

Detailed Knowledge of Anatomy, Physiology, and Kinesiology

chapter

2

CHAPTER OUTLINE

Areas of Competence

Anatomical Position

Planes of Motion

Cavities of the Body

Body Movements

Types of Contractions

Muscle Movers

Biomechanics and Kinesiology

Muscles

Joints

Dermatomes

Nutrition

The Six Basic Nutrients

Questions

Answers and Explanations

AREAS OF COMPETENCE

This chapter includes sections that correspond to the organization of the NCBTMB exam as follows:

NCETM (26%); MBLEx (11%)

A. Anatomy

- Anatomical position and terminology (e.g., planes, directions)
- Individual muscles/muscle groups
- Muscle attachments

- Muscle fiber direction
- Tendons
- Fascia
- Joint structure
- Ligaments
- Bursae
- Dermatomes

B. Physiology

- Response of the body to stress
- Basic nutrition principles

C. Kinesiology

- Actions of individual muscles/muscle groups
- Types of muscle contractions (e.g., concentric, eccentric, isometric)
- Joint movements
- Movement patterns
- Proprioception

NCETMB (26%)

Same as above with the following additions:

A. Anatomy

- Primary and extraordinary meridians
- Chakras

B. Physiology

- Meridians/channels (e.g., bladder, liver, spleen)

(See Chapter 7 for Traditional Chinese Medicine modalities.)

Strategies to Success

Study Skills

Find a good place to study!

Think about the atmosphere where you study best. Are you distracted by the slightest noise? Do you like a certain level of noise to keep you going and focused? Do you like studying alone or in groups? Also consider your comfort level. Do you find yourself drifting off when you study in bed or in a comfortable chair? Is studying at a desk too uncomfortable? There is no right place or way to study. Some people pace the halls while others find a secluded place where they will not be bothered. We do suggest finding a place that is well lighted. Eye strain can make you tired. Whatever place you pick, make sure it is right for you and study there regularly.

Anatomical Position

When learning and reviewing anatomical terms, remember to view the body from the anatomical position (Figure 2-1 and Table 2-1).

Planes of Motion

Imaginary sections or planes are made in the body in order to examine the internal anatomy and describe body position of one body part to another. These sections are called planes of motion. There are three planes of motion (see Figure 2-1).

Sagittal plane: This plane separates the body into left and right. Motions that occur in the sagittal plane run parallel to the plane (or an imaginary line splitting the body into left and right). Those motions would be flexion, extension, dorsiflexion, and plantar flexion.

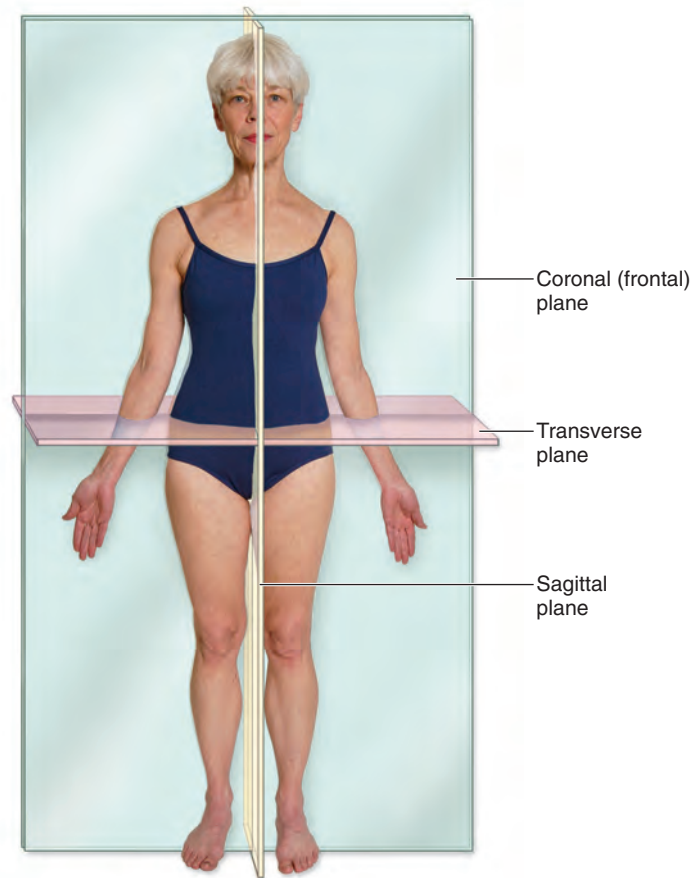


Figure 2-1 Anatomical position and planes of motion.
Source: ©The McGraw-Hill Companies, Inc./Photo by JW Ramsey.

TABLE 2-1

At a Glance: Anatomical Terms

Anatomical Position	Location
Superior (cephalad)	Higher than or above. Example: the heart is superior to the pelvis.
Inferior (caudal)	Lower than or below. Example: the patella is inferior to the pelvis.
Medial	Closest to the midline from anatomical position. Example: the adductor magnus is medial to the iliotibial band.
Lateral	Farther from the midline from anatomical position. Example: the axillary border of the scapula is lateral to the vertebral border of the scapula.
Proximal	Proximal and distal are dealing with the arms, hands, fingers, and feet. This is because when standing in the anatomical position, the arms are out at an angle. Therefore, they cannot be "superior" or "inferior." Proximal means closest to the midline or closer to the root of a limb. Example: the carpals are more proximal than the metacarpals.
Distal	Farther away from the midline in the arms, hands, fingers, feet or farther from the root of a limb. Example: the phalanges of the foot are more distal than the metatarsals.
Anterior (ventral)	Closer to the front side of the body. Example: the pectoralis major is anterior to the trapezius.
Posterior (dorsal)	Closer to the back side of the body. Example: the erector spinae is posterior to the rectus abdominus.
Superficial	Closer to the skin surface. Also, if you think about a superficial cut, that is one that can be taken care of with a band-aid. Example: the trapezius is superficial to the rhomboids.
Deep	Closer to the core of the body. Again, think about a cut. If it is deep, it might require stitches. Example: the vastus intermedius is deep to the rectus femoris.

Transverse plane: This is the plane that separates the body into top and bottom. The motion that occurs in the transverse plane runs parallel to the plane (or an imaginary line splitting the body into top and bottom). This motion is rotation (medial, lateral, trunk).

Coronal (frontal) plane: The coronal (frontal) plane separates the body into front and back. Motions that occur in the coronal (frontal) plane run parallel to the plane (or an imaginary line splitting the body into front and back). These motions are abduction, adduction, shoulder elevation, and shoulder depression.

Cavities of the Body

The body has two main cavities: the ventral and dorsal cavities (Figure 2-2).

Ventral cavity:

This cavity is more anteriorly located on the body and contains the following:

- The thoracic cavity (heart/lungs and area above the diaphragm)

- The abdominopelvic cavity (organs and structures below the diaphragm)

Dorsal cavity:

This cavity is more posterior on the body and contains the following:

- The cranial cavity (contains the brain)
- The spinal cavity (contains the spinal cord and vertebrae), also known as the vertebral canal.

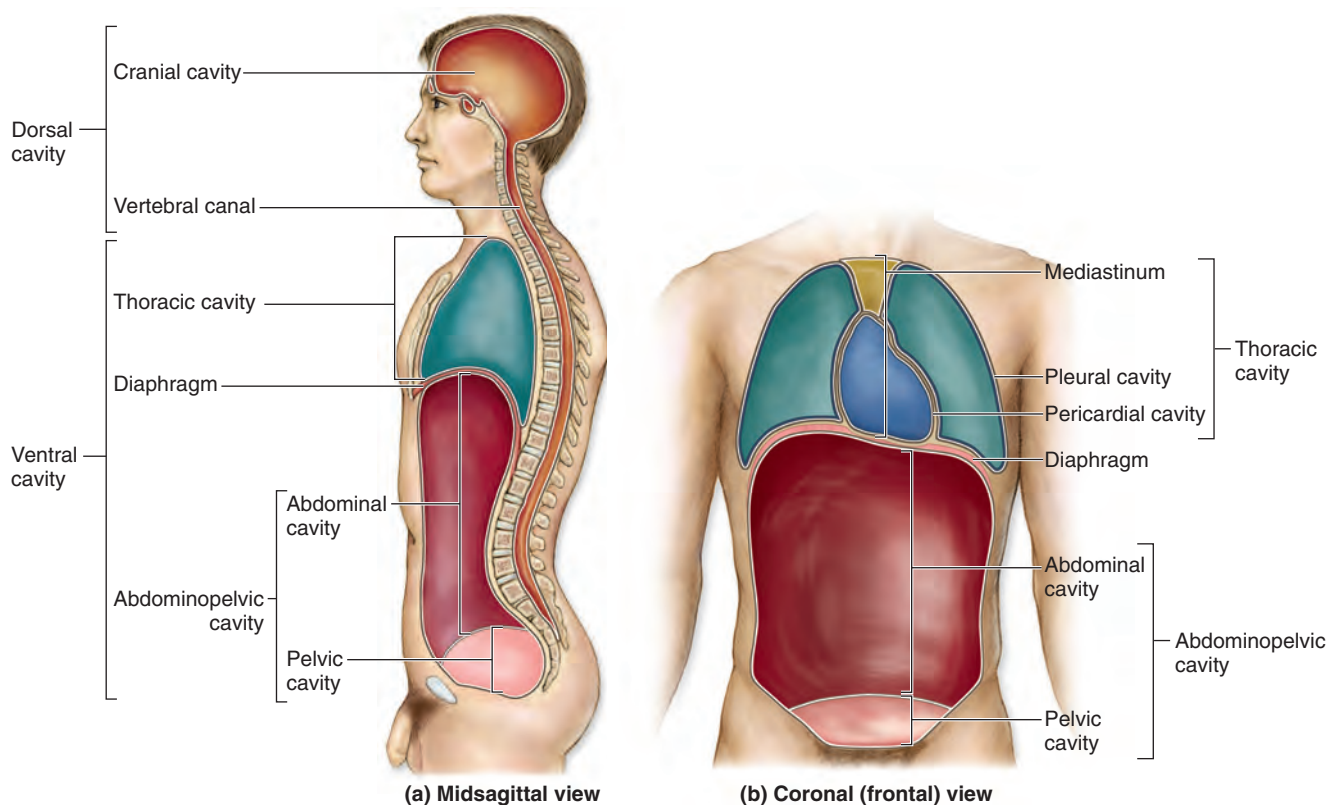


Figure 2-2 The cavities of the body.



Go to the Online Learning Center at www.mhhe.com/massagereview2e to practice identifying cavities of the body.

Body Movements

There are a variety of body movements. Remember, all body movements are from the anatomical position

(Table 2-2 and Figure 2-3). It is important as health care professionals that we understand each movement in order to be consistent with our clients.

TABLE 2-2

At a Glance: Body Movements and Their Descriptions

Movement	Description
Flexion	a decrease in the angle of a joint
Extension	an increase in the angle of a joint
Abduction	movement away from the midline
Adduction	movement toward the midline
Supination	turning the palms of the hands upward, or walking on the outer edge of the foot
Pronation	turning the palms of the hands downward, or walking on the inside edge of the foot
Medial rotation (internal rotation)	rotating toward the midline
Lateral rotation (external rotation)	rotating away from the midline
Elevation	raising the shoulders upward
Depression	lowering the shoulders
Dorsiflexion	pulling the toes upward toward the lower leg (flatten the feet)
Plantar flexion	pointing the toes (remember the "P" in point and the "P" in plantar flexion)
Eversion	soles of the feet away from the midline
Inversion	soles of the feet in toward the midline
Protraction	moving the scapula away from the spine, also called scapular abduction or jutting the mandible forward
Retraction	moving the scapula toward the spine, also called scapular adduction or pulling the mandible backward
Circumduction	moving a body part in a circular motion combining flexion, abduction, extension, and adduction

Figure 2-3 Body movements.

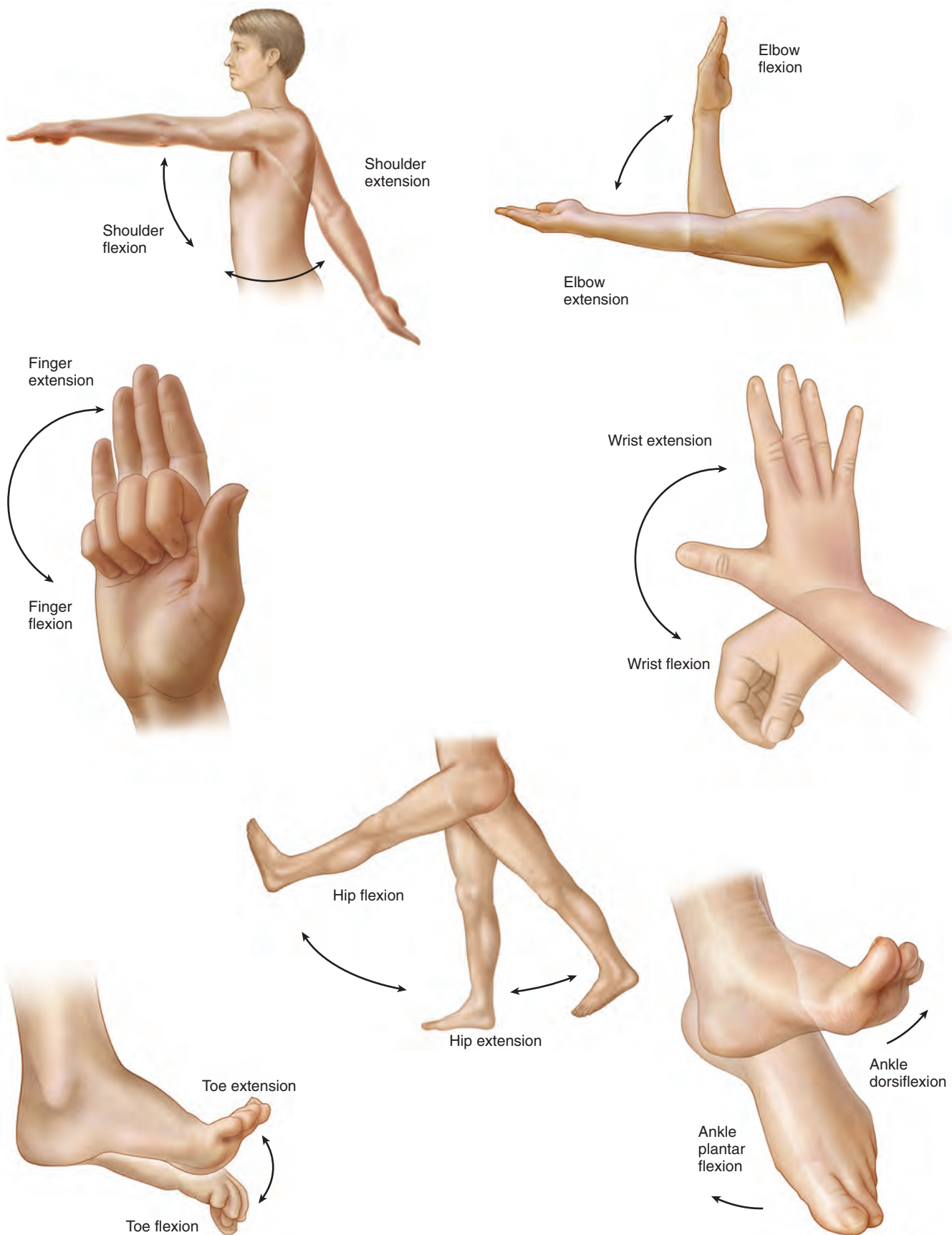


Figure 2-3 (continued)

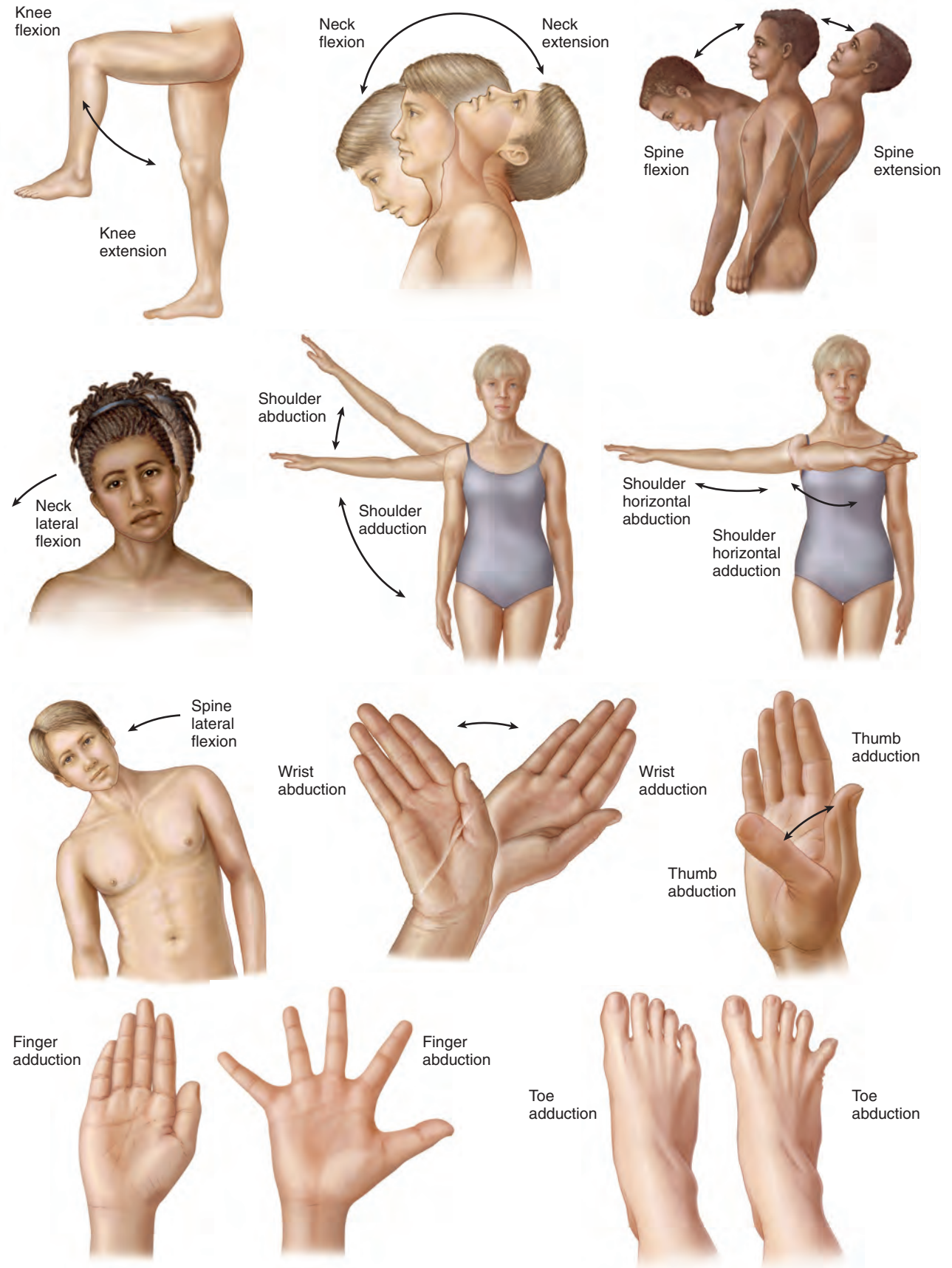


Figure 2-3 (continued)

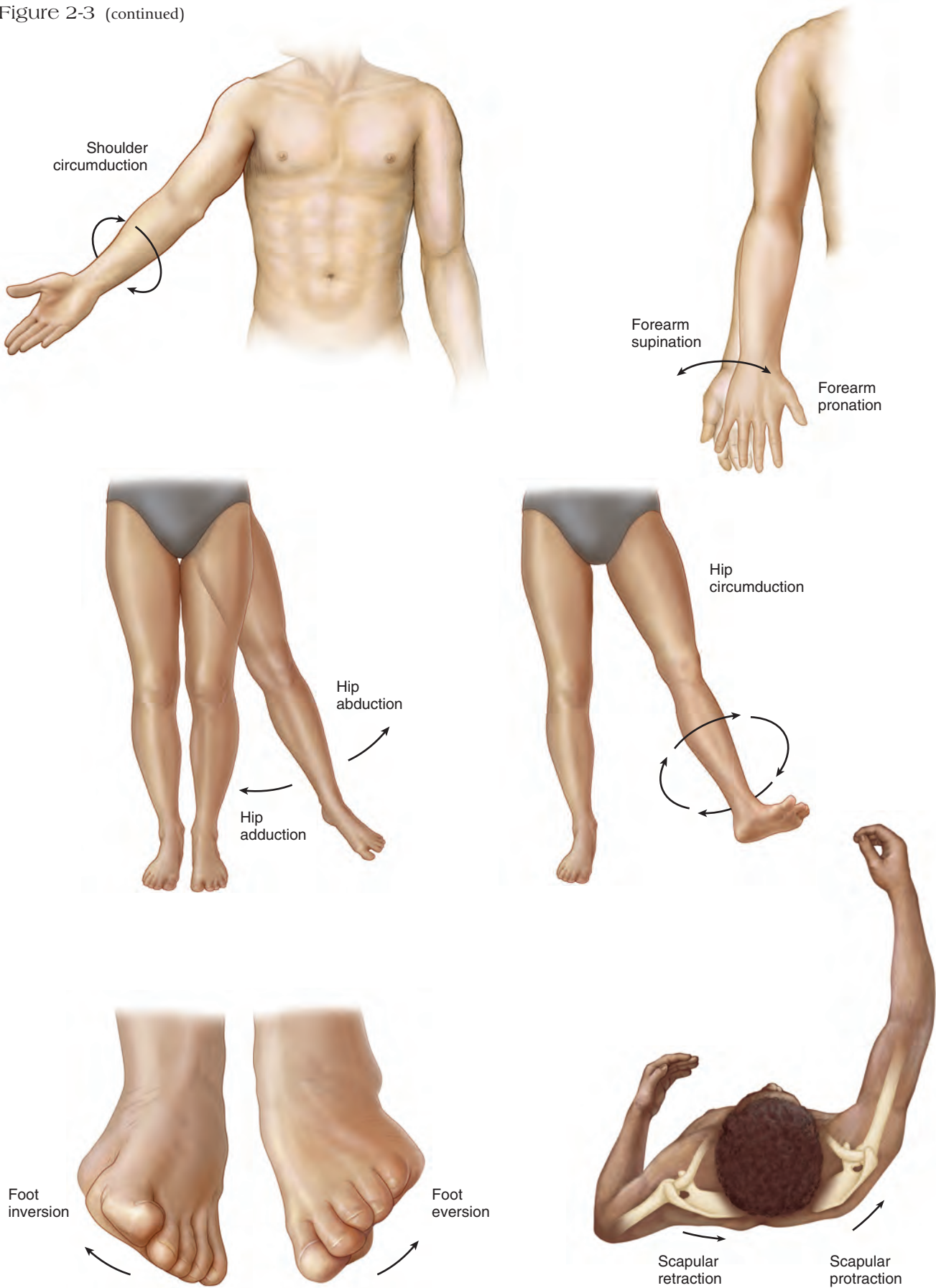
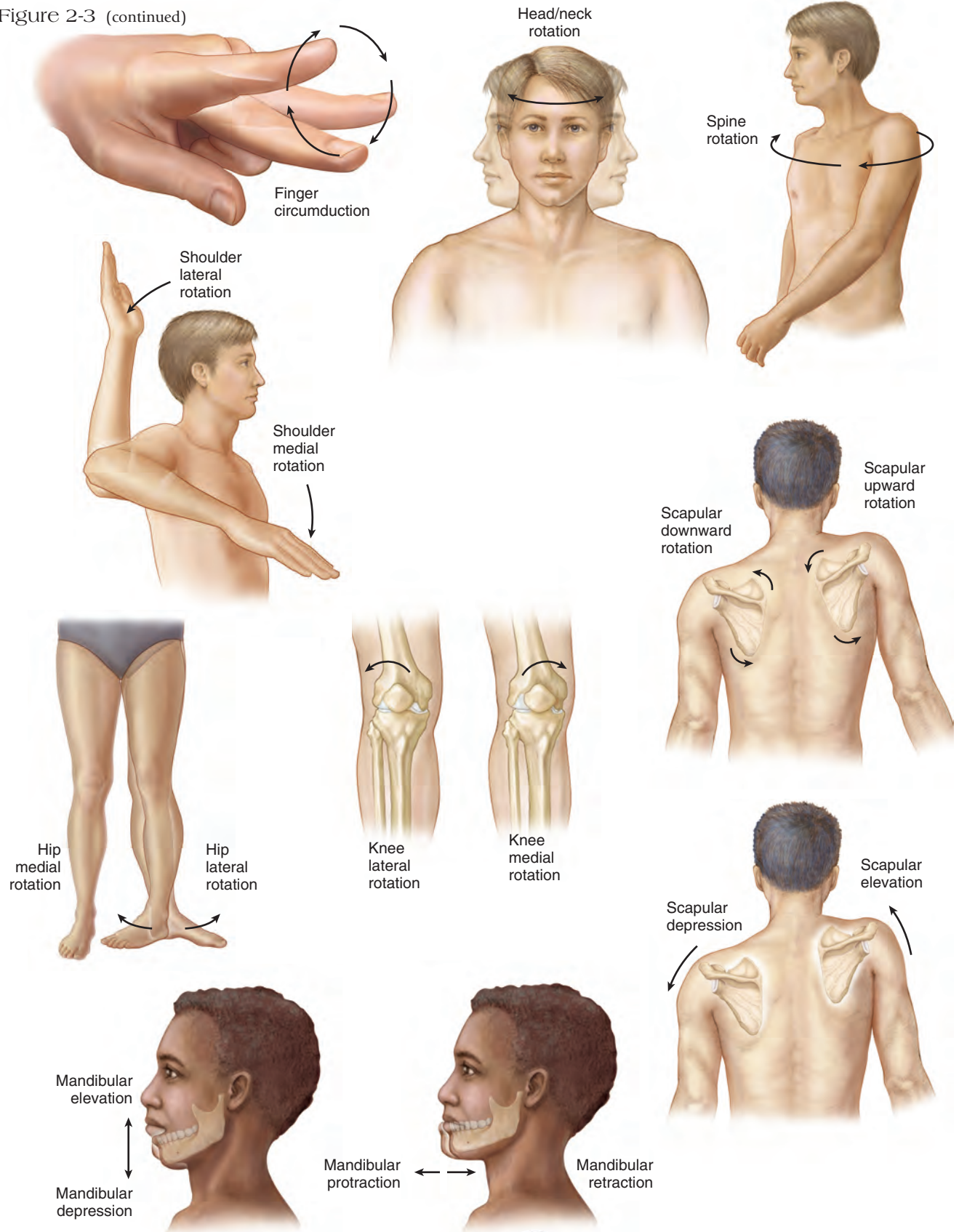


Figure 2-3 (continued)



Go to the Online Learning Center at www.mhhe.com/massage2e to practice identifying body movements.

Types of Contractions

A contraction is a shortening or lengthening, as in a muscle (Table 2-3). The following list includes common contractions.

Isometric: (*iso* = same; *metric* = length) This is when the muscle is contracting, but the joint/s is/are not moving. For example, push your hands together palm-to-palm. You feel the muscles contracting in your arms, but the shoulder, elbow, and wrist are not moving.

Isotonic: (*iso* = same; *tonic* = tension) Movement occurs with this type of contraction. The tension is either external force, such as a fifty-pound dumbbell

(the dumbbell “tension” will stay the same) or internal force (such as using weightlifting machines where the cam makes some movements easier than others). With internal force, the muscle tension stays the same throughout the range of motion. Internal force is generally seen in a gym setting. However, in our normal movements, we generally deal with external force, so that will be our focus. There are two types of isotonic contractions:

1. **Concentric**—the lifting phase of movement. The muscles shorten and contract.
2. **Eccentric**—the lowering phase of movement. The muscles are contracting but lengthening, which allows us to put things down gently.

TABLE 2-3

At a Glance: Muscle Contractions

Type of Contraction	Description
Isometric	Stabilizing—both agonist and antagonist exert the same amount of force preventing movement at the joint.
Isotonic	Movement at the joint occurs
1. concentric	1. The agonist (primary mover) shortens while contracting, otherwise known as the “up” phase.
2. eccentric	2. The agonist (primary mover) is lengthening while still contracting, otherwise known as the “down” phase.

Muscle Movers

Agonists (primary movers): Agonists are the main muscle(s) doing the movements. These are usually the larger muscles since they have to be strong.

Assisters: The assister muscles help the primary movers in one of two ways:

1. *Synergist* helps the primary mover by moving the same way. If the primary mover is in a concentric contraction, so is the synergist. If the primary mover is in an eccentric contraction, so is the synergist.
2. *Antagonist* helps the primary mover by moving opposite. If the primary mover is in a concentric contraction, the antagonist is in an eccentric contraction.

Stabilizers: These muscles help prevent motion. We usually get hurt when our stabilizers become primary movers, such as in lifting something off the floor by bending at the waist instead of using our legs.

Connective tissue: The function of connective tissue is to support, protect, and connect other tissues. Types of connective tissue relating to the muscular system include tendons, ligaments, and cartilage.

Tendons: Tendons attach muscle to bone (for example, the Achilles tendon attaches the gastrocnemius to the calcaneus).

Ligaments: Ligaments attach bone to bone (for example, the anterior cruciate ligament attaches the femur to the tibia).

Cartilage: Cartilage provides the cushion between bones. An example is the two cartilages between the femur and the tibia of the knee.

Fascia: Fascia is a web of tissue that serves to maintain structural integrity by providing support and protection while acting as a shock absorber.

Bursa (pl. bursae): Bursa is a small fluid-filled sac that provides cushion between bones and tendons and/or muscles around a joint. They are filled with synovial fluid.

See Figures 2-4 and 2-5 for diagrams of main muscles of the body. Remember, origins are the strong non moveable ends of a muscle. Insertion is the moveable end. Generally, origins are closer to the center or midline of the body, and insertions are farther away from the midline.

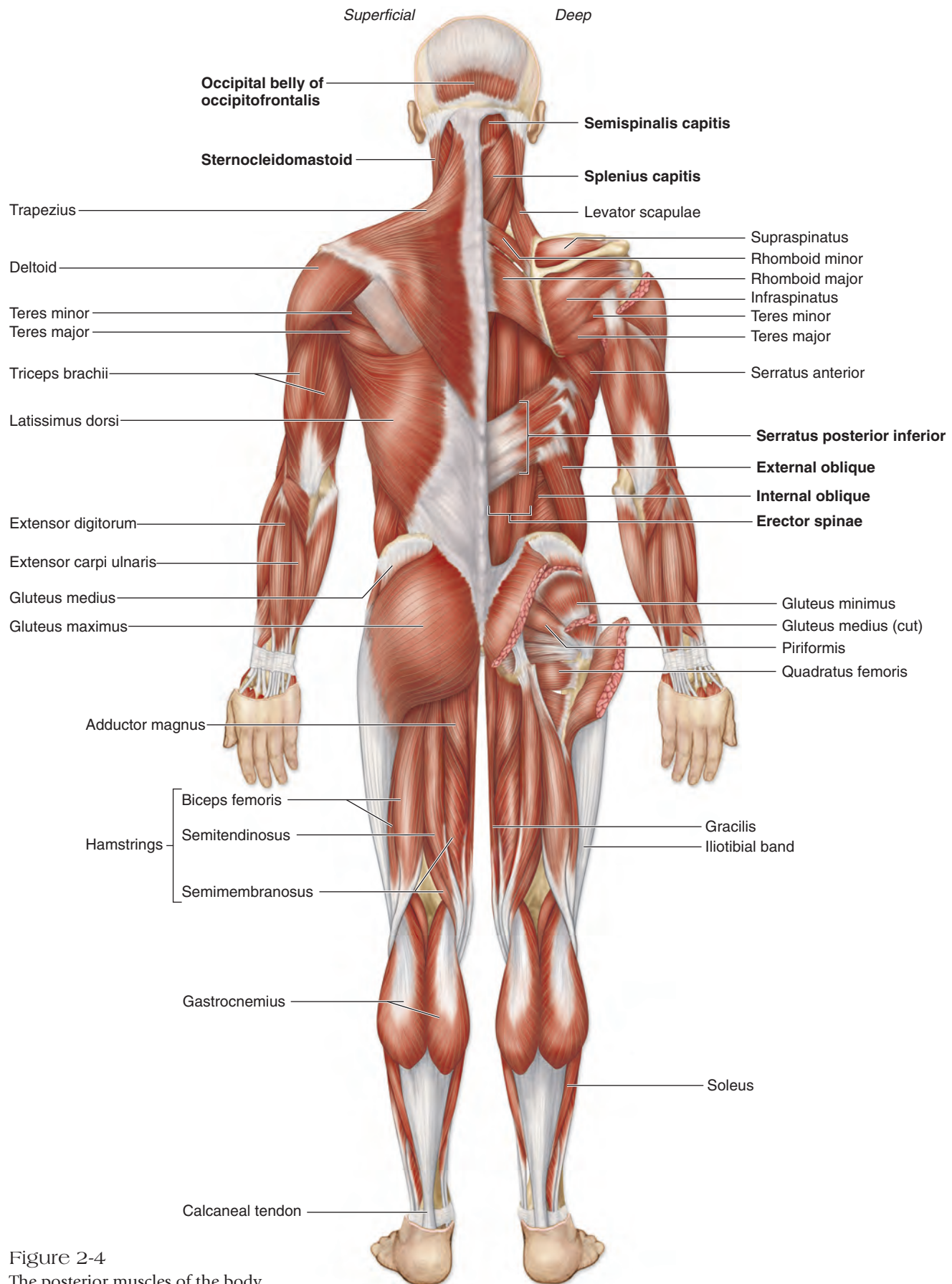


Figure 2-4
The posterior muscles of the body.

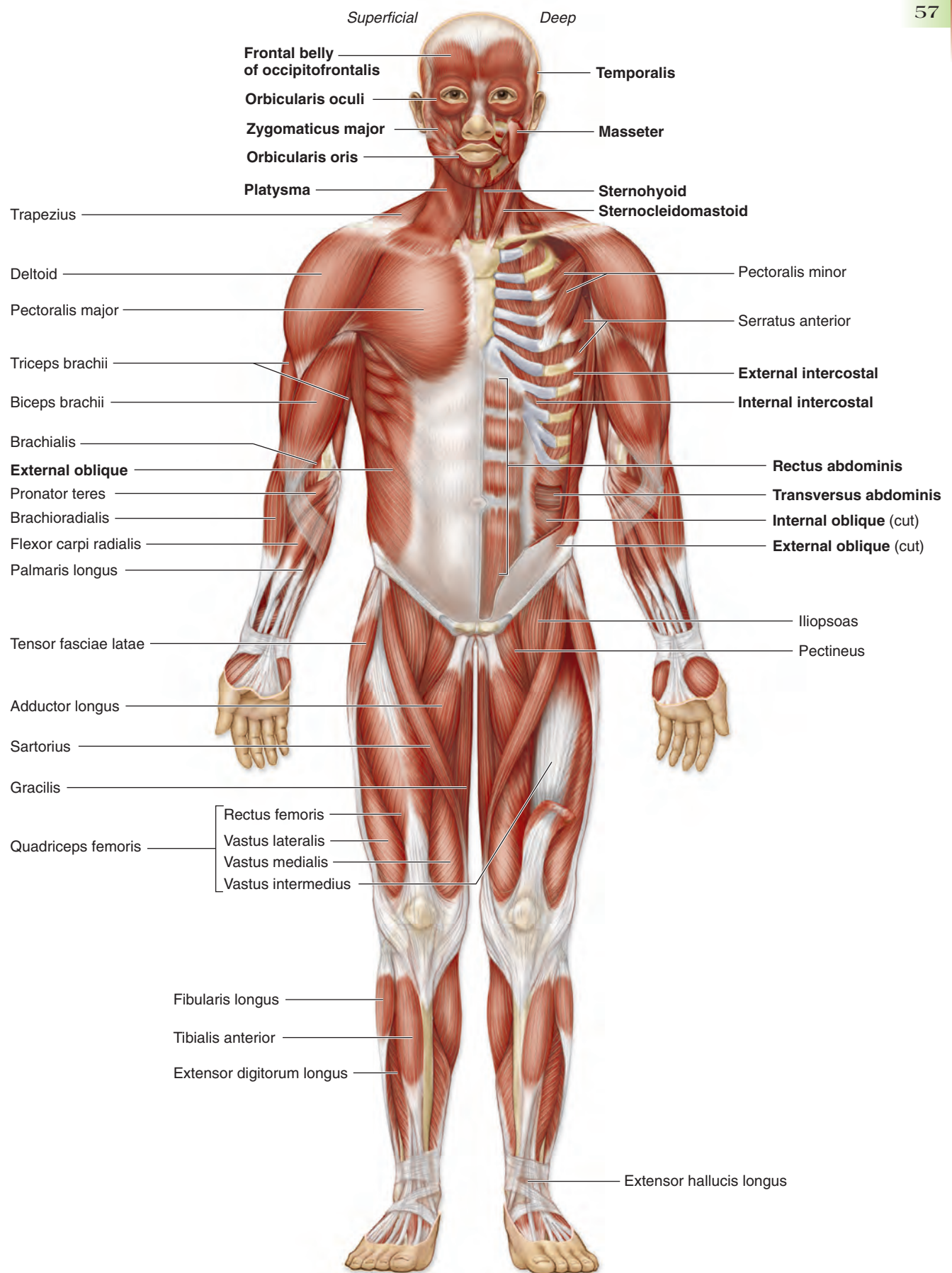


Figure 2-5
The anterior muscles of the body.

 Go to the Online Learning Center at www.mhhe.com/massagereview2e to practice identifying muscles of the body.

Biomechanics and Kinesiology

Biomechanics is the analysis of biological systems in mechanical terms, and kinesiology is the study of body movement. The body has muscle spindles and Golgi tendon organs to help us with body position (proprioception). The benefits of using proper body mechanics for massage include the following:

- Increased strength and power
- Increased pressure
- Decreased possibility of injury
- Enhanced quality and effectiveness of massage
- Increased career and life span as a therapist/bodyworker

Proprioception: Proprioception is the ability to know where your body is in space. For example, if you were to close your eyes and lift your leg up to hip level, you would know it was at hip level without having to look. See Chapter 1 for a detailed discussion.

Golgi tendon organs: Golgi tendon organs are nerve endings located within tendons near a muscle–tendon

junction. They help keep us from over-contracting by sending signals to the interneurons in the spinal cord, which in turn inhibit the actions of the motor neurons. This allows the muscle to relax, thus protecting the muscle and tendon from excessive tension damage. So if we try to lift an object that is too heavy, our muscles will respond so that we realize it is too heavy and drop it. Otherwise, we end up straining a muscle.

Muscle spindles: A muscle spindle is a stretch receptor found in the muscle that detects a stretching force in the muscles. When too much of a stretch occurs, the muscle spindles causes a contraction of the muscle to prevent overstretching.

Muscles

Knowledge of muscle origins and insertions is a must for any massage therapist or bodyworker. Remember, origins are generally the stronger, nonmoveable end of the muscle, while insertions are the weaker, moveable end of the muscle. See Figures 2-6 and 2-7 and Table 2-4 for the main muscles of the face and head.

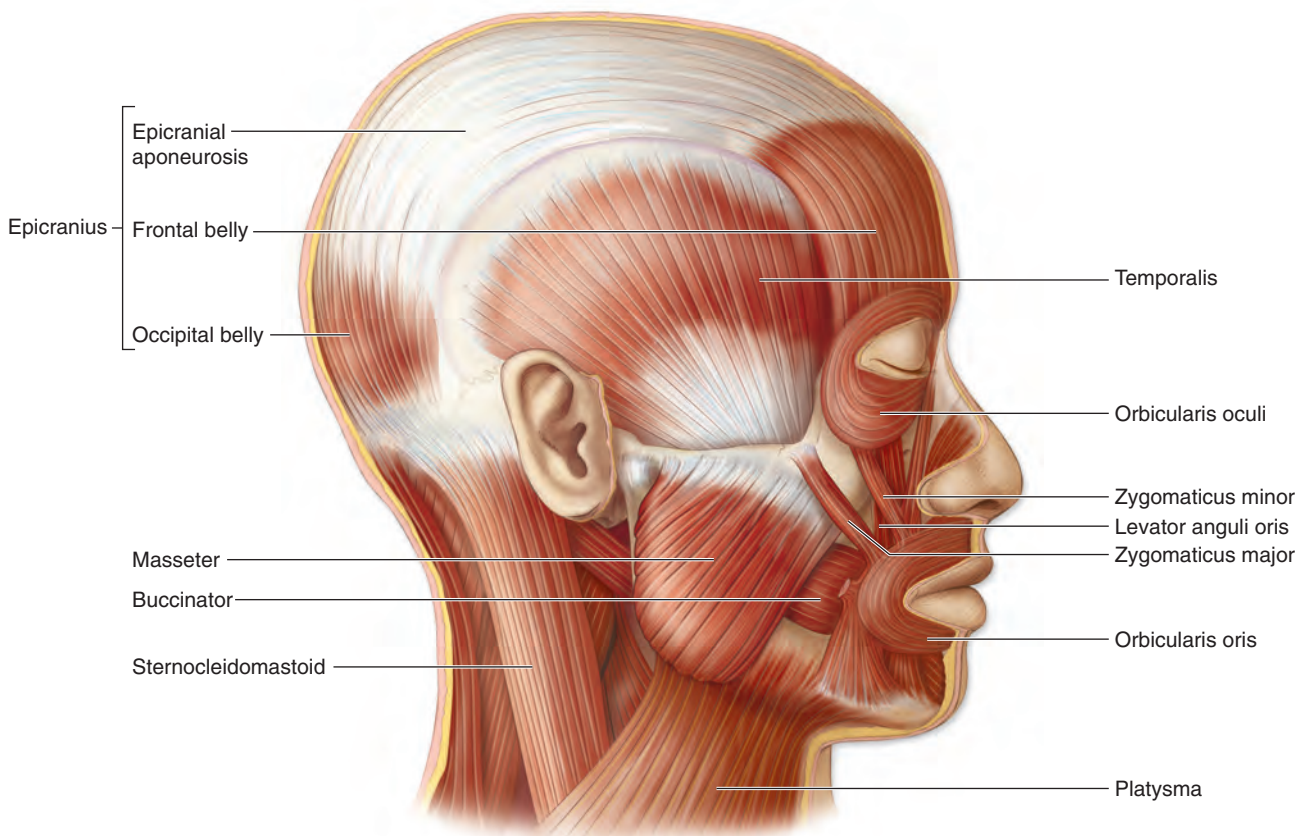


Figure 2-6 Side view of the muscles of the face.

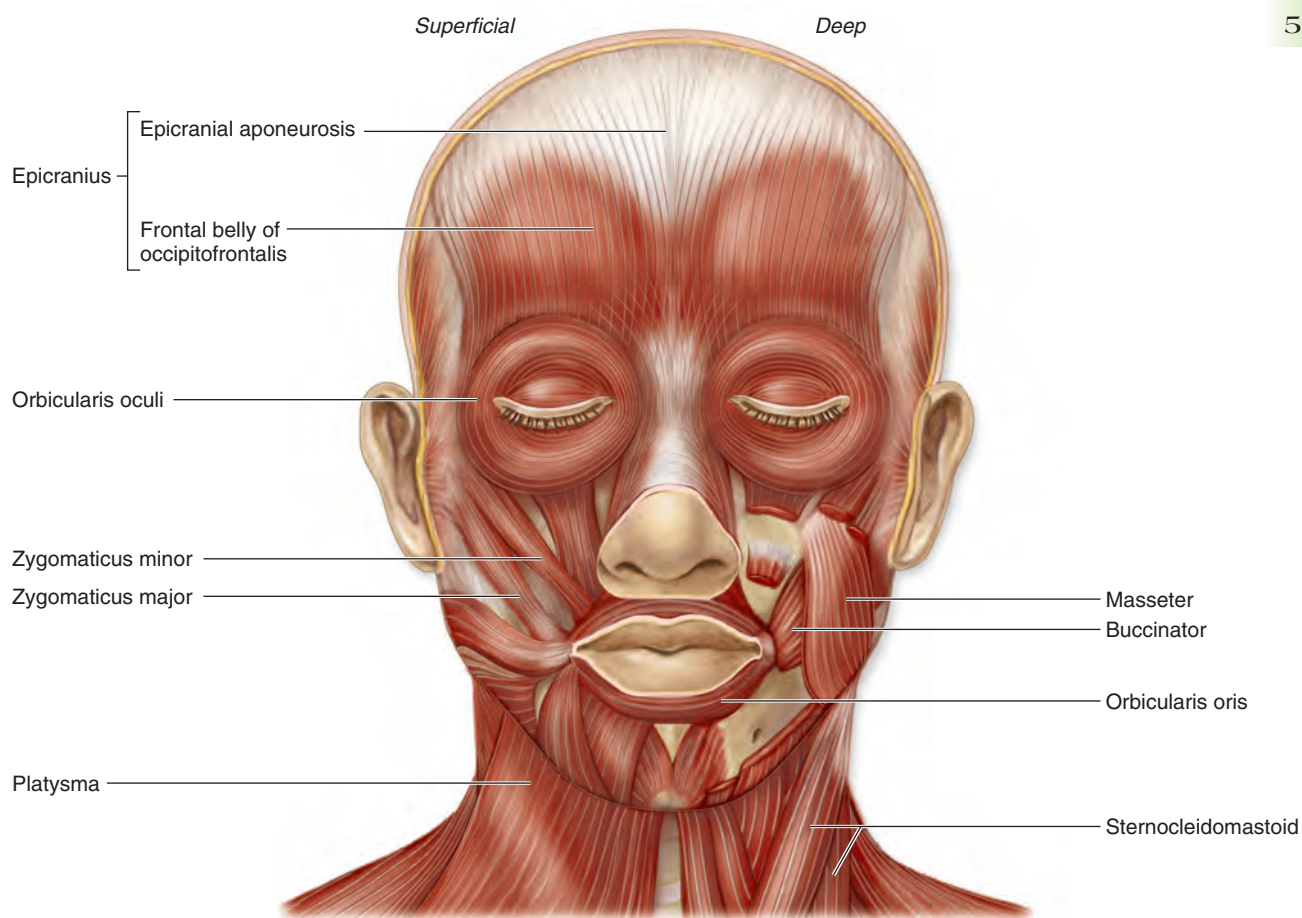


Figure 2-7 Muscles of facial expression and mastication.



Go to the Online Learning Center at www.mhhe.com/massagereview2e to practice identifying muscles of the face.

TABLE 2-4

At a Glance: Muscles of the Face and Head

Muscle	Origin	Insertion	Action
Epicranius	Occipital bone	Skin and muscles around eye	Raises eyebrow
Orbicularis oculi	Maxillary and frontal bones	Skin around the eye	Closes eye
Orbicularis oris	Muscles near the mouth	Skin of lips	Closes and protrudes lips
Buccinator	Outer surface of maxilla and mandible	Orbicularis oris	Compresses cheeks inward
Zygomaticus	Zygomatic bone	Orbicularis oris	Raises corner of mouth
Masseter	Zygomatic arch	Angle and ramus of the mandible	Elevates the mandible
Temporalis	Temporal bone and lateral surface	Coronoid process of mandible	Closes jaw
Platysma	Subcutaneous tissue of infraclavicular and supraclavicular regions	Base of mandible, skin of cheek and lower lip, angle of mouth, orbicularis oris	Depresses mandible (against resistance), tenses skin of inferior face and neck

Now, we will take a look at muscles that actually move the head (Figures 2-8 and 2-9). Notice that some of these muscles attach onto the spine, clavicle, and ribs to provide stabilization as well as movement at the neck and/or head. The name

of the muscle oftentimes tells you the location. For example, splenius cervicis tells you there is an attachment on the cervical vertebrae (*cervicus*); splenius capitis tells you there is an attachment on the skull (*capitus* = head). See Table 2-5.

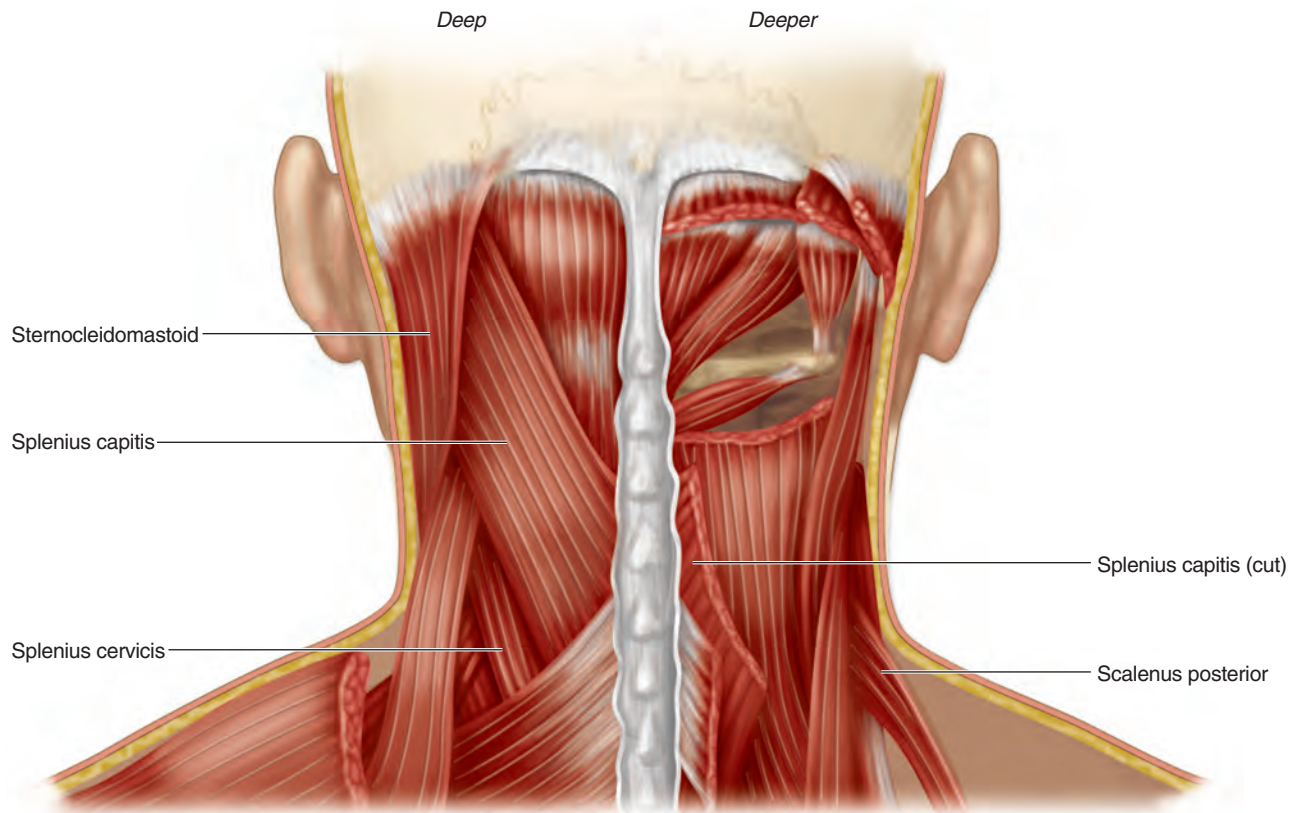


Figure 2-8 Posterior view of muscles that move the head.

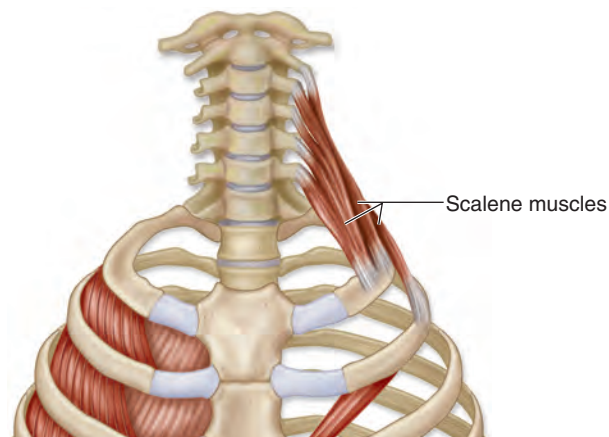


Figure 2-9 View of the scalenes: posterior, anterior, and medius.



Go to the Online Learning Center at www.mhhe.com/massagereview2e to practice identifying muscles of the neck.

TABLE 2-5

At a Glance: Muscles That Move the Head

Muscle	Origin	Insertion	Action
Sternocleidomastoid	Manubrium of sternum, medial one-third of clavicle	Mastoid process of temporal bone	Unilaterally: laterally flexes neck and rotates head to one side Bilaterally: flexes neck and assists in forced inspiration
Splenius capitis	Nuchal ligament, spinous process of C7–T3	Mastoid process, inferior nuchal line-lateral region	Unilaterally: rotates the head and laterally flexes the neck Bilaterally: extends the head
Splenius cervicus	Spinous processes of T3–T6	Transverse processes of C1–C3	Unilaterally: rotates the head and laterally flexes the neck Bilaterally: extends the head
Scalenes posterior	Transverse processes of C5–C6	Rib 2 (superior surface)	Unilaterally: laterally flexes the neck, rotates the head Bilaterally: elevates the second rib during inhalation
Scalenes anterior	Transverse process of C3–C6	Rib 1 (superior surface)	Unilaterally: laterally flexes the neck and rotates the head Bilaterally: elevates the first rib during inhalation
Scalenes medius	Transverse process of C2–C7	Rib 1 (superior surface)	Unilaterally: laterally flexes the neck and rotates the head Bilaterally: elevates the first rib during inhalation

Remember, the shoulder girdle muscles either attach to or move the scapula, or they attach to the clavicle. Shoulder joint muscles only move the shoulder joint

and have no action or attachment to the scapula or the clavicle (Table 2-6). See Figures 2-10 through 2-12 for muscles that move the pectoral girdle and the trunk.

TABLE 2-6

At a Glance: Muscles That Move the Pectoral Girdle and Trunk

Muscle	Origin	Insertion	Action
Trapezius	External occipital protuberance, superior nuchal lines, nuchal ligament, spinous processes of C7–T12	Lateral one-third of clavicle, acromion process, scapular spine	Upper fibers: extends the neck and head, elevates scapula, and upwardly rotates the scapula Bilaterally: extends the head and neck Middle fibers: retracts the scapula Lower fibers: depresses the scapula
Rhomboid major	Spinous processes of T2–T5	Vertebral border of scapula	Retracts the scapula and downwardly rotates the scapula
Rhomboid minor	Spinous processes of C7–T1	Vertebral border of the scapula	Retracts the scapula and downwardly rotates the scapula
Levator scapulae	Transverse processes of C1–C4	Superior angle of the spine of scapula at the root	Unilaterally: elevates the scapula, downwardly rotates the scapula, laterally flexes the neck Bilaterally: extends head and neck
Serratus anterior	Ribs 1–8	Anterior medial border of the scapula	Protracts the scapula and upwardly rotates the scapula
Pectoralis minor	Ribs 3–5	Coracoid process of scapula	Depresses the scapula, protracts the scapula, downwardly rotates the scapula, and assists in forced inspiration
Internal oblique	Iliac crest, thoracolumbar fascia, inguinal ligament	Ribs 7–12, linea alba	Unilaterally: laterally flexes and rotates the vertebral column Bilaterally: flexes the vertebral column
External oblique	Ribs 5–12	Iliac crest, abdominal fascia, linea alba	Unilaterally: laterally flexes and rotates the vertebral column Bilaterally: flexes the vertebral column
Rectus abdominus	Pubic symphysis and pubic tubercle	Ribs 5–7 and xiphoid process	Flexes the vertebral column, compresses the abdominal contents
Transverse abdominus	Ribs 7–12, iliac crest, thoracolumbar aponeurosis, inguinal ligament	Abdominal aponeurosis, linea alba	Compresses the abdominal contents
Erector spinae	Spinous processes of C1–L5, nuchal ligament, posterior iliac crest, ribs 1–12, posterior sacrum	Mastoid process, ribs 1–12, transverse processes of C2–T8, occipital bone	Unilaterally: laterally flexes the vertebral column Bilaterally: extends the vertebral column and head
Quadratus lumborum	Posterior iliac crest	Ribs 12 (inferior surface), transverse process of L1–L4	Unilaterally: laterally flexes the vertebral column and elevates the hip Bilaterally: extends the lumbar spine and anteriorly tilts the pelvis

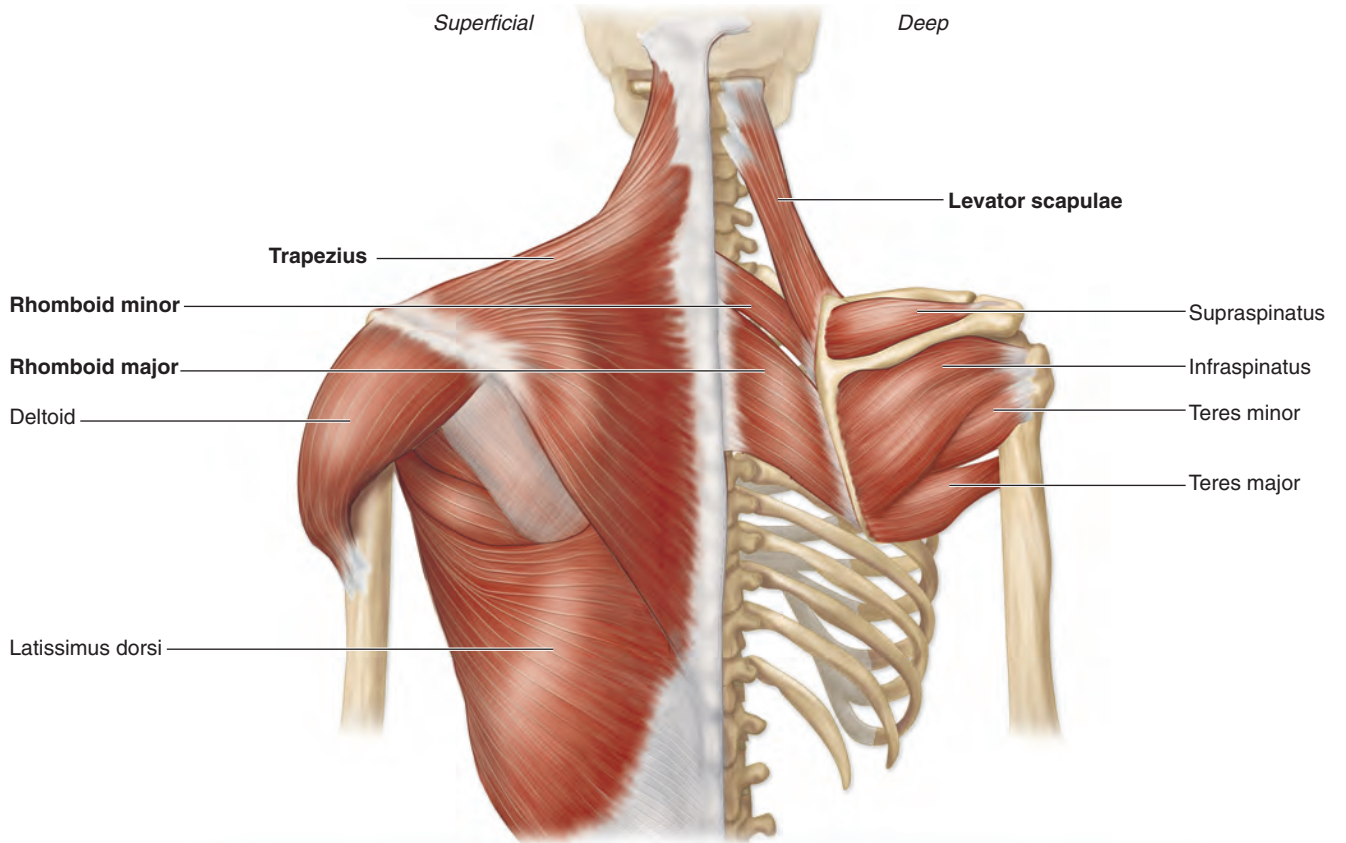


Figure 2-10 Muscles of the posterior shoulder. The right trapezius is removed to show underlying muscles.

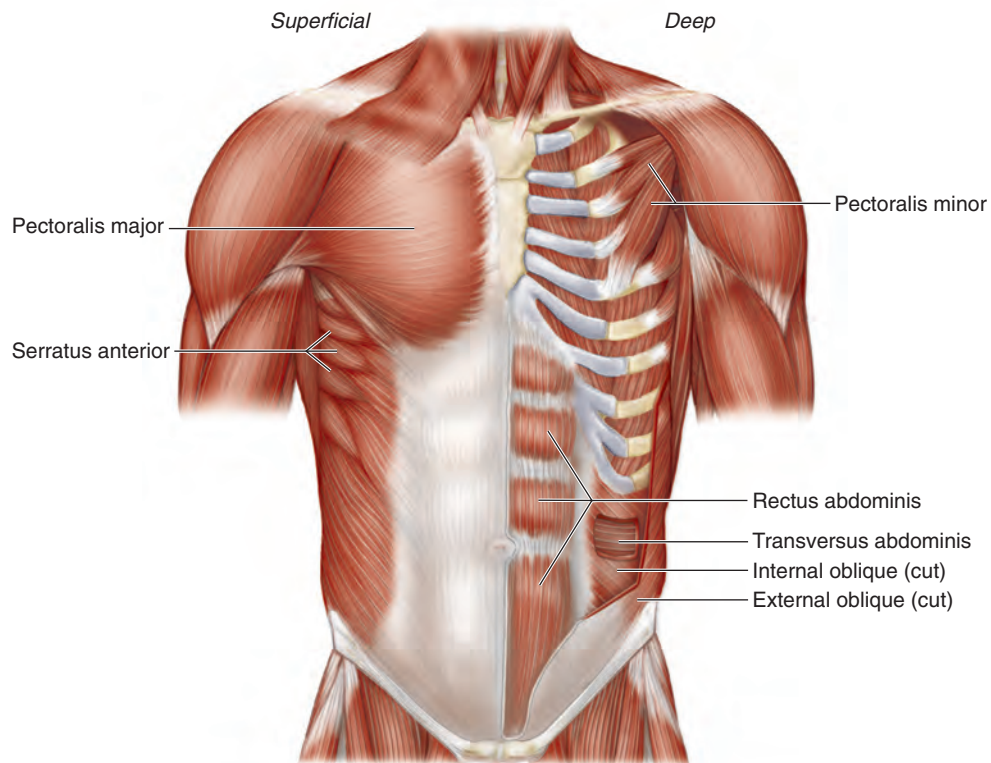


Figure 2-11 Muscles of the anterior chest and abdominal wall. The right pectoralis is removed to show the pectoralis minor.

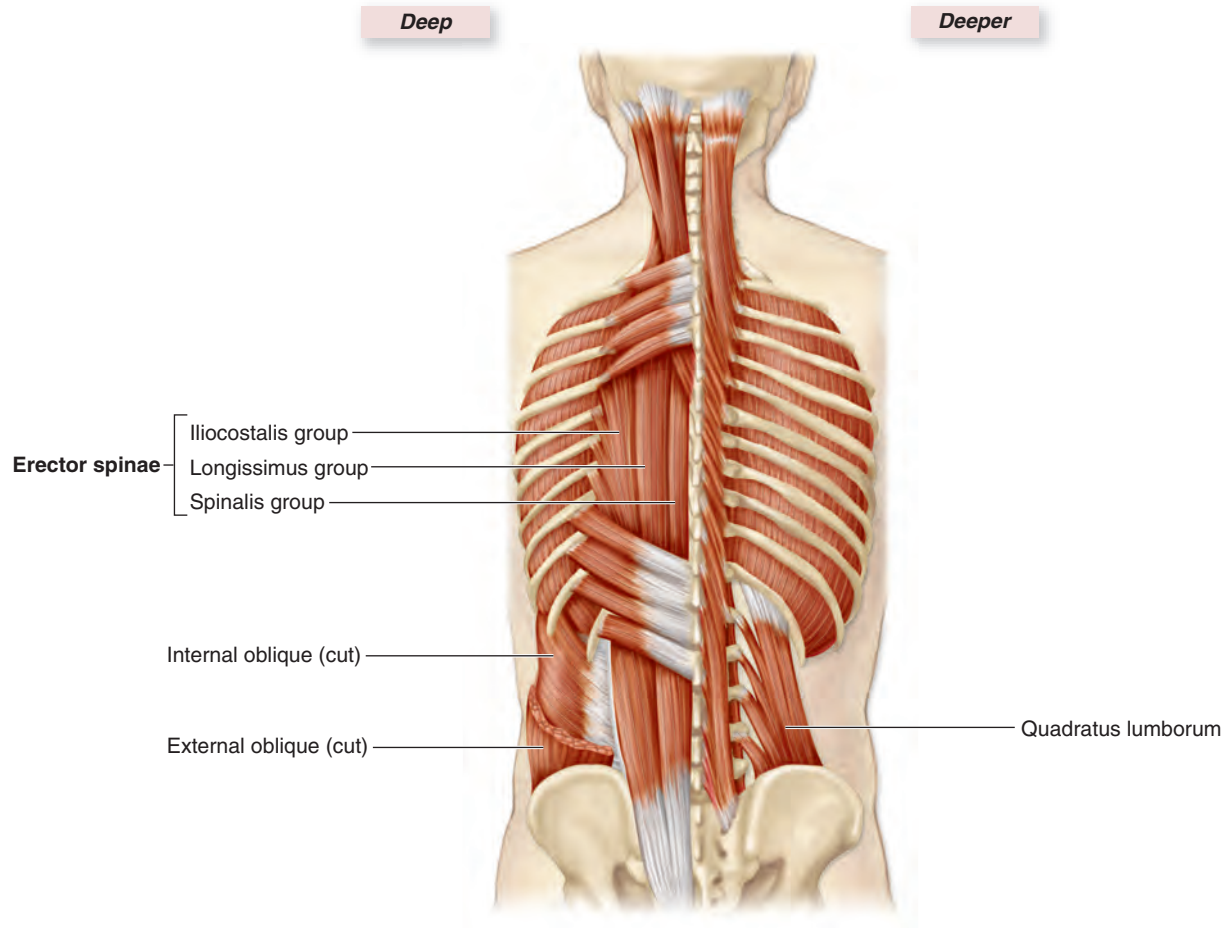


Figure 2-12 Muscles of the erector spinae and quadratus lumborum.



Go to the Online Learning Center at www.mhhe.com/massagereview2e to practice identifying muscles of the shoulder, chest, and abdominal wall.

Figures 2-13 and 2-14 show muscles that move the arm; however, notice that some of the muscles also affect the shoulder which would make them shoulder girdle muscles. Note that the rotator muscles are the SITS muscles and are listed in the order that they “sit” on the

shoulder. The origin is the name of the fossa from which they originate. The insertion can be remembered by the subscapularis—it is “sub” standard and is the only rotator cuff muscle to attach to the lesser tubercle. The others are so great, they attach to the greater tubercle. See Table 2-7.

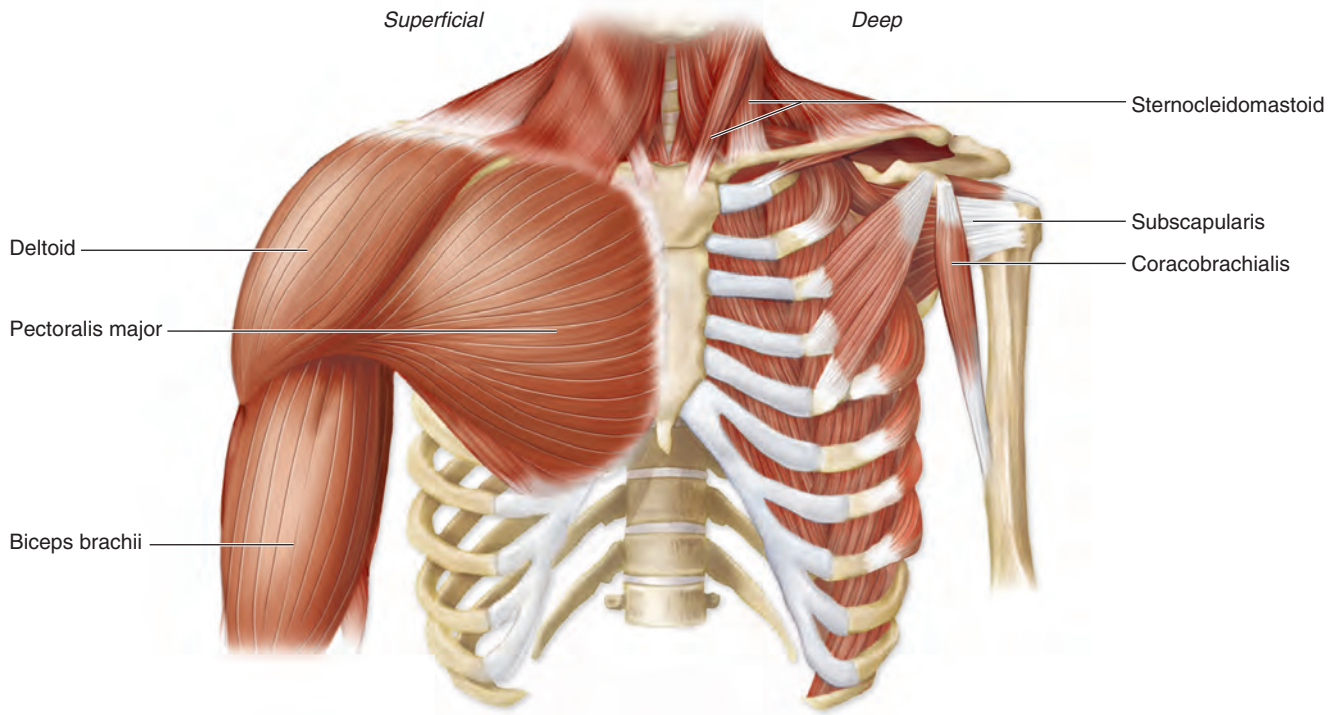


Figure 2-13 Muscles of the anterior shoulder and arm.



Go to the Online Learning Center at www.mhhe.com/massagereview2e to practice identifying muscles of the shoulder and arms.

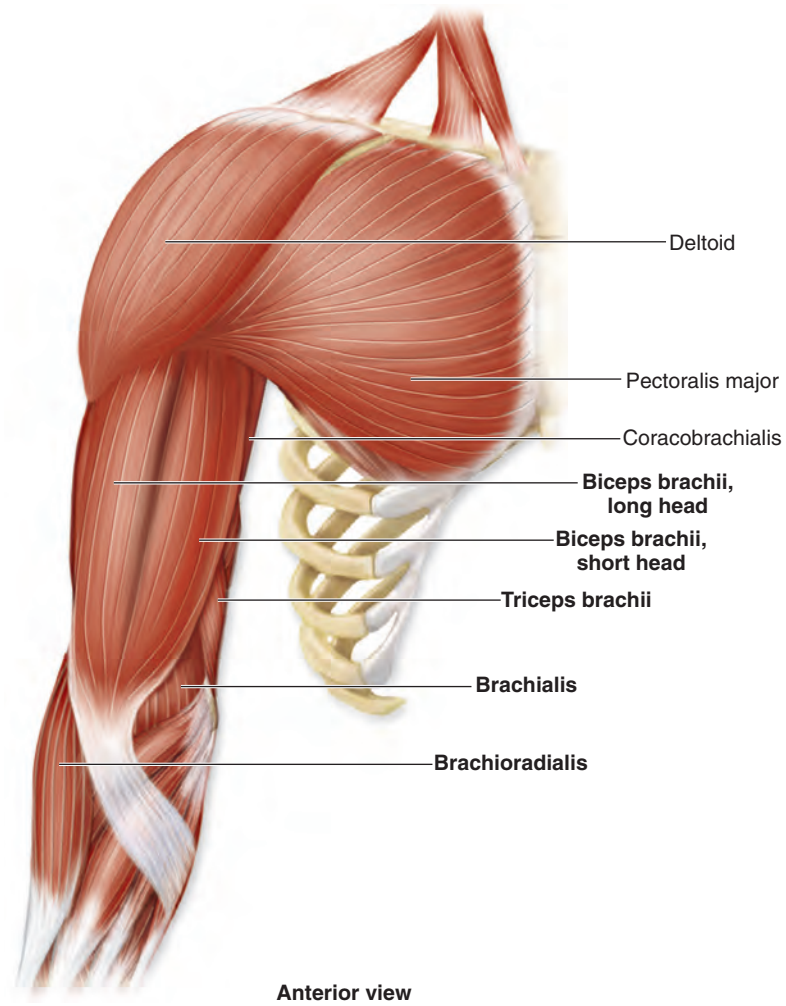


Figure 2-14 Muscles of the arm.



Go to the Online Learning Center at www.mhhe.com/massagereview2e to practice identifying muscles of the arms.

TABLE 2-7

At a Glance: Muscles That Move the Arm

Muscle	Origin	Insertion	Action
Coracobrachialis	Coracoid process of the scapula	Medial humeral shaft	Flexes and adducts the shoulder
Pectoralis major	Medial half of clavicle edge of sternal body, ribs 1–8	Intertubercular groove of the humerus	Adducts the shoulder, medially rotates the shoulder, flexes the shoulder (clavicular fibers only), and extends the shoulder (sternal and costal fibers)
Teres major	Inferior half of the lateral border of the scapula	Intertubercular groove of the humerus	Teres major extends the shoulder, medially rotates the shoulder, adducts the shoulder
Latissimus dorsi	Spinous process of T6–L5, ribs 9–12, posterior iliac crest, and posterior sacrum	Intertubercular groove of the humerus	Extends the shoulder, medially rotates the shoulder, adducts the shoulder
Deltoid	Lateral third of clavicle, acromion process, scapular spine	Deltoid tuberosity of humerus	Anterior fibers: flex and medially rotate the shoulder Medial fibers: abduct the shoulder Posterior fibers: extend and laterally rotate the shoulder
Rotator Cuff Muscles			
Supraspinatus	Supraspinous fossa of the scapula	Greater tubercle of the humerus	Abducts the shoulder Stabilizes head of humerus in glenoid cavity
Infraspinatus	Infraspinous fossa of the scapula	Greater tubercle of the humerus	Laterally rotates the shoulder Adducts the shoulder, extends the shoulder, horizontally abducts the shoulder
Teres minor	Superior half of the lateral border of the scapula	Greater tubercle of the humerus	Adducts the shoulder and laterally rotates the shoulder Extends the shoulder; horizontally abducts the shoulder; stabilizes head of humerus in glenoid cavity
Subscapularis	Subscapular fossa of the scapula	Lesser tubercle of the humerus	Medially rotates the shoulder Stabilizes head of humerus in glenoid cavity

Memory Helper
Internal shoulder rotators

L – Latissimus dorsi
I – Internal rotation (the action)
P – Pectoralis major
S – Subscapularis

Memory Helper
Rotator cuff muscles

S – Supraspinatus
I – Infraspinatus
T – Teres minor
S – Subscapularis

Memory Helper
External rotator cuff muscles

E – both E and X stand for External Rotation
X
I – Infraspinatus
T – Teres minor

Remember, many muscles' names tell you either the location (*brachio* = arm and *radialis* = radius bone), or how many origins they might have (*bi* = 2, so bicep has two origins), or the action (supinator supinates the forearm). See Figure 2-15a for muscles that move the anterior forearm (Table 2-8).

Generally speaking, the wrist/finger flexors are on the anterior side of the forearm, and the wrist/finger extensors are on the posterior forearm. See

Figure 2-15b for muscles that move the posterior forearm (Table 2-8). Place your hand on the medial epicondyle, and you will feel muscles flexing when you flex your wrist. The medial epicondyle is the common origin for most wrist flexors. Now place your hand on the lateral epicondyle, and extend your wrist. The lateral epicondyle is the common origin for most wrist extensors. See Table 2-9 for muscles that move the wrist, hand, and fingers. See Figures 2-16 and 2-17.

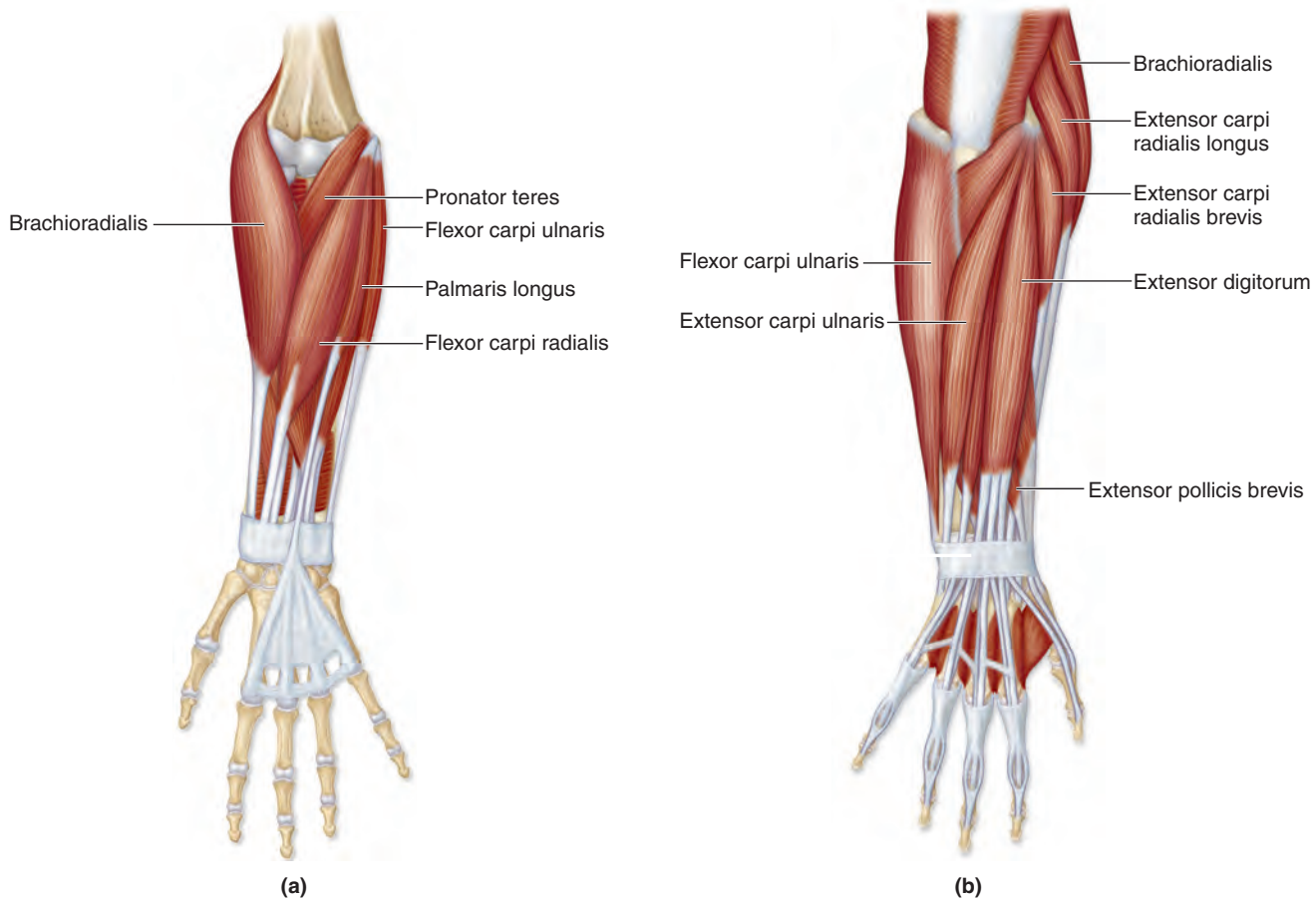


Figure 2-15 Muscles of the forearm.



Go to the Online Learning Center at www.mhhe.com/massagereview2e to practice identifying muscles of the forearm.

TABLE 2-8

At a Glance: Muscles That Move the Forearm

Muscle	Origin	Insertion	Action
Biceps brachii	Long head: supraglenoid tubercle of scapula Short head: coracoid process of scapula	Radial tuberosity	Flexes the elbow, supinates the forearm, and flexes the shoulder
Brachialis	Distal anterior humeral shaft	Ulnar tuberosity	Flexes the elbow
Brachioradialis	Lateral supracondylar ridge of the humerus	Styloid process of radius	Flexes the elbow when the hand is in the neutral position
Triceps brachii	Long head: infraglenoid tubercle of the scapula Lateral head: posterior proximal humeral shaft Medial head: posterior distal humeral shaft	Olecranon process	Extends the elbow and extends the shoulder
Supinator	Lateral epicondyle of the humerus, proximal one-eighth of ulnar shaft, radial collateral ligament, and annular ligament	Proximal lateral radial shaft	Supinates the forearm
Pronator teres	Medial epicondyle of the humerus and the coronoid process of the ulna	Lateral proximal radial shaft	Pronates the forearm and flexes the elbow
Pronator quadratus	Anterior distal one-eighth of the ulnar shaft	Anterior distal one-eighth of the radial shaft	Pronates the forearm

TABLE 2-9

At a Glance: Muscles That Move the Wrist, Hand, and Fingers

Muscle	Origin	Insertion	Action
Flexor carpi radialis	Lateral supracondylar ridge of the humerus	Bases of metacarpals 2–3	Flexes and abducts the wrist
Flexor carpi ulnaris	Medial epicondyle of the humerus	Base of metacarpal 5, pisiform, and hamate	Flexes and adducts the wrist
Palmaris longus	Medial epicondyle of humerus	Transverse carpal ligament and palmar aponeurosis	Flexes the wrist and cups the palm
Flexor digitorum profundus	Anterior proximal three-fourths of the ulnar shaft	Distal phalanges of fingers 2–5	Flexes the fingers and the distal interphalangeal joint (DIP), the proximal interphalangeal joint (PIP), and the middle phalanx (MP) joints
Extensor carpi radialis longus and brevis	Longus: supracondylar ridge of the humerus	Longus: base of metacarpal 2	Extends and abducts the wrist
	Brevis: lateral epicondyle of the humerus	Brevis: base of metacarpal 3	Extends the distal interphalangeal joint (DIP), the proximal interphalangeal joint (PIP), and the middle phalanx (MP) joints
Extensor carpi ulnaris	Lateral epicondyle of the humerus	Base of metacarpal 5	Extends and adducts the wrist
Extensor digitorum	Lateral epicondyle of the humerus	Middle phalanges of the four fingers	Extends the wrist and extends the fingers at the DIP, PIP, and MP joints
Extensor pollicis longus and brevis	Longus: posterior ulnar shaft middle region, posterior radial shaft middle region, and interosseous membrane	Longus: distal phalanx of thumb	Extends the thumb
	Brevis: posterior radial shaft distal region and interosseous membrane	Brevis: proximal phalanx of thumb	
Flexor pollicis longus and brevis	Longus: anterior radial shaft middle region, interosseous membrane, and anterior ulnar shaft middle region	Longus: distal phalanx of thumb	Flexes the thumb
	Brevis: trapezium and transverse carpal ligament	Brevis: proximal phalanx of thumb	
Opponens pollicis	Trapezium and transverse carpal ligament	Proximal phalanx of thumb	Flexes and adducts the thumb

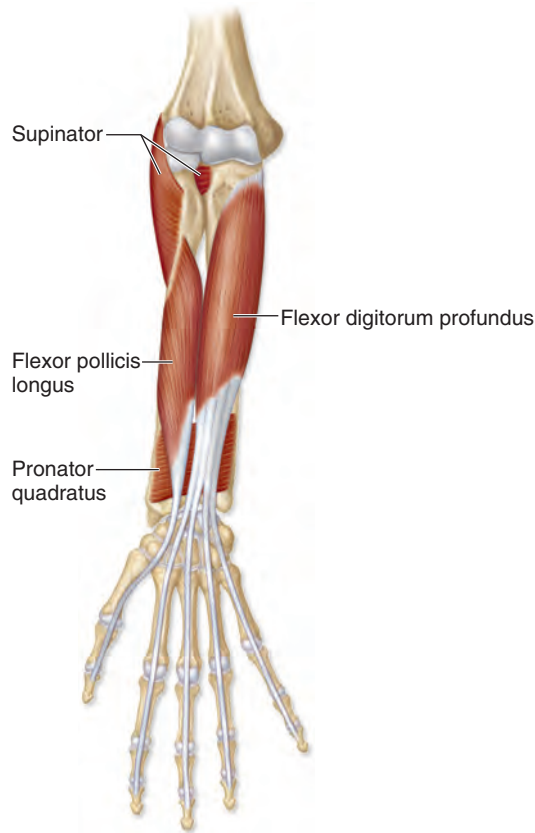


Figure 2-16 Muscles of the wrist and forearm.

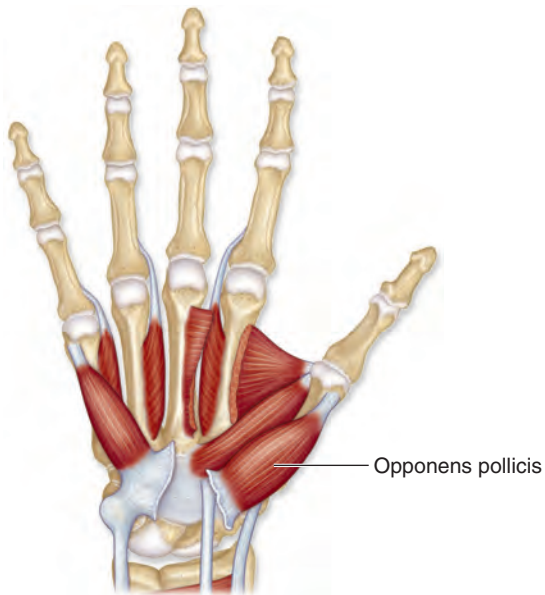


Figure 2-17 Opponens pollicis muscle.

Look for similarities among muscle groups. For example, the quadriceps group (rectus femoris, vastus medialis, vastus lateralis, and vastus intermedius) all have a common insertion—the tibial tuberosity. See Table 2-10 for muscles that move the hip, thigh, and knee (Figures 2-18 through 2-22).

Think about the action of the muscle to help you figure out its location. For example, for the toes to flex, it makes sense that the flexors be on the plantar aspect of the foot, whereas the extensors would be on the dorsal. Remember, muscles only pull; they never push. See Table 2-11 for muscles that move the ankle, foot, and toes (Figures 2-23 through 2-26).

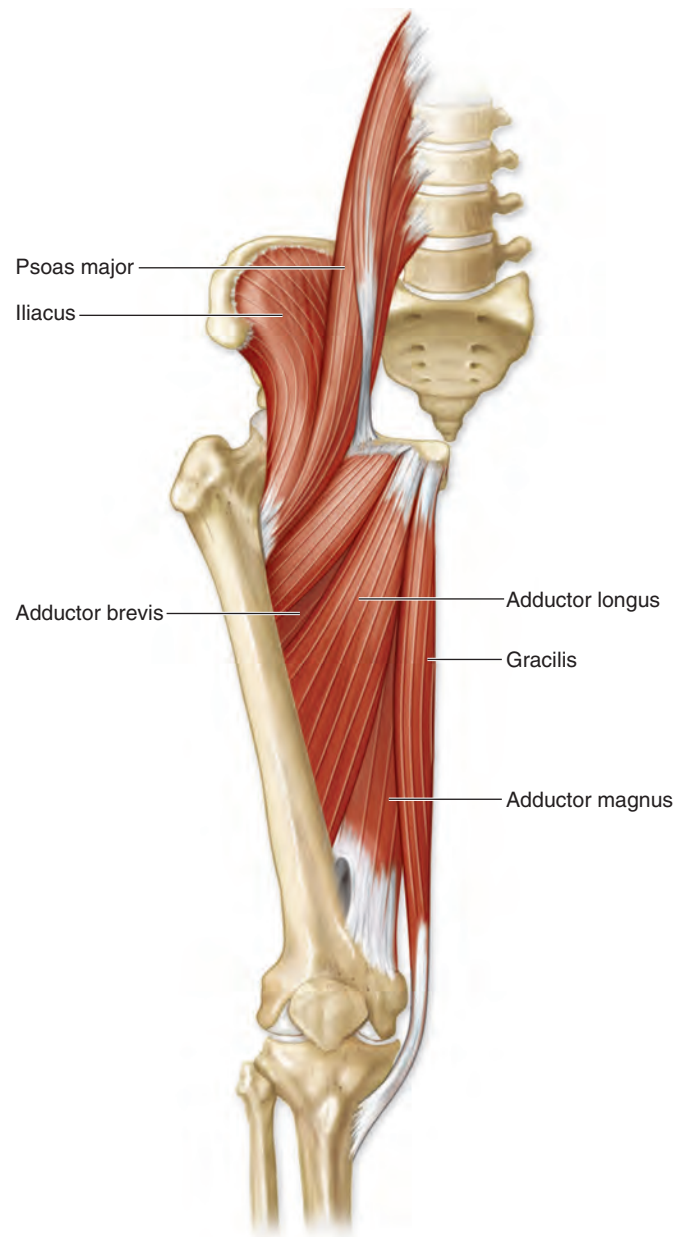


Figure 2-18 Deeper muscles of the right anterior thigh.



Go to the Online Learning Center at www.mhhe.com/massagereview2e to practice identifying muscles of the wrist and forearm.

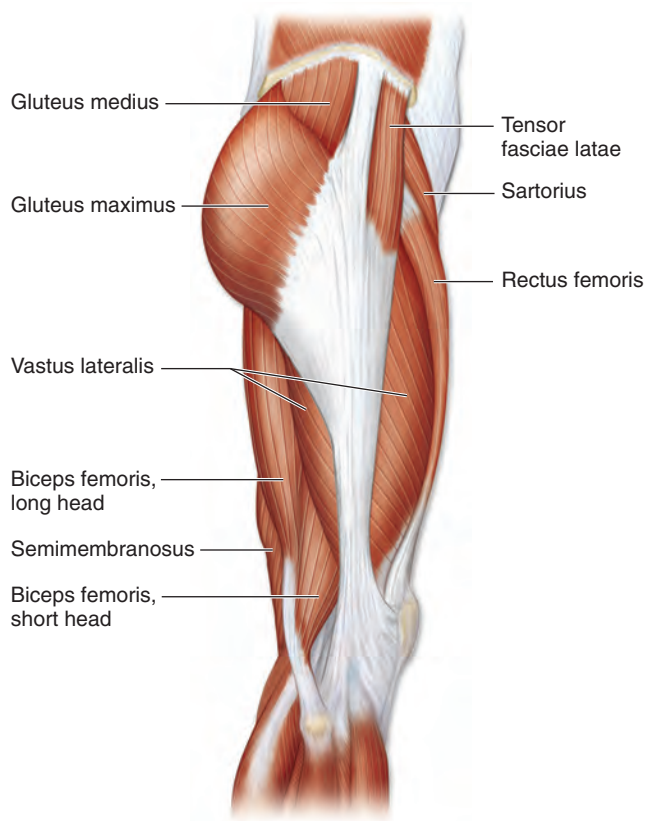


Figure 2-19 Muscles of the right lateral thigh.

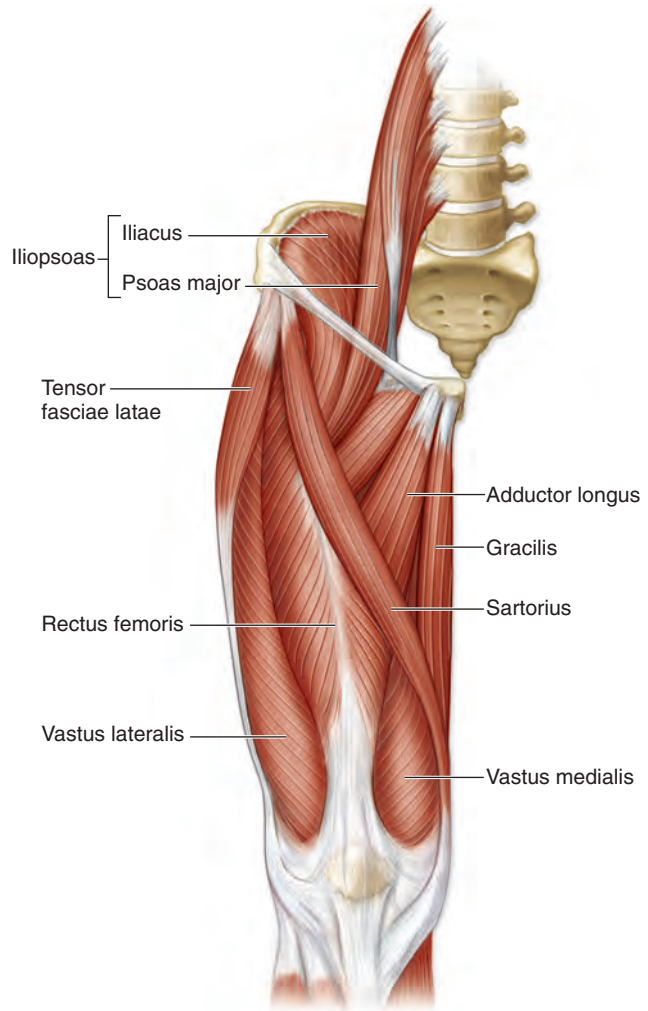


Figure 2-20 Muscles of the right anterior thigh.

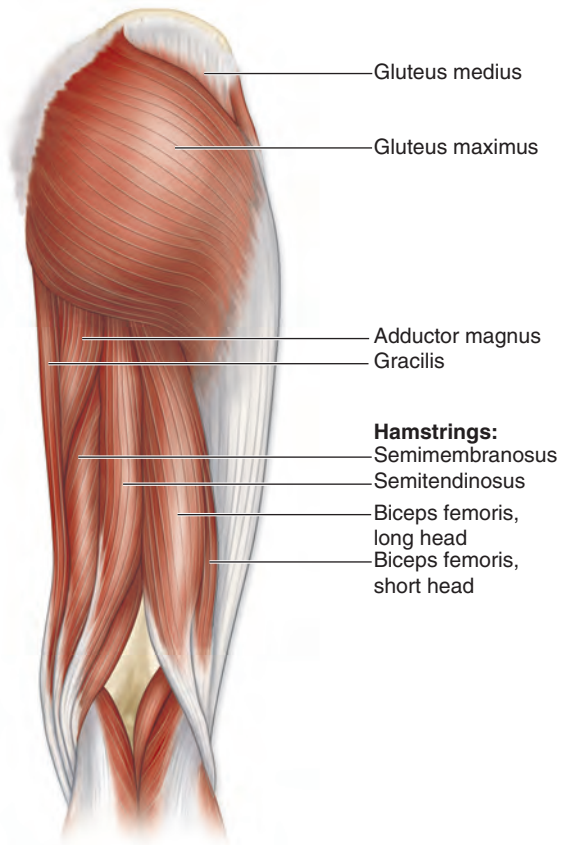


Figure 2-21 Muscles of the right posterior thigh.



Go to the Online Learning Center at www.mhhe.com/massagereview2e to practice identifying muscles of the thigh and hip.

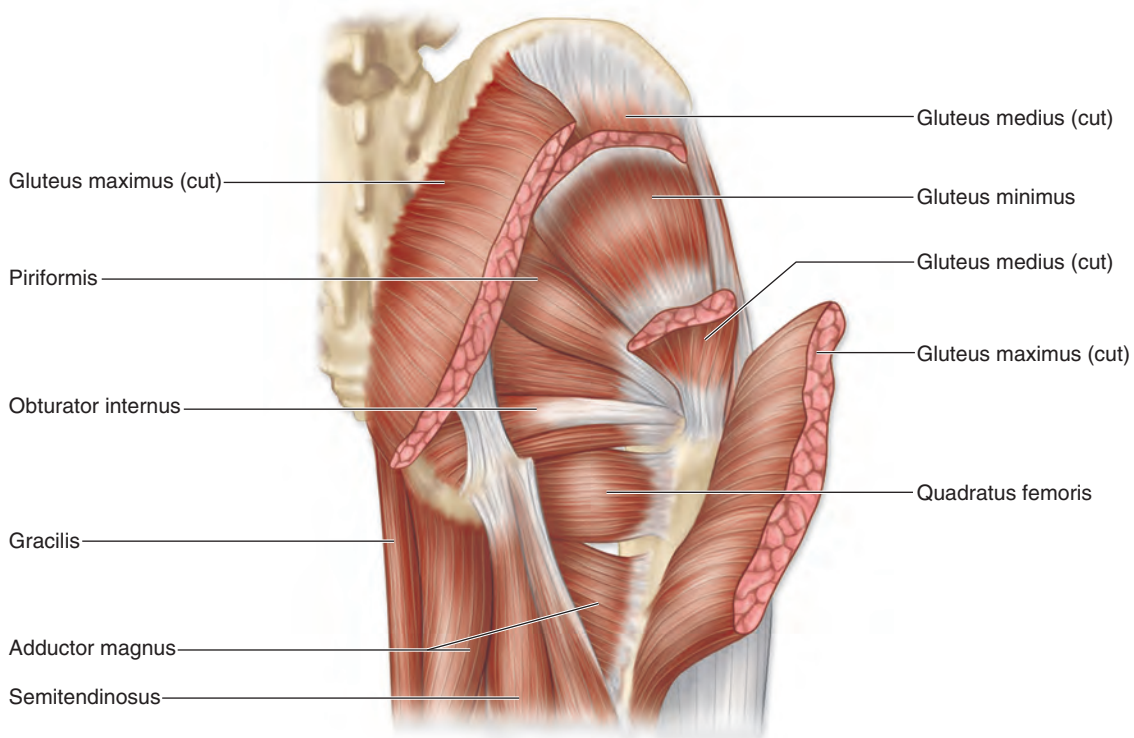


Figure 2-22 Muscles of the thigh and hip.

TABLE 2-10

At a Glance: Muscles That Move the Thigh and Leg

Muscle	Origin	Insertion	Action
Psoas major	Transverse processes and vertebral bodies of T12–L5	Lesser trochanter	Unilaterally: laterally rotates the hip Bilaterally: flexes the hip and the vertebral column
Iliacus	Iliac fossa and anterior inferior iliac spine	Lesser trochanter	Flexes and laterally rotates the hip Flexes hip; extends hip
Gluteus maximus	Posterior sacrum, posterior coccyx, and posterior iliac crest	Gluteal tuberosity (25%) and iliotibial band (75%)	Extends, laterally rotates, and abducts the hip
Gluteus medius	Superior gluteal line	Greater trochanter	Abducts and medially rotates the hip Flexes hip; extends hip
Gluteus minimus	Inferior gluteal line	Greater trochanter	Abducts and medially rotates the hip, and flexes hip
Tensor fasciae latae	Anterior iliac crest and anterior superior iliac spine	Iliotibial band	Abducts, flexes, and medially rotates the hip
Adductor longus	Pubic tubercle	Linea aspera	Adducts and flexes the hip, medially rotates hip
Adductor magnus	Ischial tuberosity, inferior pubic ramus, and ischial ramus	Linea aspera and adductor tubercle of the femur	Adducts, flexes, and extends the hip, and medially rotates hip
Adductor brevis	Inferior pubic ramus	Linea aspera	Adducts the hip and medially rotates the hip
Gracilis	Inferior pubic ramus	Medial proximal tibial shaft (pes anserine)	Adducts and flexes the hip; flexes and medially rotates the knee
Sartorius	Anterior superior iliac spine	Medial proximal tibial shaft (pes anserine)	Flexes, laterally rotates, and abducts the hip; medial and laterally rotates the knee when the knee is flexed.
Pectineus	Pectineal line of pubis	Pectineal line of femur	Adducts and flexes thigh
Hamstrings Group			
Biceps femoris	Ischial tuberosity	Fibular head	Flexes the knee, laterally rotates the knee (when knee is flexed), extends the hip, medially rotates hip, posteriorly tilts the pelvis
Semitendinosus	Ischial tuberosity	Medial proximal tibial shaft (pes anserine)	Flexes the knee, medially rotates the knee (when knee is flexed), extends the hip, medially rotates hip, posteriorly tilts the pelvis
Semimembranosus	Ischial tuberosity	Medial condyle of the tibia	Flexes the knee, medially rotates the knee (when knee is flexed), extends the hip, medially rotates hip, posteriorly tilts the pelvis

TABLE 2-10 (continued)

Deep Six Hip Rotators

Piriformis	Anterior surface of sacrum	Greater trochanter	Laterally rotates hip, abducts the hip when the hip is flexed
Quadratus femoris	Lateral border of ischial tuberosity	Intertrochanteric crest, between the greater and lesser trochanters	Laterally rotates the hip
Obturator internus	Obturator membrane and inferior surface of the obturator foramen	Medial surface of the greater trochanter	Laterally rotates the hip
Obturator externus	Superior and inferior rami of pubis	Trochanteric fossa of femur	Laterally rotates the hip
Gemellus superior	Ischial spine	Upper border of greater trochanter	Laterally rotates the hip
Gemellus inferior	Ischial tuberosity	Upper border of greater trochanter	Laterally rotates the hip
Quadriceps Group			
Rectus femoris	Anterior inferior iliac spine	Tibial tuberosity	Flexes the hip and extends the knee
Vastus lateralis	Linea aspera and gluteal tuberosity	Tibial tuberosity	Extends the knee
Vastus intermedius	Anterior lateral femoral shaft	Tibial tuberosity	Extends the knee
Vastus medialis	Linea aspera	Tibial tuberosity	Extends the knee

TABLE 2-11

At a Glance: Muscles That Move the Ankle, Foot, and Toes

Muscle	Origin	Insertion	Action
Tibialis anterior	Lateral tibial shaft and interosseous membrane	Base of the first metatarsal and cuneiform 1	Dorsiflexes the ankle and inverts the foot
Peroneus brevis (fibularis brevis)	Lateral distal two-thirds of the fibular shaft	Base of fifth metatarsal	Everts the foot and plantar flexes the ankle
Peroneus longus (fibularis longus)	Fibular head and lateral proximal two-thirds of the fibular shaft	Base of first metatarsal and cuneiform 1	Everts the foot and plantar flexes the ankle
Extensor digitorum longus and brevis	Longus: fibular head, proximal two-thirds of fibular shaft, and lateral condyle of the tibia.	Longus: middle phalanges 2–5 and distal phalanges 2–5.	Extends digits 2–5 and dorsiflexes the ankle (longus only)
	Brevis: calcaneus	Brevis: tendons of extensor digitorum longus	
Gastrocnemius	Medial and lateral epicondyles of the femur	Calcaneus via the Achilles tendon (aka: calcaneal tendon)	Plantar flexes the ankle and flexes the knee
Soleus	Superior posterior one-third of the fibular shaft and soleal line of the tibia	Calcaneus via the Achilles tendon	Plantar flexes the ankle
Flexor digitorum longus	Posterior tibial shaft-middle region	Distal phalanges 2–5	Flexes digits 2–5 at the DIP, PIP, MP joints, and plantar flexes the ankle
Tibialis posterior	Posterior tibial shaft, posterior fibular shaft, and interosseous membrane	Navicular bone, third cuneiform, cuboid, and bases of metatarsals 2–4	Inverts the foot and plantar flexes the ankle
Flexor hallucis longus	Posterior fibular shaft	Distal phalanx of big toe	Flexes big toe, plantar flexes the ankle, inverts the foot, and supports the longitudinal arch
Extensor hallucis longus	Anterior fibular shaft, interosseous membrane	Distal phalanx of big toe	Extends the big toe and dorsiflexes the ankle

Joints

In order for muscles to move, we must have joints or articulations. The main types of joints in our bodies, as well as their description, movements, and examples, are listed below.

Fibrous: With this type of joint, articulating bones are fastened together by a thin layer of dense connective tissue. An example is the sutures between bones of the skull. These joints generally do not move, making them

classified as synarthrosis. However, the articulation between the radius and ulna and between the tibia and fibula, while fibrous, are functionally classified as amphiarthrosis or slightly moveable.

Cartilaginous: In cartilaginous joints, articulating bones are connected by hyaline cartilage or fibrocartilage. They provide for limited movement, as when the back is bent or twisted. An example is the joints between the bodies of vertebrae and the symphysis pubis (amphiarthrosis or slightly movable). Another

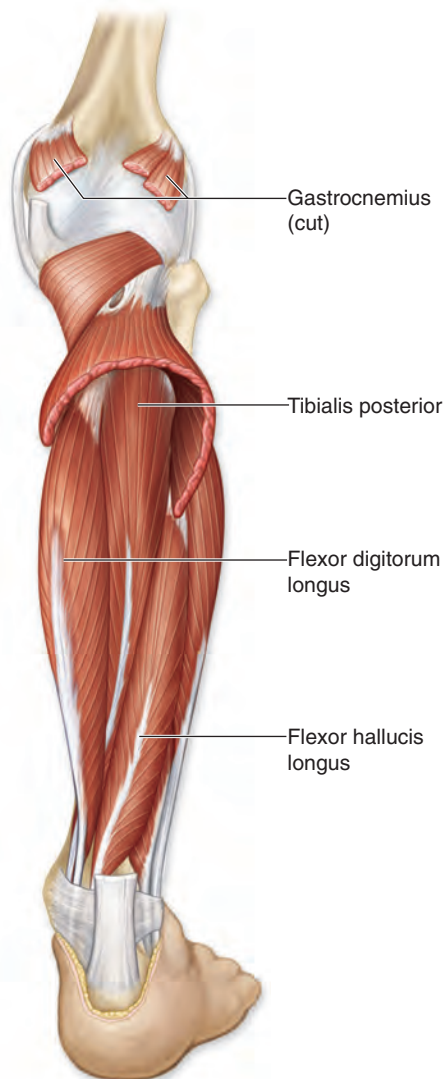


Figure 2-23 Deep posterior, leg muscles.

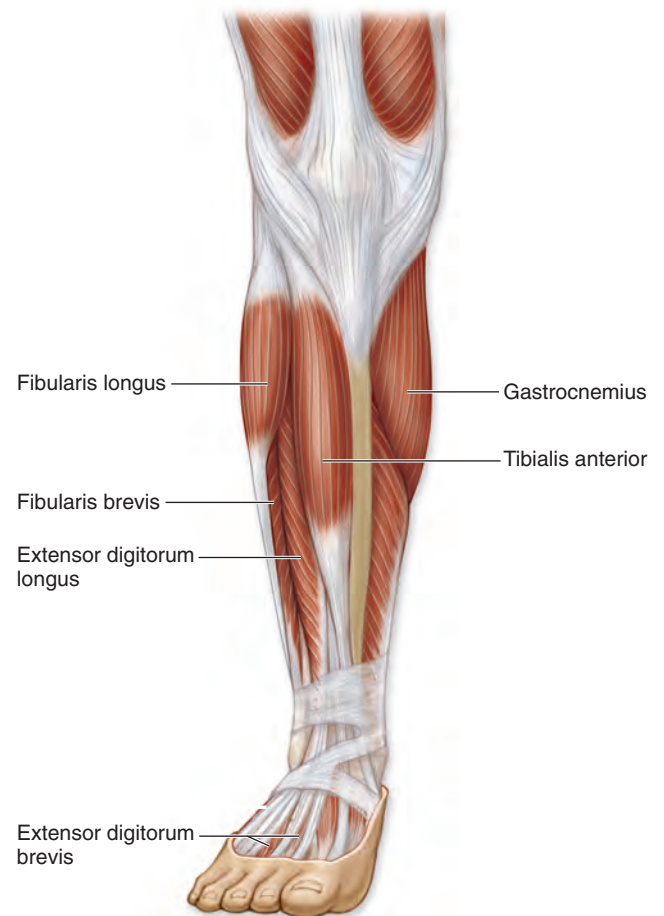


Figure 2-24 Muscles of the right anterior leg.

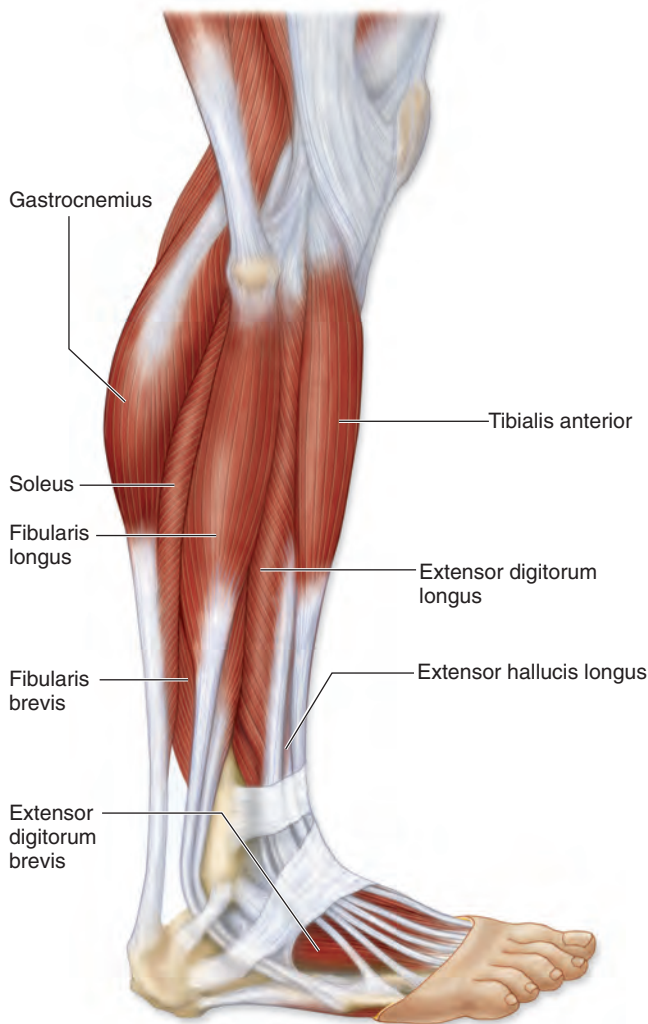


Figure 2-25 Muscles of the right lateral leg.

example is the hyaline cartilage plate between bones, which is functionally classified as synarthrosis.

Synovial: With these joints, articulating bones are surrounded by a joint capsule of ligaments and synovial membranes; the ends of articulating bones are covered by hyaline cartilage and separated by synovial fluid. Several types are listed here. See Figure 2-27. Synovial joints are functionally classified as diarthrosis or freely movable joints.

1. **Ball-and-Socket:** The ball-shaped head of one bone articulates with the cup-shaped cavity of another bone. This movement occurs in all planes and rotations. Examples include the shoulder and hip.
2. **Condylloid:** The oval-shaped condyle of one bone articulates with the elliptical cavity of another. A variety of movements occur in different planes but no rotation. An example is the joints between the metacarpals and phalanges.

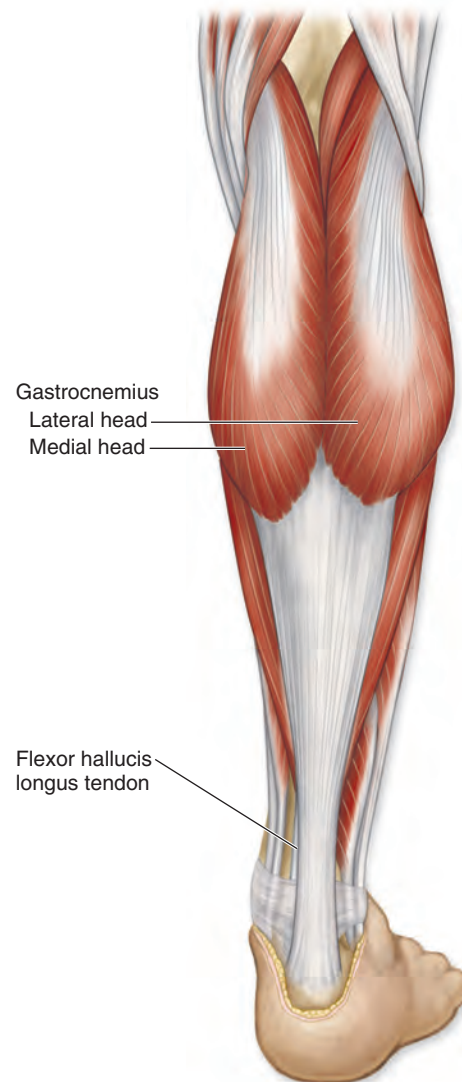


Figure 2-26 Muscles of the right posterior leg.



Go to the Online Learning Center at www.mhhe.com/massagereview2e to practice identifying muscles of the leg.

3. **Gliding:** Articulating surfaces are nearly flat or slightly curved, which provides sliding or twisting movements. Gliding joints occur between various bones of the wrist and ankle, sacroiliac joint, joints between ribs two and the sternum and rib 7 and the sternum.
4. **Hinge:** The convex surface of one bone articulates with the concave surface of another. This makes flexion and extension possible, for example, in the elbows, joints of phalanges, and knees.
5. **Pivot:** The cylindrical surface of one bone articulates with ring of bone and ligament, and rotates around

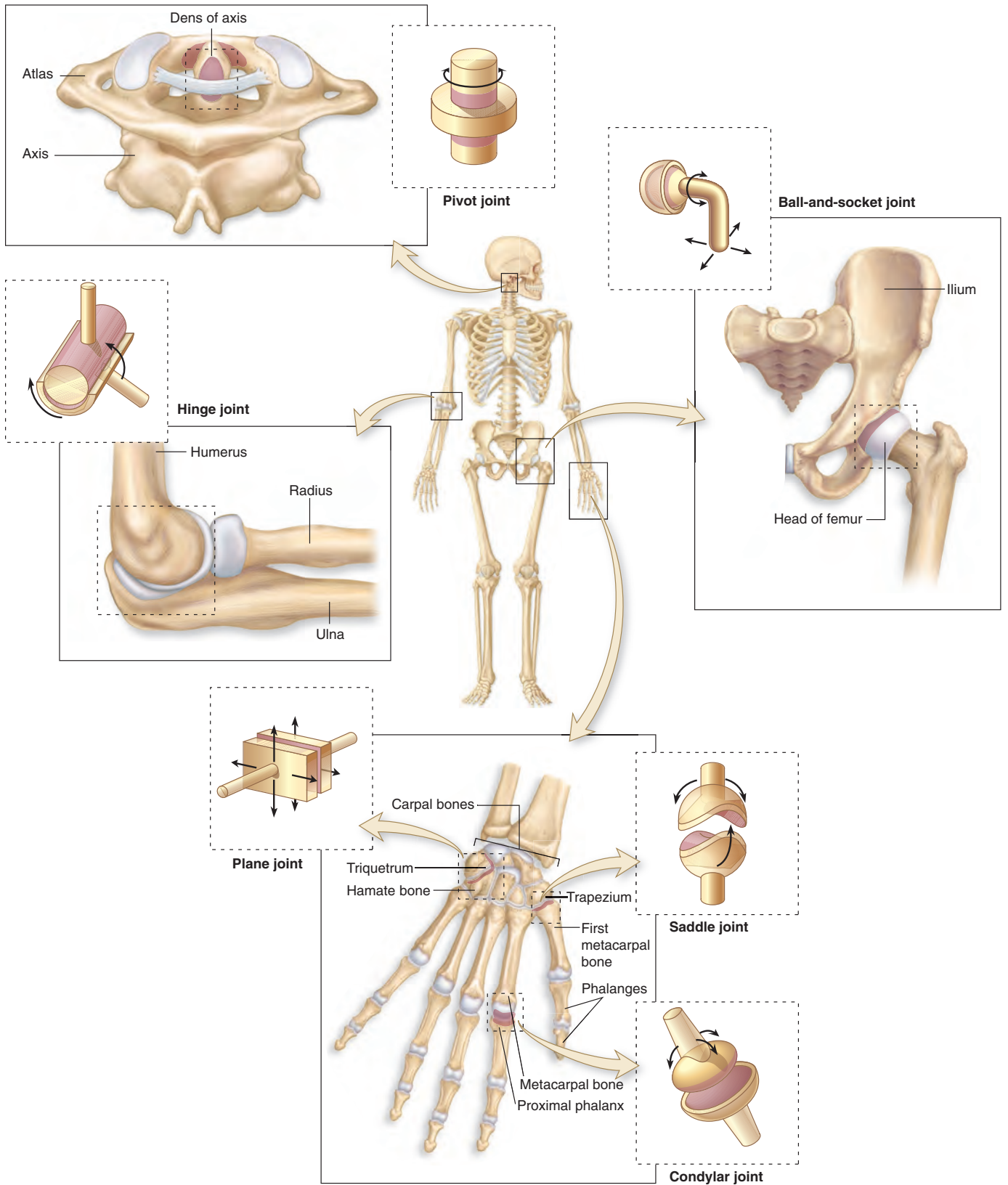


Figure 2-27 Types of synovial joints.



Go to the Online Learning Center at www.mhhe.com/massageandreview2e to practice identifying these joints.

a central axis. An example is the joint between the proximal ends of the radius and ulna.

6. **Saddle:** Articulating surfaces have both concave and convex regions; the surface of one bone fits the complementary surface of another, providing a variety of movements, for example, the joints between the carpal and metacarpal of the thumb.

Dermatomes

Dermatomes: These are band-like unilateral patterns of peripheral nerves or an area or section supplied by a single spinal nerve. This means that the skin of the body may be divided into sensory segments that collectively make up a dermatome map. (See Figure 2-28.)

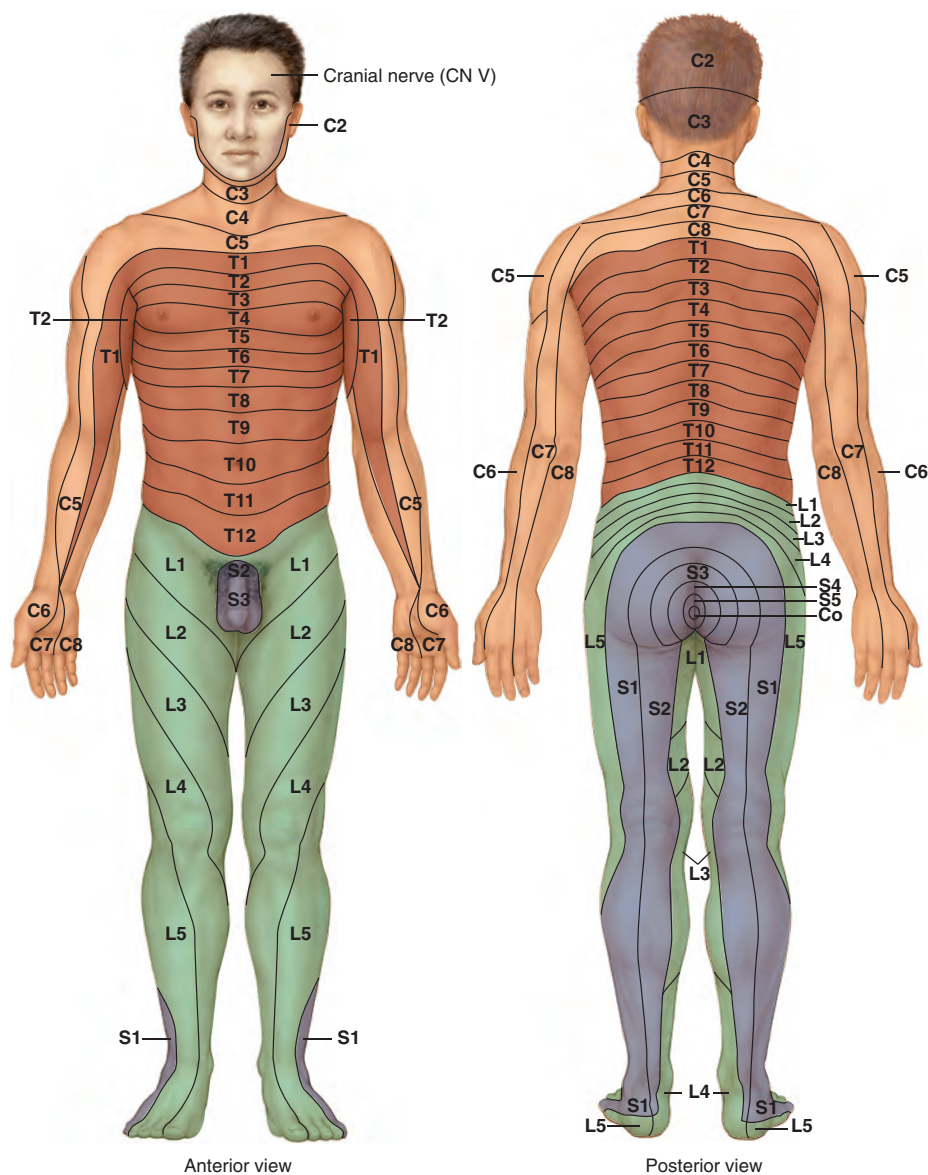


Figure 2-28 The dermatomes.

Nutrition

The Six Basic Nutrients

Six basic nutrients are needed in order for our bodies to survive.

Water: Water assists in many chemical functions, such as the formation of ATP. That is one reason we feel fatigued when we are dehydrated. Generally it is recommended to drink half your body weight in ounces of water daily; however, some disease situations contradict that. For example, those with congestive heart failure should follow the recommendations of their physician as to how much water they should drink.

Protein: Twelve to twenty percent of our diet should be made up of protein. Food sources include meats, poultry, beans, and legumes. Protein helps to repair and rebuild muscle. It does not *build* muscle as some think . . . exercise does!

Carbohydrates: Carbohydrates should make up fifty-five to sixty percent of our total diet. Carbohydrates help us to hold onto needed water. We have simple carbohydrates (refined sugars) that should be limited in our diet and complex carbohydrates (breads, pastas, cereals) that benefit our bodies and provide necessary energy. Carbohydrates are our primary fuel source—your brain uses twenty percent of all carbohydrates just to function. Some carbohydrates are high glycemic (good to eat after a bout of exercise to replace the fuel used), and others are mid/low glycemic (best to eat before a long bout of exercise).

Fats: Fats should make up no more than thirty percent of our total diet. Saturated fats are the bad fats that are generally solid at room temperature and should be no more than ten percent of our diet. Unsaturated fats are

oils or liquid at room temperature and should make up no more than twenty percent of our caloric intake. Cholesterol falls into the fat category.

Vitamins: Vitamins have no caloric value but play a big role in a healthy diet. We have water soluble vitamins (B and C). If too much is ingested, our bodies expel the excess through the urine. Fat soluble vitamins (A, D, E, and K) are not expelled easily. Excesses are stored in the body fat and can create toxicity.

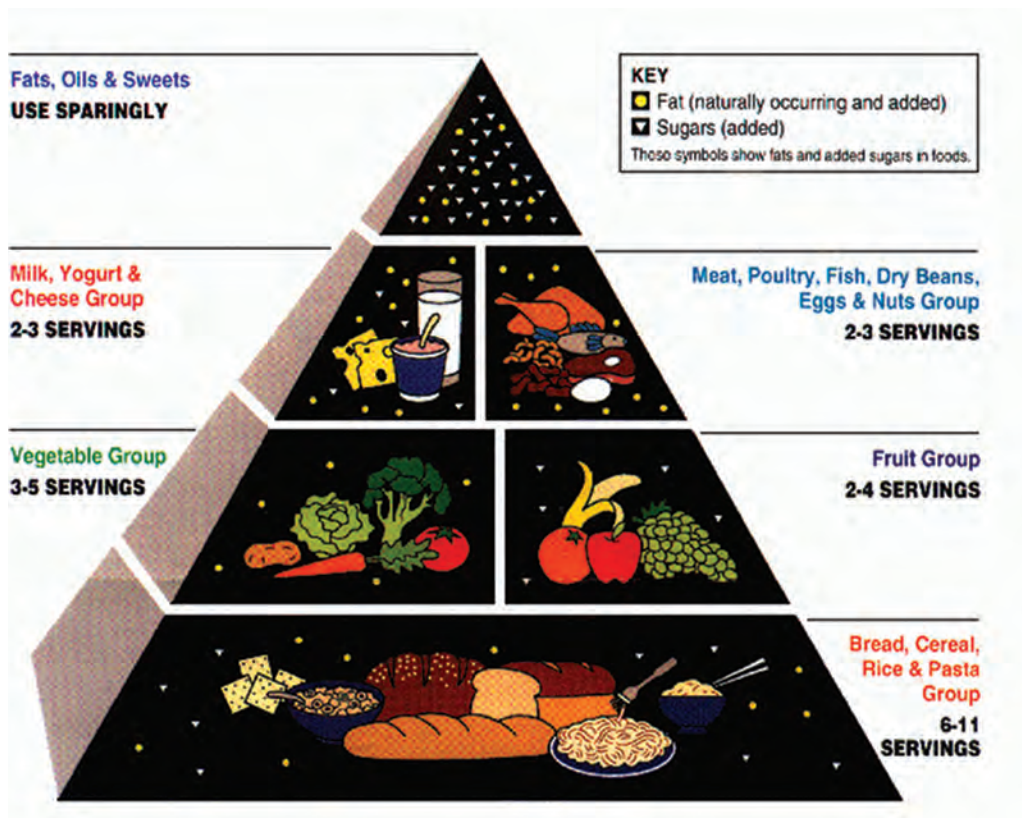
Minerals: Minerals are generally needed only in trace amounts. However, two minerals of concern to women are iron (important during the menstrual cycle years) and calcium (important during bone growing years of eleven to twenty-five and postmenopausal years). If supplemental iron or calcium is taken, it should be through a physician's recommendation.

Remember, our role in nutrition is to provide basic information, follow the FDA Food Guide Pyramid (Figure 2-29), and refer to a registered and licensed dietitian or the client's physician.

Memory Helper

Cholesterol

There are two main types of cholesterol: HDL (high density lipoproteins), which are the good or "happy" cholesterol, and LDL (low density lipoprotein), which are the bad or "lousy" cholesterol.



Anatomy of MyPyramid

One size doesn't fit all

USDA's new MyPyramid symbolizes a personalized approach to healthy eating and physical activity. The symbol has been designed to be simple. It has been developed to remind consumers to make healthy food choices and to be active every day. The different parts of the symbol are described below.

Activity

Activity is represented by the steps and the person climbing them, as a reminder of the importance of daily physical activity.

Moderation

Moderation is represented by the narrowing of each food group from bottom to top. The wider base stands for foods with little or no solid fats or added sugars. These should be selected more often. The narrower top area stands for foods containing more added sugars and solid fats. The more active you are, the more of these foods can fit into your diet.

Personalization

Personalization is shown by the person on the steps, the slogan, and the URL. Find the kinds and amounts of food to eat each day at MyPyramid.gov.

Proportionality

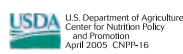
Proportionality is shown by the different widths of the food group bands. The widths suggest how much food a person should choose from each group. The widths are just a general guide, not exact proportions. Check the Web site for how much is right for you.

Variety

Variety is symbolized by the 6 color bands representing the 5 food groups of the Pyramid and oils. This illustrates that foods from all groups are needed each day for good health.

Gradual Improvement

Gradual improvement is encouraged by the slogan. It suggests that individuals can benefit from taking small steps to improve their diet and lifestyle each day.



USDA is an equal opportunity provider and employer.

GRAINS

VEGETABLES

FRUITS

STO

MILK

MEAT & BEANS

MyPyramid.gov
STEPS TO A HEALTHIER YOU

Figure 2-29 The FDA Food Guide Pyramid. In 2005, the FDA announced a new food pyramid, seen here alongside the previous pyramid, which you will need to know for your exam.

Strategies to Success

Test-Taking Skills

No tricks, just focus!

Always read all of the responses to a question before answering. If you choose an answer too quickly, you might miss the best answer. Do not make assumptions about the questions and how the writer of the question might be trying to trick you. Use only the information provided in the question, and choose the best answer based on your knowledge of the subject.

*Some questions are not directly addressed in this chapter, but are meant to act as a general review of subjects studied in various school curriculums.

Questions

Detailed Knowledge of Anatomy, Physiology, and Kinesiology

NCETM (26%); MBLEx (11%); and NCETMB (26%)

- The type of stretching where temporary lengthening of the muscle is the goal is called
 - stretch reflex.
 - elastic elongation.
 - plastic elongation.
 - post-event stretch.
- When the anterior superior iliac spine (ASIS) is lower than the posterior superior iliac spine (PSIS) in postural analysis, this means
 - an anterior pelvic tilt.
 - a posterior pelvic tilt.
 - a high hip.
 - None of the above are correct.
- The insertion of the sternocleidomastoid is
 - manubrium.
 - medial clavicle.
 - sternum.
 - mastoid process.
- Two muscles that insert on rib 1 are
 - posterior scalenes and anterior scalenes.
 - middle scalenes and anterior scalenes.
 - posterior scalenes and sternocleidomastoid.
 - posterior scalenes only.
- The muscle that is also known as the "six pack" is the
 - external oblique.
 - rectus abdominus.
 - internal oblique.
 - transverse abdominus.
- The insertion for the triceps brachii is
 - radial tuberosity.
 - supraglenoid fossa.
 - coracoid process.
 - olecranon process.
- External rotators of the shoulder are
 - supraspinatus and teres minor.
 - subscapularis and supraspinatus.
 - teres major and infraspinatus.
 - teres minor and infraspinatus.
- A band of connective tissue that wraps around tendons is called
 - retinaculum.
 - aponeurosis.
 - fascia.
 - myocardium.
- If your client has an anterior pelvic tilt, this means that the
 - hamstrings are tight and the rectus femoris is stretched.
 - rectus femoris is tight and the biceps femoris is stretched.
 - biceps femoris is tight and the rectus femoris is stretched.
 - hamstrings are tight and the iliopsoas is stretched.
- If your client has an exaggerated outward curve of the thoracic spine, he or she is
 - kyphotic.
 - lordotic.
 - sway back.
 - scoliotic.
- Your client is internally rotated at the shoulders. This means you need to focus on what muscles in his or her massage session?
 - infraspinatus and teres minor
 - latissimus dorsi and teres minor
 - supraspinatus and latissimus dorsi
 - subscapularis and latissimus dorsi
- Which of the following represents poor body mechanics or positioning?
 - bending at the waist to increase leverage
 - hands and arms relaxed to the side of the body
 - knees slightly bent with weight evenly distributed on both feet
 - shoulders relaxed

13. The anterior cruciate ligament attaches the
 - A. humerus to the radius.
 - B. anterior side of each vertebrae.
 - C. femur and the tibia.
 - D. fibula and the femur.
14. What type of muscle is NOT striated?
 - A. visceral
 - B. cardiac
 - C. mylineated
 - D. skeletal
15. The vastus lateralis muscle inserts at the
 - A. posterior medial tibial condyle.
 - B. tibial tuberosity.
 - C. posterior lateral tibial condyle.
 - D. ischial tuberosity.
16. The nerve endings located in the tendon that protect the tendon and muscle from over-contracting and are over-ridden in fight or flight are called
 - A. Golgi tendon organs.
 - B. muscle spindles.
 - C. proprioceptors.
 - D. stretch reflex.
17. The hip joint is made up of
 - A. the femur and infraglenoid fossa.
 - B. the femur and the pubic symphysis.
 - C. the femur and the acetabulum.
 - D. the femur and the ischium.
18. The medial malleolus is the distal end of the
 - A. radius.
 - B. ulna.
 - C. tibia.
 - D. fibula.
19. The muscles that perform mastication are the
 - A. masseter, medial pterygoid, lateral pterygoid, and temporalis.
 - B. masseter, suprahyoid, platysma, and temporalis.
 - C. masseter, omohyoid, temporalis, and platysma.
 - D. masseter, medial pterygoid, lateral pterygoid, and platysma.
20. The deep six hip rotators include all of the following except
 - A. gemellus superior.
 - B. gemellus interior.
 - C. quadratus femoris.
 - D. obturator internus.
21. Which of the following muscles does NOT attach to the os coxae?
 - A. internal oblique
 - B. sartorius
 - C. vastus lateralis
 - D. semimembranosus
22. What are the three muscles that attach to the coracoid process?
 - A. pectoralis minor, biceps brachii, and coracobrachialis
 - B. pectoralis major, biceps brachii, and coracobrachialis
 - C. pectoralis major, brachialis, and coracobrachialis
 - D. pectoralis minor, brachialis, and coracobrachialis
23. The tibialis anterior muscle attaches at the base of the
 - A. first metatarsal and dorsiflexes the foot.
 - B. first metatarsal and plantar flexes the foot.
 - C. fifth metatarsal and dorsiflexes the foot.
 - D. fifth metatarsal and plantar flexes the foot.
24. Another name for a hairline fracture is a
 - A. stress fracture.
 - B. comminuted fracture.
 - C. compression fracture.
 - D. compound fracture.
25. The joint type that allows for the most range of motion is the
 - A. diarthroses.
 - B. synchondrosis.
 - C. sutured.
 - D. fibrous.
26. The ligament that helps support the femur-tibia joint is the
 - A. deltoid ligament.
 - B. anterior cruciate ligament.
 - C. glenoid labrum.
 - D. femoral acetabulum ligament.
27. Your client has hurt his or her ankle. It is very swollen and discolored. He or she may have what type of injury?
 - A. a third-degree sprain
 - B. a third-degree strain
 - C. a first-degree sprain
 - D. a first-degree strain
28. A muscle that when tight can cause sciatica and externally rotate the hip is the
 - A. gluteus maximus.
 - B. gluteus minimus.
 - C. iliopsoas.
 - D. piriformis.
29. A muscle that flexes the knee and extends the hip is the
 - A. biceps femoris.
 - B. rectus femoris.
 - C. vastus lateralis.
 - D. gluteus maximus.

30. All of the following are rotator cuff muscles except the
- teres minor.
 - teres major.
 - subscapularis.
 - supraspinatus.
31. The origin of the deltoid muscle is the
- lateral one-third of clavicle, acromion process, and crest of scapular spine.
 - medial one-third of clavicle, acromion process, and crest of scapular spine.
 - lateral one-third of clavicle, glenoid fossa, and crest of scapular spine.
 - deltoid tuberosity.
32. What nerve innervates the trapezius?
- spinal accessory
 - long thoracic
 - pectoral nerve
 - trapezius nerve
33. What is the insertion of the long head of the triceps?
- olecranon process
 - infraglenoid fossa
 - supraglenoid fossa
 - coracoid process
34. What muscles flex the elbow?
- triceps and anconeus
 - brachialis, biceps brachii, and supinator
 - brachioradialis, supinator, and coracobrachialis
 - pronator teres, brachioradialis, and brachialis
35. What muscles extend the elbow?
- triceps and anconeus
 - brachialis, biceps, and supinator
 - brachioradialis, supinator, and coracobrachialis
 - pronator teres, brachioradialis, and brachialis
36. What are the boundaries/borders of the cubital fossa?
- semitendonosis, sartorius, and biceps femoris.
 - brachioradialis, pronator teres, and the line between the humeral epicondyles.
 - adductor magnus, gracilis, and adductor brevis.
 - None of the above are correct.
37. What two muscles are connected by the broad epicranial aponeurosis?
- temporalis and occipitalis
 - temporalis and frontalis
 - frontalis and occipitalis
 - frontalis and masseter
38. The meeting of the ilium, ischium, and pubis forms the
- pubis symphysis.
 - ischial tuberosity.
 - ramus.
 - acetabulum.
39. The ligaments that help prevent rotation of the knee are the
- anterior cruciate and the posterior cruciate.
 - medial collateral and the lateral collateral.
 - the inferior cruciate and the superior cruciate.
 - the patellar ligament.
40. Which specific joint in the body is the most mobile?
- the shoulder
 - the hip
 - the metacarpal-phalange
 - the wrist
41. Synovial joints functional classification is
- synarthrosis.
 - diarthrosis.
 - amphiarthrosis.
 - symphysis.
42. The mouth opens in a hinge-like motion due to which joint?
- temporopeteygoid joint
 - maxilla-mandibular joint
 - ethmoid-sphenoid joint
 - temporomandibular joint
43. Paresthesia is a medical term for
- paralysis.
 - prickly, tingling feeling in a limb.
 - an abnormal opening.
 - excessive thirst.
44. How many types of synovial joints are there?
- three
 - four
 - five
 - six
45. Which of the following is NOT one of the carpal bones?
- hamate
 - scaphoid
 - lunate
 - cuneiform
46. All of the following muscles form the tendon of the ligamentum patellae except
- rectus femoris.
 - vastus lateralis.
 - biceps femoris.
 - vastus intermedius.
47. The weight-bearing part of the foot is
- calcaneus.
 - heads of metatarsal bones one and five.
 - heads of metatarsal bones one through five.
 - Both A and B are correct.

48. The border of the posterior triangle of the neck are all of the following except
- middle one-third of the clavicle.
 - sternocleidomastoid.
 - latissimus dorsi.
 - trapezius.
49. Hinge joints allow what type of movements?
- abduction and adduction
 - medial and lateral rotation
 - flexion and extension
 - circumduction
50. The cartilage that surrounds and protects the ends of long bones is called
- fibrocartilage.
 - hyaline cartilage.
 - periosteum.
 - None of the above are correct.
51. The class of joints where bones or cartilage are joined only by fibrous tissue are called
- fibrous.
 - syndesmosis.
 - hinge.
 - condylar.
52. The bony projection on C2 is called the
- axis.
 - atlas.
 - odontoid.
 - None of the above are correct.
53. Movement between C1 and the skull is
- flexion/extension.
 - lateral flexion.
 - rotation.
 - No movement occurs here.
54. Movement between C1 and C2 is
- flexion/extension.
 - lateral flexion.
 - rotation.
 - No movement occurs here.
55. What bone is on the anterior neck?
- thyroid
 - cricoid
 - hyoid
 - thymus
56. All of the following muscles form the border of the popliteal fossa except
- biceps femoris.
 - gastrocnemius.
 - semimembranosus.
 - gracilis.
57. Which of the following is a rounded bony landmark that is for articulation?
- epicondyle
 - tuberosity
 - condyle
 - fossa
58. What structure in the popliteal fossa makes this area an endangerment site?
- sciatic nerve
 - tibial nerve
 - the posterior thigh nerve
 - peroneal nerve
59. What anatomical structure should be avoided when massaging around the sartorius and adductor longus muscles?
- sciatic nerve
 - popliteal artery
 - inferior vena cava
 - femoral artery
60. All of the following are general effects of heat except
- increased blood flow.
 - decreased metabolic rate.
 - increased pulse rate.
 - dilation of peripheral blood vessels.
61. Which of the following is considered an ellipsoidal joint?
- wrist
 - elbow
 - knee
 - hip
62. Your client has had an inversion ankle sprain. The muscle that should be strengthened is the
- tibialis anterior.
 - posterior tibialis.
 - gastrocnemius.
 - peroneus longus.
63. The carotid sinus is located
- posterior neck triangle.
 - anterior neck triangle.
 - brachial plexus area.
 - deltpectoral area.
64. Ligaments are
- slow to heal.
 - receive poor blood supply.
 - attach bone to bone.
 - All of the above are correct.

65. The lubricating fluid that is found in moveable joints is called
- serous fluid.
 - synovial fluid.
 - arthropometric fluid.
 - diarthrotic fluid.
66. The anterior superior iliac spine is located on which bone?
- vertebrae
 - hyoid
 - ischium
 - ilium
67. This joint allows pronation and supination of the hand
- radioulnar.
 - intercarpal.
 - radiocarpal.
 - ulnocarpal.
68. The abdominal muscle group includes all of the following except
- rectus femoris.
 - rectus abdominus.
 - internal oblique.
 - external oblique.
69. The coranoid process is located on the
- radius.
 - ulna.
 - scapula.
 - clavicle.
70. The most abundant and widely distributed tissue of the body is
- connective tissue.
 - epithelial tissue.
 - serous tissue.
 - tendons.
71. Which muscle is the only muscle that moves the head but does not attach to any vertebrae?
- scalenes
 - trapezius
 - splenius capitus
 - sternocleidomastoid
72. The muscle that can entrap the brachial nerve, artery, and vein is pectoralis minor and
- SCM.
 - scalenes.
 - splenius capitus.
 - None of the above are correct.
73. Which of the following is not a function of the muscular system?
- creating external and internal movement
 - maintaining posture
 - production of heat
 - exchange of gases
74. The ischial tuberosity is located on the
- ischium.
 - ilium.
 - sacrum.
 - pubic bone.
75. The largest joint in the body
- shoulder.
 - knee.
 - hip.
 - elbow.
76. The sensory receptors stimulated by both tension and excessive stretch and activated an inhibitory response in the motor neuron are called
- muscle spindles.
 - Golgi tendon organs.
 - baroreceptors.
 - proprioceptors.
77. Which muscle crosses two joints?
- anconeus
 - brachialis
 - gastrocnemius
 - soleus
78. The function of ligaments is
- to provide mobility.
 - to stabilize the joint.
 - to cushion.
 - None of the above are correct.
79. The sciatic nerve can be compressed and irritated when which muscle is tight?
- biceps femoris
 - rectus abdominus
 - adductor magnus
 - piriformis
80. The type of movement that occurs at the distal radioulnar joint is
- gliding.
 - abduction.
 - circumduction.
 - rotation.
81. Your client's lower back hurts when he or she lies flat. The muscles that might be tight would be
- iliopsoas and rectus femoris.
 - iliopsoas and biceps femoris.
 - quadratus femoris and rectus femoris.
 - quadratus lumborum and biceps femoris.

82. Winged scapula is weakness in which muscle?
A. supraspinatus
B. infraspinatus
C. serratus anterior
D. subscapularis
83. From the anatomical position, the semitendinosus is immediately superficial to the
A. biceps femoris.
B. semimembranosus.
C. rectus femoris.
D. plantaris.
84. Fats are classified as
A. solid or liquid.
B. saturated or unsaturated.
C. water soluble or fat soluble.
D. Both A and B are correct.
85. The largest sesamoid bone in the body is the
A. ischial tuberosity.
B. xiphoid process.
C. patella.
D. malleolus.
86. The muscles used in forced expiration are
A. diaphragm and abdominals.
B. abdominals.
C. internal and external intercostals.
D. external intercostals and levator scapula.
87. The joint that is generally involved in a shoulder separation is the
A. glenohumeral.
B. acromioclavicular.
C. coracoid-humeral.
D. humeral-scapular.
88. Migraine headaches are generally
A. tension headaches.
B. vascular headaches.
C. phantom headaches.
D. All of the above are correct.
89. A tough, dense material that has the greatest tensile strength and is found in the intervertebral discs is
A. elastic cartilage.
B. fibrocartilage.
C. hyaline cartilage.
D. osseous cartilage.
90. This is referred to as the yes-yes joint
A. atlanto-occipital joint.
B. atlantoaxial joint.
C. acromioclavicular joint.
D. the occipital-temporal joint.
91. The bones of the vertebral column, skull, hyoid, and pelvis make up the
A. appendicular skeleton.
B. diarthrotic skeleton.
C. axial skeleton.
D. axis skeleton.
92. The pes anserine is made up of all of the following muscles except
A. sartorius.
B. semimembranosus.
C. gracilis.
D. semitendinosus.
93. Golfer's elbow is irritation on the
A. lateral epicondyle.
B. medial epicondyle.
C. olecranon process.
D. radial tuberosity.
94. This bone is also known as the atlas
A. C2.
B. C1.
C. L2.
D. S1.
95. Slow, light, and rhythmic movements are soothing to the nerves because they produce a low level of excitement to the nervous system, whereas vigorous movements
A. stimulate the parasympathetic nervous system.
B. decrease synaptic transmission.
C. excite nociceptors.
D. stimulate the sympathetic nervous system.
96. The receptors for vibration and touch are called the
A. proprioceptors.
B. nociceptors.
C. mechanoreceptors.
D. noreceptors.
97. First stages of healing result in
A. increased fibrin production.
B. histamine release.
C. redness of skin.
D. collagen remodeling.
98. Functions of the connective tissue include all of the following except
A. nutrient transportation.
B. defense against disease.
C. clotting mechanisms.
D. neural transport.

99. Fluid found in all diarthrotic joints is
- synovial.
 - serous.
 - tissue.
 - visceral.
100. Nerve endings that are pressure sensitive and respond to skin displacement are
- free nerve endings.
 - Meissner's corpuscles.
 - Pacinian's corpuscles.
 - Krause's end bulbs.
101. What layer of connective tissue wraps around the entire muscle?
- endomysium
 - ectomysium
 - perimysium
 - epimysium
102. Which bones are not one of the five classifications?
- long
 - short
 - regular
 - sesmoid
103. Certain massage strokes create minute muscle contractions by
- increasing Golgi tendon organs response.
 - increasing muscle spindle activity.
 - increasing lymph flow.
 - stimulation of the myosin.
104. Cartilage that is found on the tip of the nose and the lobes of the ears is called
- fibrocartilage.
 - hyaline cartilage.
 - meniscus.
 - elastic cartilage.
105. Carbohydrates are classified as
- solid or liquid.
 - mono-, di-, tri-, and polysaccharides.
 - water soluble or fat soluble.
 - saturated or unsaturated.
106. All of the following are types of connective tissue except
- blood.
 - cartilage.
 - ligaments.
 - organs.
107. All of the following are functions of adipose tissue except
- protection.
 - thermal heat.
 - movement.
 - insulation.
108. The ability of a muscle to return to its original shape after being stretched is known as
- irritability.
 - contractibility.
 - plastic elongation.
 - PNF.
109. The three main types of connective tissue of the skeletal or muscular system are all of the following except
- ligaments.
 - joint capsule.
 - cartilage.
 - tendons.
110. The common origin of the hamstrings is the
- medial tibial condyle.
 - lateral tibial condyle.
 - PSIS.
 - ischial tuberosity.
111. Which area of the spine has the most vertebrae?
- cervical
 - thoracic
 - lumbar
 - sacral
112. The name of the upper jaw bone is the
- zygomatic.
 - masseter.
 - mandible.
 - maxilla.
113. Receptors responding to air vibrations or sound waves are the
- mechanoreceptors.
 - chemoreceptors.
 - photoreceptors.
 - nociceptors.
114. Lumbricles are located in the
- hands.
 - feet.
 - lumbar vertebrae.
 - Both A and B are correct.
115. Small canals found in the bone that help to nourish it are called
- Pacinian canals.
 - Haversian canals.
 - Meissner canals.
 - marrow.
116. The capitulum of the humerus articulates with
- lateral condyles of the humerus.
 - olecranon.
 - ulnar head.
 - radial head.

117. The sternum articulates with how many ribs?
- twelve pairs
 - six pairs
 - seven pairs
 - five pairs
118. The greater amount of rotation in the spine occurs in the
- thoracic region.
 - cervical region.
 - lumbar region.
 - sacral region.
119. Which bone is not in the distal row of the carpals?
- capitate
 - hamate
 - lunate
 - trapezoid
120. What are the major actions of the peroneus longus and brevis?
- Inversion and dorsiflexion of the foot
 - Inversion and plantar flexion of the foot
 - Eversion and plantar flexion of the foot
 - Eversion and dorsiflexion of the foot
121. Your client has an anterior pelvic tilt. In addition to the quads and iliopsoas, what other muscle would tilt the pelvis anteriorly if tight?
- gluteus maximus
 - piriformis
 - biceps femoris
 - Tensor fascia latae/ITB
122. The quadriceps muscles are all of the following except
- vastus lateralis.
 - rectus femoris.
 - biceps femoris.
 - vastus intermedius.
123. What is the largest muscle in the body?
- sartorius
 - gluteus maximus
 - quadriceps
 - abdominus
124. When the quads receive information to contract and the hamstrings receive information to relax, this is known as
- muscle tone.
 - atrophy.
 - reciprocal inhibition.
 - sliding filament theory.
125. The type of heat illness that is a medical emergency is
- heat cramps.
 - hypothermia.
 - heat stroke.
 - heat exhaustion.
126. If your client has an exaggerated outward curve of the thoracic spine, he or she is
- kyphotic.
 - lordotic.
 - sway back.
 - scoliotic.
127. Another term for pes planus is
- flat feet.
 - high arches.
 - lost transverse arch.
 - None of the above are correct.
128. The pear-shaped sac located on the right side of the body that stores bile is called the
- liver.
 - pancreas.
 - gallbladder.
 - stomach.
129. A client with lordosis may experience a reduction in low back discomfort if a pillow is placed under the
- abdomen in the prone position.
 - chest in the prone position.
 - pelvis in the prone position.
 - None of the above are correct.
130. Stretching can be done _____ by the therapist with no assistance from the client or _____ by the client with no assistance from the therapist.
- passively; actively
 - actively; passively
 - PNF; MET
 - ballistically; statically
131. A muscle synergistic to the biceps brachii is the
- brachialis.
 - coracobrachialis.
 - brachioradialis.
 - triceps.
132. Repetitive motion injuries are caused by
- repeated flexing and extending of a joint against resistance.
 - normal daily activities.
 - manual manipulation of tools.
 - Both A and C are correct.
133. When the hamstrings are acting as an antagonist, the movement is
- hip extension.
 - knee extension.
 - knee flexion.
 - Both A and C are correct.

134. Which muscle is not a part of the shoulder girdle group?
 A. pectoralis minor
 B. trapezius
 C. deltoid
 D. bicep brachii
135. Where is the least amount of movement in the spine?
 A. C3–C6
 B. T4–T6
 C. T1–T3
 D. L4–L5
136. The muscle that initiates shoulder abduction is
 A. the medial deltoid.
 B. supraspinatus.
 C. subscapularis.
 D. latissimus dorsi.
137. Plantar fasciitis can be caused by all of the following except
 A. old shoes.
 B. high arches.
 C. low arches.
 D. tight peroneals.
138. When slowly sitting down in a chair, how are muscles being worked?
 A. hamstrings concentrically
 B. quadriceps eccentrically
 C. gluteals concentrically
 D. all of the above
139. Which muscle abducts the hip?
 A. gluteus maximus
 B. gluteus medius
 C. hamstrings
 D. gracilis
140. Another name for the cheek bone is the
 A. temporalis bone.
 B. ethmoid bone.
 C. zygomatic bone.
 D. pterygoid.
141. The ITB is _____ to the gracilis.
 A. medial
 B. lateral
 C. superior
 D. proximal
142. The function of the masseter muscle is to
 A. extend the jaw.
 B. retract the jaw.
 C. open the jaw.
 D. close the jaw.
143. Which muscle helps us to smile?
 A. zygomaticus
 B. masseter
 C. orbicularis oris
 D. temporalis
144. When the serratus anterior contracts, what movement takes place?
 A. scapular retraction
 B. scapular protraction
 C. scapular elevation
 D. scapular depression
145. Which muscle depresses the ribs?
 A. scalenes
 B. pectoralis minor
 C. internal intercostals
 D. external intercostals
146. Which muscle is also known as the “hip hiker”?
 A. quadratus femoris
 B. quadratus lumborum
 C. quadratus teres
 D. latissimus dorsi
147. The trapezius is _____ to the rhomboids.
 A. superficial
 B. deep
 C. medial
 D. superior
148. In placing the bolster under the ankle when the client is prone, you are preventing excessive
 A. dorsiflexion of the ankle.
 B. flexion of the knee.
 C. plantar flexion.
 D. None of the above are correct.
149. The metacarpals are _____ to the carpals.
 A. proximal
 B. distal
 C. medial
 D. lateral
150. Muscles that adduct the femur include all of the following except
 A. adductor magnus.
 B. gracilis.
 C. sartorius.
 D. pectineus.
151. In lordosis, which muscles would be weakened?
 A. quadriceps
 B. hamstrings
 C. iliopsoas
 D. quadratus lumborum
152. When the body is standing with the hands supinated, arms slightly abducted, and feet facing forward, this is known as the
 A. Traditional Chinese Medicine anatomical position.
 B. Northern anatomical position.
 C. Western anatomical position.
 D. essential medical position.

153. With your client's elbow bent to ninety degrees, you apply resistance as he pulls his hand toward the navel. Pain is felt. This would be inflammation of
- latissimus dorsi.
 - pectoralis major.
 - subscapularis.
 - All of the above are correct.
154. The most common ankle sprain is the inversion sprain because
- the medial malleolus is lower on the medial side.
 - because the stronger ligaments are on the lateral side of the ankle.
 - because the lateral malleolus is lower on the lateral side.
 - because talo fibular ligament is not in a mechanically strong place.
155. You are performing a push-up. You get about halfway off the floor and cannot push the rest of the way up. You struggle to go up, but you will not move. What type of muscle contraction is occurring on the biceps brachii?
- isometric
 - isotonic
 - eccentric
 - concentric
156. Your client states he or she was running outdoors, planted his or her foot and twisted the knee, which is now painful and swollen. What structure may be damaged?
- the ACL
 - the PCL
 - the MCL
 - the patellar tendon
157. Which rotator cuff muscle does not rotate the humerus?
- supraspinatus
 - infraspinatus
 - teres minor
 - subscapularis
158. Which end of the muscle has the most movement?
- the ligament
 - the insertion
 - the origin
 - none of the above
159. The "kissing" muscle is the
- buccinator.
 - masseter.
 - orbicularis oris.
 - platysma.
160. Which of the following is not part of the iliopsoas muscle?
- iliacus
 - psoas major
 - psoas minor
 - iliacus major
161. If the erector spinae is contracted bilaterally, this would result in
- scoliosis.
 - kyphosis.
 - rotation.
 - lordosis.
162. If a client has torn his or her supraspinatus muscle, he or she will not be able to
- open a door.
 - hold his or her arm out to the side.
 - push a grocery cart.
 - None of the above are correct.
163. If a client has drop foot, the muscle affected is
- gastrocnemius.
 - soleus.
 - anterior tibialis.
 - peroneals.
164. A concentric contraction of the biceps femoris results in
- hip extension.
 - hip flexion.
 - knee extension.
 - internal hip rotation.
165. A concentric contraction of the biceps brachii results in
- elbow extension.
 - shoulder extension.
 - shoulder adduction.
 - elbow flexion.
166. When standing and performing trunk flexion, the primary muscle mover is
- rectus abdominus.
 - internal/external oblique.
 - erector spinae eccentrically.
 - None of the above are correct.
167. In order to strengthen anterior tibialis, your client can
- walk on his or her heels only.
 - walk on his or her toes.
 - perform heel raises.
 - All of the above are correct.
168. Thrusting the lower jaw forward is called
- protraction.
 - retraction.
 - elevation.
 - depression.

169. The three muscles that cause internal shoulder rotation include all of the following except
- infraspinatus.
 - latissimus dorsi.
 - pectoralis major.
 - subscapularis.
170. Starches belong to which basic nutrient group?
- proteins
 - fats
 - meats
 - carbohydrates
171. When the sole of the foot is turned outward, this is called
- inversion.
 - eversion.
 - pronation.
 - supination.
172. Which muscle flexes the knee and attaches to the fibula?
- biceps femoris
 - rectus femoris
 - semitendinosus
 - semimembranosus
173. What muscle initiates walking?
- iliopsoas
 - vastus lateralis
 - vastus medialis
 - hamstrings
174. Your client is having trouble laterally flexing his or her head. Which muscle is not involved?
- sternocleidomastoid
 - splenius capitis
 - cervical lamina
 - splenius cervicis
175. When stepping down off a curb, what kind of contraction is occurring?
- concentric on the quads
 - eccentric on the quads
 - concentric on the hamstrings
 - eccentric on the hamstrings
176. The three muscles of the erector spinae in order from most lateral to most medial are
- longissimus, spinalis, and iliocostalis.
 - spinalis, iliocostalis, and longissimus.
 - iliocostalis, spinalis, and longissimus.
 - iliocostalis, longissimus, and spinalis.
177. The most distal bones of the foot are called
- tarsals.
 - phalanges.
 - carpals.
 - metatarsals.
178. Another term for scapular adduction is
- horizontal shoulder flexion.
 - protraction.
 - retraction.
 - extension.
179. In performing a squat, the stabilizer would be
- gastrocnemius/soleus.
 - rectus abdominus.
 - iliopsoas.
 - hamstrings.
180. The fat-soluble vitamins include all of the following except
- A.
 - E.
 - B.
 - K.
181. The basic nutrients include the following except
- carbohydrates.
 - cholesterol.
 - fats.
 - protein.
182. Guidelines to consider when using herbs or supplements include
- more is not necessarily better.
 - ask friends their dosage since one dosage is suitable for all.
 - if the dosage does not work quickly, change your dosage.
 - All of the above are correct.
183. An excellent natural antibiotic is
- basil.
 - jojoba.
 - licorice.
 - garlic.
184. The appropriate amount of carbohydrates in the diet according to the American Dietetic Association (ADA) is
- twelve to twenty percent.
 - forty-five to sixty-five percent.
 - ten to twenty percent.
 - more than thirty percent.
185. The most unhealthy fats are called
- unsaturated.
 - HDL.
 - saturated.
 - LDL.
186. High glycemic foods are
- foods that are low in sugar.
 - foods that are high in sugar.
 - foods best eaten before a long bout of exercise.
 - Both A and C are correct.

187. _____ are one of the six basic nutrients with no caloric value that are needed in the body in small (trace) amounts.
- Vitamins
 - Proteins
 - Minerals
 - Fats
188. Vitamins that can be harmful to the body if taken in huge amounts are called
- fat soluble.
 - water soluble.
 - vitamin C.
 - vitamin B.
189. One gram of fat equals _____ calories.
- four
 - seven
 - nine
 - twelve
190. The glucose amount that is ideal in sports drinks is
- more than ten percent.
 - ten to twelve percent.
 - less than five percent.
 - six to eight percent.
191. Which vitamin best helps the body to absorb calcium?
- vitamin A
 - vitamin B
 - vitamin C
 - vitamin D
192. Which mineral is a concern for those taking diuretics because it tends to be flushed out of the body easier?
- zinc
 - potassium
 - calcium
 - chromium
193. Organic acid(s) that assist in the production of ATP are
- chromium.
 - creatine.
 - potassium.
 - Both A and B are correct.
194. A plant that is excellent to use on minor burns is
- aloe vera.
 - licorice.
 - ivy.
 - wild cherry bark.
195. The following are true concerning sugar except
- can improve the immune system.
 - contributes to obesity.
 - can increase the risk of osteoporosis.
 - can produce an acidic stomach.

Answers and Explanations

Detailed Knowledge of Anatomy, Physiology, and Kinesiology

NCETM (26%); MBLEx (11%); and NCETMB (26%)

- B** Remember, rubber bands are elastic and temporarily lengthen before going back to their original length. Plastic elongation is more permanent, like the plastic bottle that will maintain its shape. Therefore, elastic elongation is temporary and more for pre-event or pre-exercise with the goal of preparing you for exertional movement. Plastic elongation stretch is for post-exercise to help improve, in a more permanent way, flexibility.
- A** Think of your pelvis as a basin of water. Tilt the basin downward in the front, and the water spills out in front. If the pelvis does the same movement, this is an anterior pelvic tilt. In this case, the anterior superior iliac spine is tilted down or lower in front than the posterior iliac spine in back. This is commonly seen in people whose pants are higher in the back on the waist and low in front on the waist.
- D** The origin is the medial clavicle and the manubrium of the sternum. The insertion, which is the question, is the mastoid process.
- B** The posterior scalenes attaches to rib 2; the sternocleidomastoid attaches to the clavicle and the sternum, not to the ribs.
- B** When someone is very toned with low body fat, the rectus abdominus gives the appearance of separate little muscle bulges, thus the name "six pack."
- D** The other three answer choices listed are origins and insertions for the biceps brachii.
- D** Remember the EX in EXternal, the I in Infraspina-tus, and the T in Teres minor, and you have EXIT.
- A** Aponeurosis is a flat, broad tendon that attaches skeletal muscle to bone, to another muscle, or to skin; myocardium is the muscle of the heart; fascia is the lining around muscles, blood vessels, and nerves that connects them to surrounding tissue to hold them in place.
- B** An anterior pelvic tilt means muscles attaching to the anterior side of the pelvis are pulling it downward in the front (the ASIS is lower than the PSIS). Therefore muscles attaching to the ASIS and the AIIS are tight; muscles attaching to the PSIS, ischial tuberosity will be stretched.

10. A By definition, kyphosis is an exaggerated outward curve of the spine; lordosis is an exaggerated inward curve of the spine (more commonly seen in the cervical and lumbar sections of the spine).
11. D Remember LIPS—Latissimus dorsi, the action of Internal rotation, Pectoralis major, and Subscapularis. These muscles are the internal rotators of the shoulder.
12. A Bending at the waist not only puts pressure on the back, but it also probably means too much pressure is being exerted on an extended wrist, which can lead to wrist/hand problems.
13. C The anterior cruciate ligament is one of two ligaments situated behind the patella that connects the femur to the tibia.
14. A Visceral muscle needs to be smooth in order for organ functions to occur such as digestion.
15. B The vastus lateralis is one of the four quadriceps muscles. All four muscles insert at the tibial tuberosity.
16. A Golgi tendon organs protect the muscle from over-contracting; muscles spindles protect the muscle from overstretching; the stretch reflex is the combined action of the two that occurs when stretching properly. Proprioceptors assist us with balance and movement in relation to space.
17. C The infraglenoid fossa is in the shoulder (scapula); the pubis symphysis is in the anterior middle of the pelvis. The ischium is the bottom portion of the pelvis (ischial tuberosity, that on which we sit).
18. C The lateral malleolus is the distal end of the fibula. Distal means farthest away; proximal means closest to.
19. A Mastication is chewing.
20. B The six hip rotators are gemellus superior, gemellus inferior, obturator internus, obturator externus, piriformis, and the quadratus femoris.
21. C The vastus lateralis does not cross the pelvis; it only crosses the knee joint, and the os coxae is on the pelvis.
22. A The pectoralis major originates on the clavicle and ribs 1 through 6; the brachialis originates on the shaft of the humerus.
23. A While the tibialis anterior inserts on the base of the first metatarsal, it dorsiflexes the foot. Remember muscles pull; they do not push.
24. A Comminuted is shattered; compression is fractured by a compressive force; and compound is a fracture that breaks through the skin.
25. A These joints are also the synovial joints (the moveable ones).
26. B The deltoid ligament is in the ankle, the glenoid labrum is in the shoulder, and the femoral-acetabulum is in the hip joint.
27. A Third degree means tearing has occurred—a complete tear. This would also possibly tear the joint capsule causing synovial fluid to spread throughout the joint. Blood vessels would also possibly be torn, which would cause the bleeding and bruising.
28. D The sciatic nerve runs through or under the piriformis, so tightness of this muscle can cause pressure on the nerve and mimic sciatica.
29. A Rectus femoris and vastus lateralis are a part of the quadriceps group that extends, or straightens, the knee. Gluteus maximus extends the hip.
30. B SITS = Supraspinatus, Infraspinatus, Teres minor, Subscapularis.
31. A The deltoid tuberosity is the insertion of the deltoid muscle.
32. A The pectoral nerve innervates the pectoral muscles; the long thoracic muscles innervate the thoracic region. There is no trapezius nerve.
33. A The infraglenoid tubercle is the origin of the long head of the triceps, the question asked for the insertion. The other two choices are attachments for biceps brachii.
34. D One muscle not included is biceps brachii.
35. A Brachialis, biceps, and brachioradialis flex the elbow, supinator supinates the forearm, pronator teres pronates the forearm, and oracobrachialis flexes the shoulder.
36. B This is the elbow area (anterior side).
37. C This refers to the top of the head (scalp).
38. D The acetabulum is also referred to as the hip joint.
39. B Movement of the tibia anteriorly or posteriorly are handled by the ACL and the PCL. There is no such ligament in the knee as the inferior or superior cruciate. The patellar ligament attaches the patella to the tibial tuberosity and is commonly lumped in with the patellar tendon.
40. A The shoulder is the most mobile as a ball and socket joint but also the most injured.

41. **B** Synovial joints are diarthrosis (freely movable). Most fibrous joints are synarthrosis (immovable). Cartilaginous joints are amphiarthrosis (slightly movable).
42. **D** The temporomandibular joint is a hinge joint.
43. **B** This is the basic definition of paresthesia—the prickly, burning, tingling feeling you get in a limb when a nerve is damaged or compressed; also, it is the same feeling you get when your arm falls asleep.
44. **D** Hinge, ball and socket, condylar, saddle, pivot, gliding are all synovial joints.
45. **D** Cuneiform is one of the tarsals. The other carpal bones are the pisiform, triquetrum, capitate, trapezoid, and trapezium.
46. **C** Biceps femoris is one of the hamstring muscles; the others are part of the quad group.
47. **D** The medial and longitudinal arches place the pressure points on heads of metatarsals one and five and the heel (calcaneus).
48. **C** Latissimus dorsi does not border the neck.
49. **C** The other choices could be ball and socket joints or condyloid (abduction/adduction or medial/lateral rotation). Hinge joints move like a door on a hinge.
50. **B** Periosteum is the fascia around bones. Fibrocartilage cushions between bones.
51. **A** Syndesmosis is a type of fibrous joint but not a class.
52. **C** This is also known as the dens.
53. **A** This is the movement as if you are nodding “yes.”
54. **C** This is the movement as if you are nodding “no.”
55. **C** The others are cartilage; thymus is a gland.
56. **D** Gracilis is located on the medial thigh and does not border the popliteal fossa (which is the area behind the knee joint).
57. **C** Epicondyle and tuberosity are more for muscle attachments, not articulation. A fossa is not a rounded bump but a rounded groove such as the olecranon fossa of the humerus.
58. **B** The nerve located at this point of the leg is the tibial nerve.
59. **D** The femoral triangle is in this area, which includes the femoral artery and nerve.
60. **B** When internal heat goes up, blood vessels dilate in order for blood flow to reach the superficial areas, thus causing us to sweat. This requires an increase in pulse and an increase in metabolism.
61. **A** Ellipsoidal joints allow for flexion, extension, abduction, and adduction. Rotation is not permitted.
62. **D** An inversion ankle sprain means the sole of the foot has turned inward. That means the muscles on the lateral side have been stretched and need to be strengthened.
63. **B** This is also an endangerment site where the carotid artery is located (also where we often take a pulse).
64. **D** Ligaments are slow to heal because they receive little or no blood supply.
65. **B** Both C and D are made-up terms.
66. **D** The word “iliac” helps with this one.
67. **A** It is both the radius and the ulna that allow for pronation and supination movements at the wrist/hand.
68. **A** The rectus femoris is a part of the quadriceps group.
69. **B** Review bony landmarks; coracoid process is on the scapula.
70. **A** Connective tissue includes fascia, tendons, ligaments, skin, and other material.
71. **D** Scalenes attach to the transverse process of C2–C7, trapezius attaches to C1–T12, and the splenius capitus attaches to C7–T3. SCM attaches to the medial clavicle and sternum and inserts on the mastoid process.
72. **B** Because of the attachments of the three scalenes on ribs one and two, and along with the pec minor attachments on ribs three through five, tightness in this area can compress these blood vessels.
73. **D** Exchange of gases is the respiratory system.
74. **A** Just like it sounds, the word itself reveals the location.
75. **B** Although the shoulder can be pretty complicated, it is not the largest. While the hip is large, the knee is the largest of the synovial joints.
76. **B** Muscle spindles are stretch sensitive only, baroreceptors are pressure sensitive, and proprioceptors are balance sensitive.
77. **C** Review muscle anatomy: gastrocnemius crosses the knee joint (originates on the femoral condyles) and the ankle joint (attaches to the calcaneus).

78. **B** Ligaments attach bone to bone and therefore work to create a stabilized joint.
79. **D** The sciatic nerve runs either through or just under the piriformis (it can be either). Therefore, if it is tight, the nerve will be compressed and will create sciatica symptoms.
80. **D** Circumduction is flexion, abduction, extension, and adduction, and the abduction/adduction does not occur at this joint. Gliding occurs at the carpal joints.
81. **A** The problem here is when he or she lies down his or her back arches and is unsupported. That would mean an anterior pelvic tilt and tightness in the quadratus lumborum, rectus femoris (quad), and iliopsoas. The best answer choice, then, is "A." Quadratus femoris is a hip rotator, and biceps femoris is a hamstring that, if tight, would posteriorly tilt the pelvis.
82. **C** The serratus anterior helps keep the scapula flat along the rib cage when they are retracted. If the muscle is weak, the scapula stick out or look like wings.
83. **B** In other words, the semitendonosis sits on top of the semimembranosis.
84. **D** Water soluble and fat soluble are vitamin classifications.
85. **C** The other bones are not sesamoid bones.
86. **B** Answer "A" is wrong because the diaphragm is not used in forced expiration.
87. **B** Review bony landmarks: shoulder separation is a third degree sprain of the AC ligament (or the sternoclavicular ligament, which is not listed here).
88. **B** Because of the effect on the blood vessels (vascular), it can affect vision, balance, and other senses, which is why migraines can be so terrible.
89. **B** It is also found in between the tibia and femur (also called meniscus) and between the pubic bones. Hyaline cartilage is on the ends of moveable bones.
90. **A** Skull and C1 moves flexion/extension.
91. **C** The appendicular skeleton includes the appendages (arms, legs, hands, feet); as far as axis goes, there is an axis vertebrae and atlas but not an axis skeleton system. Diarthrotic skeleton is a made-up term.
92. **B** Say Grace before Tea—Sartorius, Gracilis, semi-Tendonosis.
93. **B** Remember General Manager: Golfer's elbow is Medial epicondyle.
94. **B** Atlas holds up the world (Greek mythology), so the atlas holds up the head.
95. **D** Remember that parasympathetic has the "parachute" (the "para") that slows us down; therefore, the vigorous massage will stimulate the sympathetic system.
96. **C** Proprioceptors are more for balance; nociceptors are for detecting pain.
97. **A** This allows clotting to occur.
98. **D** That would be nerve tissue.
99. **A** These are your moving joints, and synovial fluid helps to lubricate them.
100. **C** Meissner's corpuscles detect light pressure; Pacinian's detects pressure and respond to skin displacement and high frequency vibration; Krause's end bulbs are believed to respond to cold. Free nerve endings are the pain receptors.
101. **D** The endomysium encloses each muscle fiber. The perimysium is a fascial layer within the muscle that binds the fasciculi together. The ectomysium does not exist.
102. **C** The five categories are long, short, flat, irregular, and sesmoid.
103. **B** Strokes such as petrissage with the pulling and tugging can activate the muscle spindles for protection of overstretching.
104. **D** Fibrocartilage and meniscus are the same and are found between bones; hyaline cartilage is around the ends of bones.
105. **B** Saturated and unsaturated pertain to fats; water or fat soluble to vitamins.
106. **D** Blood, cartilage, tendons, ligaments are all connective tissues.
107. **C** Another name for adipose tissue is fat tissue. Fat does not move.
108. **B** This is what allows us to move.
109. **B** The joint capsule holds the connective tissue and synovial fluid together to nourish the joints but is not considered a main type of connective tissue in the skeletal system.
110. **D** The medial and lateral condyles of the tibia are insertions.
111. **B** Cervical (7), thoracic (12), lumbar (5), sacrum (5 fused). Remember, breakfast at 7, lunch at 12, dinner at 5.
112. **D** Zygomatic is the cheekbone; masseter is the jaw muscle; mandible is the lower jaw bone.

113. **A** The nociceptors detect pain, photoreceptors are related to vision, and chemoreceptors detect taste and smell.
114. **D** These are the muscles in between the metacarpals and the metatarsals.
115. **B** Marrow is the soft material in the bone containing blood cells and other material. The other terms are made up.
116. **D** The capitulum is on the lateral side of the humerus near the lateral epicondyle. The trochlea is closest to the medial epicondyle.
117. **C** The true ribs that articulate with the sternum (hence their name) are ribs one through seven. The false ribs are eight through twelve, and the floating ribs are eleven and twelve.
118. **B** We have more rotation in the neck than anywhere else in the spine (ninety degrees each direction).
119. **C** Remember, the mnemonic device Sally Left The Party . . . (Scaphoid, Lunate, Triquetrum, Pisiform) is the proximal row. . . . To Take Cathy Home (Trapezium, Trapezoid, Capitate, Hamate) is the distal row.
120. **C** Tibialis anterior performs inversion and dorsiflexion.
121. **D** Because of the TFL/ITB attachment on the anterior crest of the ilium, it can tilt the pelvis anteriorly if tight.
122. **C** Biceps femoris is the hamstring group. If you remember that the rectus abdominus is on the anterior side of the body, it might help you to remember that the rectus femoris is on the anterior side—quads!
123. **B** Quads and abs are muscle groups not individual muscles. The gluteus maximus is the strongest; the sartorius is the longest.
124. **C** Muscle tone is a state of continuous, partial contraction, so the muscles stay systemically stimulated. It allows us to stay upright. Atrophy is the decrease in size of a muscle. The sliding filament theory explains how a muscle contracts via the myosin and actin.
125. **C** Heat stroke occurs when the thermoregulatory system has shut down. Body temperature can rise to very dangerous levels and cause permanent brain damage and even death.
126. **A** By definition, kyphosis is an exaggerated outward curve of the spine, and lordosis is an exaggerated inward curve of the spine (more commonly seen in the cervical and lumbar sections of the spine).
127. **A** Think of the Great Plains of the Midwest: they are flat, as are feet that have pes “planus.”
128. **C** The pancreas and stomach are on the left side.
129. **A** This will help to lengthen the low back and put the client in a more neutral pelvic position, which would be more comfortable. Remember, lordosis is sway back.
130. **A** Passive stretching means the therapist does the work, and/or both antagonistic and agonistic muscles are relaxed. Active means the client does the work and/or the antagonistic muscle is contracting to stretch the agonist.
131. **A** The “S” in synergist and the “S” in same: the synergist performs the same movement as the primary mover (agonist).
132. **D** Normal daily activities should not create repetitive stress injuries.
133. **B** If the hamstrings are the antagonist, the quadriceps are the agonist. The quads perform knee extension and hip flexion (rectus femoris).
134. **D** The bicep only acts on the shoulder joint, not the girdle (meaning the scapula and clavicle). The other muscles either act on the scapula or attach to the clavicle and therefore are girdle muscles.
135. **B** This is mainly due to the true rib attachments.
136. **B** The supraspinatus initiates abduction, then, at about seventy to eighty degrees, the medial deltoid takes over. Latissimus dorsi performs adduction, and the subscapularis performs external shoulder rotation.
137. **D** The peroneals attach to the base of metatarsals and therefore do not affect the development of plantar fasciitis directly. Old shoes will lower shock absorption, high arches will tighten the fascia, and low arches will stretch it.
138. **B** Because of gravity, the quadriceps are doing the work to make sure the body does not slam down into the chair. Even though the knees are flexing and hamstrings do that, gravity must be taken into account.
139. **B** The gluteus medius and minimus abduct the hip. Gluteus max extends the hip, gracilis adducts the hip, and hamstrings extend the hip.
140. **C** The temporalis is on the skull by the ears; the ethmoid bone is part of the nasal/sinus cavity and forms part of the orbital wall. The pterygoid provide attachments of muscles for the lower jaw and soft palate.

141. **B** The gracilis is on the medial thigh, and the iliotibial band is on the lateral thigh.
142. **D** The masseter originates on the lower border of the zygomatic arch and inserts on the mandible. Remember, muscles pull, they do not push, it makes sense that it closes the jaw.
143. **A** The masseter closes the jaw, the orbicularis oris is the “kissing” muscle (helps us pucker!), and the temporalis muscle elevates and retracts the mandible.
144. **B** Another term for scapular protraction is scapular abduction.
145. **C** Scalenes elevate the first and second rib; the pectoralis minor elevates the ribs. The external intercostals also elevate the ribs.
146. **B** The quadratus lumborum originates on the inferior surface of rib twelve and the transverse processes of the lumbar vertebrae. It inserts on the iliac crest. When the muscle pulls or tightens, it lifts the hip upward.
147. **A** The trapezius sits on top of the rhomboids; therefore, the correct term is superficial.
148. **C** When lying prone, our feet tend to be extremely plantar flexed, or pointed.
149. **B** The metacarpals are further away from the midline than the carpals, and the terms distal and proximal are used for the upper extremities.
150. **C** Sartorius performs hip flexion, external rotation, and knee flexion.
151. **B** This would be an anterior pelvic tilt which would mean the hip flexor muscles would be tight (quads, iliopsoas), and the hip extensors would be stretched and weakened.
152. **C** Traditional Chinese Medicine anatomical position is with the arms overhead, palms facing forward. The other terms do not exist.
153. **D** The movement described is internal rotation. Remember LIPS for Latissimus dorsi, the action of Internal rotation, Pectoralis major, and Subscapularis.
154. **C** Not only is it due to the lateral malleolus being lower than the medial, but the deltoid ligament on the medial side of the ankle is also very strong. Both of these help prevent more eversion ankle sprains.
155. **A** Because the muscles are contracting, but there is no joint movement (you are stuck halfway up), everything is in an isometric contraction.
156. **C** The medial collateral and lateral collateral ligaments prevent rotation of the knee. The anterior and posterior cruciate ligaments prevent forward or backward motion of the femur on the tibia.
157. **A** The supraspinatus initiates shoulder abduction.
158. **B** The origin is the immovable end, and the insertion is the moveable end. Ligaments attach bone to bone and have no direct involvement with muscle movement.
159. **C** The buccinator compresses the cheeks, the masseter is a chewing muscle, and the platysma is the sheath on the anterior neck.
160. **D** There is no iliacus major.
161. **D** This would affect the lumbar spine the most and cause an exaggerated inward curve of the spine.
162. **B** Supraspinatus initiates humeral abduction.
163. **C** Drop foot means the client is unable to dorsiflex the foot. The muscle that dorsiflexes is anterior tibialis.
164. **A** Biceps femoris is a part of the hamstrings group. Centrally, it extends the hip and flexes the knee.
165. **D** The biceps brachii performs shoulder flexion and elbow flexion.
166. **C** Because of gravity, the erector spinae controls trunk flexion in an eccentric way when standing or sitting, which is why we do not work our abs from this position.
167. **A** Anterior tibialis performs dorsiflexion; therefore, walking only on the heels will strengthen it.
168. **A** Retraction is pulling the mandible backward. Closing the jaw is elevation; opening the jaw is depression.
169. **A** Remember LIPS—Latissimus dorsi, Internal rotation, Pectoralis major, and Subscapularis.
170. **D** Amino acids are proteins; lipids and triglycerides are fats. Meats generally fall into the protein category.
171. **B** Pronation is a combination of dorsiflexion and eversion, and supination is a combination of plantar flexion and inversion.
172. **A** The semitendinosus and semimembranosus attach medial tibia. The rectus femoris, being a part of the quadriceps group, inserts on the tibia, but extends the knee.
173. **A** Hip flexion is what needs to occur, so it would not be the hamstrings since they are involved

- in hip extension. The vastus lateralis and medialis do not cross the hip joint and therefore do not perform hip flexion.
174. **C** Cervical lamina is an area of the neck, not a muscle.
175. **B** Because gravity is acting downward on the body, the quads are lengthening and contracting in order to prevent you from falling.
176. **D** Remember I Like Spaghetti: ILS are the first letters of each muscle.
177. **B** Distal means farthest away, which would be the phalanges. The tarsals are more proximal, and the carpals are in the hands.
178. **C** Remember adduction means you are “adding” everything toward the midline (or spine), so when you retract something, you take it back; therefore, the scapula are pulling back toward the spine.
179. **B** Stabilizers prevent motion; therefore, the rectus abdominus (along with the erector spinae) would be a stabilizer in order to prevent trunk flexion. The gastroc/soleus is an assister because the foot goes from dorsiflexion into slight plantar flexion, movement is taking place there. Hamstrings are antagonist; quads and gluteus max are the primary movers. Iliopsoas at the hip is an antagonist because the hip is extending (but not hamstrings because the knee is extending, and that is quads!).
180. **C** Vitamin A is a fat-soluble vitamin, meaning the body cannot expel overdoses easily; it gets stored in the fat. B and C overdoses are excreted through the urine because these vitamins are water soluble.
181. **B** There are six basic nutrients: water, fat, protein, carbohydrates, vitamins, and minerals.
182. **A** Herbs should be treated as medicine; many of them are used as such. You would not ask friends about dosages for prescription medicine or increase your prescription dosages if they do not work immediately, so you do not want to do that with herbs.
183. **D** While many herbs are wonderful for many situations, garlic has been shown to be an excellent antibiotic.
184. **B** Protein recommendations are twelve to twenty percent, fats less than thirty percent, and unsaturated fats ten to twenty percent.
185. **C** HDL and LDL are types of cholesterol. The “S” in Saturated, and the “S” in Sorry: saturated fats are the sorry fats.
186. **B** High glycemic foods have to do with the glucose, which is a simple sugar. Since carbs are the primary fuel source, after exercise it is better to eat the high glycemic foods to replace the energy burned for fuel. Mid-to-low glycemic is better before exercise, so a rush of sugar does not enter the bloodstream and cause a spike in energy.
187. **C** Vitamins and minerals both are a basic nutrient with no calories, but minerals are the ones needed in small, trace amounts.
188. **A** A, D, E, and K are fat-soluble vitamins. Water-soluble vitamins (B and C) will be excreted in the urine if taken in large amounts, but the fat-soluble will not.
189. **C** One gram of protein or carbohydrates equals four calories; one gram of fat equals nine calories.
190. **D** The purpose of the glucose is for energy. Too little or too much produces an undesirable effect. While five to ten percent is acceptable, six to eight percent is ideal.
191. **D** Fortified milk has vitamin D.
192. **B** Potassium can be easily flushed out of the body with diuretics, and thus causes cramping. Some doctors will advise or prescribe a potassium supplement in severe cases or recommend eating bananas or potato skins (plain!).
193. **D** Creatine and chromium are both involved in the Krebs cycle, which produces ATP (chemical energy). Although potassium is a mineral, it is a component in muscle contractions but does not assist in the production of ATP.
194. **A** Aloe vera has an antiseptic cooling effect, which is wonderful for minor burns.
195. **A** Too much sugar can actually suppress the immune system.