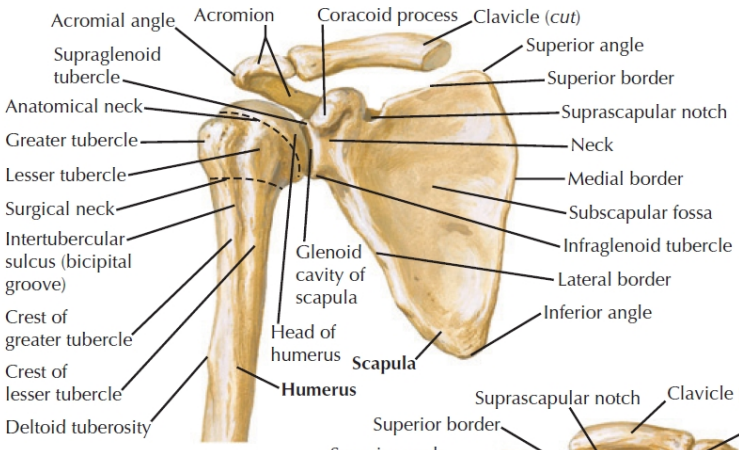
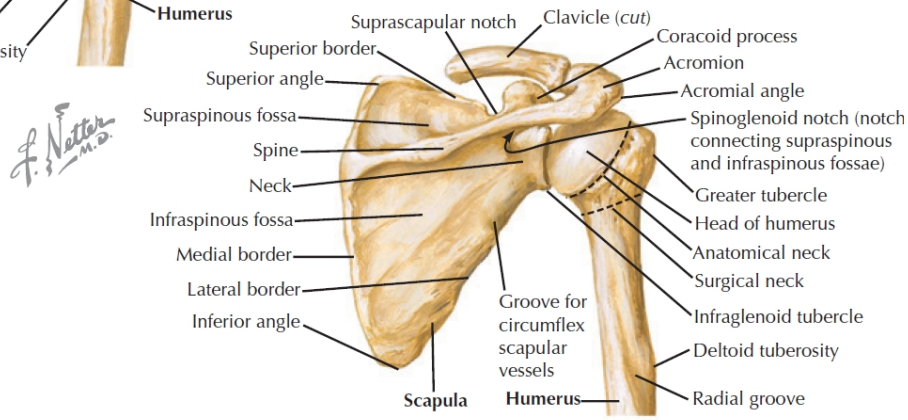
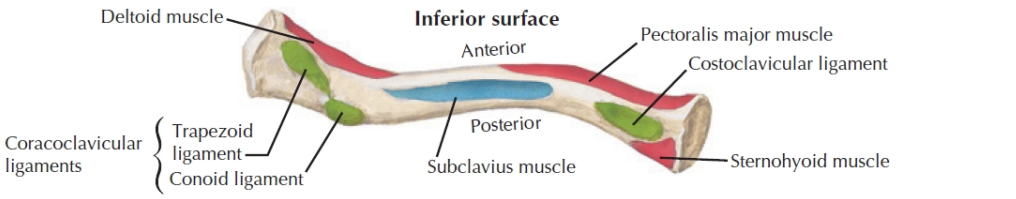
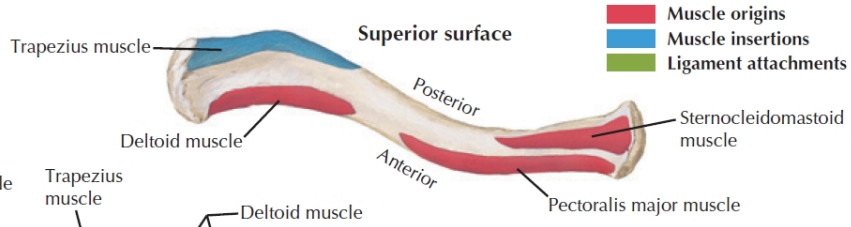
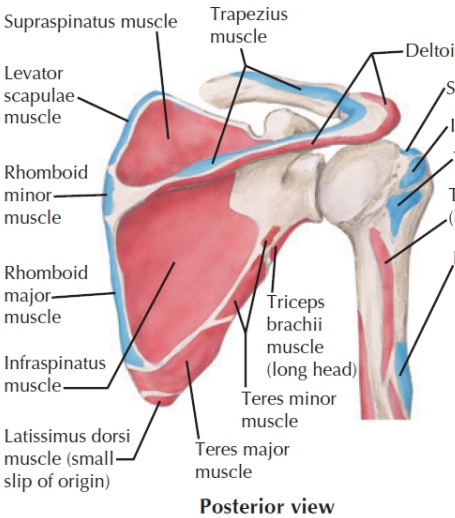
Bones of the UL

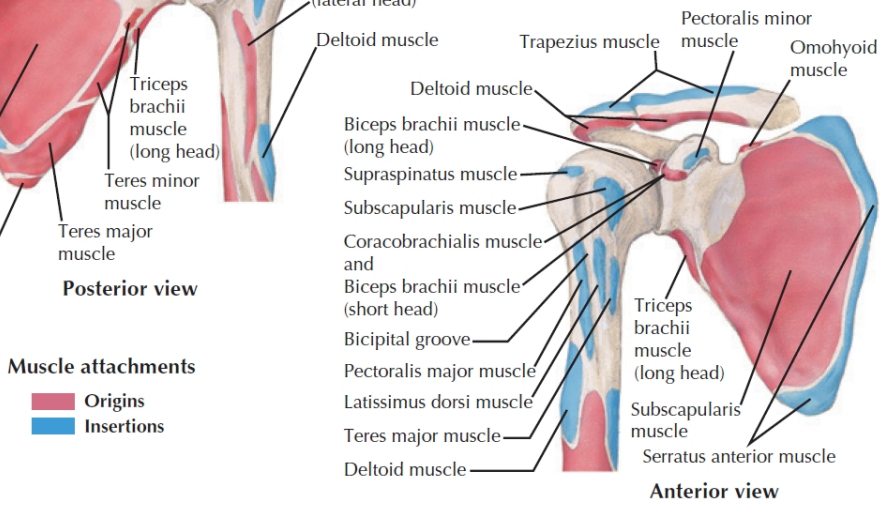


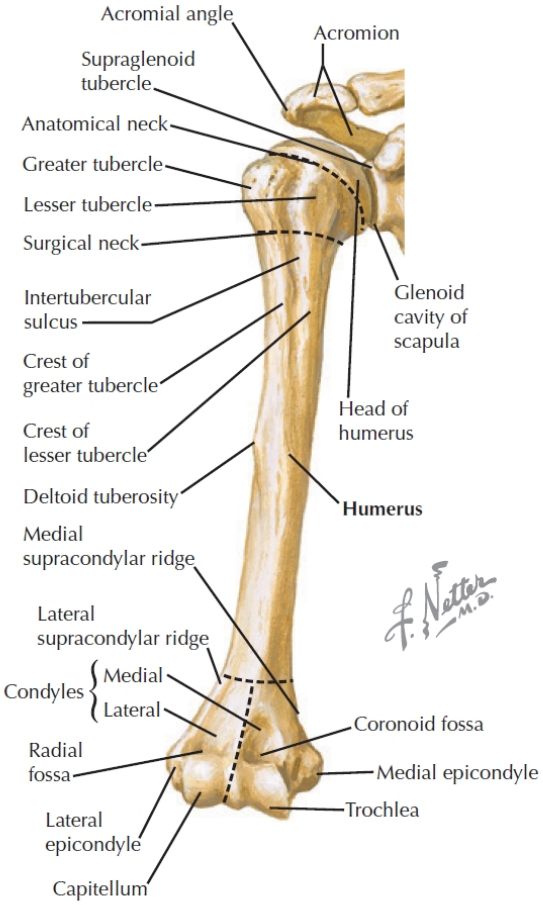




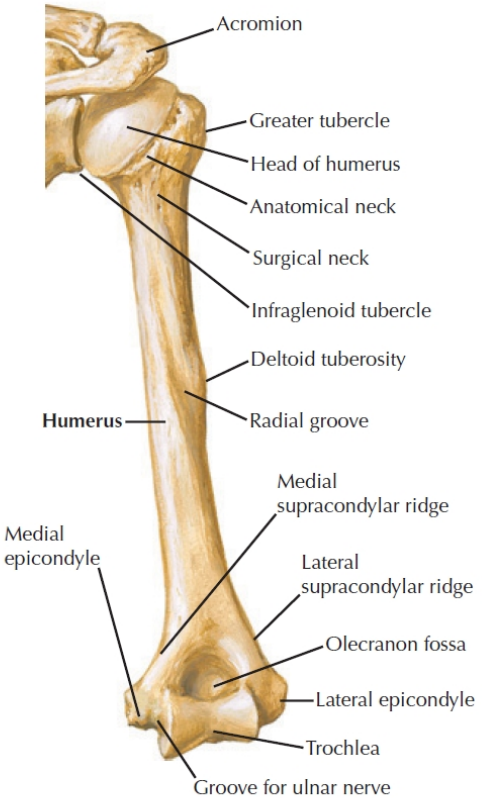




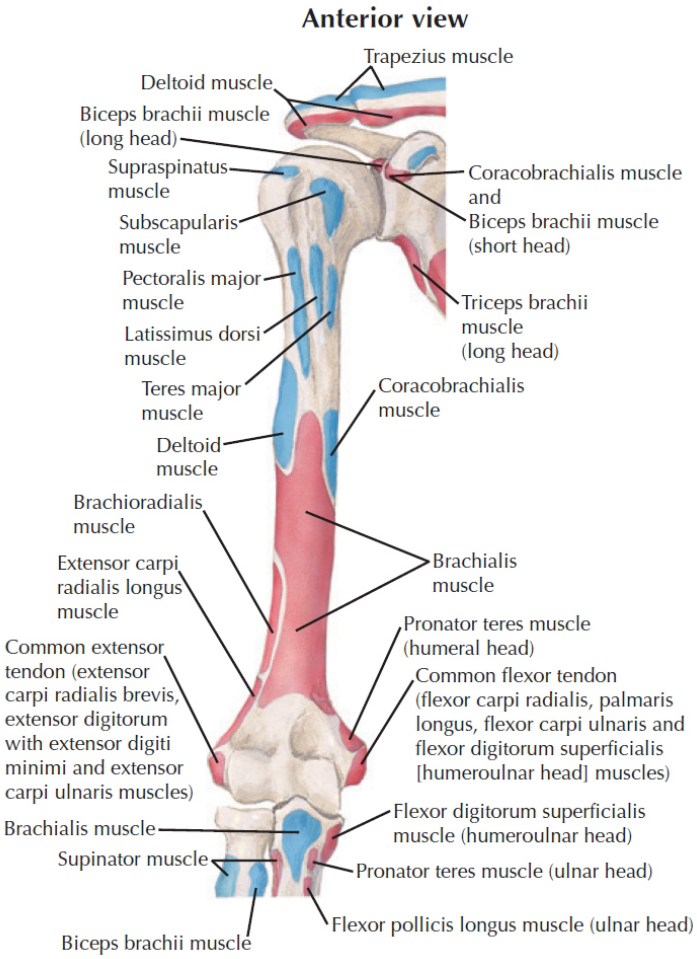


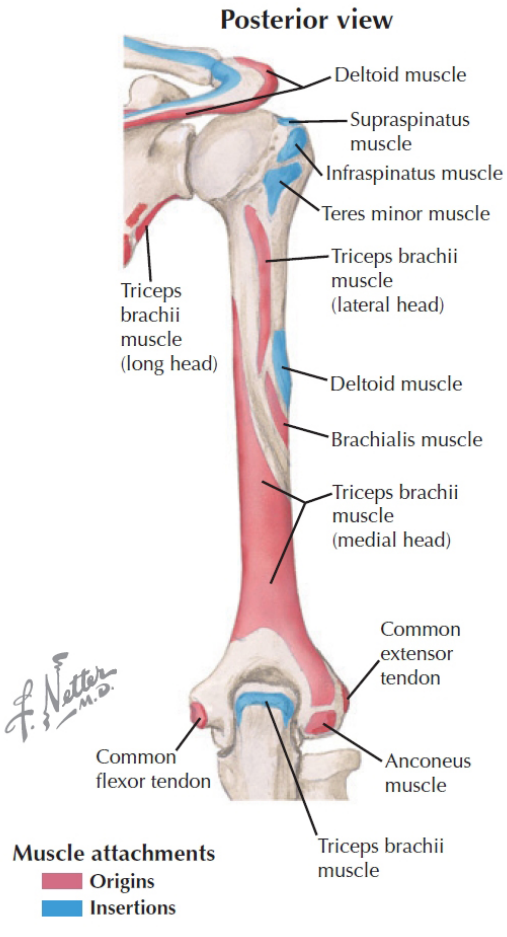


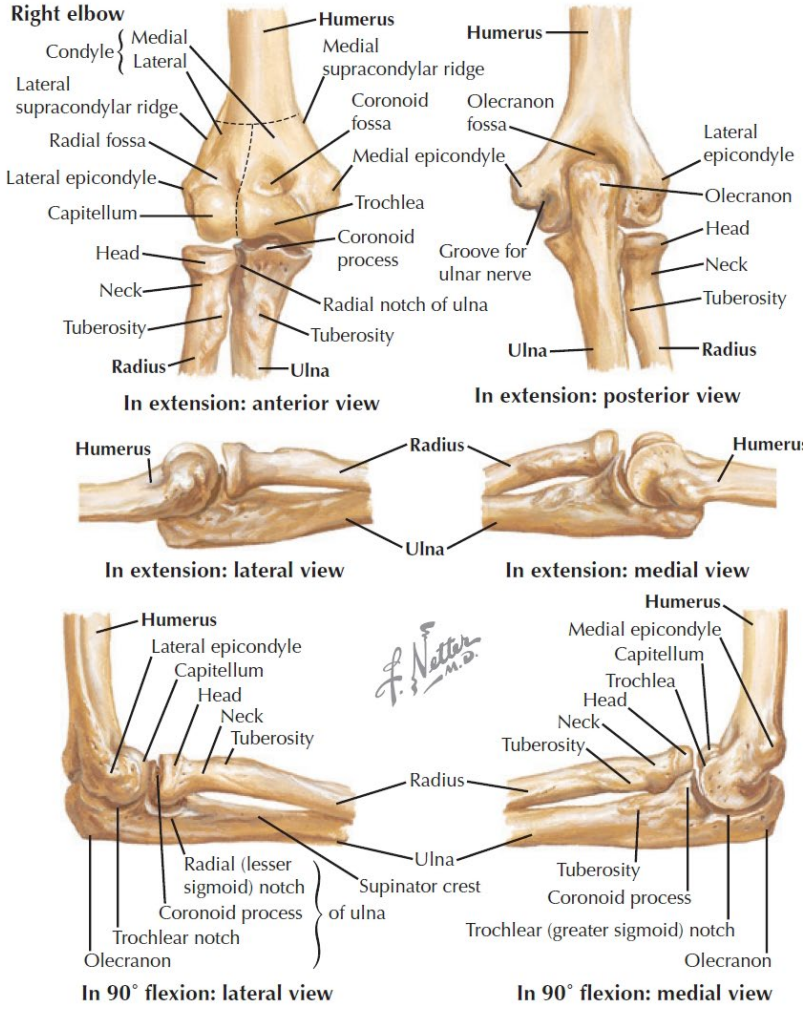
Anterior view

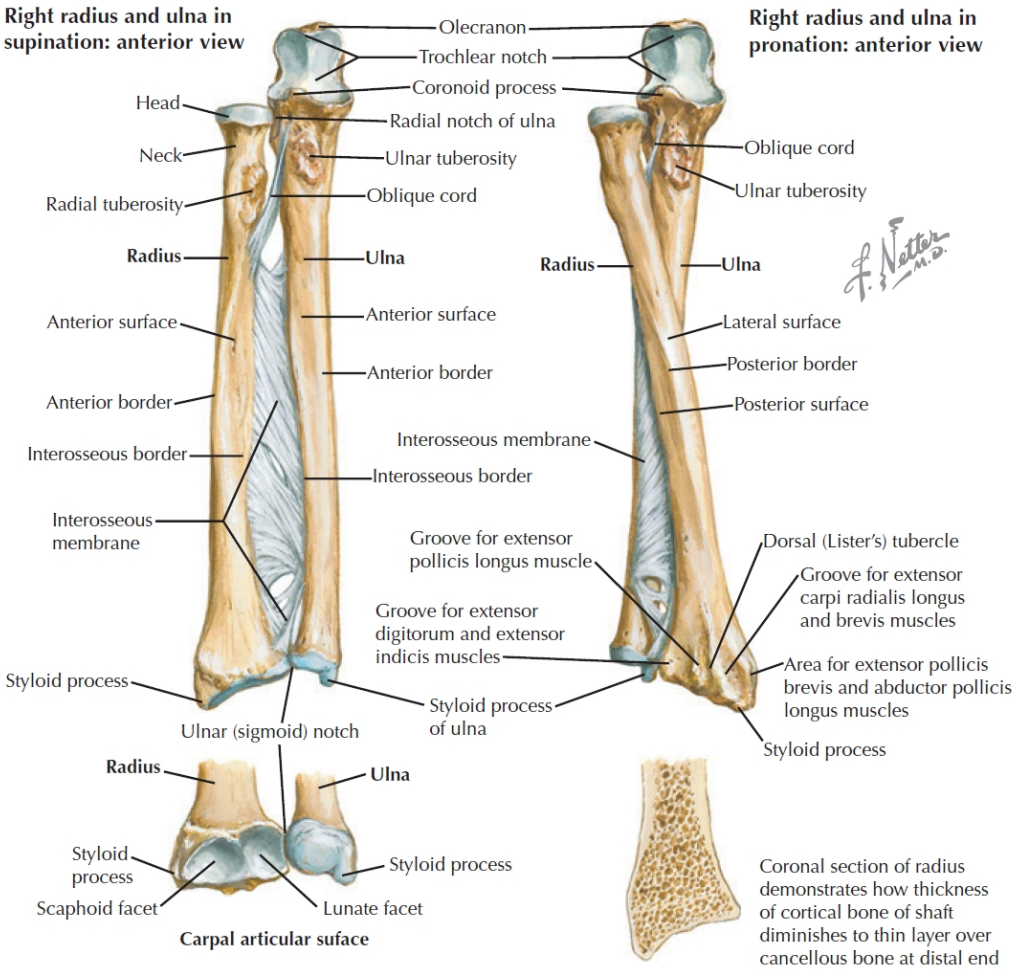


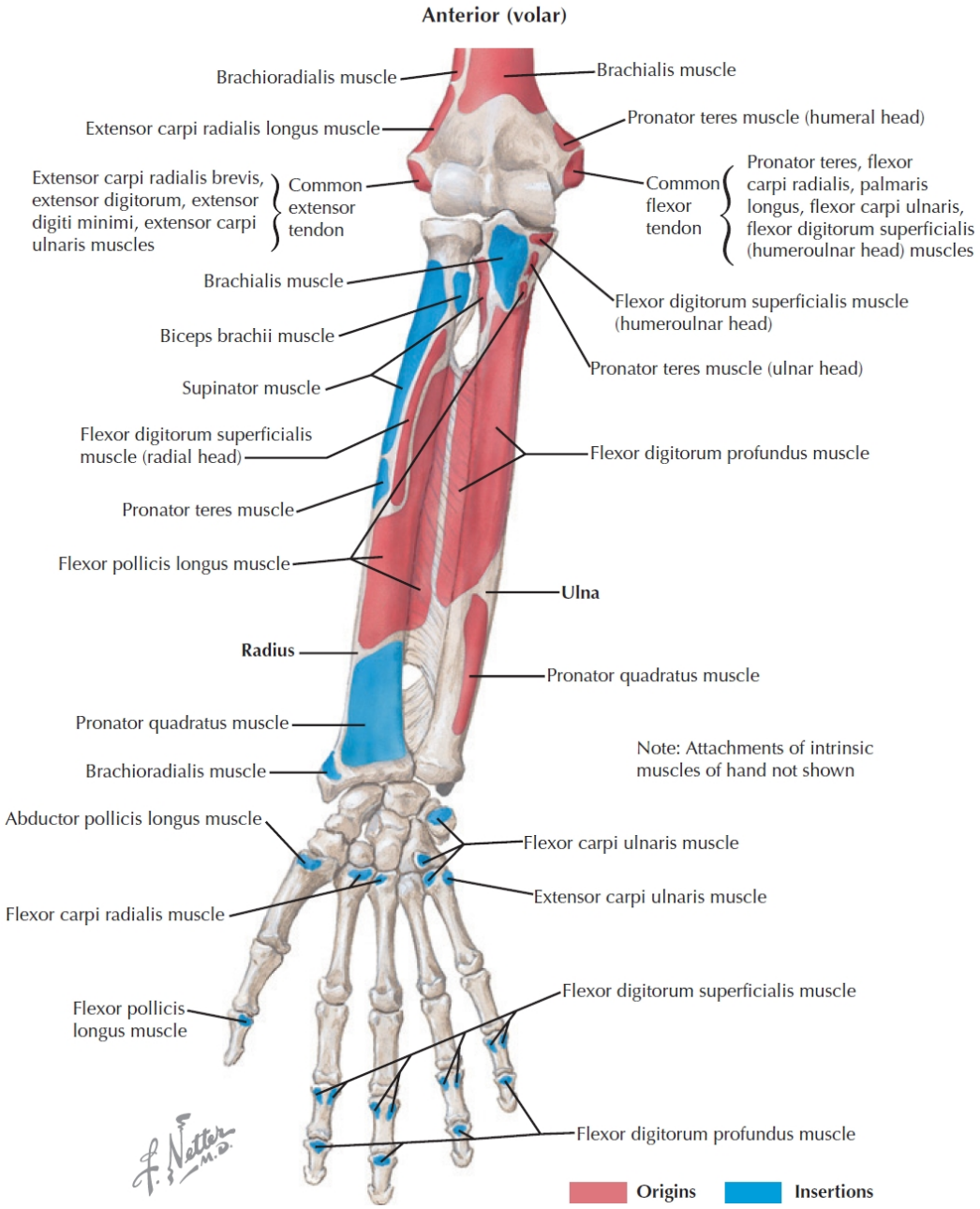
Posterior view

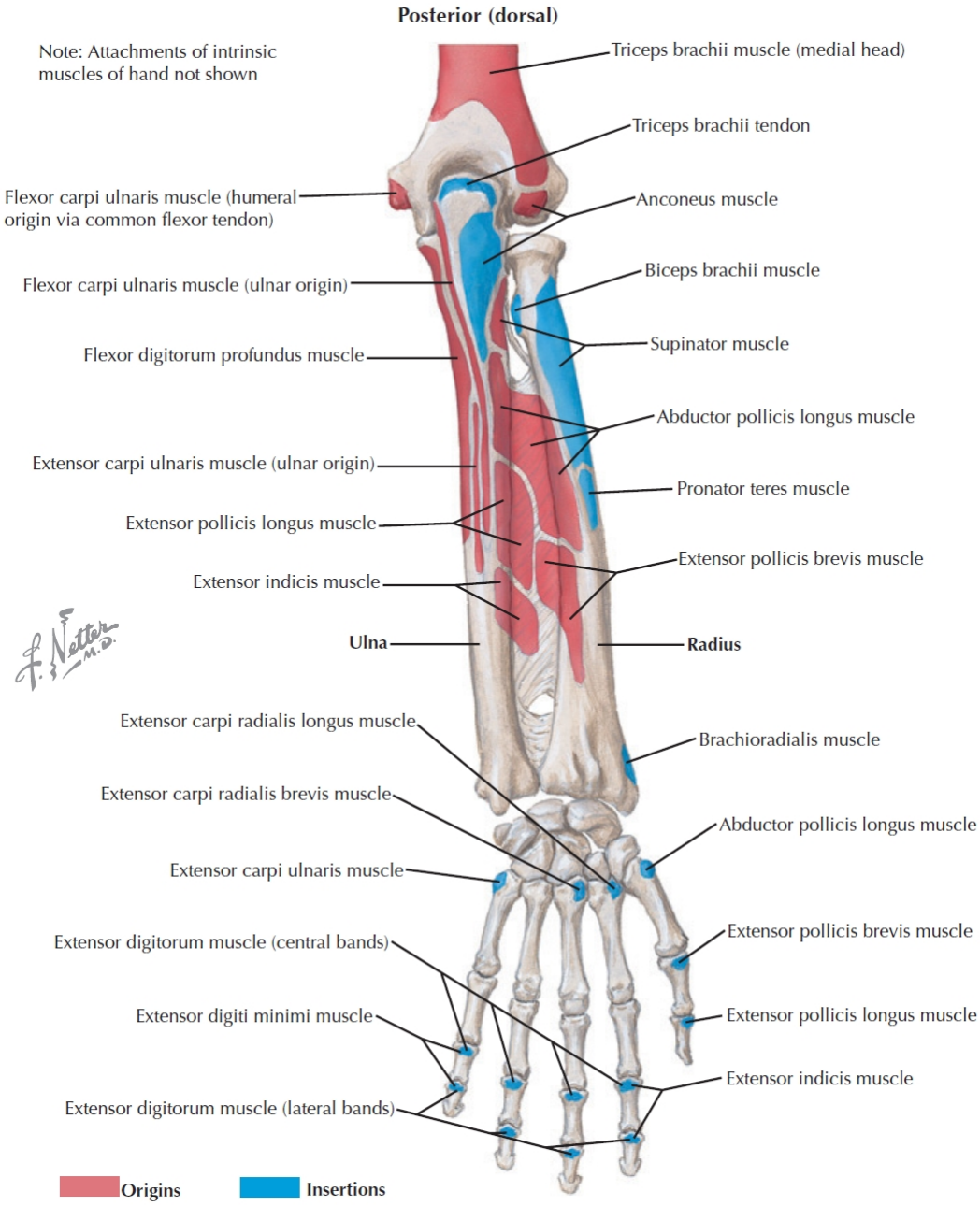


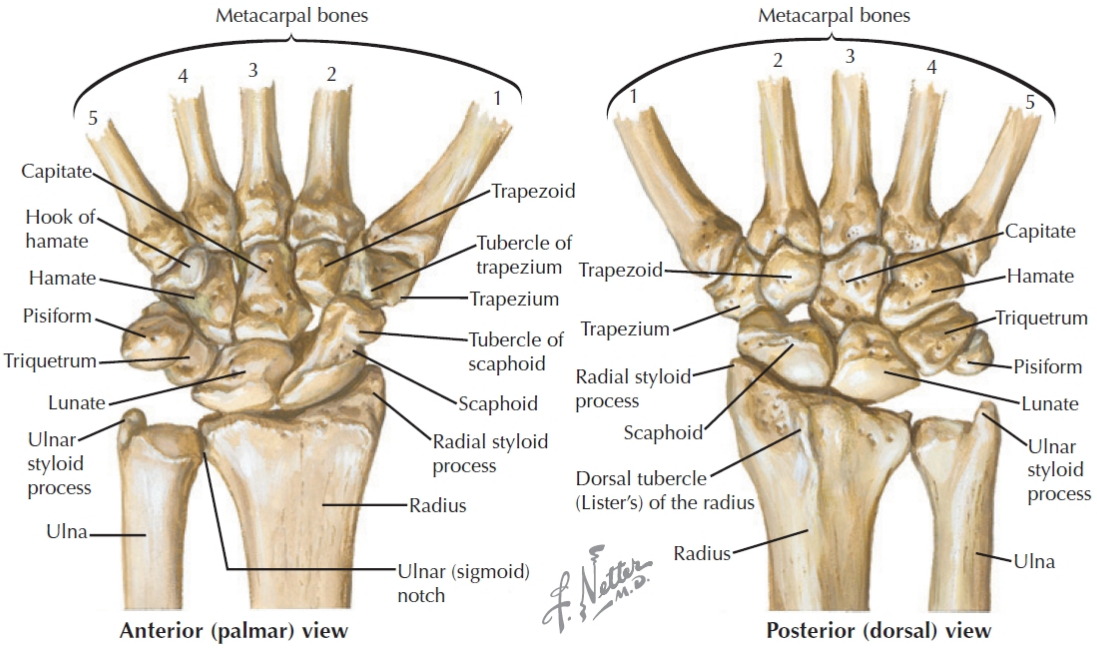



Right elbow
Humerus
Condyle
Medial
Lateral
Medial supracondylar ridge
Lateral supracondylar ridge
Coronoid fossa
Radial fossa
Medial epicondyle
Lateral epicondyle
Trochlea
Capitellum
Coronoid process
Head
Neck
Radial notch of ulna
Tuberosity
Tuberosity
Radius
Ulna
In extension: anterior view
Humerus
Olecranon fossa
Lateral epicondyle
Olecranon
Head
Groove for ulnar nerve
Neck
Tuberosity
Ulna
Radius
In extension: posterior view
Humerus
Radius
Ulna
In extension: lateral view
Humerus
In extension: medial view
Humerus
Lateral epicondyle
Capitellum
Head
Neck
Tuberosity
Radius
Ulna
Radial (lesser sigmoid) notch
Coronoid process
Trochlear notch
Olecranon
Supinator crest of ulna
In 90° flexion: lateral view
Humerus
Medial epicondyle
Capitellum
Trochlea
Head
Neck
Tuberosity
Tuberosity
Coronoid process
Trochlear (greater sigmoid) notch
Olecranon
In 90° flexion: medial view


Right radius and ulna in supination: anterior view
Olecranon
Trochlear notch
Coronoid process
Head
Radial notch of ulna
Neck
Ulnar tuberosity
Radial tuberosity
Oblique cord
Radius
Ulna
Anterior surface
Anterior surface
Anterior border
Anterior border
Interosseous border
Interosseous border
Interosseous membrane
Styloid process
Ulnar (sigmoid) notch
Styloid process of ulna
Radius
Ulna
Styloid process
Styloid process
Scaphoid facet
Lunate facet
Carpal articular suface
Right radius and ulna in pronation: anterior view
Oblique cord
Ulnar tuberosity
Radius
Ulna
Lateral surface
Posterior border
Posterior surface
Interosseous membrane
Groove for extensor pollicis longus muscle
Dorsal (Lister's) tubercle
Groove for extensor carpi radialis longus and brevis muscles
Groove for extensor digitorum and extensor indicis muscles
Area for extensor pollicis brevis and abductor pollicis longus muscles
Styloid process
Coronal section of radius demonstrates how thickness of cortical bone of shaft diminishes to thin layer over cancellous bone at distal end


Anterior (volar)
Brachioradialis muscle
Brachialis muscle
Extensor carpi radialis longus muscle
Pronator teres muscle (humeral head)
Extensor carpi radialis brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris muscles
Common extensor tendon
Common flexor tendon
Pronator teres, flexor carpi radialis, palmaris longus, flexor carpi ulnaris, flexor digitorum superficialis (humeroulnar head) muscles
Brachialis muscle
Flexor digitorum superficialis muscle (humeroulnar head)
Biceps brachii muscle
Pronator teres muscle (ulnar head)
Supinator muscle
Flexor digitorum superficialis muscle (radial head)
Flexor digitorum profundus muscle
Pronator teres muscle
Flexor pollicis longus muscle
Ulna
Radius
Pronator quadratus muscle
Pronator quadratus muscle
Note: Attachments of intrinsic muscles of hand not shown
Brachioradialis muscle
Abductor pollicis longus muscle
Flexor carpi ulnaris muscle
Extensor carpi ulnaris muscle
Flexor carpi radialis muscle
Flexor digitorum superficialis muscle
Flexor pollicis longus muscle
Flexor digitorum profundus muscle
Origins
Insertions


Posterior (dorsal)
Note: Attachments of intrinsic muscles of hand not shown
Triceps brachii muscle (medial head)
Triceps brachii tendon
Flexor carpi ulnaris muscle (humeral origin via common flexor tendon)
Anconeus muscle
Flexor carpi ulnaris muscle (ulnar origin)
Biceps brachii muscle
Flexor digitorum profundus muscle
Supinator muscle
Abductor pollicis longus muscle
Extensor carpi ulnaris muscle (ulnar origin)
Pronator teres muscle
Extensor pollicis longus muscle
Extensor pollicis brevis muscle
Extensor indicis muscle
Ulna
Radius
F. Netter M.D.
Extensor carpi radialis longus muscle
Brachioradialis muscle
Extensor carpi radialis brevis muscle
Abductor pollicis longus muscle
Extensor carpi ulnaris muscle
Extensor digitorum muscle (central bands)
Extensor pollicis brevis muscle
Extensor digiti minimi muscle
Extensor pollicis longus muscle
Extensor indicis muscle
Extensor digitorum muscle (lateral bands)
Origins
Insertions

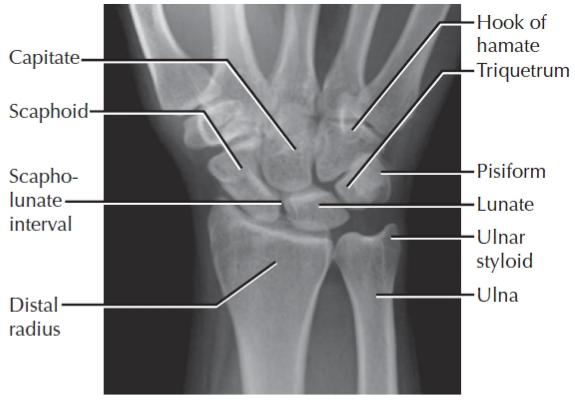


<u>Carpal bones</u>

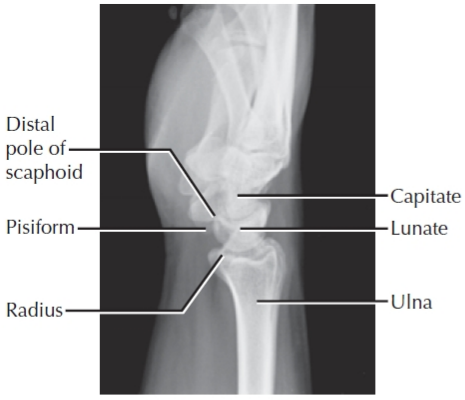
Sally **L**ikes **T**o **P**lay **T**he **T**iny **C**hrome **H**armonica

She **L**ooks **T**oo **P**retty **T**ry **T**o **C**atch **H**er

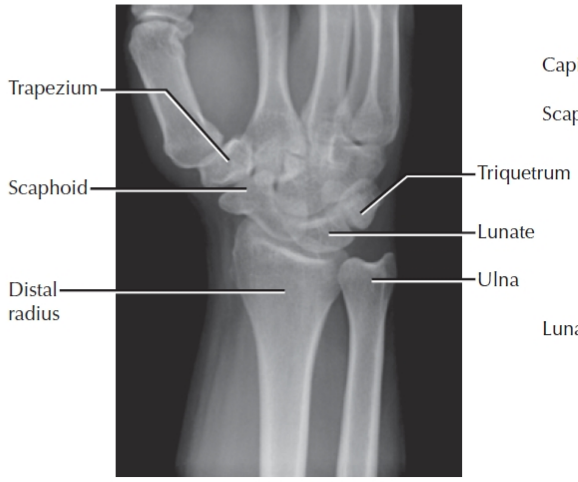
Scared **L**overs **T**ry **P**ositions **T**hat **T**hey **C**an't **H**andle



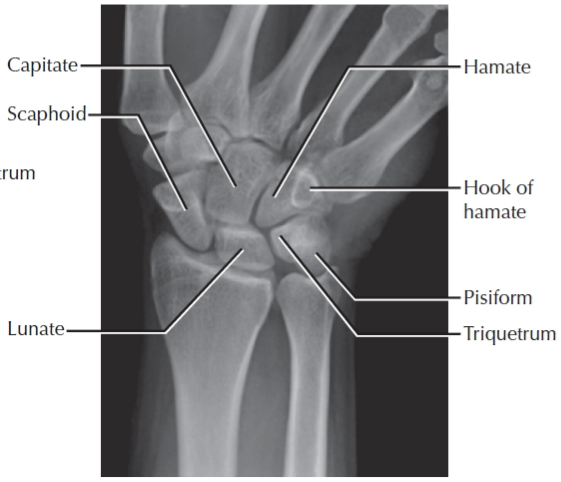
Wrist x-ray, AP



Wrist x-ray, lateral



Wrist x-ray, oblique

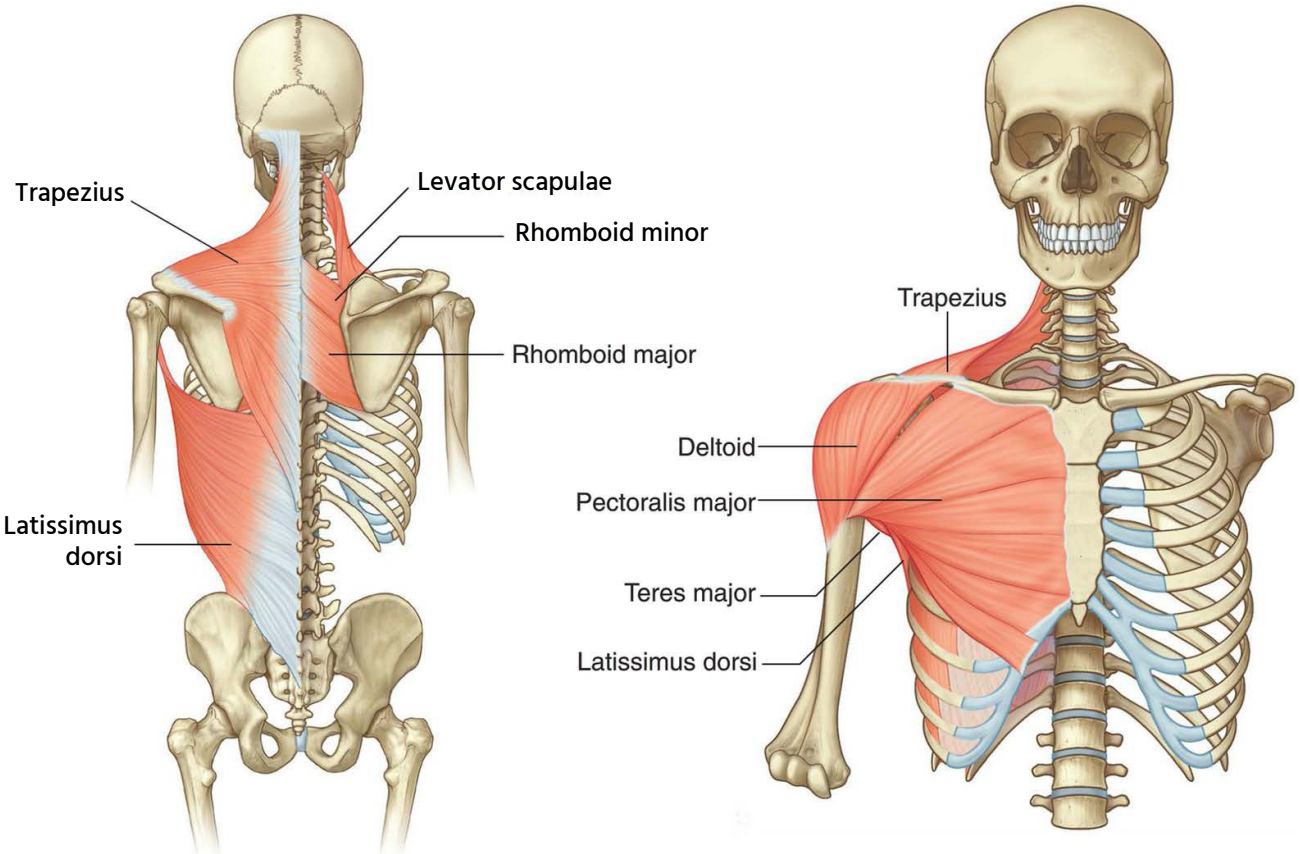


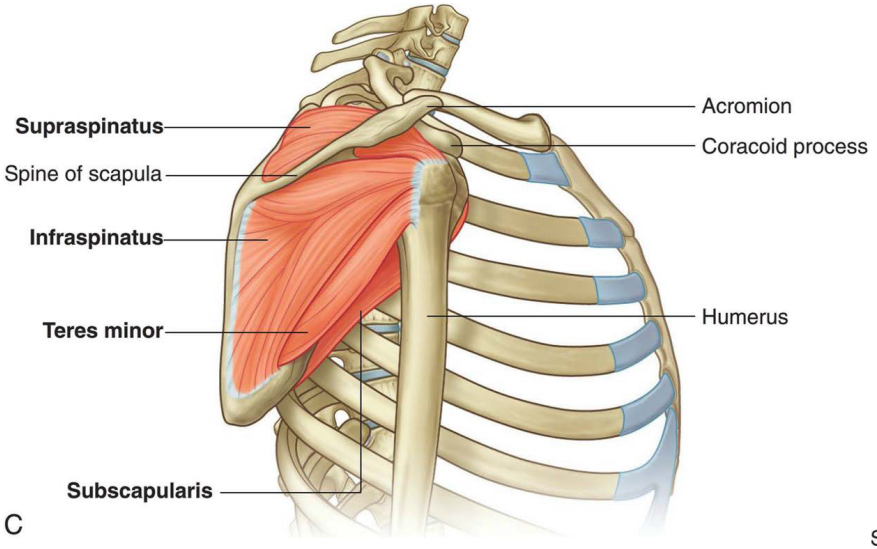
Wrist x-ray, ulnar deviation

Muscles of the UL

Muscles of the Shoulder

Muscle	Origin	Insertion	Action	Innervation
Trapezius	SP C7-T12	Clavicle, scapula (acromion, SP)	Rotating scapula	Cranial nerve XI
Latissimus dorsi	SP T6-S5, ilium	Humerus (ITG)	Extending, adducting, internally rotating humerus	Thoracodorsal nerve
Rhomboid major	SP T2-T5	Scapula (medial border)	Adducting scapula	Dorsal scapular nerve
Rhomboid minor	SP C7-T1	Scapula (medial spine)	Adducting scapula	Dorsal scapular nerve
Levator scapulae	Transverse process C1-C4	Scapula (superior medial)	Elevating, rotating scapula	C3, C4 nerves
Pectoralis major	Sternum, ribs, clavicle	Humerus (lateral ITG)	Adducting, internally rotating arm	Medial and lateral pectoral nerves
Pectoralis minor	Ribs 3-5	Scapula (coracoid)	Protracting scapula	Medial pectoral nerve
Subclavius	Rib 1	Inferior clavicle	Depressing clavicle	Upper trunk nerves
Serratus anterior	Ribs 1-9	Scapula (ventral medial)	Preventing winging	Long thoracic nerve
Deltoid	Lateral clavicle, scapula	Humerus (deltoid tuberosity)	Abducting arm	Axillary nerve
Teres major	Inferior scapula	Humerus (medial ITG)	Adducting, internally rotating, extending arm	Lower subscapular nerve
Rotator cuff muscles				
Subscapularis	Ventral scapula *(subscapular fossa)*	Humerus (lesser tuberosity)	Internally rotating arm, providing anterior stability	Upper and lower subscapular nerves
Supraspinatus	Superior scapula *(supraspinatus fossa)*	Humerus (GT)	Abducting and externally rotating arm, providing stability	Suprascapular nerve
Infraspinatus	Dorsal scapula (infraspinatus fossa)	Humerus (GT)	Providing stability, externally rotating arm	Suprascapular nerve
Teres minor	Upper ⅔ scapula (dorsolateral)	Humerus (GT)	Providing stability, externally rotatjng arm	Axillary nerve





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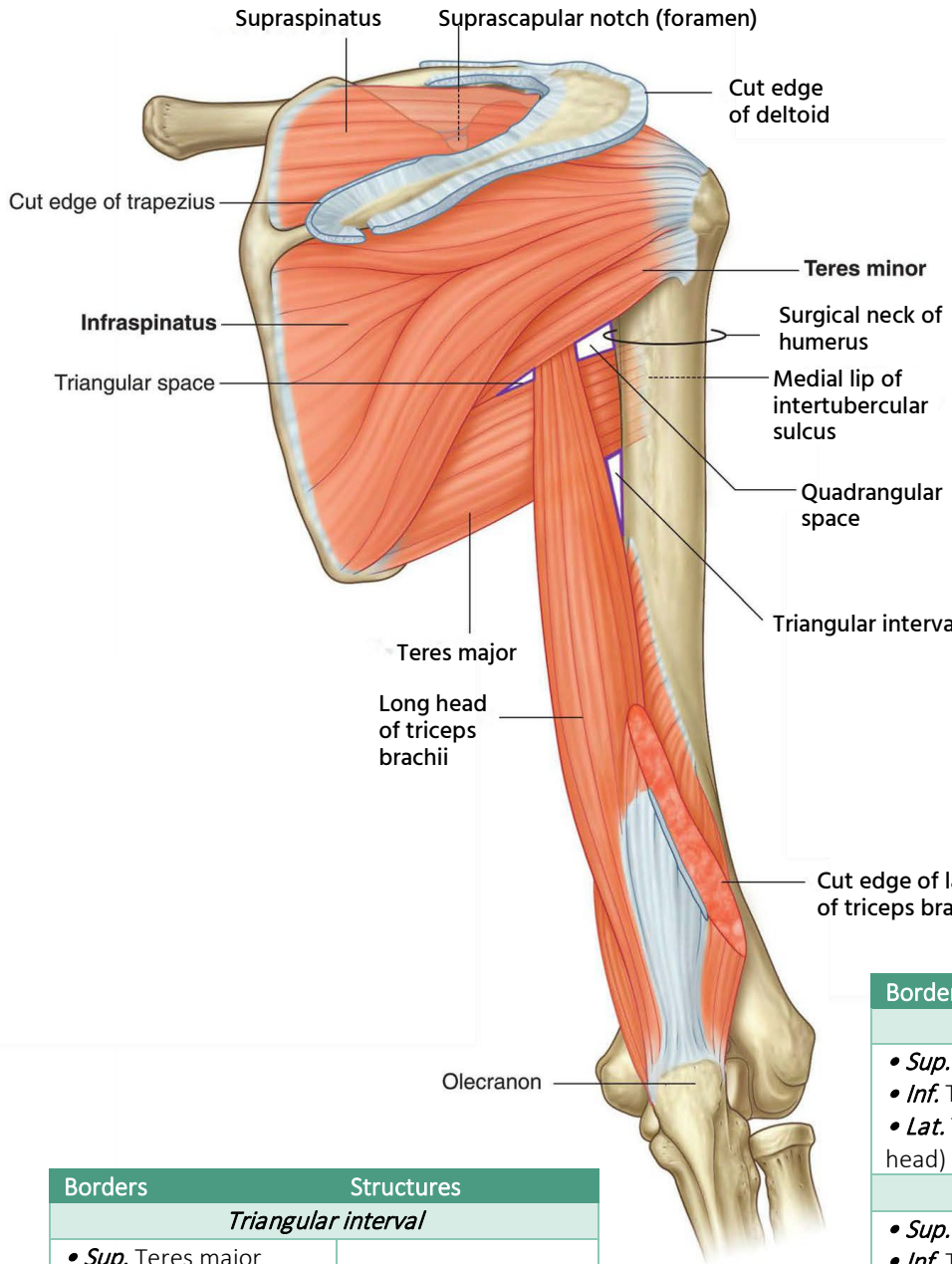
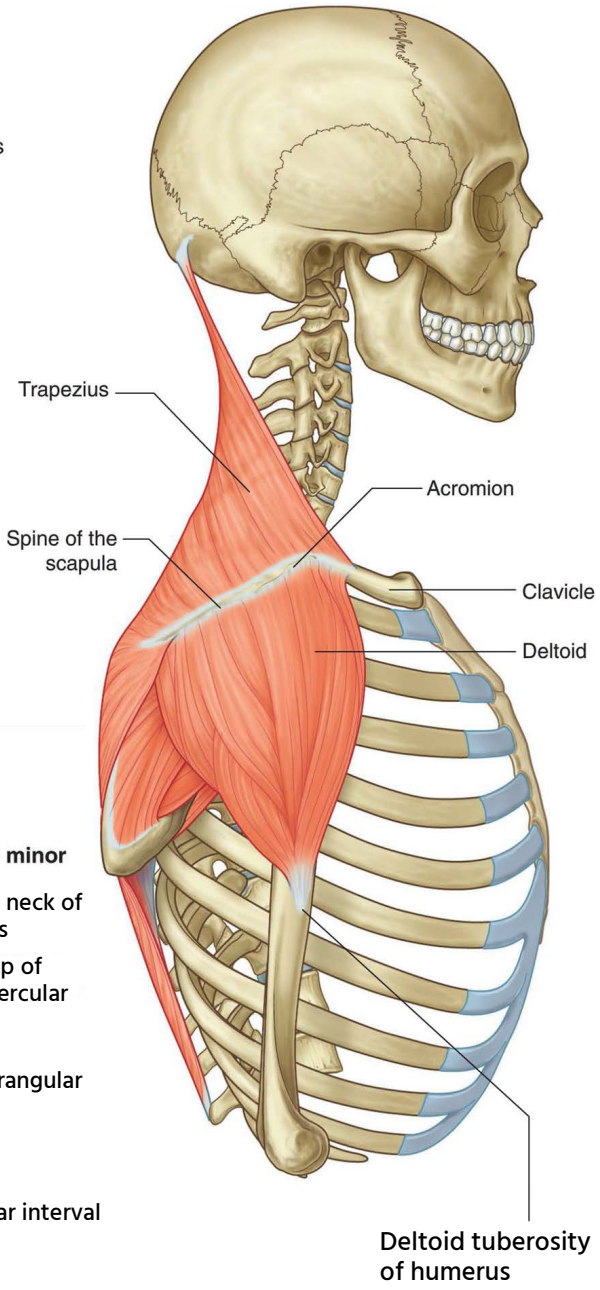




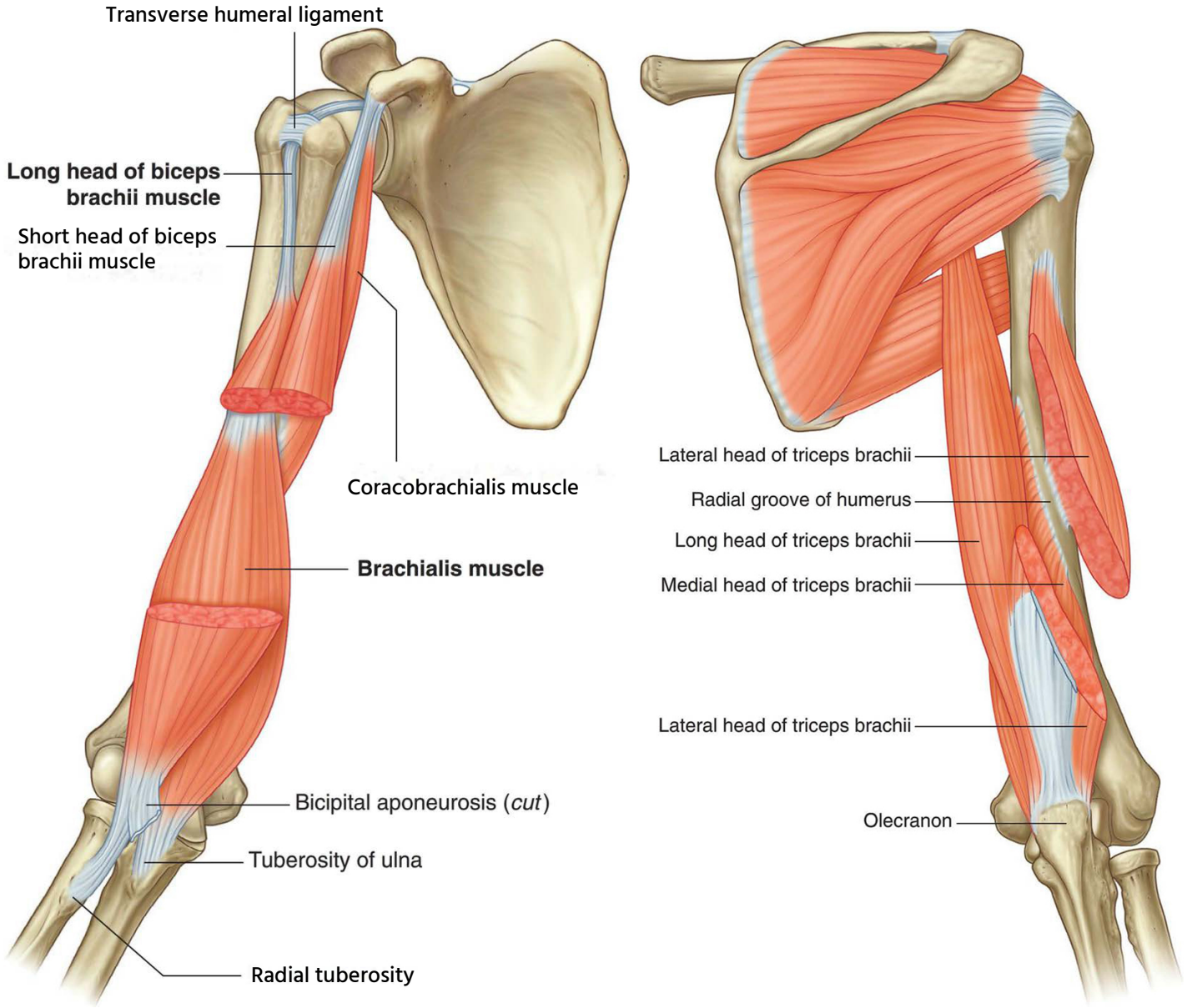
Borders	Structures
Triangular interval	
• ***Sup.*** Teres major • ***Med.*** Triceps (long head) • ***Lat.*** Triceps (lateral head)	• Radial nerve • Deep artery of arm

Borders	Structures
Triangular Space	
• ***Sup.*** Teres minor • ***Inf.*** Teres major • ***Lat.*** Triceps (Long head)	• Circumflex scapular artery
Quadrangular space	
• ***Sup.*** Teres minor • ***Inf.*** Teres major • ***Med.*** Triceps (long head) • ***Lat.*** Humerus (medial border)	• Axillary nerve • Posterior circumflex a. • Humeral a.

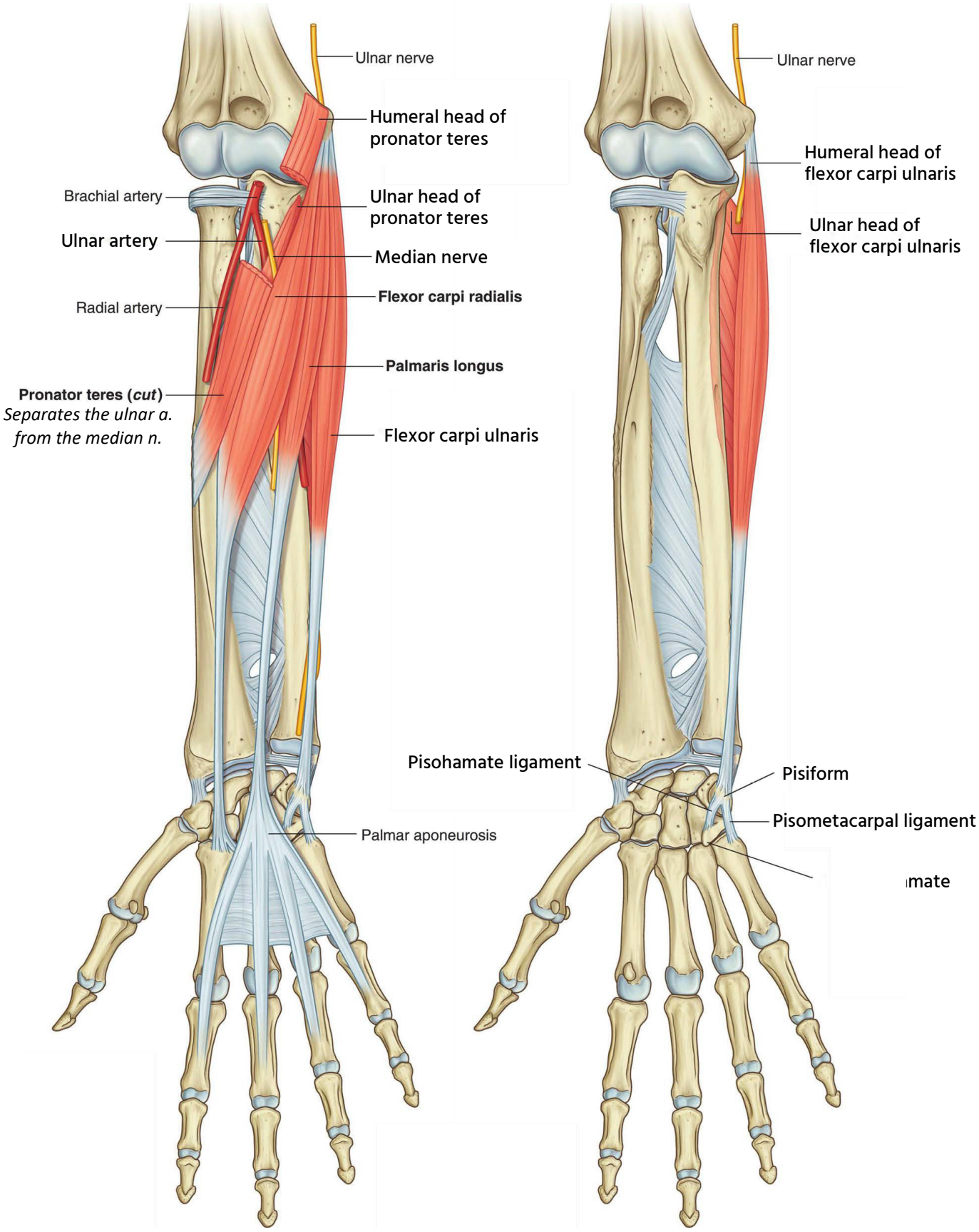
Muscles of the Arm and Forearm

Muscle	Origin	Insertion	Action	Innervation
Muscles of the Arm				
Coracobrachialis	Coracoid	Mid-humerus (medial)	Flexion, adduction	Musculocutaneous
Biceps brachii	Coracoid (short head) Supraglenoid (long head)	Radial tuberosity	Supination, flexion	Musculocutaneous
Brachialis	Anterior humerus	Ulnar tuberosity (anterior)	Flexing forearm	Musculocutaneous, Radial
Triceps brachii	Infraglenoid (long head) Posterior humerus (lateral head) Posterior humerus (medial head)*	Olecranon	Extending forearm (Elbow extension). The long head can adduct the humerus and and extend it from a flexed position	Radial *Blood supply by Profunda brachii artery*

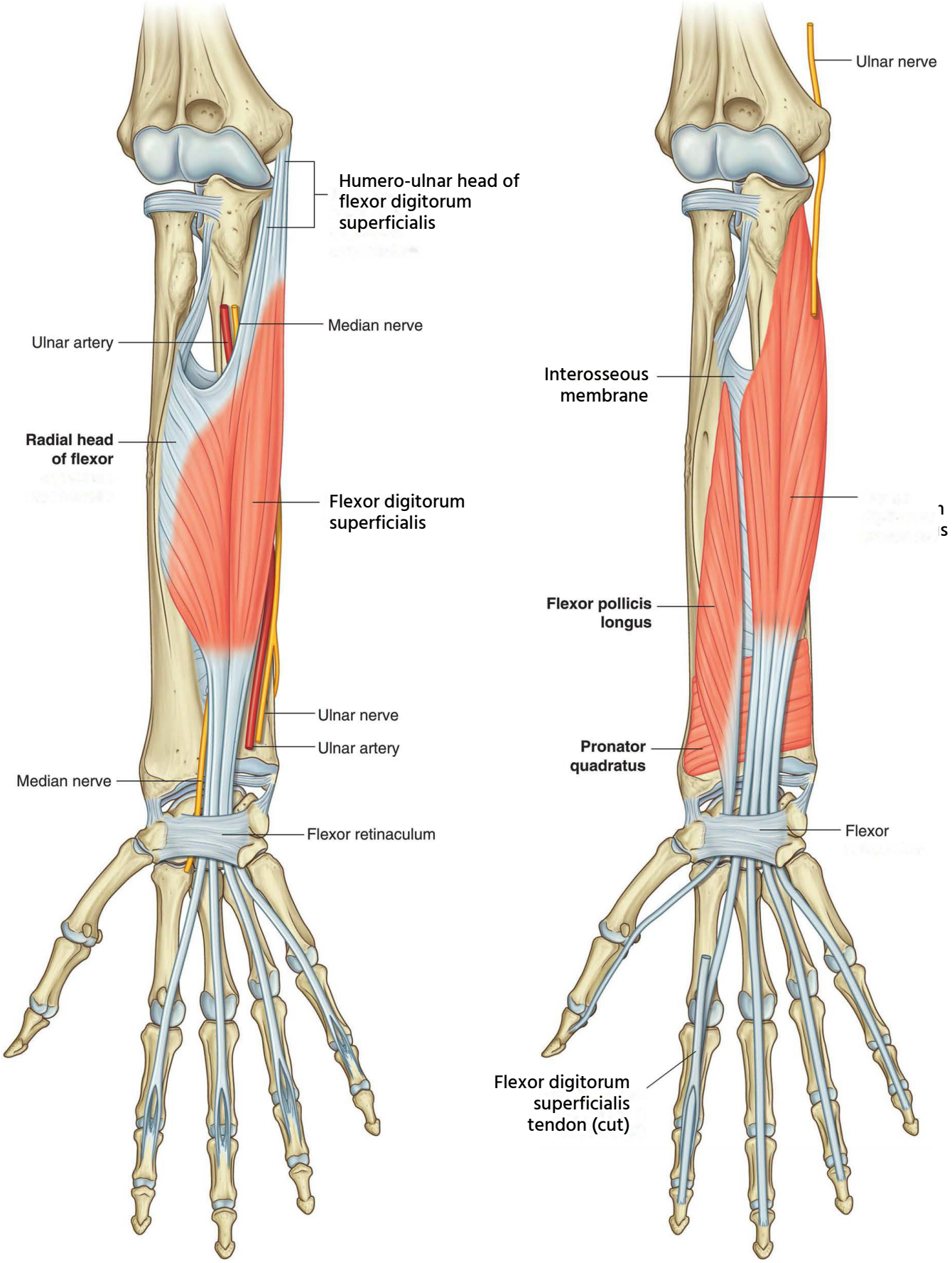
The radial nerve and profunda brachii vessels lie between the lateral and medial heads



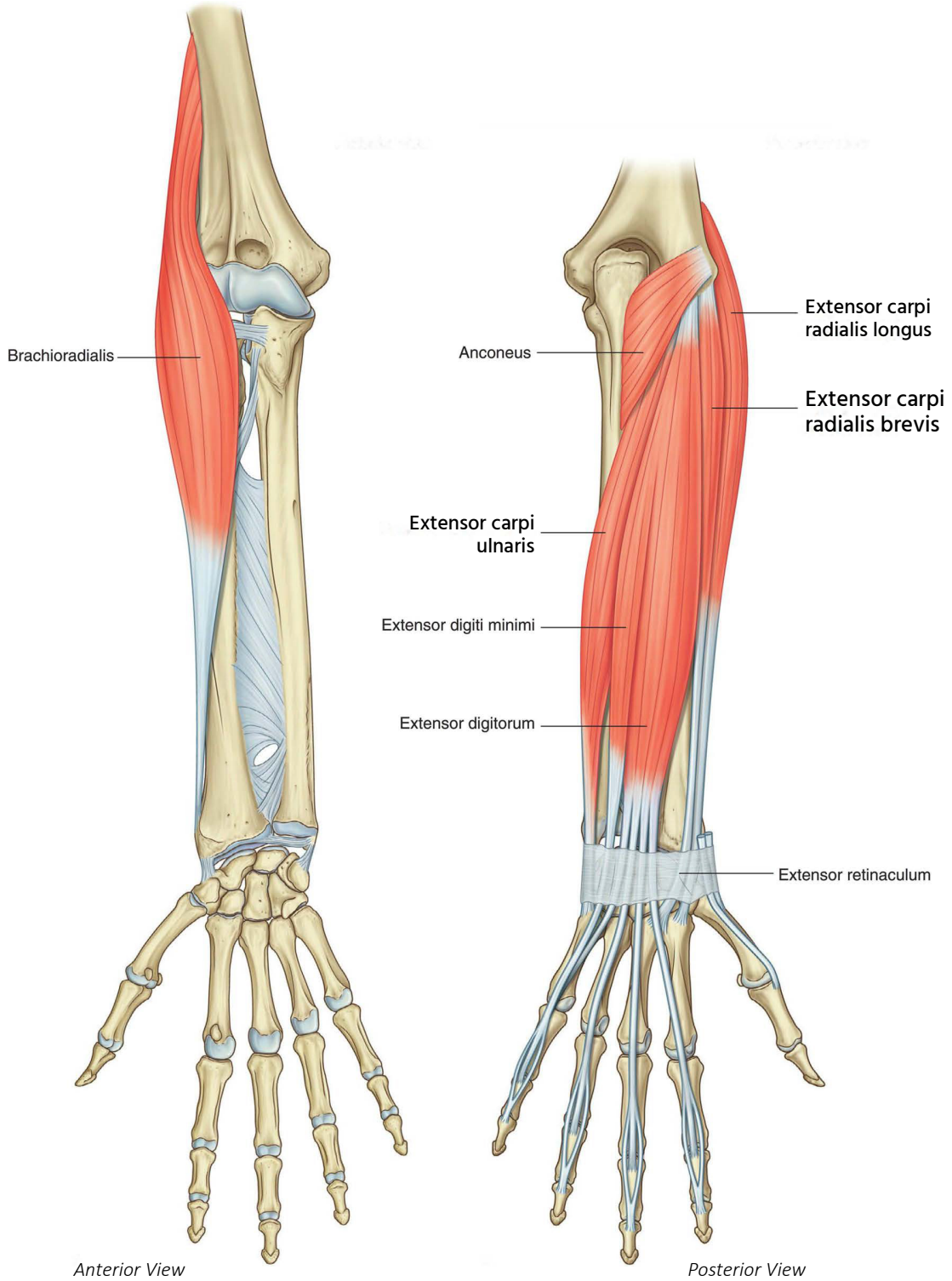
Muscle	Origin	Insertion	Action	Innervation
Superficial Flexors of the Forearm				
Pronator teres	Medial epicondyle and coronoid	Mid-lateral radius	Pronating, flexing forearm	Median nerve
Flexor carpi radialis	Medial epicondyle	2nd & 3rd MC bases	Flexing wrist	Median nerve
Palmaris longus	Medial epicondyle	Palmar aponeurosis	Flexing wrist	Median nerve
Flexor carpi ulnaris	Medial epicondyle and posterior ulna	Pisiform	Flexing wrist	Ulnar nerve
Flexor digitorum superficialis	Medial epicondyle, proximal anterior ulna and anterior radius	Base of middle phalanges	Flexing PIP joint	Median nerve



Muscle	Origin	Insertion	Action	Innervation
Deep Flexors of the Forearm				
Flexor digitorum profundus	Anterior and medial ulna	Base of distal phalanges	Flexing DIP joint	Median–anterior interosseous/ulnar nerves
Flexor pollicis longus	Anterior and lateral radius	Base of distal phalanges	Flexing IP joint, thumb	Median–anterior interosseous nerve
Pronator quadratus	Distal ulna	Volar radius	Pronating hand	Median–anterior interosseous nerve

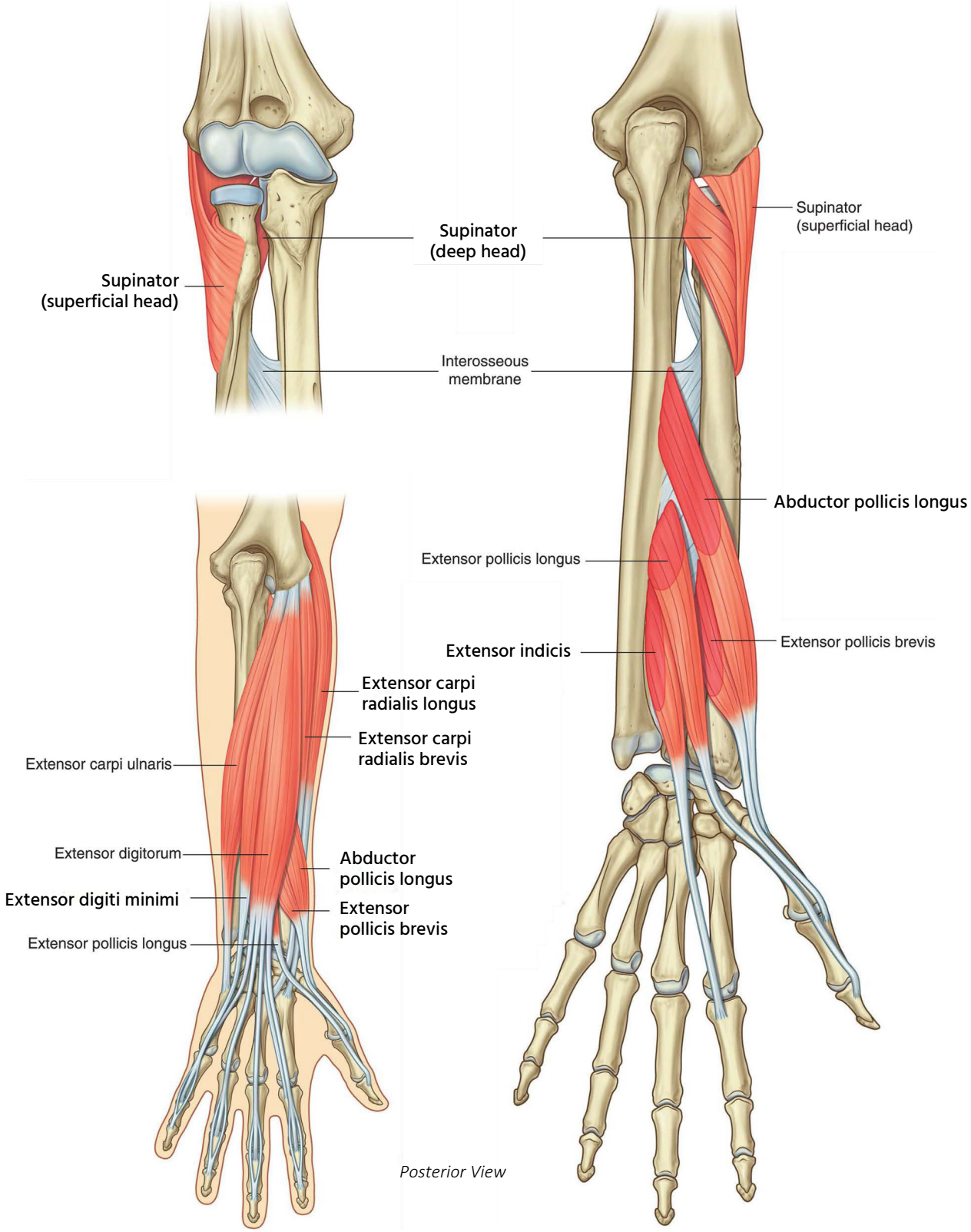


Muscle	Origin	Insertion	Action	Innervation
Superficial Extensors of the Forearm				
Brachioradialis	Lateral supracondylar humerus	Lateral distal radius	Flexing forearm	Radial nerve
Extensor carpi radialis longus	Lateral supracondylar humerus	Second metacarpal base	Extending wrist	Radial nerve
Extensor carpi radialis brevis	Lateral epicondyle of humerus	Third metacarpal base	Extending wrist	Radial nerve
Anconeus	Lateral epicondyle of humerus	Proximal dorsal ulna	Extending forearm	Radial nerve
Extensor digitorum	Lateral epicondyle of humerus	Extensor aponeurosis	Extending digits	Radial–posterior interosseous nerve
Extensor digiti minimi	Common extensor tendon	Small finger extensor expansion over P1	Extending small finger	Radial–posterior interosseous nerve
Extensor carpi ulnaris	Lateral epicondyle of humerus	Fifth metacarpal base	Extending/adducting hand	Radial–posterior interosseous nerve



Anterior View *Posterior View*

Muscle	Origin	Insertion	Action	Innervation
Deep Extensors of the Forearm				
Supinator	Lateral epicondyle of humerus, ulna	Dorsolateral radius	Supinating forearm	Radial–posterior interosseous nerve
Abductor pollicis longus	Dorsal ulna/radius	First metacarpal base	Abducting/extending thumb	Radial–posterior interosseous nerve
Extensor pollicis brevis	Dorsal radius	Thumb proximal phalanx base	Extending thumb MCP joint	Radial–posterior interosseous nerve
Extensor pollicis longus	Dorsolateral ulna	Thumb dorsal phalanx base	Extending thumb IP joint	Radial–posterior interosseous nerve
Extensor indicis proprius	Dorsolateral ulna	Index finger extensor apparatus (ulnarly)	Extending index finger	Radial–posterior interosseous nerve



Extensor Retinaculum / Dorsal Wrist Compartments

The extensor retinaculum is a thickening of the deep fascia that stretches across the back of the wrist and holds the long extensor tendons in position.

Its attachments are:

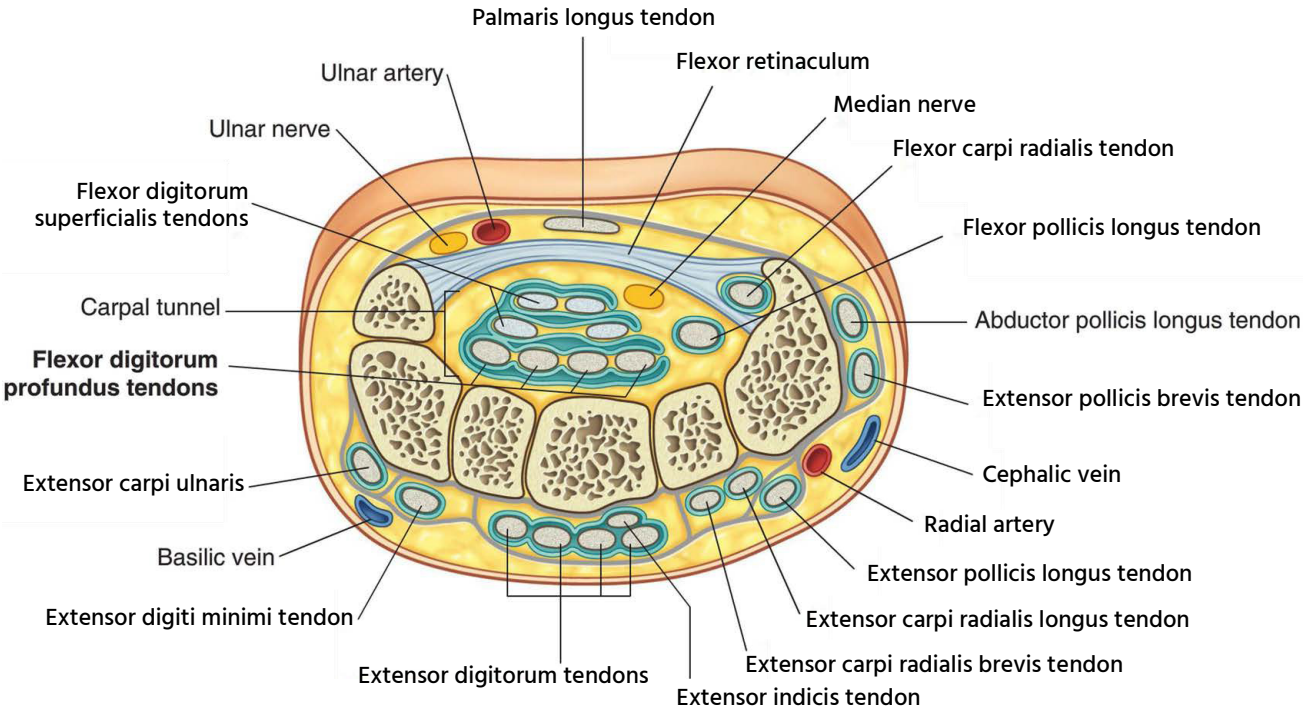
- The pisiform and triquetral medially
- The end of the radius laterally

Structures superficial to the retinaculum

- Basilic vein
- Dorsal cutaneous branch of the ulnar nerve
- Cephalic vein
- Superficial branch of the radial nerve

Beneath the extensor retinaculum fibrous septa form six compartments that contain the extensor muscle tendons. Each compartment has its own synovial sheath.

Compartment	Contents	Pathologic Condition
I	Abductor pollicis longus Extensor pollicis brevis	De Quervain's tenosynovitis
II	Extensor carpi radialis longus, Extensor carpi radialis brevis	Extensor tendinitis (intersection syndrome)
III	Extensor pollicis longus	Rupture at Lister's tubercle (after wrist fractures) Drummer's tendinitis of the wrist
IV	Extensor digitorum communis Extensor indicis proprius	Extensor tenosynovitis
V	Extensor digiti minimi	Rupture (rheumatoid arthritis: Vaughn-Jackson syndrome)
VI	Extensor carpi ulnaris	Snapping at ulnar styloid



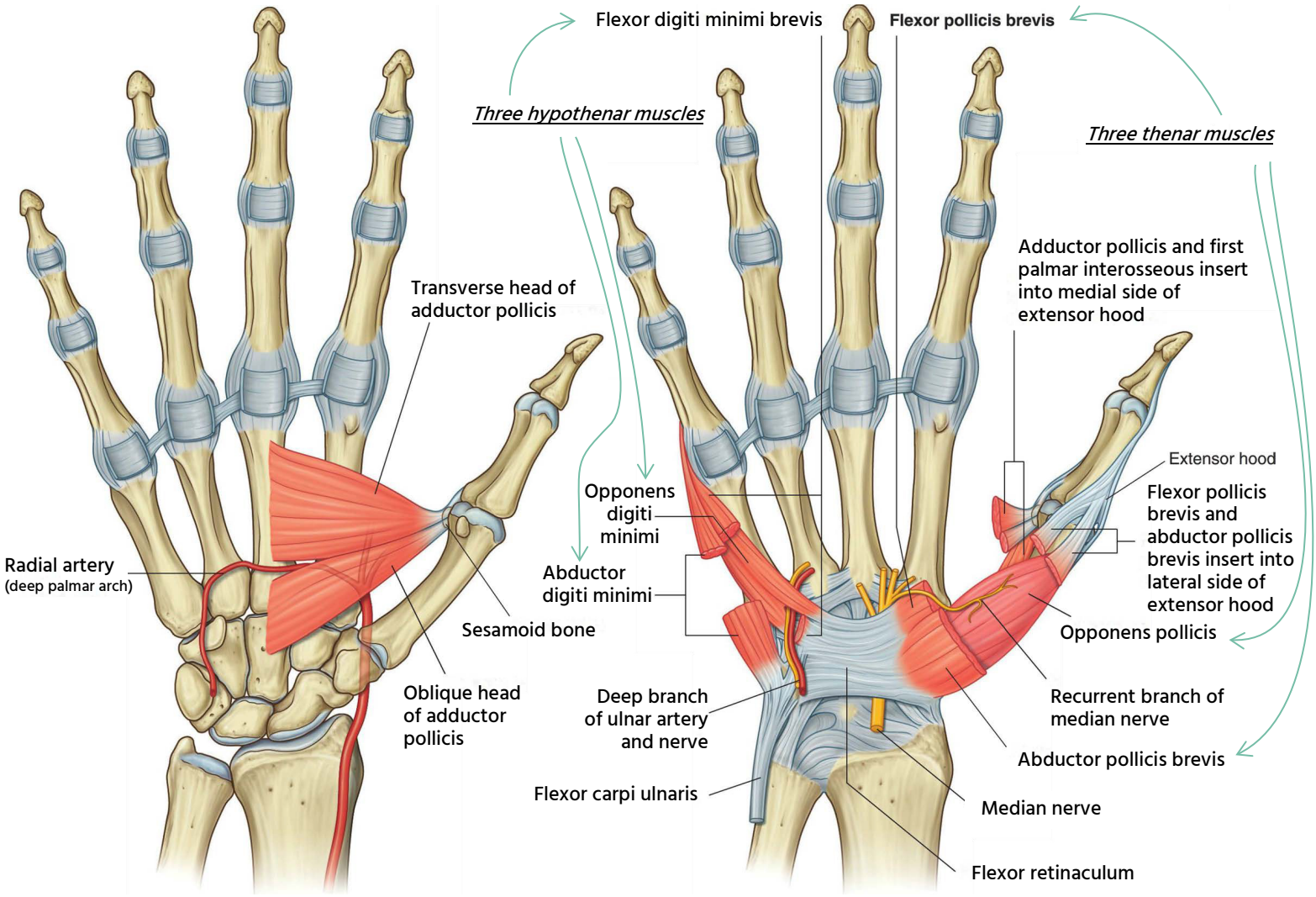
Neuroanatomic Relationships in the Forearm

Nerve	Relationships
Radial	Between brachialis and brachioradialis
Posterior interosseous	Splits supinator
Superficial radial	Between brachioradialis and extensor carpi radialis longus
Median	Medial to brachial artery at elbow
Anterior interosseous	Splits pronator teres and runs between flexor digitorum superficialis and flexor digitorum profundus Between flexor pollicis longus and flexor digitorum profundus
Ulnar	Between flexor carpi ulnaris and flexor digitorum profundus

*The **radial artery** passes between the lateral collateral ligament of the wrist joint and the tendons of the abductor pollicis longus and extensor pollicis brevis.*

Muscles of the Hand and Wrist

Muscle	Origin	Insertion	Action	Innervation
Thenar Muscles				
Abductor pollicis brevis	Scaphoid, trapezoid	Base of proximal phalanx, radial side	Abducting thumb	Median nerve
Opponens pollicis	Trapezium	Thumb metacarpal	Abducting, flexing, rotating (medially)	Median nerve
Flexor pollicis brevis	Trapezium, capitate	Base of proximal phalanx, radial side	Flexing MCP joint	Median, ulnar nerves
Adductor pollicis	Capitate, second and third metacarpals	Base of proximal phalanx, ulnar side	Adducting thumb	Ulnar nerve
Hypothenar Muscles				
Palmaris brevis	TCL, palmar aponeurosis	Ulnar palm	Retracting skin	Ulnar nerve
Abductor digiti minimi	Pisiform	Base of proximal phalanx, ulnar side	Abducting small finger	Ulnar nerve
Flexor digiti minimi brevis	Hamate, TCL	Base of proximal phalanx, ulnar side	Flexing MCP joint	Ulnar nerve
Opponens digiti minimi	Hamate, TCL	Small-finger metacarpal	Abducting, flexing, rotating (laterally)	Ulnar nerve
Intrinsic Muscles				
Lumbrical	Flexor digitorum profundus	Lateral bands (radial)	Extending proximal interphalangeal joint	Median, ulnar nerves
Dorsal interosseous	Adjacent metacarpals	Proximal phalanx base/extensor apparatus	Abducting, flexing MCP joint	Ulnar nerve
Volar interosseous	Adjacent metacarpals	Proximal phalanx base/extensor apparatus	Adducting, flexing MCP joint	Ulnar nerve



Hand

Anatomy of the hand

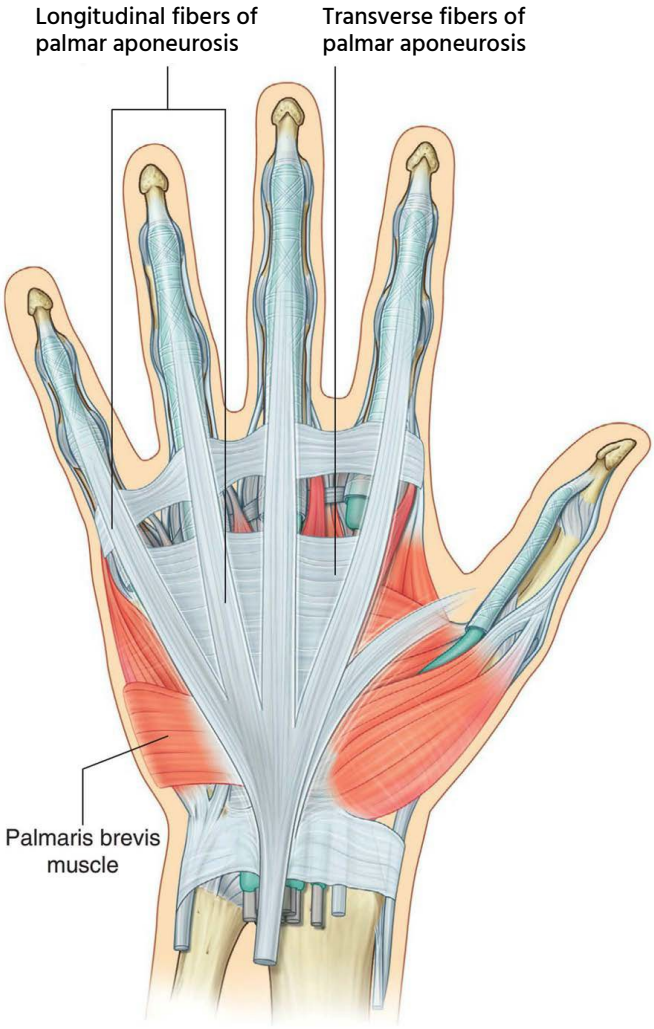
Bones	• 8 Carpal bones • 5 Metacarpals • 14 phalanges
Intrinsic Muscles	7 Interossei - Supplied by ulnar nerve • 3 palmar-*adduct fingers* • 4 dorsal- *abduct fingers*
Intrinsic muscles	Lumbricals • Flex MCPJ and extend the IPJ. • Origin deep flexor tendon and insertion dorsal extensor hood mechanism. • Innervation: 1st and 2nd- median nerve, 3rd and 4th- deep branch of the ulnar nerve.
Thenar eminence	• Abductor pollicis brevis • Opponens pollicis • Flexor pollicis brevis
Hypothenar eminence	• Opponens digiti minimi • Flexor digiti minimi brevis • Abductor digiti minimi

Fascia and compartments of the palm

The fascia of the palm is continuous with the antebrachial fascia and the fascia of the dorsum of the hand. The palmar fascia is thin over the thenar and hypothenar eminences. In contrast, the central palmar fascia is relatively thick. The palmar aponeurosis covers the soft tissues and overlies the flexor tendons. The apex of the palmar aponeurosis is continuous with the flexor retinaculum and the palmaris longus tendon. Distally, it forms four longitudinal digital bands that attach to the bases of the proximal phalanges, blending with the fibrous digital sheaths.

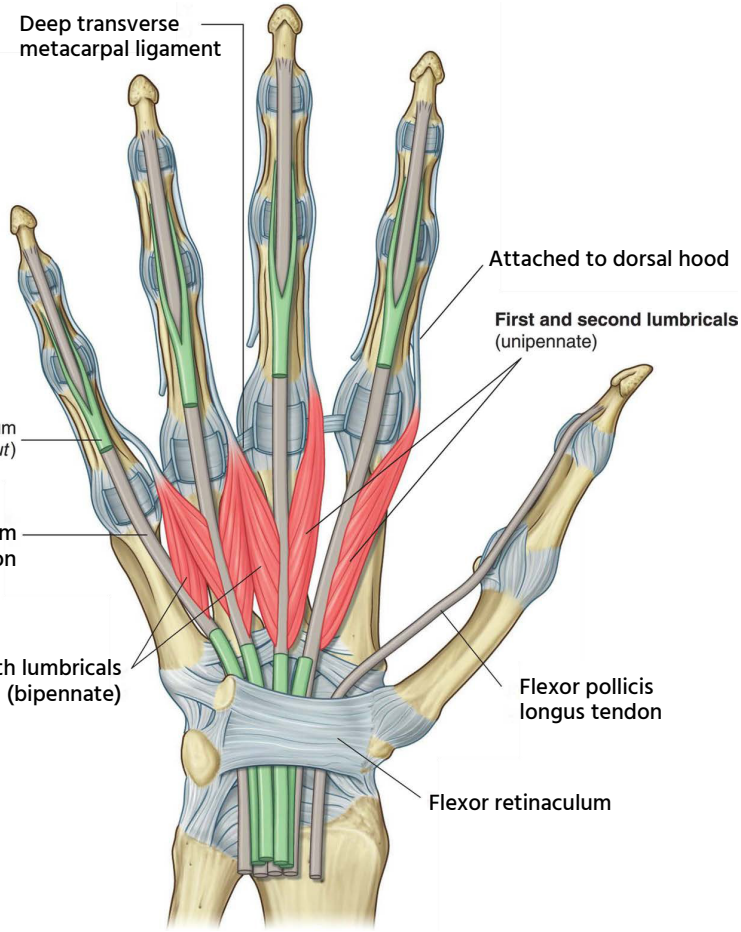
A medial fibrous septum extends deeply from the medial border of the palmar aponeurosis to the 5th metacarpal. Lying medial to this are the hypothenar muscles. In a similar fashion, a lateral fibrous septum extends deeply from the lateral border of the palmar aponeurosis to the 3rd metacarpal. The thenar compartment lies lateral to this area. Lying between the thenar and hypothenar compartments is the central compartment. It contains the flexor tendons and their sheaths, the lumbricals, the superficial palmar arterial arch and the digital vessels and nerves.

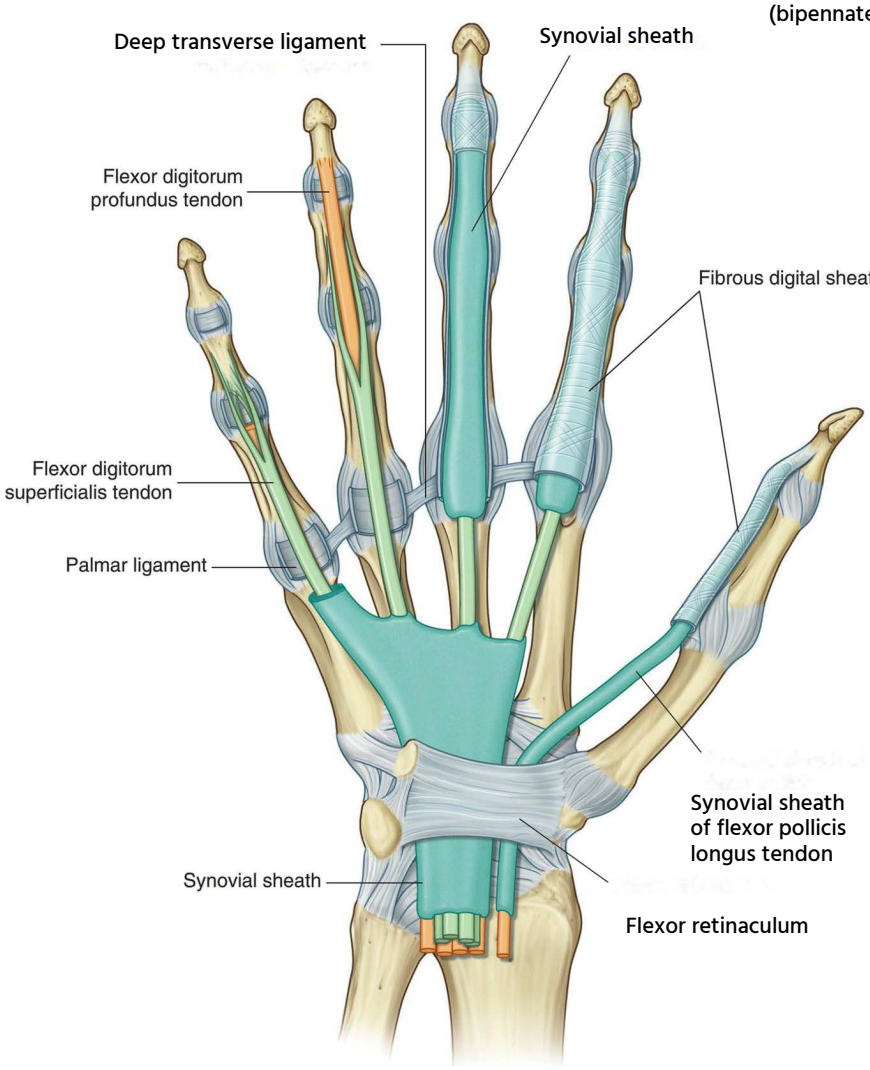
The deepest muscular plane is the adductor compartment, which contains adductor pollicis.



Short muscles of the hand

These comprise the lumbricals and interossei. The four slender lumbrical muscles flex the fingers at the metacarpophalangeal joints and extend the interphalangeal joint. The four dorsal interossei are located between the metacarpals and the four palmar interossei lie on the palmar surface of the metacarpals in the interosseous compartment of the hand.





Long flexor tendons and sheaths in the hand

The tendons of FDS and FDP enter the common flexor sheath deep to the flexor retinaculum. The tendons enter the central compartment of the hand and fan out to their respective digital synovial sheaths.

Near the base of the proximal phalanx, the tendon of FDS splits to permit the passage of FDP. The FDP tendons are attached to the margins of the anterior aspect of the base of the distal phalanx.

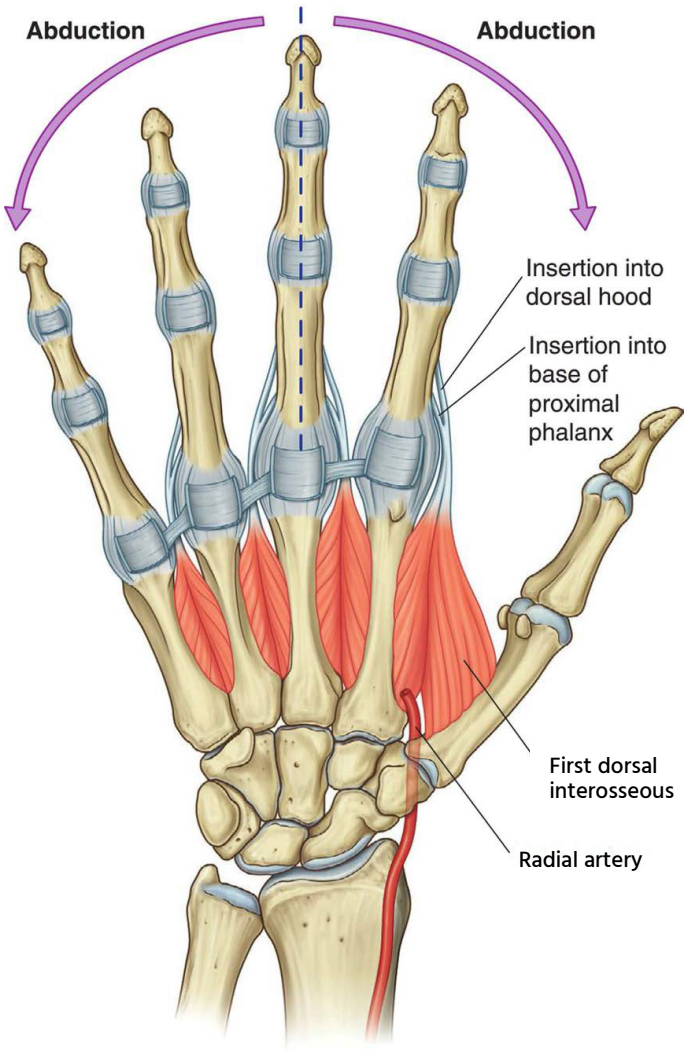
The fibrous digital sheaths contain the flexor tendons and their synovial sheaths. These extend from the heads of the metacarpals to the base of the distal phalanges.

Interossei

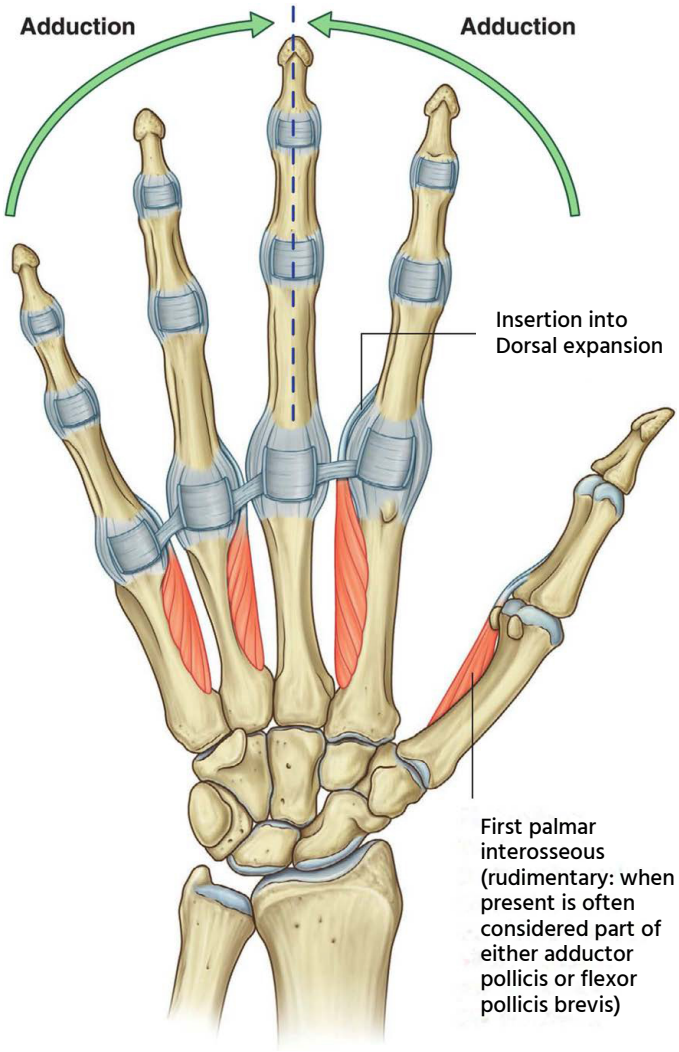
Origin and insertion	Nerve supply	Actions
Three palmar and four dorsal interossei occupy the spaces between the metacarpal bones. Each palmar interossei originates from the metacarpal of the digit on which it acts. Each dorsal interossei comes from the surface of the adjacent metacarpal on which it acts. As a result, the dorsal interossei are twice the size of the palmar ones. The interossei tendons, except the first palmar, pass to one or other side of the metacarpophalangeal joint posterior to the deep transverse metacarpal ligament. They become inserted into the base of the proximal phalanx and partly into the extensor hood	They are all innervated by the ulnar nerve	Dorsal interossei abduct the fingers, palmar interossei adduct the fingers

Clinical notes

Along with the lumbricals the interossei flex the metacarpophalangeal joints and extend the proximal and distal interphalangeal joints. They are responsible for fine tuning these movements. When the interossei and lumbricals are paralysed the digits are pulled into hyperextension by extensor digitorum and a claw hand is seen.



Dorsal interossei (palmar view)



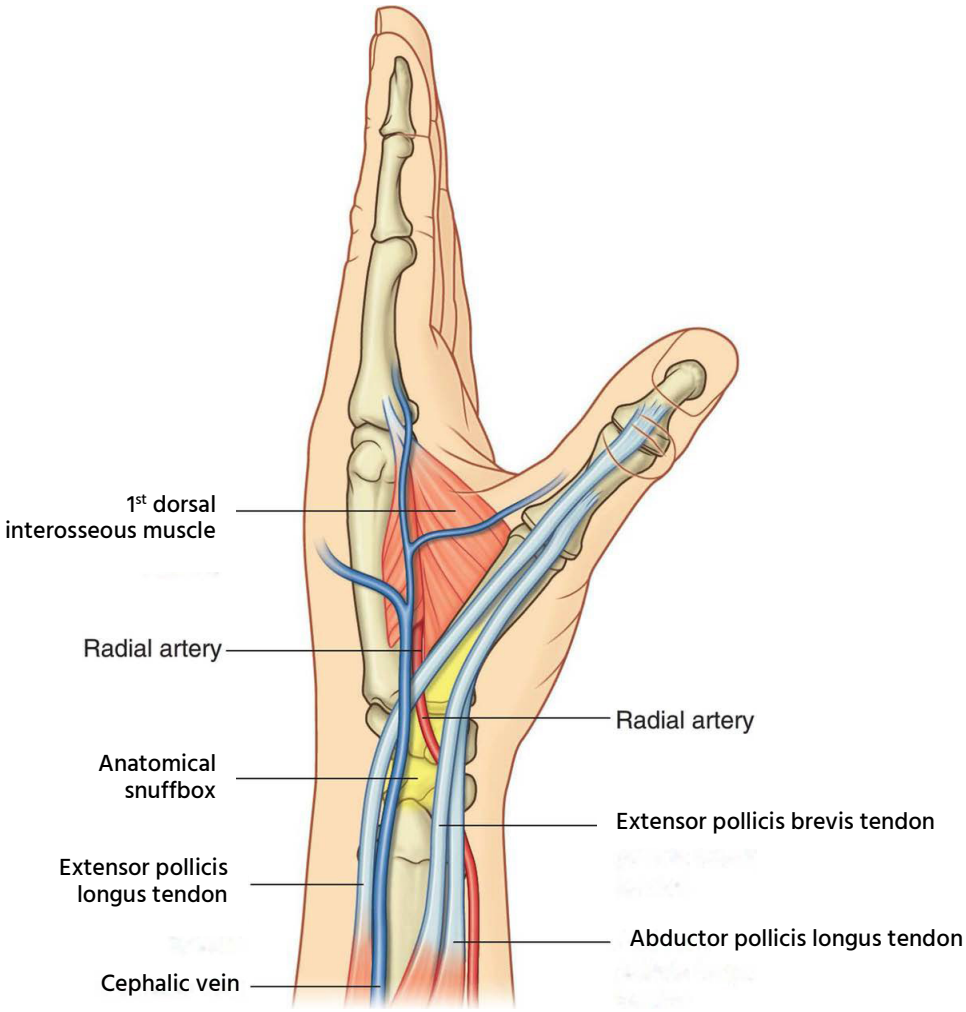
Palmar interossei (palmar view)

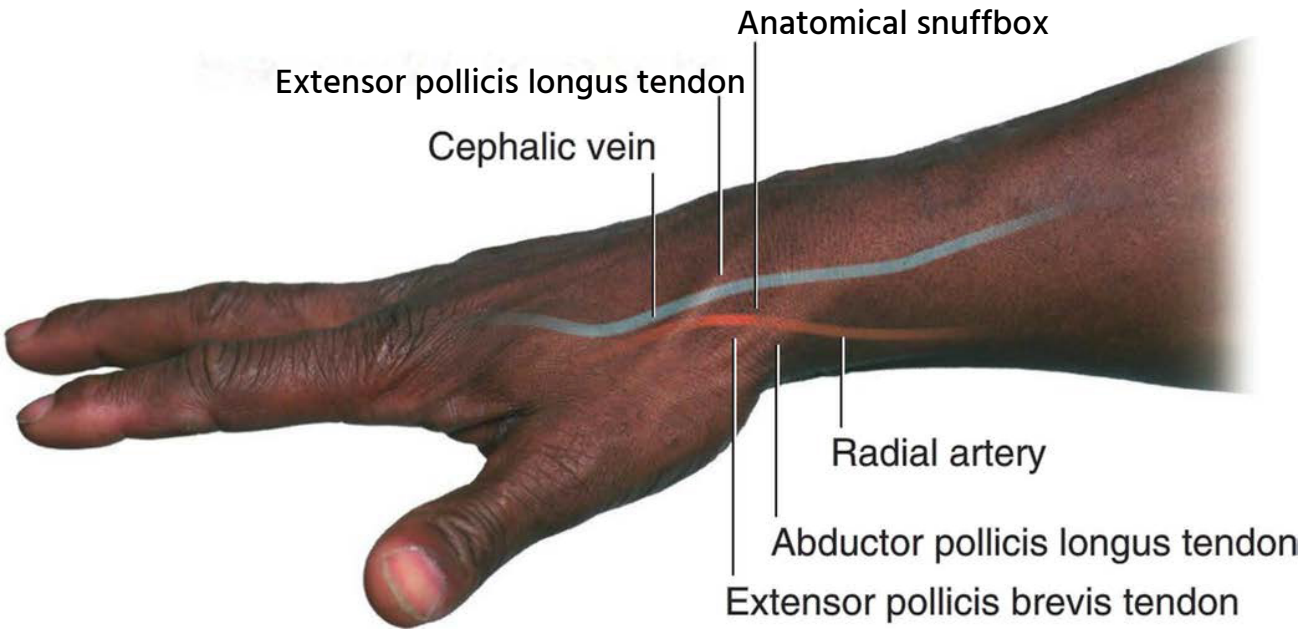
Mnemonic *"PAD & DAB"*

- Palmar interossei **AD**duct
- **D**orsal interossei **AB**duct

Anatomical snuffbox

Posterior border (medially)	Tendon of extensor pollicis longus
Anterior border (laterally)	Tendons of extensor pollicis brevis and abductor pollicis longus
Proximal border	Styloid process of the radius
Distal border	Apex of snuffbox triangle
Floor	Trapezium and scaphoid
Content	Radial artery



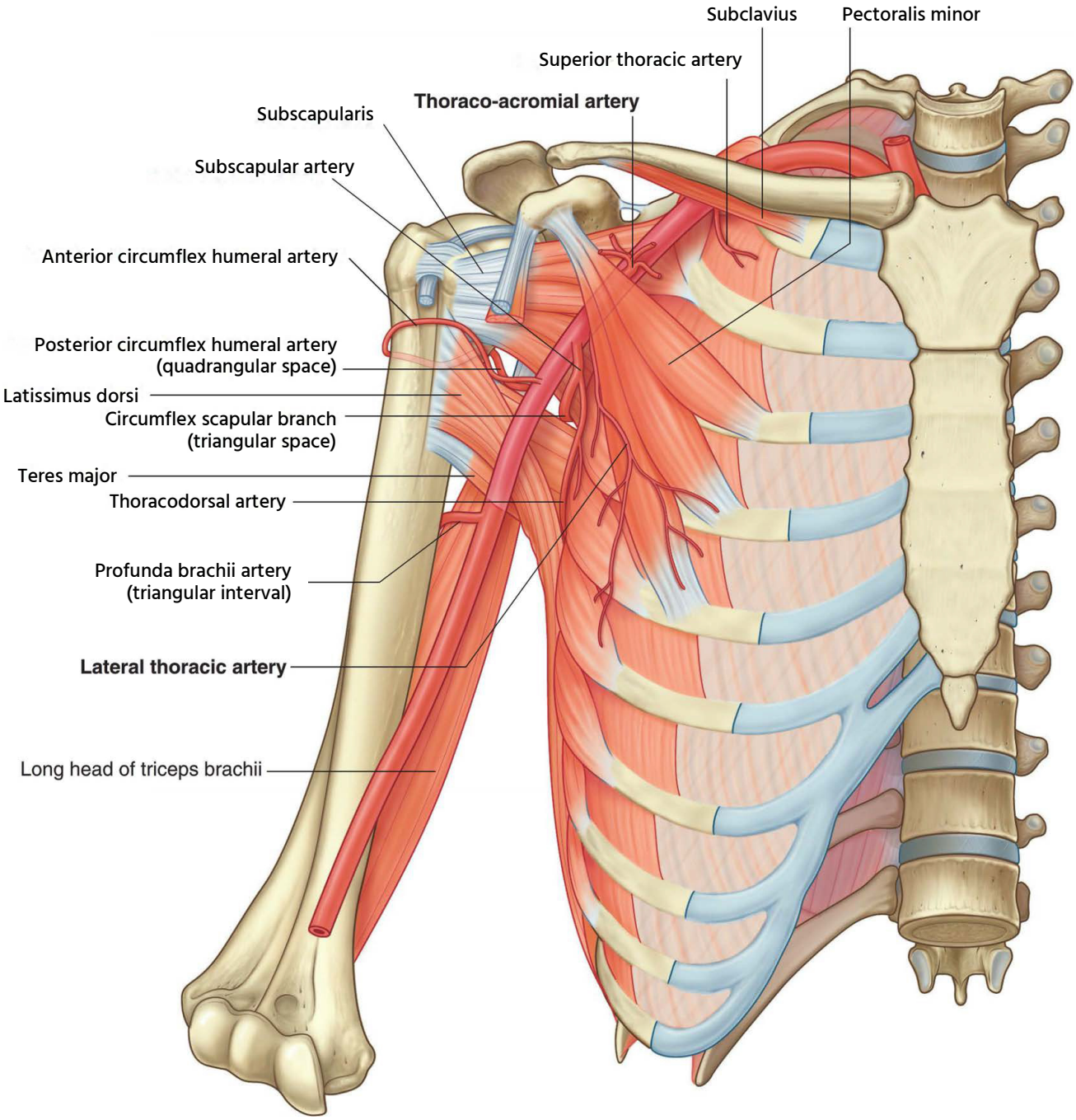


Arteries of the UL

Axillary Artery

Mnemonic for branches *"Screw The Lawyer, Save A Patient"*

Part	Branch	Course
I	Sup. Thoracic a.	Medial to serratus anterior and pectoral muscles
II	Thoracoacromial a.	Four branches: deltoid, acromial, pectoralis, clavicular
	Lateral thoracic a.	Descends to serratus anterior
III	Subscapular a. (largest br.)	Two branches: thoracodorsal and circumflex scapular (triangular space)
	Anterior humeral circumflex a.	Blood supply to humeral head: arcuate artery lateral to bicipital groove
	Posterior humeral circumflex a.	Branch in the quadrangular space accompanying the axillary nerve



Thoracoacromial Artery

The thoracoacromial artery (acromiothoracic artery; thoracic axis) is a short trunk, which arises from the forepart of the axillary artery, its origin being generally overlapped by the upper edge of the Pectoralis minor.

Projecting forward to the upper border of the Pectoralis minor, it pierces the coracoclavicular fascia and divides into four branches: pectoral, acromial, clavicular, and deltoid.

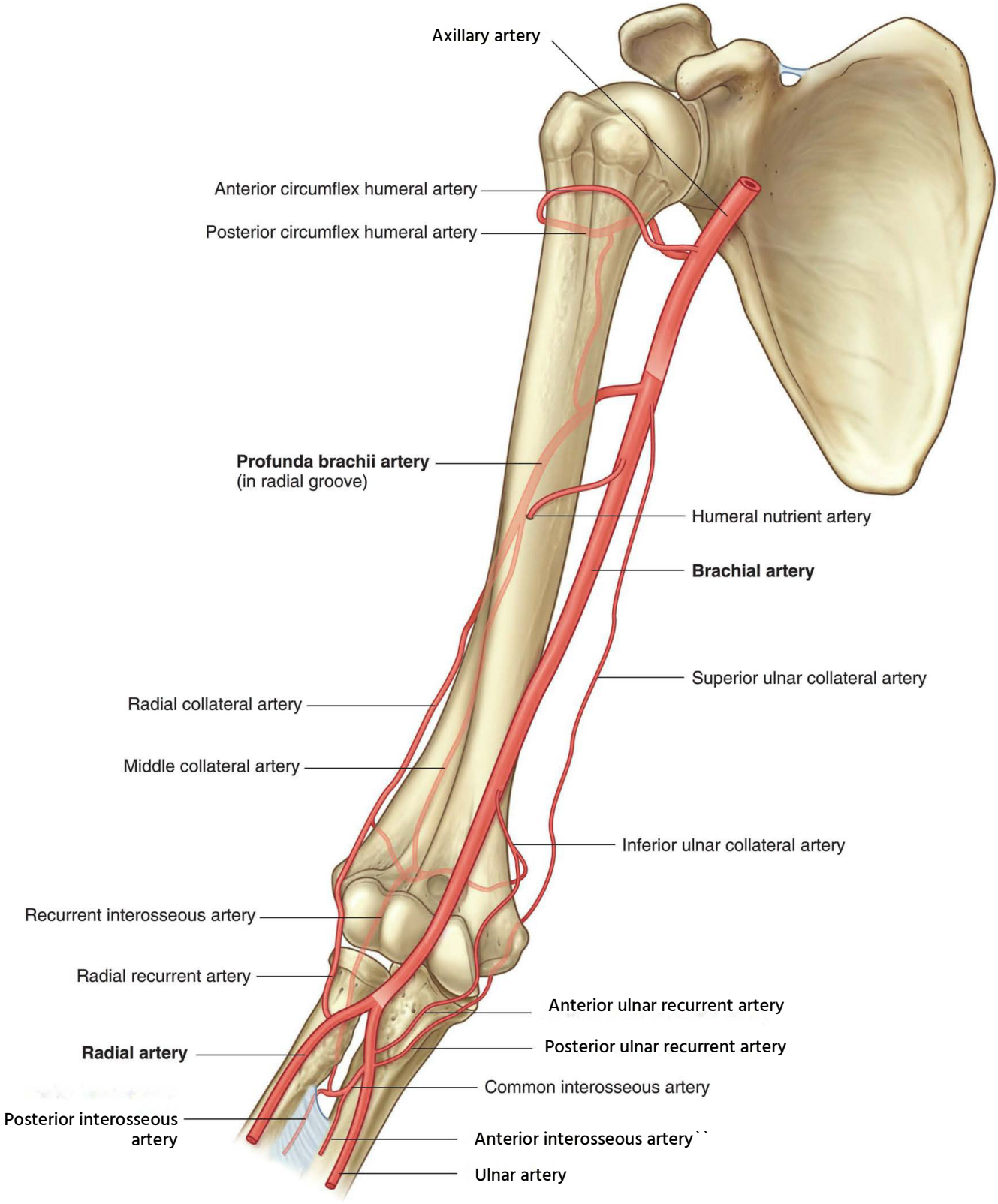
Branch	Description
Pectoral branch	Descends between the two Pectoral muscles, and is distributed to them and to the breast, anastomosing with the intercostal branches of the internal thoracic artery and with the lateral thoracic.
Acromial branch	Runs laterally over the coracoid process and under the Deltoid, to which it gives branches; it then pierces that muscle and ends on the acromion in an arterial network formed by branches from the suprascapular, thoracoacromial, and posterior humeral circumflex arteries.
Clavicular branch	Runs upwards and medially to the sternoclavicular joint, supplying this articulation, and the Subclavius.
Deltoid branch	Arising with the acromial, it crosses over the Pectoralis minor and passes in the same groove as the cephalic vein, between the Pectoralis major and Deltoid, and gives branches to both muscles.

Brachial Artery

The brachial artery begins at the lower border of teres major as a continuation of the axillary artery. It terminates in the cubital fossa at the level of the neck of the radius by dividing into the radial and ulnar arteries.

Relations

- Posterior relations include the long head of triceps with the radial nerve and profunda vessels intervening.
- Anteriorly it is overlapped by the medial border of biceps.
- It is crossed by the median nerve in the middle of the arm.
- In the cubital fossa it is separated from the **median cubital vein by the bicipital aponeurosis.**
- The basilic vein is in contact at the most proximal aspect of the cubital fossa and lies medially.



Ulnar Artery

Path

- Starts: middle of antecubital fossa
- Passes obliquely downward, reaching the ulnar side of the forearm at a point about midway between the elbow and the wrist. It follows the ulnar border to the wrist, crossing over the flexor retinaculum. It then divides into the superficial and deep volar arches.

Relations

Deep to- Pronator teres, Flexor carpi radialis, Palmaris longus

Lies on- Brachialis and Flexor digitorum profundus

Superficial to the flexor retinaculum at the wrist

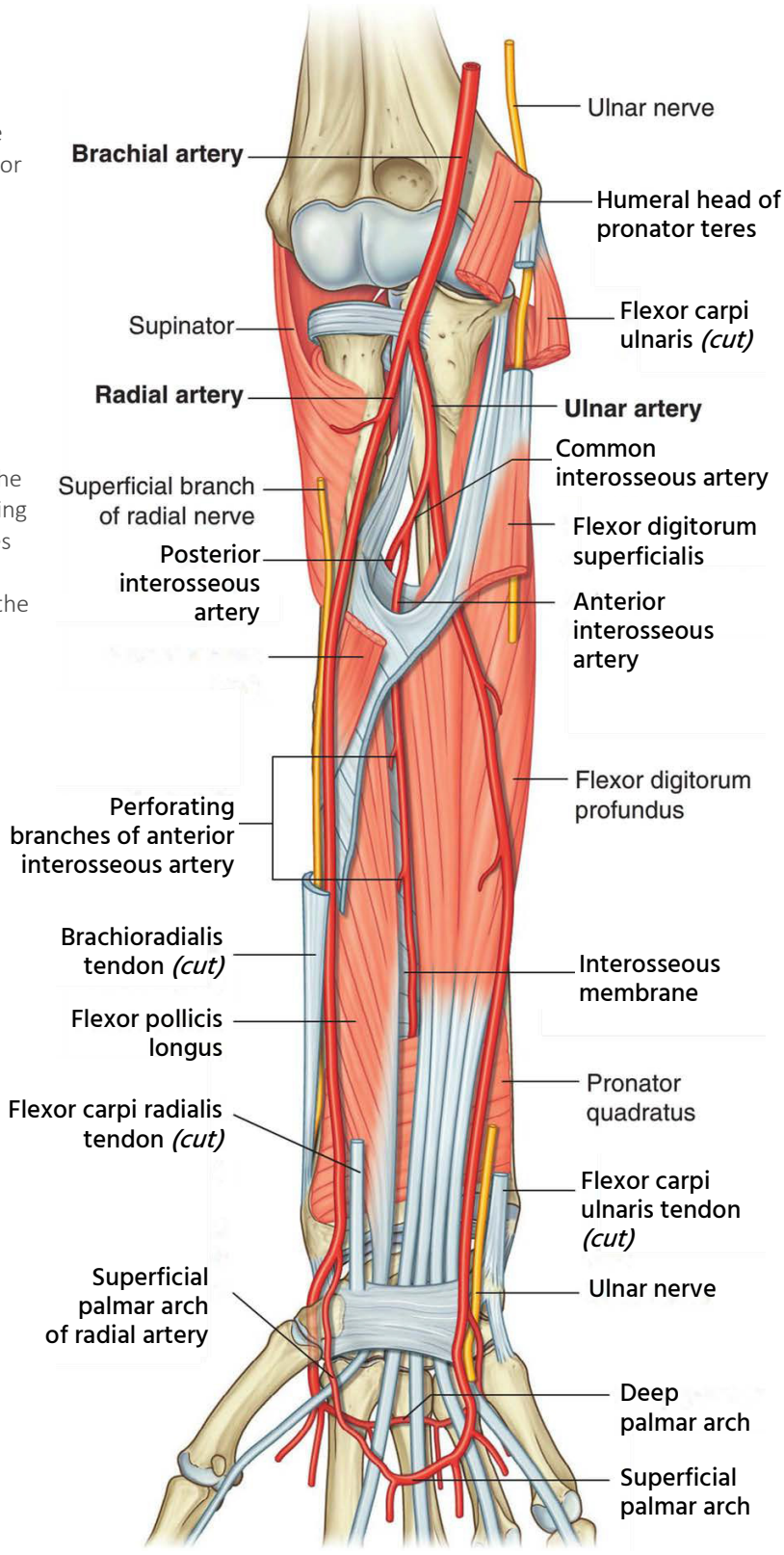
The median nerve is in relation with the medial side of the artery for about 2.5 cm. And then crosses the vessel, being separated from it by the ulnar head of the Pronator teres

The ulnar nerve lies medially to the lower two-thirds of the artery

Branch

- Anterior interosseous artery

Radial Artery



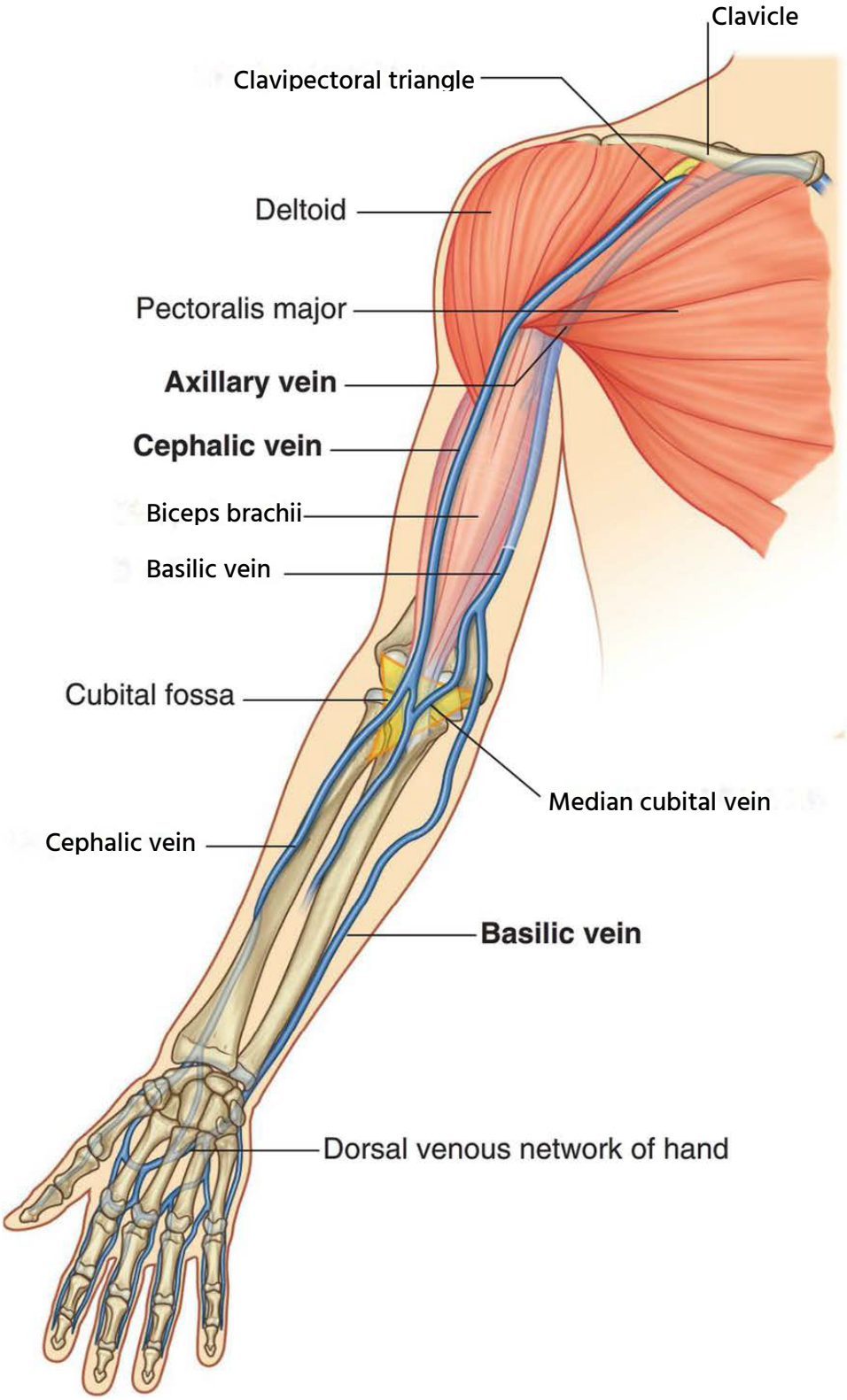
Veins of the UL

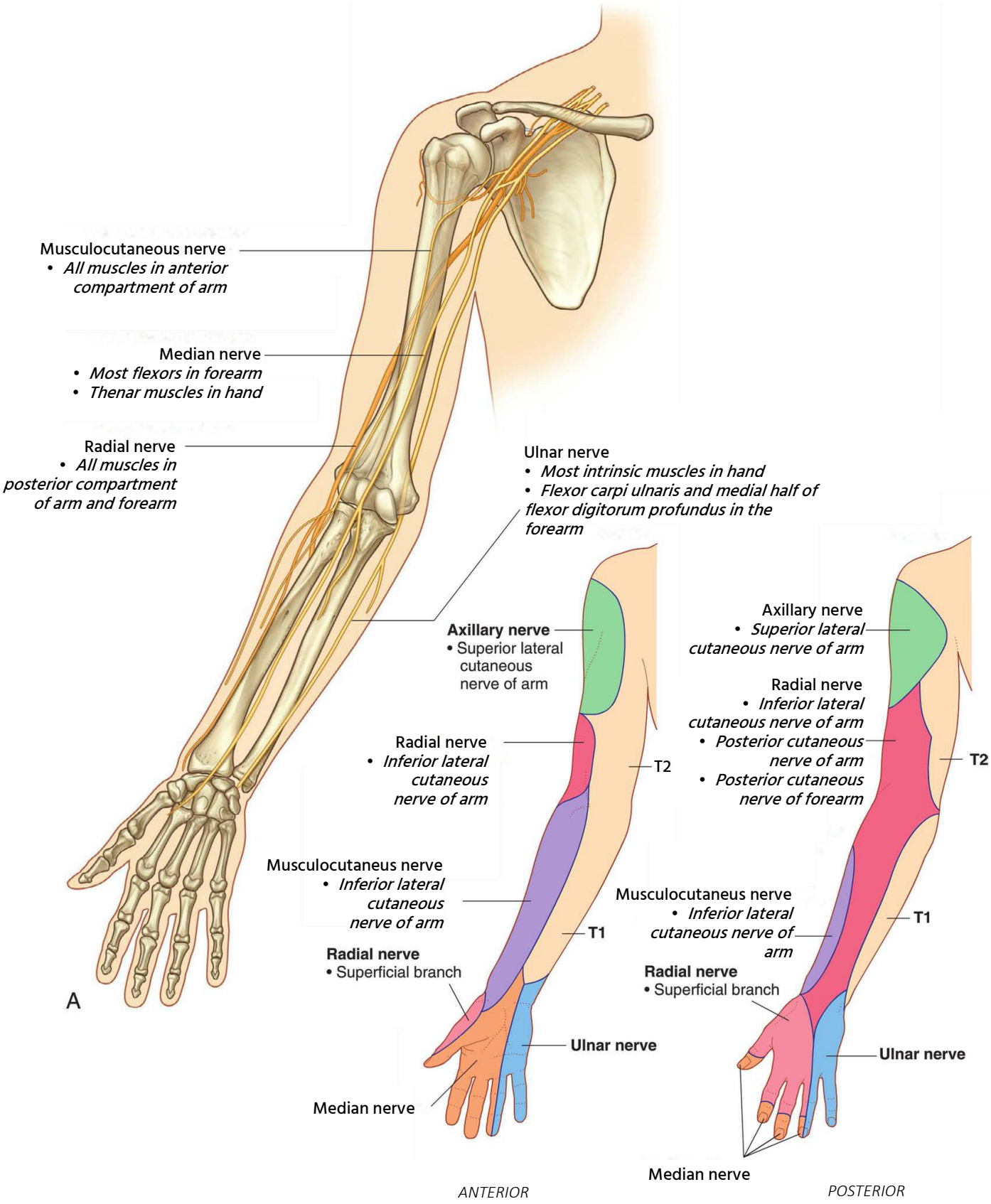
Basilic Vein

The basilic and cephalic veins both provide the main pathways of venous drainage for the arm and hand. It is continuous with the palmar venous arch distally and the axillary vein proximally.

Path

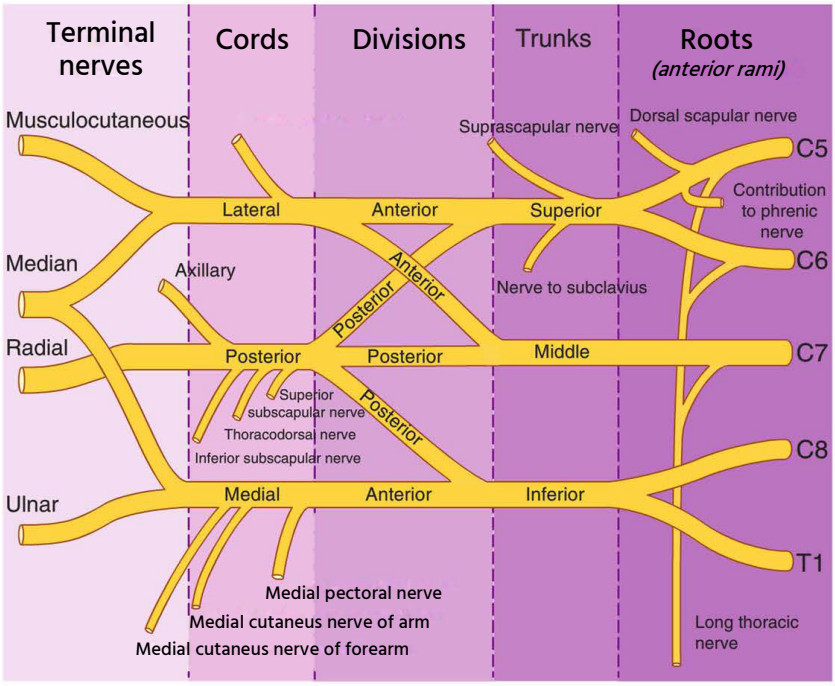
- Originates on the medial side of the dorsal venous network of the hand, and passes up the forearm and arm.
- Most of its course is superficial.
- Near the region anterior to the cubital fossa the vein joins the cephalic vein.
- Midway up the humerus the basilic vein passes deep under the muscles.
- At the lower border of the teres major muscle, the anterior and posterior circumflex humeral veins feed into it.
- It is often joined by the medial brachial vein before **draining into the axillary vein**.

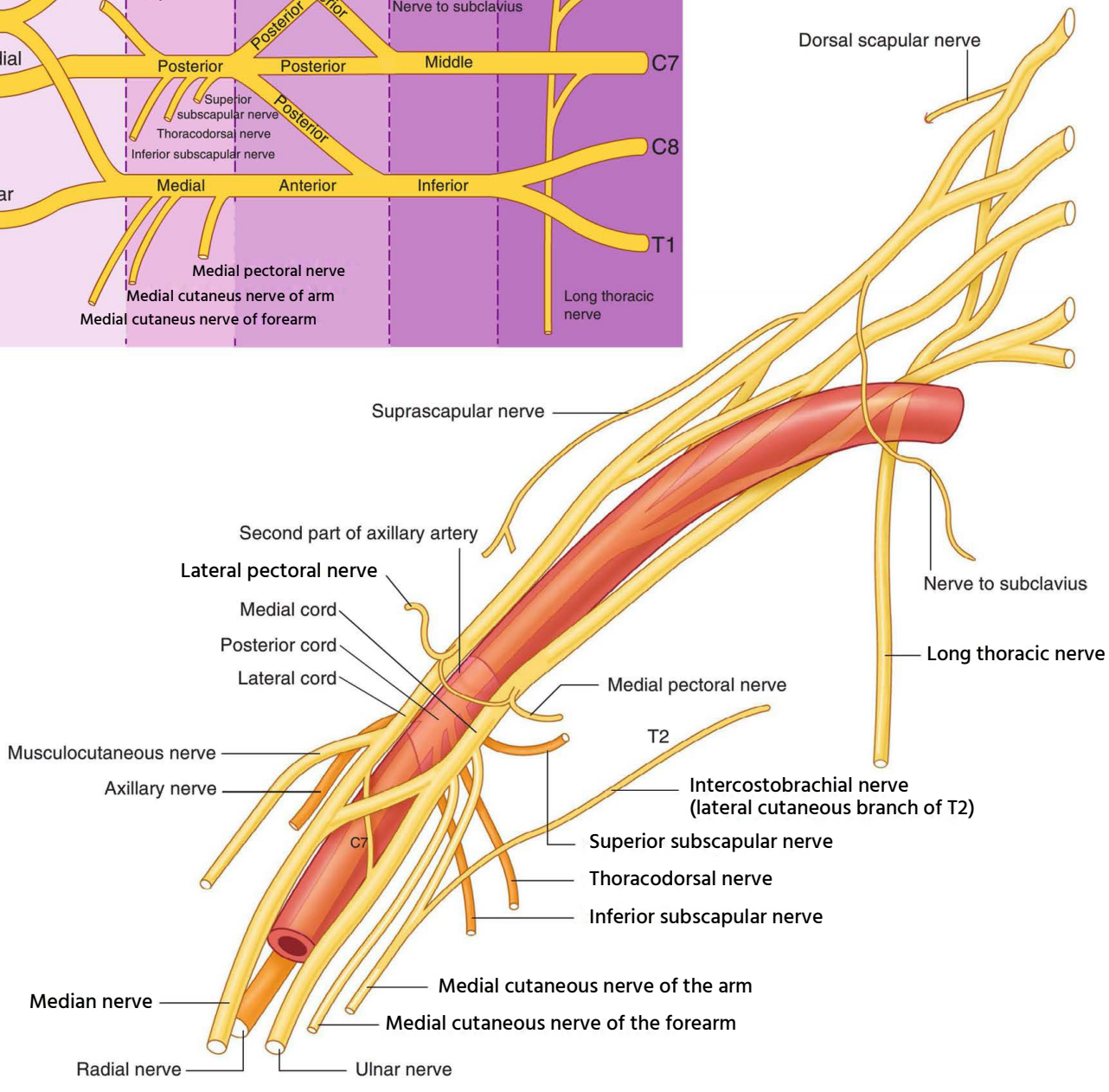



Musculocutaneous nerve
• All muscles in anterior compartment of arm
Median nerve
• Most flexors in forearm
• Thenar muscles in hand
Radial nerve
• All muscles in posterior compartment of arm and forearm
Ulnar nerve
• Most intrinsic muscles in hand
• Flexor carpi ulnaris and medial half of flexor digitorum profundus in the forearm
A
Axillary nerve
• Superior lateral cutaneous nerve of arm
Radial nerve
• Inferior lateral cutaneous nerve of arm
T2
Musculocutaneus nerve
• Inferior lateral cutaneous nerve of arm
T1
Radial nerve
• Superficial branch
Ulnar nerve
Median nerve
ANTERIOR
Axillary nerve
• Superior lateral cutaneous nerve of arm
Radial nerve
• Inferior lateral cutaneous nerve of arm
• Posterior cutaneous nerve of arm
• Posterior cutaneous nerve of forearm
T2
Musculocutaneus nerve
• Inferior lateral cutaneous nerve of arm
T1
Radial nerve
• Superficial branch
Ulnar nerve
Median nerve
POSTERIOR

Brachial Plexus

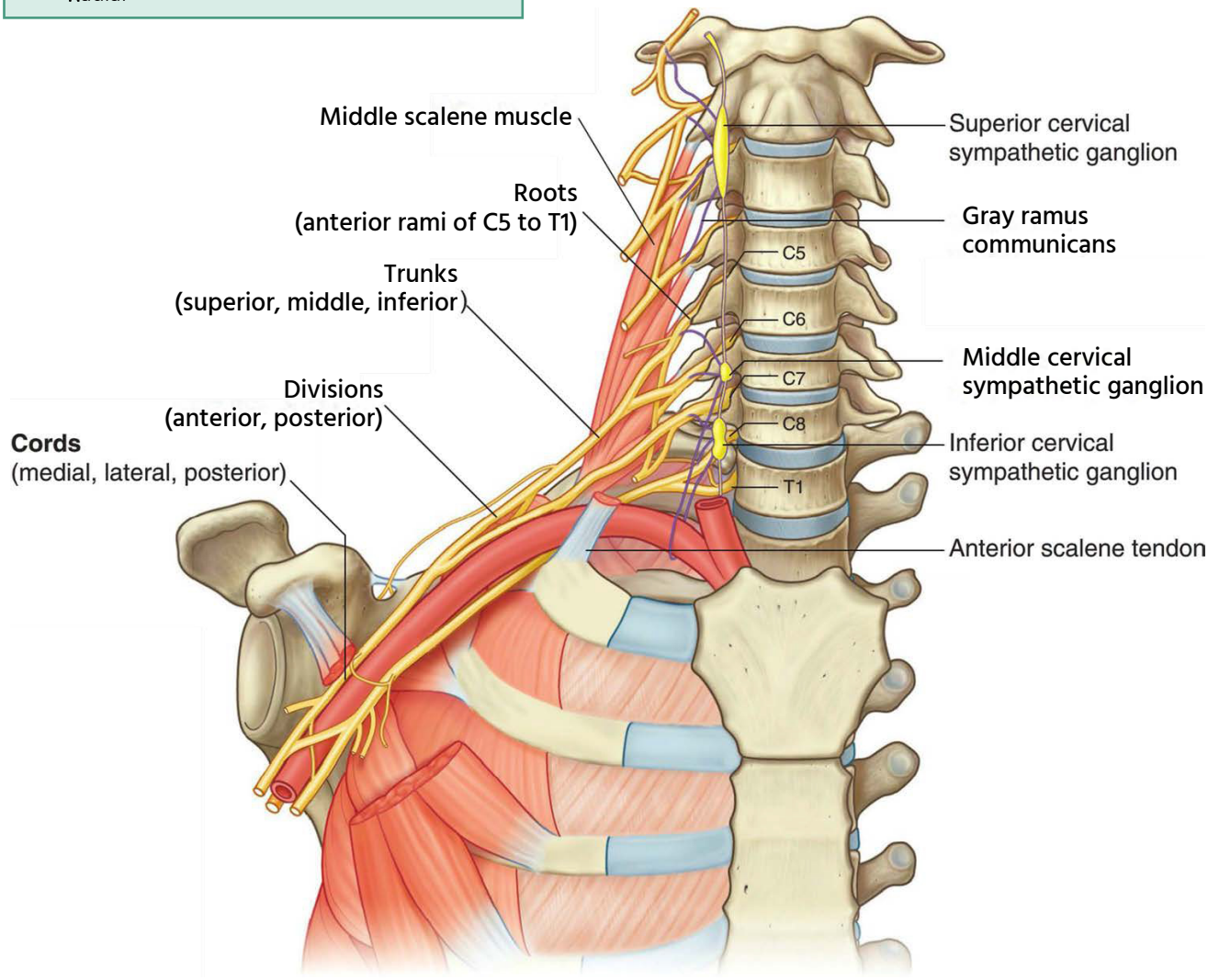
Origin	Anterior rami of C5 to T1
Sections of the plexus	• Roots, trunks, divisions, cords, branches • Mnemonic : *Real Teenagers Drink Cold Beer*
Roots	• Located in the posterior triangle • Pass between scalenus anterior and medius
Trunks	• Located posterior to middle third of clavicle • Upper and middle trunks related superiorly to the subclavian artery • Lower trunk passes over 1st rib posterior to the subclavian artery
Divisions	Apex of axilla
Cords	Related to axillary artery





Mnemonic branches off the posterior cord

- **S**ubscapular (upper and lower)
- **T**horacodorsal *(Nerve to latissimus dorsi)*
- **A**xillary
- **R**adial



Summary of Upper Extremity Innervation

Nerves	Muscles Innervated
Musculocutaneous (lateral cord)	Coracobrachialis, biceps, brachialis
Axillary (posterior cord)	Deltoid, teres minor
Radial (posterior cord)	Triceps, brachioradialis, extensor carpi radialis longus and brevis
Posterior interosseous	Supinator, extensor carpi ulnaris, extensor digitorum, extensor digiti minimi, abductor pollicis longus, extensor pollicis longus and brevis, extensor indicis proprius
Median (medial and lateral cord)	Pronator teres, flexor carpi radialis, palmaris longus, flexor digitorum superficialis, abductor pollicis brevis, supinator head of flexor pollicis brevis, opponens pollicis, first and second lumbrical muscles
Anterior interosseous	Flexor digitorum profundus (first and second), flexor pollicis longus, pronator quadratus
Ulnar (medial cord)	Flexor carpi ulnaris, flexor digitorum profundus (third and fourth), palmaris brevis, abductor digiti minimi, opponens digiti minimi, flexor digiti minimi, third and fourth lumbrical muscles, interossei, adductor pollicis, deep head of flexor pollicis brevis

Musculocutaneous Nerve

Path

- Branch of lateral cord of brachial plexus
- It penetrates the coracobrachialis muscle
- Passes obliquely **between the biceps brachii and the brachialis to the lateral side of the arm**
- Above the elbow it pierces the deep fascia lateral to the tendon of the biceps brachii
- Continues into the forearm as the lateral cutaneous nerve of the forearm

Innervates

- Coracobrachialis
- Biceps brachii
- Brachialis

Median Nerve

The median nerve is formed by the union of a lateral and medial root respectively from the lateral (C5,6,7) and medial (C8 and T1) cords of the brachial plexus; the medial root passes anterior to the third part of the axillary artery. The nerve descends lateral to the brachial artery, crosses to its medial side (usually passing anterior to the artery). It passes deep to the bicipital aponeurosis and the median cubital vein at the elbow.
It passes between the two heads of the pronator teres muscle, and runs on the deep surface of flexor digitorum superficialis (within its fascial sheath).
Near the wrist it becomes superficial between the tendons of flexor digitorum superficialis and flexor carpi radialis, deep to palmaris longus tendon. It passes deep to the flexor retinaculum to enter the palm, but lies anterior to the long flexor tendons within the carpal tunnel.

Branches

Region	Branch
Upper arm	No branches, although the nerve commonly communicates with the musculocutaneous nerve
Forearm	Pronator teres Flexor carpi radialis Palmaris longus Flexor digitorum superficialis
	Pronator quadratus Flexor pollicis longus Flexor digitorum profundus (only the radial half)
Distal forearm	Palmar cutaneous branch
Hand (Motor)	Motor supply (*LOAF*) • Lateral 2 lumbricals • Opponens pollicis • Abductor pollicis brevis • Flexor pollicis brevis
Hand (Sensory)	• Over thumb and lateral 2 ½ fingers • On the palmar aspect this projects proximally, on the dorsal aspect only the distal regions are innervated with the radial nerve providing the more proximal cutaneous innervation.

Patterns of damage:

Damage at wrist

- e.g. Carpal tunnel syndrome
- Paralysis and wasting of thenar eminence muscles and opponens pollicis (ape hand deformity)
- Sensory loss to palmar aspect of lateral (radial) 2 ½ fingers

Damage at elbow, as above plus:

- Unable to pronate forearm
- Weak wrist flexion
- Ulnar deviation of wrist

Anterior interosseous nerve (branch of median nerve)

- Leaves just below the elbow
- Results in loss of pronation of forearm and weakness of long flexors of thumb and index finger
- Loss of **pincer movement** of the thumb and index finger.

Ulnar Nerve

Origin

- C8, T1

Supplies (no muscles in the upper arm)

- Flexor carpi ulnaris
- Flexor digitorum profundus
- Flexor digiti minimi
- Abductor digiti minimi
- Opponens digiti minimi
- Adductor pollicis
- Interossei muscle
- Third and fourth lumbricals
- Palmaris brevis

Ulnar nerve: ***Mafia P***
Medial 2 lumbricals
Adductor pollicis
Flexor digitorum profundus/Flexor carpi ulnaris
Interossei
Abductor and Opponens and flexor digiti minimi *(hypothenar eminence)*
Palmaris brevis

Innervates all intrinsic muscles of the hand
(EXCEPT 2: thenar muscles & first two lumbricals - supplied by median n.)

Path

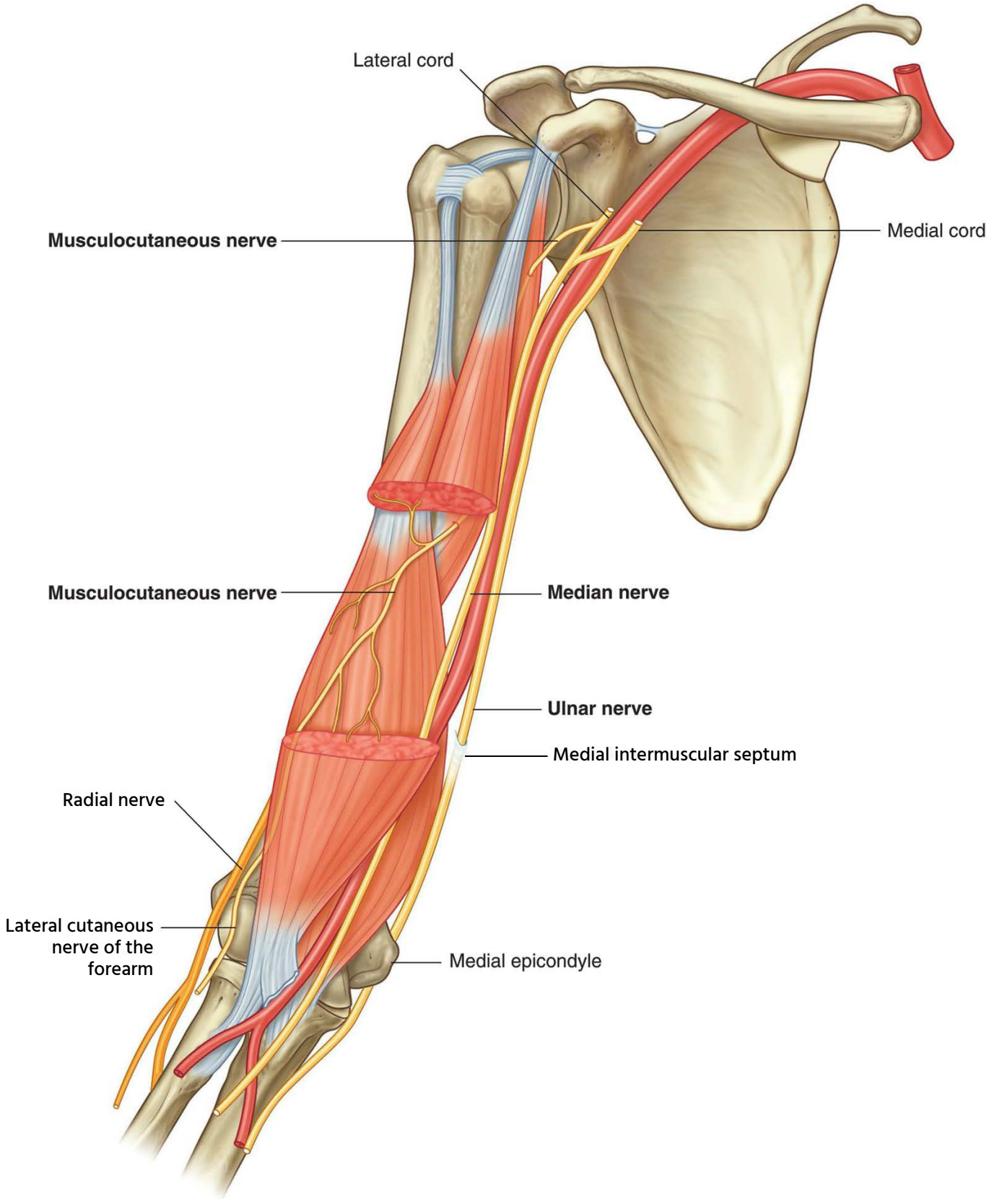
- Posteromedial aspect of upper arm to flexor compartment of forearm, then along the ulnar. Passes beneath the flexor carpi ulnaris muscle, then superficially through the flexor retinaculum into the palm of the hand.

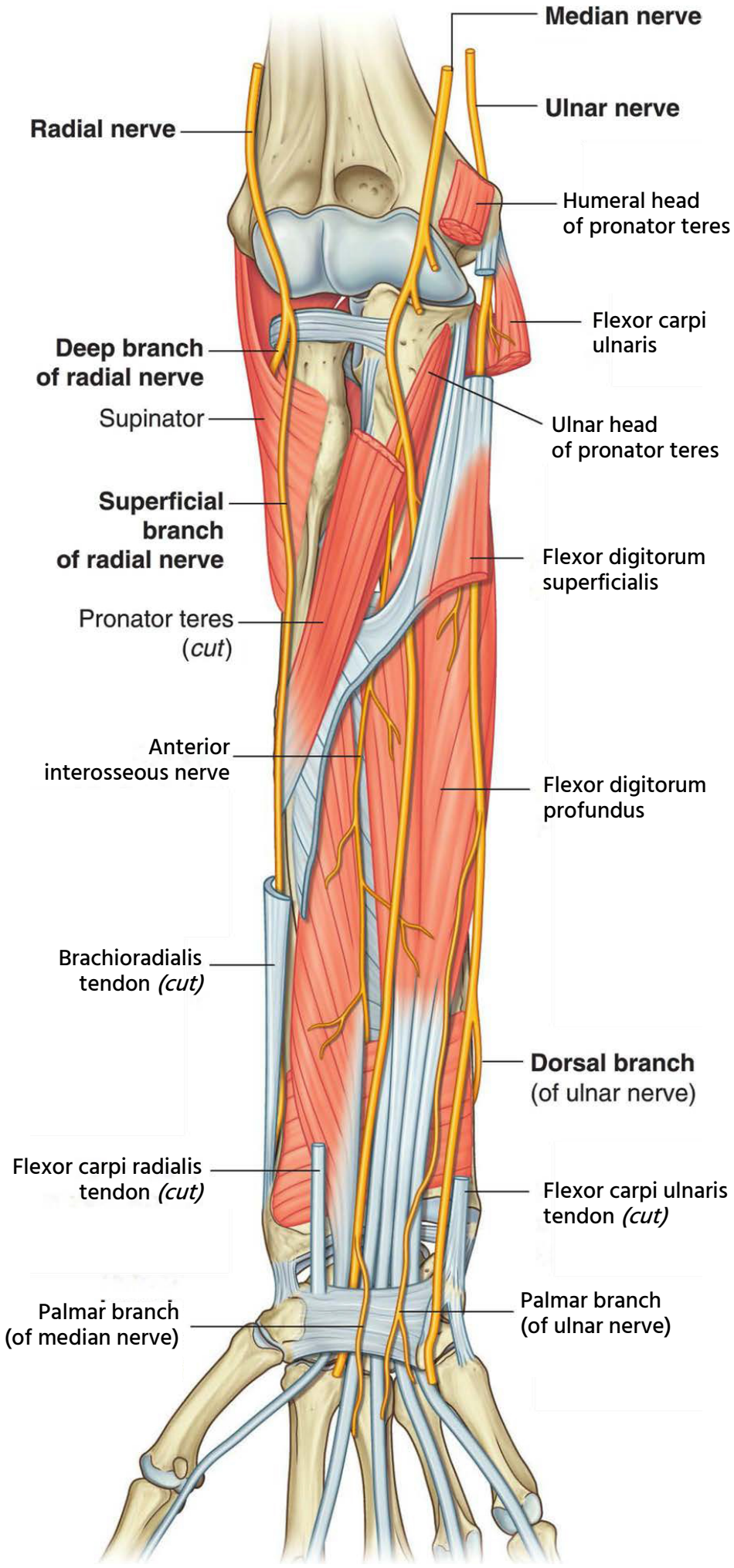
Branches

Branch	Supplies
Muscular branch	Flexor carpi ulnaris Medial half of the flexor digitorum profundus
Palmar cutaneous branch (Arises near the middle of the forearm)	Skin on the medial part of the palm
Dorsal cutaneous branch	Dorsal surface of the medial part of the hand
Superficial branch	Cutaneous fibres to the anterior surfaces of the medial one and one-half digits
Deep branch	Hypothenar muscles All the interosseous muscles Third and fourth lumbricals Adductor pollicis Medial head of the flexor pollicis brevis

Effects of injury

Damage at the wrist	• Wasting and paralysis of intrinsic hand muscles (claw hand) • Wasting and paralysis of hypothenar muscles • Loss of sensation medial 1 and half fingers
Damage at the elbow	• Radial deviation of the wrist • Clawing less in 4th and 5th digits


Lateral cord
Musculocutaneous nerve
Medial cord
Musculocutaneous nerve
Median nerve
Ulnar nerve
Medial intermuscular septum
Radial nerve
Lateral cutaneous nerve of the forearm
Medial epicondyle

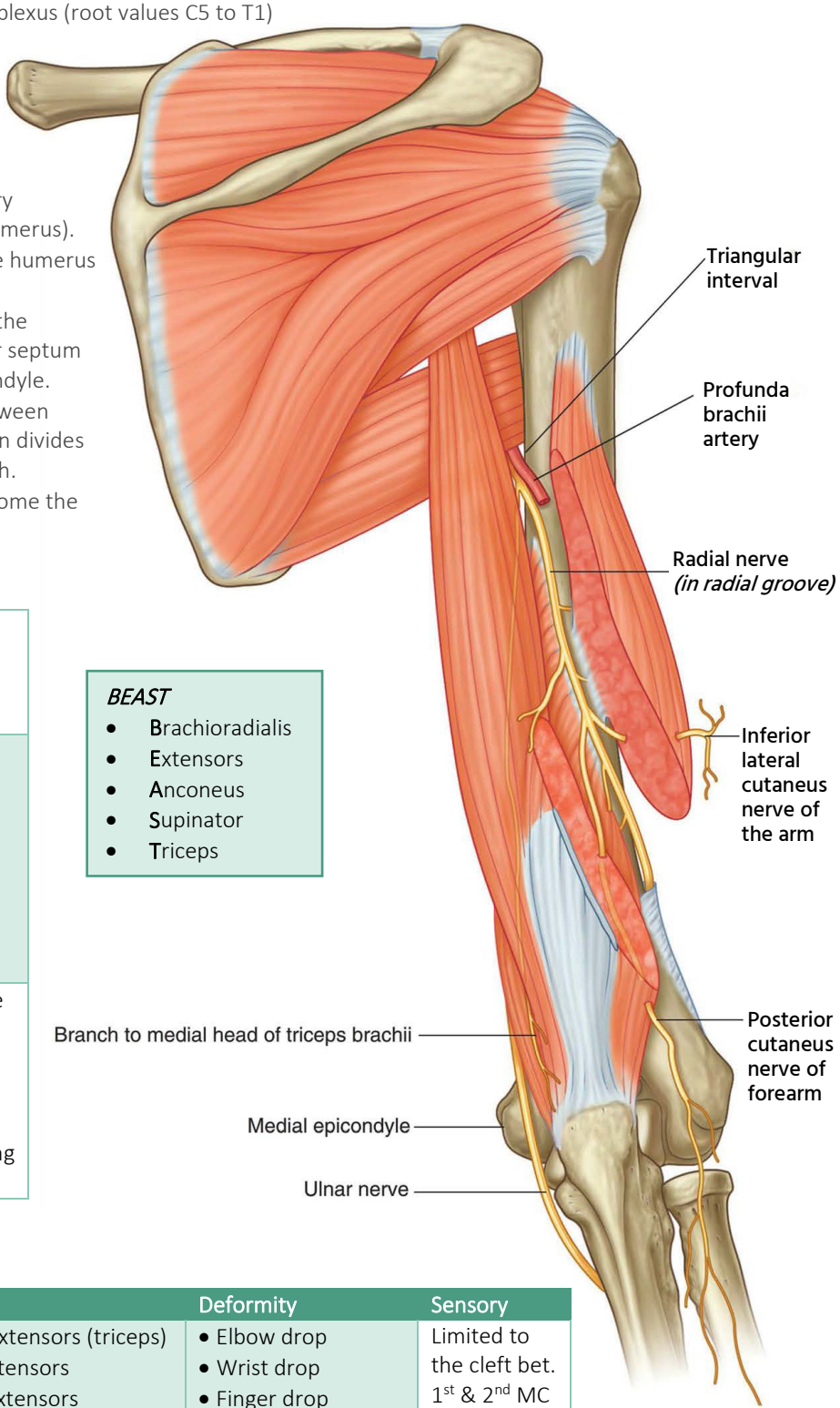

Median nerve
Ulnar nerve
Radial nerve
Humeral head of pronator teres
Flexor carpi ulnaris
Deep branch of radial nerve
Supinator
Ulnar head of pronator teres
Superficial branch of radial nerve
Flexor digitorum superficialis
Pronator teres (cut)
Anterior interosseous nerve
Flexor digitorum profundus
Brachioradialis tendon (cut)
Dorsal branch (of ulnar nerve)
Flexor carpi radialis tendon (cut)
Flexor carpi ulnaris tendon (cut)
Palmar branch (of median nerve)
Palmar branch (of ulnar nerve)

Radial Nerve

Continuation of posterior cord of the brachial plexus (root values C5 to T1)

Path

- In the axilla: lies posterior to the axillary artery on subscapularis, latissimus dorsi and **teres major**.
- Enters the arm between the brachial artery and the long head of triceps (medial to humerus).
- Spirals around the posterior surface of the humerus in the groove for the radial nerve.
- At the distal third of the lateral border of the humerus it then pierces the intermuscular septum and descends in front of the lateral epicondyle.
- At the lateral epicondyle it lies deeply between brachialis and brachioradialis where it then divides into a superficial and deep terminal branch.
- Deep branch crosses the supinator to become the posterior interosseous nerve.



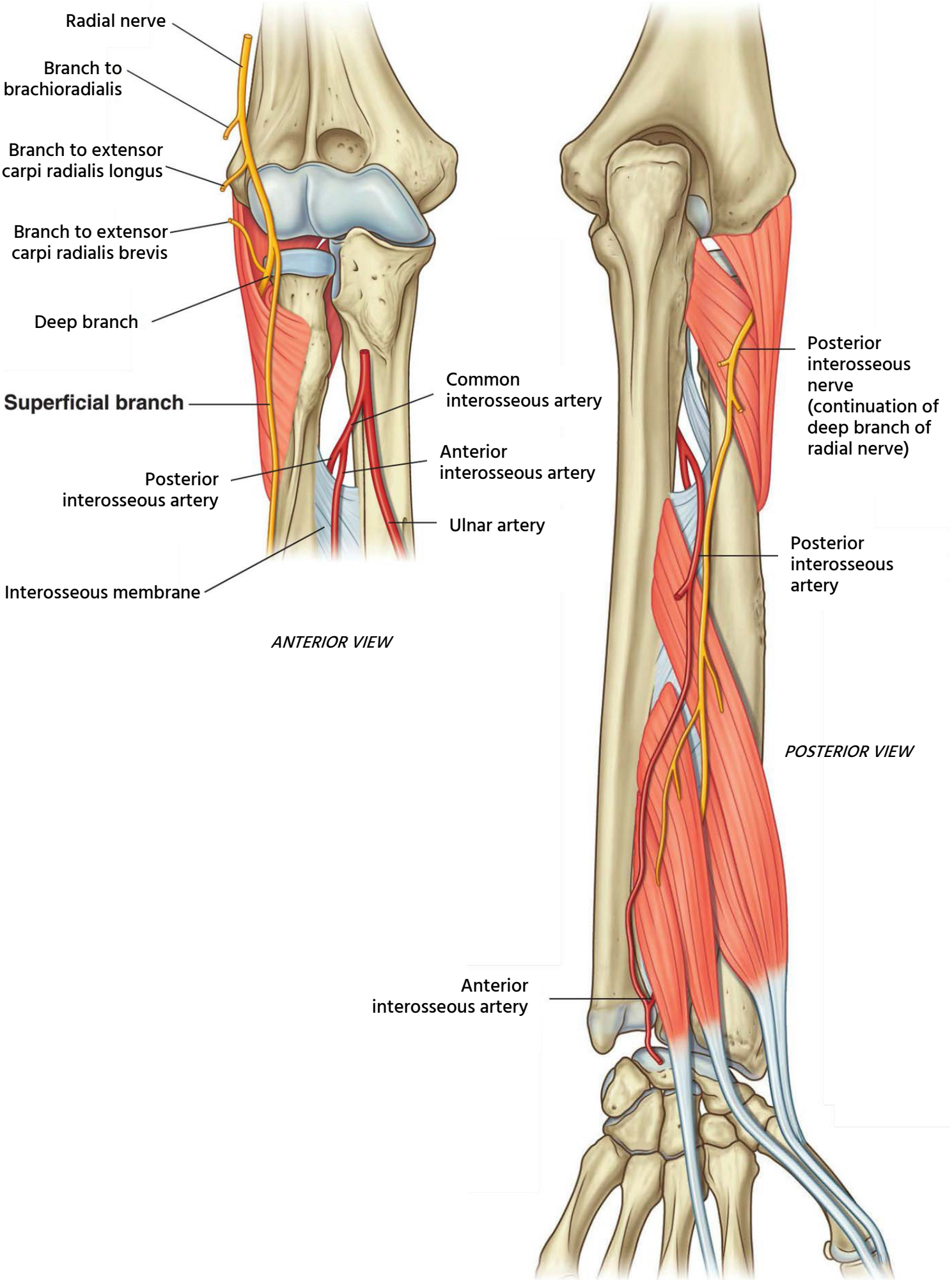
BEAST
- **B**rachioradialis
- **E**xtensors
- **A**nconeus
- **S**upinator
- **T**riceps

Regions innervated

Motor (main nerve)	• Triceps • Anconeus • Brachioradialis • Extensor carpi radialis
Motor (posterior interosseous branch)	• Supinator • Extensor carpi ulnaris • Extensor digitorum • Extensor indicis • Extensor digiti minimi • Extensor pollicis longus • Extensor pollicis brevis • Abductor pollicis longus
Sensory	The area of skin supplying the proximal phalanges on the dorsal aspect of the hand is supplied by the radial nerve (this does not apply to the little finger and part of the ring finger)

Injury of the radial nerve

Site & Causes	Motor affection	Deformity	Sensory
Axilla *e.g. Crutch palsy, Saturday night palsy*	• Paralysis of elbow extensors (triceps) • Paralysis of wrist extensors • Paralysis of finger extensors	• Elbow drop • Wrist drop • Finger drop	Limited to the cleft bet. 1st & 2nd MC bones (*due to overlap of other sensory nerves*)
Spiral groove *e.g. # humerus, wrong IM injection*	• Paralysis of wrist extensors • Paralysis of finger extensors *Normal elbow extension due to intact long and med heads of triceps*	• Wrist drop • Finger drop	
PIN *e.g. # neck of radius*	• Only paralysis of finger extensors *Normal wrist extensors due to intact ECR*	• Finger drop	**No** sensory loss
Superficial radial n. *e.g. wrist laceration*	• **No** Motor affection	• **No** deformity	Same as first two


Radial nerve
Branch to brachioradialis
Branch to extensor carpi radialis longus
Branch to extensor carpi radialis brevis
Deep branch
Superficial branch
Posterior interosseous artery
Interosseous membrane
Common interosseous artery
Anterior interosseous artery
Ulnar artery
ANTERIOR VIEW
Posterior interosseous nerve (continuation of deep branch of radial nerve)
Posterior interosseous artery
Anterior interosseous artery
POSTERIOR VIEW

Joints of the UL

Shoulder Joint

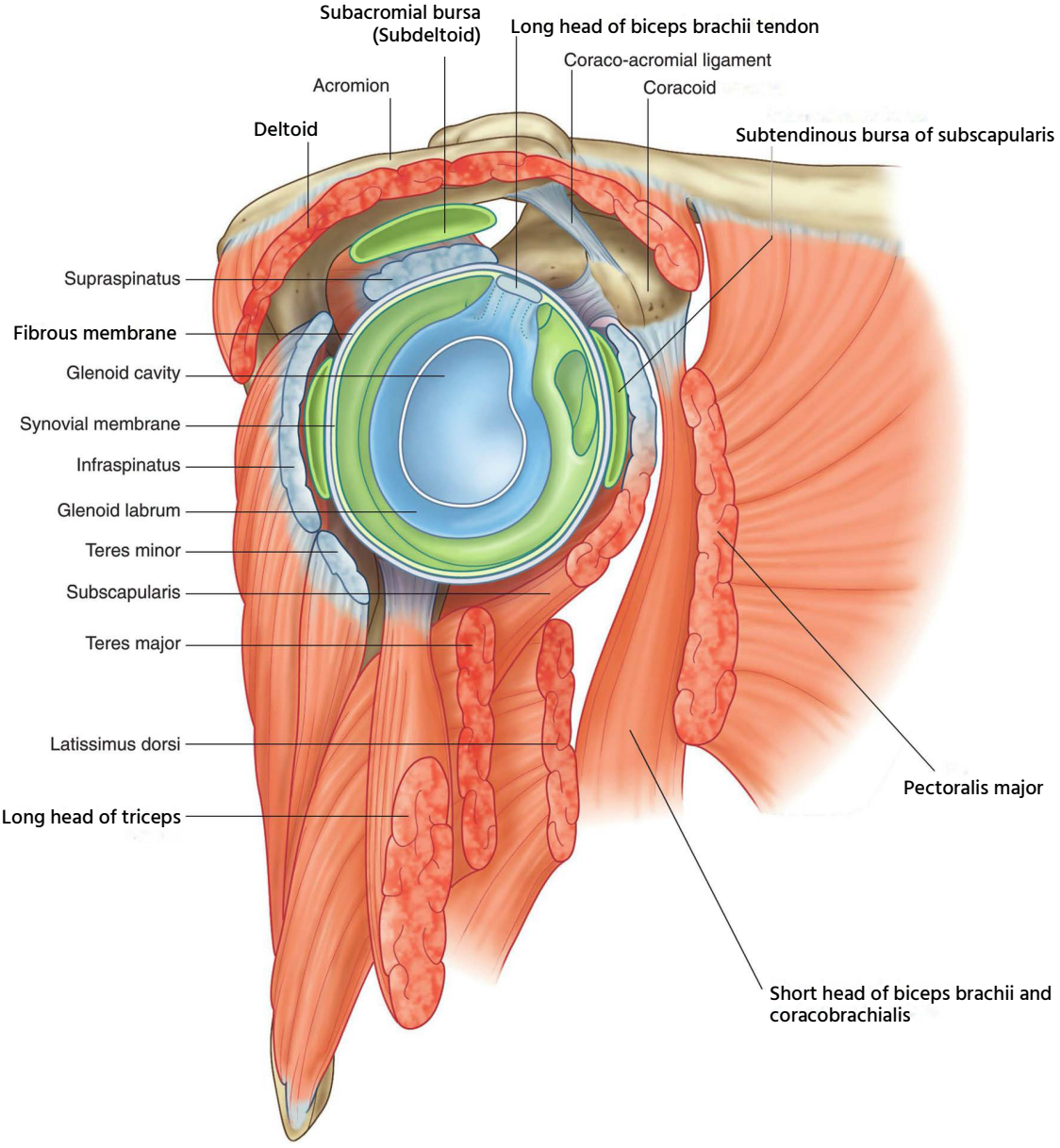
- Shallow synovial ball and socket type of joint.
- It is an inherently unstable joint, but is capable to a wide range of movement.
- Stability is provided by muscles of the rotator cuff that pass from the scapula to insert in the greater tuberosity (all except sub scapularis-lesser tuberosity).

Glenoid labrum

- Fibrocartilaginous rim attached to the free edge of the glenoid cavity
- Tendon of the long head of biceps arises from within the joint from the supraglenoid tubercle, and is fused at this point to the labrum.
- The long head of triceps attaches to the infraglenoid tubercle

Fibrous capsule

- Attaches to the scapula external to the glenoid labrum and to the labrum itself (postero-superiorly)
- Attaches to the humerus at the level of the anatomical neck superiorly and the surgical neck inferiorly
- Anteriorly the capsule is in contact with the tendon of subscapularis, superiorly with the supraspinatus tendon, and posteriorly with the tendons of infraspinatus and teres minor. All these blend with the capsule towards their insertion.
- Two defects in the fibrous capsule; superiorly for the tendon of biceps. Anteriorly there is a defect beneath the subscapularis tendon.
- The inferior extension of the capsule is closely related to the axillary nerve at the surgical neck and this nerve is at risk in anteroinferior dislocations. It also means that proximally sited osteomyelitis may progress to septic arthritis.

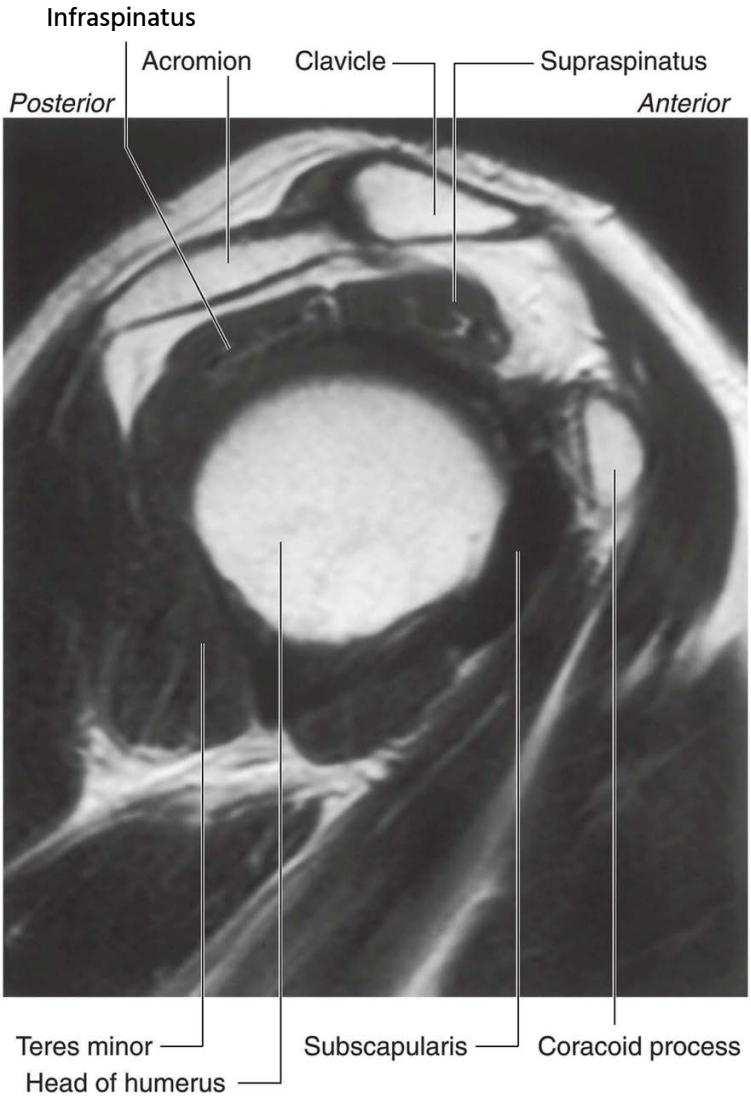


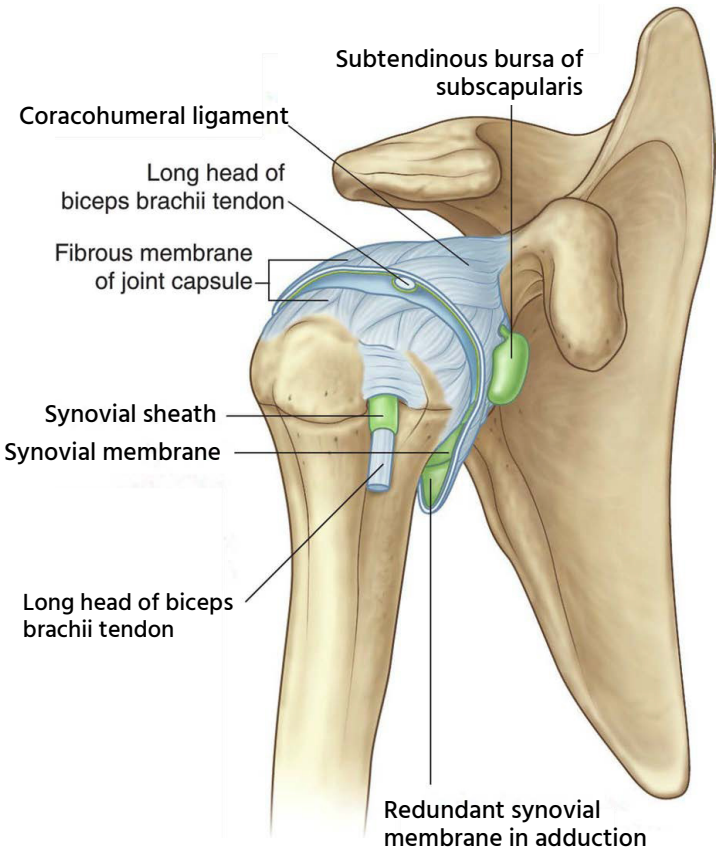
Movements and muscles

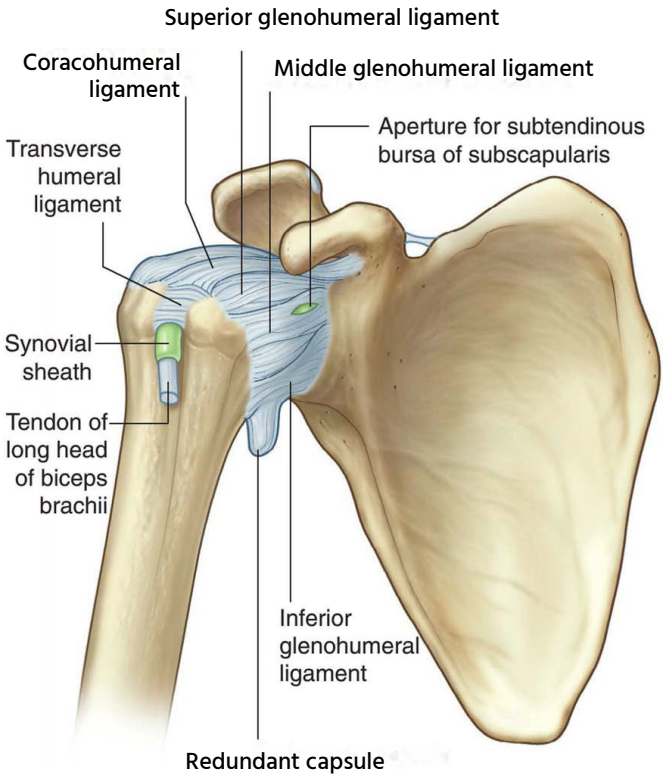
Flexion	Anterior part of deltoid Pectoralis major Biceps Coracobrachialis
Extension	Posterior deltoid Teres major Latissimus dorsi
Adduction	Pectoralis major Latissimus dorsi Teres major Coracobrachialis
Abduction	Mid deltoid Supraspinatus
Medial rotation	Subscapularis Anterior deltoid Teres major Latissimus dorsi
Lateral rotation	Posterior deltoid Infraspinatus Teres minor

Important anatomical relations

Anteriorly	Brachial plexus Axillary artery and vein
Posterior	Suprascapular nerve Suprascapular vessels
Inferior	Axillary nerve Circumflex humeral vessels







Important Regions of the UL

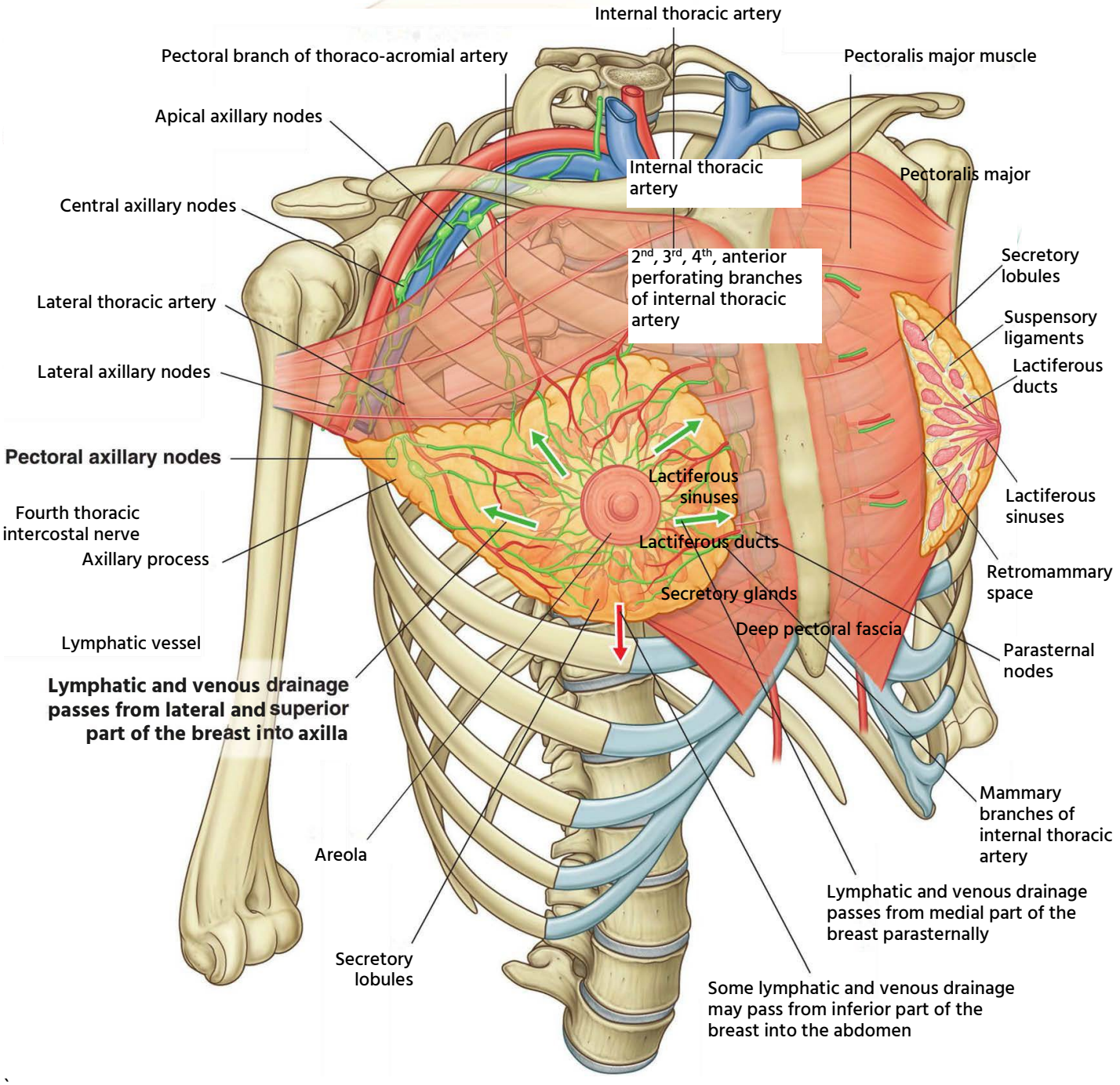
Breast

The breast itself lies on a layer of pectoral fascia and the following muscles:

1. Pectoralis major
2. Serratus anterior
3. External oblique

Breast anatomy

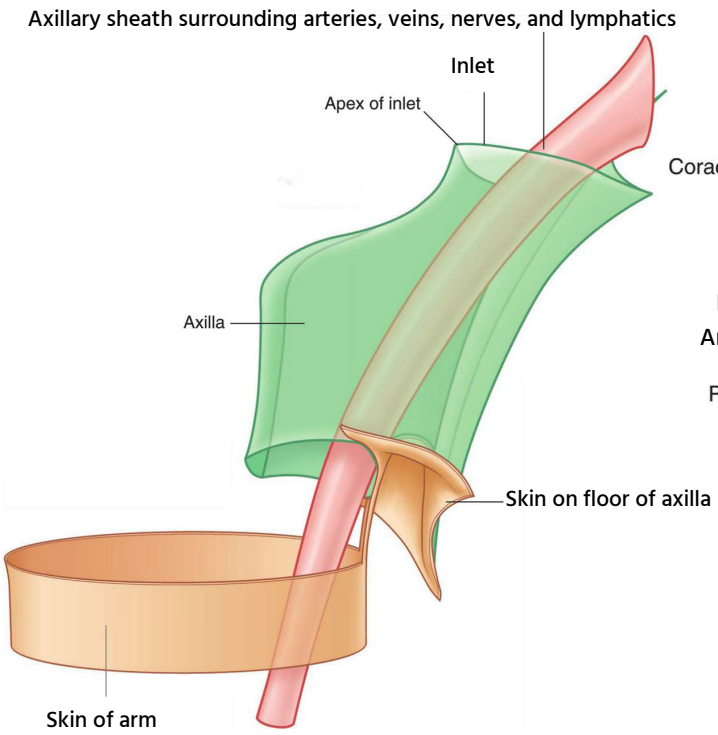
Nerve supply	Branches of intercostal nerves from T4-T6.
Arterial supply	• Internal mammary (thoracic) artery *(60% of arterial supply)* • External mammary artery (laterally) • Anterior intercostal arteries • Thoraco-acromial artery
Venous drainage	Superficial venous plexus to subclavian, axillary and intercostal veins.
Lymphatic drainage	• 70% Axillary nodes • Internal mammary chain • Other lymphatic sites such as deep cervical and supraclavicular fossa (later in disease)

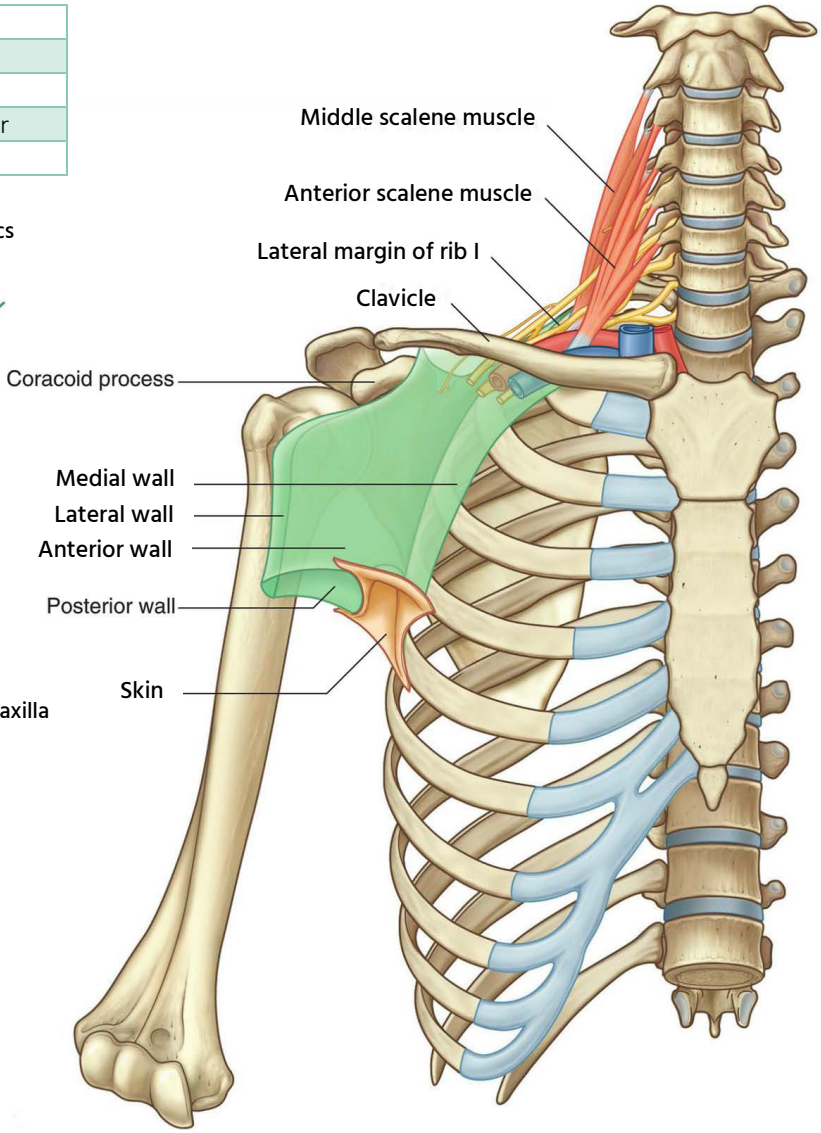


Axilla

Boundaries of the axilla

Medially	Chest wall and Serratus anterior
Laterally	Humeral head
Floor	Subscapularis
Anterior aspect	Lateral border of Pectoralis major
Fascia	Clavipectoral fascia

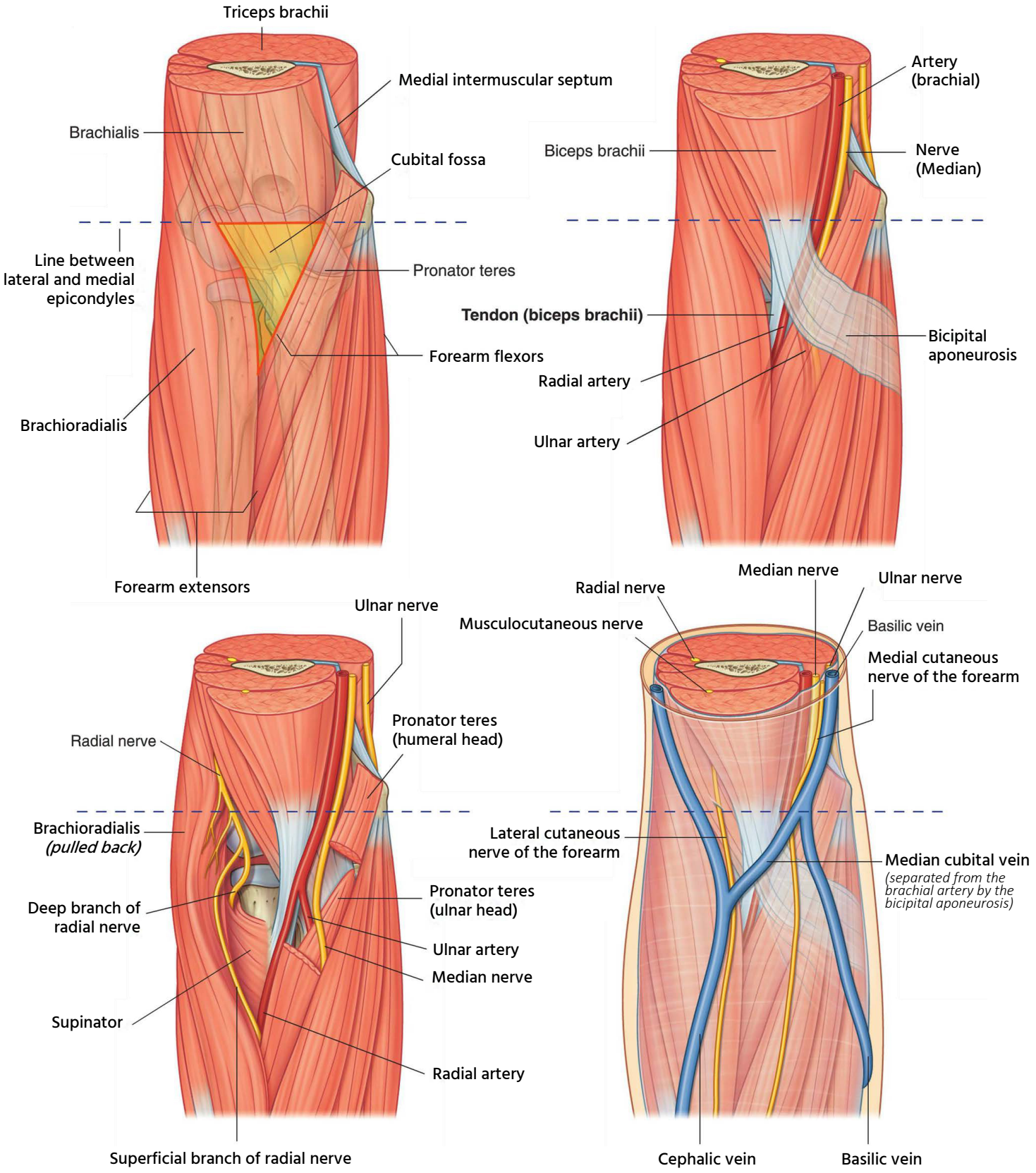


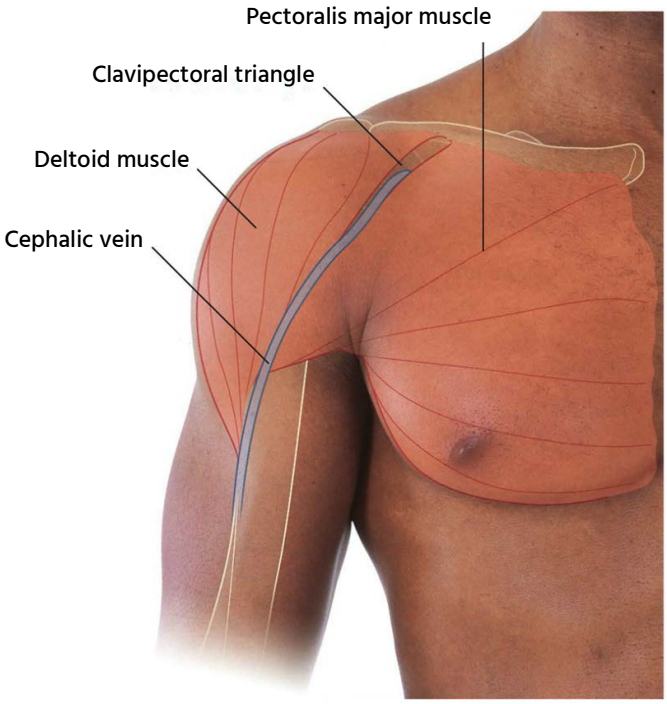


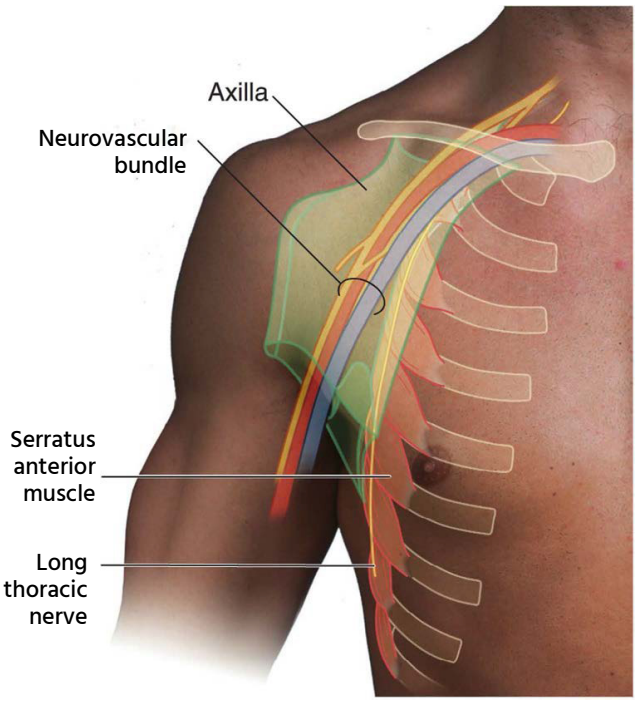
Contents

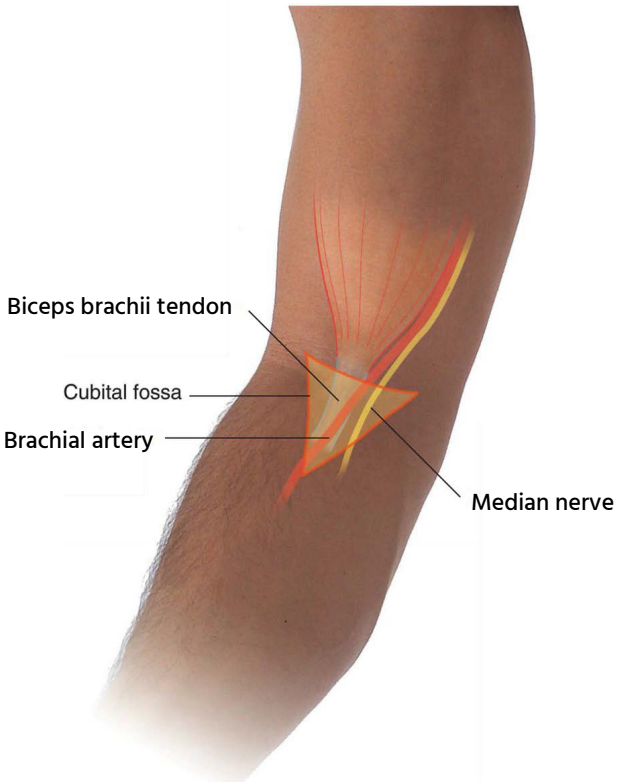
Long thoracic nerve (of Bell)	Derived from C5-C7 and passes behind the brachial plexus to enter the axilla. It lies on the medial chest wall and supplies serratus anterior. Its location puts it at risk during axillary surgery and damage will lead to winging of the scapula.
Thoracodorsal nerve and thoracodorsal trunk	Innervate and vascularise latissimus dorsi.
Axillary vein	Lies at the apex of the axilla, it is the continuation of the basilic vein. Becomes the subclavian vein at the outer border of the first rib.
Intercostobrachial nerves	Traverse the axillary lymph nodes and are often divided during axillary surgery. They provide cutaneous sensation to the axillary skin.
Lymph nodes	The axilla is the main site of lymphatic drainage for the breast.

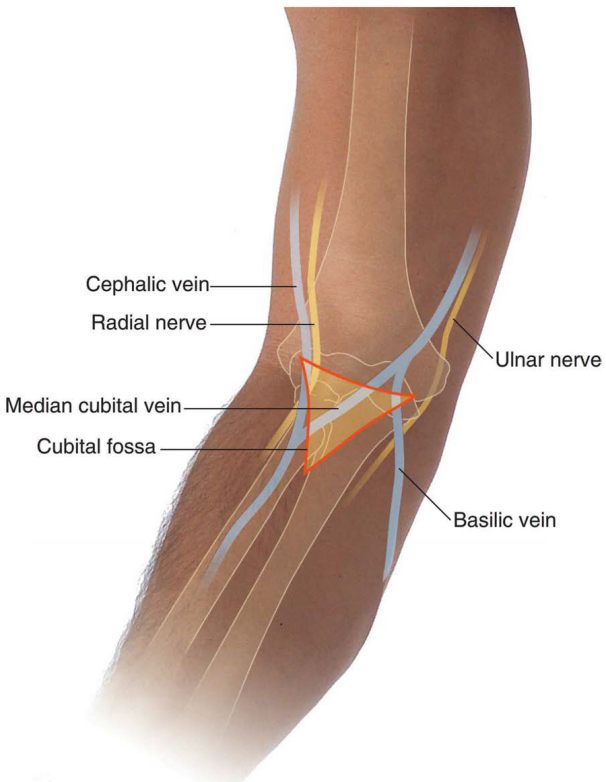
Cubital Fossa

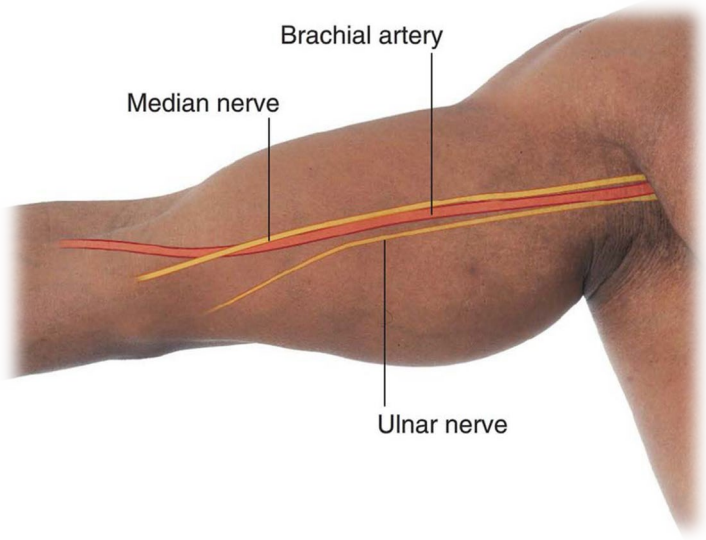


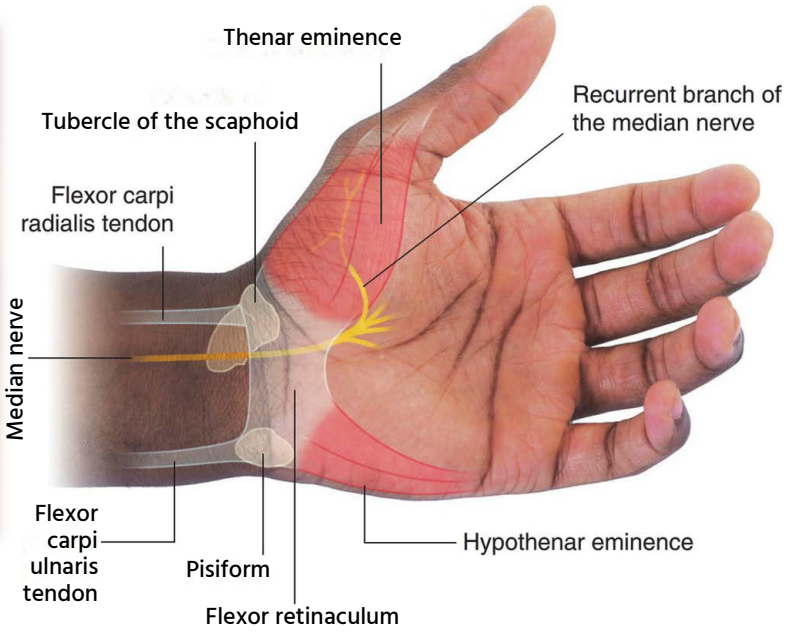

Pectoralis major muscle
Clavipectoral triangle
Deltoid muscle
Cephalic vein

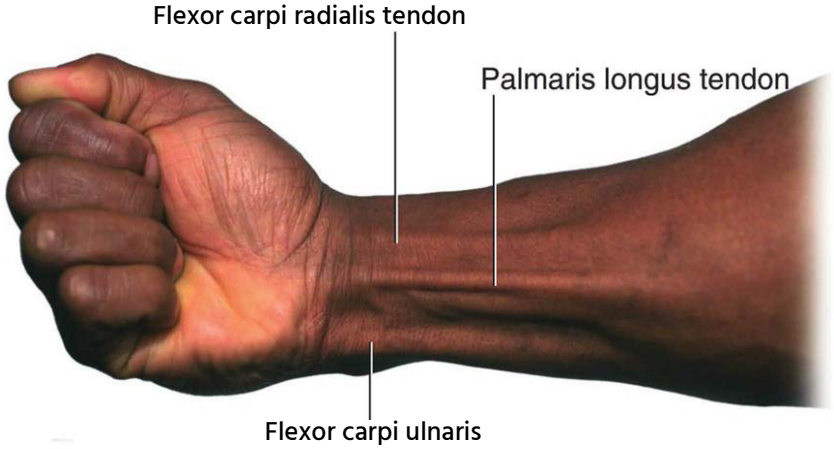

Axilla
Neurovascular bundle
Serratus anterior muscle
Long thoracic nerve

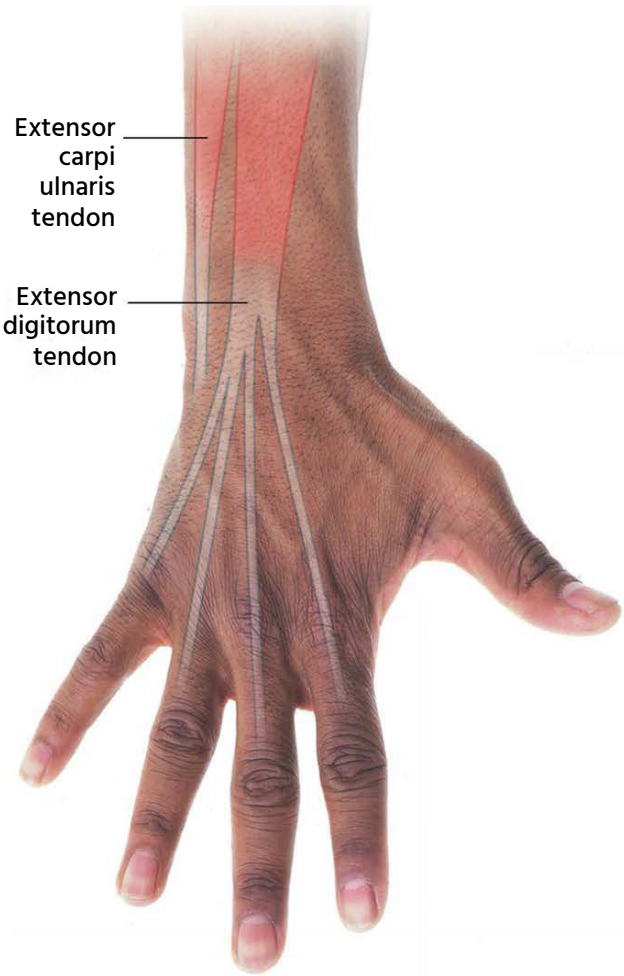

Biceps brachii tendon
Cubital fossa
Brachial artery
Median nerve

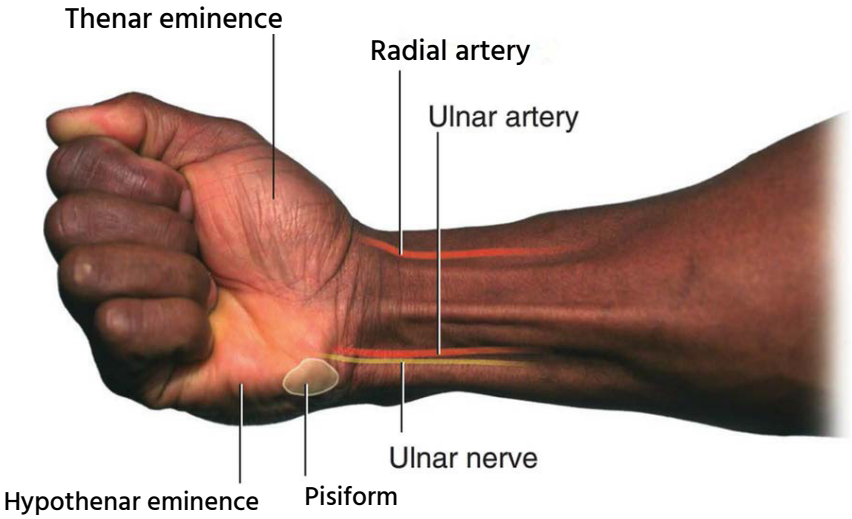

Cephalic vein
Radial nerve
Ulnar nerve
Median cubital vein
Cubital fossa
Basilic vein

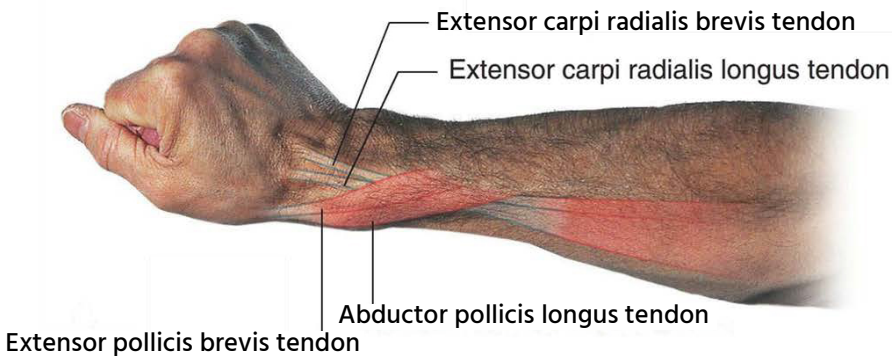

Brachial artery
Median nerve
Ulnar nerve


Thenar eminence
Recurrent branch of the median nerve
Tubercle of the scaphoid
Flexor carpi radialis tendon
Median nerve
Flexor carpi ulnaris tendon
Pisiform
Flexor retinaculum
Hypothenar eminence


Flexor carpi radialis tendon
Palmaris longus tendon
Flexor carpi ulnaris


Extensor carpi ulnaris tendon
Extensor digitorum tendon


Thenar eminence
Radial artery
Ulnar artery
Ulnar nerve
Hypothenar eminence
Pisiform


Extensor carpi radialis brevis tendon
Extensor carpi radialis longus tendon
Abductor pollicis longus tendon
Extensor pollicis brevis tendon