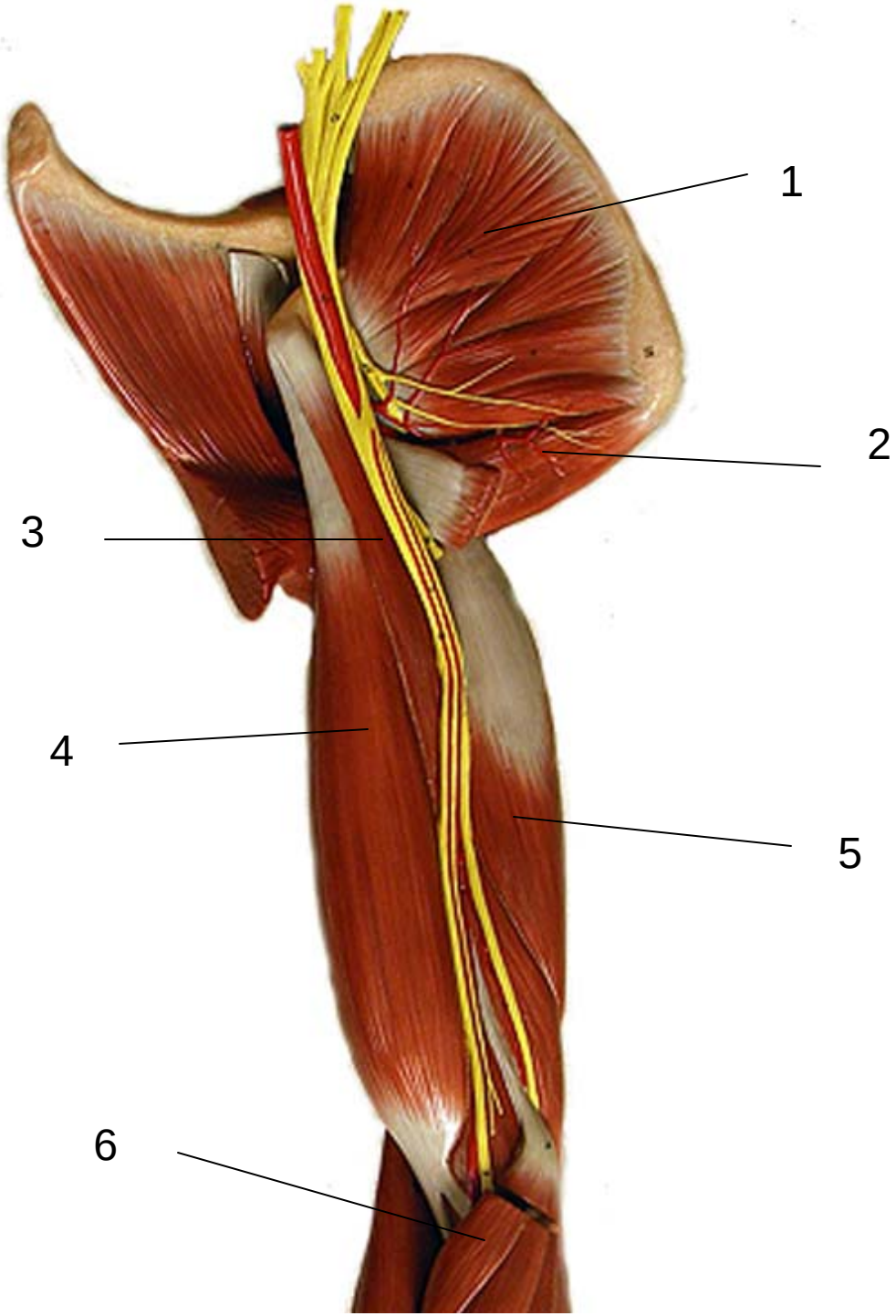
Muscle Anatomy

The Arm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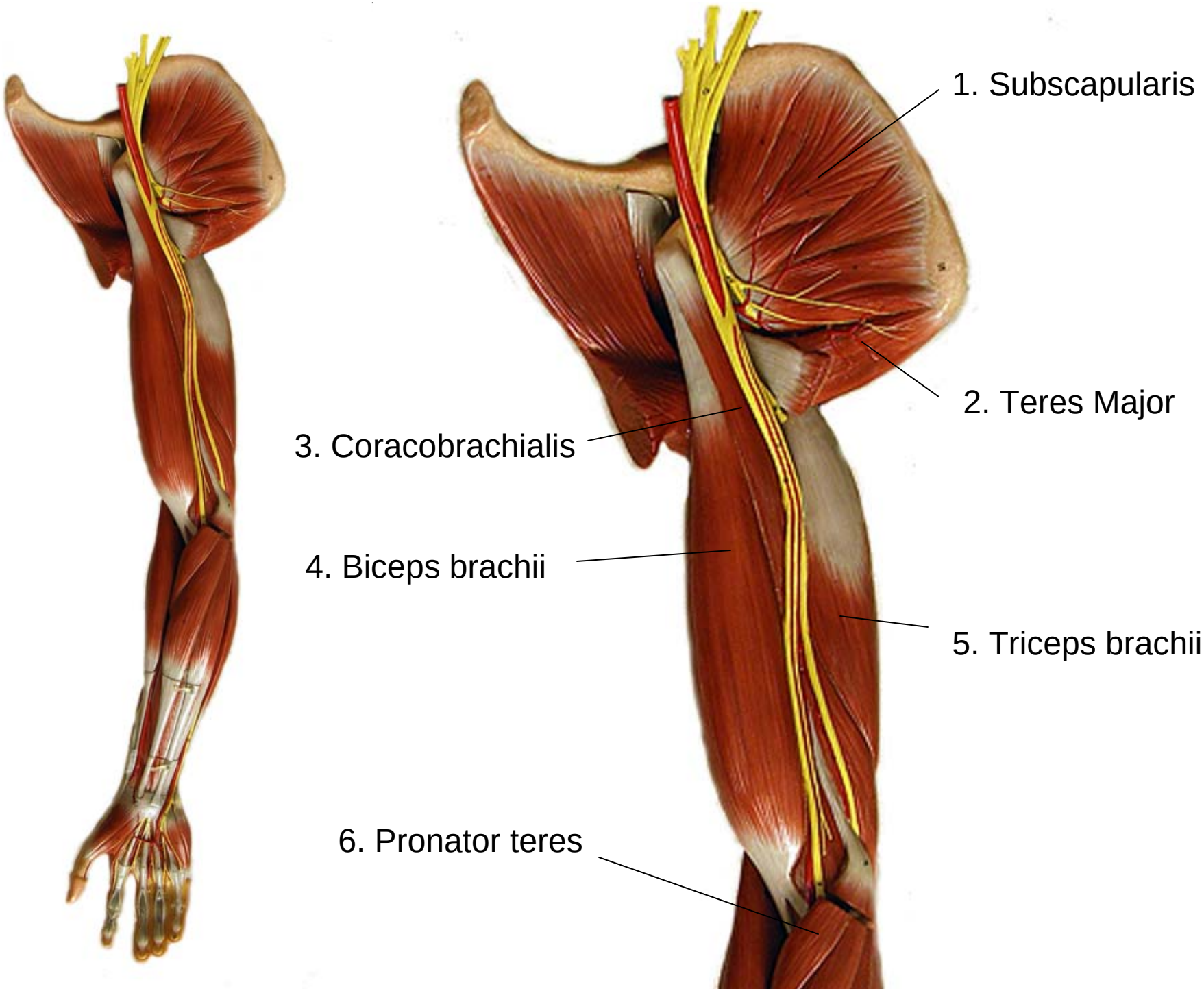
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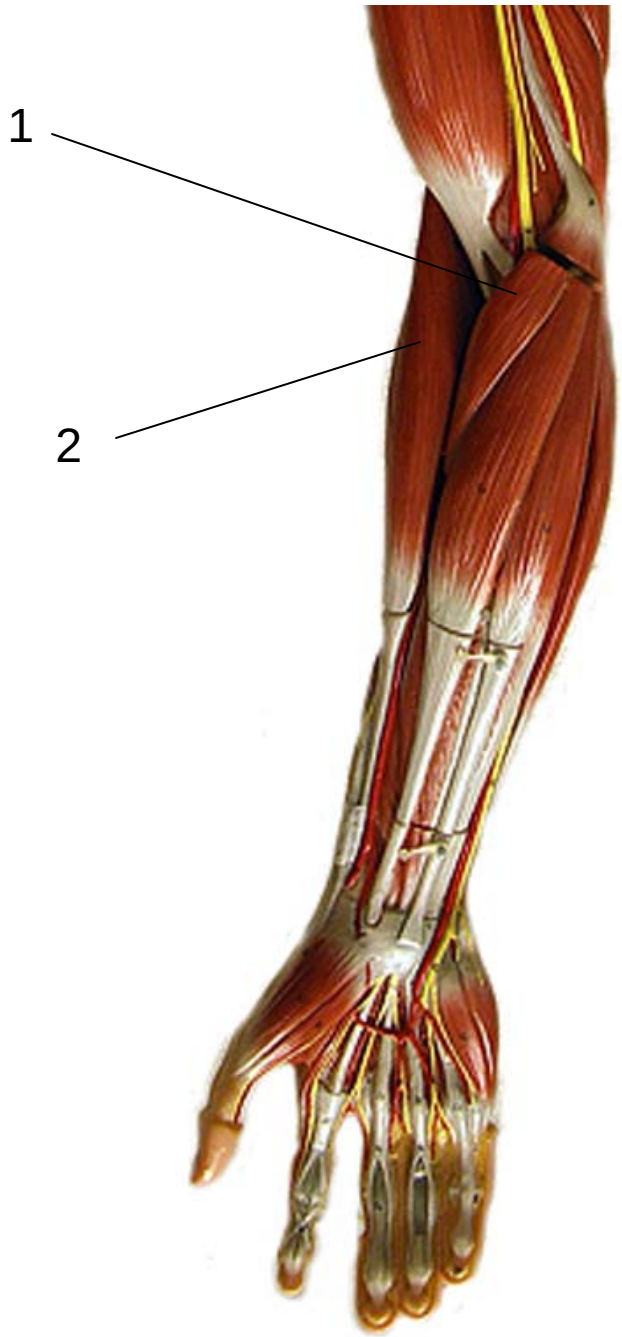
2. Teres Major
3. Coracobrachialis
4. Biceps brachii
5. Triceps brachii
6. Pronator teres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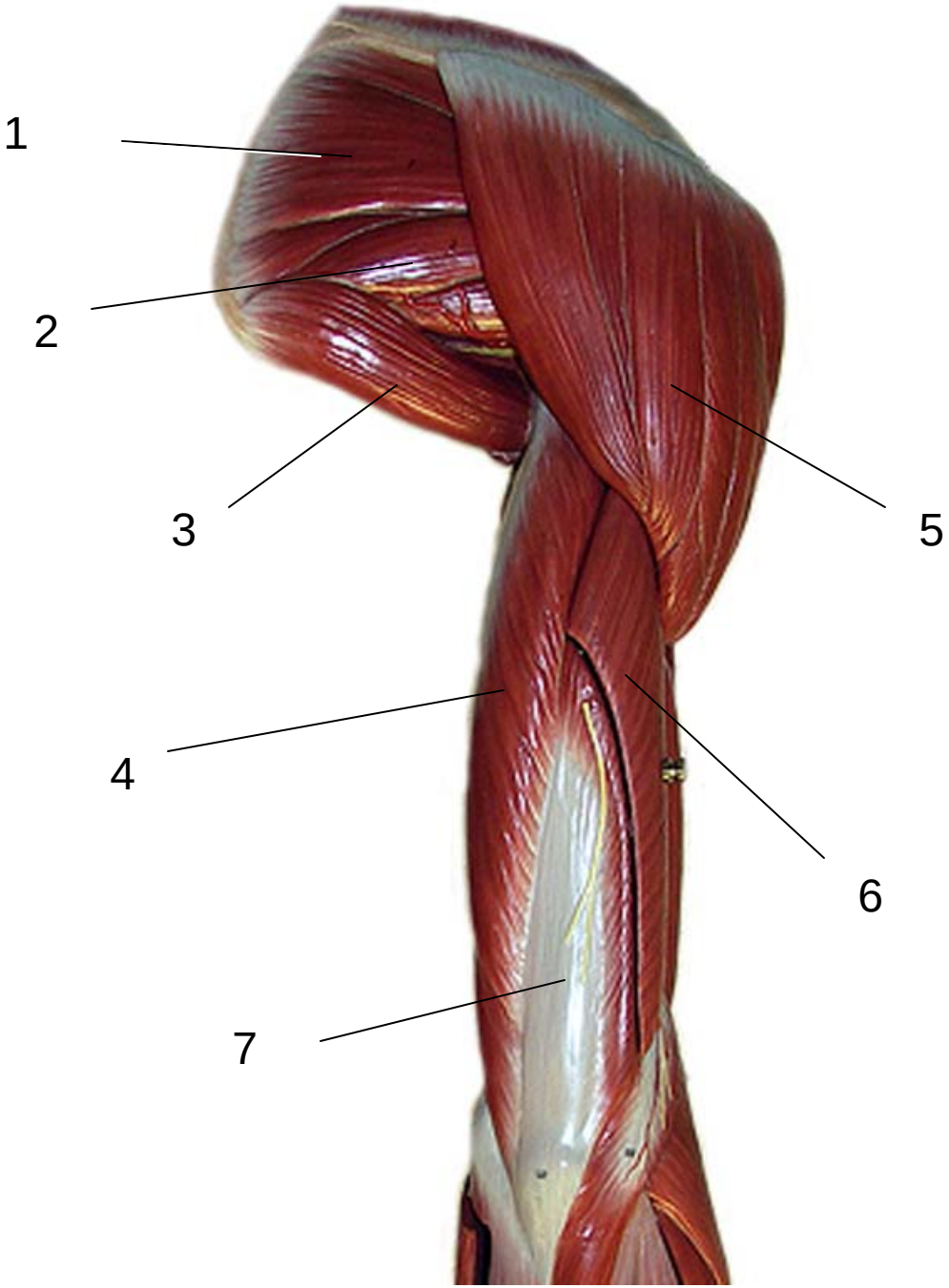
1. Pronator teres

2. Brachioradialis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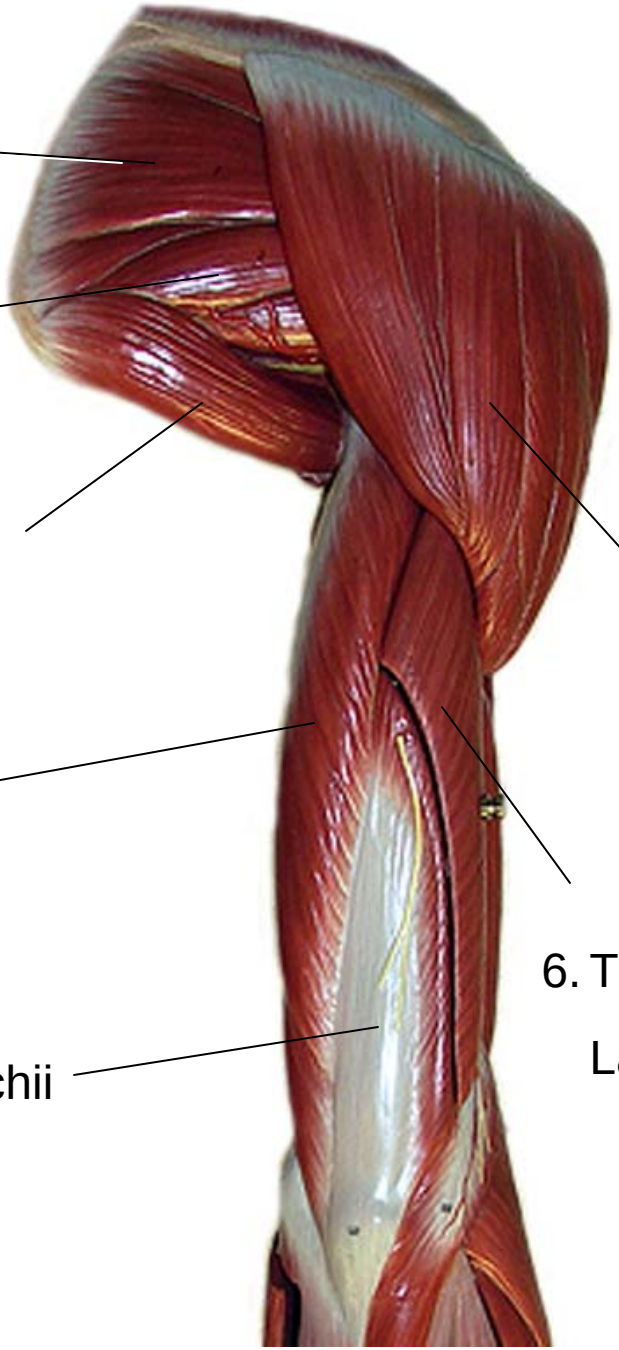
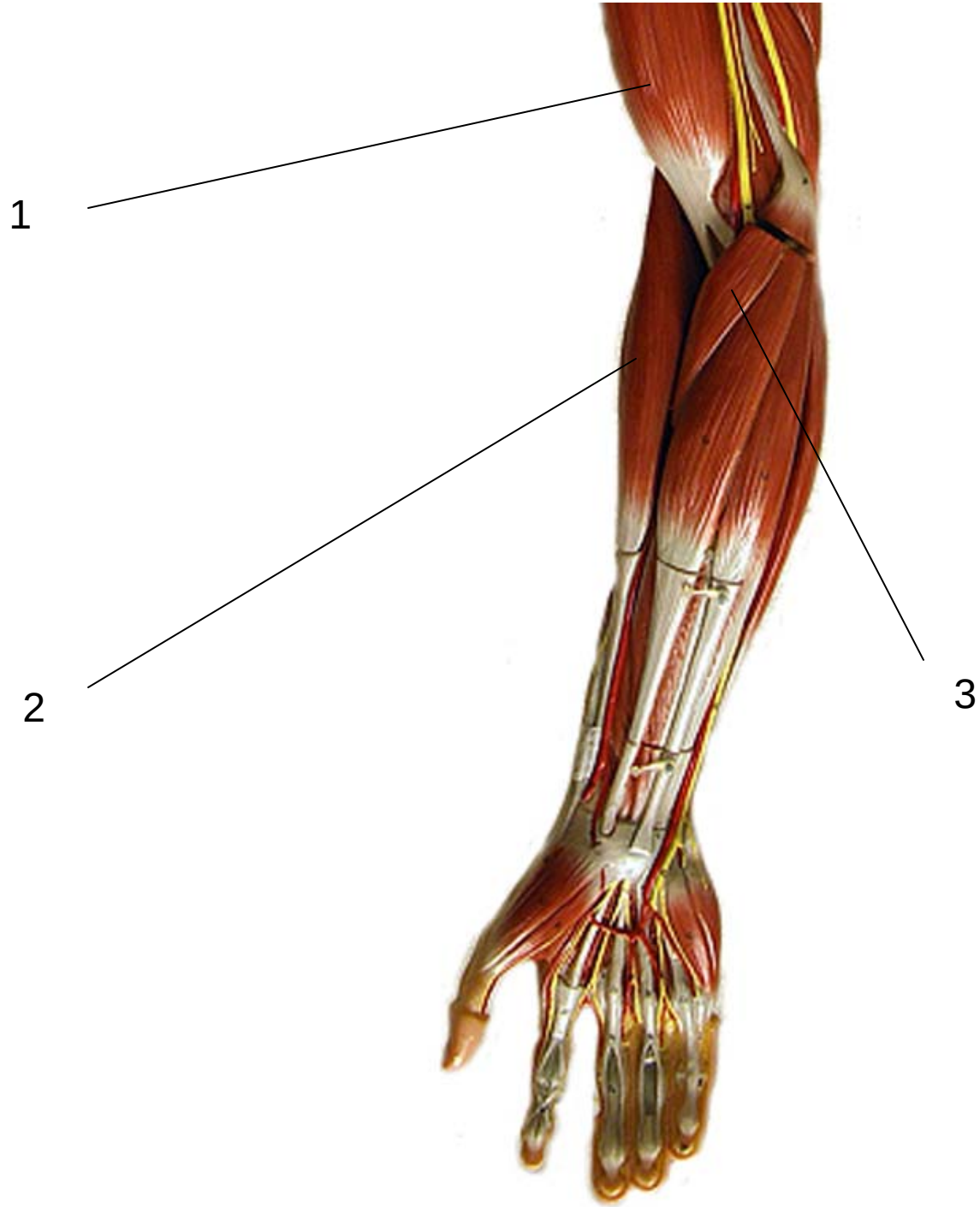
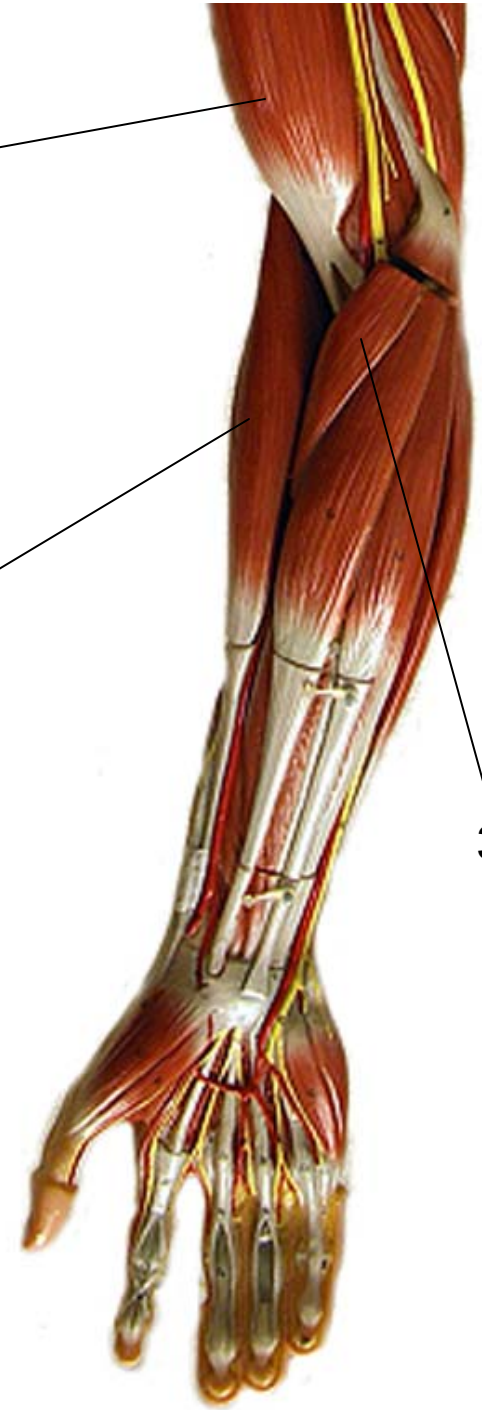


1. Infraspinatus
2. Teres minor
3. Teres major
4. Triceps brachii, long head
5. Deltoid
6. Triceps Brachii Lateral head
7. Triceps brachii



Anterior View



1. Biceps brachii

2. Brachioradialis

3. Pronator teres

Anterior View

Posterior View

TABLE 10.8 Muscles Acting on the Shoulder (continued)

Anterior Group. Muscles of the pectoral girdle fall into anterior and posterior groups (see figs. 10.23 and 10.24). The major muscles of the anterior group are the *pectoralis minor* and *serratus anterior* (see fig. 10.15b). The pectoralis minor arises by three heads from ribs 3 to 5 and converges on the coracoid process of the scapula. The serratus anterior arises from separate heads on all or nearly all of the ribs, wraps laterally around the chest, passes across the back between the rib cage and scapula, and inserts on the medial (vertebral) border of the scapula. Thus, when it contracts, the scapula glides laterally and slightly forward around the ribs. The serratus anterior is nicknamed the "boxer's muscle" because of its role in powerful thrusting movements of the arm such as a boxer's jab.

Name	Action	O: Origin I: Insertion	Innervation
Pectoralis Minor (PECK-toe-RAY-liss)	With serratus anterior, draws scapula laterally and forward around chest wall; with other muscles, rotates scapula and depresses apex of shoulder, as in reaching down to pick up a suitcase	**O:** Ribs 3–5 and overlying fascia **I:** Coracoid process of scapula	Medial and lateral pectoral nerves
Serratus[56] Anterior (serr-AY-tus)	With pectoralis minor, draws scapula laterally and forward around chest wall; protracts scapula, and is the prime mover in all forward-reaching and pushing actions; aids in rotating scapula to elevate apex of shoulder; fixes scapula during abduction of arm	**O:** All or nearly all ribs **I:** Medial border of scapula	Long thoracic nerve
Posterior Group. The posterior muscles that act on the scapula include the large, superficial trapezius, already discussed (table 10.3), and three deep muscles: the *levator scapulae*, *rhomboideus minor*, and *rhomboideus major* (the *rhomboids*). The action of the trapezius depends on whether its superior, middle, or inferior fibers contract and whether it acts alone or with other muscles. The levator scapulae and superior fibers of the trapezius rotate the scapula in opposite directions if either of them acts alone. If both act together, their opposite rotational effects balance each other and they elevate the scapula and shoulder, as when you lift a suitcase from the floor. Depression of the scapula occurs mainly by gravitational pull, but the trapezius and serratus anterior can depress it more rapidly and forcefully, as in swimming, hammering, and rowing.			
Trapezius (tra-PEE-zee-us)	Stabilizes scapula and shoulder during arm movements; elevates and depresses apex of shoulder; acts with other muscles to rotate and retract scapula (see also roles in head and neck movements in table 10.3)	**O:** External occipital protuberance; medial one-third of superior nuchal line; nuchal ligament; spinous processes of vertebrae C7–T3 or T4 **I:** Acromion and spine of scapula; lateral one-third of clavicle	Accessory nerve; anterior rami of C3–C4
Levator Scapulae (leh-VAY-tur SCAP-you-lee)	Elevates scapula if cervical vertebrae are fixed; flexes neck laterally if scapula is fixed; retracts scapula and braces shoulder; rotates scapula and depresses apex of shoulder	**O:** Transverse processes of vertebrae C1–C4 **I:** Superior angle to medial border of scapula	Spinal nerves C3–C4, and C5 via posterior scapular nerve
Rhomboideus Minor (rom-BOY-dee-us)	Retracts scapula and braces shoulder; fixes scapula during arm movements	**O:** Spinous processes of vertebrae C7–T1; nuchal ligament **I:** Medial border of scapula	Posterior scapular nerve
Rhomboideus Major	Same as rhomboideus minor	**O:** Spinous processes of vertebrae T2–T5 **I:** Medial border of scapula	Posterior scapular nerve

TABLE 10.9 Muscles Acting on the Arm

Axial Muscles. Nine muscles cross the shoulder joint and insert on the humerus. Two are considered **axial muscles** because they originate primarily on the axial skeleton—the *pectoralis major* and *latissimus dorsi* (figs. 10.15, 10.23, and 10.24). The pectoralis major is the thick, fleshy muscle of the mammary region, and the latissimus dorsi is a broad muscle of the back that extends from the waist to the axilla. These muscles bear the primary responsibility for attaching the arm to the trunk and are the prime movers of the shoulder joint.

Name	Action	O: Origin I: Insertion	Innervation
Pectoralis Major (PECK-toe-RAY-liss)	Flexes, adducts, and medially rotates humerus, as in climbing or hugging; aids in deep inspiration	**O:** Medial half of clavicle; lateral margin of sternum; costal cartilages 1–7; aponeurosis of external oblique **I:** Lateral lip of intertubercular sulcus of humerus	Medial and lateral pectoral nerves
Latissimus Dorsi[57] (la-TISS-ih-mus DOR-sye)	Adducts and medially rotates humerus; extends the shoulder joint as in pulling on the oars of a rowboat; produces backward swing of arm in such actions as walking and bowling; with hands grasping overhead objects, pulls body forward and upward, as in climbing; aids in deep inspiration, sudden expiration such as sneezing and coughing, and prolonged forceful expiration as in singing or blowing a sustained note on a wind instrument	**O:** Vertebrae T7–L5; lower three or four ribs; iliac crest; thoracolumbar fascia **I:** Floor of intertubercular sulcus of humerus	Thoracodorsal nerve
Scapular Muscles. The other seven muscles of the shoulder are considered **scapular muscles** because they originate on the scapula. Four of them form the rotator cuff and are treated in the next section. The most conspicuous scapular muscle is the *deltoid*, the thick triangular muscle that caps the shoulder. This is a commonly used site of drug injections. Its anterior, lateral, and posterior fibers act like three different muscles.			
Deltoid	Anterior fibers flex and medially rotate arm; lateral fibers abduct arm; posterior fibers extend and laterally rotate arm; involved in arm swinging during such actions as walking or bowling, and in adjustment of hand height for various manual tasks	**O:** Acromion and spine of scapula; clavicle **I:** Deltoid tuberosity of humerus	Axillary nerve
Teres Major (TERR-eez)	Extends and medially rotates humerus; contributes to arm swinging	**O:** Inferior angle of scapula **I:** Medial lip of intertubercular sulcus of humerus	Lower subscapular nerve
Coracobrachialis (COR-uh-co-BRAY-kee-AY-lis)	Flexes and medially rotates arm; resists deviation of arm from frontal plane during abduction	**O:** Coracoid process **I:** Medial aspect of humeral shaft	Musculocutaneous nerve

The Rotator Cuff. Tendons of the remaining four scapular muscles form the **rotator cuff** (fig. 10.25). These muscles are nicknamed the "SITS muscles" for the first letters of their names—*supraspinatus, infraspinatus, teres minor,* and *subscapularis.* The first three muscles lie on the posterior side of the scapula (see fig. 10.23b). The supraspinatus and infraspinatus occupy the supraspinous and infraspinous fossae, above and below the scapular spine. The teres minor lies inferior to the infraspinatus. The subscapularis occupies the subscapular fossa on the anterior surface of the scapula, between the scapula and ribs (see fig. 10.23d). The tendons of these muscles merge with the joint capsule of the shoulder as they cross it en route to the humerus. They insert on the proximal end of the humerus, forming a partial sleeve around it. The rotator cuff reinforces the joint capsule and holds the head of the humerus in the glenoid cavity. The rotator cuff, especially the supraspinatus tendon, is easily damaged by strenuous circumduction or hard blows to the shoulder (see Deeper Insight 10.5).

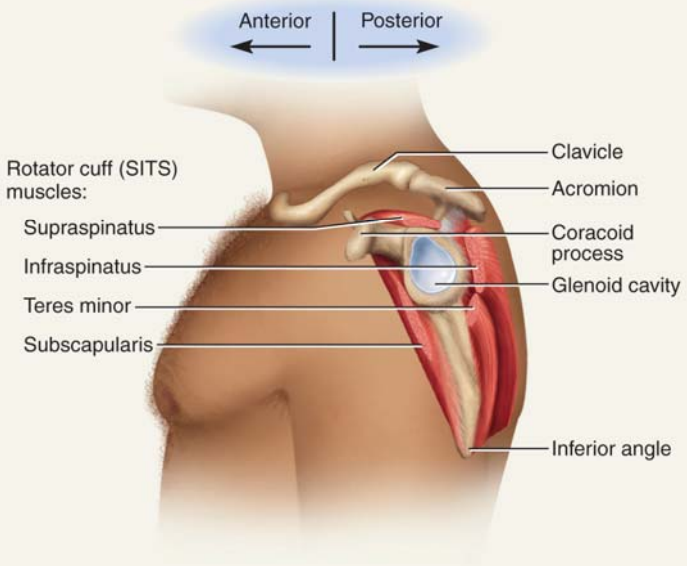


FIGURE 10.25 Rotator Cuff Muscles in Relation to the Scapula. Lateral view. For posterior and anterior views of these muscles, see figure 10.23b, d.

Name	Action	O: Origin I: Insertion	Innervation
Supraspinatus[58] (SOO-pra-spy-NAY-tus)	Aids deltoid in abduction of arm; resists downward slippage of humeral head when arm is relaxed or when carrying weight	**O:** Supraspinous fossa of scapula **I:** Greater tubercle of humerus	Suprascapular nerve
Infraspinatus[59] (IN-fra-spy-NAY-tus)	Modulates action of deltoid, preventing humeral head from sliding upward; rotates humerus laterally	**O:** Infraspinous fossa of scapula **I:** Greater tubercle of humerus	Suprascapular nerve
Teres Minor (TERR-eez)	Modulates action of deltoid, preventing humeral head from sliding upward as arm is abducted; rotates humerus laterally	**O:** Lateral border and adjacent posterior surface of scapula **I:** Greater tubercle of humerus; posterior surface of joint capsule	Axillary nerve
Subscapularis[60] (SUB-SCAP-you-LERR-iss)	Modulates action of deltoid, preventing humeral head from sliding upward as arm is abducted; rotates humerus medially	**O:** Subscapular fossa of scapula **I:** Lesser tubercle of humerus; anterior surface of joint capsule	Upper and lower subscapular nerves

The elbow and forearm are capable of four motions—flexion, extension, pronation, and supination—carried out by muscles in both the brachium and antebrachium (arm and forearm).

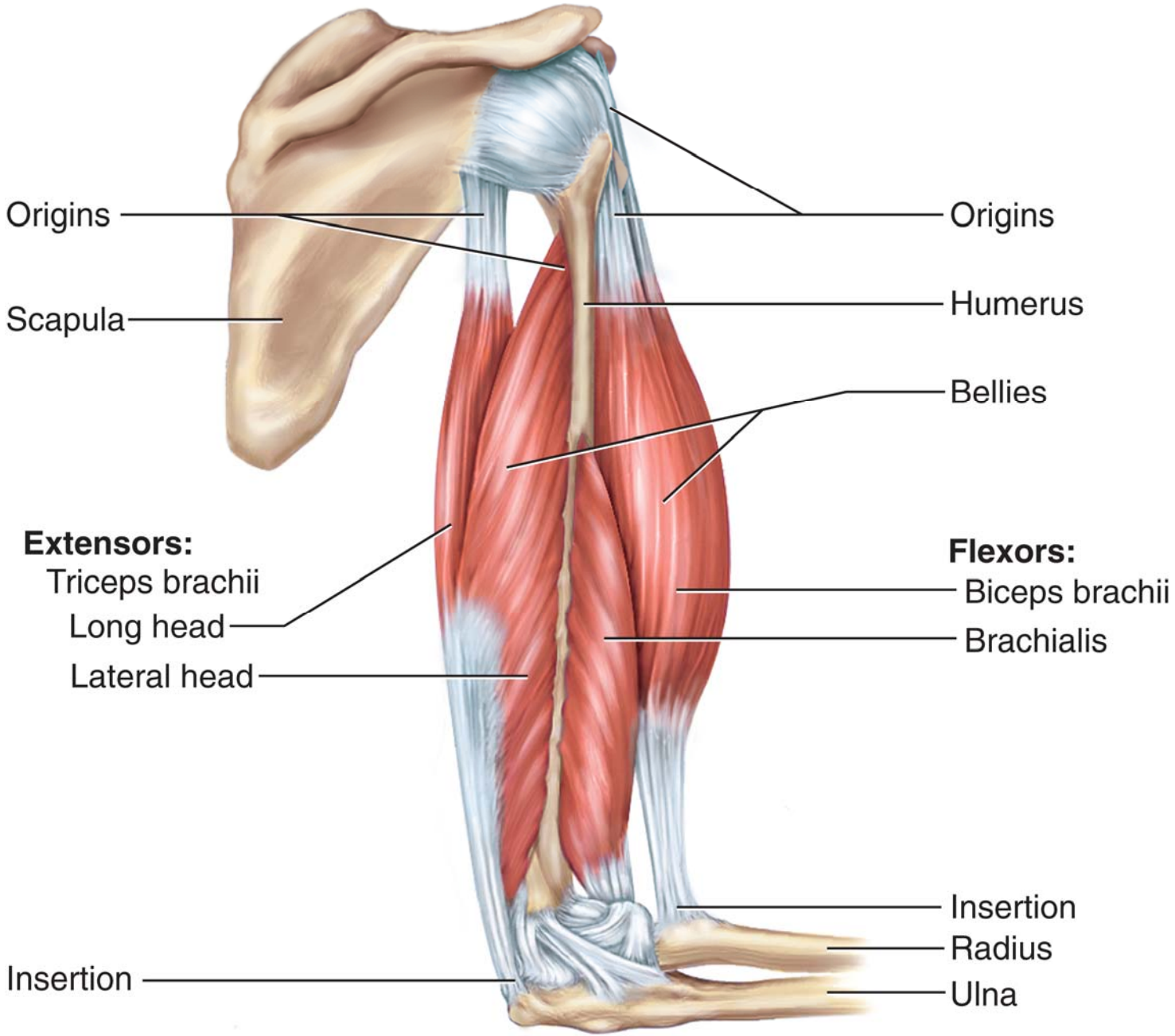
Muscles with Bellies in the Arm (Brachium). The principal elbow flexors are in the anterior compartment of the arm—the brachialis and biceps brachii (see fig. 10.23c–d). The *biceps brachii* appears as a large anterior bulge on the arm and commands considerable interest among body builders, but the *brachialis* underlying it generates about 50% more power and is thus the prime mover of elbow flexion. The biceps is not only a flexor but also a powerful forearm supinator. It is named for its two heads: a *short head* whose tendon arises from the coracoid process of the scapula, and a *long head* whose tendon originates on the superior margin of the glenoid cavity, loops over the shoulder, and braces the humerus against the glenoid cavity (see p. 300). The two heads converge close to the elbow on a single distal tendon that inserts on the radius and on the fascia of the medial side of the upper forearm. Note that *biceps* is the singular term; there is no such word as *bicep*. To refer to the biceps muscles of both arms, the plural is *bicipites* (by-SIP-ih-teez).

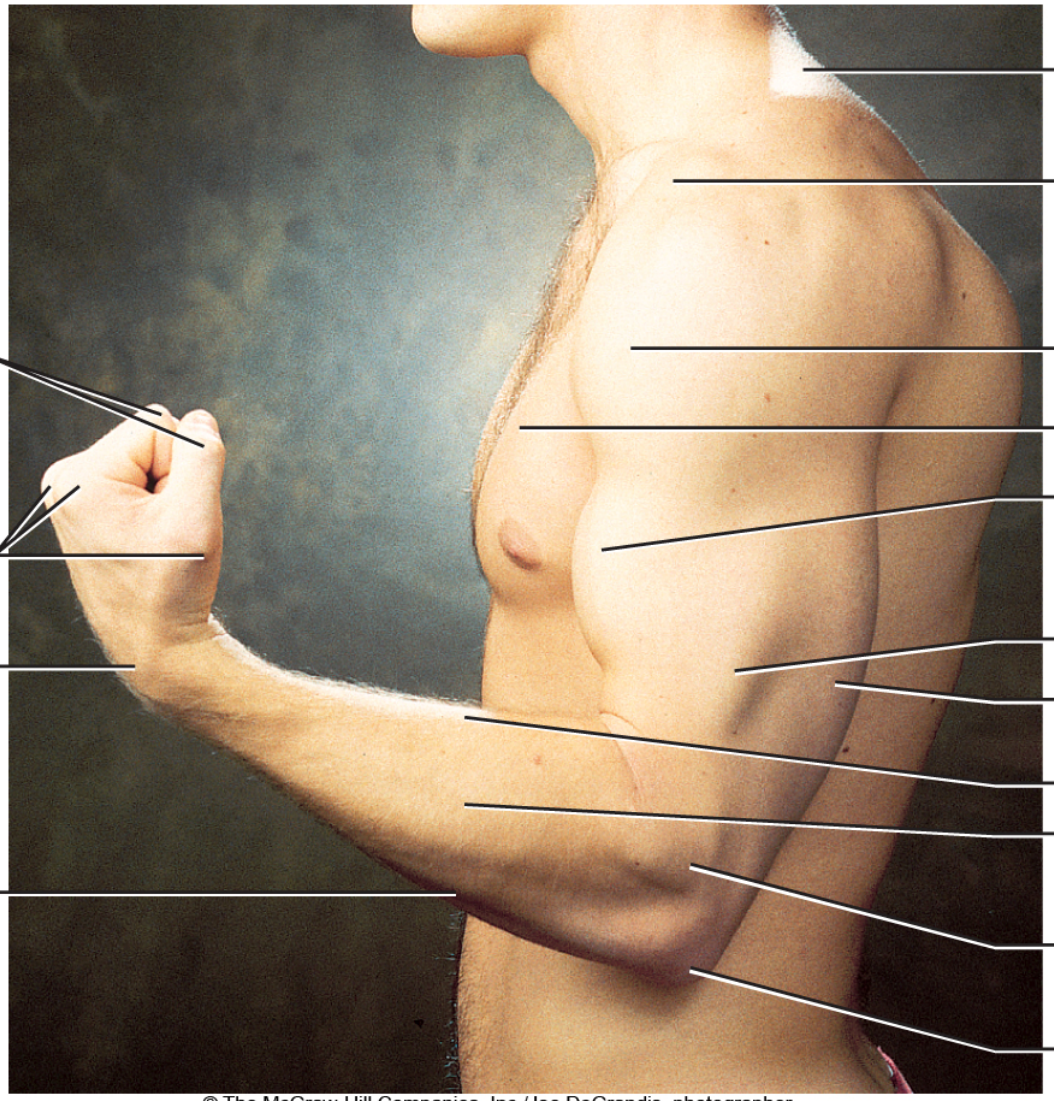
The triceps brachii is a three-headed muscle on the posterior side of the humerus, and is the prime mover of elbow extension (see fig. 10.23b).

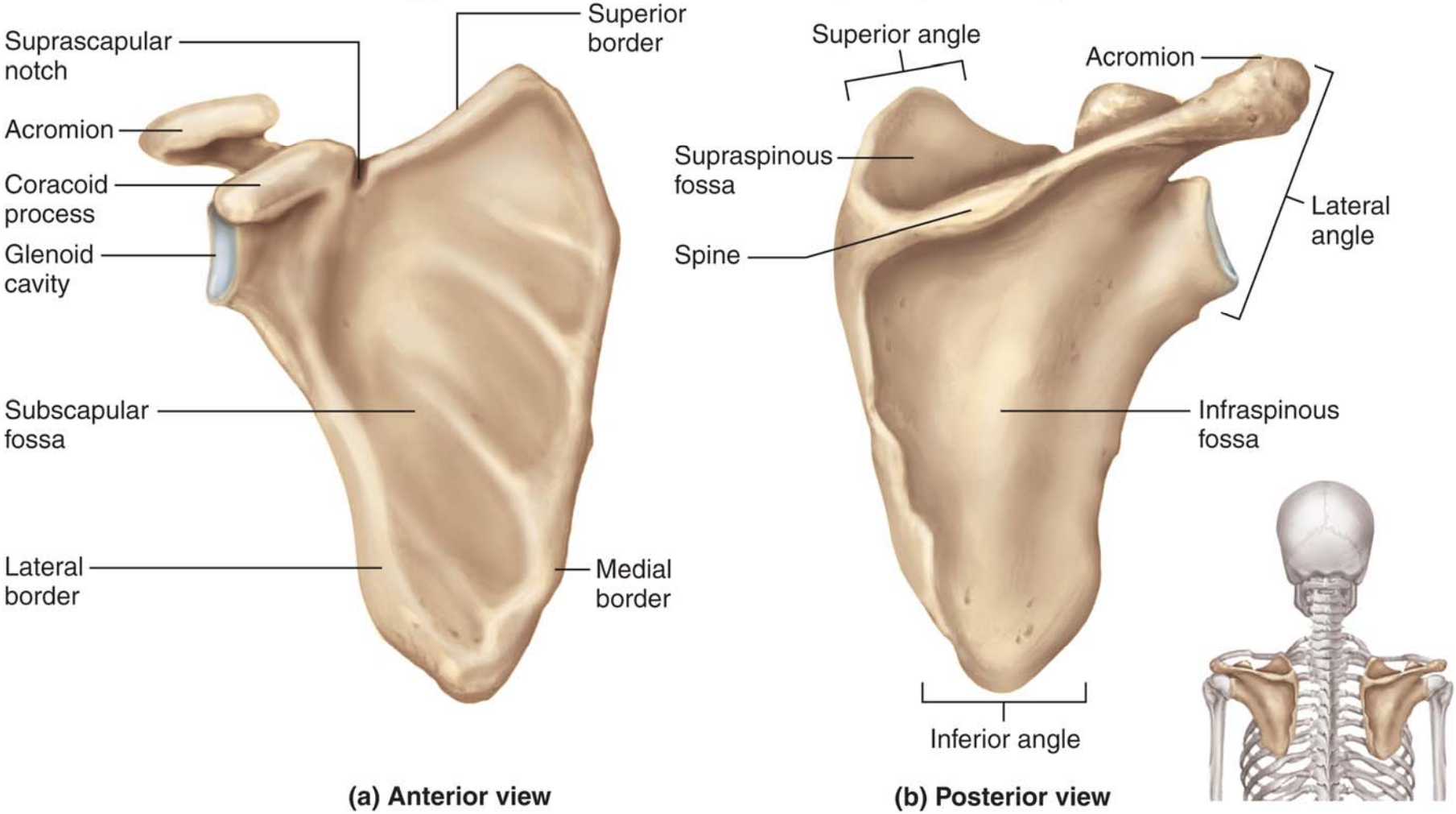
Name	Action	O: Origin I: Insertion	Innervation
Brachialis (BRAY-kee-AY-lis)	Prime mover of elbow flexion	**O:** Anterior surface of distal half of humerus **I:** Coronoid process and tuberosity of ulna	Musculocutaneous nerve; radial nerve
Biceps Brachii (BY-seps BRAY-kee-eye)	Rapid or forceful supination of forearm; synergist in elbow flexion; slight shoulder flexion; tendon of long head stabilizes shoulder by holding humeral head against glenoid cavity	**O:** Long head–superior margin of glenoid cavity Short head–coracoid process **I:** Tuberosity of radius; fascia of forearm	Musculocutaneous nerve
Triceps Brachii (TRI-seps BRAY-kee-eye)	Extends elbow; long head extends and adducts humerus	**O:** Long head–inferior margin of glenoid cavity and joint capsule Lateral head–posterior surface of proximal end of humerus Medial head–posterior surface of entire humeral shaft **I:** Olecranon; fascia of forearm	Radial nerve

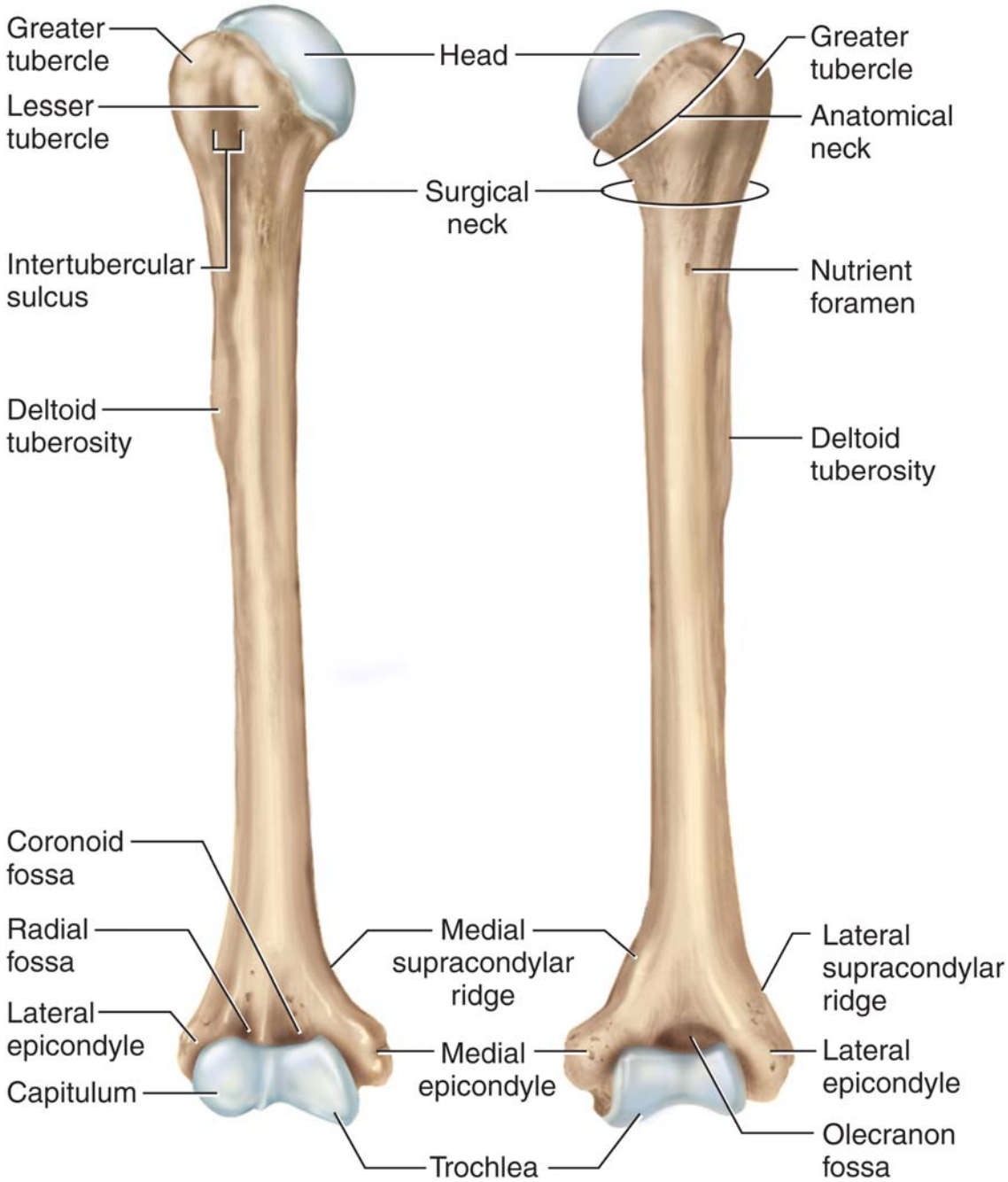
Muscles with Bellies in the Forearm (Antebrachium). Most forearm muscles act on the wrist and hand, but two of them are synergists in elbow flexion and extension and three of them function in pronation and supination. The *brachioradialis* is the large fleshy mass of the lateral (radial) side of the forearm just distal to the elbow (see figs. 10.23a and 10.28a). Its origin is on the distal end of the humerus and its insertion on the distal end of the radius. With the insertion so far from the fulcrum of the elbow, it does not generate as much force as the brachialis and biceps; it is effective mainly when those muscles have already partially flexed the elbow. The *anconeus* is a weak synergist of elbow extension on the posterior side of the elbow (see fig. 10.29). Pronation is achieved by the *pronator teres* near the elbow and *pronator quadratus* (the prime mover) near the wrist. Supination is usually achieved by the *supinator* of the upper forearm, with the biceps brachii aiding when additional speed or power is required (fig. 10.26).

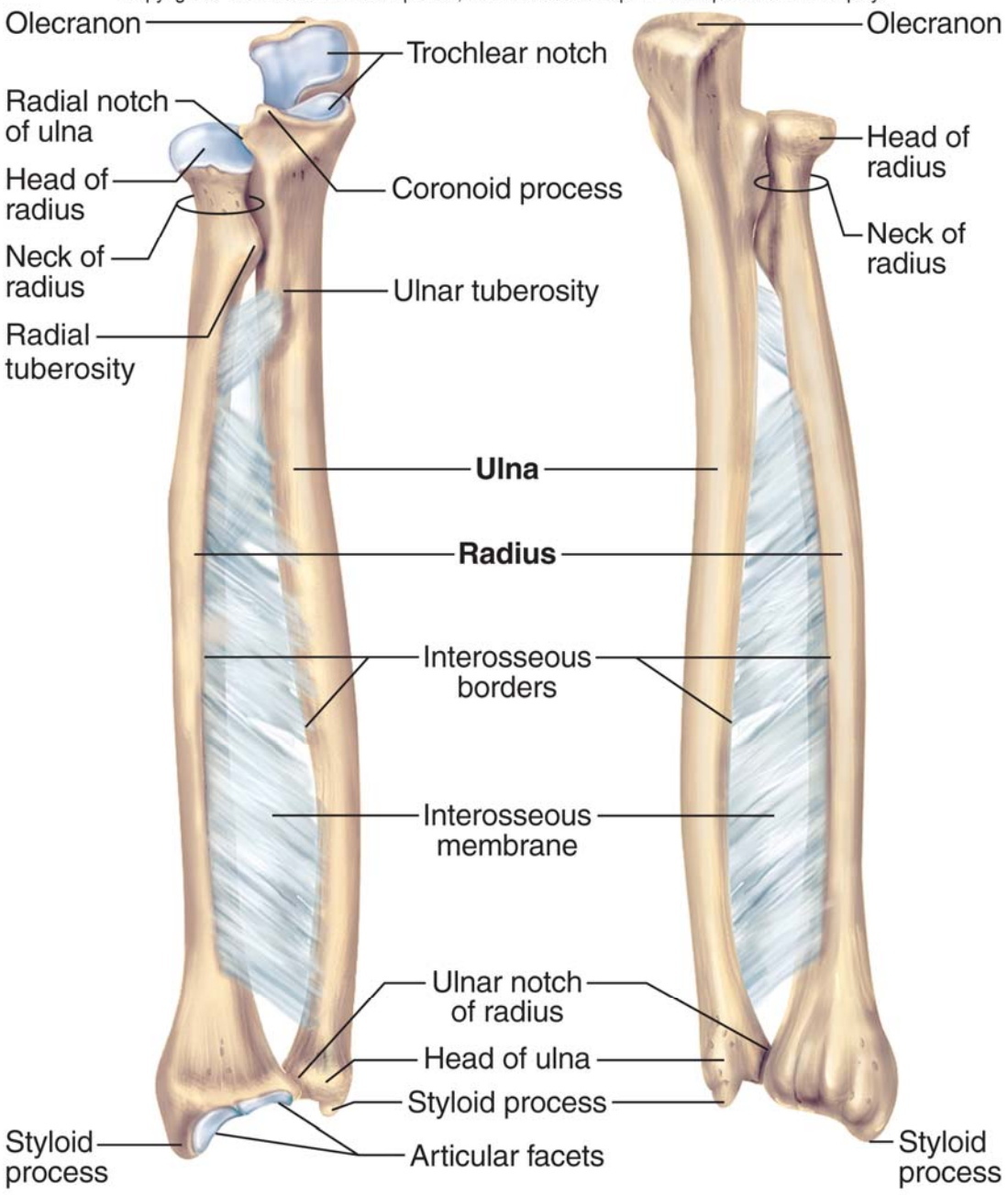
Brachioradialis (BRAY-kee-oh-RAY-dee-AY-lis)	Flexes elbow	**O:** Lateral supracondylar ridge of humerus **I:** Lateral surface of radius near styloid process	Radial nerve
Anconeus[61] (an-CO-nee-us)	Extends elbow; may help to control ulnar movement during pronation	**O:** Lateral epicondyle of humerus **I:** Olecranon and posterior surface of ulna	Radial nerve
Pronator Quadratus (PRO-nay-tur quad-RAY-tus)	Prime mover of forearm pronation; also resists separation of radius and ulna when force is applied to forearm through wrist, as in doing push-ups	**O:** Anterior surface of distal ulna **I:** Anterior surface of distal radius	Median nerve
Pronator Teres (PRO-nay-tur TERR-eez)	Assists pronator quadratus in pronation, but only in rapid or forceful action; weakly flexes elbow	**O:** Humeral shaft near medial epicondyle; coronoid process of ulna **I:** Lateral surface of radial shaft	Median nerve
Supinator (SOO-pih-NAY-tur)	Supinates forearm	**O:** Lateral epicondyle of humerus; supinator crest and fossa of ulna just distal to radial notch; anular and radial collateral ligaments of elbow **I:** Proximal one-third of radius	Posterior interosseous nerve











(a) Anterior view **(b) Posterior view**