

Joints of upper limb

David Kachlík

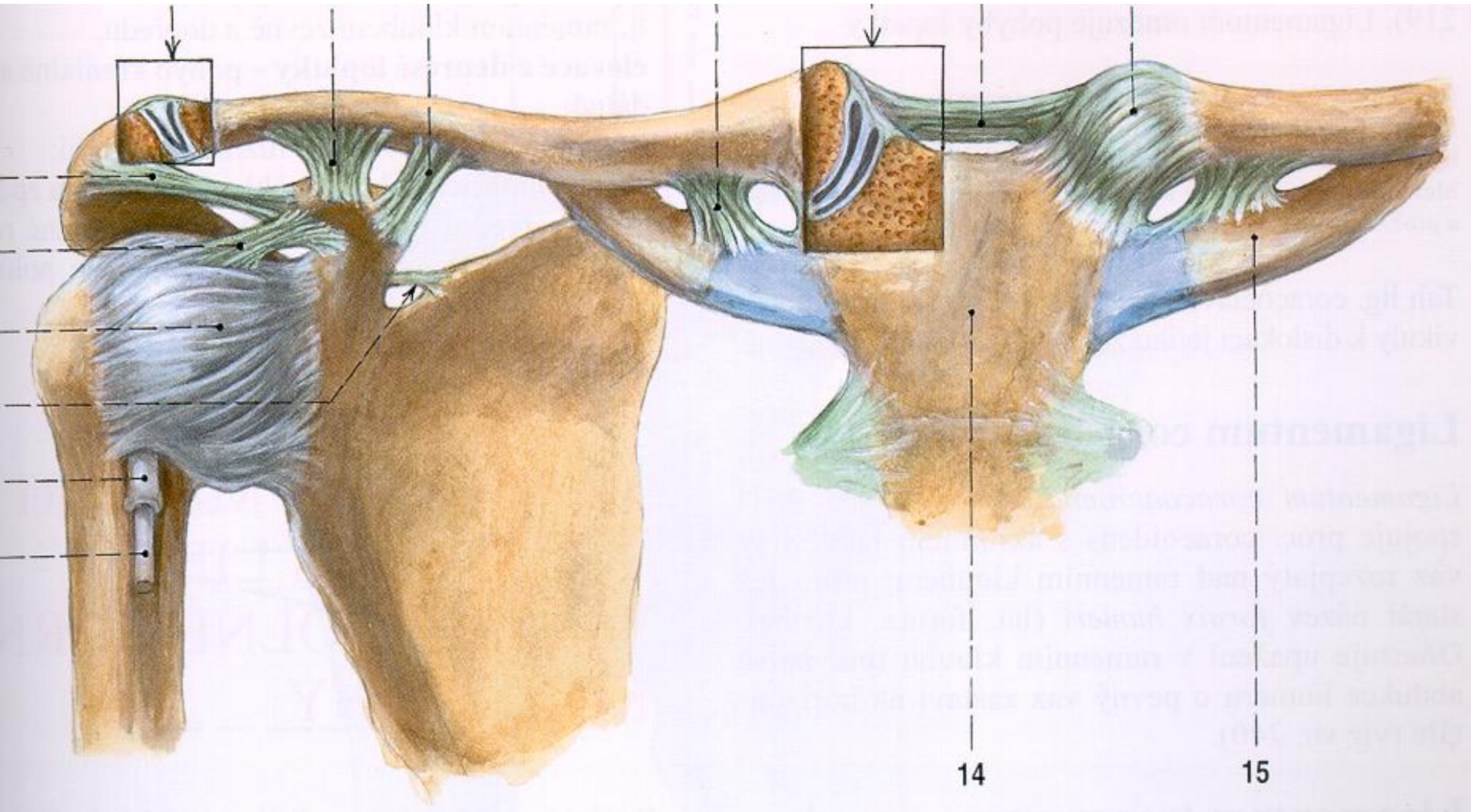
Joints of pectoral girdle

Juncturae cinguli membri superioris

- art. sternoclavicularis (sternoclavicular joint)
- art. acromioclavicularis (acromioclavicular joint)
- lig. coracoacromiale *seu* fornix humeri
 - prevent arm from abduction above horizontal plane in fixed scapula
- lig. transversum scapulae superius (above incisura scapulae)
 - under: n. suprascapularis
 - across: vasa suprascapularia
- lig. transversum scapulae inferius (above incisura spinoglenoidalis)
 - passage for n. suprascapularis and vasa suprascapularia

Joints of pectoral girdle

Juncturae cinguli membri superioris



Articulatio sternoclavicularis

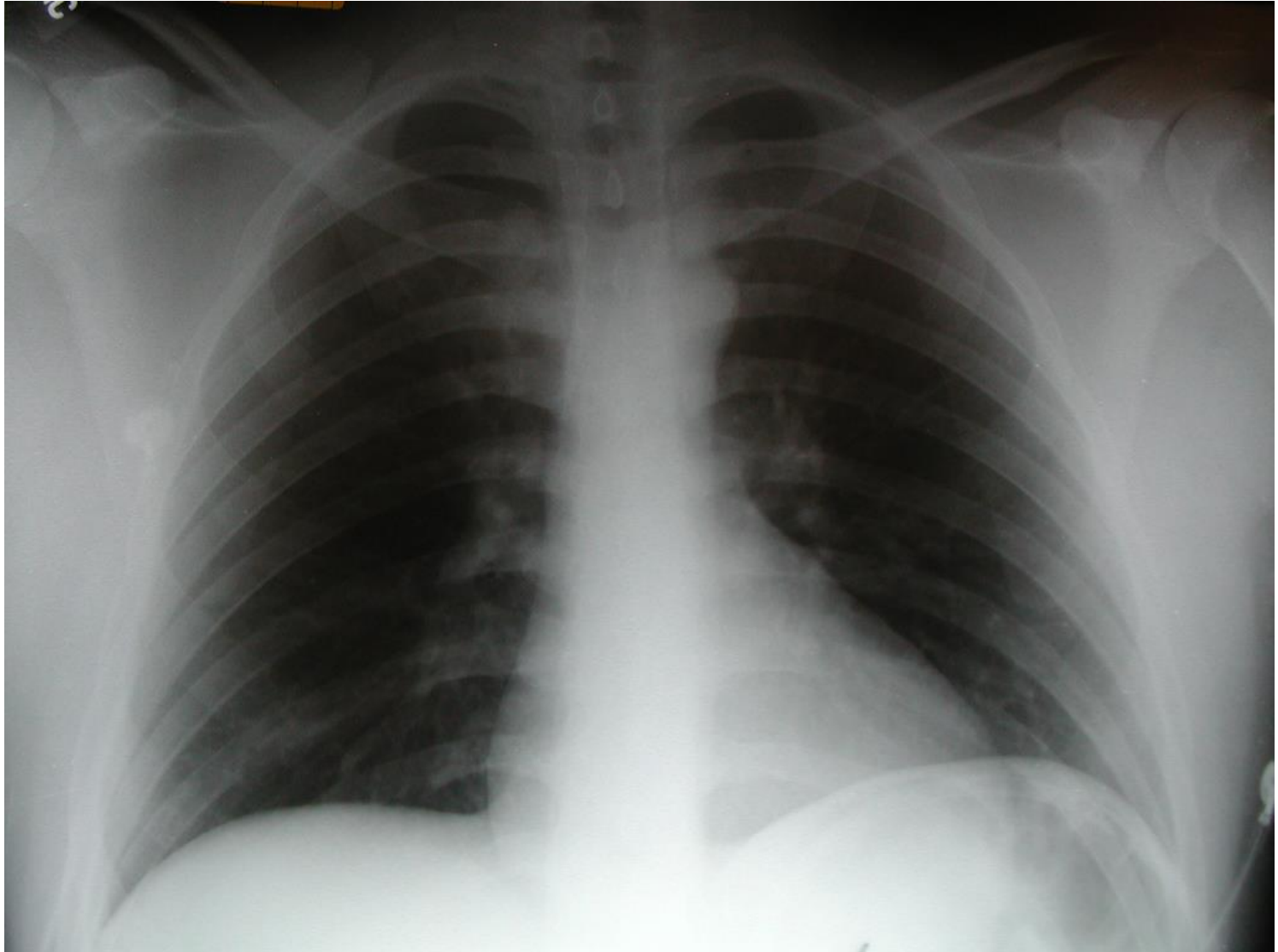
joint type	composed (discus articularis), spheroid (ball-and-socket), limited movements
head	facies articularis sternalis claviculae
fossa	incisura clavicularis sterni (of manubrium sterni)
articular capsule and its ligaments	lig. sternoclaviculare anterius et posterius, lig. interclaviculare, lig. costoclaviculare
movements	tri-axial, very limited in all directions
neutral position	arm freely hanging along the body (= basic position)
note	clavicle is larger than superior margin of manubrium sterni → enlarges incisura jugularis <i>very firm joint → during limb axis impacts is clavicle more prone to fracture</i>

Articulatio sternoclavicularis



Netter, Atlas of Clinical Anatomy

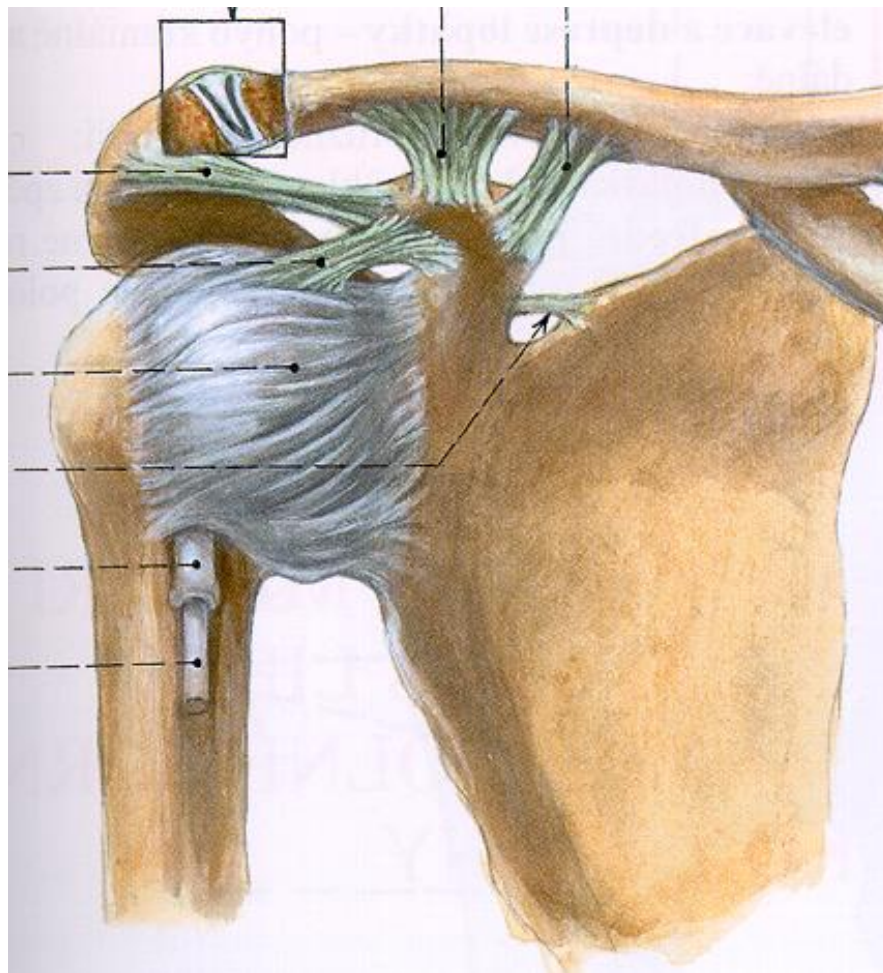
Dislocation in art. sternoclavicularis dx.



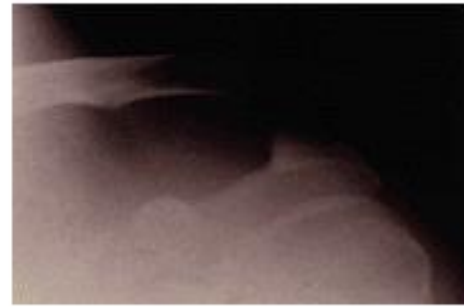
Articulatio acromioclavicularis

joint type	simple or compound (discus articularis in 50%), plane, amphiarthrosis
head	facies articularis acromialis claviculae
fossa	facies articularis clavicularis acromii
articular capsule and its ligaments	lig. acromioclaviculare (above); extracapsular – lig. coracoclaviculare (anterior portion: lig. trapezoideum, posterior portion: lig. conoideum)
movements	tri-axial, very limited in all directions
neutral position	arm freely hanging along the body (= basic position)
note	<i>joint prone to injury in direct blow to shoulder – classification after Tossy (depending on ligament's injury) – distorsion, subluxation (rupture of LAC, rupture of LCC), luxation (ruptures of both ligaments)</i>

Articulatio acromioclavicularis



Dislocation of articulatio acromioclavicularis



Netter, Atlas of Clinical Anatomy

Subluxation of art. acromioclavicularis Tossy/Rockwood II

Se:68094
m:2



Basic movements of shoulder

- neutral position:
 - arm freely, deflected 30° ventrally from frontal plane
- retraction
- protraction
- elevation
- depression
- rotation

Joints of free upper limb

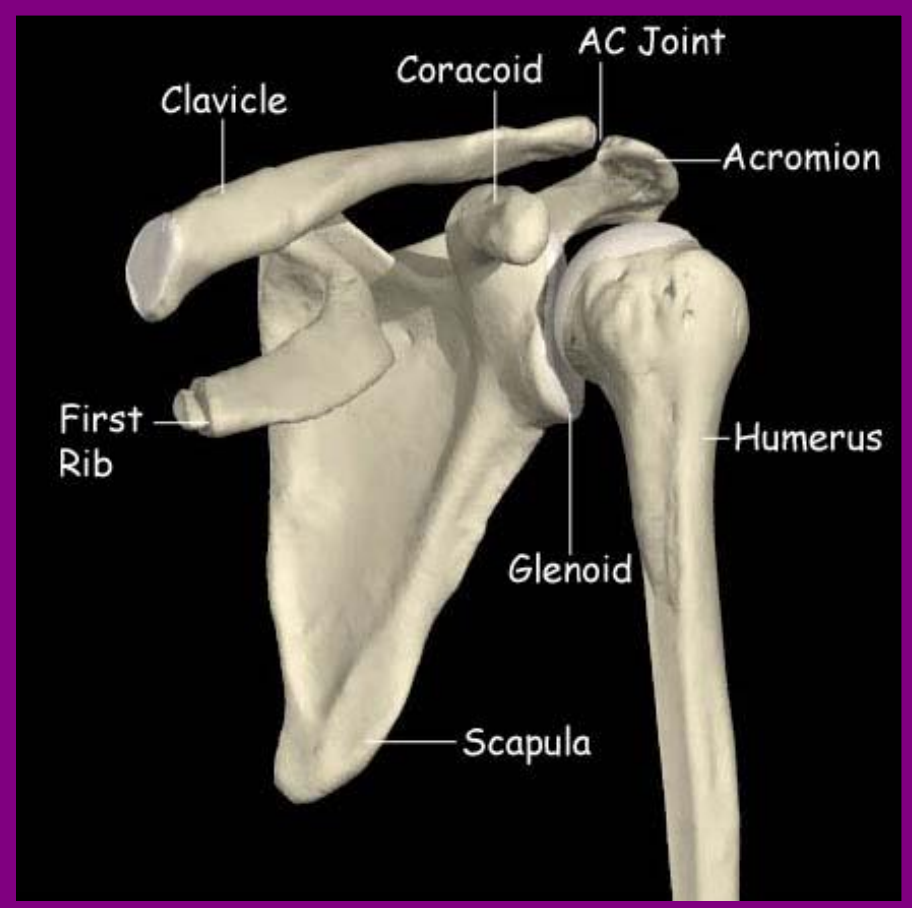
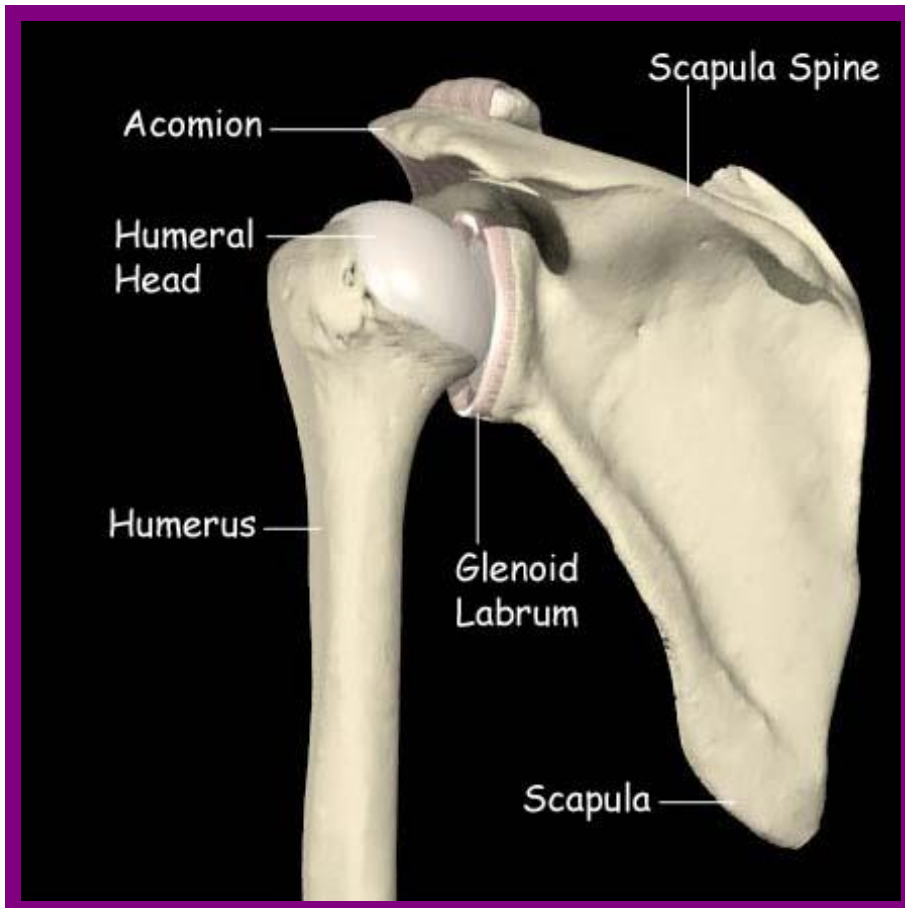
Juncturae membri superioris liberi

- articulationes (joints)
 - articulatio humeri s. glenohumeralis (shoulder joint)
 - articulatio cubiti (elbow joint)
 - art. humeroulnaris (humero-ulnar joint)
 - art. humeroradialis (humeroradial joint)
 - art. radioulnaris proximalis (proximal radio-ulnar joint)
 - articulatio radioulnaris distalis (distal joint)
 - articulationes manus (hand joints)
 - art. radiocarpalis (wrist joint)
 - articulationes intercarpales
 - art. mediocarpalis
 - art. carpometacarpales
 - articulationes intermetacarpales
 - articulationes metacarpophalangeae
 - articulationes interphalangeae manus
- syndesmosis radioulnaris (radio-ulnar syndesmosis)
 - membrana interossea antebrachii (antebrachial interssoeous membrane)
 - chorda obliqua

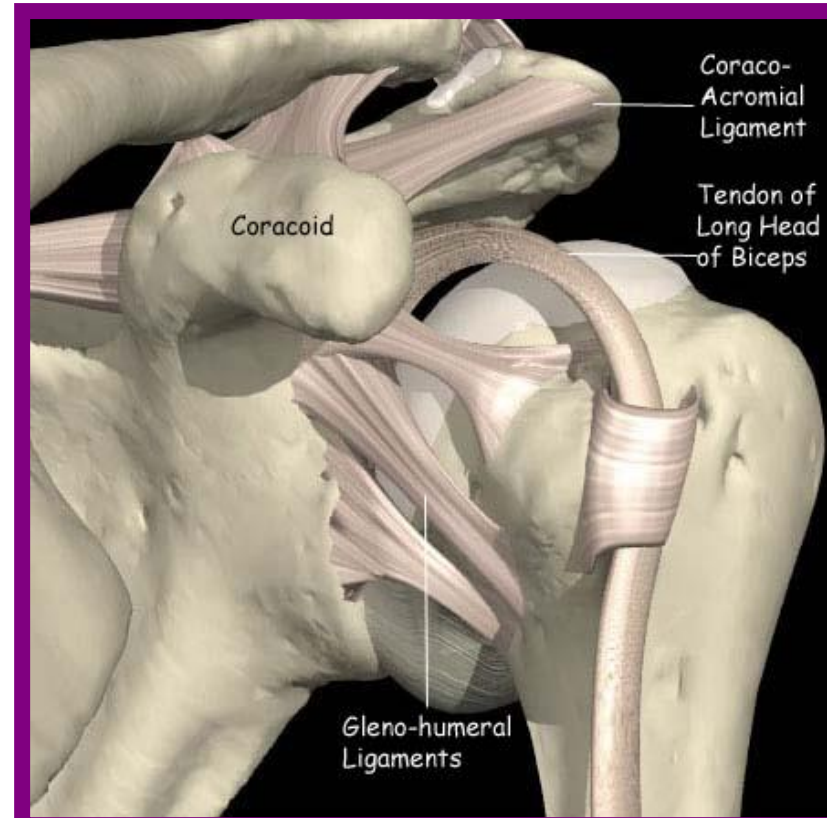
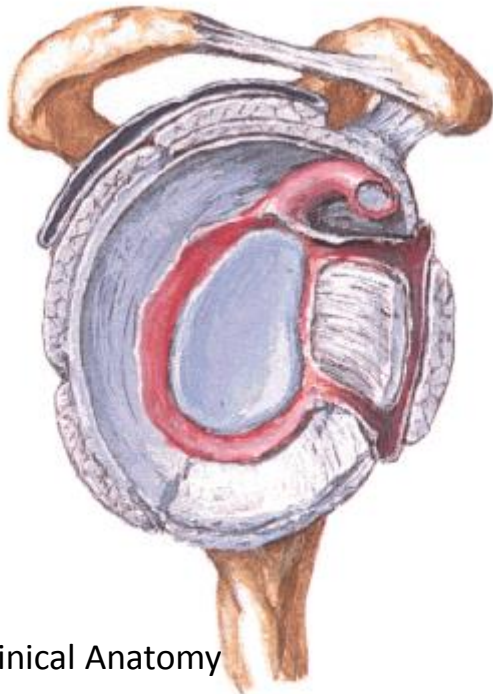
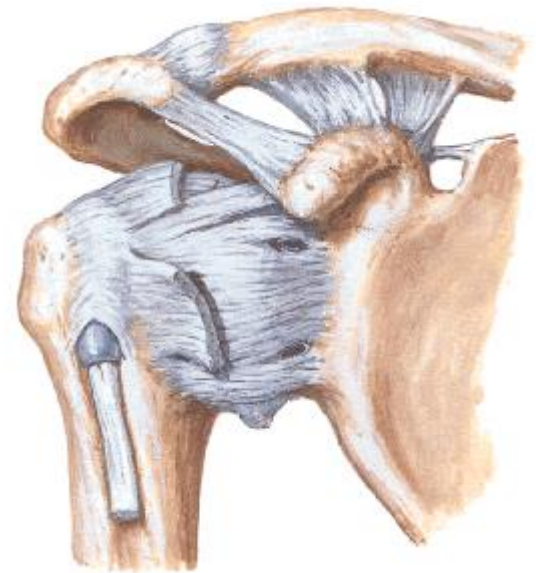
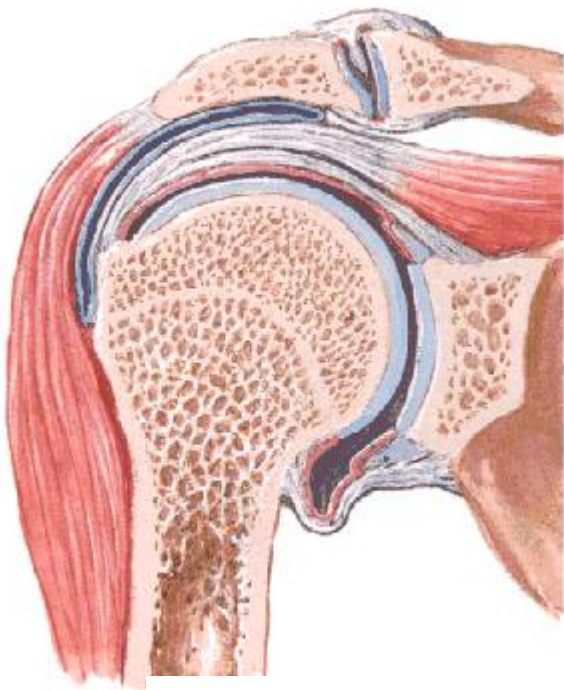
Articulatio humeri (Art. glenohumeralis) – Shoulder joint

joint type	simple, spheroid (ball-and-socket), mobile
head	caput humeri
fossa	cavitas glenoidalis scapulae (+ labrum glenoidale)
articular capsule and its ligaments	<p>collum scapulae – collum anatomicum humeri</p> <p>exception in attachment of articular capsule: capsule pouch → vagina synovialis intertubercularis into sulcus intertubercularis</p> <p>- looser and folded in inferior margin (recessus axillaris)</p> <p>ligg. glenohumeralia (sup., medium, inf.) – weakened spot between superior and middle ligg. = foramen Weitbrechti)</p> <p>lig. transversum humeri (across sulcus intertubercularis), lig. coracohumerale, tendons of rotator cuff's muscles</p> <p><i>capsule weakened ventrally and distally → easy luxation</i></p>
special structures	<p>inside articular capsule: labrum glenoidale, tendo capitis longi musculi bicipitis brachii</p> <p>outside bursae synoviales (8): e.g. bursa subacromialis, subdeltoidea, subcoracoidea</p>
movements	flexion-extension (=dorsal flexion), abduction (90°)-adduction (+hyperdduction), internal-external rotation (45°), circumduction
neutral position	mild flexion + abduction 45°
note	<p>rotator cuff composed of 4 muscles' insertional tendons (m. supraspinatus, m. infraspinatus, m. teres minor, m. subscapularis)</p> <p>CD (capitodiaphyseal) angle = 130°</p> <p>the most mobile joint in the body</p>

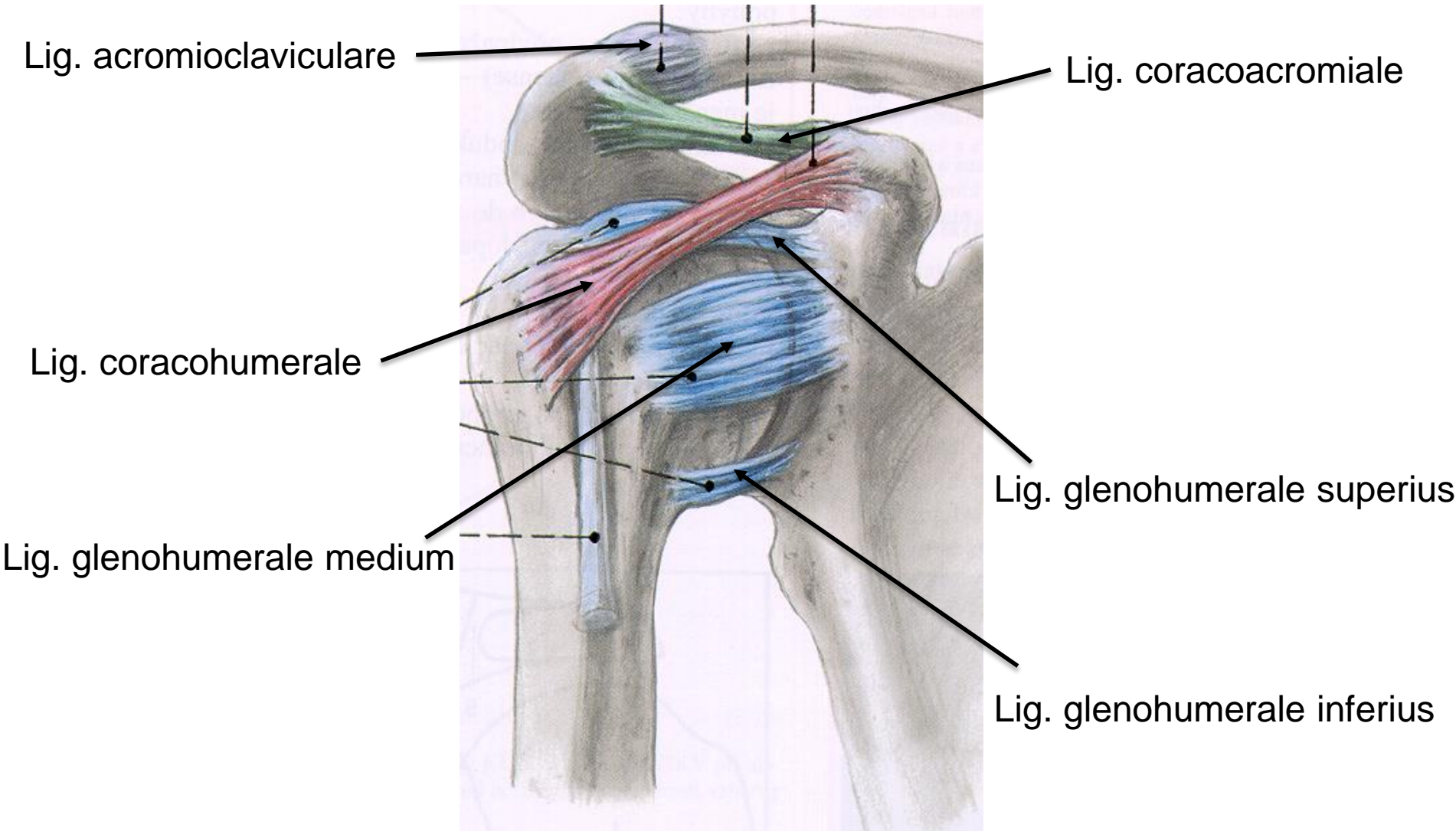
Articulatio humeri = Glenohumeral / shoulder joint



Articulatio humeri

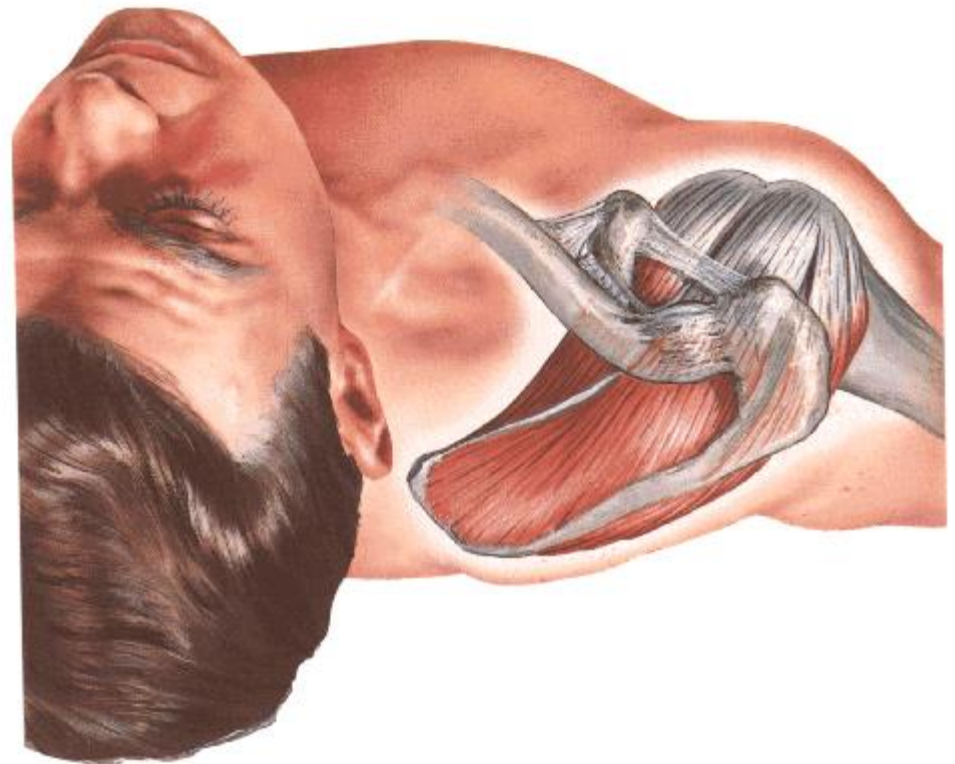


Ligaments of shoulder joint



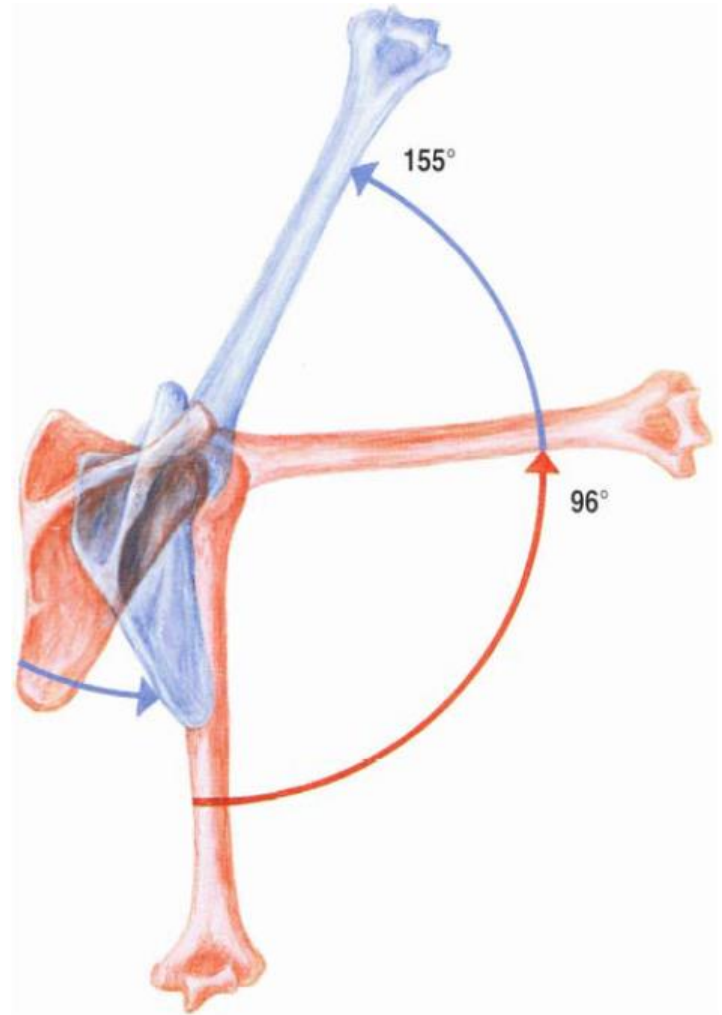
Rotator cuff

- *complex of muscles and their tendons*
- *protects and fixes shoulder joint against subluxation*
 - m. supraspinatus
 - m. infraspinatus
 - m. teres minor
 - m. subscapularis



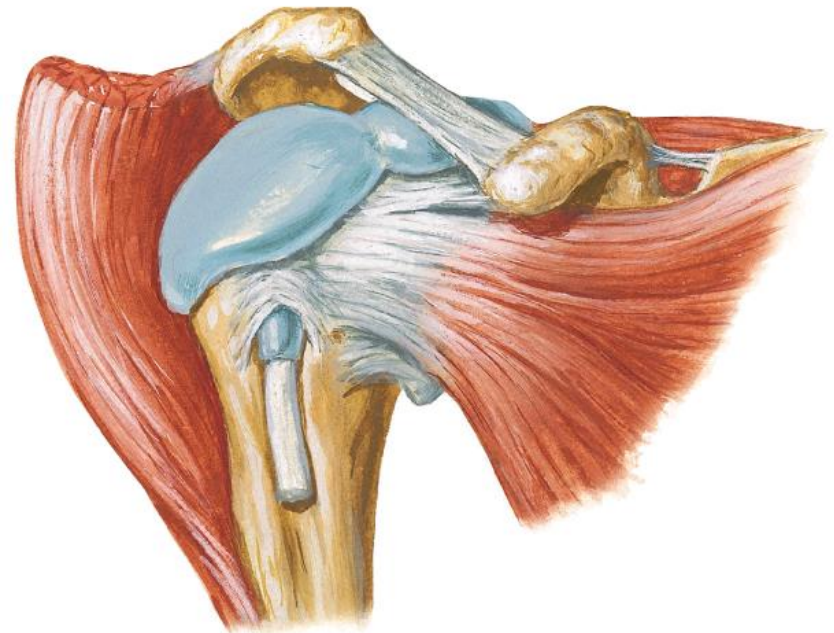
Stability and movements's extent in shoulder joint

- static
 - labrum glenoidale
 - capsula articularis
 - ligaments
- dynamic
 - rotator cuff
 - caput longum musculi bicipitis brachii
 - m. deltoideus



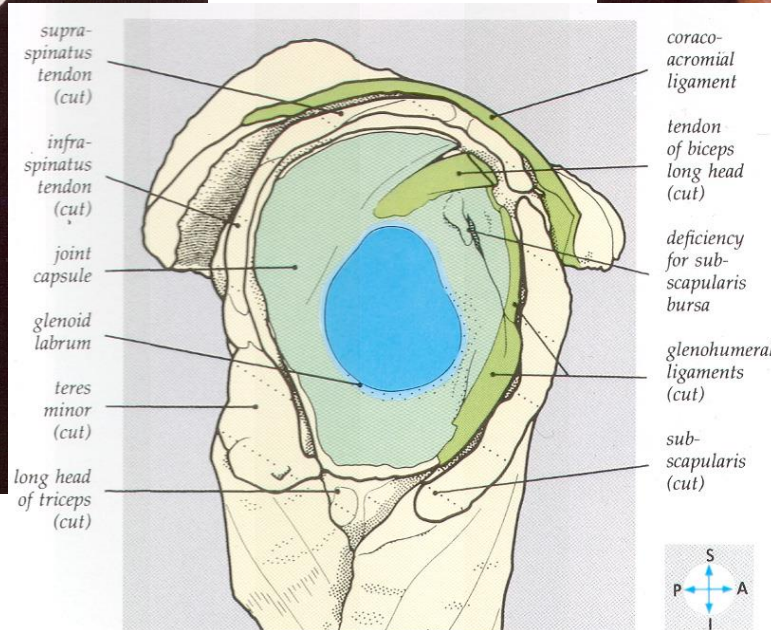
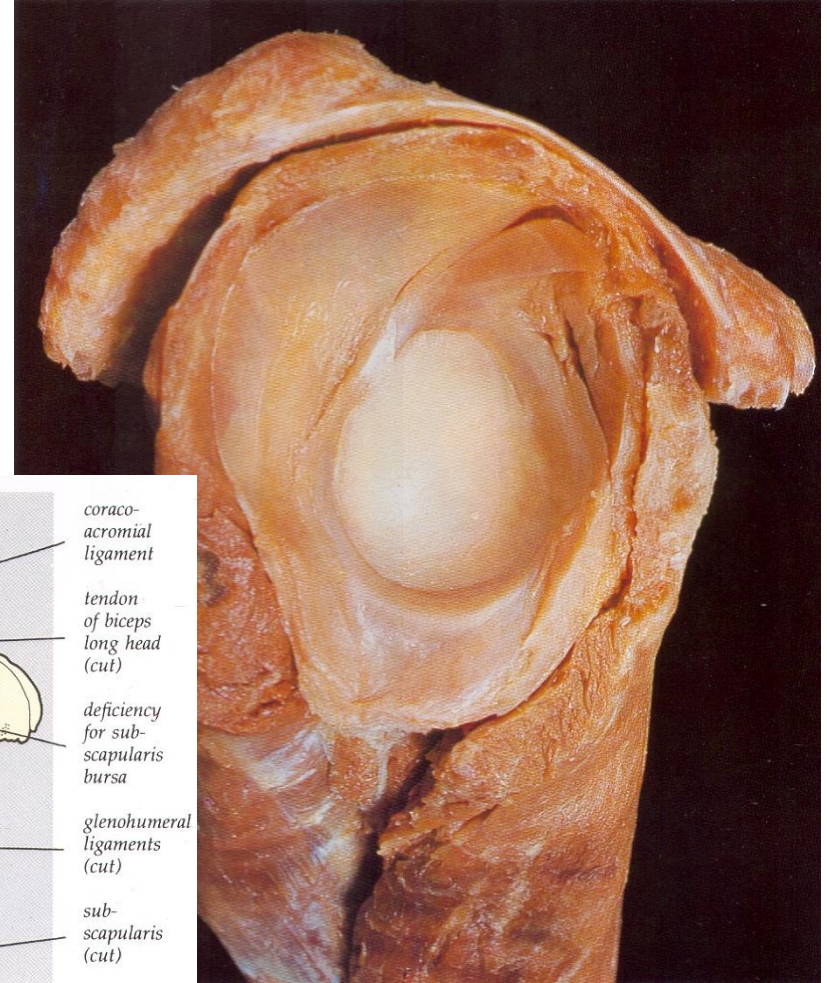
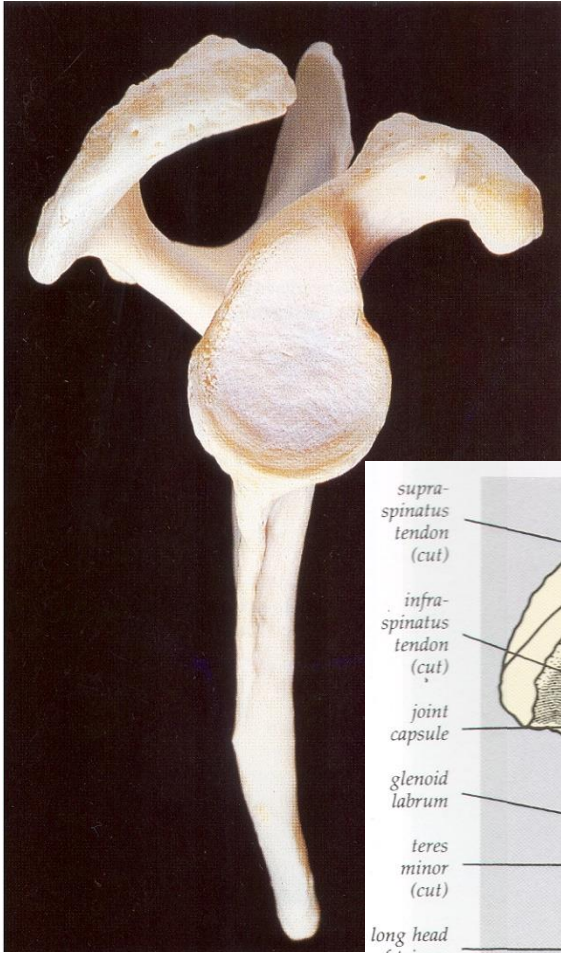
Bursae synoviales of shoulder joint

- bursa subtendinea musculi subscapularis
- bursa subcoracoidea
- bursa subacromialis
- bursa subdeltoidea
- bursa subtendinea musculi infraspinati
- bursa subtendinea musculi teretis majoris

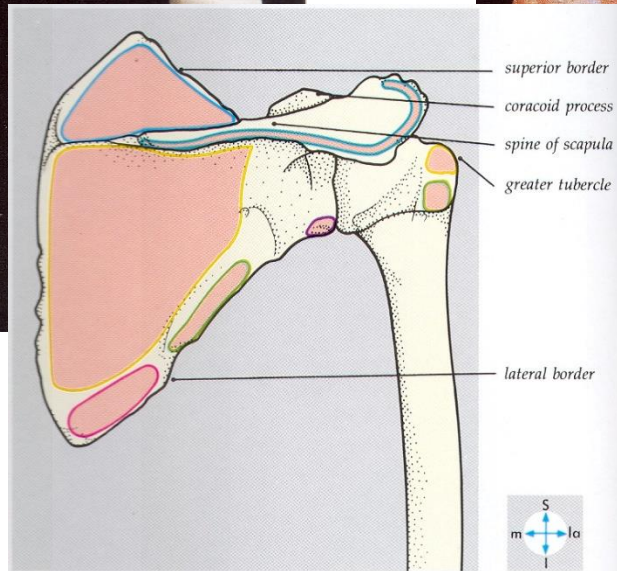
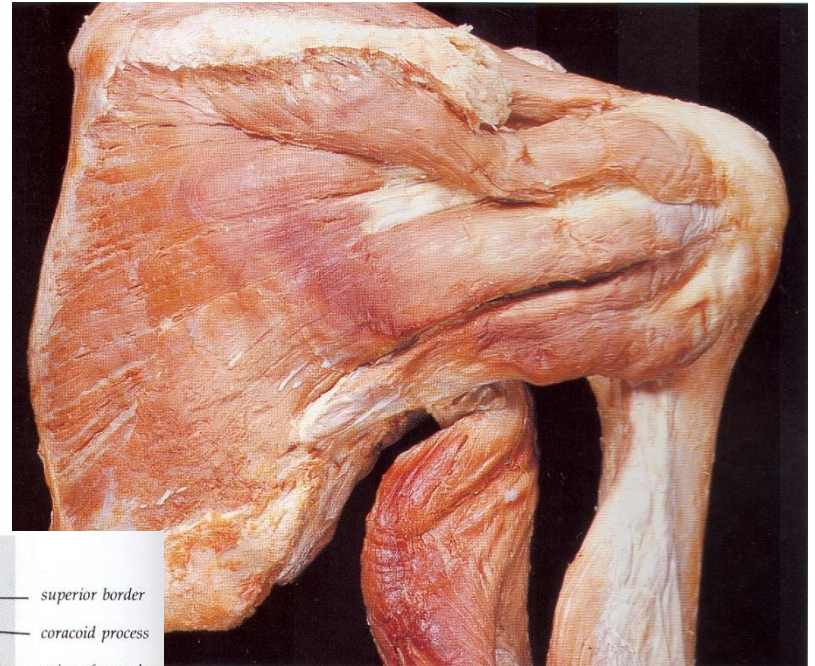
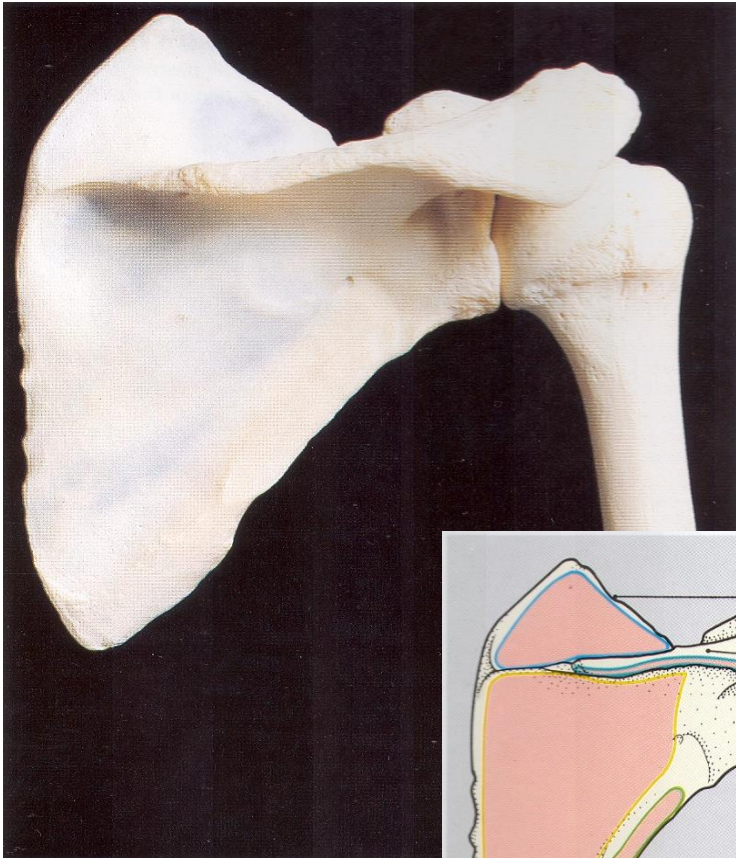


Netter, Atlas of Clinical Anatomy

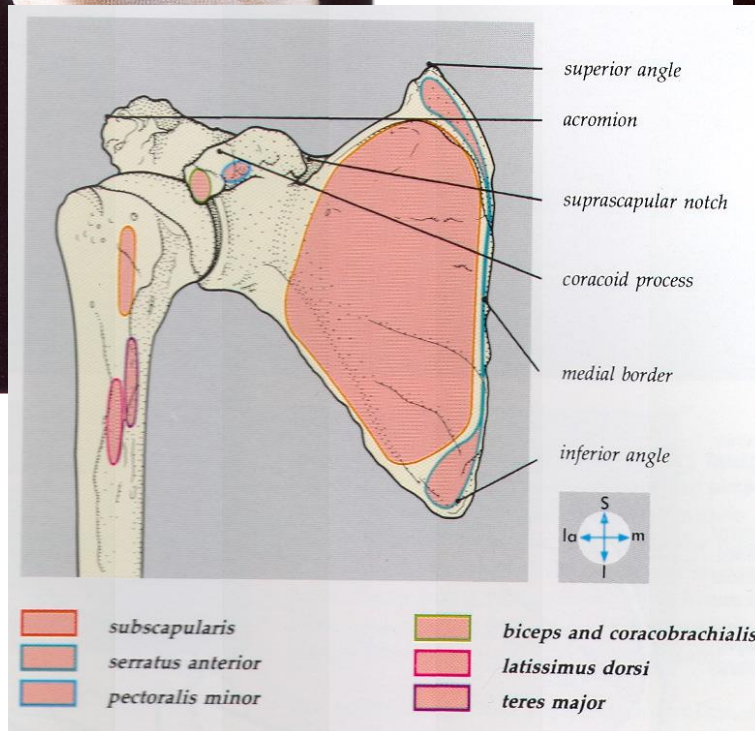
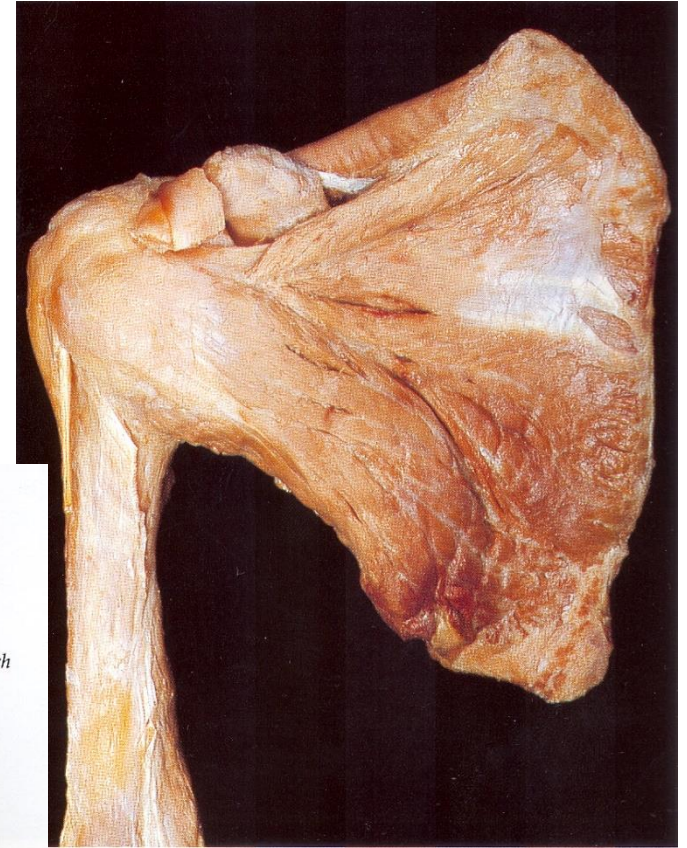
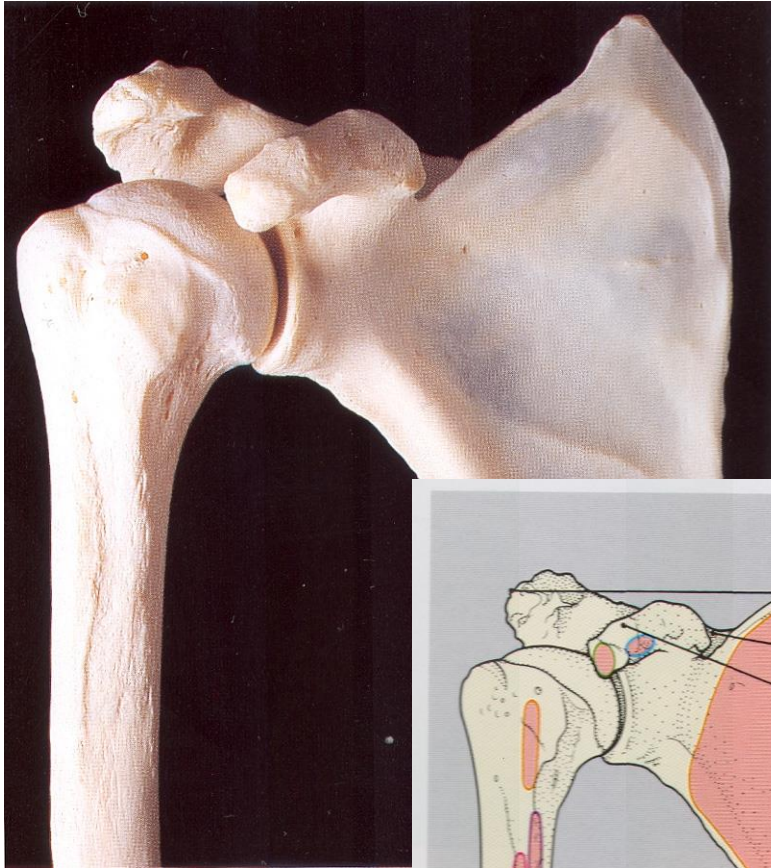
Shoulder – lateral view



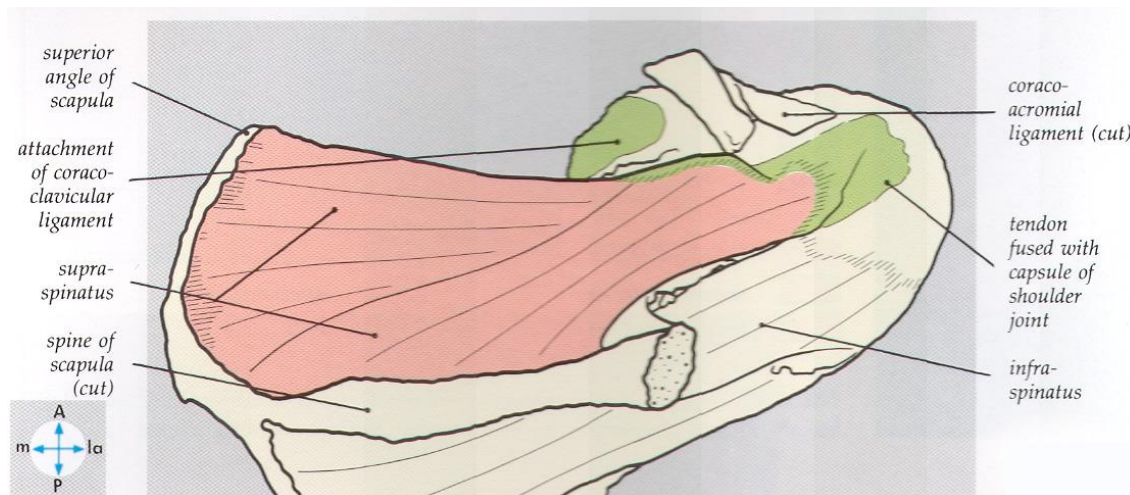
Periarticular muscles – posterior view



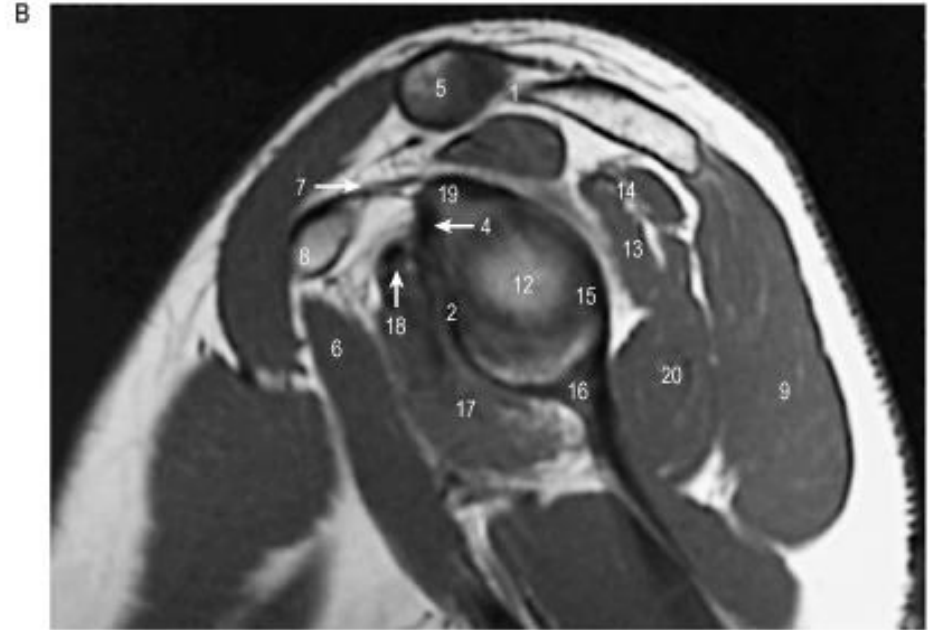
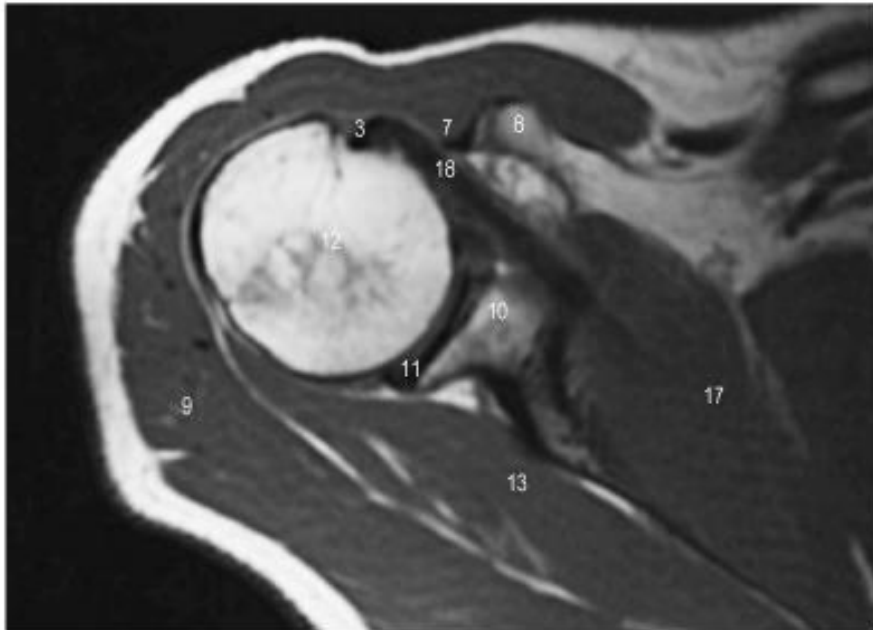
Periarticular muscles – anterior view



Periarticular muscles – superior view



Shoulder - MRI

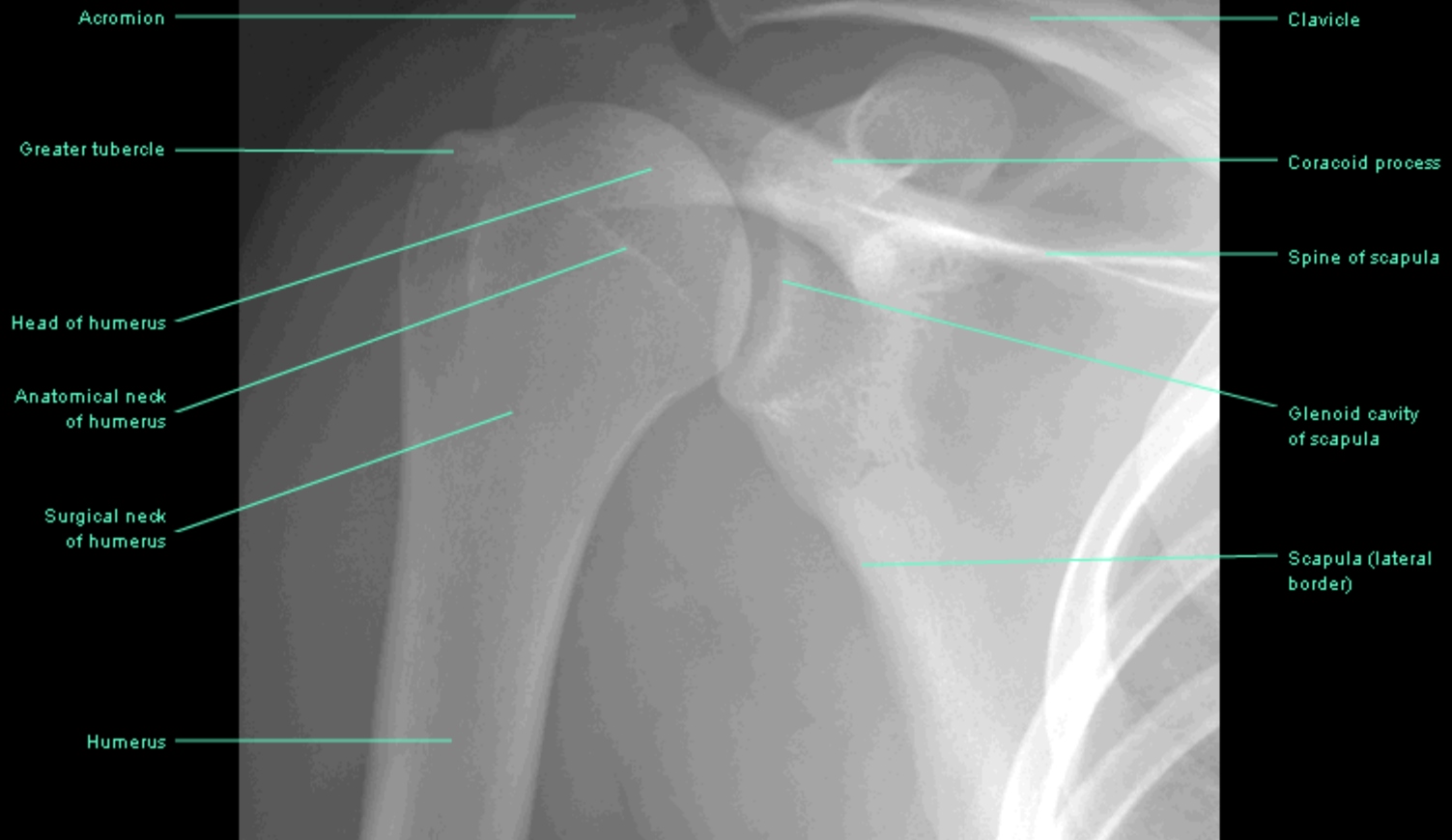


1. Acromioclavicular joint. 2. Anterior labrum. 3. Biceps brachii tendon. 4. Biceps brachii tendon – long head. 5. Clavicle. 6. Coracobrachialis muscle. 7. Coracohumeral ligament. 8. Coracoid process. 9. Deltoid muscle. 10. Glenoid. 11. Glenoid labrum. 12. Head of humerus. 13. Infraspinatus muscle. 14. Infraspinatus tendon. 15. Posterior labrum. 16. Scapula. 17. Subscapularis muscle. 18. Subscapularis tendon. 19. Superior labrum. 20. Teres minor muscle.

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Figure 49.19 MRI of shoulder. A, Axial image. B, Sagittal oblique section. (By permission from Weir J, Abrahams PH 2003 Imaging Atlas of Human Anatomy, 3rd edn, London: Mosby, and contributions from Anna-Maria Belli, Margaret Hourihan, Nail Moore and Philip Owen.)

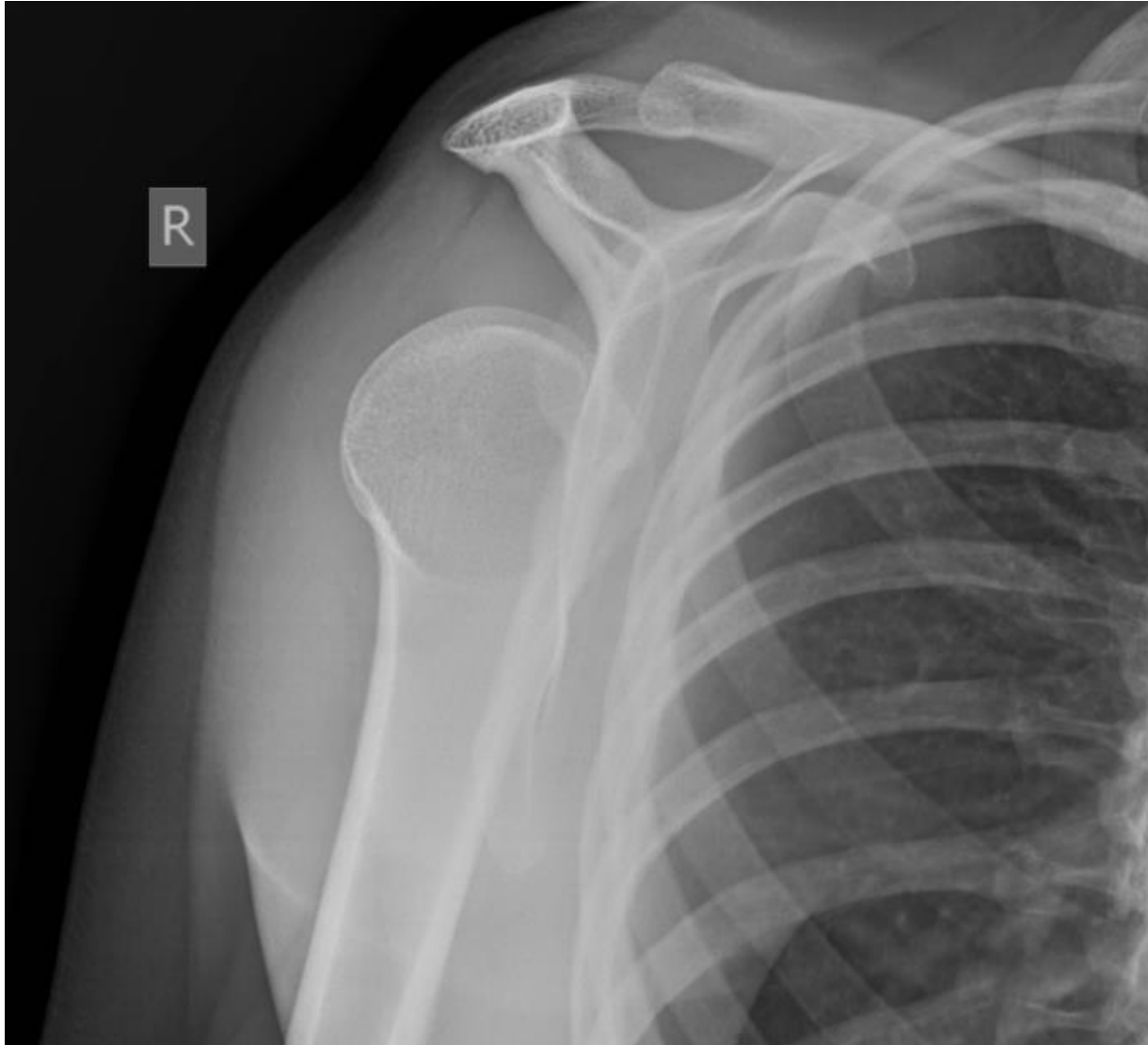




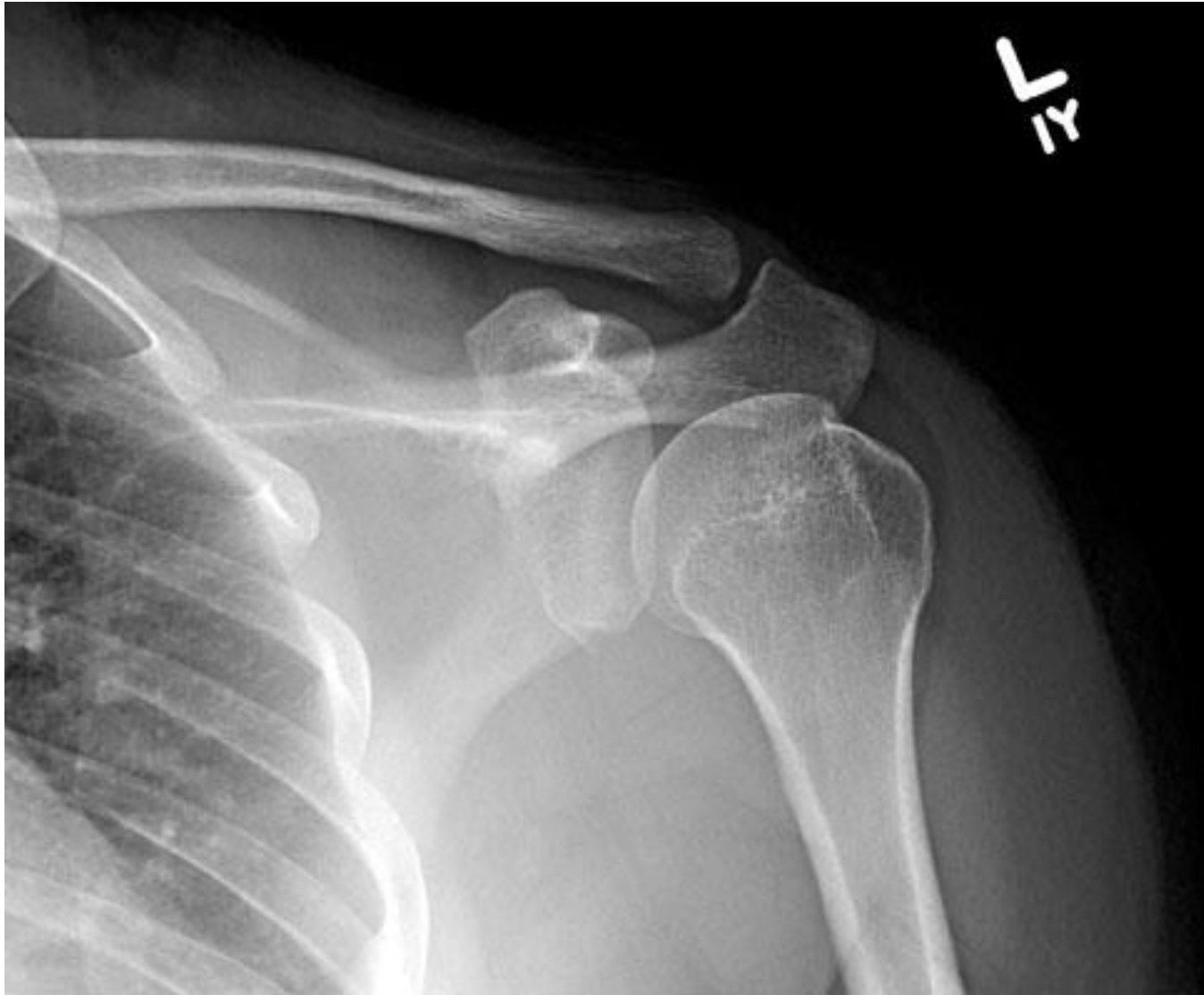
X-ray: Y projection of shoulder joint



Posterior dislocation of shoulder joint



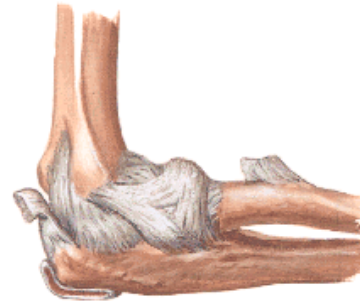
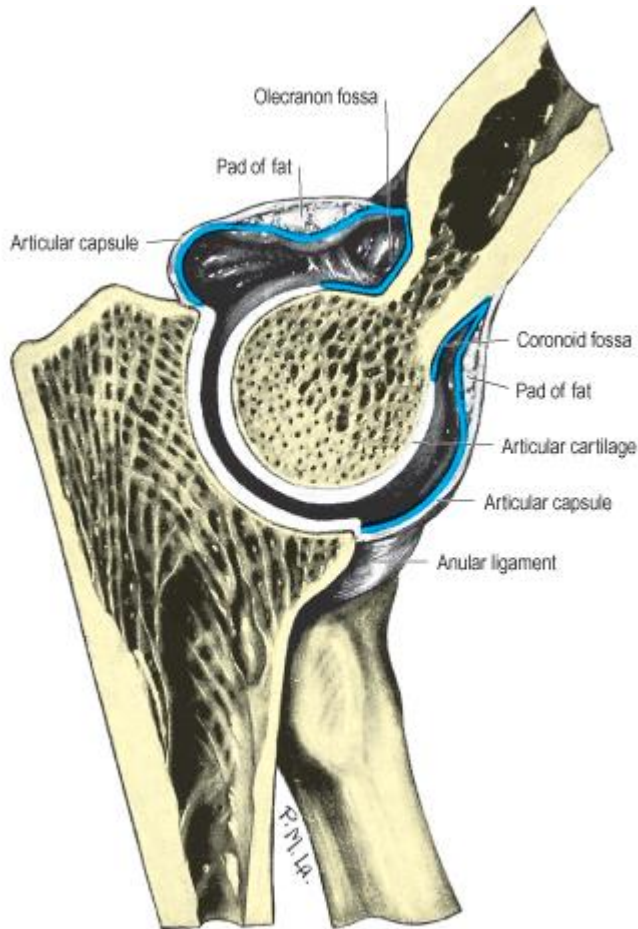
Complicated anterior luxation of shoulder joint



Articulatio cubiti (Elbow joint)

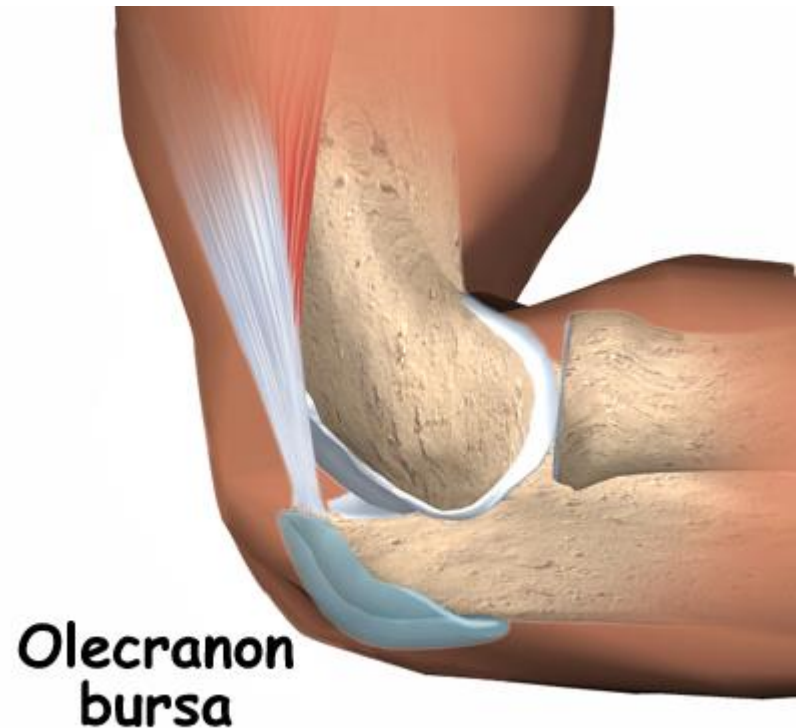
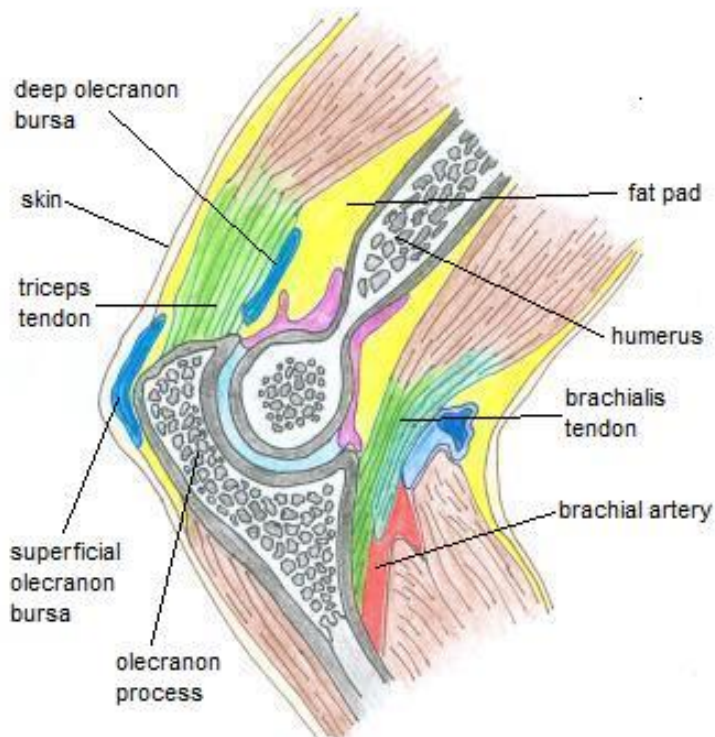
joint type	<p>compound (3 bones), bi-axial</p> <p>a) art. humeroulnaris (trochlear)</p> <p>b) art. humeroradialis (spheroid)</p> <p>c) art. radioulnaris proximalis (pivot)</p>
head	<p>a) trochlea humeri</p> <p>b) capitulum humeri</p> <p>c) circumferentia articularis radii</p>
fossa	<p>a) incisura trochlearis ulnae</p> <p>b) fovea articularis radii</p> <p>c) incisura radialis ulnae</p>
articular capsule and its ligaments	<p>condylus humeri (epicondyli outside the capsule, serving for muscle origins)</p> <p>ulna: along the articular surfaces; radius: recessus sacciformis</p> <p>lig. collaterale radiale et ulnare (3 parts: lig. humerocoronoideum, olecranohumerale, obliquum Cooperi)</p> <p>lig. anulare radii, lig. quadratum (forms the floor of recessus sacciformis)</p>
special structures	<p>musculi articulares (m. anconaeus)</p> <p>corpus adiposum intraarticulare</p> <p>bursa subcutanea olecrani, bursa subtendinea musculi tricipitis brachii</p>
movements	<p>flexion-extension, pronation-supination (= radius crosses over ulna, interconnected with movements in art. radioulnaris distalis)</p>
neutral position	<p>flexion and mild pronation</p>
note	<p>potential hyperextension in small olecranon or present foramen supratrochleare</p>

Articulatio cubiti

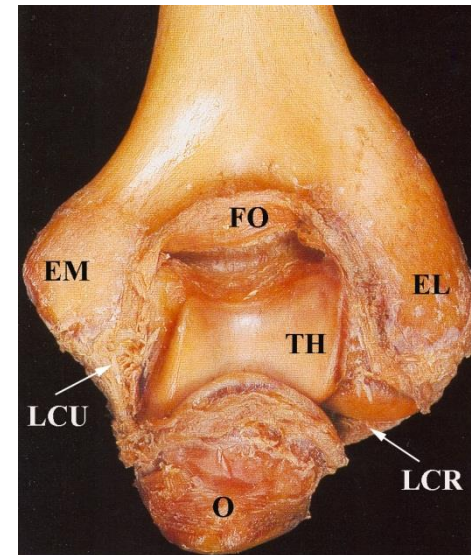
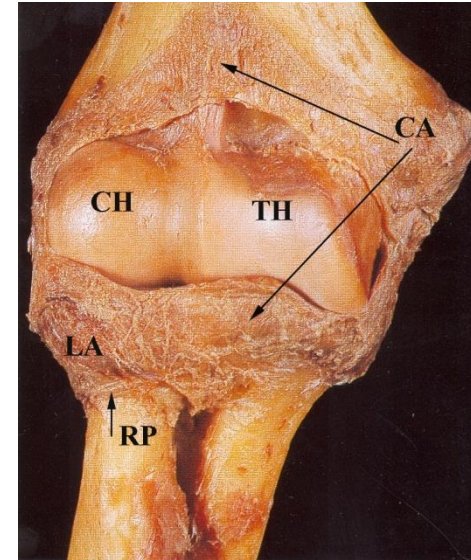
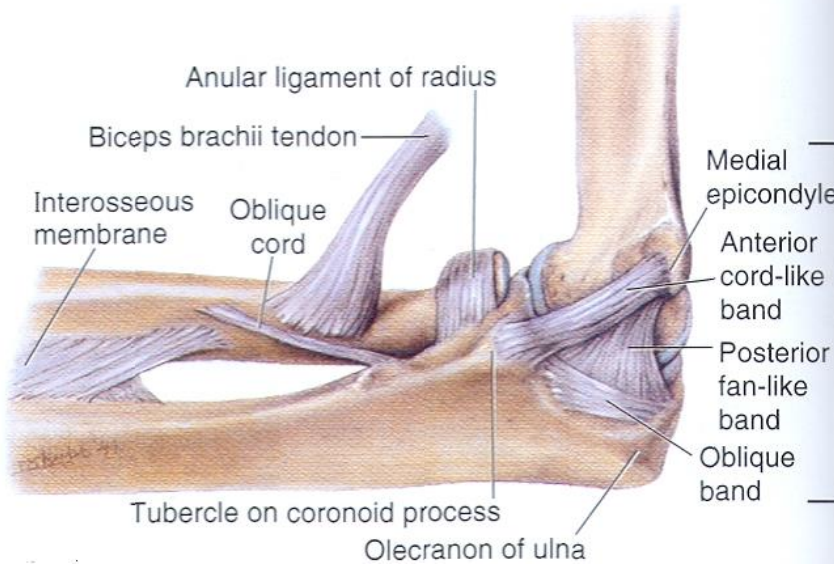
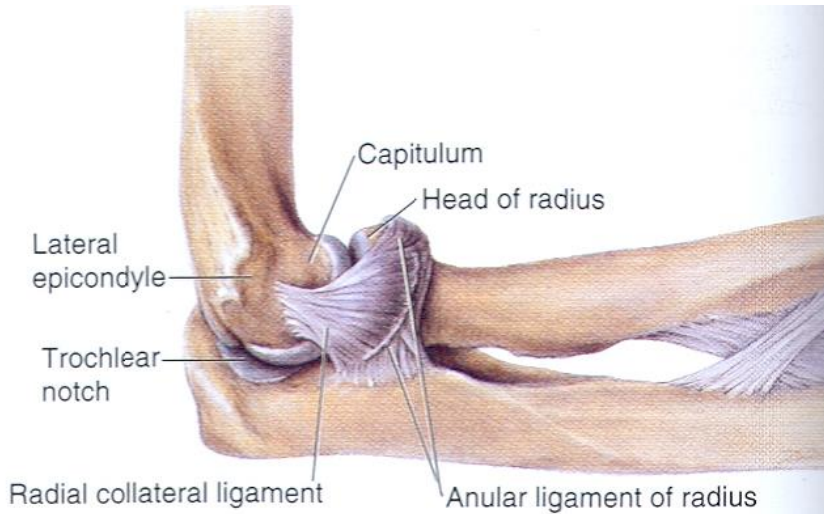


Bursae synoviales of elbow joint

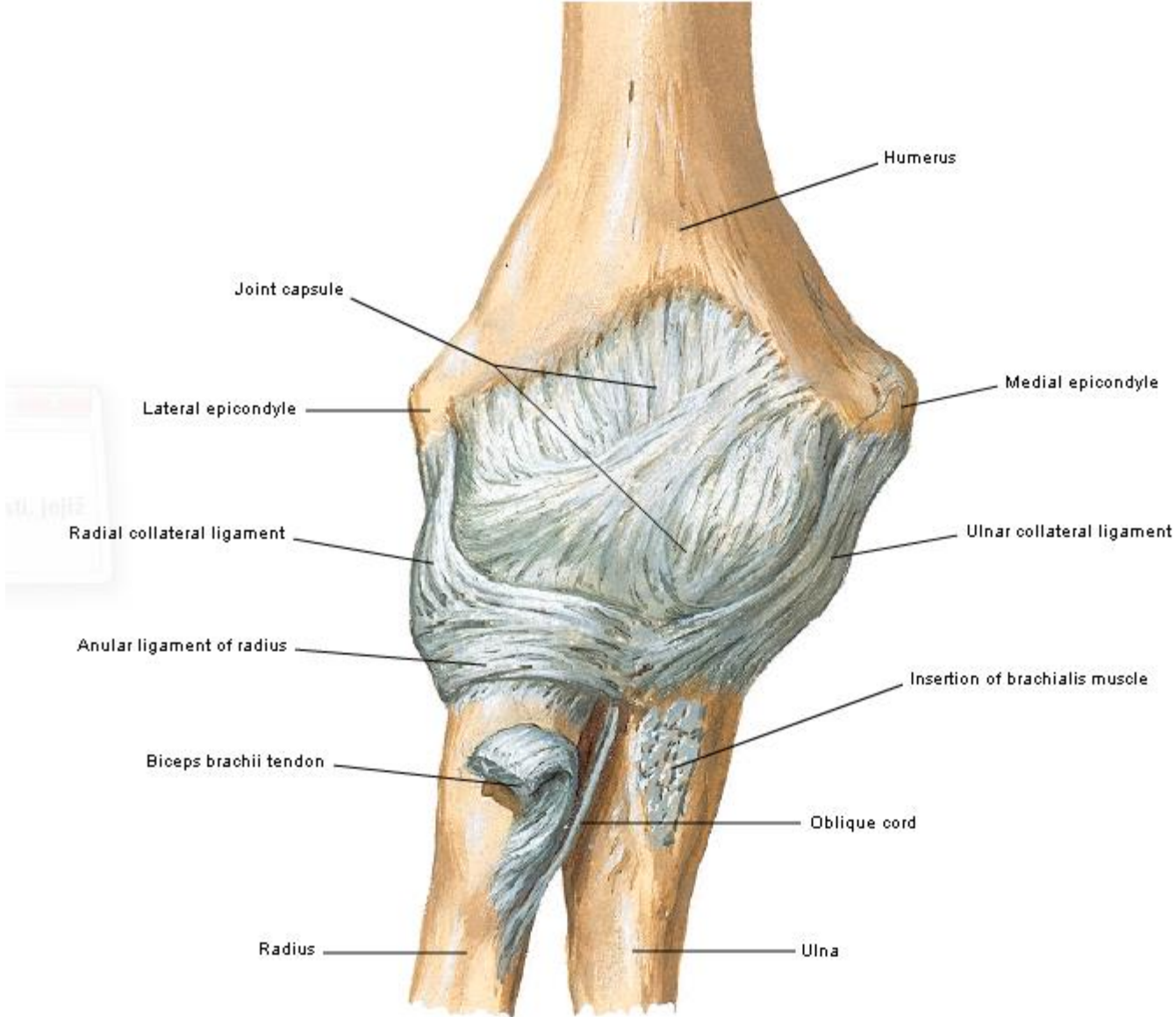
- **bursa subcutanea olecrani**
- bursa intratendinea olecrani
- **bursa subtendinea muscui tricipitis brachii**
- bursa bicipitoradialis
- bursa cubitalis interossea



Elbow joint = Articulatio cubiti



Elbow joint = Articulatio cubiti



Elbow joint = Articulatio cubiti



Elbow joint = Articulatio cubiti



X-ray of elbow joint

- postero-anterior projection



- lateral projection



posterior luxation
of elbow joint



divergent luxation
of elbow joint





Syndesmosis radioulnaris

- membrana interossea antebrachii
- chorda obliqua
- openings for a. interossea anterior + its accompanying veins



Articulatio radioulnaris distalis

joint type	simple, mobile, pivot
head	circumferentia articularis ulnae
fossa	incisura ulnaris radii
articular capsule and its ligaments	recessus sacciformis
movements	pronation-supination (= radius crosses over ulna, interconnected with movements in art. radioulnaris proximalis)
neutral position	mild pronation
note	works only together with s art. radioulnaris proximalis

Articulatio radioulnaris distalis



http://www.wheelsonline.com/ortho/distal_radial_ulnar_joint

Luxation of art. radioulnaris distalis

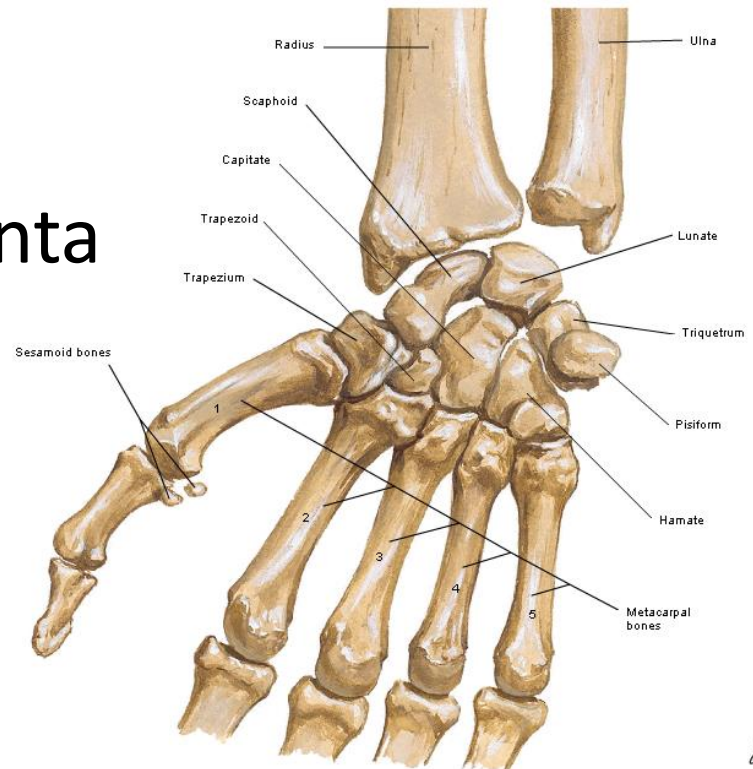


Articulatio radiocarpalis (Wrist joint)

joint type	compound (4 bones + discus articularis), mobile, ellipsoid
head	os scaphoideum, os lunatum, os triquetrum
fossa	facies articularis carpalis radii + discus articularis
articular capsule and its ligaments	(recessus prestyloideus) lig. radiocarpale palmare et dorsale; lig. ulnocarpale palmare et dorsale; lig. collaterale ulnare et radiale (weak and functionally negligible)
special structures	discus articularis
movements	palmar flexion-extension (= dorsal flexion), radial and ulnar duction (60°), circumduction
neutral position	continuation of forearm axis
note	ulna is not part of the joint!

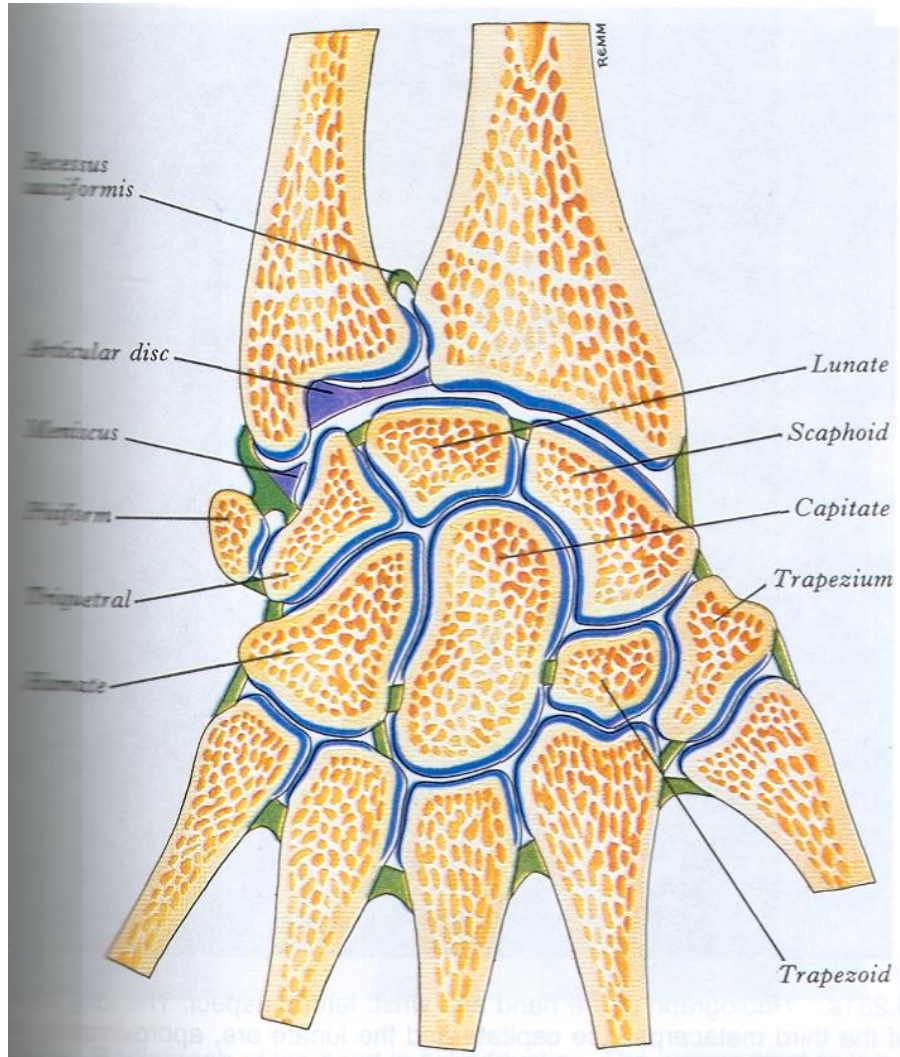
Wrist = functional unit

- compound, functionally ellipsoid
 - art. radiocarpalis
 - art. mediocarpalis (two heads and fossae)
 - artt. intercarpales
 - (art. carpometacarpales)
- discus articularis + ligamenta
- **movements:**
 - palmar and dorsal flexion
 - radial and ulnar duction
 - (circumduction)

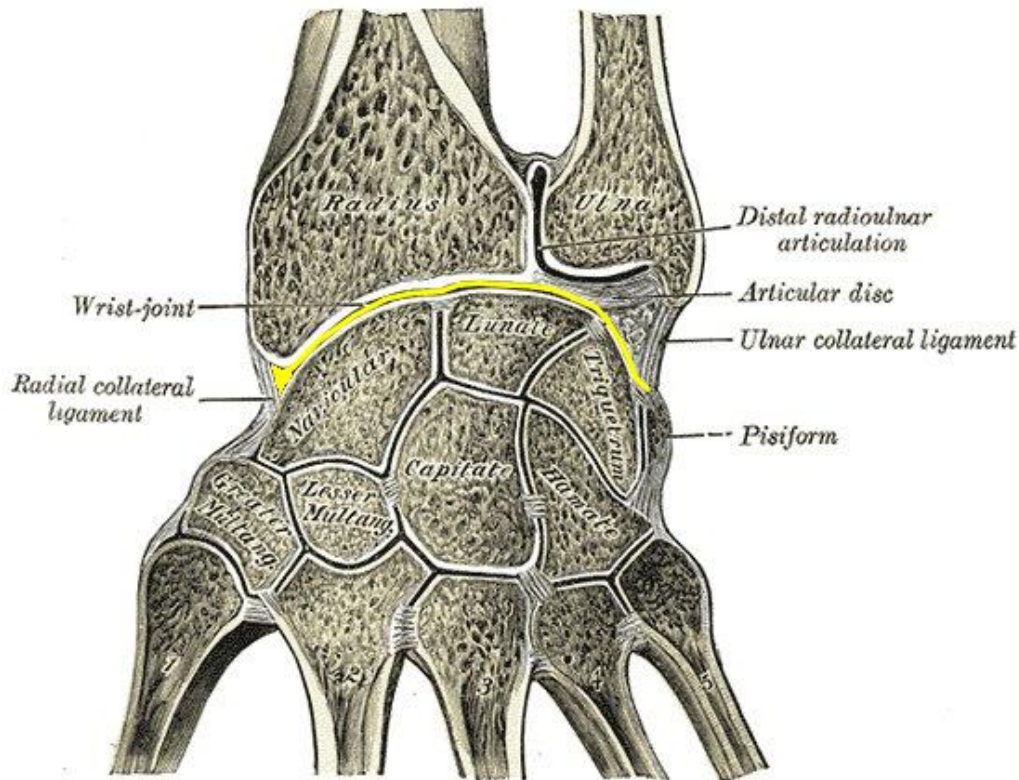


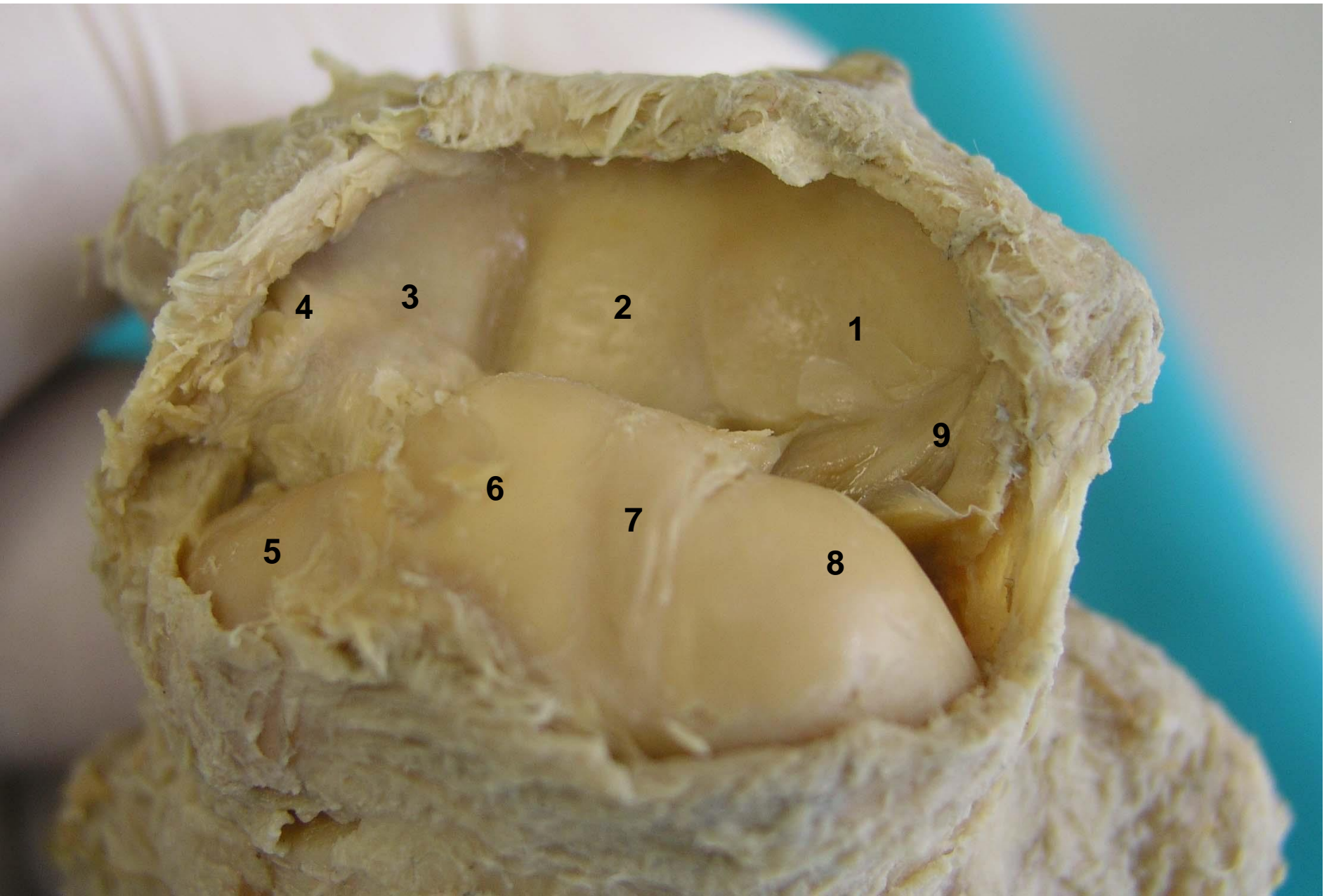
Wrist = functional unit

Articular cavities



Articulatio radiocarpalis

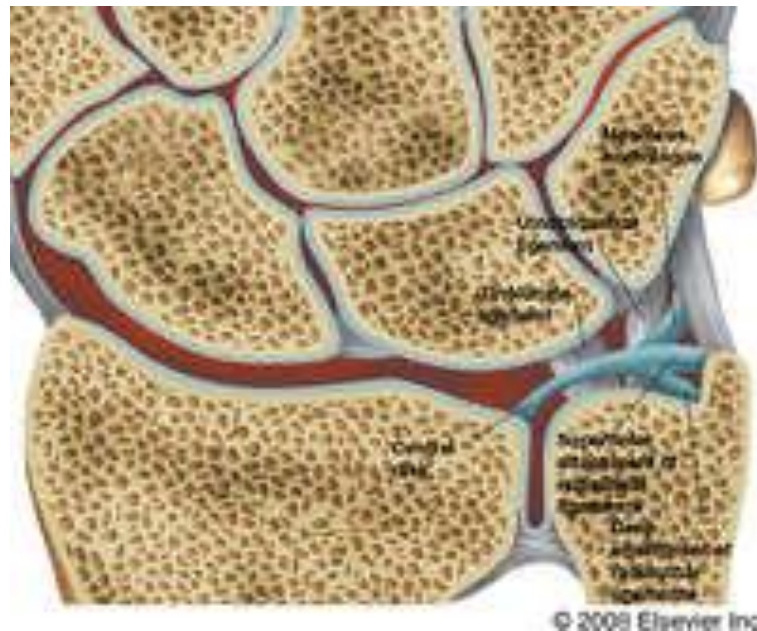




TFCC

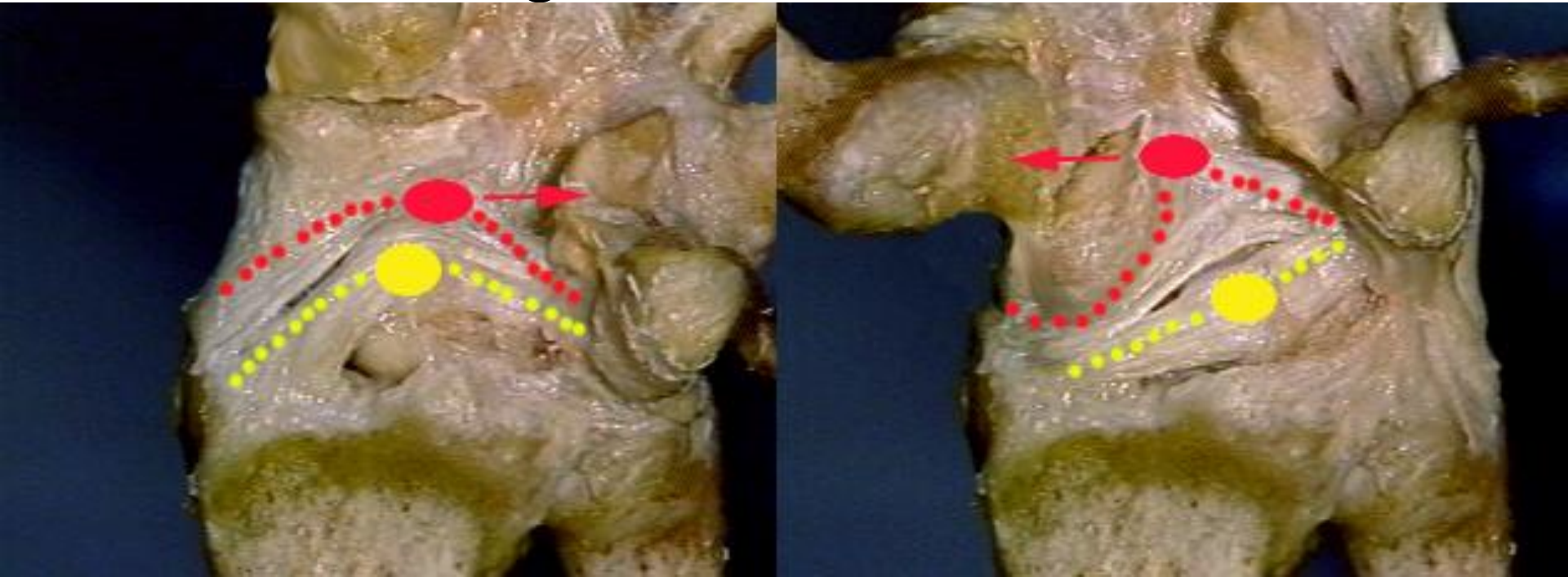
triangular fibrocartilagineous complex

- discus triangularis (lig. subcruentum)
- lig. radioulnare palmare (lig. ulnolunatum et ulnotriquetrum) et dorsale
- meniscus ulnocarpalis
- lig. collaterale carpi ulnare
- (+ vagina tendinis musculi flexoris carpi ulnaris)



Wrist joint - ligaments

- TFCC („triangular fibrocartilagineous complex“)
- discus articularis – triangular shape
- ligaments of articular capsule
 - palmar (“V”), dorsal (“V”), collaterall (weak)
- interosseous ligaments



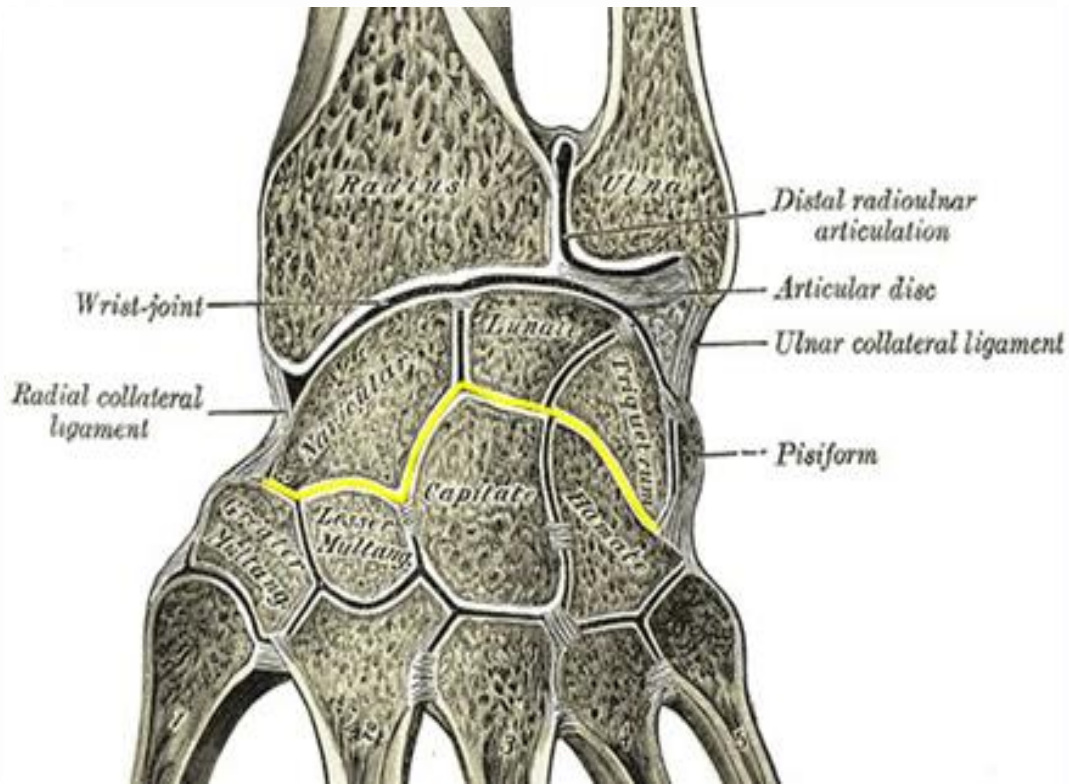
Radiocarpal luxation



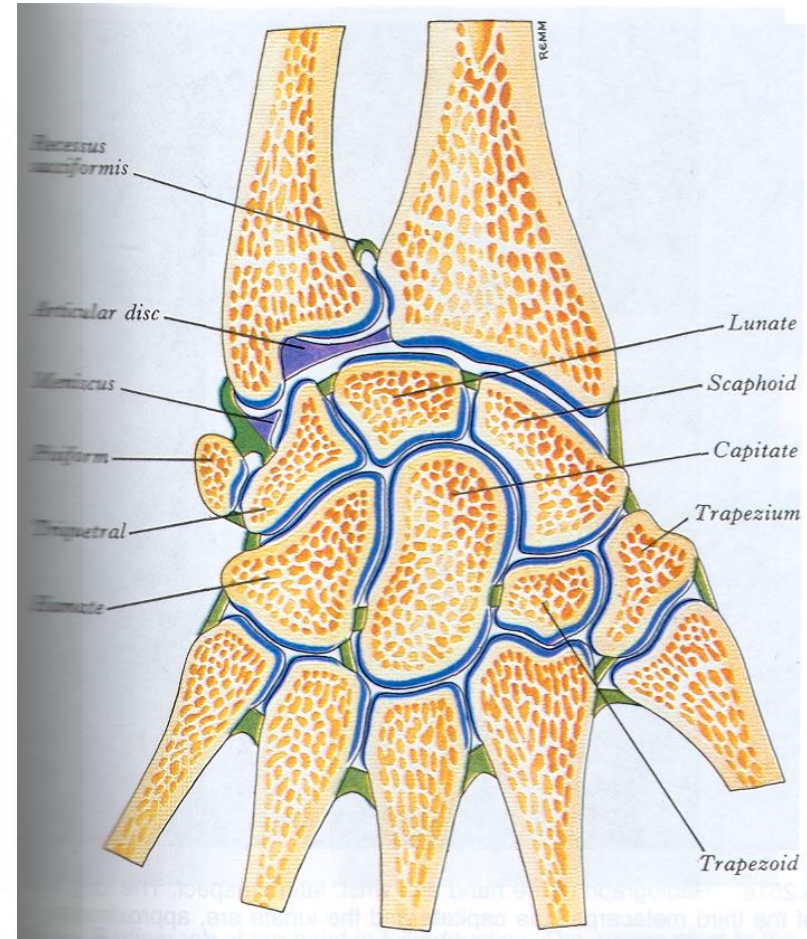
Articulatio mediocarpalis (Mediocarpal joint)

joint type	compound (2 heads and 2 fossae), limited movements
head	a) ulnar: os hamatum, os capitatum (functional center of the joint!) b) radial: os scaphoideum
fossa	a) ulnar: os scaphoideum, os lunatum, os triquetrum b) radial: os trapezium, os trapezoideum
articular capsule and its ligaments	lig. carpi radiatum ligg. intercarpalia dorsalia, palmaria, interossea
movements	minimal in all directions, shifts of all bones around the functional head hand as a whole
neutral position	continuation of forearm axis
note	articular cleft in the shape of letter S, composed of artt. intercarpales between proximal and distal rows of carpal bones

Articulatio mediocarpalis



<http://www.prohealthsys.com/anatomy/grays/arthrology/carpometacarpalarticulations.php>



Gray's anatomy, 37th edition, Churchill Livingstone 1989

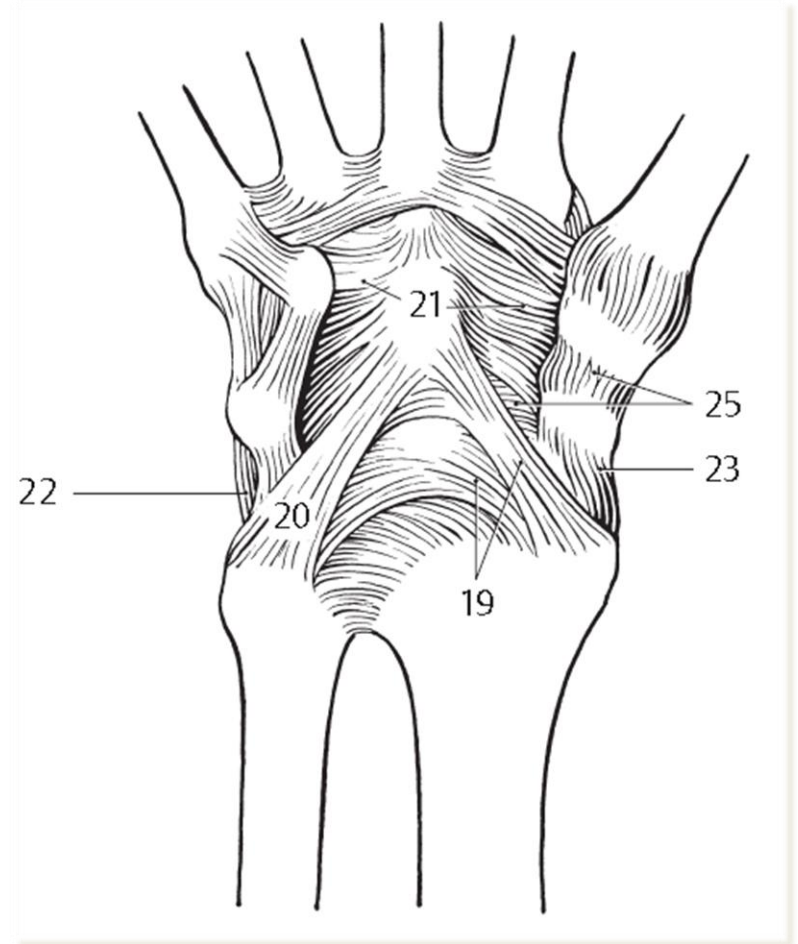
Articulatio carpometacarpalis pollicis

joint type	simple, mobile, saddle
head	basis ossis metacarpi primi
fossa	os trapezium (saddle-shaped surface)
articular capsule and its ligaments	ligg. carpometacarpalia dorsalia, palmaria, interossea
movements	flexion-extension, abduction-adduction, circumduction, opposition-reposition
neutral position	mild flexion and abduction
note	-

Ligamentous apparatus of wrist

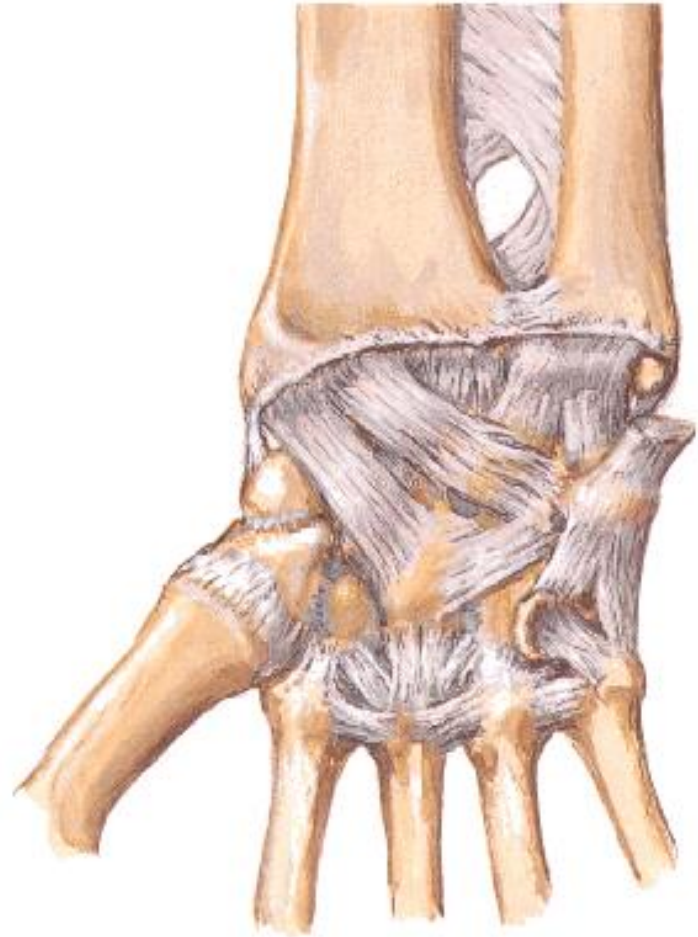
stretching radially across the functional center of wrist = caput ossis capitati

- palmar
 - lig. radiocarpale palmare
 - lig. ulnocarpale palmare
 - lig. carpi radiatum
 - ligg. intercarpalia palmaria
- interosseous
 - ligg. intercarpalia interossea



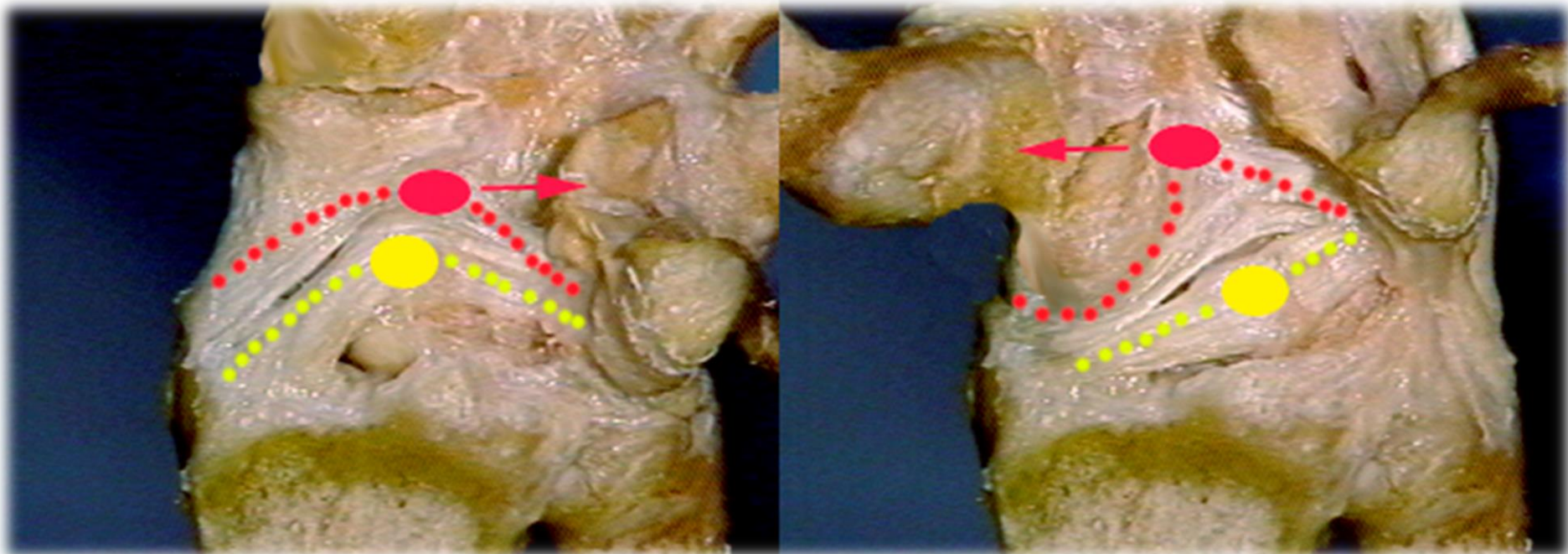
Palmar ligaments of wrist

- complex of lig. radiocarpale palmare
 - lig. radiocapitatum
 - lig. radiotriquetrum (radiolunatriquetrum)
 - lig. radioscapolunatum *Testuti*
- complex of lig. ulnocarpale palmare
 - lig. ulnolunatum
 - lig. ulnotriquetrum
 - lig. capitotriquetrum



Functional arrangement of palmar ligaments of wrist

- **proximal ligamentous „V“ shackle**
 - lig. radiotriquetrum + ulnotriquetrum
- **distal ligamentous „V“ shackle**
 - lig. radiocapitatum + capitatotriquetrum
- *space of Poirier* = locus minoris resistentiae between both shackles
 - here luxation of os lunatum occurs

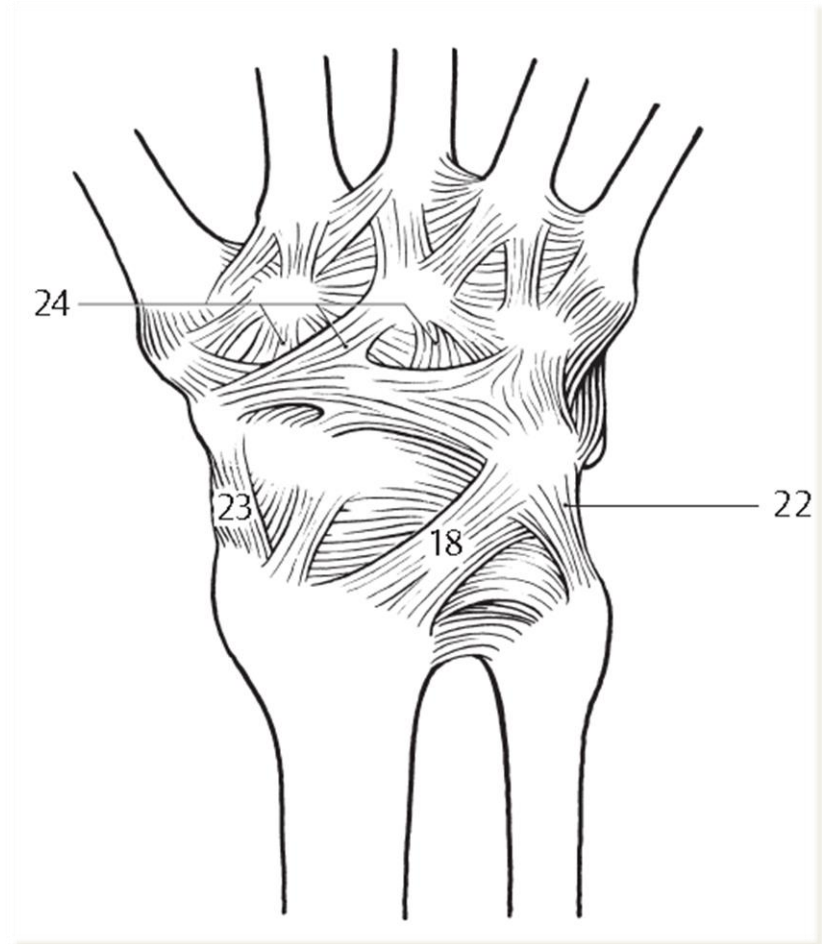


Luxation of os lunatum



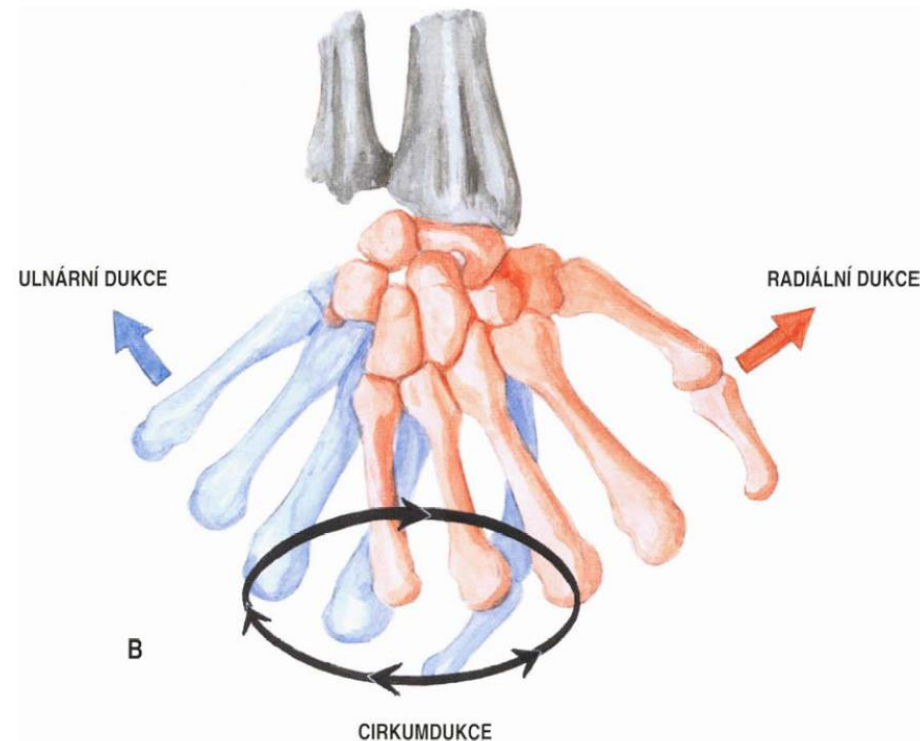
Ligamentous apparatus of wrist

- dorsal
 - lig. radiocarpale dorsale
 - lig. ulnocarpale dorsale
 - ligg. intercarpalia dorsalia
- collateral
 - *weak ligaments*
 - lig. collaterale carpi radiale
 - lig. collaterale carpi ulnare



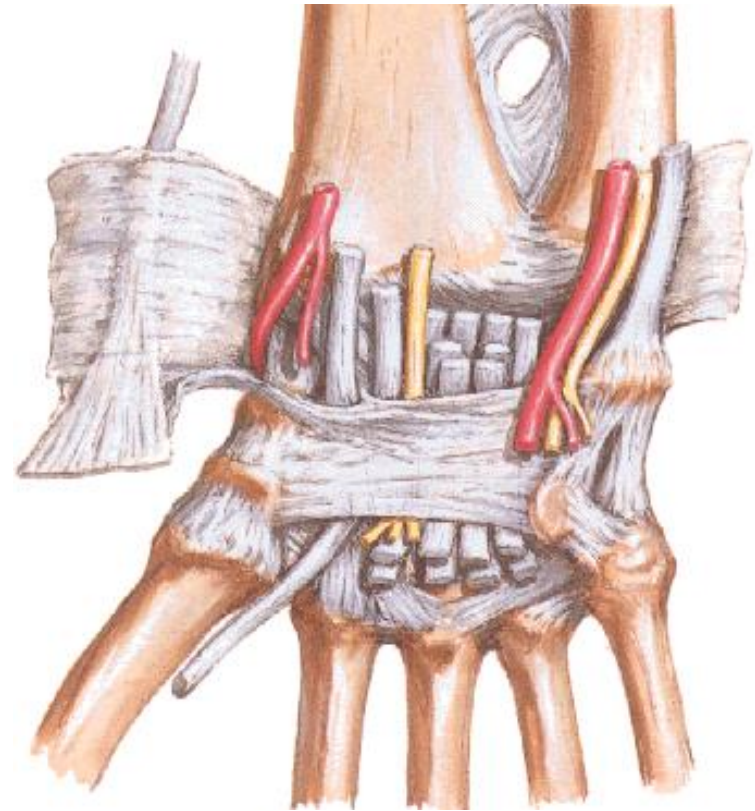
Function of carpal and metacarpal joints

- movements:
 - palmar + dorsal flexion
 - total extent up to 170°, 85° to both sides
 - radial + ulnar duction
 - total extent 60°
 - circumduction
- neutral position
 - in direct continuation of wrist axis



Canalis carpi (Carpal tunnel)

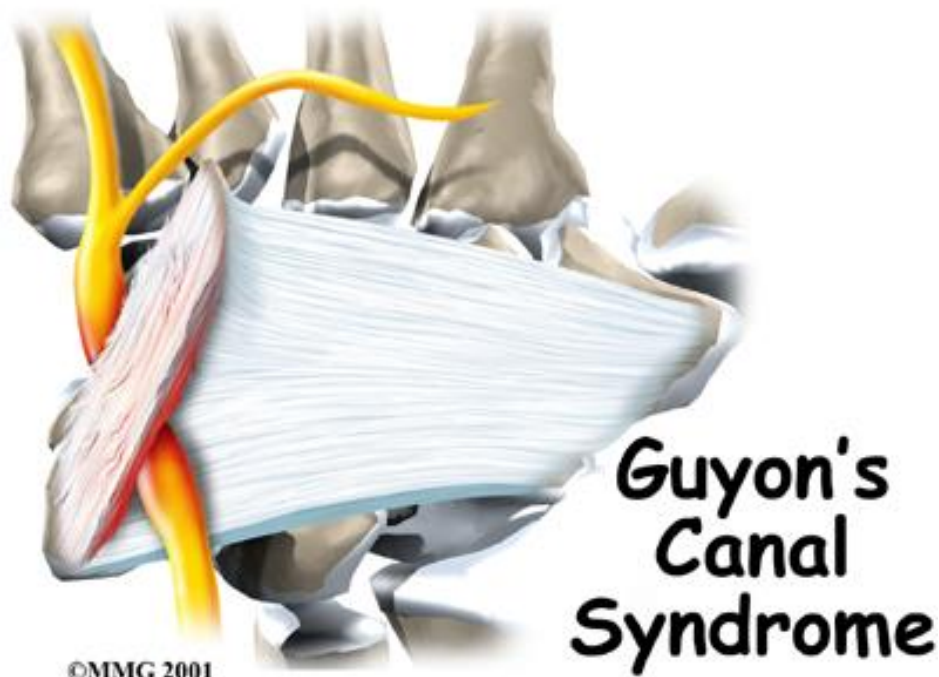
- lig. carpi transversum s. retinaculum musculorum flexorum
 - between eminentia carpi ulnaris et radialis
- contents
 - tendons of flexors
 - n. medianus
- cave: compartment syndrome



Canalis ulnaris

Guyoni

- n. ulnaris
- a. ulnaris
- vv. ulnares



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http://idsportsmed.com/patient_education/11/991123cca7f68f0b6b5904c2cd937724

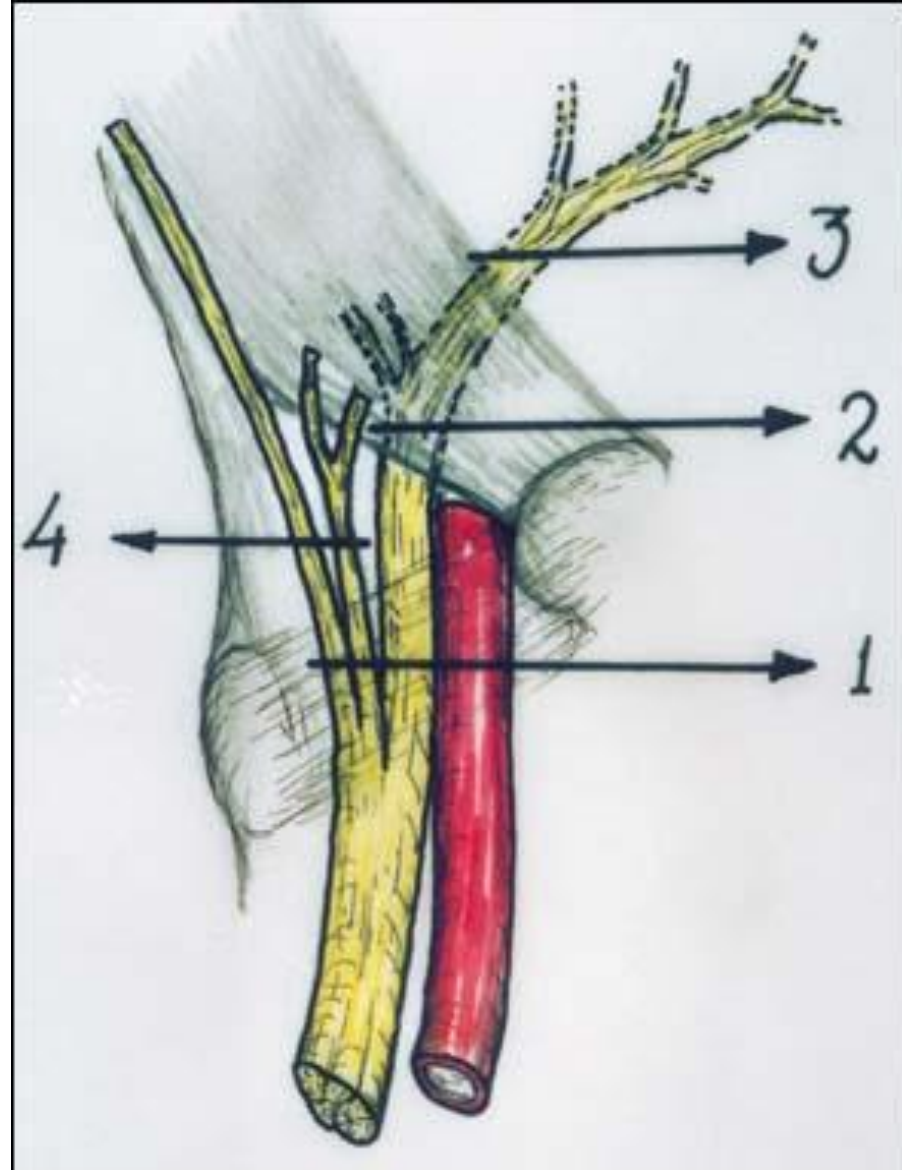


Fig 3. Anatomical drawing demonstrating the main four points for compression of the ulnar branches in the hand (1, palmar carpal ligament; 2, transverse carpal ligament; 3, deep motor ulnar branch; 4, superficial sensory ulnar branch).

http://www.scielo.br/scielo.php?pid=s0004-282x2001000100022&script=sci_arttext

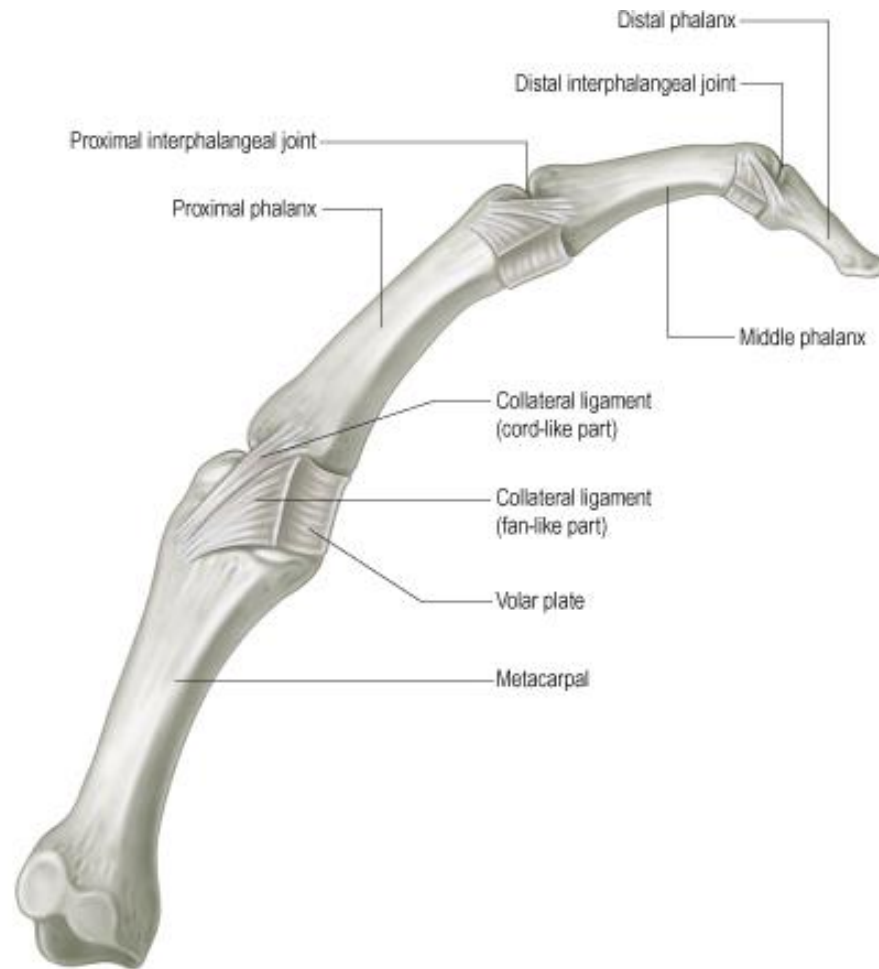
Articulationes metacarpophalangeae (5)

joint type	simple, mobile, dorsally spheroid, palmarily cylindric (groove) → functionally ellipsoid
head	caput ossis metacarpi
fossa	basis phalangis proximalis (+ fibrocartilago palmaris)
articular capsule and its ligaments	ligg. collateralia (med.+lat.), ligg. palmaria (comprising fibrocartilago), lig. metacarpale transversum profundum (between individual caput ossis metacarpi)
special structure	fibrocartilago palmaris
movements	flexion-extension, in extension ulnar and radial duction, circumduction, (passive rotation in extension)
neutral position	middle flexion
note	-

Articulationes interphalangeae proximales et distales (PIP and DIP joints)

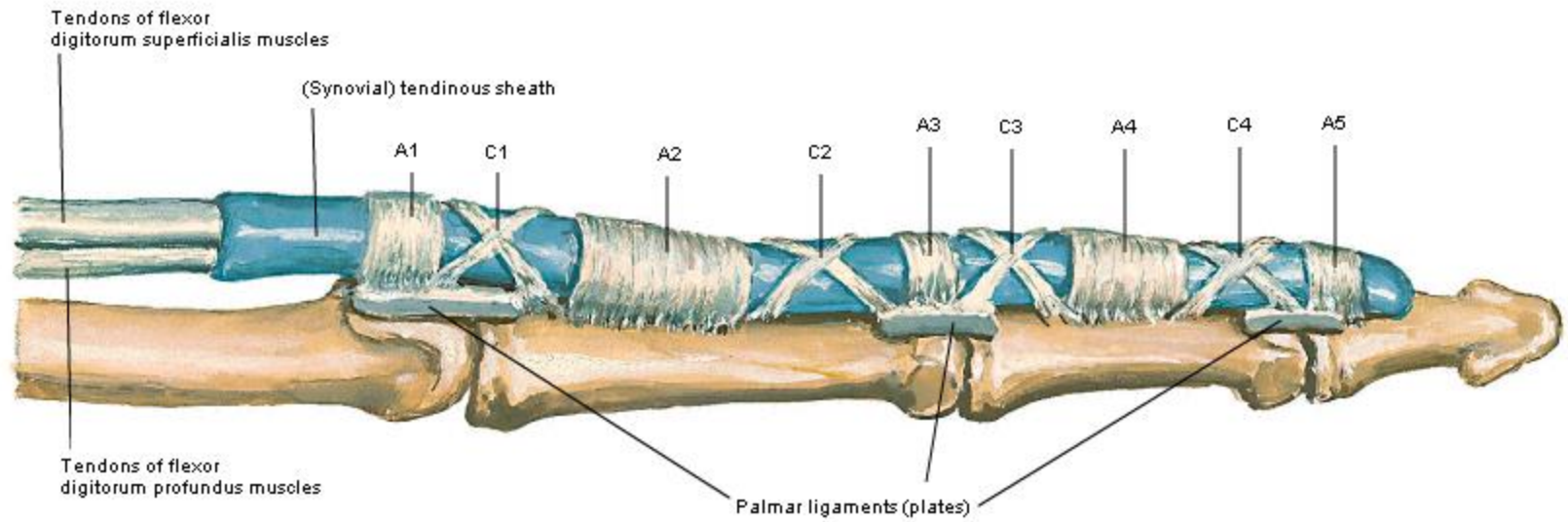
joint type	simple, mobile, trochlear
head	trochlea phalangis (of caput phalagis proximalis et media) (<i>crest</i>)
fossa	basis phalangis mediae et distalis (<i>groove</i>)
articular capsule and its ligaments	ligg. collateralia (med.+lat.), ligg. palmaria (comprising fibrocartilago)
movements	flexion-extension
neutral position	middle flexion
note	-

MP and IP ligaments



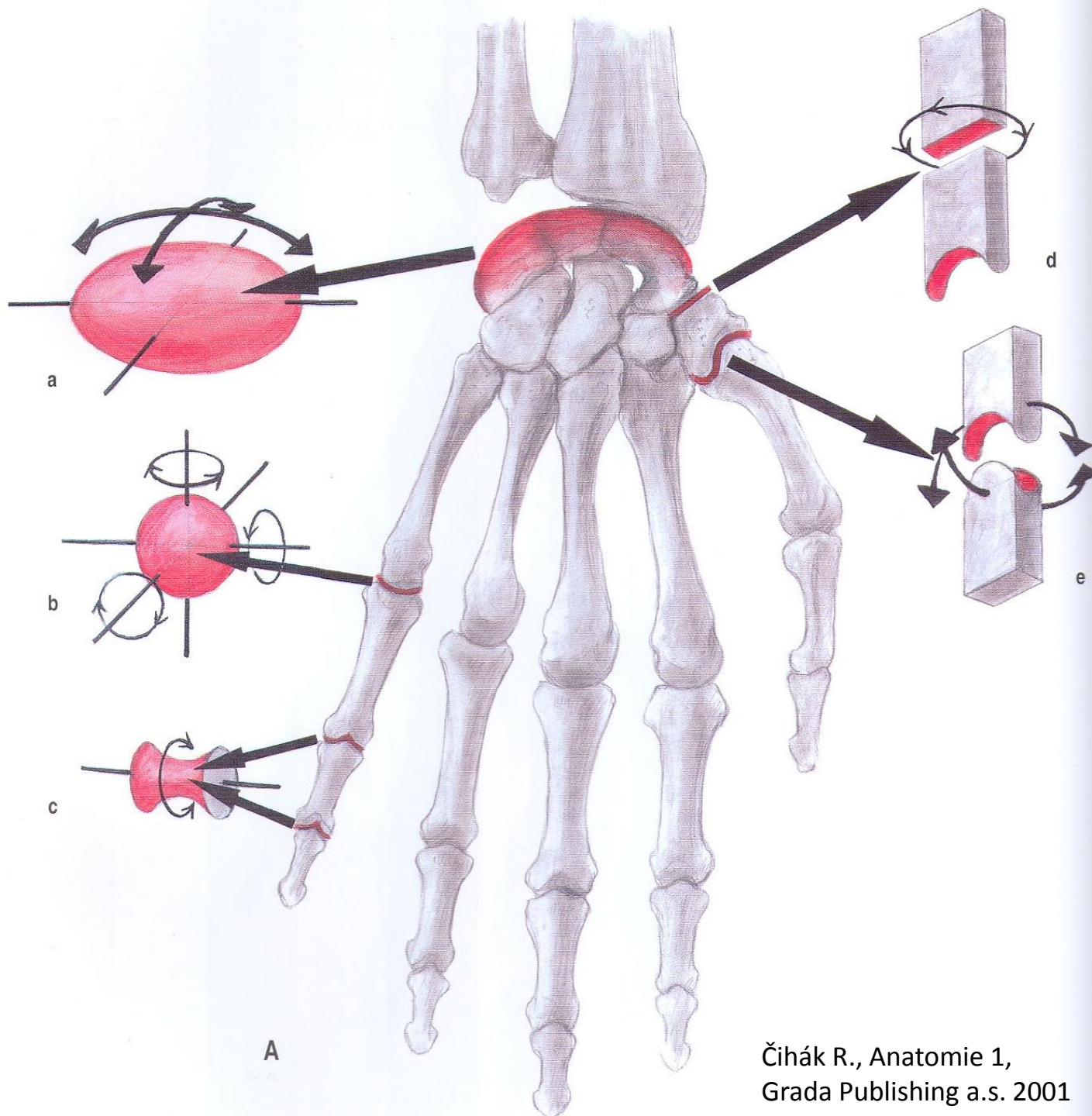
Gray's anatomy, 39th edition,
Elsevier Churchill Livingstone 2005

Vincula



Tvary kloubů ruky

- a) elipsový
- b) kulový
- c) kladkový
- d) plochý
- e) sedlový



A