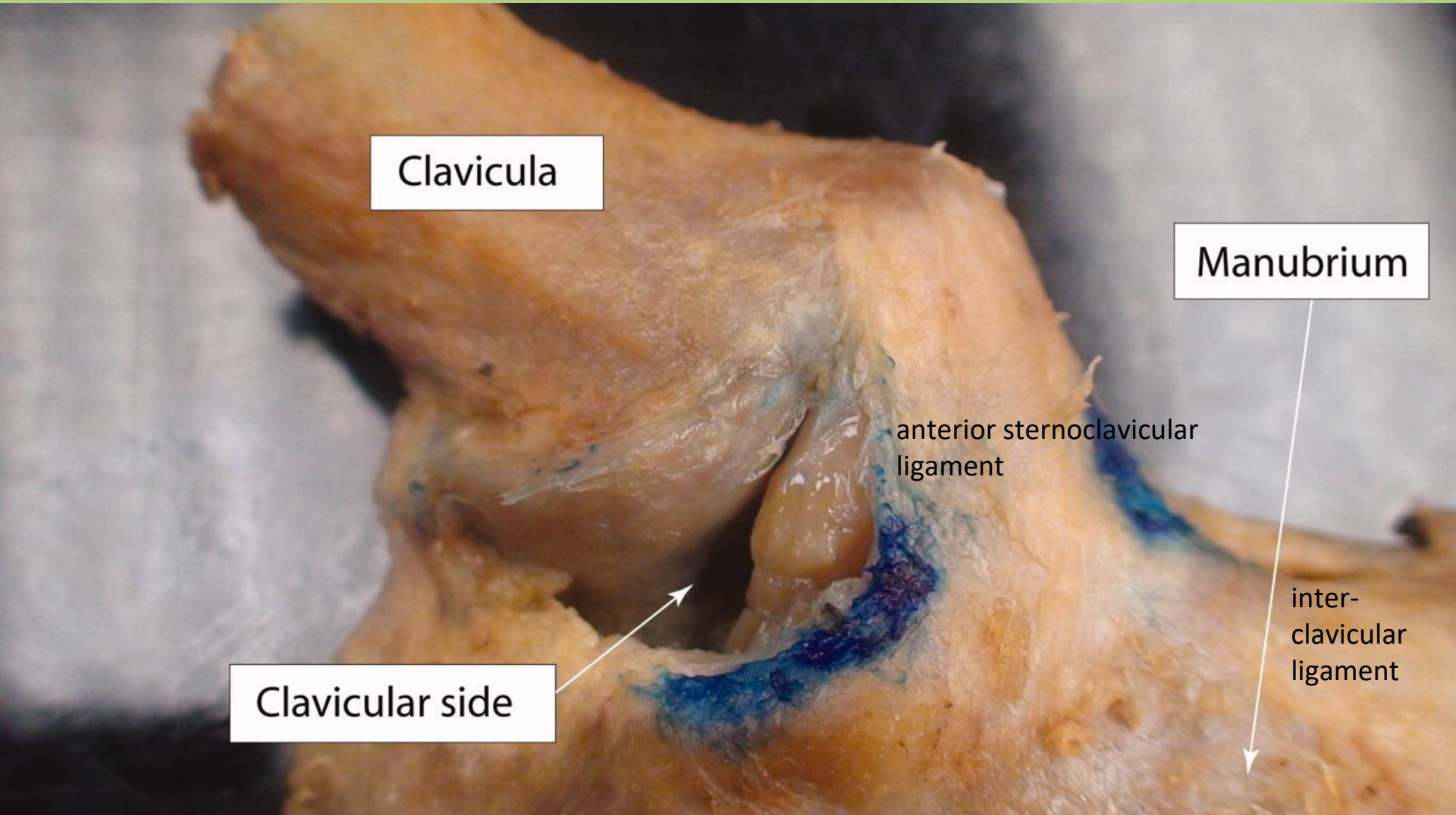
- **Restricted ball-and-socket:** e.g. II.-V.  
metacarpophalangeal joints
- **Amphiarthrosis:** intercarpal and II.-V.  
carpometacarpal joints

# Sternoclavicular joint

- **Type:** plane (functionally restricted ball-and-socket)
- **Articular surfaces:** sternal articular facet – clavicular notch of sternum
- **Articular disc**
- **Ligaments:** costoclavicular, interclavicular and anterior and posterior sternoclavicular ligaments.
- **Movement:** rotation: 50°.

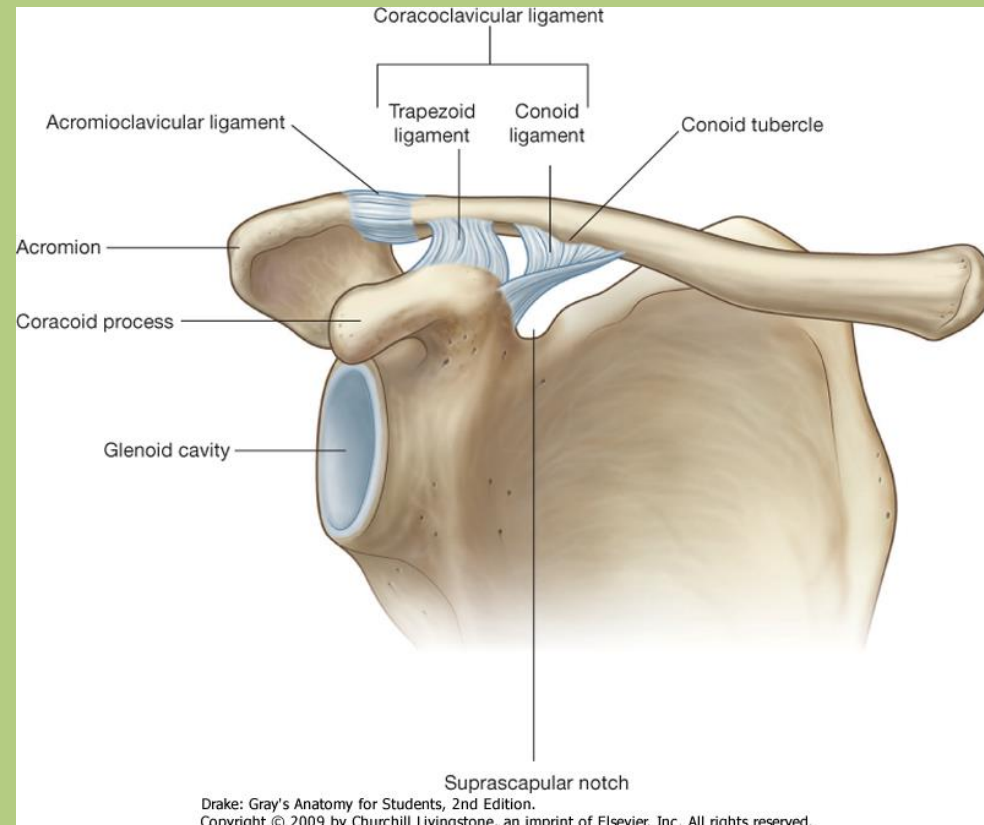


# Sternoclavicular joint



# Acromioclavicular joint

- **Type:** plane (functionally restricted ball-and-socket)
- **Articular surfaces:** acromial articular facet- acromion
- **Articular disc**
- **Ligaments:** acromioclavicular and coracoclavicular (*conoid and trapezoid ligaments*) ligaments
- **Movement:** rotation.

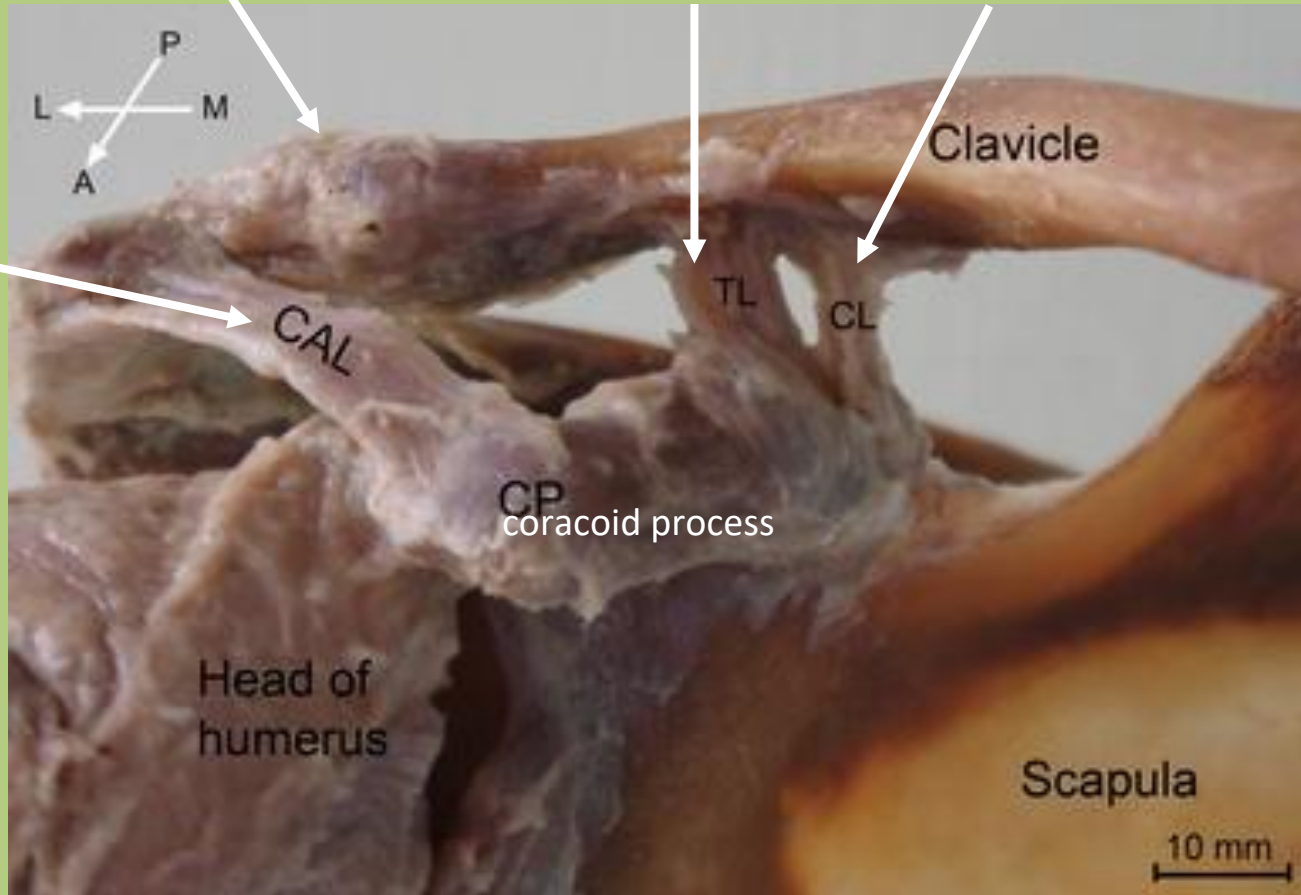


# Acromioclavicular joint

acromioclavicular lig.

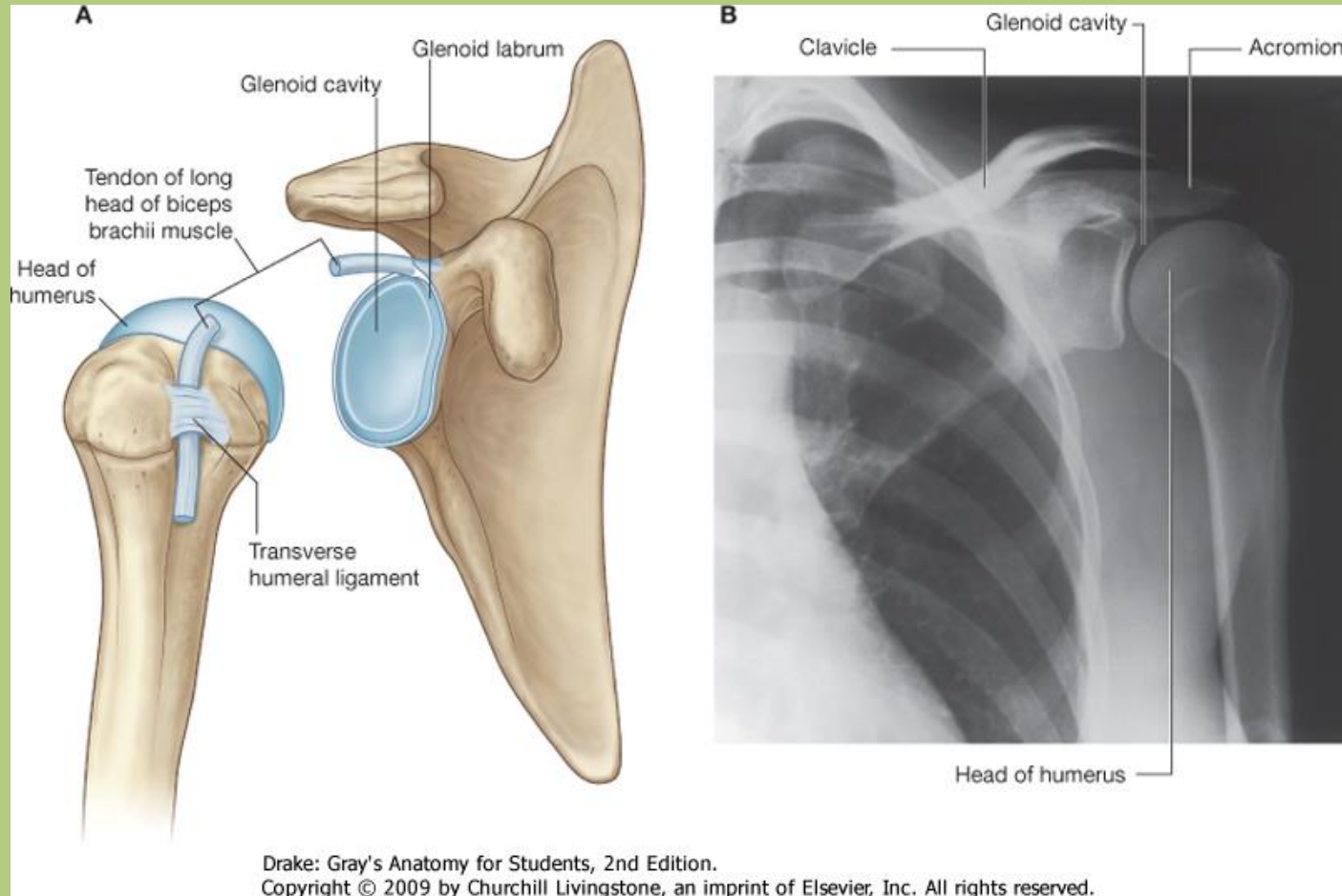
trapezoid lig.

conoid lig.



# Shoulder joint

- **Type:** ball-and-socket
- **Articular surfaces:** head of humerus – glenoid cavity
- **Glenoid labrum**



# Shoulder joint

## Bursae:

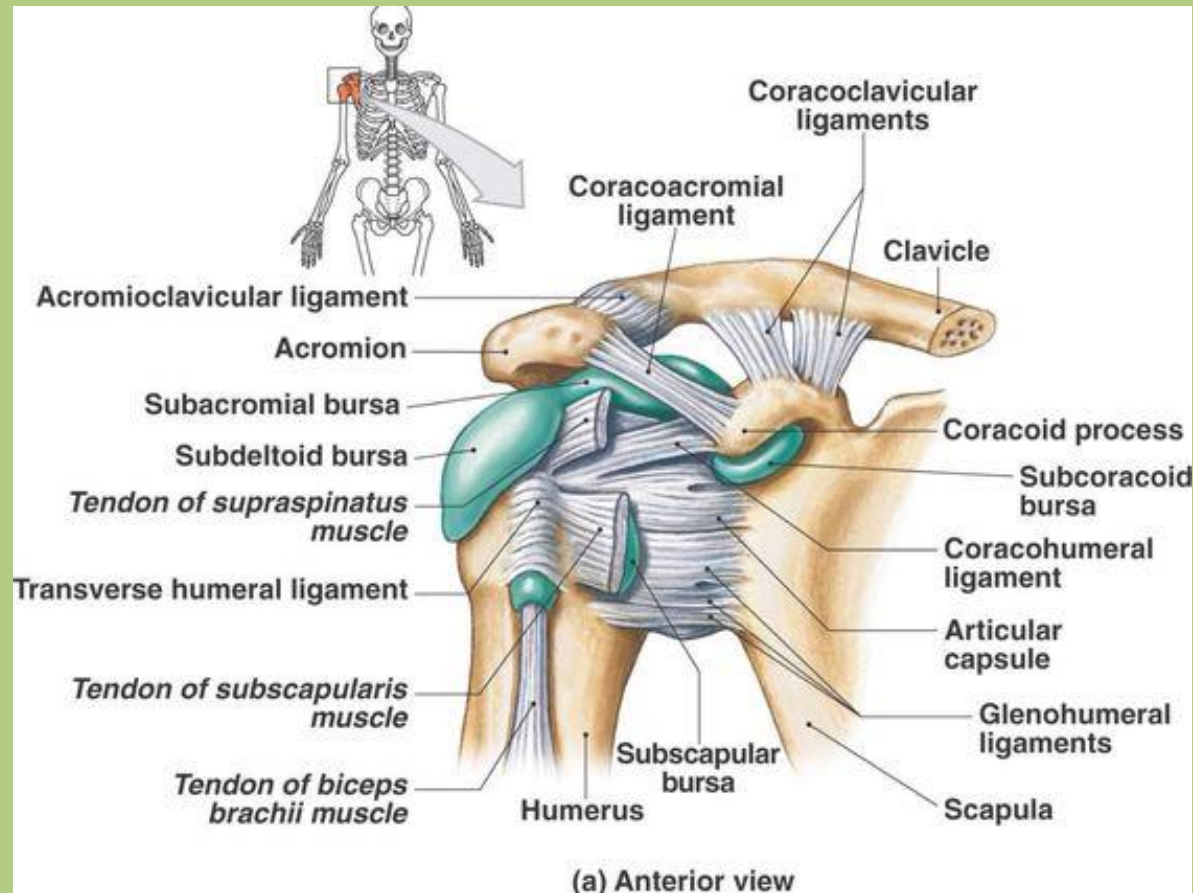
- subdeltoid bursa
- subacromial bursa
- subcoracoid bursa
- subtendinous bursa

*they communicate with the articular cavity*

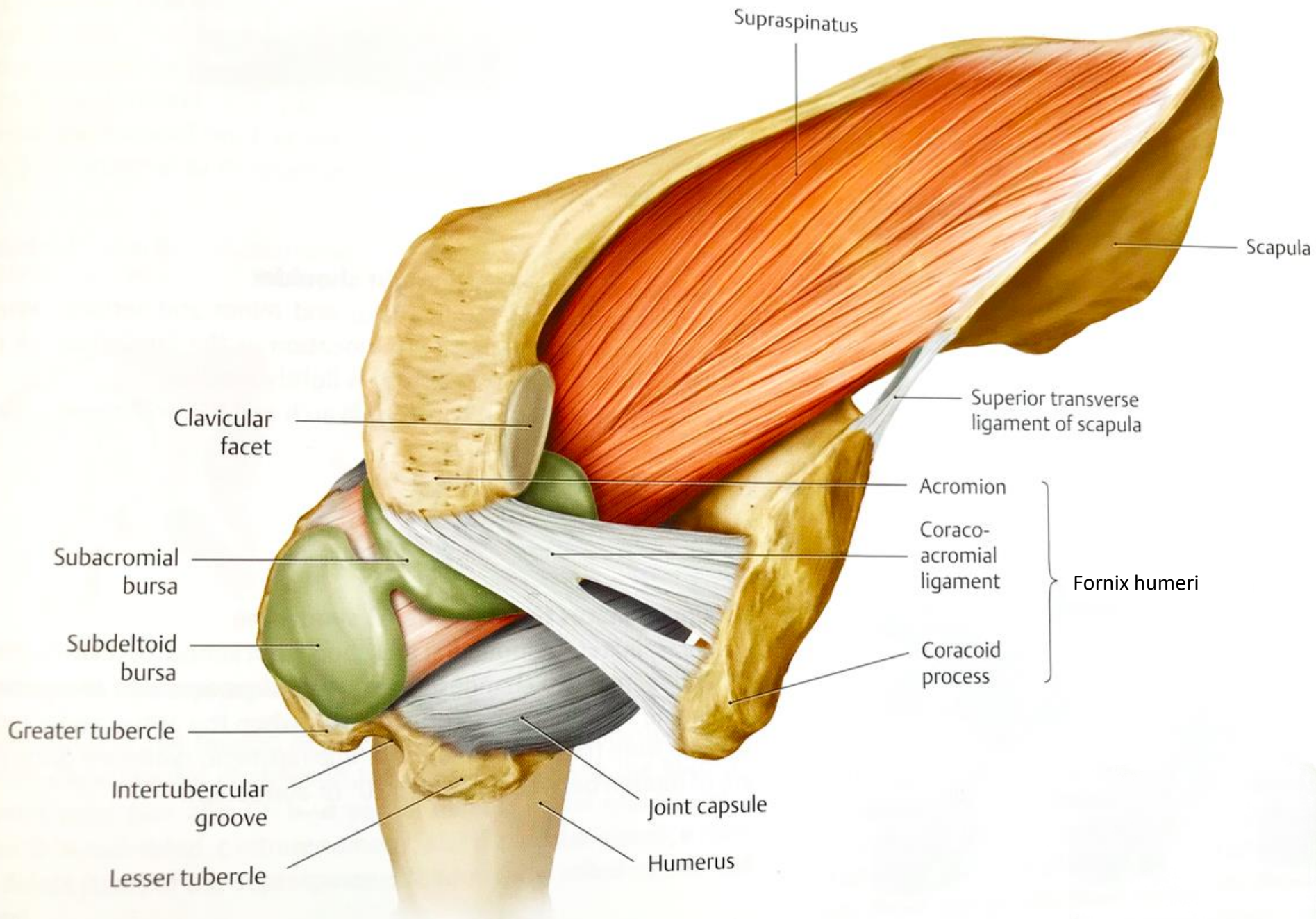
## Ligaments:

- *coracohumeral ligament*
- *glenohumeral ligament*
- *coracoacromial ligament*

**Coracoacromial arch** (*fornix humeri*):  
**coracoacromial ligament, acromion  
and coracoid process**

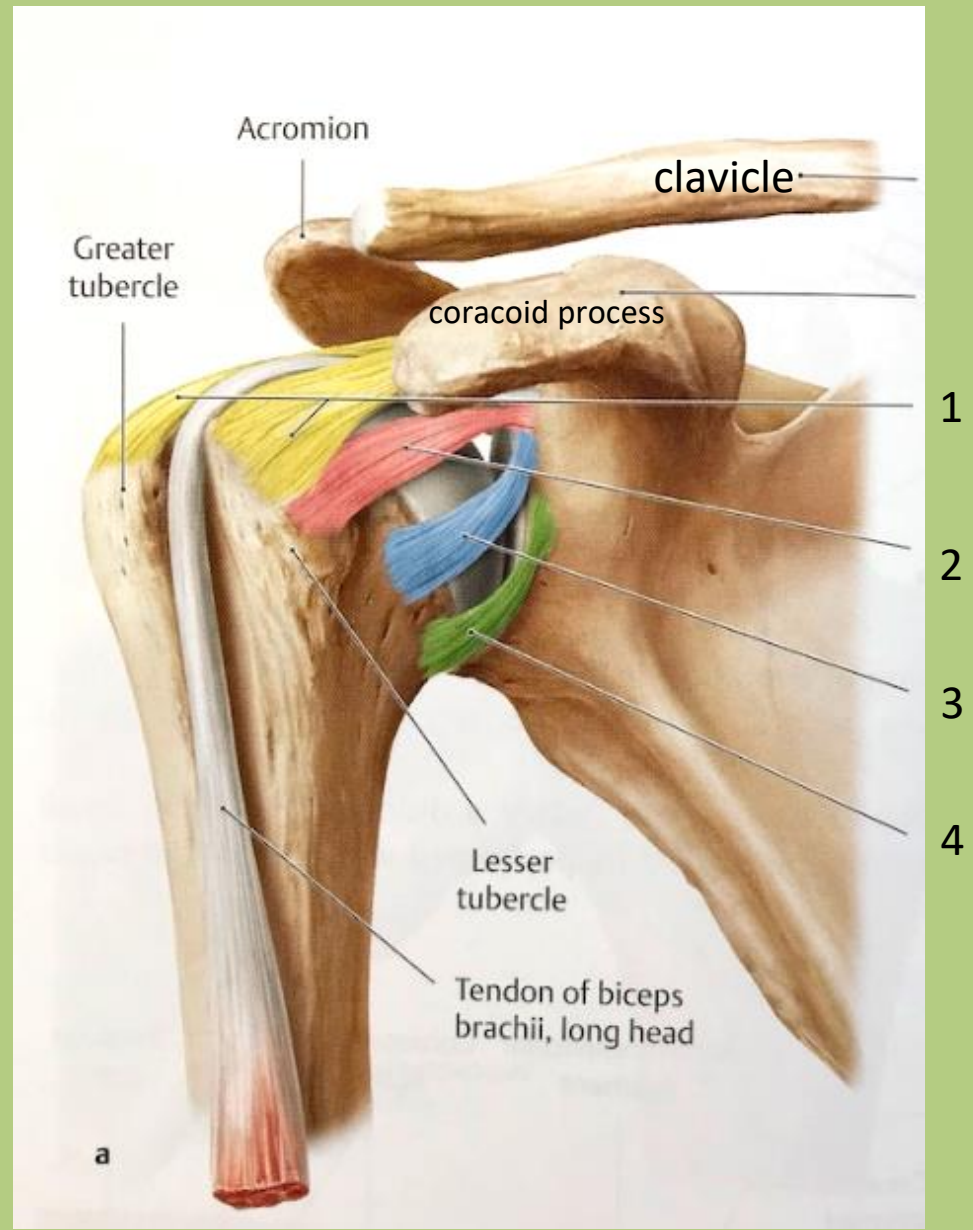


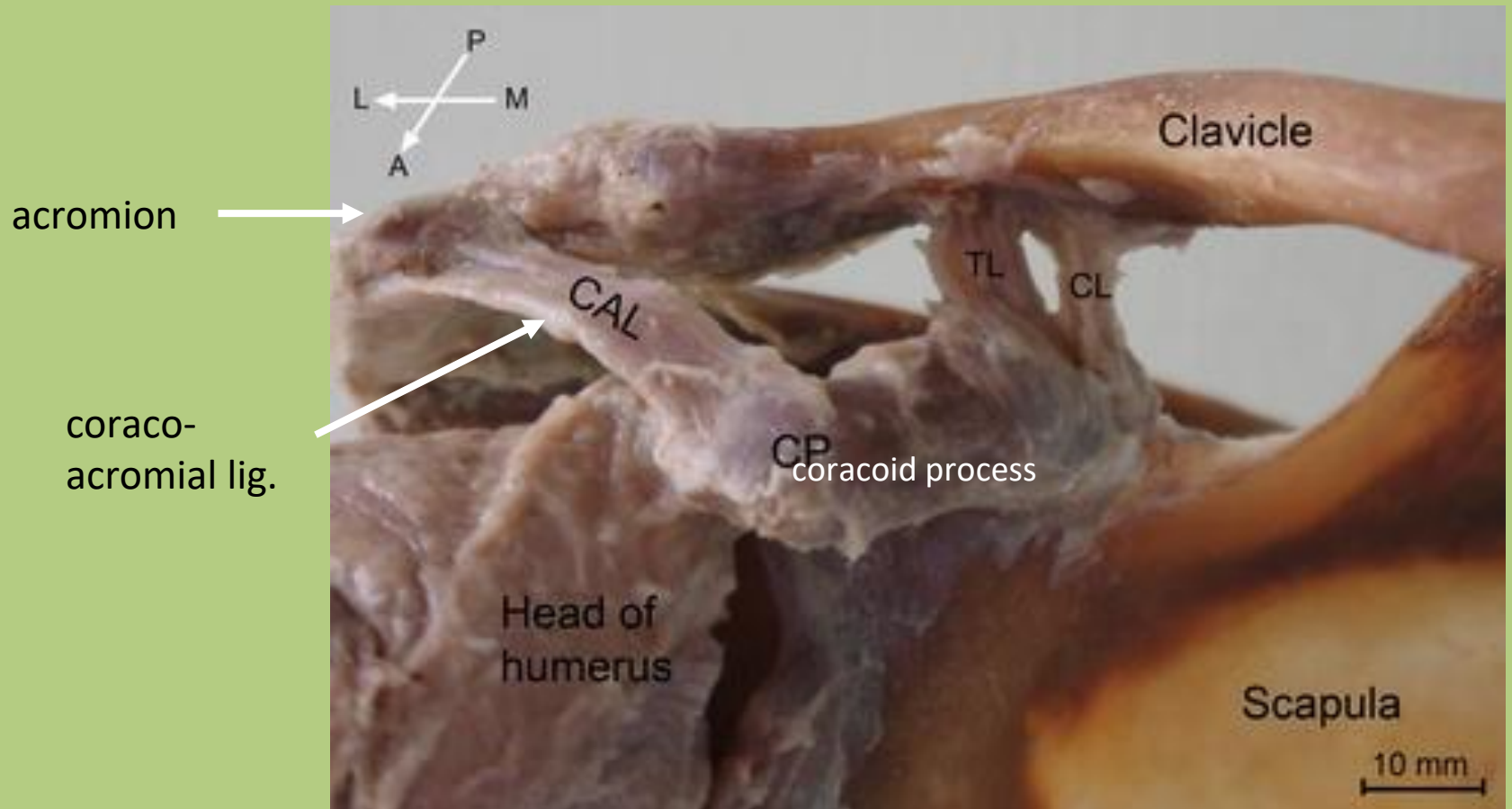




# Shoulder joint

- *coracohumeral lig. (1)*
- *superior glenohumeral lig. (2)*
- *middle glenohumeral lig. (3)*
- *inferior glenohumeral lig. (4)*





# Shoulder joint

- **Movements:**

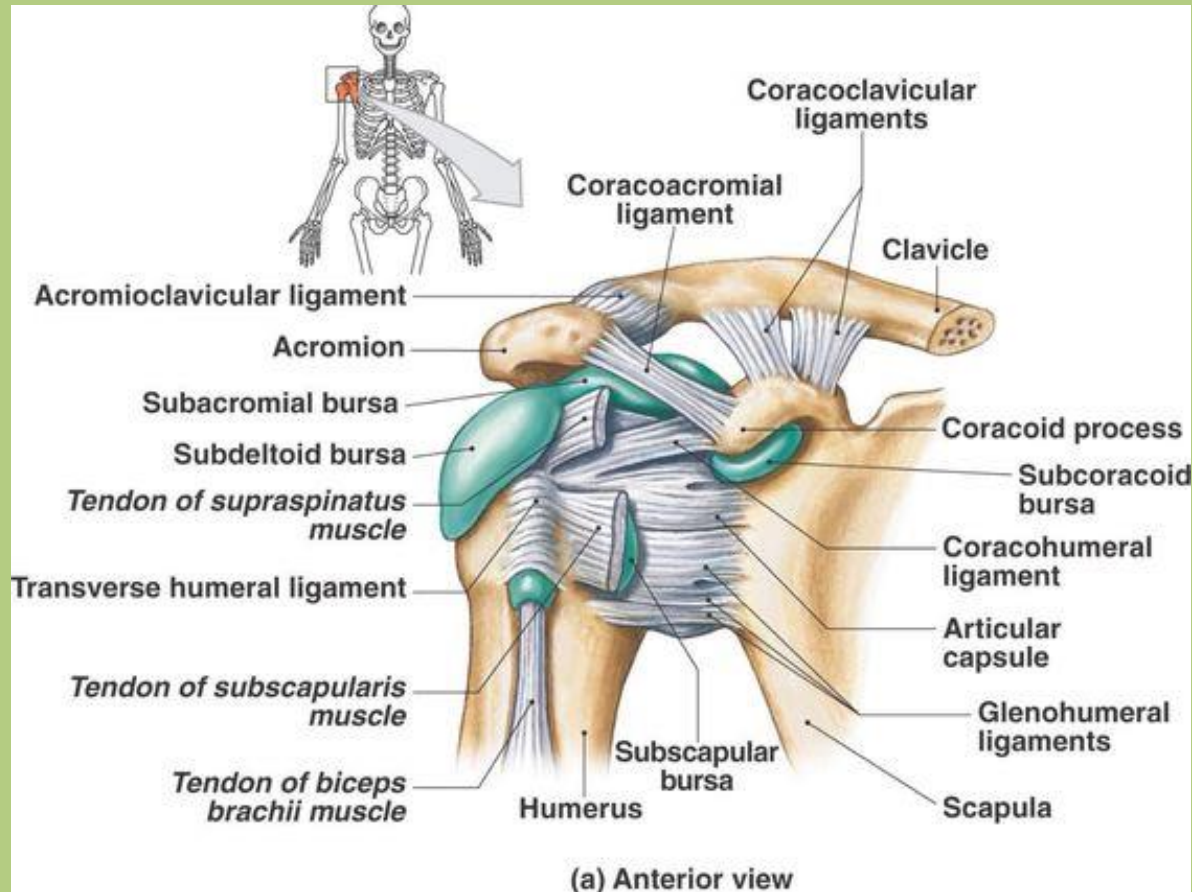
**Horizontal axis:** anteversion:  $60^\circ$  -  
retroversion:  $5^\circ$

**Sagittal axis:** abduction:  $90^\circ$  -  
adduction:  $20-30^\circ$

**Vertical axis:** lat. rotation:  $60^\circ$ ,  
med. rotation:  $70^\circ$

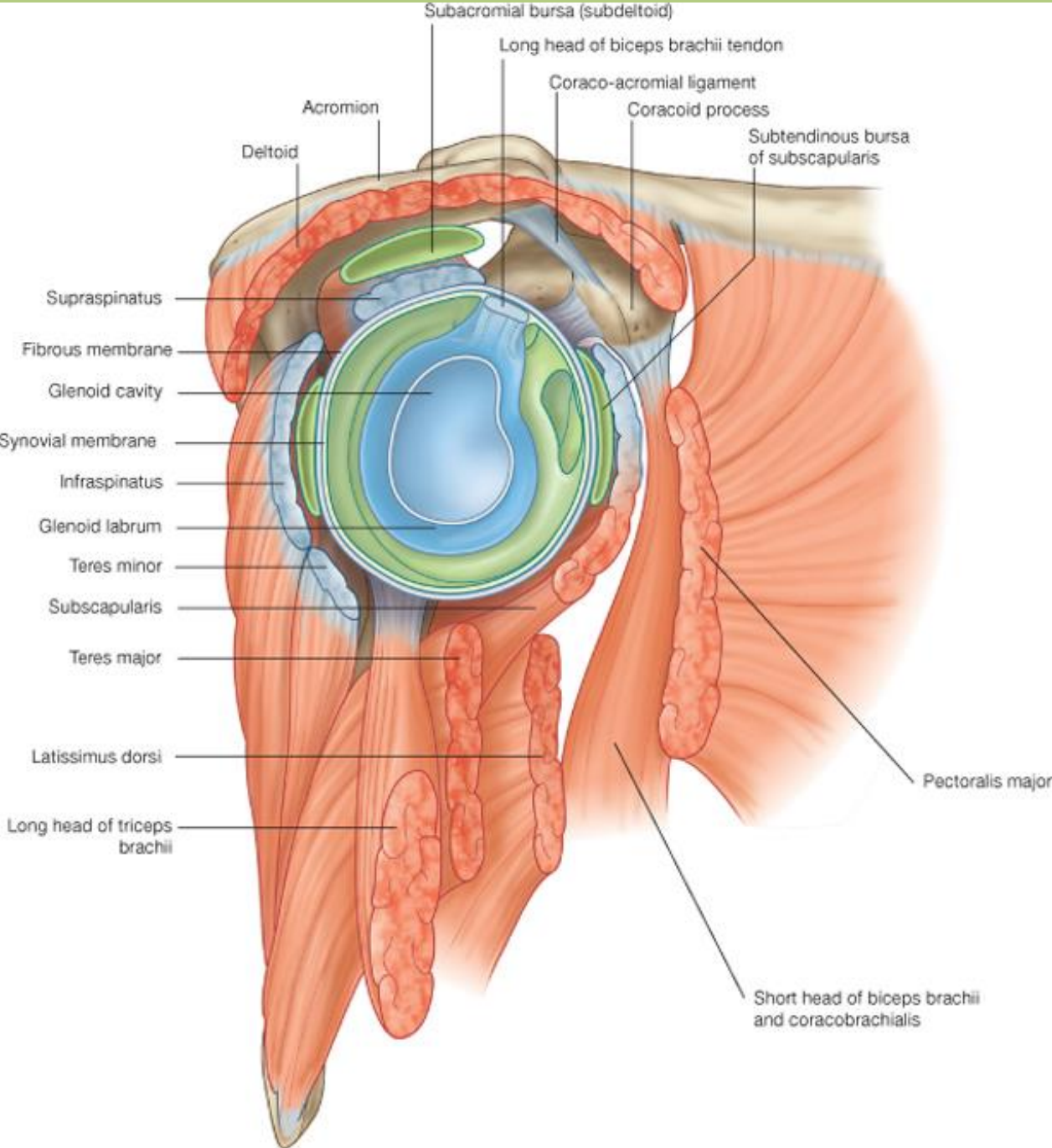


**circumduction**



**Blood supply:** anterior and posterior circumflex humeral arteries,  
subscapular artery, circumflex scapular artery

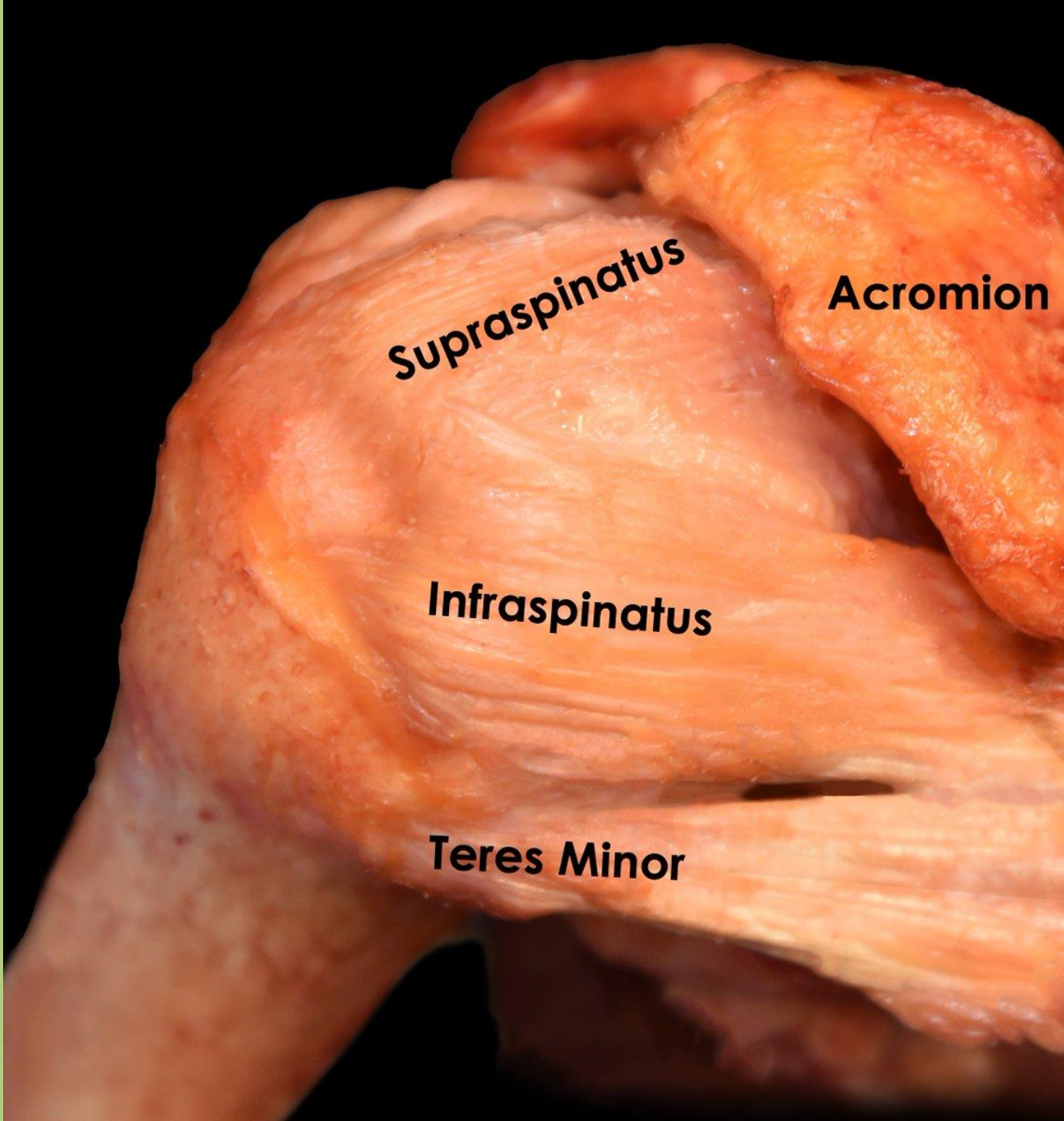
**Innervation:** suprascapular nerve



## Rotator cuff muscles:

- **supraspinatus:**  
abduction, lat. rotation
- **infraspinatus:**  
adduction, lat. rotation
- **teres minor:**  
adduction, lat rotation
- **subscapularis:**  
adduction, med.  
rotation

The main stabilizers of the shoulder joint, and they have important role in abduction, medial and lateral rotations.

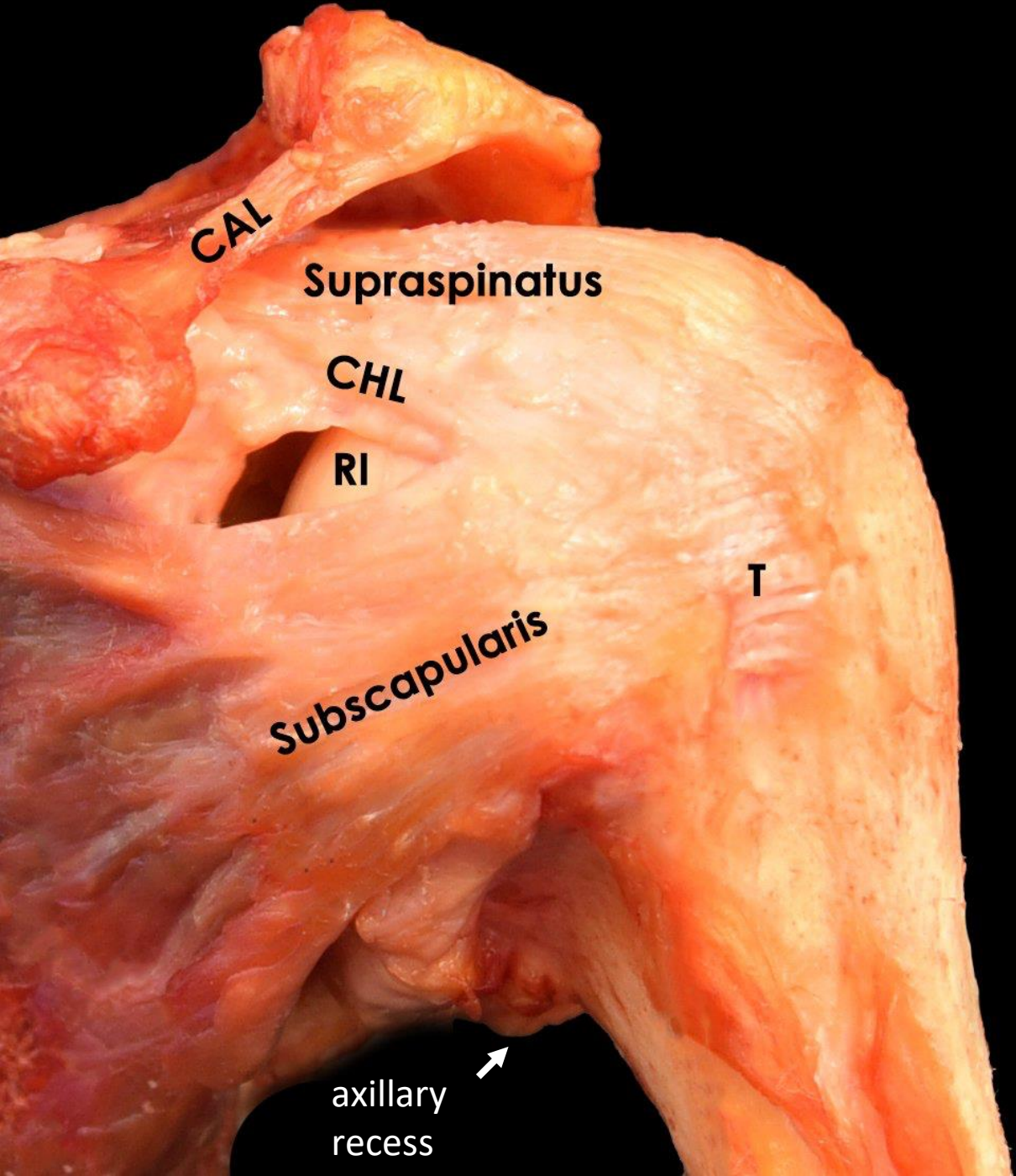


**Supraspinatus**

**Acromion**

**Infraspinatus**

**Teres Minor**



CAL

Supraspinatus

CHL

RI

Subscapularis

T

axillary  
recess



dislocation of the humeral head





L  
K  
F  
C

## Proximal humeral fractures

4-5% of all fractures.

extraarticular fracture  
at the level of surgical  
neck

Case courtesy of Assoc  
Prof Frank Gaillard,  
Radiopaedia.org, rID:  
18279





Thank you for your attention.

References:

Thieme, Atlas of Anatomy, General Anatomy and Musculoskeletal System

Drake: Gray's Anatomy for Students, 2nd ed.

Standring: Gray's Anatomy, 39th ed.

[radiopaedia.org](http://radiopaedia.org)