



الجامعة الهاشمية
The Hashemite University



Anatomy & Embryology

Lecture 1: Upper Limb Muscles

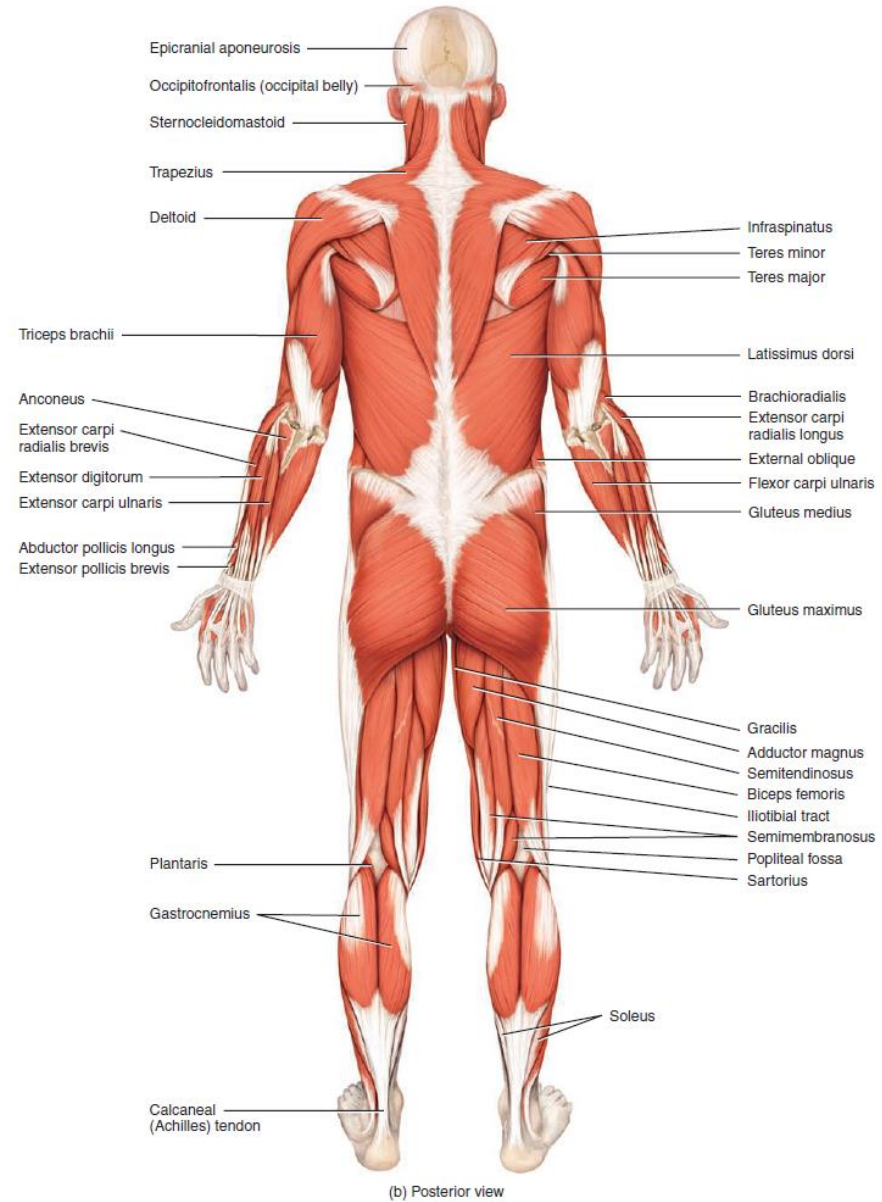
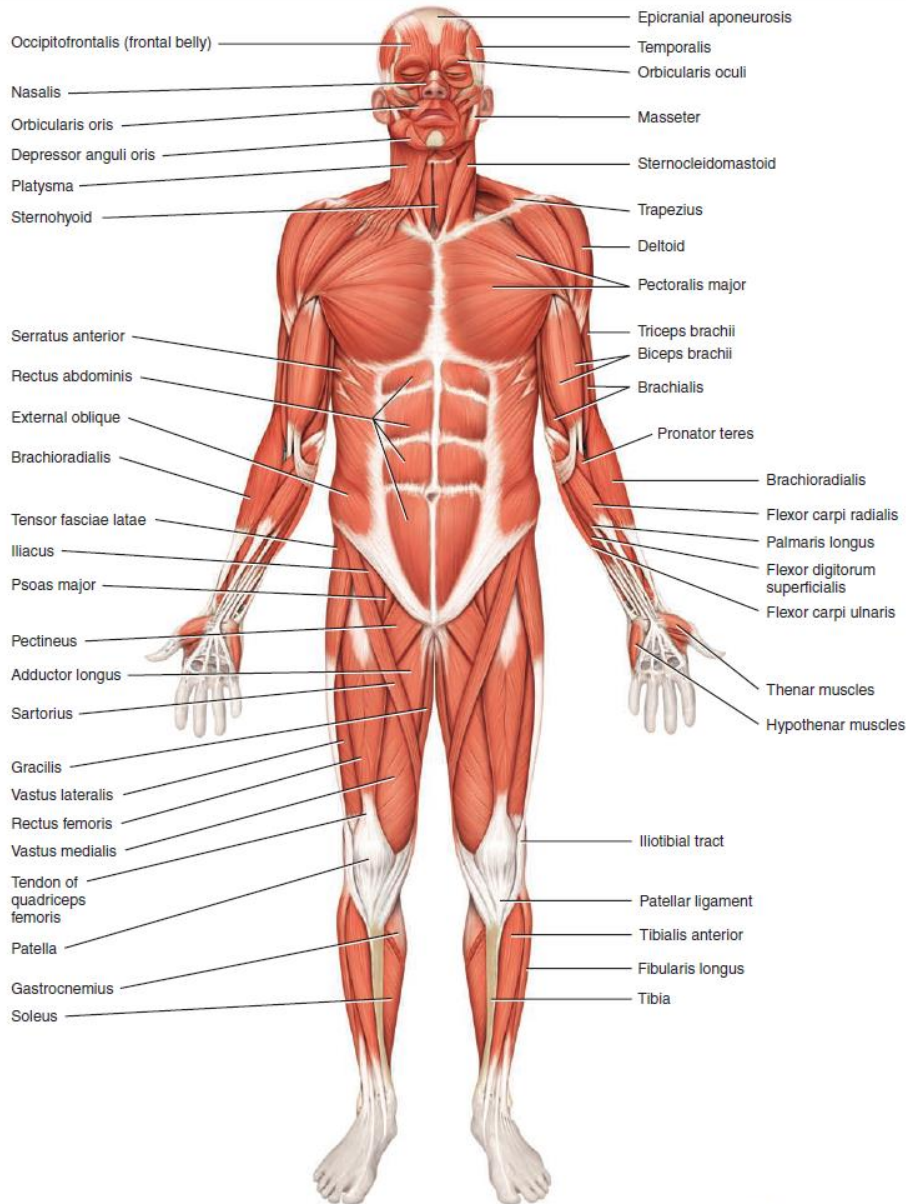
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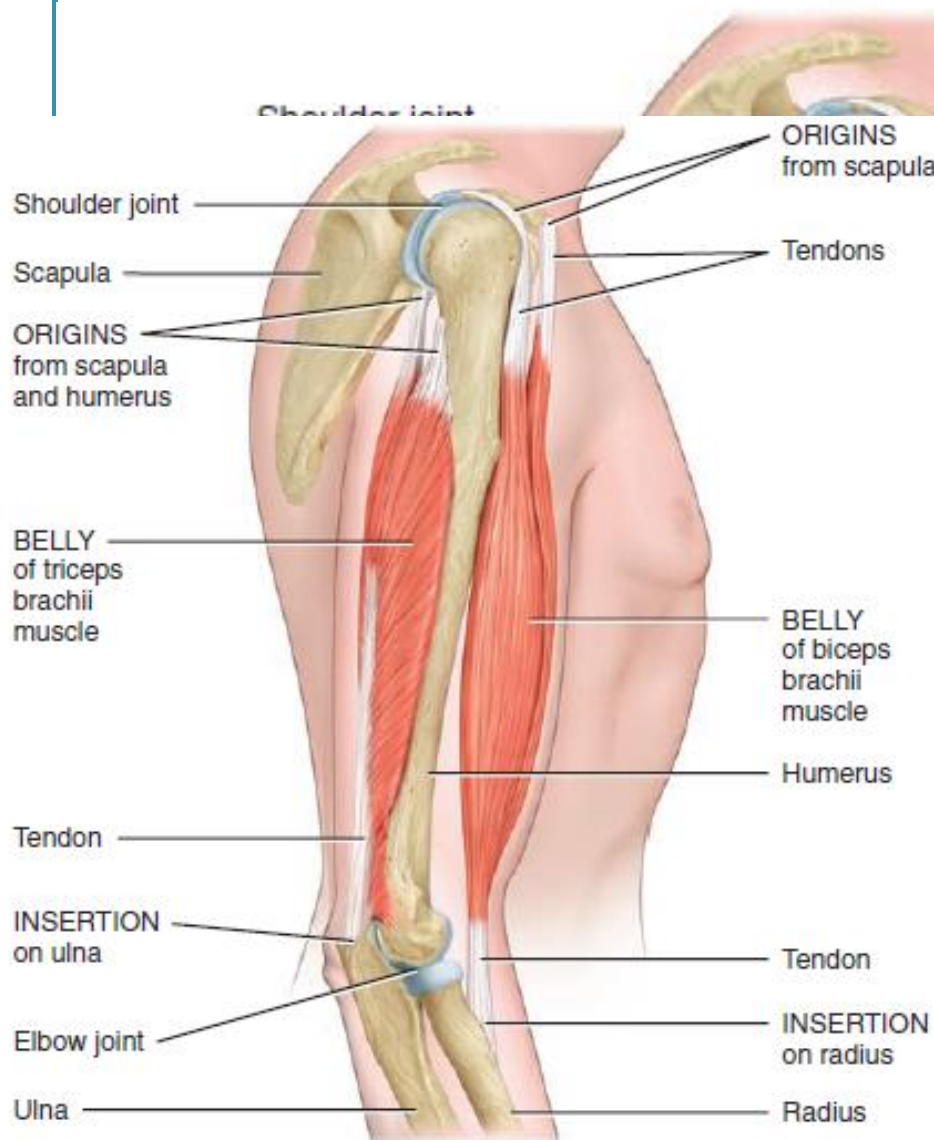
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The Muscular System

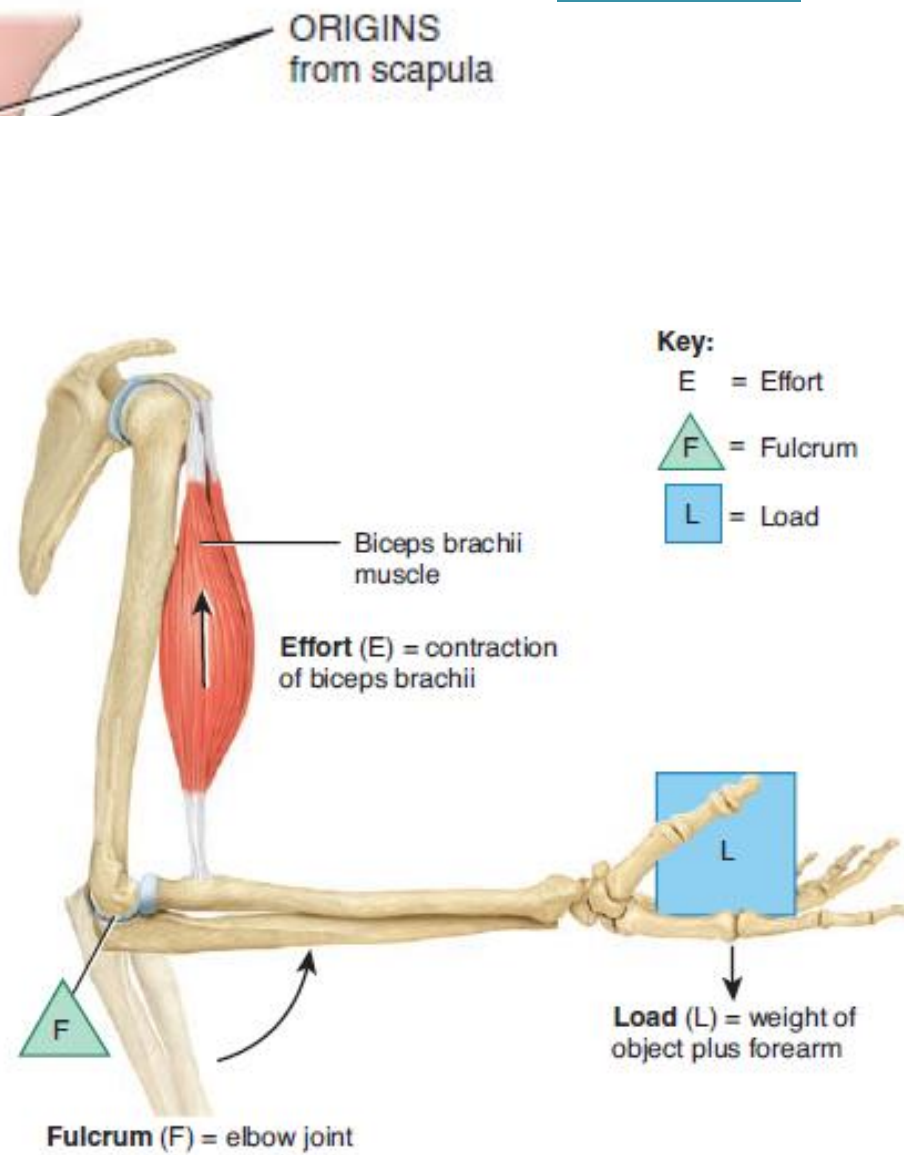


Skeletal muscles are formed of several bundles (fascicles) of skeletal muscle cells. They are attached by tendons to bones

- When the skeletal muscle contracts, the tendon will be pulled and this will pull the bone resulting in **Movement**
 - The **belly** of the muscle is the fleshy (wide) part between the tendons
 - Muscles have more than one bony attachment:
 - the attachment of a tendon to the stationary bone is called the **origin**.
 - the attachment of the muscle's other tendon to the movable bone is called the **insertion**.
 - the **action/s** of a muscle are the main movements that occur during contraction (e.g., flexion or extension).
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(a) Origin and insertion of a skeletal muscle



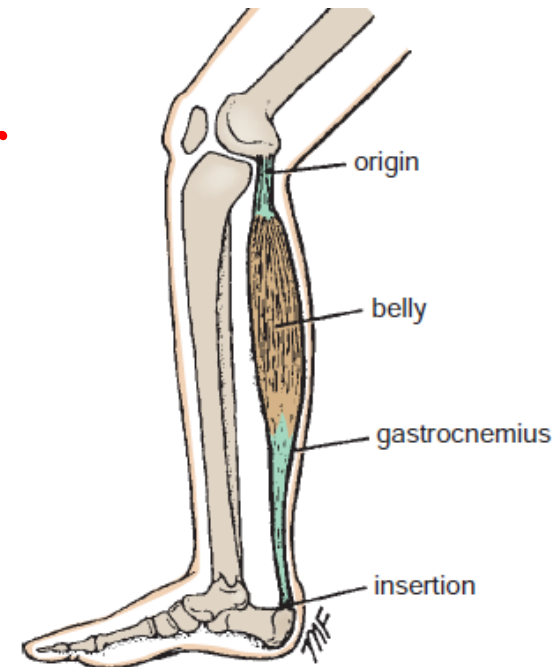
(b) Movement of the forearm lifting a weight on radius



Arrangement of the fascicles:

- Skeletal muscle fibres (cells) within a muscle are arranged in bundles known as fascicles.
- Within a fascicle, all muscle fibres are parallel to one another.
- The fascicles, however, may form one of five patterns with respect to the tendons:-

**Parallel – Fusiform – Circular – Triangular
Pennate**



PARALLEL

Fascicles parallel to longitudinal axis of muscle; terminate at either end in flat tendons.



Example: Sternohyoid muscle (see [Figure 11.8a](#))

CIRCULAR

Fascicles in concentric circular arrangements form sphincter muscles that enclose an orifice (opening).



Example: Orbicularis oculi muscle (see [Figure 11.4a](#))

FUSIFORM

Fascicles nearly parallel to longitudinal axis of muscle; terminate in flat tendons; muscle tapers toward tendons, where diameter is less than at belly.



Example: Digastric muscle (see [Figure 11.8a](#))

TRIANGULAR

Fascicles spread over broad area converge at thick central tendon; gives muscle a triangular appearance.



Example: Pectoralis major muscle (see [Figure 11.3a](#))

PENNATE

Short fascicles in relation to total muscle length; tendon extends nearly entire length of muscle.

Unipennate

Fascicles are arranged on only one side of tendon.



Example: Extensor digitorum longus

Bipennate

Fascicles are arranged on both sides of centrally positioned tendons.



Example: Rectus femoris muscle

Multipennate

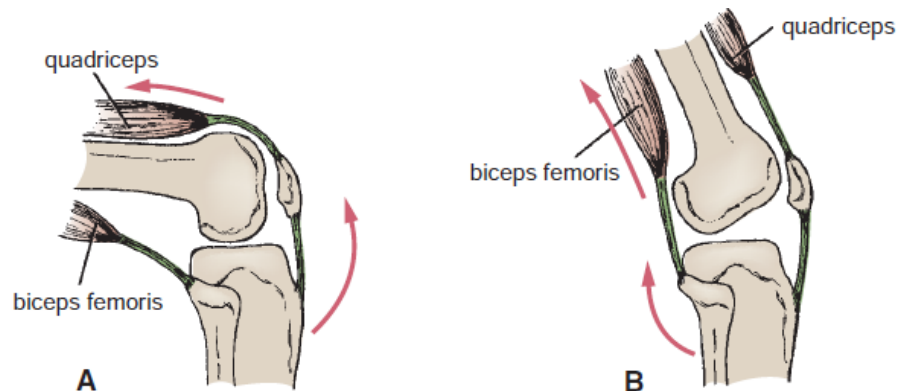
Fascicles attach obliquely from many directions to several tendons.



Example: Deltoid muscle

Coordination among muscles:

- It is common to attribute a specific action at a joint to a single muscle, but remember that muscles do not work in isolation.
 - Movements usually result from several skeletal muscles acting as a group.
- 1) Most skeletal muscles are arranged in opposing pairs at joints (**antagonistic**) (e.g., flexors vs. extensors):
- **Prime mover** or **agonist** and is responsible for the action (Contract)
 - **Antagonist** stretches (relaxed) and yields to the effects of the agonist.



Muscles Of The Upper Limb

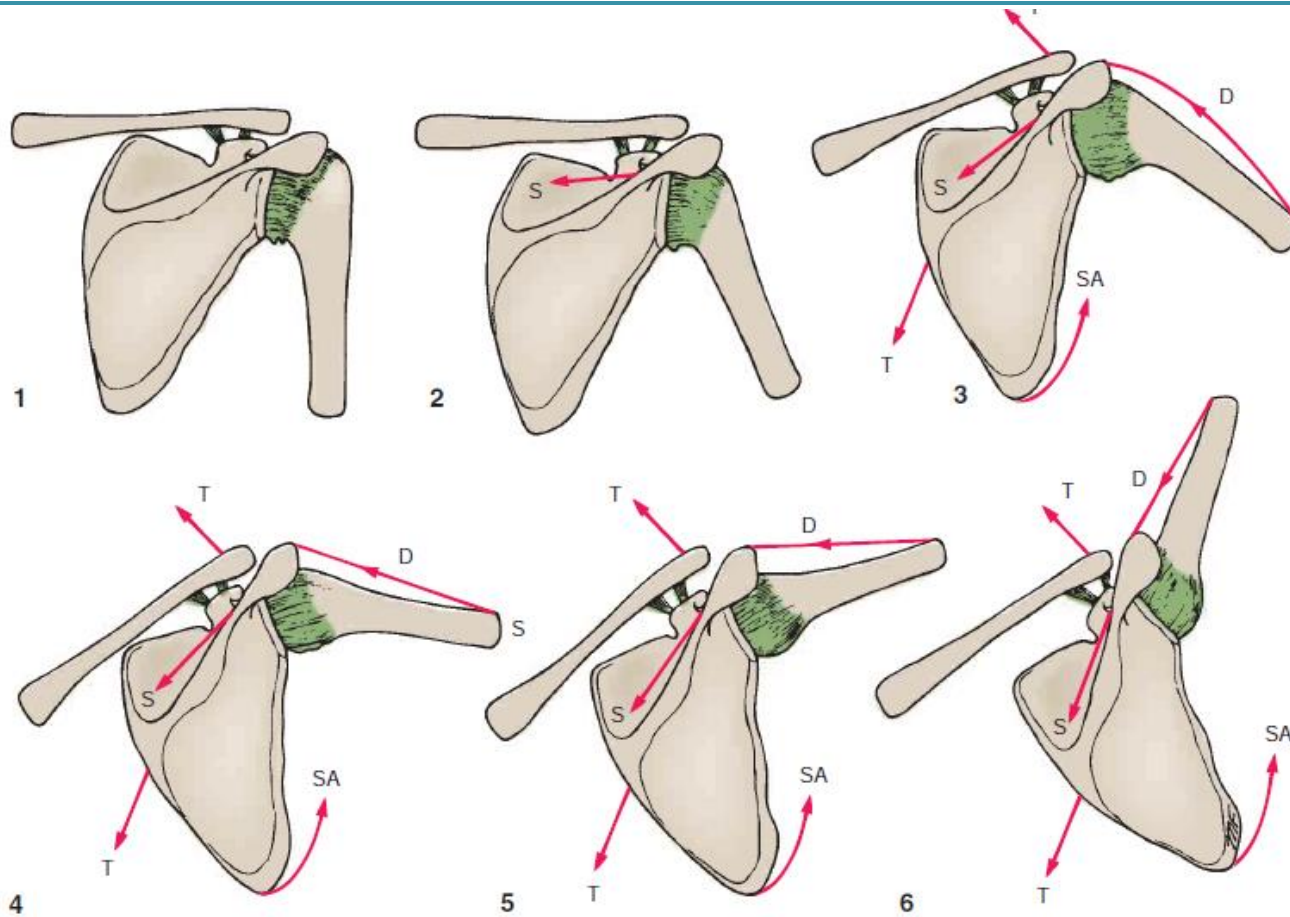
Muscles that move the Pectoral Girdle

- 1) **Serratus anterior (Punching muscle):** connects first 8 or 9 ribs to the scapula Known as “boxer’s muscle” because it is important in horizontal arm movements such as punching and pushing.
(Long thoracic nerve)
- 2) **Pectoralis minor:** connects ribs 3 to 5 and Coracoid process of scapula. **Moves scapula and helps in inhalation**
- 3) **Subclavius:** connects 1st rib to clavicle
- 4) **Levator scapulae, Rhomboid major and rhomboid minor:**
Originate from the vertebrae and insert into the scapula. They elevate and adduct the scapula.

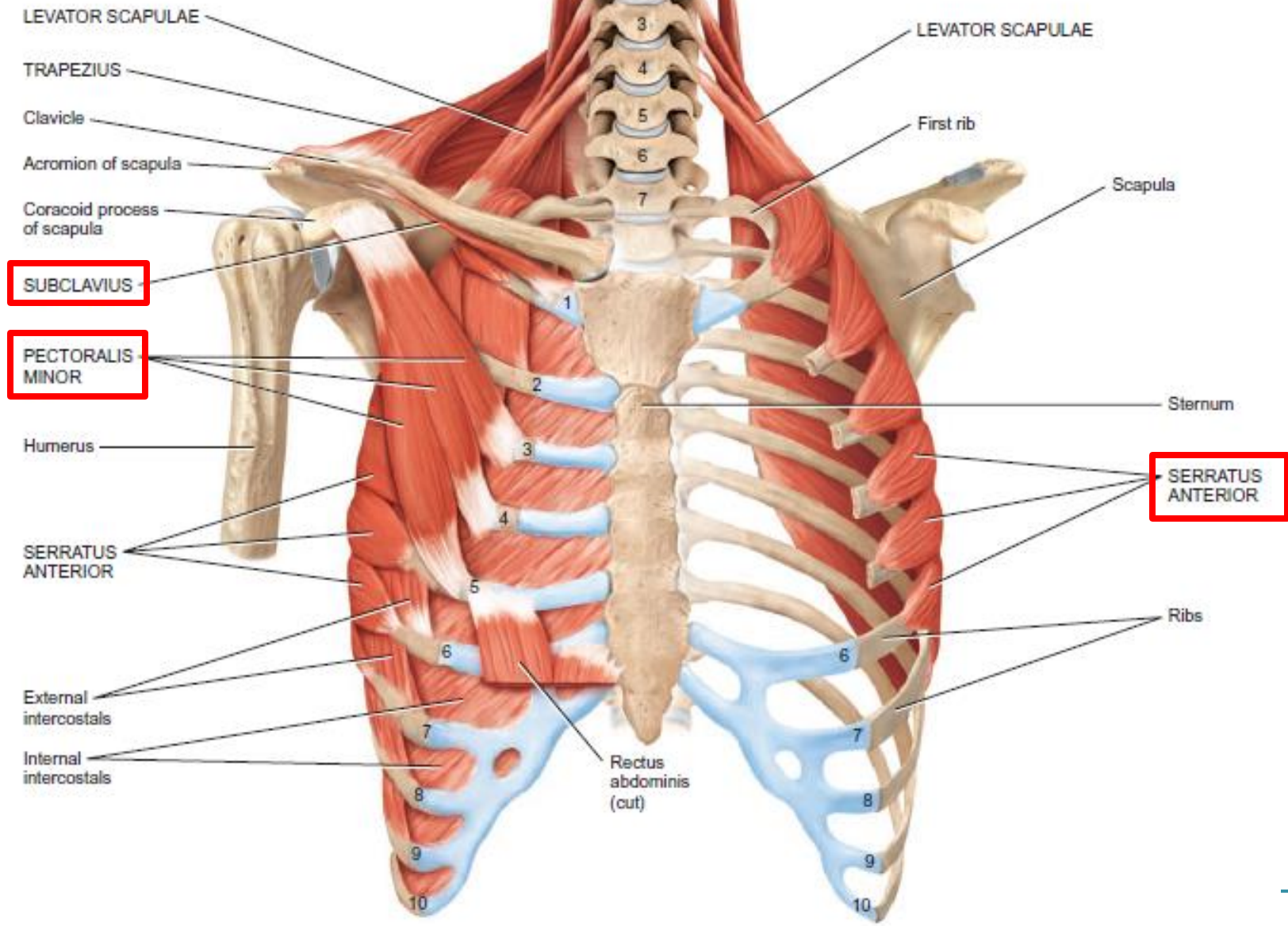
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- 4) **Trapezius:** The trapezius is a large, flat, triangular sheet of muscle extending from the skull and vertebral column medially to the pectoral girdle laterally (clavicle, acromion, scapulae spine). It is the most superficial back muscle and covers the posterior neck region and superior portion of the trunk. (**spinal accessory nerve (11th cranial N.)**).

Both Trapezius and Serratus anterior muscles will rotate the scapula so that its glenoid cavity is raised. This allows the arm to be raised above the head (abduction of arm > 90°).

- These muscles also stabilize (**fixators**) the girdle so that the free limb can have a firm base to move on & Move the scapulae
-



→ **Winging of the scapula:**
Paralysis of serratus anterior muscle



(a) Anterior deep view

(b) Anterior deeper view

Sternocleidomastoid

TRAPEZIUS (superior fibers)

TRAPEZIUS (middle fibers)

Acromion of scapula

Deltoid

Infraspinatus

Teres minor

Teres major

TRAPEZIUS (inferior fibers)

SERRATUS ANTERIOR

Triceps brachii

Twelfth thoracic vertebra

Occipital bone

Ligamentum nuchae

Cervical vertebrae

LEVATOR SCAPULAE

Clavicle

SUBCLAVIUS

RHOMBOID MINOR

Scapula

RHOMBOID MAJOR

SERRATUS ANTERIOR

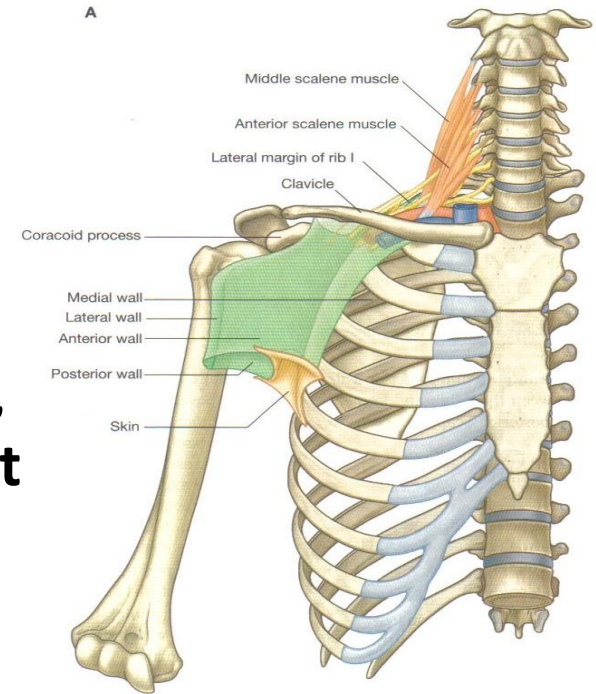
Ribs

(d) Posterior superficial view

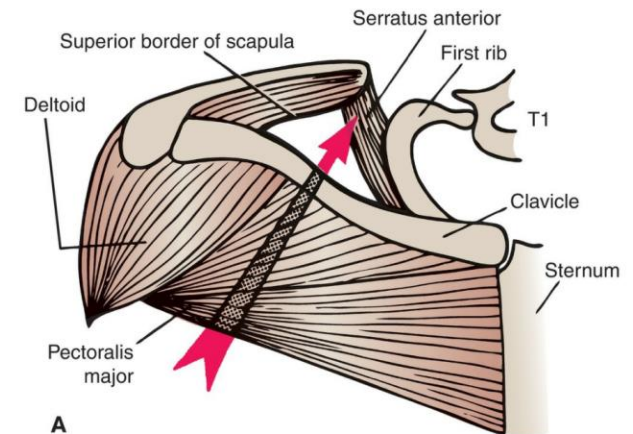
(e) Posterior deep view

AXILLA

- It is a pyramidal space between the upper part of the arm (laterally) and the side of the chest wall (medially).
- Forms an important passage for nerves, blood and lymphatic vessels from the root of the neck to the upper limb.
- Has an **apex** directed upwards into the root of the neck, lower end or **base**, and **4 walls** (anterior, posterior, medial and lateral).



Posterior axillary fold



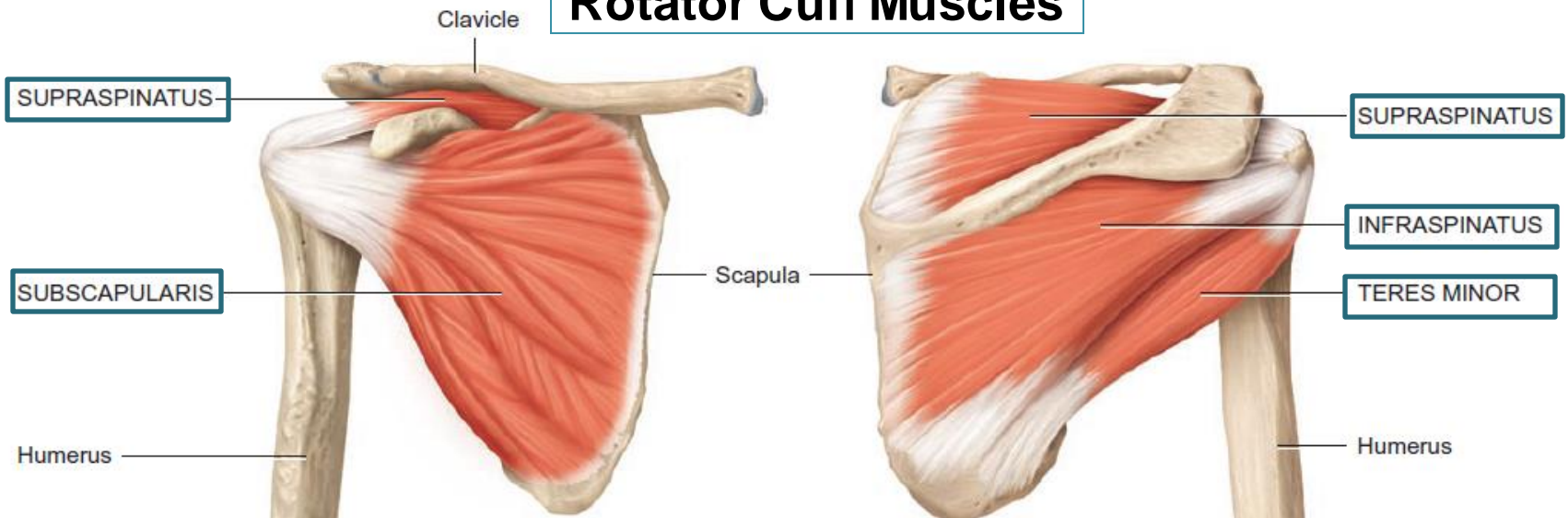
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Muscles of shoulder and thorax that move the humerus (cross shoulder joint)

Muscle	Origin	Insertion	Main Actions/Nerve supply
Deltoid <u>Injection</u>	Clavicle and scapula	Deltoid tuberosity humerus	<u>Abduction of arm (15-90°)</u> <u>Axillary nerve.</u>
Teres major	Scapula	Intertubercular sulcus (Bicipital groove) humerus	Adduction, extension & medial rotation of shoulder joint. Subscapular nerve
Pectoralis major	Clavicle, sternum and costal cartilages		Adduction, flexion & medial rotation of the arm. Lateral & Medial pectoral Ns
Latissimus dorsi “swimmer’s muscle”	Vertebrae (T-L-S) Iliac crest of the hip bone		Adduction, medial rotation and extension of the arm. / Nerve to latissimus dorsi

Subscapularis	Scapula	Humerus	Medial rotates arm
Supraspinatous			helps initiate abduction of the arm 0-15°
Infraspinatous			Lateral rotate arm
Teres minor			

Rotator Cuff Muscles



➤ The Rotator Cuff Muscles tendons all blend with the capsule of the shoulder joint, thus help in stabilizing it.

DELTOID (cut)

SUPRASPINATUS

SUBSCAPULARIS

CORACOBRACHIALIS

PECTORALIS MAJOR (cut)

TERES MAJOR

Biceps brachii (cut)

LATISSIMUS DORSI

Brachialis

Biceps brachii (cut)

Radius

Ulna

Coracoid process of scapula

Clavicle

Subclavius

Serratus anterior

PECTORALIS MAJOR (cut)

2nd rib

Pectoralis minor

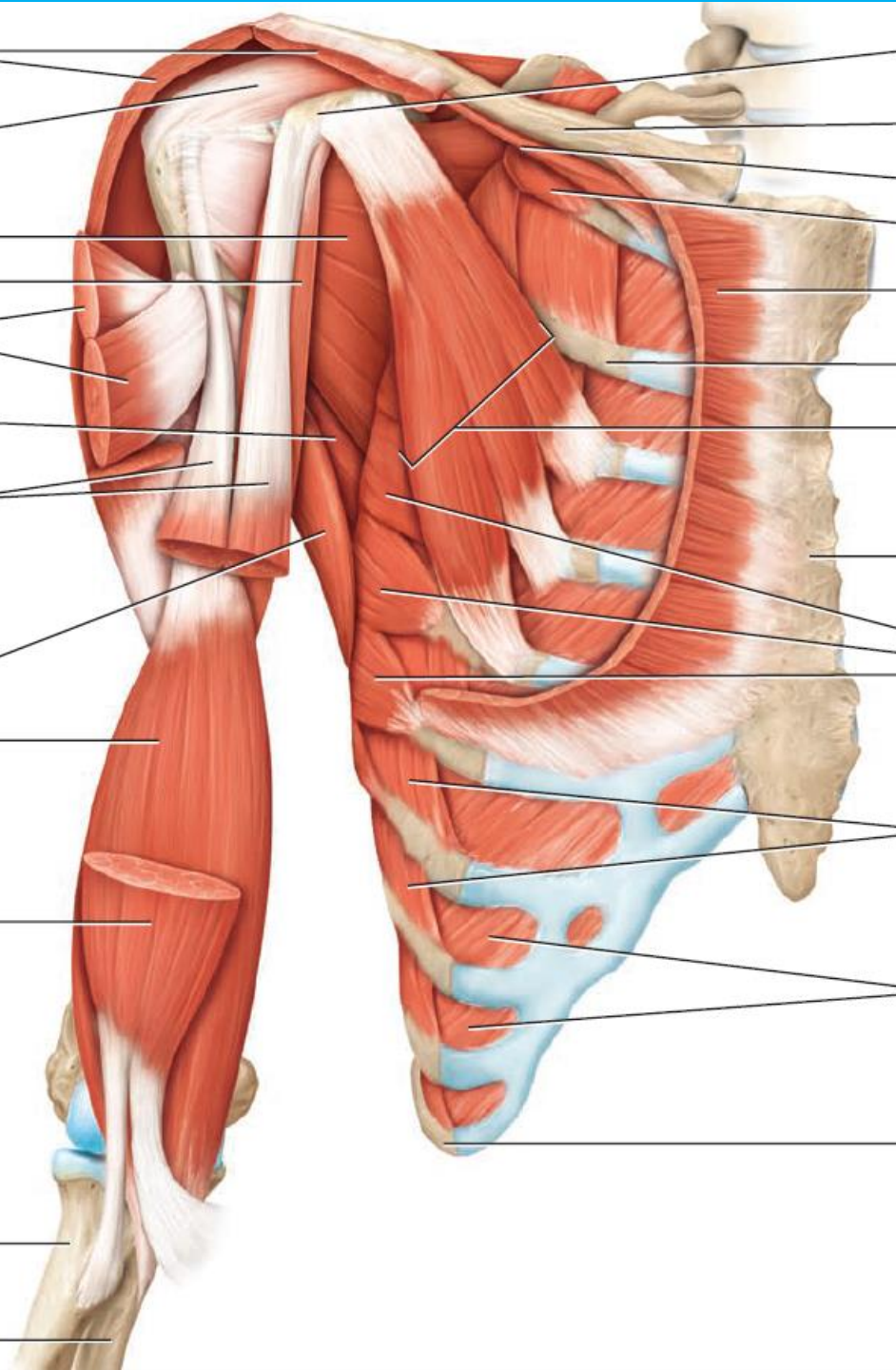
Sternum

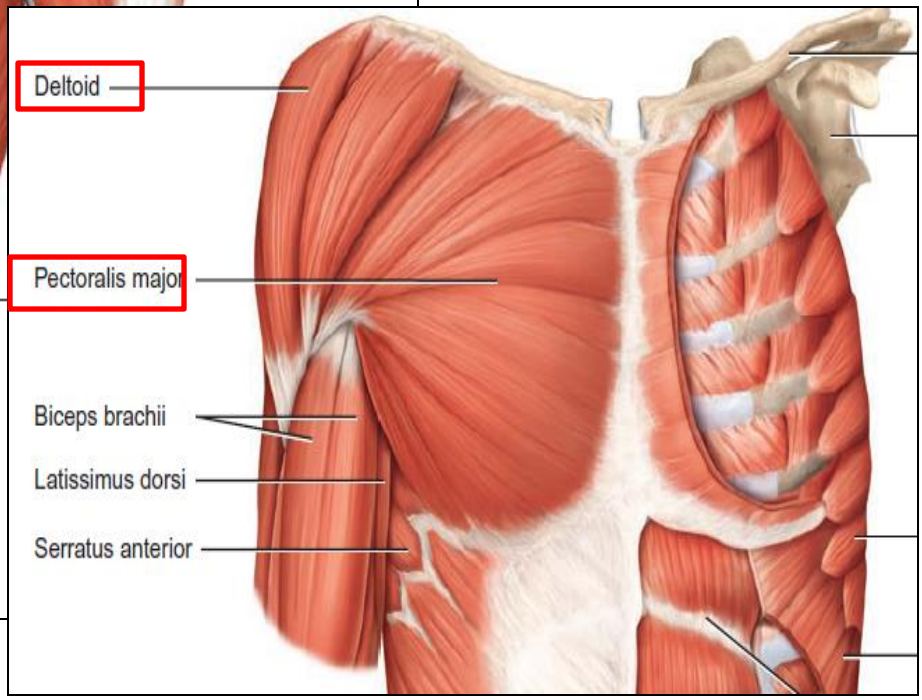
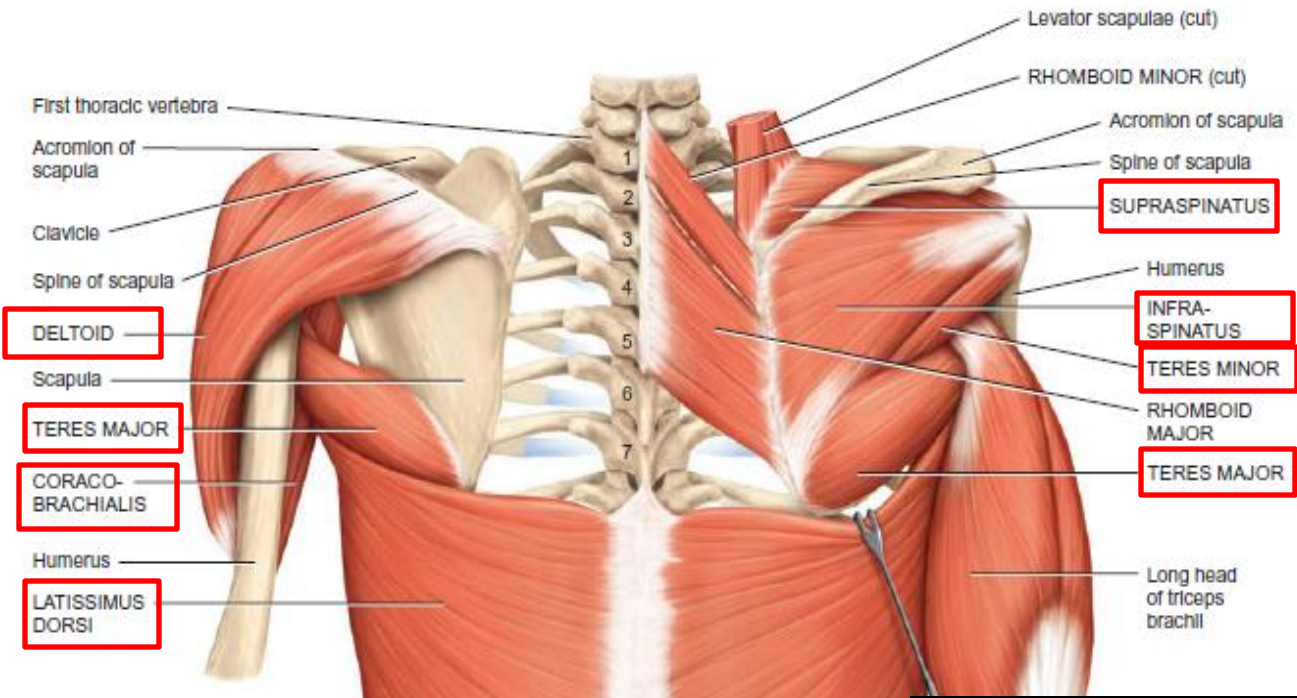
Serratus anterior

External intercostals

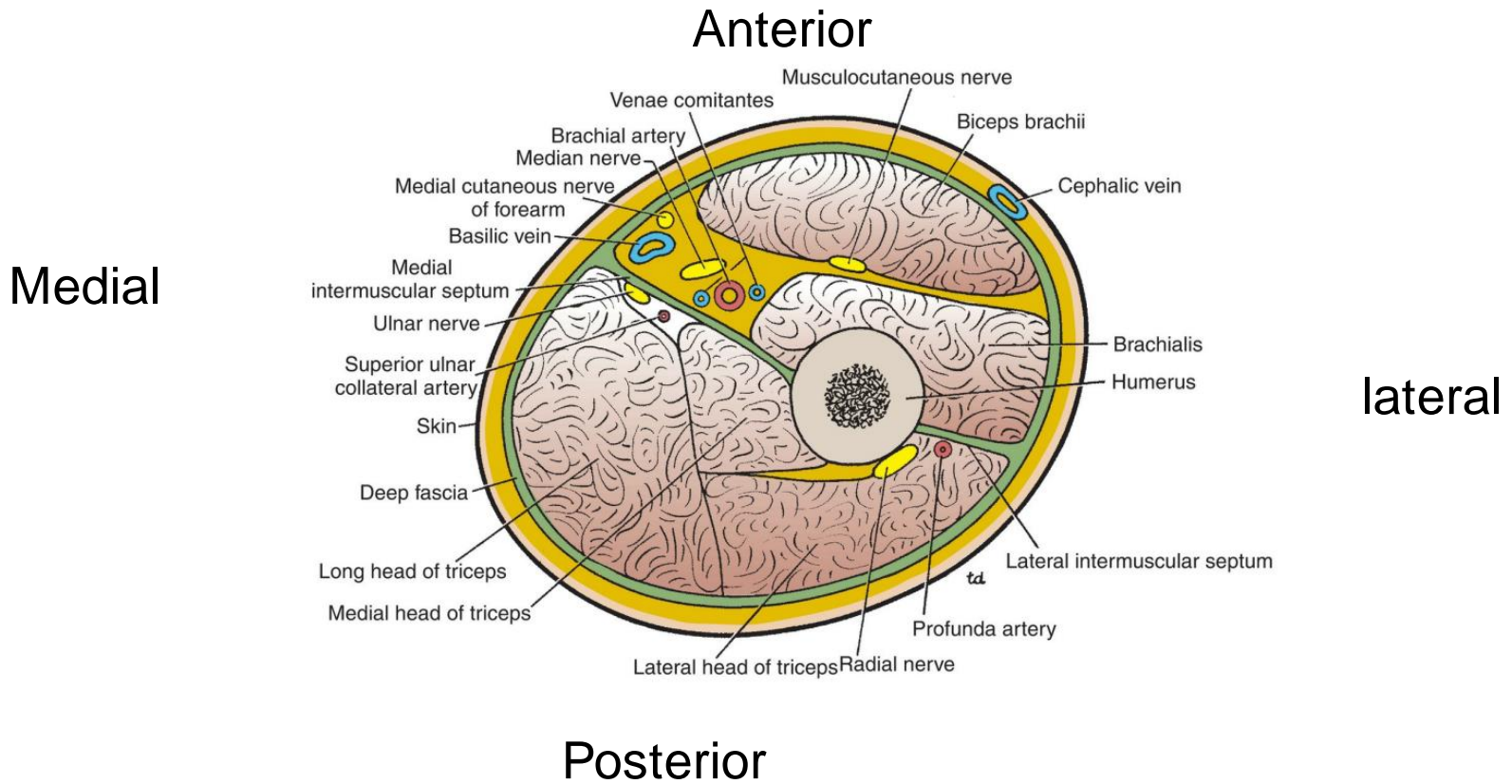
Internal intercostals

10th rib





Arm



Muscles of the arm (that move the forearm)

Anterior compartment

Nerve supply: Musculocutaneous nerve

Muscle	Origin	Insertion	Action
Biceps brachii	Two heads (Long / Short) scapula	Radial tuberosity (radius)	Flexion and Supination of forearm
Brachialis	Humerus	Ulna	Most powerful Flexor of the forearm

The **biceps** long head pass through the humerus intertubercular sulcus and inserts into the **radial** tuberosity. Biceps at elbow forms an aponeurosis that inserts medially (ulna) which can produce supination of the forearm.

Posterior compartment

Nerve supply: Radial nerve

Triceps brachii	Three heads Long (scapula)/ Lateral / Medial (humerus)	Olecranon process (ulna)	Most powerful Extensor of the forearm
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Coracobrachialis

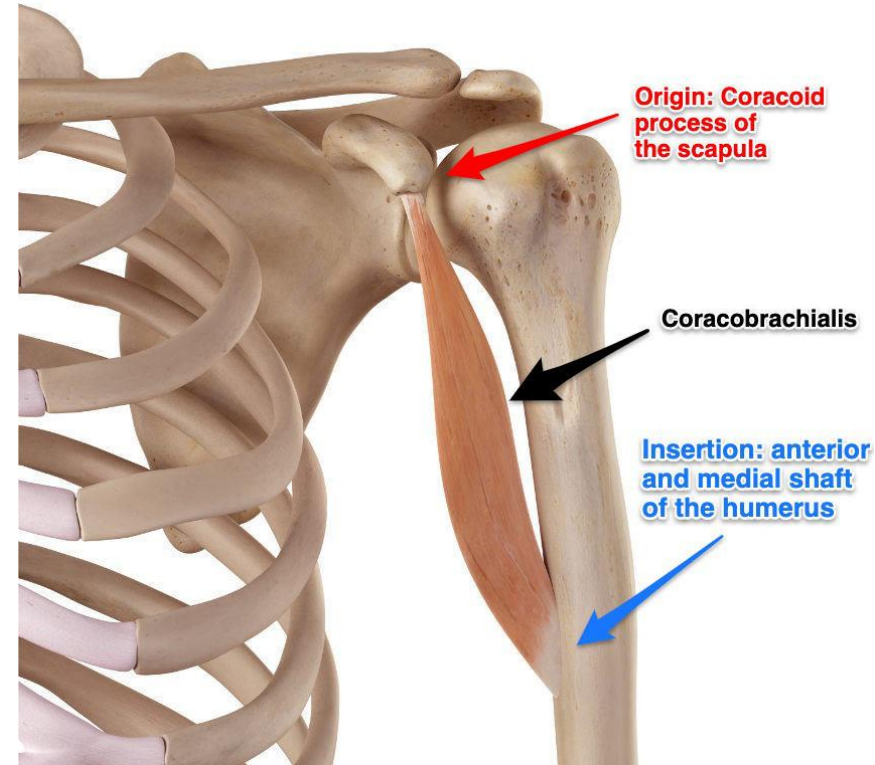
Arises from the **apex of coracoid** process scapulae and is inserted into the **middle** of the **humerus**.

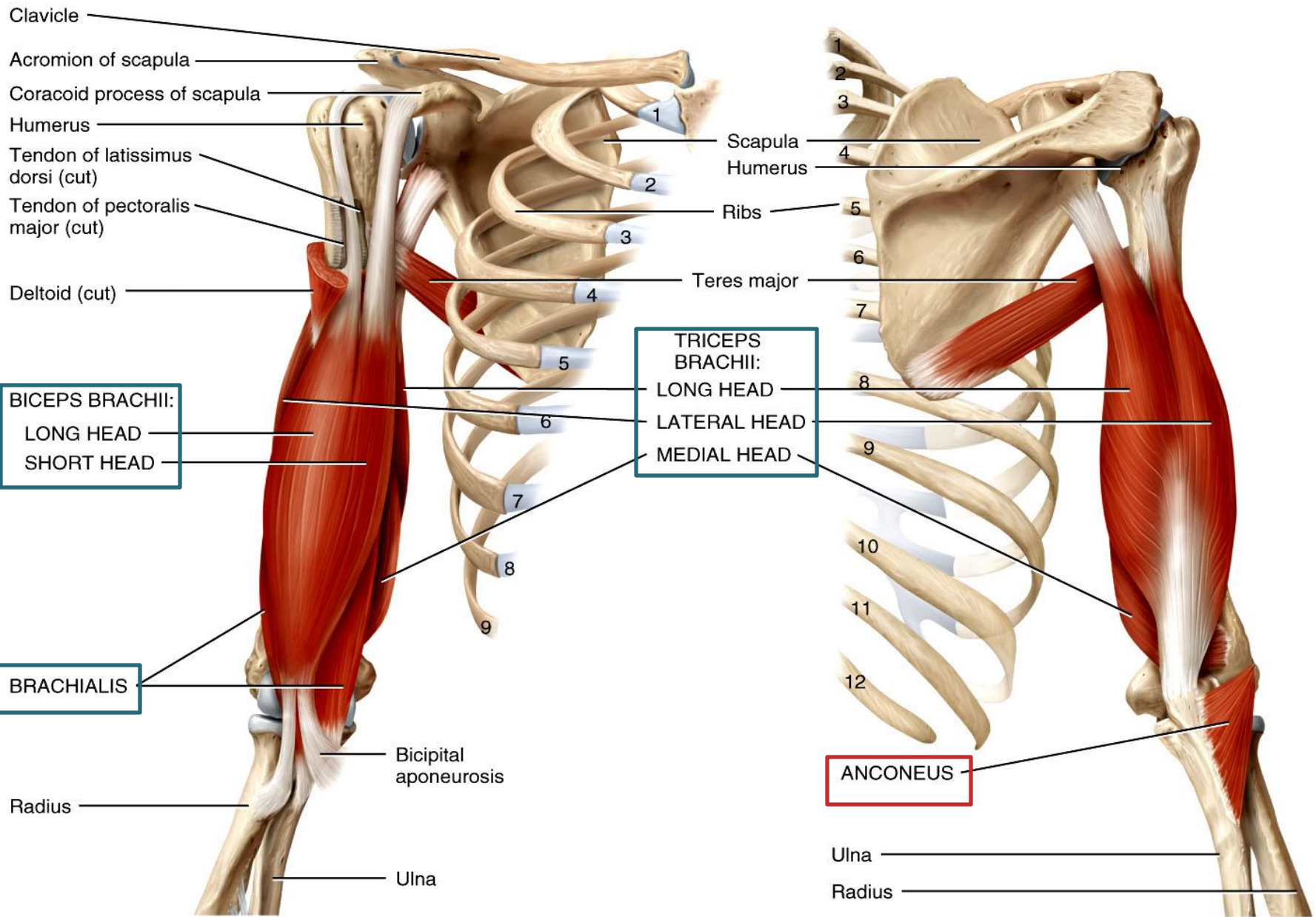
Action:

- Flexion & Adduction of Arm.

Nerve supply:

- Musculo-cutaneous nerve.





(a) Anterior view

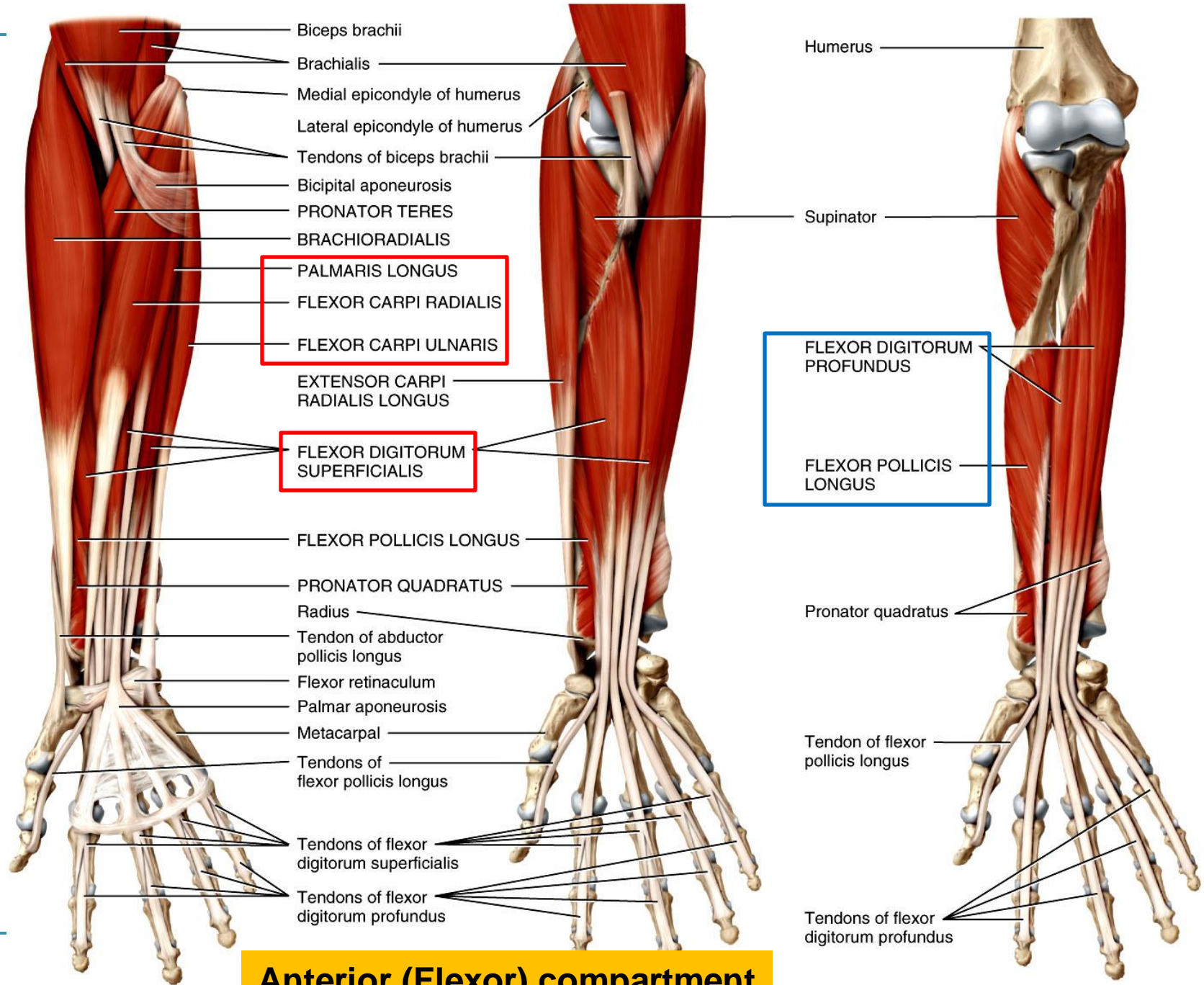
(b) Posterior view

Movement of Forearm	Muscles that produce them
Flexion (elbow)	Biceps Brachialis
Extension (elbow)	Triceps
Supination Twist a corkscrew (radioulnar)	Biceps Supinator (forearm muscle)
Pronation Twist a corkscrew (radioulnar)	Pronator teres (forearm muscle) Pronator quadratus (forearm muscle)

Muscles of the Forearm (20)

- Muscles in this group that act on the wrist, hand and digits are known as **extrinsic muscles of the hand** because they originate *outside* the hand and *insert* within it.
- Based on location and function, these muscles are divided into:
- **Anterior compartment (flexors – medial epicondyle)**
- **posterior compartment (extensors – lateral epicondyle)**
- The tendons of these muscles that continue into the hand are held close to the bones at **wrist** by strong fascial bands called **flexor and extensor retinaculum**.
- Some muscles in the forearm act on the forearm, like the **Supinator – Pronator Quadratus - Pronator teres**

Compartment	Muscles
<p>Anterior (Flexor) compartment</p>	<p>Flexor carpi radialis (Pulse) Palmaris longus Flexor carpi ulnaris Flexor digitorum superficialis Flexor pollicis longus Flexor digitorum profundus </p>
<p>Posterior (Extensor) compartment Tennis elbow</p>	<p>Extensor carpi radialis longus (brevis) Extensor digitorum Extensor carpi ulnaris. Abductor pollicis longus (brevis) Extensor pollicis longus Extensor indicis. </p>

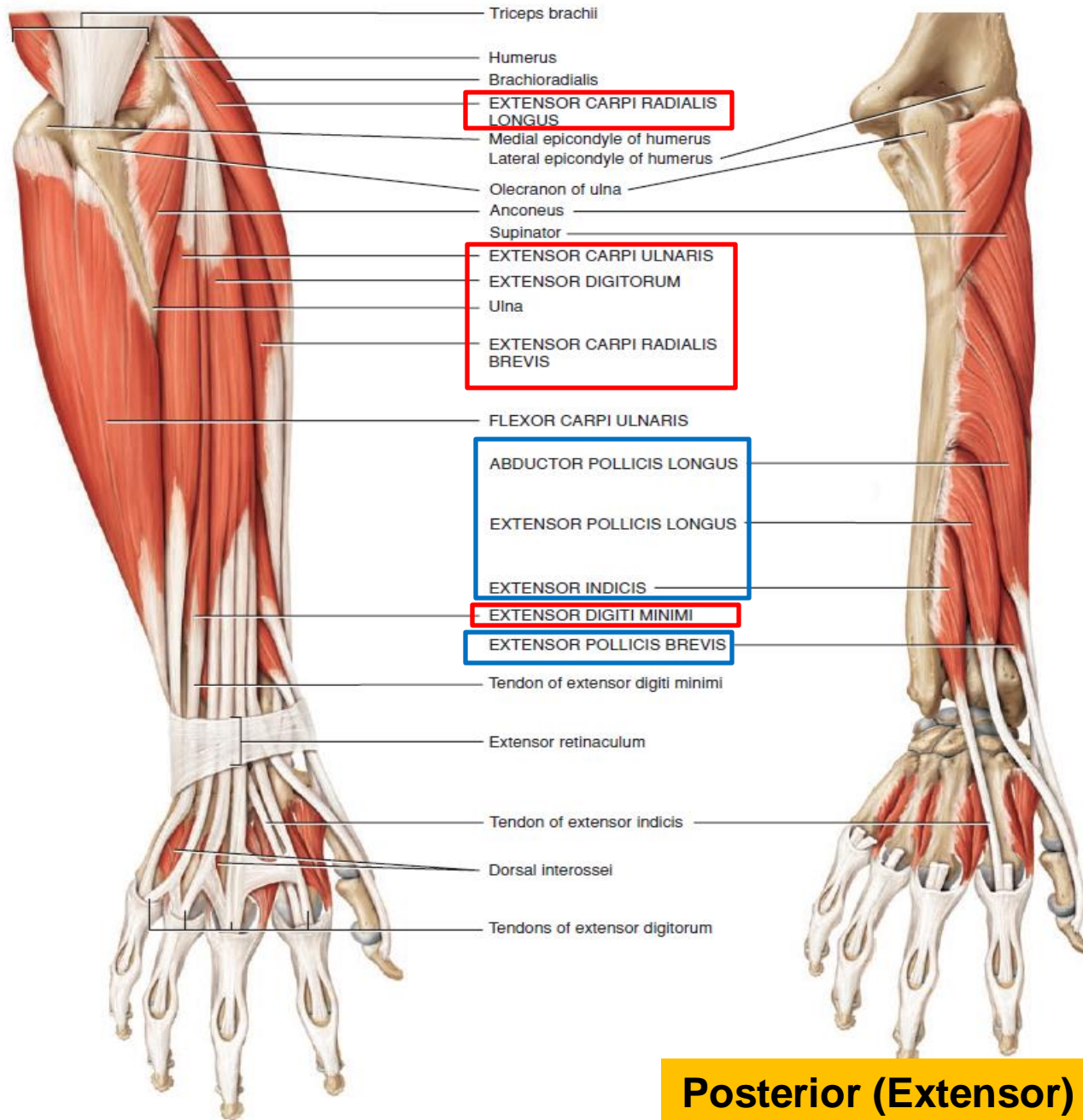


Anterior (Flexor) compartment

(a) Anterior superficial view

(b) Anterior intermediate view

(c) Anterior deep view



(d) Posterior superficial view

(e) Posterior deep view

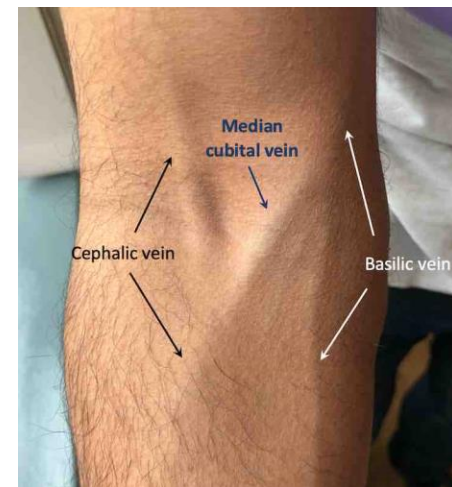
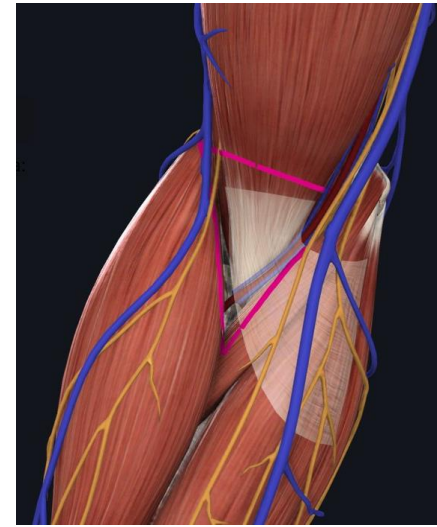
Posterior (Extensor) compartment

Cubital Fossa

- The elbow is the area connecting the arm with the forearm
- The cubital fossa is a **triangular depression that lies in the anterior aspect of the elbow**

Bicipital aponeurosis

- In the cubital fossa, the **median cubital vein** is separated from the underlying brachial artery by the bicipital aponeurosis.
- This is important because the aponeurosis protects the **brachial artery** from the mistaken introduction of irritating drugs that should have been injected into the vein.
- It also protects **median nerve from injuries**



Intrinsic Muscles of the Hand (19)

- Produce weak but precise movements.

Writing - Typing - Playing a piano – Pincer-like action.

- Split into 3 groups:.

1. The intermediate group (12) includes

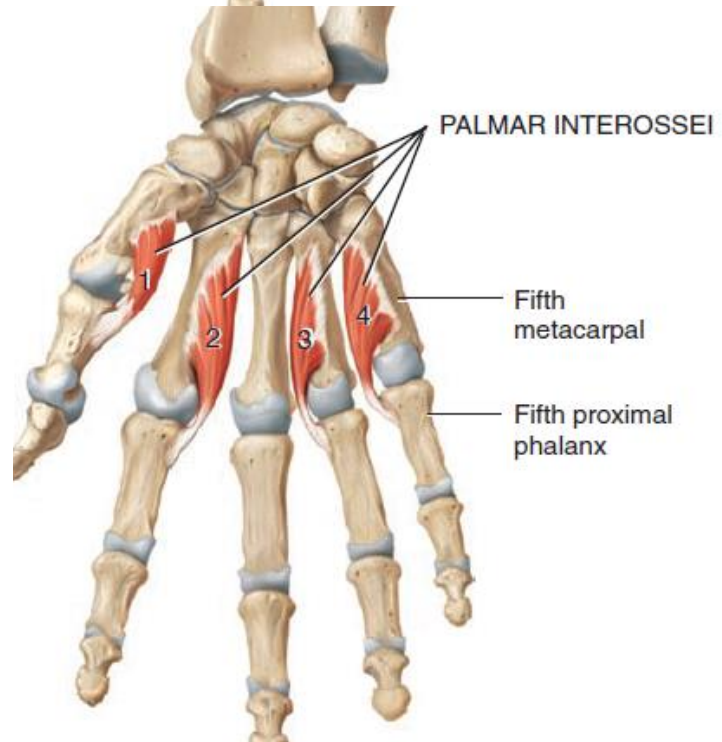
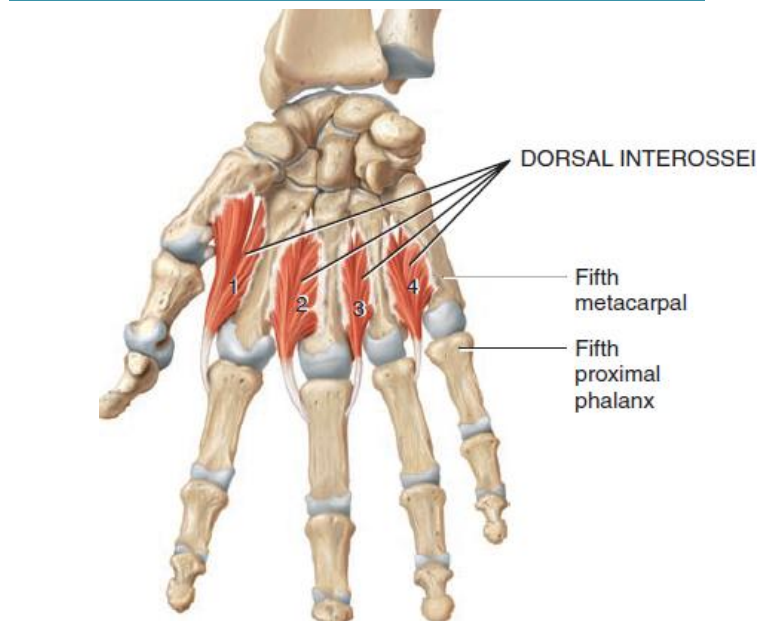
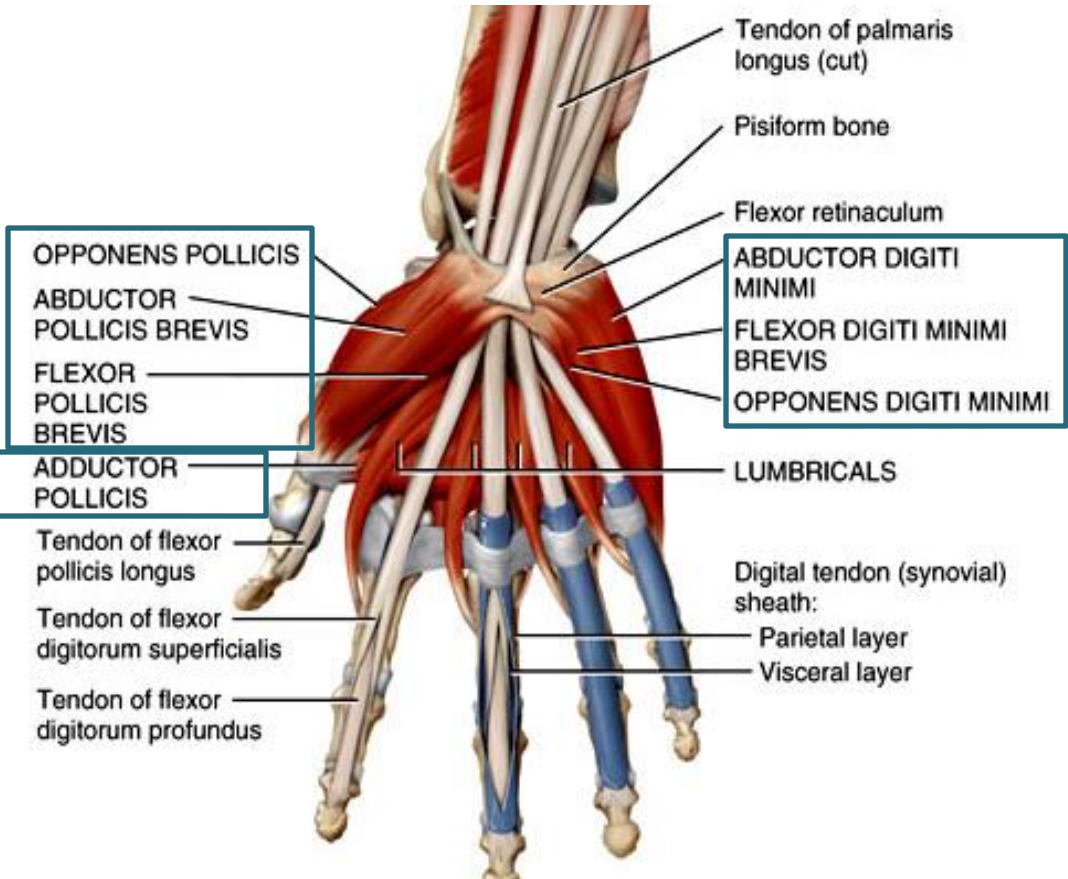
A. The lumbricals (4):

B. The palmar interossei (4): **adduct** the fingers towards the middle finger.

C. The dorsal interossei (4): **abduct** the fingers away from the middle finger.

2. The thenar muscles plus the adductor pollicis form the **thenar eminence**. These produce the various movements of the thumb (**Pollex**).

3. Hypothenar muscles act on the little finger and form the **hypothenar eminence**.



Flexion



Extension



Abduction



Adduction



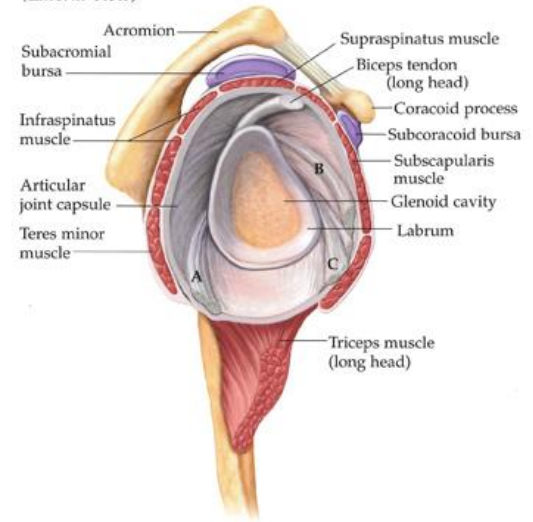
Opposition

Glenohumeral Joint (Shoulder Joint)

- **Articulation:** the rounded head of the humerus and the shallow glenoid cavity of the scapula.
- **Type:** Synovial ball-and-socket joint
- **Most mobile and most frequently dislocated**
- The tendons of the subscapularis, supraspinatus, infraspinatus, and teres minor muscles (the rotator cuff muscles) strengthened the capsule



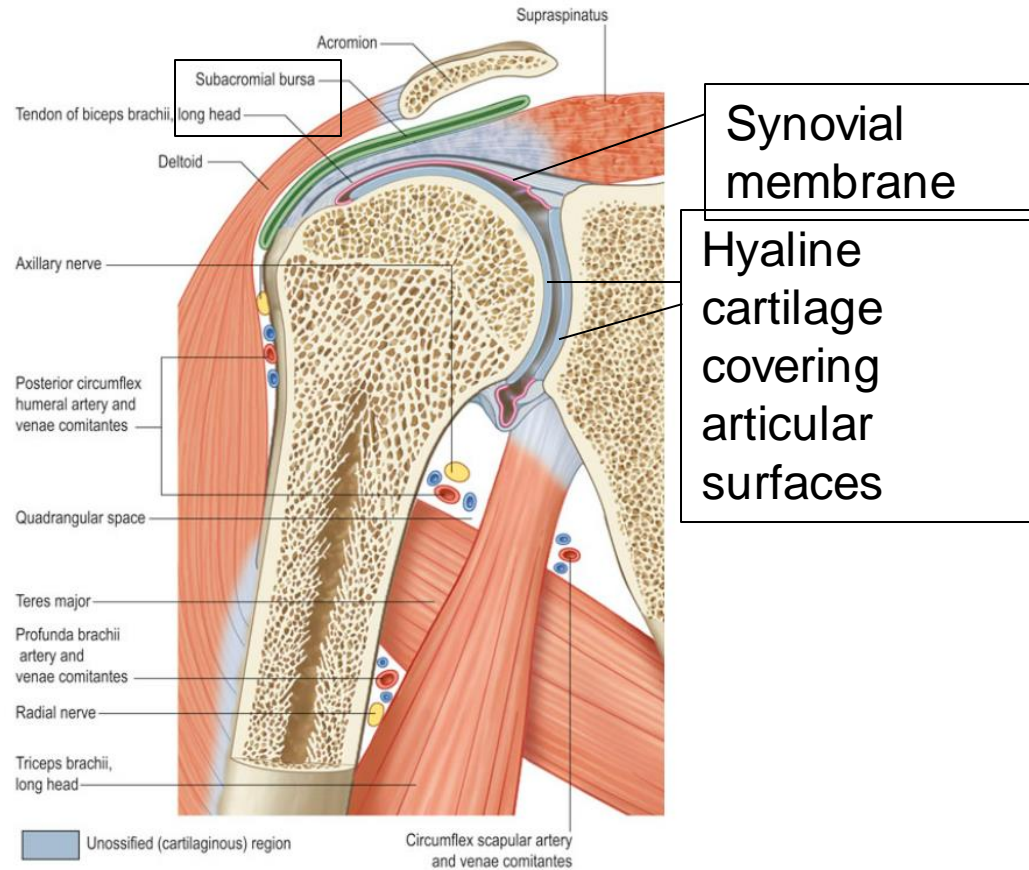
Socket of Right Shoulder Joint
(Lateral view)



Glenohumeral joint (shoulder joint)

The articular surfaces are covered by **hyaline articular cartilage**, and the glenoid cavity is deepened by the presence of a fibrocartilaginous rim termed the **glenoid labrum**

Capsule: attached medially to the margin of the glenoid cavity outside the labrum; laterally, it is attached to the anatomic neck of the humerus



Glenohumeral joint (shoulder joint)

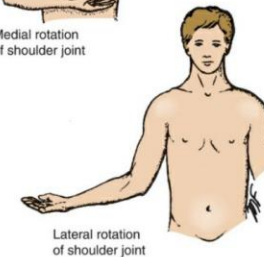
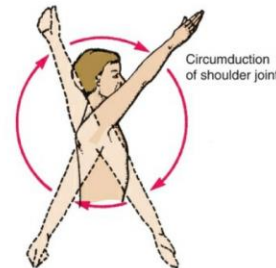
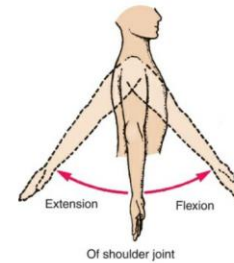
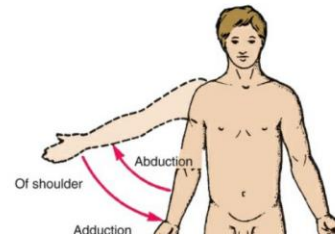
Movements:

Flexion-Extension

Adduction-Abduction

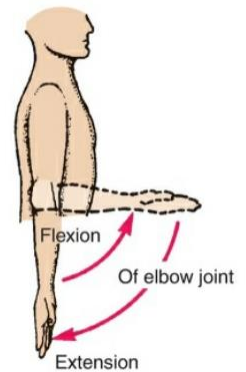
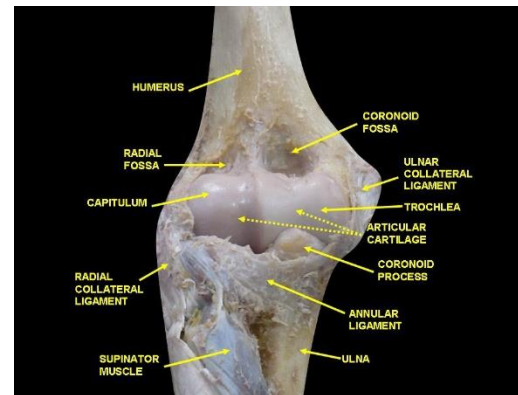
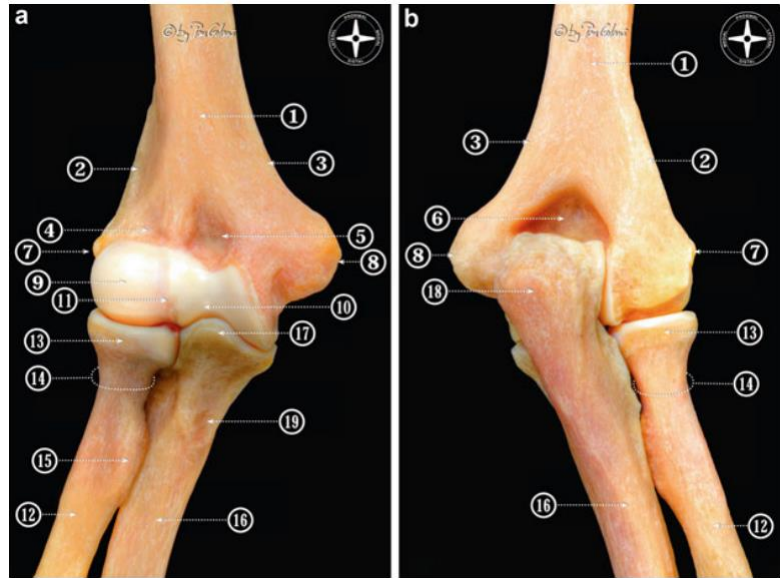
Medial rotation-Lateral rotation

Circumduction



Elbow joint

- **Articulation:** This occurs between the trochlea and capitulum of the humerus and the trochlear notch of the ulna and the head of the radius
- **Type:** **Synovial hinge joint.**
- **Ligaments:** **lateral (radial) collateral ligament** and **medial (ulnar) collateral ligament**
- **Nerve supply:** Branches from the **median, ulnar, musculocutaneous,** and **radial nerves.**
- **Movements:** **flexion and extension**



Proximal Radioulnar Joint

- **Articulation:** Between the circumference of the head of the radius and the radial notch on the ulna
- **Type:** Synovial pivot joint.
- **Ligament:** The anular ligament
- **Nerve supply:** Branches of the median, ulnar, musculocutaneous, and radial nerves.
- **Movements:** pronation and supination

