

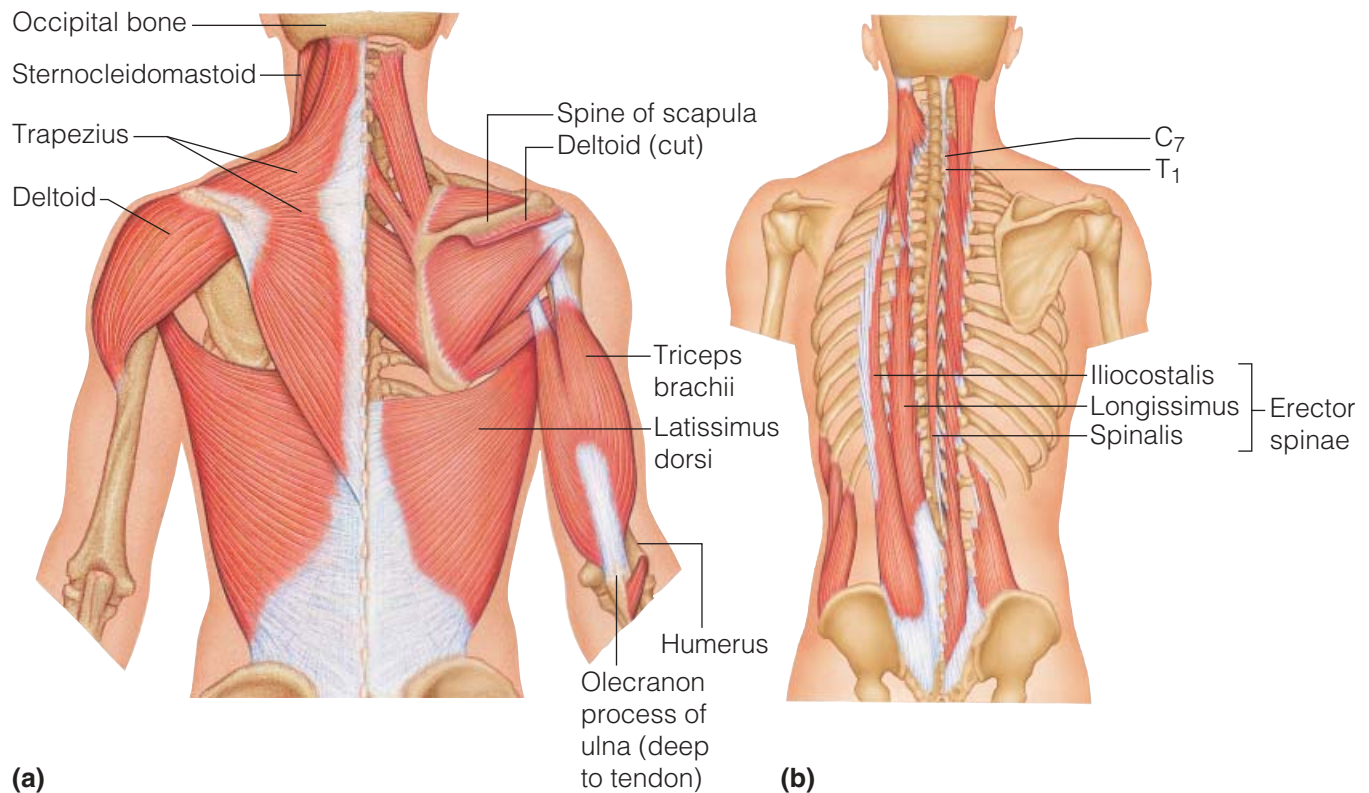


FIGURE 6.17 Muscles of the posterior neck, trunk, and arm.
(a) Superficial muscles. **(b)** The erector spinae muscles (longissimus, iliocostalis, and spinalis), deep muscles of the back.

and clavicle. The trapezius muscles extend the head (thus they are antagonists of the sternocleidomastoids). They also can elevate, depress, adduct, and stabilize the scapula.

Latissimus Dorsi The latissimus (lah-tis'ī-mus) dorsi is the large, flat muscle pair that covers the lower back. It originates on the lower spine and ilium and then sweeps superiorly to insert into the proximal end of the humerus. The latissimus dorsi extends and adducts the humerus. These are very important muscles when the arm must be brought down in a power stroke, as when swimming or striking a blow.

Erector Spinae The erector spinae (e-rek'tor spi'ne) group is a prime mover of back extension. These paired muscles are deep muscles of the back; they are shown in Figure 6.17b. Each erector spinae is a composite muscle consisting of three muscle columns (longissimus, iliocostalis, and spinalis) that collectively span the entire length of the vertebral column. These muscles not only act as powerful back extensors (“erectors”), but also provide resis-

tance that helps control the action of bending over at the waist. Following injury to back structures, these muscles go into spasms, a common source of lower back pain.

Deltoid The deltoids are fleshy, triangle-shaped muscles that form the rounded shape of your shoulders (see Figure 6.17a). Because they are so bulky, they are a favorite injection site (Figure 6.18) when relatively small amounts of medication (less than 5 ml) must be given intramuscularly (into muscle). The origin of each deltoid winds across the shoulder girdle from the spine of the scapula to the clavicle. It inserts into the proximal humerus. The deltoids are the prime movers of arm abduction.

Muscles of the Upper Limb

The upper limb muscles fall into three groups. The first group includes muscles that arise from the shoulder girdle and cross the shoulder joint to insert into the humerus (see Figures 6.16 and 6.17a). These muscles, which move the arm, have

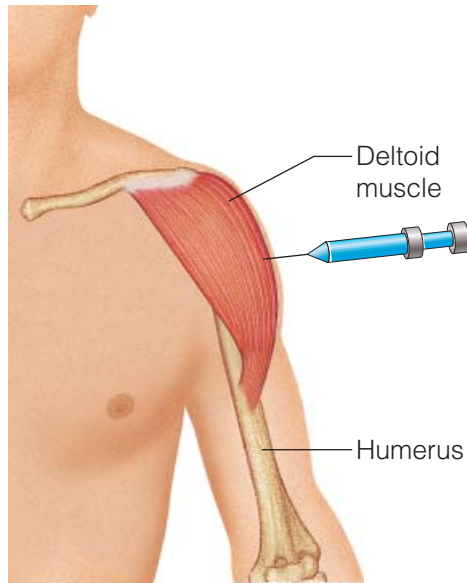


FIGURE 6.18 The fleshy deltoid muscle is a favored site for administering intramuscular injections.

already been considered—the pectoralis major, latissimus dorsi, and deltoid.

The second group causes movement at the elbow joint. These muscles enclose the humerus and insert on the forearm bones. Only the muscles of this second group will be described in this section. The third group includes the muscles of the forearm, which insert on the hand bones and cause their movement. The muscles of this last group are thin and spindle-shaped, and there are many of them. They will not be considered here except to mention their general naming and function. As a rule, the forearm muscles have names that reflect their activities. For example, the flexor carpi and flexor digitorum muscles, found on the anterior aspect of the forearm, cause flexion of the wrist and fingers, respectively. The extensor carpi and extensor digitorum muscles, found on the lateral and posterior aspect of the forearm, extend the same structures. (Some of these muscles are described briefly in Table 6.4 and illustrated in Figure 6.22.)

Muscles of the Humerus That Act on the Forearm

All *anterior* arm muscles cause elbow flexion. In order of decreasing strength these are the brachialis, biceps brachii, and brachioradialis (Figures 6.16a and 6.21).

Biceps Brachii The biceps brachii (bra'ke-i) is the most familiar muscle of the forearm because it bulges when the elbow is flexed (see Figure 6.16a). It originates by two heads from the shoulder girdle and inserts into the radial tuberosity. This muscle is the powerful prime mover for flexion of the forearm and acts to supinate the forearm. The best way to remember its action is that “it turns the corkscrew *and* pulls the cork.”

Brachialis The brachialis lies deep to the biceps muscle and is as important as the biceps in elbow flexion.

Brachioradialis The brachioradialis is a fairly weak muscle that arises on the humerus and inserts into the distal forearm (see Figures 6.16a and 6.21). Hence, it resides mainly in the forearm.

Triceps Brachii The triceps muscle is the only muscle fleshing out the posterior humerus (see Figure 6.17a). Its three heads arise from the shoulder girdle and proximal humerus, and it inserts into the olecranon process of the ulna. Being the powerful prime mover of elbow extension, it is the antagonist of the biceps brachii. This muscle is often called the “boxer’s” muscle because it can deliver a straight-arm knockout punch.

Muscles of the Lower Limb

Muscles that act on the lower limb cause movement at the hip, knee, and foot joints. They are among the largest, strongest muscles in the body and are specialized for walking and balancing the body. Because the pelvic girdle is composed of heavy, fused bones that allow little movement, no special group of muscles is necessary to stabilize it. This is very different from the shoulder girdle, which requires several fixator muscles.

Many muscles of the lower limb span two joints and can cause movement at both of them. Therefore, the terms *origin* and *insertion* are often interchangeable in referring to these muscles.

Muscles acting on the thigh are massive muscles that help hold the body upright against the pull of gravity and cause various movements at the hip joint. Muscles acting on the leg form the flesh of the thigh. (Recall that in common usage the term *leg* refers to the whole lower limb, but anatomically the term refers only to that part between the knee and the ankle.) The thigh muscles cross the knee and cause its flexion or extension. Because many

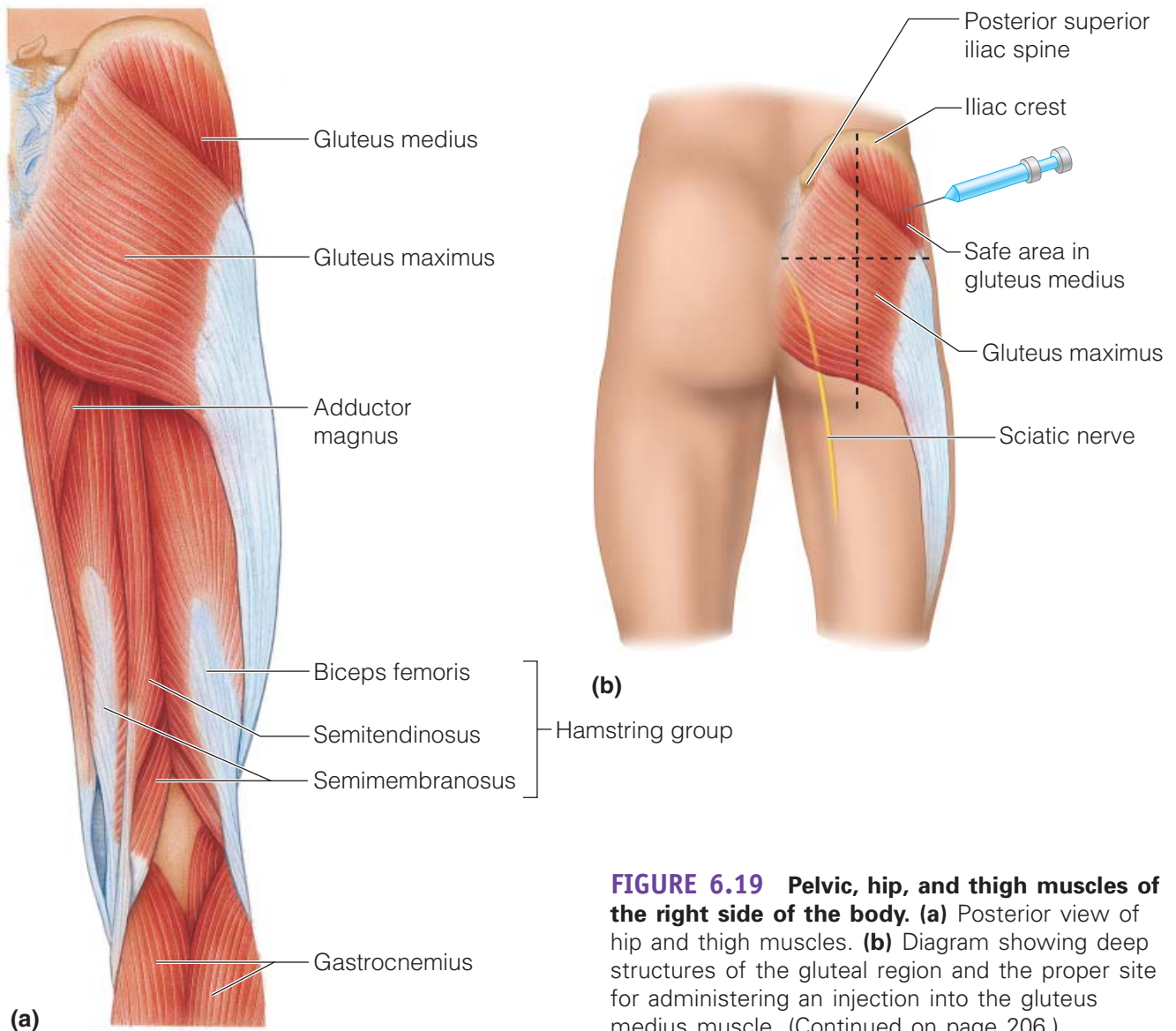


FIGURE 6.19 Pelvic, hip, and thigh muscles of the right side of the body. (a) Posterior view of hip and thigh muscles. (b) Diagram showing deep structures of the gluteal region and the proper site for administering an injection into the gluteus medius muscle. (Continued on page 206.)

of the thigh muscles also have attachments on the pelvic girdle, they can cause movement at the hip joint as well.

Muscles originating on the leg cause assorted movements of the ankle and foot. Only three muscles of this group will be considered, but there are many others that act to extend and flex the ankle and toe joints.

Muscles Causing Movement at the Hip Joint (Figure 6.19)

Gluteus Maximus The gluteus maximus (gloo'te-us max'i-mus) is a superficial muscle of the hip that forms most of the flesh of the buttock (Figure 6.19a). It is a powerful hip extensor that acts to bring the

thigh in a straight line with the pelvis. Although it is not very important in walking, it is probably the most important muscle for extending the hip when power is needed, as when climbing stairs and when jumping. It originates from the sacrum and iliac bones and inserts on the gluteal tuberosity of the femur.

Gluteus Medius The gluteus medius runs from the ilium to the femur, beneath the gluteus maximus for most of its length. The gluteus medius is a hip abductor and is important in steadying the pelvis during walking. The gluteus medius is an important site for giving intramuscular injections, particularly when more than 5 ml is administered (see Figure 6.19b). Although it might appear that the

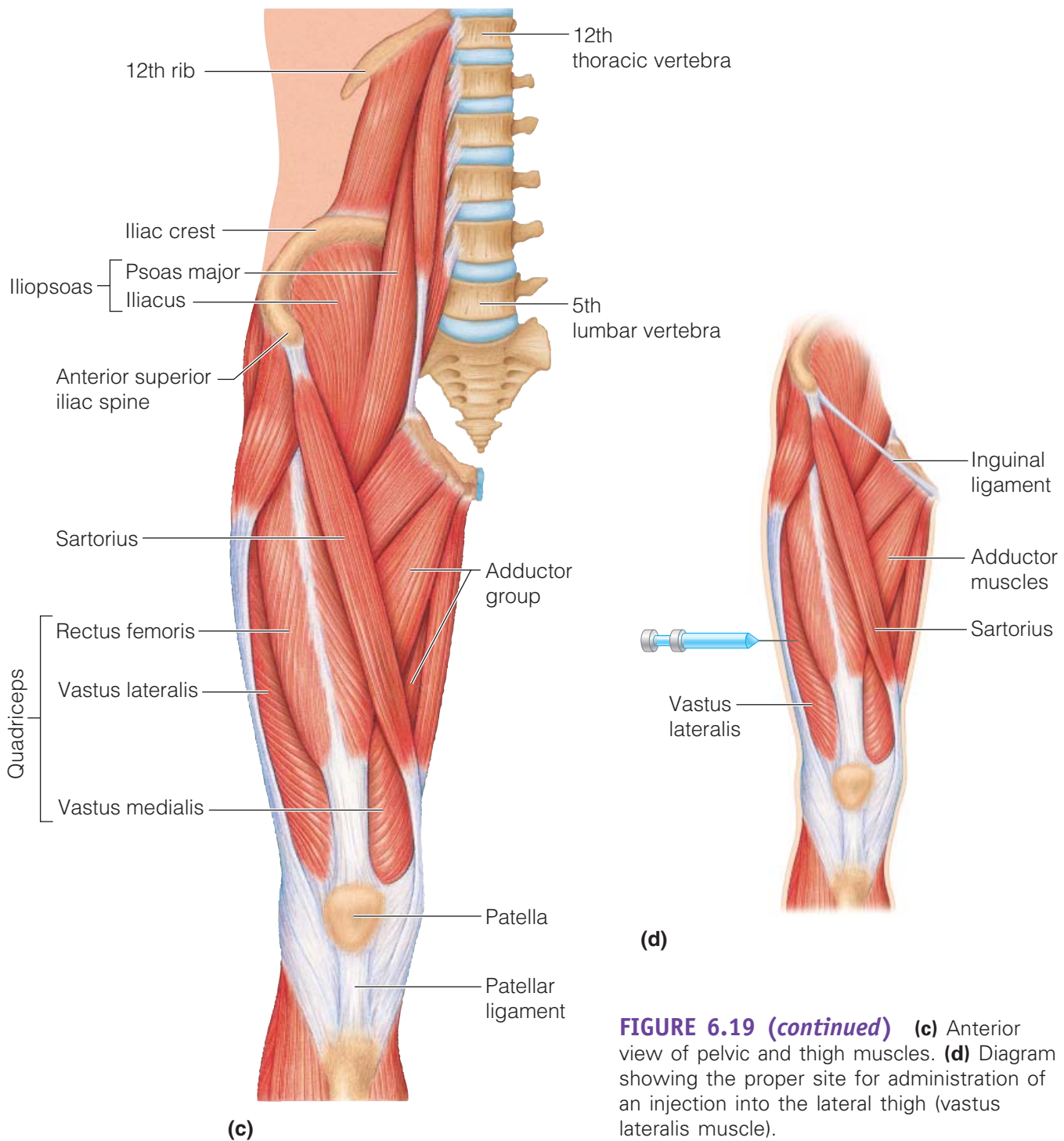


FIGURE 6.19 (continued) (c) Anterior view of pelvic and thigh muscles. (d) Diagram showing the proper site for administration of an injection into the lateral thigh (vastus lateralis muscle).

large, fleshy gluteus maximus that forms the bulk of the buttock mass would be a better choice, notice that the medial part of each buttock overlies the large *sciatic nerve*; hence this area must be carefully avoided. This can be accomplished by *mentally* dividing the buttock into four equal quadrants (shown by the division lines on Figure 6.19b).

The upper outer quadrant then overlies the gluteus medius muscle, which is usually a very safe site for an intramuscular injection.

Iliopsoas The iliopsoas (il'e-o-so'as; the *p* is silent) is a fused muscle composed of two muscles, the *iliacus* and the *psoas major* (Figure 6.19c). It

runs from the iliac bone and lower vertebrae deep inside the pelvis to insert on the lesser trochanter of the femur. It is a prime mover of hip flexion. It also acts to keep the upper body from falling backward when we are standing erect.

Adductor Muscles The muscles of the adductor group form the muscle mass at the medial side of each thigh (Figure 6.19c). As their name indicates, they adduct or press the thighs together. However, since gravity does most of the work for them, they tend to become flabby very easily. Special exercises are usually needed to keep them toned. The adductors have their origin on the pelvis and insert on the proximal aspect of the femur.

Muscles Causing Movement at the Knee Joint (Figure 6.19)

Hamstring Group The muscles forming the muscle mass of the posterior thigh are the hamstrings (Figure 6.19a). The group consists of three muscles, the **biceps femoris**, **semimembranosus**, and **semitendinosus**, which originate on the ischial tuberosity and run down the thigh to insert on both sides of the proximal tibia. Their name comes from the fact that butchers use their tendons to hang hams (consisting of thigh and hip muscles) for smoking. These tendons can be felt at the back of the knee.

Sartorius Compared to other thigh muscles described here, the thin, straplike sartorius (sar-to're-us) muscle is not too important. However, it is the most superficial muscle of the thigh so it is rather hard to miss (Figure 6.19c). It runs obliquely across the thigh from the anterior iliac crest to the medial side of the tibia. It is a weak thigh flexor. The sartorius is commonly referred to as the “tailor’s” muscle because it acts as a synergist to bring about the cross-legged position in which old-time tailors are often shown.

Quadriceps Group The quadriceps (kwod'ri-seps) group consists of four muscles—the **rectus femoris** and three **vastus muscles**—that flesh out the anterior thigh. The vastus muscles originate from the femur; the rectus femoris originates on the pelvis. All four muscles insert into the tibial tuberosity via the patellar ligament. The group as a whole acts to extend the knee powerfully, as when kicking a football. Because the rectus femoris crosses two joints, the hip and the knee, it can also

help to flex the hip. The vastus lateralis and rectus femoris are sometimes used as intramuscular injection sites (Figure 6.19d), particularly in infants, who have poorly developed gluteus muscles.

Muscles Causing Movement at the Ankle and Foot (Figure 6.20)

Tibialis Anterior The tibialis anterior is a superficial muscle on the anterior leg. It arises from the upper tibia and then parallels the anterior crest as it runs to the tarsal bones, where it inserts by a long tendon. It acts to dorsiflex and invert the foot.

Extensor Digitorum Longus Lateral to the tibialis anterior, this muscle arises from the lateral tibial condyle and proximal radius and inserts into the phalanges of toes 2 to 5. It is a prime mover of toe extension and a dorsiflexor of the foot.

Fibularis Muscles The three fibularis muscles—**longus**, **brevis**, and **tertius**—are found on the lateral part of the leg. They arise from the fibula and insert into the metatarsal bones of the foot. The group as a whole plantar flexes and everts the foot.

Prove It Yourself

Palpate Muscles as They Contract

The following demonstrations will help you locate and identify specific muscles discussed in this chapter:

- Go into a deep bend. Now palpate your *gluteus maximus* muscle as you extend your hip to stand up again.
- Sit down and have a friend hold on to your leg. Demonstrate the contraction of the anterior *rectus femoris* by trying to extend your knee against resistance. Note how the patellar tendon reacts. The *biceps femoris* of the posterior thigh comes into play when you flex your knee against your friend's applied resistance.
- Now stand on your toes. Have a friend palpate the lateral and medial heads of your *gastrocnemius* and follow it to its insertion in the calcaneal tendon.
- Dorsiflex and invert your foot while palpating your *tibialis anterior* muscle, which parallels the sharp anterior crest of the tibia laterally.

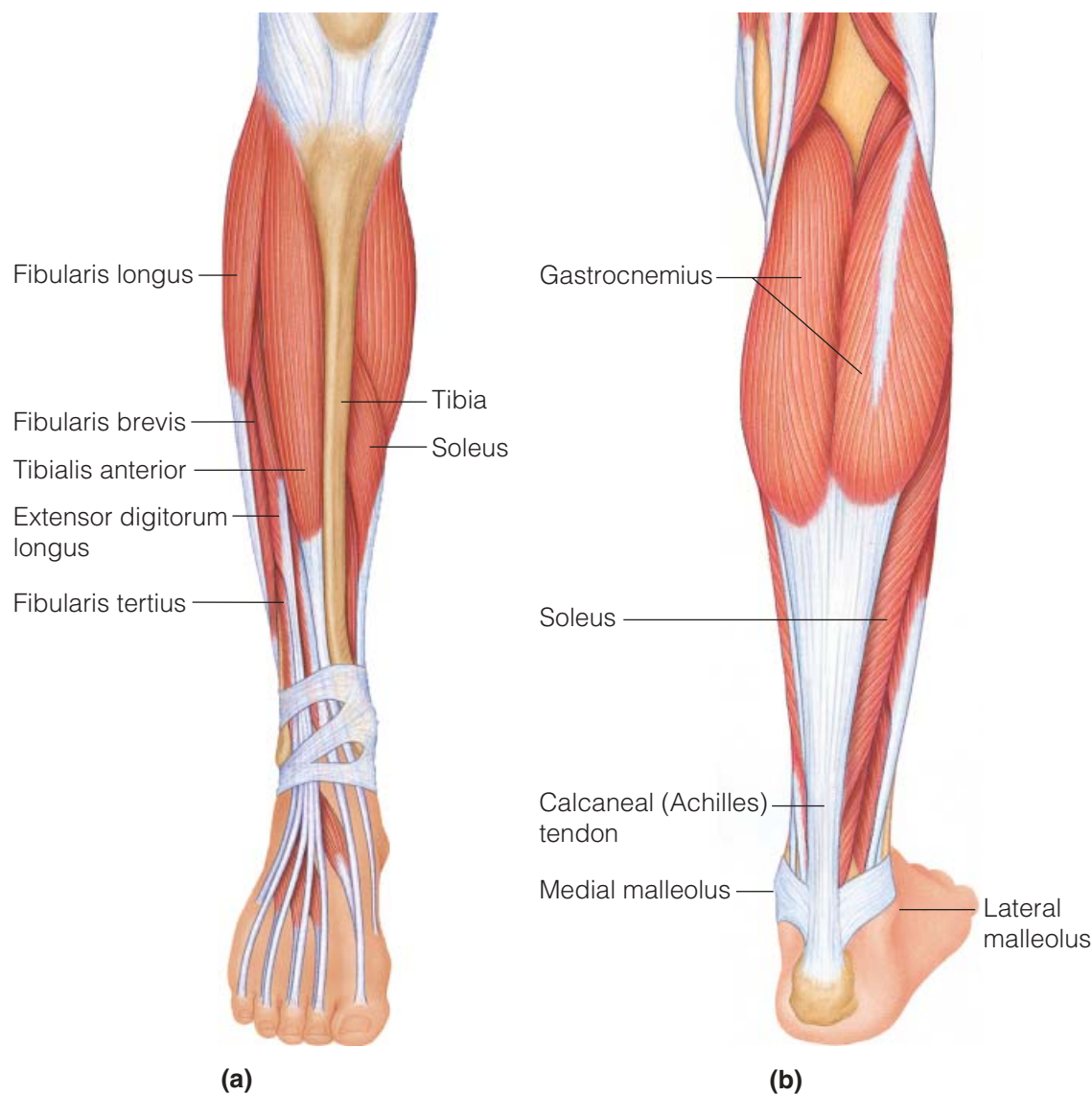


FIGURE 6.20 Superficial muscles of the right leg. (a) Anterior view; (b) posterior view.

Gastrocnemius The gastrocnemius (gas"trok-ne' me-us) muscle is a two-bellied muscle that forms the curved calf of the posterior leg. It arises by two heads, one from each side of the distal femur, and inserts through the large *calcaneal (Achilles) tendon* into the heel of the foot. It is a prime mover for plantar flexion of the foot; for this reason it is often called the "toe dancer's" muscle. If its insertion tendon is cut, walking is very difficult. The foot drags because the heel cannot be lifted.

Soleus Deep to the gastrocnemius is the fleshy soleus muscle. Because it arises on the tibia and fibula (rather than the femur), it does not affect knee movement, but like the gastrocnemius, it is a strong plantar flexor of the foot.

Remember that most of the superficial muscles previously described are shown in anterior and posterior views of the body as a whole in Figures 6.21 and 6.22 and are summarized in Tables 6.3 and 6.4. Take the time to review these muscles again before continuing with this chapter.

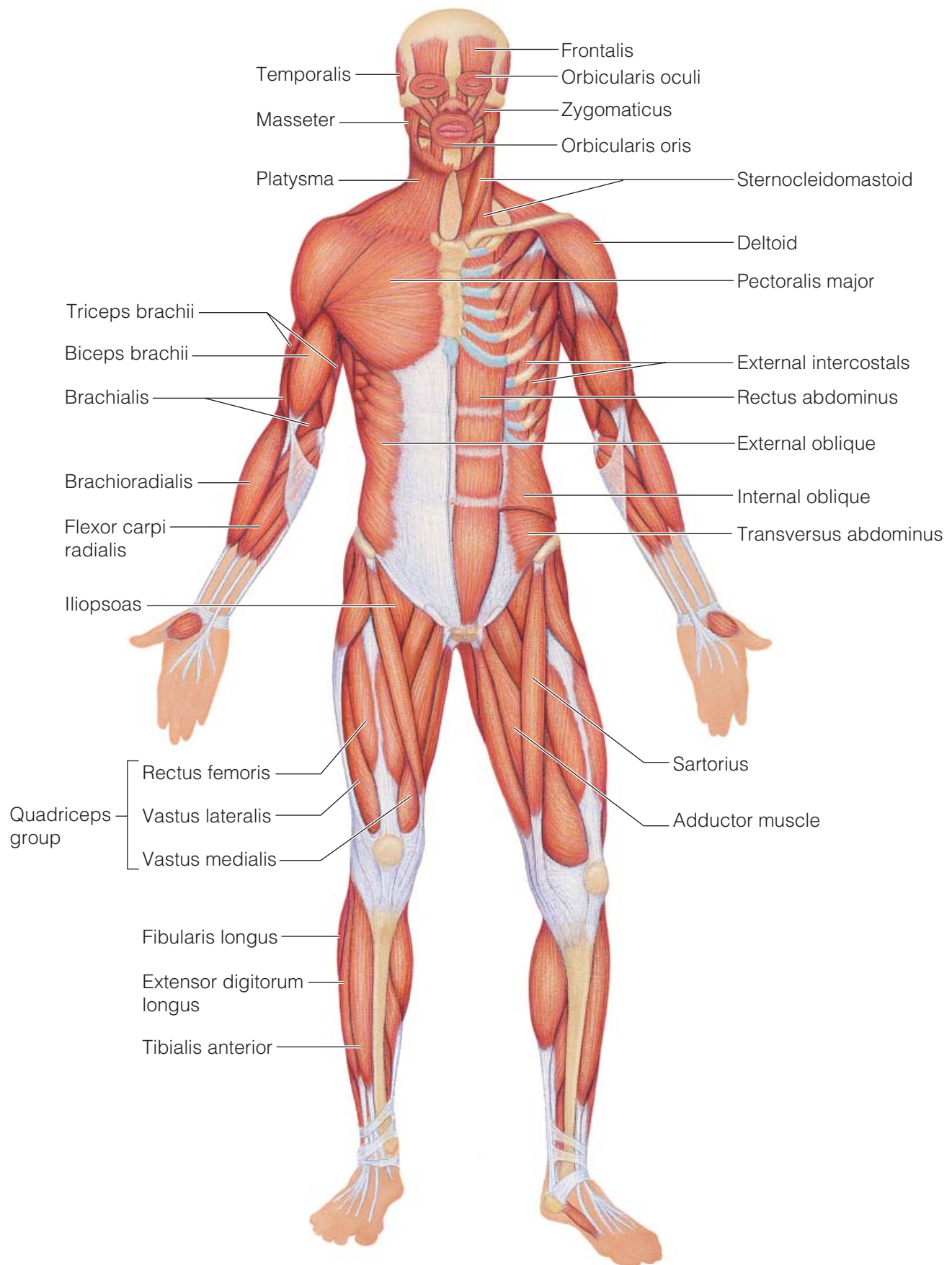
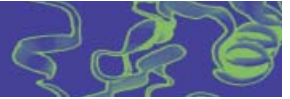


FIGURE 6.21 Major superficial muscles of the anterior surface of the body.

TABLE 6.3 Superficial Anterior Muscles of the Body (See Figure 6.21)

Name	Origin	Insertion	Primary Action(s)
Head/Neck Muscles			
Frontalis	Cranial aponeurosis	Skin of eyebrows	Raises eyebrows
Orbicularis oculi	Frontal bone and maxilla	Tissue around eyes	Blinks and closes eyes
Orbicularis oris	Mandible and maxilla	Skin and muscle around mouth	Closes and protrudes lips
Temporalis	Temporal bone	Mandible	Closes jaw
Zygomaticus	Zygomatic bone	Skin and muscle at corner of lips	Raises corner of mouth
Masseter	Temporal bone	Mandible	Closes jaw
Buccinator	Maxilla and mandible near molars	Orbicularis oris	Compresses cheek as in whistling and sucking; holds food between teeth during chewing
Sternocleidomastoid	Sternum and clavicle	Temporal bone (mastoid process)	Flexes neck; rotates head
Platysma	Connective tissue covering of superior chest muscles	Tissue around mouth	Pulls corners of mouth inferiorly
Trunk Muscles			
Pectoralis major	Sternum, clavicle, and first to sixth ribs	Proximal humerus	Adducts and flexes humerus
Rectus abdominis	Pubis	Sternum and fifth to seventh ribs	Flexes vertebral column
External oblique	Lower eight ribs	Iliac crest	Flexes and rotates vertebral column
Arm/Shoulder Muscles			
Biceps brachii	Scapula of shoulder girdle	Proximal radius	Flexes elbow and supinates forearm
Brachialis	Distal humerus	Proximal ulna	Flexes elbow
Deltoid	See Table 6.4		Abducts arm
Hip/Thigh/Leg Muscles			
Iliopsoas	Ilium and lumbar vertebrae	Femur (lesser trochanter)	Flexes hip
Adductor muscles	Pelvis	Proximal femur	Adduct thigh
Sartorius	Ilium	Proximal tibia	Flexes thigh on hip
Quadriceps group (vastus medialis, inter-medius, and lateralis; and the rectus femoris)	Vasti: Femur Rectus femoris: Pelvis	Tibial tuberosity via patellar ligament Tibial tuberosity via patellar ligament	All extend knee; rectus femoris also flexes hip on thigh
Tibialis anterior	Proximal tibia	First cuneiform (tarsal) and first metatarsal of foot	Dorsiflexes and inverts foot
Extensor digitorum longus	Proximal tibia and radius	Distal toes 2–5	Extends toes and dorsiflexes foot
Fibularis muscles	Fibula	Metatarsals of foot	Plantar flex and evert foot

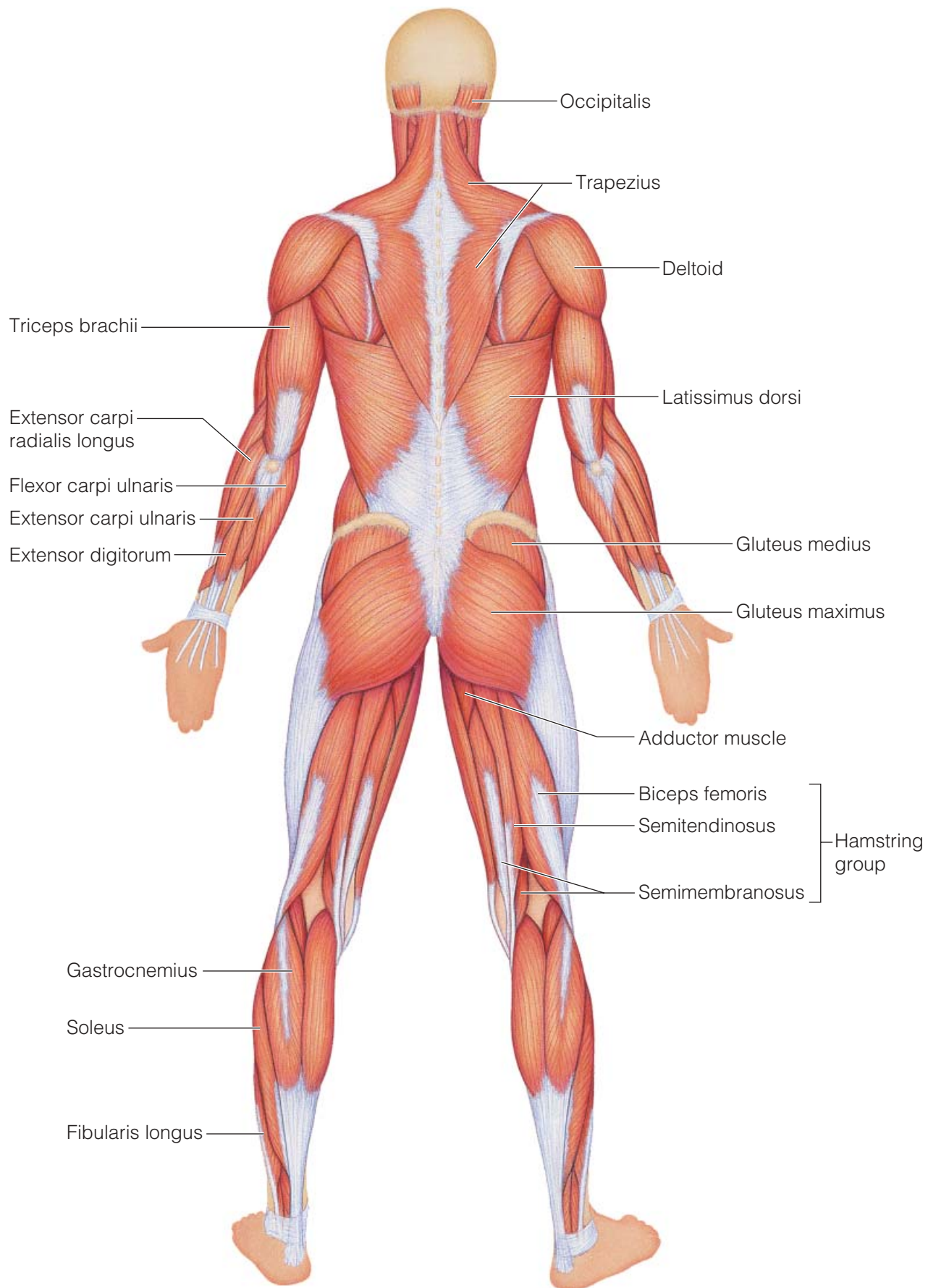


FIGURE 6.22 Major superficial muscles of the posterior surface of the body.

TABLE 6.4 Superficial Posterior Muscles of the Body (Some Forearm Muscles Also Shown) (See Figure 6.22)

Name	Origin	Insertion	Primary Action(s)
Neck/Trunk/Shoulder Muscles			
Trapezius	Occipital bone and all cervical and thoracic vertebrae	Scapular spine and clavicle	Extends neck and adducts scapula
Latissimus dorsi	Lower spine and iliac crest	Proximal humerus	Extends and adducts humerus
Erector spinae*	Iliac crests, ribs 3–12, and vertebrae	Ribs, thoracic and cervical vertebrae	Extends back
Deltoid	Scapular spine and clavicle	Humerus (deltoid tuberosity)	Abducts humerus
Arm/Forearm Muscles			
Triceps brachii	Shoulder girdle and proximal humerus	Olecranon process of ulna	Extends elbow
Flexor carpi radialis	Distal humerus	Second and third metacarpals	Flexes wrist and abducts hand (see Figure 6.21)
Flexor carpi ulnaris	Distal humerus and posterior ulna	Carpals of wrist and fifth metacarpal	Flexes wrist and adducts hand
Flexor digitorum superficialis†	Distal humerus, ulna and radius	Middle phalanges of second to fifth fingers	Flexes wrist and fingers
Extensor carpi radialis	Humerus	Base of second and third metacarpals	Extends wrist and abducts hand
Extensor digitorum	Distal humerus	Distal phalanges of second to fifth fingers	Extends fingers and wrist
Hip/Thigh/Leg Muscles			
Gluteus maximus	Sacrum and ilium	Proximal femur (gluteal tuberosity)	Extends hip (when forceful extension is required)
Gluteus medius	Ilium	Proximal femur	Abducts thigh; steadies pelvis during walking
Hamstring muscles (semitendinosus, semimembranosus, biceps femoris)	Ischial tuberosity	Proximal tibia (head of fibula in the case of biceps femoris)	Flex knee and extend hip
Gastrocnemius	Distal femur	Calcaneus (heel via calcaneal tendon)	Plantar flexes foot and flexes knee
Soleus	Proximal tibia and fibula	Calcaneus	Plantar flexes foot

*Erector spinae is a deep muscle group and not shown in Figure 6.22.

†Although its name indicates that it is a superficial muscle, the flexor digitorum superficialis lies deep to the flexor carpi radialis and is not visible in a superficial view.