CHAPTER

The Musculoskeletal System

5

After studying this chapter, you will be able to:

- Name the parts of the musculoskeletal system and discuss the function of each part
- Define combining forms used in building words that relate to the musculoskeletal system
- Name the common diagnoses, laboratory tests, and clinical procedures used in treating disorders of the musculoskeletal system
- List and define the major pathological conditions of the musculoskeletal system
- Define surgical terms related to the musculoskeletal system

Structure and Function

The **musculoskeletal system** forms the framework that holds the body together, enables it to move, and protects and supports all the internal organs. X-ref This system includes **bones, joints,** and **muscles.** Figure 5-1 shows the musculoskeletal system.

Bones

Bones are made of **osseous tissue.** The cells of bone called **osteocytes.** The hardening process and development of the osteocytes is called **ossification.** This process is largely dependent on **calcium, phosphorus,** and **vitamin D.** During fetal development, bones are softer and flexible and are composed of **cartilage** until the hardening process **(ossification)** begins.

Bone-forming cells are called **osteoblasts.** As bone tissue develops, some of it dies and is reabsorbed by **osteoclasts** (also called **bone phagocytes**). There are many types of bones. The **long bones** form the arms and legs. They consiste of a **diaphysis** or shaft. At each end of the shaft, an *epiphysis*, or shaped area, is where bones connect to other bones via ligaments and muscles. The space between the diaphysis and each epiphysis called a **metaphysis** develops as one grows. In that space, an **epiphyseal plate** of cartilage is covered by **articular cartilage** that provides protection.

The outer portion of long bones is **compact bone** which surrounds **cancellous bone** (also called **spongy bone)**. This covers the **medullary cavity,** which has a lining called the **endosteum.** The outside of the bone is covered by the **periosteum.** Figure 5-2 shows the parts of a long bone. X-ref

Table 5-1 shows the five most common categories of bones. X-ref

Calcium is important for the formation of bones. It is recommended that you pay attention to your daily calcium intake throughout your life, since lack of calcium is a factor in certain diseases, such as osteoporosis. To find out about the recommended levels, go to the National Osteoporosis Foundation's Web site (www.nof.org) and click on prevention.

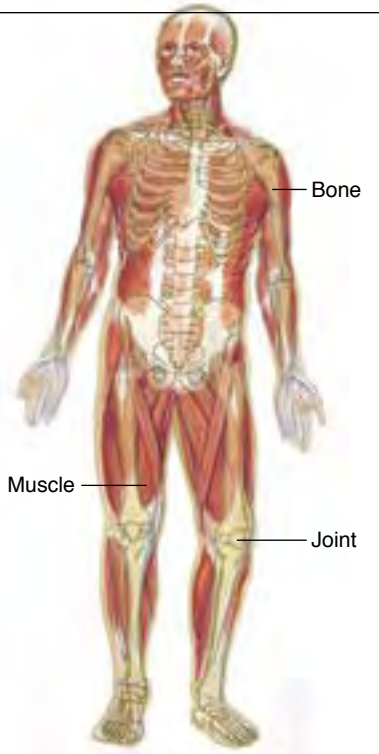

FIGURE 5-1 Muscles and bones hold the body together, enable it to move, and protect and support the internal organs.

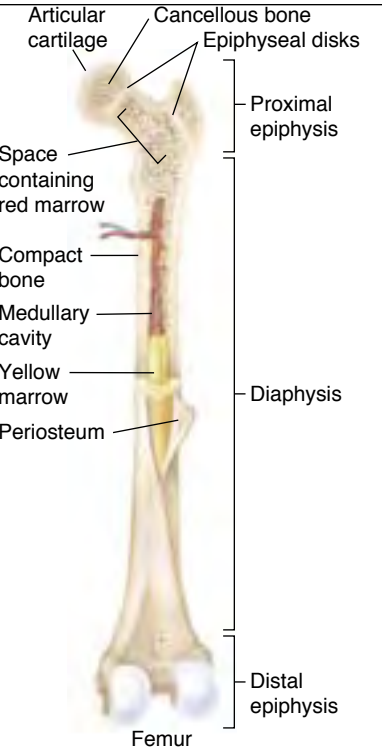

FIGURE 5-2 Parts of a long bone. The legs and arms are made up of long bones.

TABLE 5-1 Five common categories of bone

Type of Bone	Where Found	Characteristics
long bone	extremities of the body—legs and arms	outer portion is **compact bone** and ends connect to other bones.
short bones	small bones of the wrists, ankles, and toes	outer portion is compact bone; inner portion is **cancellous bone**
flat bones	cover organs or provide surface for muscles—shoulders, pelvis, and skull	large, somewhat flat surfaces
irregular bones	ears, vertebrae, face	specialized bones with irregular shapes
sesamoid bones	hands, feet, knees	formed in tendons near joints

The **skeleton** of the body is made up of bones and joints. A mature adult has 206 bones that work together with joints and muscles to move the various parts of the body.

Commonly, bones have various extensions and depressions that serve as sites for attaching muscles and tendons. The seven different kinds of bone extensions are:

1. The **bone head,** the end of a bone, often rounded, that attaches to other bones or connective material and is covered with cartilage.

2. The **crest,** a bony ridge.
3. The **process,** any bony projection to which muscles and tendons attach.
4. The **tubercle,** a slight elevation on a bone's surface where muscles or ligaments are attached.
5. The **trochanter,** a bony extension near the upper end of the femur where muscle is attached.
6. A **tuberosity,** a large elevation on the surface of a bone for the attachments of muscles or tendons.
7. A **condyle,** a rounded surface protrusion at the end of a bone.

X-ref

Figure 5-3 shows some of the extensions on a long bone.

Depressions in bone also allow bones to attach to each other. In addition, they are the passageways for blood vessels and nerves throughout the body. The most common types of depressions in bone are:

1. A **fossa,** a shallow pit in bone
2. A **foramen,** an opening through bone for blood vessels and nerves.
3. A **fissure,** a deep cleft in bone
4. A **sulcus,** a groove or furrow on the surface of a bone
5. A **sinus,** a hollow space or cavity in a bone.

X-ref

Figure 5-4 shows the types of bone depressions.

Marrow is soft connective tissue and serves important functions in the production of blood cells.

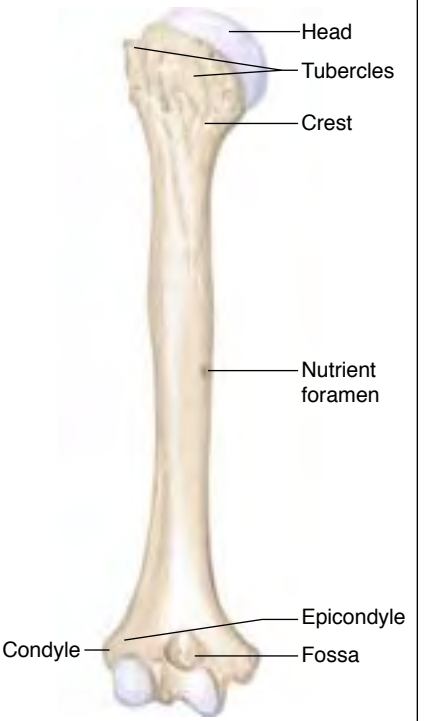

FIGURE 5-3 Bone extensions on a long bone.

Bones of the Head

Cranial bones form the skull. These bones join at points called **sutures.** The bones of the head include cavities, depressions, and extensions with specific purposes. Figure 5-5 shows the sinus cavities. Table 5-2 lists the major structures of the head.

X-ref

Bone marrow can be transplanted from one person to another to help in curing certain diseases. To find out more about bone marrow donation, go to the Bone Marrow Foundation's Web site (www.bonemarrow.org).

Spinal Column

The **spinal column** (also called the **vertebral column**) consists of five sets of **vertebrae.** Each vertebra is a bone segment with a thick, **cartilaginous disk** (also called **intervertebral disk** or **disk**) that separates the vertebrae. In the middle

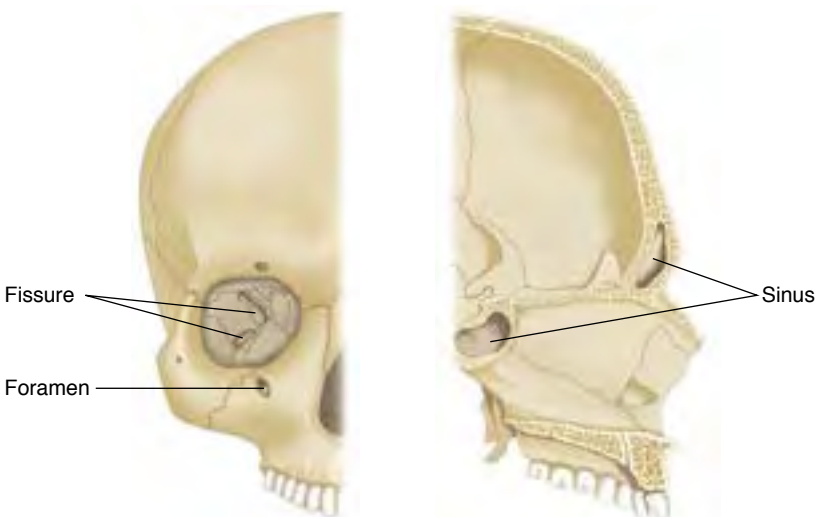

FIGURE 5-4 Types of bone depressions.

FIGURE 5-5 The bones of the skull and the sinus cavities.

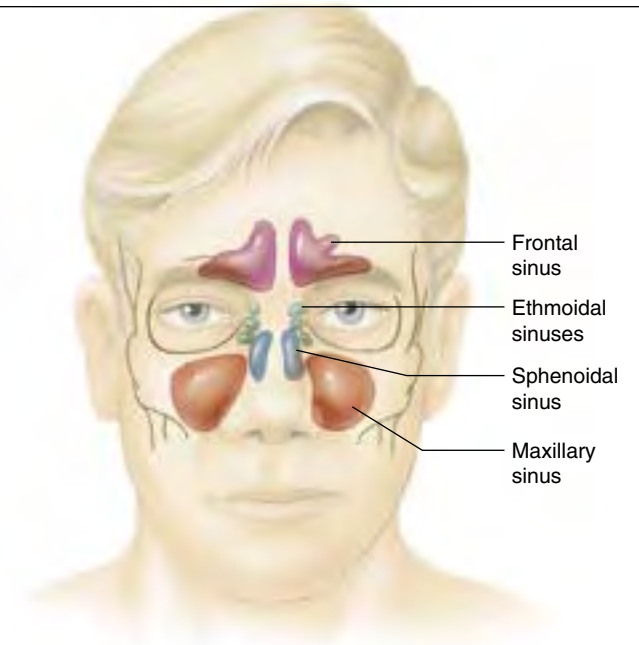

TABLE 5-2 Major structures of the head

Bone or Other Structure	Location or Purpose	Characteristics
fontanelle	skull of a newborn	soft spot that closes eventually
frontal bone	forehead and roof of eye socket	
ethmoid bone	nasal cavity and eye orbits	
parietal bone	top and upper sides of the skull	
temporal bone	lower part of skull and lower sides	includes openings for ears
temporomandibular joint (TMJ)	connects temporal bone to **mandible** (lower jawbone)	
mastoid process	bone behind the ear	round extension
styloid process	protusion from the temporal bone	peg-shaped protrusion
occipital bone	back of skull	has opening called the **foramen magnum** through which spinal cord passes
sphenoid bone	base of the cranium	holds the frontal, occipital, and ethmoid bones together
sella turcica	depression in the sphenoid bone	holds the pituitary gland
frontal sinuses	cavities above the eyes	
sphenoid sinus	caviy above and behind the nose	
ethmoid sinuses	small sinuses at the side of the **nasal cavity**	
maxillary sinuses	cavities on either side of the nasal cavity	

TABLE 5-2 Major structures of the head (*cont.*)

Bone or Other Structure	Location or Purpose	Characteristics
nasal bones	facial bone that forms the nose bridge	
lacrimal bones	holds the lacrimal gland and the canals for the tear ducts	
mandibular bone or **mandible**	lower jawbone and holds the sockets for the lower teeth	
maxillary bones	upper jawbone and sockets for the upper teeth	
vomer	nasal septum	
zygomatic bones	bones that shape the cheek	
palatine bone	forms the nasal cavity and the hard palate	

MORE ABOUT...

The Atlas and the Axis

The ancient Greeks thought that the god Atlas supported the heavens on his shoulders. When the first vertebra was named, it too was called atlas because it supports the head. The axis is so-called because it forms the pivot point on which the atlas can rotate (as when one shakes the head "no").

of the disk is a fibrous mass called the **nucleus pulposus.** The disks cushion the vertebrae and help in movement and flexibility of the spinal column. The space between the **vertebral body** and the back of the vertebra is called the **neural canal.** This is the space through which the spinal cord passes. At the back of the vertebra, the **spinous process, transverse process,** and **lamina** form the posterior side of the spinal column.

The five divisions of vertebrae are:

1. The **cervical vertebrae,** the seven vertebrae of the neck bone, which include the first vertebra (T1, first thoracic vertebra), called the **atlas,** and the second vertebra (T2, second thoracic vertebra), called the **axis.**
2. The **thoracic vertebrae** (also called the **dorsal vertebrae**), the twelve vertebrae that connect to the ribs.
3. The **lumbar vertebrae,** the five bones of the middle back.
4. The **sacrum,** the curved bone of the lower back.
5. The **coccyx,** the tailbone.

X-ref

Figure 5-6 shows the divisions of the spinal column.

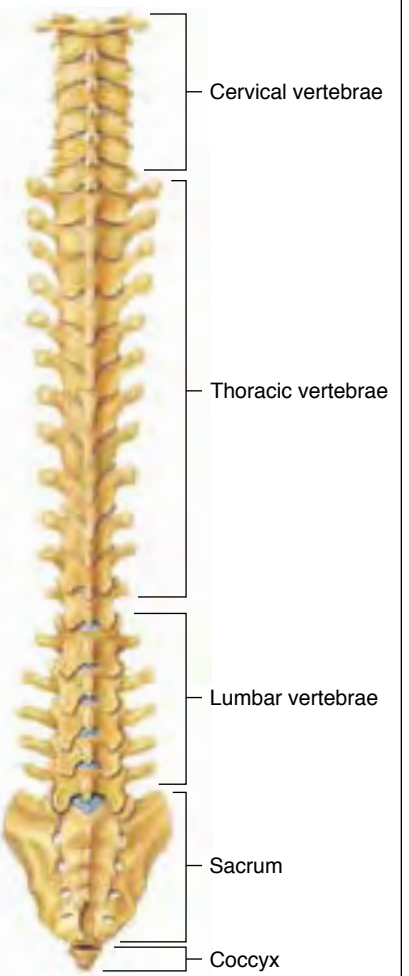

FIGURE 5-6 The divisions of the spinal column.

Bones of the Chest

The bones of the chest include two weight-transferring sections of bones. The upper group is formed by the **clavicle** (anterior collar bone) and the **scapula** (posterior shoulder bone). The point at which they join is the

acromion. Below that is the sternum or breastbone, out from which extends the twelve pairs of **ribs.** The first seven pairs of ribs are called **true ribs.** The second weight-transferring section is the pelvic girdle.

Bones of the Pelvis

Below the thoracic cavity is the pelvic area. The **pelvic girdle** is a large bone that forms the hips and supports the trunk of the body. It is composed of three fused bones, including the **ilium, ischium,** and **pubes** (the anteroinferior portion of the hip bone). It is also the point of attachment for the legs.

Inside the pelvic girdle is the **pelvic cavity.** In the pelvic cavity are located the female reproductive organs, the sigmoid colon, the bladder, and the rectum. The area where the two pubic bones join is called the **pubic symphysis.**

Bones of the Extremities

The arms and legs fit into the bones of the trunk of the body at one end and end in the fingers and toes at the other. Figures 5-7 and 5-8 show the bones of the extremities. Table 5-3 lists the bones of the extremities.

X-ref

X-ref

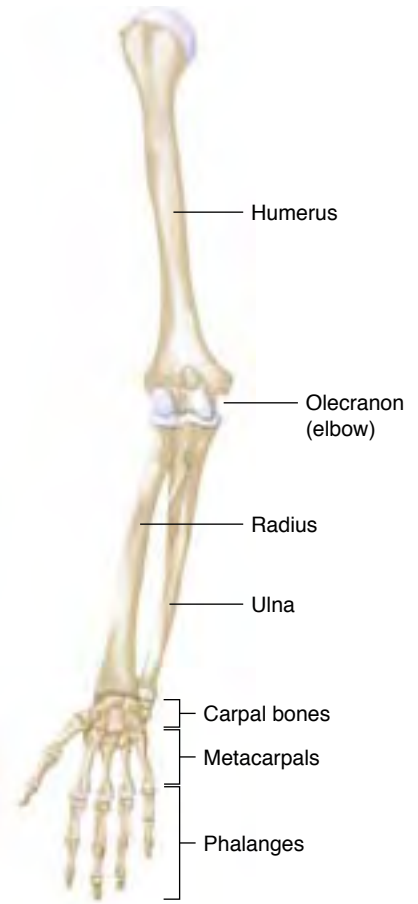

FIGURE 5-7 Bones of the arm and hand.

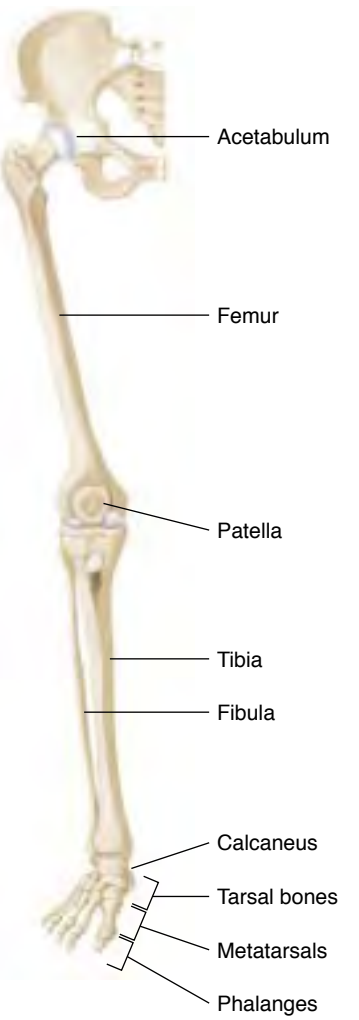

FIGURE 5-8 Bones of the leg and foot.

TABLE 5-3 Bones of the extremities.

Bone, depression, or protrusion	Where located	Characteristic or Purpose
humerus	attaches to the scapula and clavicle	
ulna	two lower arem bones	
olecranon or **elbow**	bony protrusion on the ulna	
radius	bone between the elbow and wrist	
carpus or wrist	attached to the radius and palm	
metacarpals	five palm bones that radiate to fingers	
phalanges (sing. **phalanx)**	finger bones	
acetabulum	depression in hip bone into which thigh fits	
femur	thigh bone	
tibia or **shin**	one of the two bones of the lower leg	
fibula	one of the two bones of the lower leg	
patella	kneecap	
malleoli	bony protrusions at the bottom of the lower leg	
tarsal bones	help form the **ankle, tarsus** or instep, and **calcaneus** or heel	
metatarsals	bones that connect the tarsal bones to the phalanges or toe bones	

Joints

Joints are also called **articulations,** points where bones connect. **Diarthroses** are joints that move freely, such as the knee joint. **Amphiarthroses** are cartilaginous joints that move slightly, such as the joints between vertebrae. **Synarthroses** do not move; examples are the fibrous joints between the skull bones. **Symphyses** are cartilaginous joints that unite two bones firmly; an example is the pubic symphysis.

Bones are connected to other bones with **ligaments,** bands of fibrous tissue. **Tendons** are bands of fibrous tissue that connect muscles to bone. **Synovial joints** are covered with a **synovial membrane,** which secretes **synovial fluid,** a joint lubricant. Some spaces between tendons and joints have a **bursa,** a sac lined with a synovial membrane. Figure 5-9 shows the three types of joints and the parts of a joint.

X-ref

Muscles

Muscles contract and extend to provide body movement. The **voluntary (striated) muscles** can be contracted at will, such as the arms and legs. The

More About...

Body Movement

Bones, joints, and muscles allow parts of the body to move in certain directions. To determine if movement can be done correctly, medical practitioners in a variety of fields look at the range of motion of the parts of the body. Also, position of the body involves placement in certain positions.

- *Flexion*—the bending of a limb.
- *Extension*—the straightening of a limb.
- *Rotation*—the circular movement of a part, such as the neck.
- *Abduction*—movement away from the body.
- *Adduction*—movement toward the body
- *Supination*—a turning up, as of the hand.
- *Pronation*—a turning down, as of the hand.
- *Dorsiflexion*—a bending up, as of the ankle.
- *Plantar flexion*—a bending down, as of the ankle.

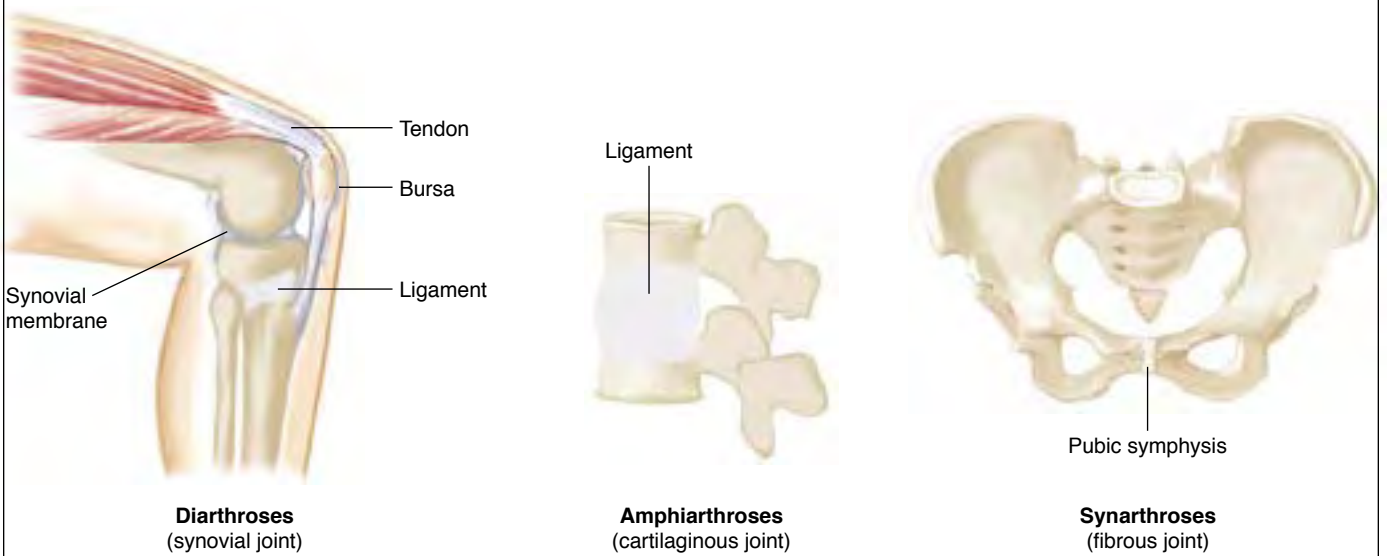

FIGURE 5-9 Types of and parts of a joint.

involuntary (smooth or **visceral) muscles** control movement that is not controlled by will, such as respiration, urination, and digestion. **Cardiac muscle,** which controls the contractions of the heart, is the only involuntary muscle that is also striated.

Most muscles are covered by **fascia,** a band of connective tissue. Muscles attach to a stationary bone at a point called the **origin.** They attach to a movable bone at a point called the **insertion.** Figure 5-10 shows the various types of muscle. X-ref

More About...

Muscles

Normal muscles contract and extend during routine movement and exercise. In unusual circumstances, muscles can *atrophy* (waste away). This can happen from a number of diseases that affect muscles and movement or from lack of use, as in a sedentary lifestyle. People who are paralyzed and find it difficult to get help moving muscles generally have areas where muscle atrophies. On the other hand, overuse of muscles can cause *hyperplasia,* an abnormal increase in muscle cells.

Building muscle by exercising is generally a healthy thing to do. However, some athletes take dangerous shortcuts to building muscle. They take *anabolic steroids* or supplements containing products similar to anabolic steroids that build muscle quickly. Unfortunately, these products can have devastating health and emotional consequences, sometimes even fatal ones. Also, athletes who take these illegal substances often have an unfair advantage in competition over those who don't. These substances are outlawed in most competitive sports.

For more information about steroid abuse, go to the National Institute on Drug Abuse's Web site on steroid abuse (www.steroidabuse.org).

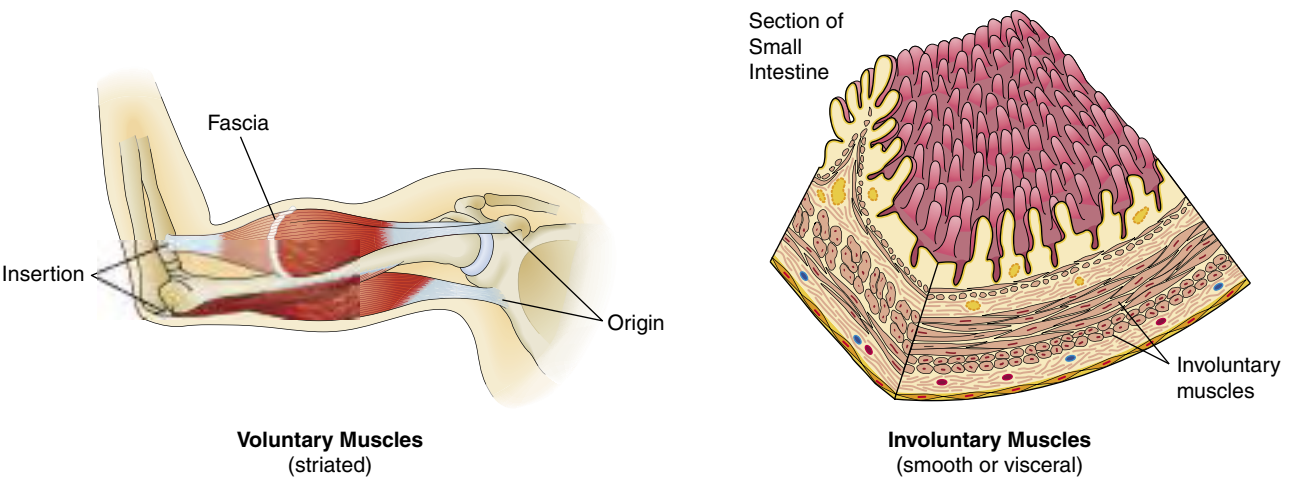

FIGURE 5-10 Types and parts of muscle.

Vocabulary Review

In the previous section, you learned terms relating to the musculoskeletal system. Before going on to the exercises, read the definitions below. Pronunciations are provided for certain terms.

Term	Definition
acetabulum [ăs-ĕ-TĂB-yū-lŭm]	Cup-shaped depression in the hip bone into which the top of the femur fits.

Term	Definition
acromion [ă-KRŌ-mē-oñ]	Part of the scapula that connects to the clavicle.
amphiarthrosis *(pl.,* amphiarthoses) [ĂM-fĭ-ăr-THRŌ-sĭs (ĂM-fĭ-ăr-THRŌ-sēs)]	Cartilaginous joint having some movement at the union of two bones.
ankle [ĂNG-kl]	Hinged area between the lower leg bones and the bones of the foot.
articular [ăr-TĬK-yū-lăr] **cartilage**	Cartilage at a joint.
articulation [ăr-tĭk-yū-LĀ-shŭn]	Point at which two bones join together to allow movement.
atlas [ĂT-lăs]	First cervical vertebra.
axis [ĂK-sĭs]	Second cervical vertebra.
bone	Hard connective tissue that forms the skeleton of the body.
bone head	Upper, rounded end of a bone.
bone phagocyte [FĂG-ō-sīt]	Bone cell that ingests dead bone and bone debris.
bursa *(pl.,* bursae) [BŬR-să(BŬR-sē)]	Sac lined with a synovial membrane that fills the spaces between tendons and joints.
calcaneus [kăl-KĀ-nē-ŭs]	Heel bone.
cancellous [KĂN-sĕ-lŭs] **bone**	Spongy bone with a latticelike structure.
cardiac [KĂR-dē-ăk] **muscle**	Striated involuntary muscle of the heart.
carpus [KĂR-pŭs]	Wrist.
cartilage [KĂR-tĭ-lăj]	Flexible connective tissue found in joints, fetal skeleton, and the lining of various parts of the body.
cartilaginous [kăr-tĭ-LĂJ-ĭ-nŭs] **disk**	Thick, circular mass of cartilage between the vertebrae of the spinal column.
cervical [SĔR-vĭ-kl] **vertebrae**	Seven vertebrae of the spinal column located in the neck.
clavicle [KLĂV-ĭ-kl]	Curved bone of the shoulder that joins to the scapula; collar bone.
coccyx [KŎK-sĭks]	Small bone consisting of four fused vertebrae at the end of the spinal column; tailbone.
compact bone	Hard bone with a tightly woven structure.
condyle [KŎN-dīl]	Rounded surface at the end of a bone.
crest	Bony ridge.
diaphysis [dī-ĂF-ĭ-sĭs]	Long middle section of a long bone; shaft.

Term	Definition
diarthroses (*sing.*, diarthrosis) [dī-ăr-THRŌ-sēz (dī-ăr-THRŌ-sĭs]	Freely movable joints.
disk [dĭsk] Latin *discus*	*See* cartilaginous disk.
dorsal vertebrae	Thoracic vertebrae.
elbow [ĔL-bō]	Joint between the upper arm and the forearm.
endosteum [ĕn-DŎS-tē-ŭm]	Lining of the medullary cavity.
epiphyseal [ĕp-ĭ-FĬZ-ē-ăl] **plate**	Cartilaginous tissue that is replaced during growth years, but eventually calcifies and disappears when growth stops.
ethmoid [ĔTH-mŏyd] **bone**	Irregular bone of the face attached to the sphenoid bone.
ethmoid sinuses	Sinuses on both sides of the nasal cavities between each eye and the sphenoid sinus.
fascia (*pl.*, fasciae) [FĂSH-ē-ă (FĂSH-ē-ē)]	Sheet of fibrous tissue that encloses muscles.
femur [FĒ-mūr]	Long bone of the thigh.
fibula [FĬB-yū-lă]	Smallest long bone of the lower leg.
fissure [FĬSH-ŭr]	Deep furrow or slit.
flat bones	Thin, flattened bones that cover certain areas, as of the skull.
fontanelle [FŎN-tă-nĕl]	Soft, membranous section on top of an infant's skull.
foramen [fō-RĀ-mĕn]	Opening or perforation through a bone.
fossa (*pl.*, fossae) [FŎS-ă (FŎS-ē)]	Depression, as in a bone.
frontal [FRŬN-tăl] **bone**	Large bone of the skull that forms the top of the head and forehead.
frontal sinuses	Sinuses above the eyes.
humerus [HYŪ-mĕr-ŭs]	Long bone of the arm connecting to the scapula on top and the radius and ulna at the bottom.
ilium [ĬL-ē-ŭm]	Wide portion of the hip bone.
insertion	Point at which a muscle attaches to a movable bone.
intervertebral [ĭn-tĕr-VĔR-tĕ-brăl] **disk**	*See* cartilaginous disk.
involuntary muscle	Muscle not movable at will.
irregular bones	Any of a group of bones with a special shape to fit into certain areas of the skeleton, such as the skull.
ischium [ĬS-kē-ŭm]	One of three fused bones that form the pelvic girdle.

Term	Definition
joint [jŏynt]	Place of joining between two or more bones.
lacrimal [LĂK-rĭ-măl] **bone**	Thin, flat bone of the face.
lamina (*pl.*, laminae) [LĂM-ĭ-nă (LĂM-ĭ-nē)]	Thin, flat part of either side of the arch of a vertebra.
ligament [LĬG-ă-mĕnt]	Sheet of fibrous tissue connecting and supporting bones; attaches bone to bone.
long bone	Any bone of the extremities with a shaft.
lumbar [LŬM-băr] **vertebrae**	Five vertebrae of the lower back.
malleolus (*pl.*, malleoli) [mă-LĒ-ō-lŭs (mă-LĒ-ō-lī)]	Rounded protrusion of the tibia or fibula on either side of the ankle.
mandible [MĂN-dĭ-bl]	U-shaped bone of the lower jaw.
mandibular [măn-DĬB-yū-lăr] **bone**	Mandible.
marrow [MĂR-ō]	Connective tissue filling the medullary cavity, often rich in nutrients.
mastoid [MĂS-tŏyd] **process**	Protrusion of the temporal bone that sits behind the ear.
maxillary [MĂK-sĭ-lār-ē] **bone**	Bone of the upper jaw.
maxillary sinus	Sinus on either side of the nasal cavity below the eyes.
medullary [MĔD-ū-lār-ē] **cavity**	Soft center cavity in bone that often holds marrow.
metacarpal [MĔT-ă-KĂR-păl]	One of five bones of the hand between the wrist and the fingers.
metaphysis [mĕ-TĂF-ĭ-sĭs]	Section of a long bone between the epiphysis and diaphysis.
metatarsal [MĔT-ă-TĂR-săl] **bones**	Bones of the foot between the instep (arch) and the toes.
muscle [MŬS-ĕl]	Contractile tissue that plays a major role in body movement.
musculoskeletal [MŬS-kyū-lō-SKĔL-ĕ-tăl] **system**	System of the body including the muscles and skeleton.
nasal bones	Bones that form the bridge of the nose.
neural [NŪR-ăl] **canal**	Space through which the spinal cord passes.
nucleus pulposus [NŪ-klē-ŭs pŭl-PŌ-sŭs]	Fibrous mass in the center portion of the intervertebral disk.
occipital [ŏk-SĬP-ĭ-tăl] **bone**	Bone that forms the lower back portion of the skull.

Term	Definition
olecranon [ō-LĔK-ră-nŏn]	Curved end of the ulna to which tendons of the arm muscles attach; bony prominence of the elbow.
origin	Point at which muscles attach to stationary bone.
osseous [ŎS-ē-ŭs] **tissue**	Connective tissue into which calcium salts are deposited.
ossification [ŎS-ĭ-fĭ-KĀ-shŭn]	Hardening into bone.
osteoblast [ŎS-tē-ō-blăst]	Cell that forms bone.
osteoclast [ŎS-tē-ō-klăst]	Large cell that reabsorbs and removes osseous tissue.
osteocyte [ŎS-tē-ō-sīt]	Bone cell.
palatine [PĂL-ă-tīn] **bone**	Bone that helps form the hard palate and nasal cavity; located behind the maxillary bones.
parietal [pă-RĪ-ĕ-tăl] **bone**	Flat, curved bone on either side of the upper part of the skull.
patella [pă-TĔL-ă]	Large, sesamoid bone that forms the kneecap.
pelvic [PĔL-vĭk] **cavity**	Cup-shaped cavity formed by the large bones of the pelvic girdle; contains female reproductive organs, sigmoid colon, bladder, and rectum.
pelvic girdle	Hip bones.
pelvis [PĔL-vĭs]	Cup-shaped ring of bone and ligaments at the base of the trunk.
periosteum [pĕr-ē-ŎS-tē-ŭm]	Fibrous membrane covering the surface of bone.
phalanges (*sing.*, phalanx) [fă-LĂN-jēz (FĂ-lăngks)]	Long bones of the fingers and toes.
process [PRŌ-sĕs, PRŎS-ĕs]	Bony outgrowth or projection.
pubes [PYŪ-bĭs]	Anteroinferior portion of the hip bone.
pubic symphysis [PYŪ-bĭk SĬM-fă-sĭs]	Joint between the two public bones.
radius [RĀ-dē-ŭs]	Shorter bone of the forearm.
rib	One of twenty-four bones that form the chest wall.
sacrum [SĀ-krŭm]	Next-to-last spinal vertebra made up of five fused bones; vertebra that forms part of the pelvis.
scapula [SKĂP-yū-lă]	Large flat bone that forms the shoulder blade.
sella turcica [SĔL-ă TŬR-sĭ-kă]	Bony depression in the sphenoid bone where the pituitary gland is located.

Term	Definition
sesamoid [SĔS-ă-mŏyd] **bone**	Bone formed in a tendon over a joint.
shin [shĭn]	Anterior ridge of the tibia.
short bones	Square-shaped bones with approximately equal dimensions on all sides.
sinus [SĪ-nŭs]	Hollow cavity, especially either of two cavities on the sides of the nose.
skeleton [SKĔL-ĕ-tŏn]	Bony framework of the body.
smooth muscle	Fibrous muscle of internal organs that acts involuntarily.
sphenoid [SFĒ-nŏyd] **bone**	Bone that forms the base of the skull.
sphenoid sinus	Sinus above and behind the nose.
spinal column	Column of vertebrae at the posterior of the body, from the neck to the coccyx.
spinous [SPĪ-nŭs] **process**	Protrusion from the center of the vertebral arch.
spongy bone	Bone with an open latticework filled with connective tissue or marrow.
sternum [STĔR-nŭm]	Long, flat bone that forms the midline of the anterior of the thorax.
striated [strī-ĀT-ĕd] **muscle**	Muscle with a ribbed appearance that is controlled at will.
styloid [STĪ-lŏyd] **process**	Peg-shaped protrusion from a bone.
sulcus *(pl.,* sulci) [SŬL-kŭs (SŬL-sī)]	Groove or furrow in the surface of bone.
suture [SŪ-chūr]	Joining of two bone parts with a fibrous membrane.
symphysis [SĬM-fĭ-sĭs]	Type of cartilaginous joint uniting two bones.
synarthrosis [SĬN-ăr-THRŌ-sĭs]	Fibrous joint with no movement.
synovial [sĭ-NŌ-vē-ăl] **fluid**	Fluid that serves to lubricate joints.
synovial joint	A joint that moves.
synovial membrane	Connective tissue lining the cavity of joints and producing the synovial fluid.
tarsus, tarsal [TĂR-sŭs, TĂR-săl] **bones**	Seven bones of the instep (arch of the foot).
temporal [TĔM-pō-răl] **bone**	Large bone forming the base and sides of the skull.
temporomandibular [TĔM-pō-rō-măn-DĬB-yū-lăr] **joint (TMJ)**	Joint of the lower jaw between the temporal bone and the mandible.

Term	Definition
tendon [TĚN-dŏn]	Fibrous band that connects muscle to bone or other structures.
thoracic [thō-RĂS-ĭk] **vertebrae**	Twelve vertebrae of the chest area.
thorax [THŌ-răks]	Part of the trunk between the neck and the abdomen; chest.
tibia [TĬB-ē-ă]	Larger of the two lower leg bones.
transverse process	Protrusion on either side of the vertebral arch.
trochanter [trō-KĂN-tĕr]	Bony protrusion at the upper end of the femur.
true ribs	Seven upper ribs of the chest that attach to the sternum.
tubercle [TŪ-bĕr-kl]	Slight bony elevation to which a ligament or muscle may be attached.
tuberosity [TŪ-bĕr-ŎS-ĭ-tē]	Large elevation in the surface of a bone.
ulna [ŬL-nă]	Larger bone of the forearm.
vertebra *(pl.*, vertebrae) [VĚR-tĕ-bră (VĚR-tĕ-brē)]	One of the bony segments of the spinal column.
vertebral body	Main portion of the vertebra, separate from the arches of the vertebra.
vertebral column	Spinal column.
visceral [VĬS-ĕr-ăl] **muscle**	Smooth muscle.
voluntary muscle	Striated muscle.
vomer [VŌ-mĕr]	Flat bone forming the nasal septum.
zygomatic [ZĪ-gō-MĂT-ĭk] **bone**	Bone that forms the cheek.

Case Study

Seeing a Specialist

Mary Edgarton was referred to Dr. Alana Wolf, a rheumatologist, by her internist. Mary's five-month bout of joint pain, swelling, and stiffness had not shown improvement. Dr. Wolf gave her a full musculoskeletal examination to check for swelling, abnormalities, and her ability to move her joints. Even though Mary remains a fairly active person, her movement in certain joints is now limited. She shows a moderate loss of grip strength.

In checking earlier for a number of systemic diseases, Mary's internist felt that Mary's problems were the result of some disease of her musculoskeletal system. Many of the laboratory tests that were forwarded to Dr. Wolf showed normal levels.

Critical Thinking

1. What lubricates the joints, allowing movement?
2. Exercise is usually recommended to alleviate musculoskeletal problems. Is it possible to exercise both involuntary and voluntary muscles?

Structure and Function Exercises

Check Your Knowledge

Fill in the blanks.

3. The extremities of the body include mostly _____ bones.
4. The outer portion of a long bone is _____ _____.
5. Soft connective tissue with high nutrient content in the center of some bones is called _____ .
6. An infant's skull generally has soft spots known as _____ .
7. Disks in the spinal column have a soft, fibrous mass in the middle called the _____ _____ .
8. The scapula and the clavicle join at a point called the _____ .
9. Ribs that attach to the sternum are called _____ _____ .
10. Another name for kneecap is _____ .
11. The largest tarsal is called the _____ or heel.
12. The only muscle that is both striated and involuntary is the _____ muscle.

Circle T for true or F for false.

13. Compact bone is another name for cancellous bone. T F
14. Tendons are parts of bones. T F
15. The mandible is the upper jawbone. T F
16. The twelve vertebrae that connect to the ribs are the dorsal vertebrae. T F
17. Joints are lubricated with synovial fluid. T F

Combining Forms

The lists below include combining forms that relate specifically to the musculoskeletal system. Pronunciations are provided for the examples.

Combining Form	Meaning	Example
acetabul(o)	acetabulum	*acetabulectomy* [ĂS-ĕ-tăb-yū-LĔK-tō-mē], excision of the acetabulum
acromi(o)	end point of the scapula	*acromioscapular* [ă-KRŌ-mē-ō-SKĂP-yū-lăr], relating to the acromion and the body of the scapula
ankyl(o)	bent, crooked	*ankylosis* [ĂNG-kĭ-LŌ-sĭs], fixation of a joint in a bent position, usually resulting from a disease
arthr(o)	joint	*arthrogram* [ĂR-thrō-grăm], x-ray of a joint
brachi(o)	arm	*brachiocephalic* [BRĀ-kē-ō-sĕ-FĂL-ĭk], relating to both the arm and head

Combining Form	Meaning	Example
burs(o)	bursa	*bursitis* [bŭr-SĪ-tĭs], inflammation of a bursa
calcane(o)	heel	*calcaneodynia* [kăl-KĀ-nē-ō-DĬN-ē-ă], heel pain
calci(o)	calcium	*calciokinesis* [KĂL-sē-ō-kĭ-NĒ-sĭs], mobilization of stored calcium in the body
carp(o)	wrist	*carpopedal* [KĂR-pō-PĔD-ăl], relating to the wrist and foot
cephal(o)	head	*cephalomegaly* [SĔF-ă-lō-MĔG-ă-lē], abnormally large head
cervic(o)	neck	*cervicodynia* [SĔR-vĭ-kō-DĬN-ē-ă], neck pain
chondr(o)	cartilage	*chondroplasty* [KŎN-drō-plăs-tē], surgical repair of cartilage
condyl(o)	knob, knuckle	*condylectomy* [kŏn-dĭ-LĔK-tō-mē], excision of a condyle
cost(o)	rib	*costiform* [KŎS-tĭ-fŏrm], rib-shaped
crani(o)	skull	*craniotomy* [krā-nē-ŎT-ō-mē], incision into the skull
dactyl(o)	fingers, toes	*dactylitis* [dăk-tĭ-LĪ-tĭs], inflammation of the finger(s) or toe(s)
fasci(o)	fascia	*fasciotomy* [făsh-ē-ŎT-ō-mē], incision through a fascia
femor(o)	femur	*femorocele* [FĔM-ō-rō-sēl], hernia in the femur
fibr(o)	fiber	*fibroma* [fī-BRŌ-mă], benign tumor in fibrous tissue
humer(o)	humerus	*humeroscapular* [HYŪ-mĕr-ō-SKĂP-yū-lăr], relating to both the humerus and the scapula
ili(o)	ilium	*iliofemoral* [ĬL-ē-ō-FĔM-ō-răl], relating to the ilium and the femur
ischi(o)	ischium	*ischiodynia* [ĬS-kē-ō-DĬN-ē-ă], pain in the ischium
kyph(o)	hump; bent	*kyphoscoliosis* [KĪ-fō-skō-lē-Ō-sĭs], kyphosis and scoliosis combined
lamin(o)	lamina	*laminectomy* [LĂM-ĭ-NĔK-tō-mē], removal of part of one or more of the thick cartilaginous disks between the vertebrae
leiomy(o)	smooth muscle	*leiomyosarcoma* [LĪ-ō-MĪ-ō-săr-KŌ-mă], malignant tumor of smooth muscle

Combining Form	Meaning	Example
lumb(o)	lumbar	*lumboabdominal* [LŬM-bō-ăb-DŎM-i̇̆-năl], relating to the lumbar and abdominal regions
maxill(o)	upper jaw	*maxillofacial* [măk-SĬL-ō-FĀ-shăl], pertaining to the jaws and face
metacarp(o)	metacarpal	*metacarpectomy* [MĔT-ă-kăr-PĔK-tō-mē], excision of a metacarpal
my(o)	muscle	*myocardium* [mī̆-ō-KĂR-dē-ŭm], cardiac muscle in the middle layer of the heart
myel(o)	spinal cord; bone marrow	*myelocyst* [MĪ̆-ĕ-lō-si̇̆st], cyst that develops in bone marrow
oste(o)	bone	*osteoarthritis* [ŎS-tē-ō-ăr-THRĪ̆-ti̇̆s], arthritis characterized by erosion of cartilage and bone and joint pain
patell(o)	knee	*patellectomy* [PĂT-ĕ-LĔK-tō-mē], excision of the patella
ped(i), ped(o)	foot	*pedometer* [pĕ-DŎM-ĕ-tĕr], instrument for measuring walking distance
pelv(i)	pelvis	*pelviscope* [PĔL-vi̇̆-skōp], instrument for viewing the pelvic cavity
phalang(o)	finger or toe bone	*phalangectomy* [fă̆l-ăn-JĔK-tō-mē], removal of a finger or toe
pod(o)	foot	*podalgia* [pō-DĂL-jē-ă], foot pain
pub(o)	pubis	*puborectal* [PYŪ-bō-RĔK-tăl], relating to the pubis and the rectum
rachi(o)	spine	*rachiometer* [rā-kē-ŎM-ĕ-tĕr], instrument for measuring spine curvature
radi(o)	forearm bone	*radiomuscular* [RĀ-dē-ō-MŬS-kyū-lăr], relating to the radius and nearby muscles
rhabd(o)	rod-shaped	*rhabdosphincter* [RĂB-dō-SFĬNGK-tĕr], striated muscular sphincter
rhabdomy(o)	striated muscle	*rhabdomyolysis* [RĂB-dō-mī̆-ŎL-i̇̆-si̇̆s], acute disease that includes destruction of skeletal muscle
scapul(o)	scapula	*scapulodynia* [SKĂP-yū-lō-DĬN-ē-ă], scapula pain
scoli(o)	curved	*scoliokyphosis* [SKŌ-lē-ō-kī̆-FŌ-si̇̆s], lateral and posterior curvature of the spine

Combining Form	Meaning	Example
spondyl(o)	vertebra	*spondylitis* [spŏn-dĭ-LĪ-tĭs], inflammation of a vertebra
stern(o)	sternum	*sternodynia* [stĕr-nō-DĬN-ē-ă], sternum pain
synov(o)	synovial membrane	*synovitis* [sĭn-ō-VĪ-tĭs], inflammation of a synovial joint
tars(o)	tarsus	*tarsomegaly* [tăr-sō-MĔG-ă-lē], congenital abnormality with overgrowth of a tarsal bone
ten(o), tend(o), tendin(o)	tendon	*tenodynia* [tĕn-ō-DĬN-ē-ă], tendon pain; *tendoplasty* [TĔN-dō-plăs-tē], surgical repair of a tendon; *tendinitis* [tĕn-dĭ-NĪ-tĭs], tendon inflammation
thorac(o)	thorax	*thoracoabdominal* [THŌR-ă-kō-ăb-DŎM-ĭ-năl], relating to the thorax and the abdomen
tibi(o)	tibia	*tibiotarsal* [tĭb-ē-ō-TĂR-săl], relating to the tarsal and tibia bones
uln(o)	ulna	*ulnocarpal* [ŬL-nō-KĂR-păl], relating to the ulna and the wrist
vertebr(o)	vertebra	*vertebroarterial* [VĔR-tĕ-brō-ăr-TĒR-ē-ăl], relating to a vertebral artery or to a vertebra and an artery

Combining Forms Exercises

Build Your Medical Vocabulary

Complete the words using combining forms listed in this chapter.

18. Joint pain: _____ dynia

19. Plastic surgery of the skull: _____ plasty

20. Of the upper jaw and its teeth: _____ dental

21. Relating to the large area of the hip bone and the tibia: _____ tibial

22. Operation on the instep of the foot: _____ tomy

23. Relating to the head and chest: cephalo _____

24. Production of fibrous tissue: _____ plasia

25. Inflammation of the foot: _____ itis

26. Instrument for measuring spine curvature: _____ meter

27. Incision through the sternum: _____ tomy

CASE STUDY

Checking Medication

Dr. Wolf's next patient, Laura Spinoza, is in for a follow-up visit for fibromyalgia, a disease that causes chronic muscle pain. In addition, Laura has tested positive for CTS (carpal tunnel syndrome). The patient suffers from depression, for which she is currently being treated. Laura has had earlier reactions to some of the medications meant to relieve the symptoms of fibromyalgia. She is receiving new prescriptions for the fibromyalgia as well as directions for an exercise program. Dr. Wolf sent a follow-up letter to Laura's primary care physician after her visit.

Critical Thinking

28. Dr. Wolf gets referrals from general practitioners and internists. As a specialist in rheumatology, most of her cases involve diseases of the musculoskeletal system. Refer to the letter from Dr. Wolf and use the combining forms list to provide definitions of two diseases given as examples.

29. Laura has a physical condition in addition to fibromyalgia. What is it? Give both the abbreviation and the full spelling.

Alana Wolf, M.D.
285 Riverview Road
Belle Harbor, MI 09999

March 12, 20XX

Dr. Robert Johnson
16 Tyler Court
Newtown, MI 09990

Dear Dr. Johnson

I saw Laura Spinoza on March the 7th for evaluation of her fibromyalgia. I reviewed her history with her and discussed her treatment for depression. The history suggests that there has not been any new development of an inflammatory rheumatic disease process within the last two years. She does have right thumb-carpal pain, which represents some osteoarthritis. Headaches are frequent but she is receiving no specific therapy. Her sleep pattern remains disturbed at times.

Her height was 62 inches, her weight was 170 lbs, while her BP was 162/100 in the right arm in the reclining position. Pelvic and rectal examinations were not done. The abdominal examination revealed some mild tenderness in the right lower quadrant without other abnormalities. The musculoskeletal examination revealed rotation and flexion to the left with no other cervical abnormalities. The remainder of the musculoskeletal examination revealed hypermobility in the elbow and knees and slight bony osteoarthritic enlargement of the thumb-carpal joint. Slight deformity was noted in the right knee with mild patellar-femoral crepitus. Severe bilateral pas planus was present, with the right foot more involved than the left, and ankle vagus deformity with mild bony osteoarthritic enlargement of both 1st MTP joints.

Hope these thoughts are helpful. I want to thank you for the consultation. If I can be of future service with her or other rheumatic-problem patients, please do not hesitate to contact me.

Alana Wolf, MD

Alana Wolf, M.D.

Find the Word Parts

X-ref

Give the term that fits the definition given below. Each term must contain at least one of the combining forms given in the previous section. You may refer to the Appendix of combining forms at the back of the book.

30. Joint pain _____ .

31. Removal of a bursa _____ .

32. Inflammation of cartilage _____ .

33. Removal of a vertebra _____ .

34. Bone-forming cell _____ .

35. Abnormal bone hardening _____ .

36. Plastic surgery on the neck _____ .

37. Inflammation of the spinal cord _____ .

38. Foot spasm _____ .

39. Of the ulna and the carpus _____ .

Find the misspelled word part. Write the corrected word part in the space with its definition.

40. sinovotomy _____

41. myellogram _____

42. arthrodunia _____

43. ostiomyelitis _____

44. rakiometer _____

Diagnostic, Procedural, and Laboratory Terms

Specialists in the musculoskeletal system are:

- **orthopedists** or **orthopedic surgeons**, physicians who treat musculoskeletal disorders
- **osteopaths**, physicians who combine manipulative procedures with conventional treatment
- **rheumatologists,** physicians who treat disorders of the joints
- **podiatrists**, medical specialists who treat disorders of the foot
- **chiropractors**, health care professionals who use manipulative techniques

The National Osteoporosis Foundation (www.nof.org) gives tips on prevention.

X-ref

Diagnosing musculoskeletal ailments often involves the use of imaging as well as internal examinations. Table 5-4 lists some common diagnostic techniques.

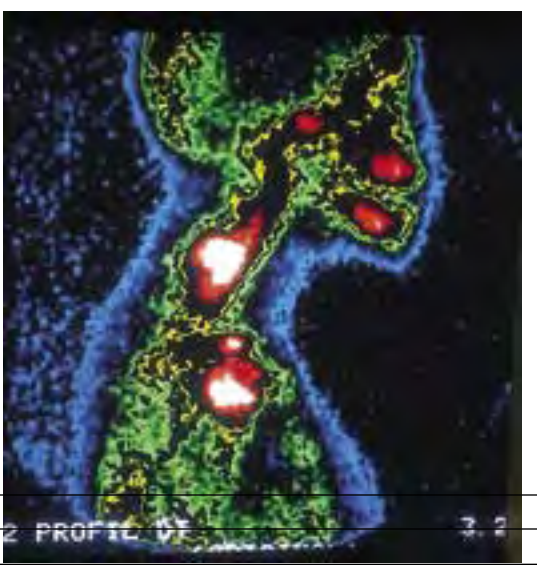

FIGURE 5-11 Bone scan of the neck and skull showing malignant tumors.

TABLE 5-4 Musculoskeletal diagnostic techniques.

arthrography	examination of joints
arthroscopy	internal examination of joints
discography	radiographic examination of disks
myelography	radiographic examination of the spinal cord
electromyogram	imaging of muscle activity
magnetic resonance imaging (MRI)	graphic imaging—used in musculoskeletal examinations as well as other body systems
X-ref **bone scan (see Figure 5-11)**	computerized scan to detect bone tumors
Tinel('s) sign	a sensation felt when tapping an injured nerve
rheumatoid factor test	laboratory test for rheumatoid arthritis
serum creatine phosphokinase (CPK)	laboratory test for skeletal injury
serum calcium and **serum phosphorus**	found in tests for substances in bone
uric acid test	laboratory test for gout
X-ref **goniometer (see Figure 5-12)**	device to measure joint motion
densitometer	imaging device for testing bone density

FIGURE 5-12 A goniometer is used to measure the range of motion of a joint.

VOCABULARY REVIEW

In the previous section, you learned terms relating to diagnosis, clinical procedures, and laboratory tests. Before going on to the exercises, read the definitions below. Pronunciations are provided for certain terms.

Term	Definition
arthrography [ăr-THRŎG-ră-fē] arthro-, joint + -graphy, process of recording	Radiography of a joint.

Term	Definition
arthroscopy [ăr-THRŎS-kō-pē] arthro-, joint + -scopy, a viewing with an instrument	Examination with an instrument that explores the interior of a joint.
bone scan	Radiographic or nuclear medicine image of a bone.
chiropractor [kī-rō-PRĂK-tōr] chiro-, hand + Greek praktikos, efficient	Health care professional who works to align the spinal column so as to treat certain ailments.
densitometer [dĕn-sĭ-TŎM-ĕ-tĕr]	Device that measures bone density using light and x-rays.
diskography [dĭs-KŎG-ră-fē]	Radiographic image of an intervertebral disk by injection of a contrast medium into the center of the disk.
electromyogram [ē-lĕk-trō-MĪ-ō-grăm] electro-, electrical + myo-, muscle + -gram, recording	A graphic image of muscular action using electrical currents.
goniometer [gō-nē-ŎM-ĕ-tĕr] Greek *gonia*, angle + -meter, measuring device	Instrument that measures angles or range of motion in a joint.
myelography [MĪ-ĕ-LŎG-ră-fĕ] myelo-, spinal cord + -graphy, process of recording	Radiographic imaging of the spinal cord.
orthopedist [ōr-thō-PĒ-dĭst]**, orthopedic** [ōr-thō-PĒD-ĭk] **surgeon** ortho-, straight + Greek *pais (paid-)*, child	Physician who examines, diagnoses, and treats disorders of the musculoskeletal system.
osteopath [ŎS-tē-ō-păth] osteo-, bone + -path(y), disease	Physician who combines manipulative treatment with conventional therapeutic measures.
podiatrist [pō-DĪ-ă-trĭst]	Medical specialist who examines, diagnoses, and treats disorders of the foot.
rheumatoid factor test	Test used to detect rheumatoid arthritis.
rheumatologist [rū-mă-TŎL-ō-jĭst]	Physician who examines, diagnoses, and treats disorders of the joints and musculoskeletal system.
serum calcium [SĒR-ŭm KĂL-sī-ŭm]	Test for calcium in the blood.
serum creatine phosphokinase [KRĒ-ă-tēn fŏs-fō-KĪ-nās]	Enzyme active in muscle contraction; usually phosphokinase is elevated after a myocardial infarction and in the presence of other degenerative muscle diseases.
serum phosphorus [FŎS-fōr-ŭs]	Test for phosphorus in the blood.
Tinel's [tĭ-NĔLZ] **sign**	"Pins and needles" sensation felt when an injured nerve site is tapped.
uric [YŪR-ĭk] **acid test**	Test for acid content in urine; elevated levels may indicate gout.

Case Study

Preventing Disease

Louella Jones (age 48) visited her gynecologist, Dr. Phillips, for her annual examination. During the past year, Louella had stopped menstruating. She had some symptoms of menopause, but they did not bother her tremendously. Louella is tall and very thin. Dr. Phillips sent her for a bone density test. The densitometer measured the density of Louella's bones and found that there was a slight increase in her bones' porosity from three years ago. Dr. Phillips suggested hormone replacement therapy and a program of weight-bearing exercises. However, Louella wanted more information about the treatment's potential impact on her condition before beginning therapy.

Critical Thinking

45. Why are bone density measurements important in the diagnosis?

46. Louella wanted more information before taking medication and starting an exercise program. What kind of information might she be given?

Diagnostic, Procedural, and Laboratory Terms Exercises

Test Your Knowledge

Answer the following questions.

47. Tests for calcium and phosphorus are given to determine blood levels of these minerals. What significance do these minerals have for the musculoskeletal system? _____

_____

_____

_____

48. Is it likely that a chiropractor would order a uric acid test? Why or why not? _____

_____

_____

49. Would a bone scan be likely to show bone cancer? _____

50. How is an osteopath like a chiropractor? _____

_____

51. What might a goniometer show about a muscle's action? _____

_____

Pathological Terms

Musculoskeletal disorders arise from congenital conditions, injury, degenerative disease, or other systemic disorders. A common injury, **fractures,** are breaks or cracks in bones. There are many different types of fractures:

- A **closed fracture** is a break with no open wound.
- An **open (compound) fracture** is a break with an open wound.
- A **simple (hairline** or **closed) fracture** does not move any part of the bone out of place.

- A **complex fracture** is a separation of part of the bone and usually requires surgery for repair.
- A **greenstick fracture** is an incomplete break of a soft (usually, a child's) bone.
- An **incomplete fracture** is a break that does not go entirely through any type of bone.
- A **comminuted fracture** is a break in which the bone is fragmented or shattered.
- A **Colles' fracture** is a break of the distal part of the radius.
- A **complicated fracture** involves extensive soft tissue injury.
- An **impacted fracture** occurs when a fragment from one part of a fracture is driven into the tissue of another part.
- A **pathological fracture** occurs at the site of bone already damaged by disease.
- A **compression fracture** is a break in one or more vertebrae caused by a compressing or squeezing of the space between the vertebrae.

X-ref

Figure 5-13 shows various types of fractures.

The National Library of Medicine has an online encyclopedia where you can learn more about almost any medical subject. Go to their Medline encyclopedia (www.nlm.nih.gov/medlineplus) and search for fractures to learn more about types and treatments for fractures.

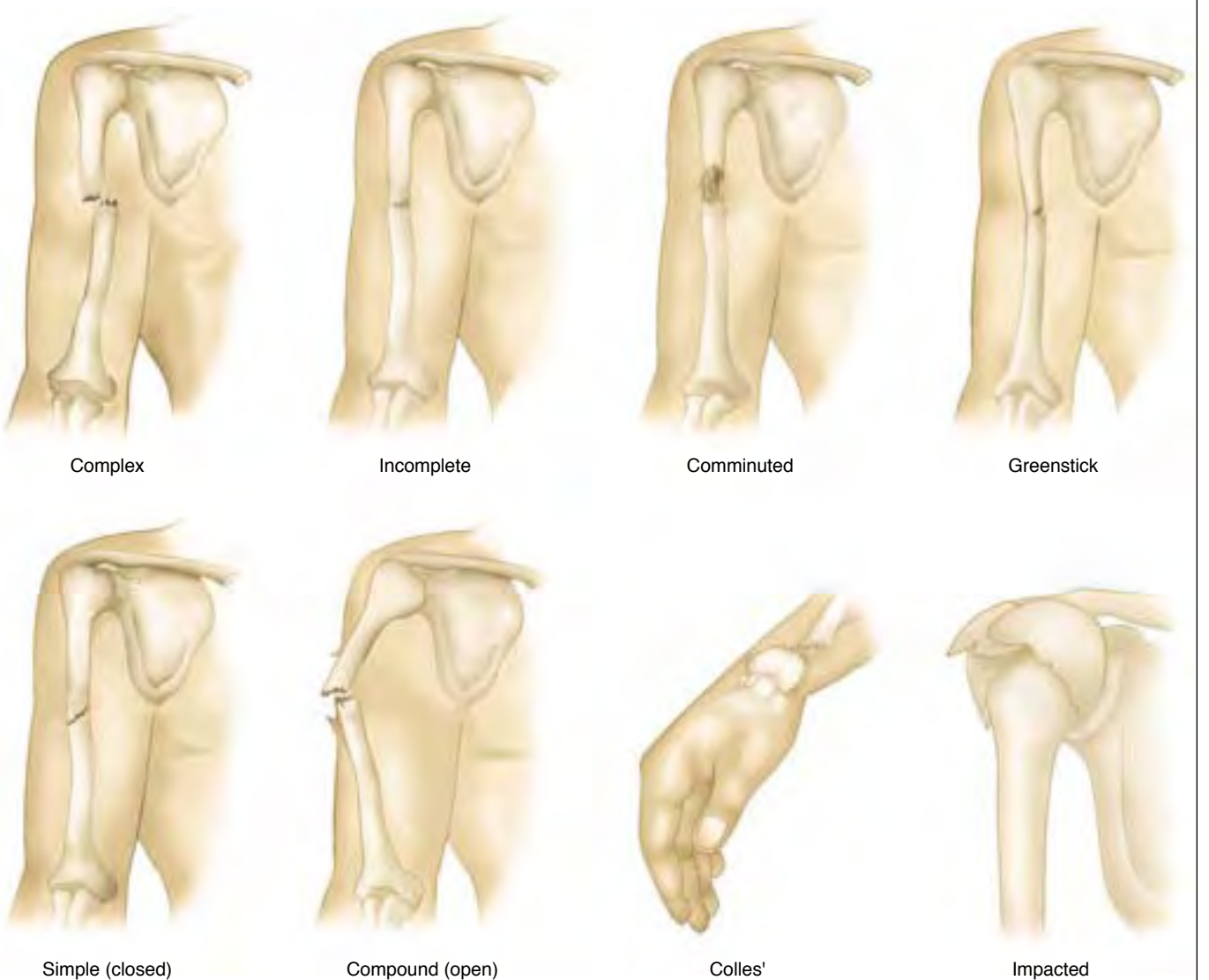

FIGURE 5-13 Some different types of fractures.

Musculoskeletal disorders may come from the musculoskeletal system itself or may result from disorders of other body systems. Some can be treated by **physical therapy.** Table 5-5 lists various musculoskeletal disorders.

X-ref

TABLE 5-5 Musculoskeletal disorders.

Condition, Disease, or Disorder	Where Located or Source	Characteristics or Causes
spina bifida	birth defect in the spine	developmental and physical disabilities
rickets	leg deformities	vitamin D deficiency
calcar or **spur**	bony projection	abnormal growth out of bone
sprain	ligament	injury
strain	muscle	overuse or improper use
carpal tunnel syndrome	hand	repetitive motion injury
tendonitis or **tendonitis**	tendon	inflammation
dislocation	point where bones meet	injury or sudden, strenuous movement
subluxation	point where bones meet	partial dislocation
osteoporosis	bones	loss of bone density
herniated disk	vertebrae	injury or disease, may lead to **sciatica**, lower back pain
contracture	muscles	disease or injury to muscle fibers
ostealgia or **osteodynia**	bones	pain
myalgia or **myodynia**	muscles	pain
arthralgia	joints	pain
ankylosis	joints	stiffness
spasm	muscles	disease
hypertrophy	muscle	abnormal increased size
hypotonia	muscle	abnormally reduced muscle tension
dystonia	muscle	abnormally increased muscle tension
rigor or **rigidity**	muscle	abnormal stiffness, usually from a disease
atrophy	muscle	shrinking from disease
muscular dystrophy	muscle	degenerative disease
myositis	muscle	inflammation
bursitis	bursa	inflammation
bunion	bursa of the big toe	inflammation

TABLE 5-5 Musculoskeletal disorders.

Condition, Disease, or Disorder	Where Located or Source	Characteristics or Causes
epiphysitis	epiphysis	inflammation
arthritis	joint	inflammation
rheumatoid arthritis	connective tissue	systemic autoimmune disease
osteoarthritis or **degenerative arthritis**	joint cartilage	degenerative disease
gout or **gouty arthritis**	joint pain	disease
podagra	big toe	painful disease
osteomyelitis	bone	infection
chondromalacia	cartilage	softening as from a herniated disk
spinal curvature, kyphosis, lordosis, scoliosis	abnormal posture conditions	pain; may be a result of poor nutrition, disease, or poor posture
phantom pain or **phantom limb**	at any paralyzed or amputated site	pain felt in missing or paralyzed limbs
myoma, myeloma, leiomyoma, leiomyosarcoma, rhabdomyoma, rhabdomyosarcoma	muscles	tumors
osteoma, osteosarcoma	bones	tumors

MORE ABOUT...

Fractures

Some types of fractures are possible indicators of child abuse. This is particularly true of *spiral fractures,* fractures caused by twisting an extremity until the bone breaks. This type of fracture is usually investigated as to its cause in a child. Also, if a child's x-rays show a number of old fractures, child abuse may be suspected. Unfortunately, there are some diseases that cause continual bone fracturing and, as a result, some people have been falsely accused of child abuse in such cases.

Go to the Arthritis Foundation's Web site (www.arthritis.org) to learn about arthritis research.

Carpal tunnel syndrome usually requires some rest period. For people who work on computers this may be difficult. There are alternative devices, such as the hands-free mouse (it uses head motion) available at www.ctsplace.com.

MORE ABOUT...

Cartilage

The replacement of damaged or lost cartilage is now possible. The procedure is to remove some of a patient's cartilage through a small incision, grow more cartilage in the laboratory using the patient's own cells, and inject them back into the small incision.

MORE ABOUT...

What Fractures Can Tell Us

Fractures can be caused by many types of injuries or diseases. Osteoporosis in older people may result in hip fractures which, in many cases, are thought to precede the actual fall. A twisting fracture may result from a twisting injury in a sports game. A comminuted fracture may result from the impact of a car crash. The type of fracture often gives clues as to how the initial injury occurred.

Vocabulary Review

In the previous section, you learned terms relating to pathology. Before going on to the exercises, read the definitions below. Pronunciations are provided for certain terms.

Term	Definition
ankylosis [ĂNG-kĭ-LŌ-sĭs]	Stiffening of a joint, especially as a result of disease.
arthralgia [ăr-THĂL-jē-ă]	Severe joint pain.
arthritis [ăr-THRĪ-tĭs]	Any of various conditions involving joint inflammation.
atrophy [ĂT-rō-fē]	Wasting away of tissue, organs, and cells, usually as a result of disease or loss of blood supply.
bunion [BŬN-yŭn]	An inflamed bursa at the foot joint, between the big toe and the first metatarsal bone.
bursitis [bŭr-SĪ-tĭs]	Inflammation of a bursa.
calcar [KĂL-kăr]	Spur.
carpal [KĂR-păl] **tunnel syndrome**	Pain and paresthesia in the hand due to repetitive motion injury of the median nerve.
chondromalacia [KŎN-drō-mă-LĀ-shē-ă]	Softening of cartilage.
closed fracture	Fracture with no open skin wound.
Colles' [kōlz] **fracture**	Fracture of the lower end of the radius.
comminuted [KŎM-ĭ-nū-tĕd] **fracture**	Fracture with shattered bones.
complex fracture	Fracture with part of the bone displaced.
complicated fracture	Fracture involving extensive soft tissue injury.
compound fracture	Fracture with an open skin wound; open fracture.
compression fracture	Fracture of one or more vertebrae caused by compressing of the space between the vertebrae.
contracture [kŏn-TRĂK-chūr]	Extreme resistance to the stretching of a muscle.
degenerative arthritis	Arthritis with erosion of the cartilage.
dislocation	Movement of a joint out of its normal position as a result of an injury or sudden, strenuous movement.
dystonia [dĭs-TŌ-nē-ă]	Abnormal tone in tissues.
epiphysitis [ĕ-pĭf-ĭ-SĪ-tĭs]	Inflammation of the epiphysis.
fracture [FRĂK-chŭr]	A break, especially in a bone.
gouty arthritis, gout [GŎWT-ē, gŏwt]	Inflammation of the joints, present in gout; usually caused by uric acid crystals.
greenstick fracture	Fracture with twisting or bending of the bone but no breaking; usually occurs in children.

Term	Definition
hairline fracture	Fracture with no bone separation or fragmentation.
herniated [HĚR-nē-ā-tĕd] **disk**	Protrusion of an intervertebral disk into the neural canal.
hypertrophy [hī-PĚR-trō-fē]	Abnormal increase as in muscle size.
hypotonia [HĪ-pō-TŌ-nē-ă]	Abnormally reduced muscle tension.
impacted fracture	Fracture in which a fragment from one part of the fracture is driven into the tissue of another part.
incomplete fracture	Fracture that does not go entirely through a bone.
kyphosis [kī-FŌ-sĭs]	Abnormal posterior spine curvature.
leiomyoma [LĪ-ō-mī-Ō-mă]	Benign tumor of smooth muscle.
leiomyosarcoma [LĪ-ō-MĪ-ō-săr-KŌ-mă]	Malignant tumor of smooth muscle.
lordosis [lōr-DŌ-sĭs]	Abnormal anterior spine curvature resulting in a sway back.
muscular dystrophy [MŬS-kyū-lăr DĬS-trō-fē]	Progressive degenerative disorder affecting the musculoskeletal system and, later, other organs.
myalgia [mī-ĂL-jē-ă]	Muscle pain.
myeloma [mī-ĕ-LŌ-mă]	Bone marrow tumor.
myodynia [MĪ-ō-DĬN-ē-ă]	Muscle pain.
myoma [mī-Ō-mă]	Benign muscle tumor.
myositis [mī-ō-SĪ-tĭs]	Inflammation of a muscle.
open fracture	Fracture with an open skin wound; compound fracture.
ostealgia [ŏs-tē-ĂL-jē-ă]	Bone pain.
osteoarthritis [ŎS-tē-ō-ăr-THRĪ-tĭs]	Arthritis with loss of cartilage.
osteodynia [ŏs-tē-ō-DĬN-ē-ă]	Bone pain.
osteoma [ŏs-tē-Ō-mă]	Benign bone tumor, usually on the skull or mandible.
osteomyelitis [ŎS-tē-ō-mī-ĕ-LĪ-tĭs]	Inflammation of the bone marrow and surrounding bone.
osteoporosis [ŎS-tē-ō-pō-RŌ-sĭs]	Degenerative thinning of bone.
osteosarcoma [ŎS-tē-ō-săr-KŌ-mă]	Malignant tumor of bone.
pathological fracture	Fracture occurring at the site of already damaged bone.
phantom limb; phantom pain	Pain felt in a paralyzed or amputated limb.
physical therapy	Movement therapy to restore use of damaged areas of the body.

Term	Definition
podagra [pō-DĂG-ră]	Pain in the big toe, often associated with gout.
rhabdomyoma [RĂB-dō-mī-Ō-mă]	Benign tumor in striated muscle.
rhabdomyosarcoma [RĂB-dō-mī-ō-săr-KŌ-mă]	Malignant tumor in striated muscle.
rheumatoid [RŪ-mă-tŏyd] **arthritis**	Autoimmune disorder affecting connective tissue.
rickets [RĬK-ĕts]	Disease of the skeletal system, usually caused by vitamin D deficiency.
rigidity	Stiffness.
rigor [RĬG-ōr]	Stiffening.
sciatica [sī-ĂT-ĭ-kă]	Pain in the lower back, usually radiating down the leg, from a herniated disk or other injury or condition.
scoliosis [skō-lē-Ō-sĭs]	Abnormal lateral curvature of the spinal column.
simple fracture	Fracture with no open skin wound.
spasm [spăzm]	Sudden, involuntary muscle contraction.
spastic [SPĂS-tĭk]	Tending to have spasms.
spina bifida [SPĪ-nă BĬF-ĭ-dă]	Congenital defect with deformity of the spinal column.
spinal curvature	Abnormal curvature of the spine.
sprain [sprān]	Injury to a ligament.
spur [spŭr]	Bony projection growing out of a bone; calcar.
strain [strān]	Injury to a muscle as a result of improper use or overuse.
subluxation [sŭb-lŭk-SĀ-shŭn]	Partial dislocation, as between joint surfaces.
tendinitis, tendonitis [tĕn-dĭn-ĪT-ĭs]	Inflammation of a tendon.

Case Study

Making a Referral

Dr. Millet, a chiropractor, sees many patients for back pain. His treatments consist primarily of spinal manipulation, heat, and nutritional and exercise counseling. He currently sees a group of patients, mainly middle-aged men, who complain of sciatica. He has been able to relieve the pain for about 50 percent of them. The others seem to have more persistent pain. Dr. Millet is not allowed to prescribe medications because he is not a licensed medical doctor. He refers some of his patients to Dr. Wolf, a specialist, who believes that Dr. Millet provides a valuable service.

Critical Thinking

52. Chiropractic is one way for some people to manage pain. Why might spinal manipulation help?

53. If spinal manipulation does not work, why should the patient see a medical specialist?

Pathological Terms Exercises

Build Your Medical Vocabulary

Match the word roots on the left with the proper definition on the right.

54. ____ myo-	**a.** bone
55. ____ myelo-	**b.** hand
56. ____ rhabdo-	**c.** rod-shaped
57. ____ osteo-	**d.** joint
58. ____ arthro-	**e.** bone marrow
59. ____ chiro-	**f.** muscle

Know the Word Parts

Match the following terms with the letter that gives the best definition.

60. ____ myeloma	**a.** malignant tumor of smooth muscle
61. ____ myoma	**b.** benign tumor in striated muscle
62. ____ leiomyoma	**c.** benign tumor of smooth muscle
63. ____ leiomyosarcoma	**d.** benign muscle tumor
64. ____ rhabdomyoma	**e.** malignant bone tumor
65. ____ rhabdomyosarcoma	**f.** bone marrow tumor
66. ____ osteoma	**g.** malignant tumor in striated muscle
67. ____ osteosarcoma	**h.** benign tumor, usually on the skull or mandible

Check Your Knowledge

Complete the sentences below by filling in the blanks.

68. A patient with painful joints and bulges around the knuckles probably has _____.

69. Fractures that are most likely to occur in young children are called _____ fractures.

70. Osteoporosis is usually a disease found in _____ women.

71. Playing tennis too vigorously may cause _____ of the elbow.

72. Repetitive motion may cause _____ _____ _____.

73. A muscle tumor is a(n) _____.

74. A slipped disk is called _____.

75. A compound fracture is a break accompanied by a(n) _____ wound.

76. Arthritis is a general term for a number of _____ diseases.

77. Paralysis may be caused by an injury to the _____.

Surgical Terms

Orthopedic surgery may involve repair, grafting, replacement, excision, or reconstruction of parts of the musculoskeletal system. Surgeons also make incisions to take biopsies. Almost any major part of the musculoskeletal

system can now be surgically replaced. **Amputation,** removal of a limb, may be necessary. **Prosthetic devices** now routinely replace knees and hips. **Bone grafting** can repair a defect. An **orthosis** or **orthotic** may be used to provide support.

Fractures are treated by **casting, splinting,** surgical manipulation, or placement in **traction. Reduction** is the return of a part to its normal position.

Historically, before the advent of antibiotics, limb amputations were often necessary due to infections or wounds that would have no way to heal. Now, amputations are much rarer. New techniques of bone repair and infection control make it more likely that they can be avoided.

Osteoplasty is repair of a bone. **Osteoclasis** is the breaking of bone for the purpose of repairing it. **Osteotomy** is an incision into a bone. **Tenotomy** is the cutting into a tendon to repair a muscle. **Myoplasty** is muscle repair. **Arthroplasty** is joint repair. **Arthrocentesis** is a puncture into a joint. A **synovectomy** is the removal of part or all of the synovial membrane of a joint. **Arthrodesis** and **spondylosyndesis** are two types of fusion. A **bursectomy** is the removal of an affected bursa. A **bunionectomy** is the removal of a bunion.

Vocabulary Review

In the previous section, you learned terms relating to surgery. Before going on to the exercises, read the definitions below. Pronunciations are provided for certain terms.

Term	Definition
amputation [ĂM-pyū-TĀ-shŭn]	Cutting off of a limb or part of a limb.
arthrocentesis [ĂR-thrō-sĕn-TĒ-sĭs] arthro-, joint + Greek *kentesis*, puncture	Removal of fluid from a joint with use of a puncture needle.
arthrodesis [ăr-thrō-DĒ-sĭs] arthro-, + Greek *desis*, a binding	Surgical fusion of a joint to stiffen it.
arthroplasty [ĂR-thrō-plăs-tē] arthro- + -plasty, repair	Surgical replacement or repair of a joint.
bone grafting	Transplantation of bone from one site to another.
bunionectomy [bŭn-yŭn-ĔK-tō-mē] bunion + -ectomy, removal	Removal of a bunion.
bursectomy [bŭr-SĔK-tō-mĕ] burs(a) + -ectomy, removal	Removal of a bursa.
casting	Forming of a cast in a mold; placing of fiberglass or plaster over a body part to prevent its movement.
myoplasty [MĪ-ō-plăs-tē] myo-, muscle + -plasty, repair	Surgical repair of muscle tissue.
orthosis, orthotic [ōr-THŌ-sĭs, ōr-THŎT-ĭk]	External appliance used to immobilize or assist the movement of the spine or limbs.
osteoclasis [ŎS-tē-ŎK-lā-sĭs] osteo-, bone + -clasis, breaking	Breaking of a bone in order to repair or reposition it.

Term	Definition
osteoplasty [ŎS-tē-ō-plăs-tē] osteo-, bone + -plasty, repair	Surgical replacement or repair of bone.
osteotomy [ŏs-tē-ŎT-ō-mē] osteo-, bone + -tomy, cutting	Cutting of bone.
prosthetic [prŏs-THĔT-ĭk] **device**	Artificial device used as a substitute for a missing or diseased body part.
reduction	Return of a part to its normal position.
splinting	Applying a splint to immobilize a body part.
spondylosyndesis [SPŎN-dĭ-lō-sĭn-DĒ-sĭs] spondylo-, vertebrae + Greek *syndesis*, a binding together	Fusion of two or more spinal vertebrae.
synovectomy [sĭn-ō-VĔK-tō-mē] synovi(o)-, synovial fluid + -ectomy, removal	Removal of part or all of a joint's synovial membrane.
tenotomy [tĕ-NŎT-ō-mē] teno-, tendon + -tomy, cutting	Surgical cutting of a tendon.
traction [TRĂK-shŭn]	Dragging or pulling or straightening of something, as a limb, by attachment of elastic or other devices.

Case Study

Musculoskeletal Injury

John Positano, a track star at a large university, suffered a knee injury during a meet. The team physician prescribed rest and medication first, to be followed by a gradual program of physical therapy. John missed about six weeks of meets and seemed fine until the end of the season, when a particularly strenuous run in which he twisted his knee left him writhing in pain. It was the same knee on which fluid had accumulated during the previous week. X-rays showed no fractures. Later, after examination by a specialist, arthroscopic surgery was recommended. John had to go through another rehabilitative program (rest, medication, and physical therapy) after the surgery.

Critical Thinking

78. A program of physical therapy was prescribed for John. Which one of his tests was most important in determining whether or not he could exercise?

79. Is physical therapy always appropriate for a musculoskeletal injury?

Surgical Terms Exercises

Build Your Medical Vocabulary

X-ref

Form two surgical words for each of the following word roots by adding suffixes learned in Chapter 2.

80. osteo- _____

81. arthro- _____

82. myo- _____

Find a Match

Match the terms in the second column to the terms in the first.

83. ____ amputation	**a.** replacement device
84. ____ prosthesis	**b.** molding
85. ____ orthosis, orthotic	**c.** muscle repair
86. ____ traction	**d.** bone cutting
87. ____ casting	**e.** limb removal
88. ____ splinting	**f.** bone repair
89. ____ myoplasty	**g.** external supporting or immobilizing device
90. ____ osteoplasty	**h.** wrapping to immobilize
91. ____ osteotomy	**i.** pulling to straighten
92. ____ arthroplasty	**j.** joint repair

Terminology in Action

After an x-ray given in the emergency room, Ellen was told that she would need to be seen by the orthopedist on call. The notes in her chart are as follows:

> *X-RAY: X-ray of the right wrist reveals distal radial fracture with about 20 degrees dorsal angulation and displaced about 30% from normal position. There is no ulnar fracture. Right knee x-ray shows a fracture of the patella with no displacement of the fragments.*

From the notes, describe what she has fractured and what you think the treatment will be.

Using the Internet

Osteoporosis can be a serious affliction of late adulthood. Visit the National Osteoporosis Foundation's Web site (http://www.nof.org). From what you read at the site, what can you do to prevent osteoporosis as you age?

CHAPTER REVIEW

The material that follows is to help you review all the material in this chapter.

DEFINITIONS

Define the following terms and combining forms. Review the chapter before starting. Make sure you know how to pronounce each term as you define it. The blue words in curly brackets are references to the Spanish glossary in Appendix C.

X-ref

WORD	DEFINITION
acetabul(o)	
acetabulum [ăs-ĕ-TĂB-yū-lŭm] {acetábulo}	
acromi(o)	
acromion [ă-KRŌ-mē-ōn] {acromion}	
amphiarthrosis [ĂM-fĭ-ăr-THRŌ-sĭs] {anfiartrosis}	
amputation [ĂM-pyū-TĀ-shŭn] {amputación}	
ankle [ĂNG-kl] {tobillo}	
ankyl(o)	
ankylosis [ĂNG-kĭ-LŌ-sĭs] {anquilosis}	
arthr(o)	
arthralgia [ăr-THRĂL-jē-ă] {artralgia}	
arthritis [ăr-THRĪ-tĭs] {artritis}	
arthrocentesis [ĂR-thrō-sĕn-TĒ-sĭs] {artrocentesis}	
arthrodesis [ăr-thrō-DĒ-sĭs]	
arthrography [ăr-THRŎG-ră-fē]	
arthroplasty [ĂR-thrō-plăs-tē]	
arthroscopy [ăr-THRŌS-kŏ-pē]	
articular [ăr-TĬK-yū-lăr] cartilage	
articulation [ăr-tĭk-yū-LĀ-shŭn] {articulación}	
atlas [ĂT-lăs] {atlas}	
atrophy [ĂT-rō-fē] {atrofia}	
axis [ĂK-sĭs] {axis}	
~~bone {hueso}~~	

Word	Definition
bone grafting	
bone head	
bone phagocyte [FĂG-ō-sīt]	
bone scan	
brachi(o)	
bunion [BŬN-yŭn] {bunio}	
bunionectomy [bŭn-yŭn-ĔK-tō-mē] {bunionectomía}	
burs(o)	
bursa (*pl.*, bursae) [BŬR-să (BŬR-sē)] {bursa}	
bursectomy [bŭr-SĔK-tō-mē] {bursectomía}	
bursitis [bŭr-SĪ-tĭs] {bursitis}	
calcane(o)	
calcaneus [kăl-KĀ-nē-ŭs] {calcáneo}	
calcar [KĂL-kăr] {calcar}	
calci(o)	
cancellous [KĂN-sĕ-lŭs] {canceloso} bone	
cardiac [KĂR-dē-ăk] muscle	
carp(o)	
carpal [KĂR-păl] tunnel syndrome	
carpus [KĂR-pŭs], carpal bone	
cartilage [KĂR-tĭ-lăj] {cartílago}	
cartilaginous [kăr-tĭ-LĂJ-ĭ-nŭs] disk	
casting {colado}	
cephal(o)	
cervic(o)	
cervical [SĔR-vĭ-kăl] vertebrae	
chiropractor [kī-rō-PRĂK-tĕr] {quiropráctico}	
chondr(o)	
chondromalacia [KŎN-drō-mă-LĀ-shē-ă] {condromalacia}	
clavicle [KLĂV-ĭ-kl] {clavicula}	
closed fracture	

Word	Definition
coccyx [KŎK-sĭks] {cóccix}	
Colles' [kōlz] fracture	
comminuted [KŎM-ĭ-nū-tĕd] fracture	
compact bone	
complex fracture	
complicated fracture	
compound fracture	
compression fracture	
condyl(o)	
condyle [KŎN-dīl]	
contracture [kŏn-TRĂK-chŭr]	
corticosteroid	
cost(o)	
crani(o)	
crest {cresta}	
dactyl(o)	
degenerative arthritis	
densitometer [dĕn-sĭ-TŎM-ĕ-tĕr]	
diaphysis [dī-ĂF-ĭ-sĭs] {diáfisis}	
diarthroses [dī-ăr-THRŌ-sēz]	
disk [dĭsk] {disco}	
diskography [dĭs-KŎG-ră-fē] {discografía}	
dislocation {dislocación}	
dorsal vertebrae	
dystonia [dĭs-TŌ-nē-ă] {distonia}	
elbow [ĔL-bō] {codo}	
electromyogram [ē-lĕk-trō-MĪ-ō-grăm] {electromiógrafo}	
endosteum [ĕn-DŎS-tē-ŭm] {endostio}	
epiphyseal [ĕp-ĭ-FĬZ-ē-ăl] plate	
epiphysitis [ĕ-pĭf-ĭ-SĪ-tĭs] {epifisitis}	
ethmoid [ĔTH-mŏyd] bone	
ethmoid sinuses	
fasci(o)	

Word	Definition
fascia (*pl.*, fasciae [FĂSH-ē-ă (FĂSH-ē-ē)] {fascia}	
femor(o)	
femur [FĒ-mūr] {fémur}	
fibr(o)	
fibula [FĬB-yū-lă] {peroné}	
fissure [FĬSH-ŭr] {fisura}	
flat bones	
fontanelle [FŎN-tă-nĕl] {fontanela}	
foramen [fō-RĀ-mĕn] {agujero}	
fossa (*pl.*, fossae) [FŎS-ă (FŎS-ē)] {fosa}	
fracture [FRĂK-chŭr] {fractura}	
frontal [FRŬN-tăl] bone	
frontal sinuses	
goniometer [gō-nē-ŎM-ĕ-tĕr] {goniómetro}	
gouty arthritis, gout [GŎWT-ē, gŏwt]	
greenstick fracture	
hairline fracture	
herniated [HĔR-nē-ā-tĕd] disk	
humer(o)	
humerus [HYŪ-mĕr-ŭs] {húmero}	
hypertrophy [hī-PĔR-trō-fē]	
hypotonia [HĪ-pō-TŌ-nē-ă]	
ili(o)	
ilium [ĬL-ē-ŭm] {ilium}	
impacted fracture	
incomplete fracture	
insertion {inserción}	
intervertebral [ĭn-tĕr-VĔR-tĕ-brăl] disk	
involuntary muscle	
irregular bones	
ischi(o)	
ischium [ĬS-kē-ŭm] {isquión}	

Word	Definition
joint [jŏynt] {empalme}	
kyph(o)	
kyphosis [kĭ-FŌ-sĭs] {cifosis}	
lacrimal [LĂK-rĭ-măl] bone	
lamin(o)	
lamina (*pl.*, laminae) [LĂM-ĭ-nă (LĂM-ĭ-nē)] {lamina}	
leiomy(o)	
leiomyoma [LĪ-ō-mĭ-Ō-mă]	
leiomyosarcoma [LĪ-ō-MĪ-ō-săr-KŌmă]	
ligament [LĬG-ă-mĕnt] {ligamento}	
long bone	
lordosis [lōr-DŌ-sĭs] {lordosis}	
lumb(o)	
lumbar [LŬM-băr] vertebrae	
malleolus (*pl.*, malleoli) [mă-LĒ-ō-lŭs (mă-LĒ-ō-lī)]	
mandible [MĂN-dĭ-bl] {mandíbula}	
mandibular [măn-DĬB-yū-lăr]	
marrow [MĂR-ō] {médula}	
mastoid [MĂS-tŏyd] process	
maxill(o)	
maxillary [MĂK-sĭ-lār-ē] bone	
maxillary sinus	
medullary [MĔD-ū-lār-ē] cavity	
metacarp(o)	
metacarpal [MĔT-ă-KĂR-păl] {metacarpiano}	
metaphysis [mĕ-TĂF-ĭ-sĭs] {metáfisis}	
metatarsal [MĔT-ă-tăr-săl] bones	
muscle [MŬS-ĕl] {músculo}	
muscular dystrophy [MŬS-kyū-lăr DĬS-trō-fē] {distrofia muscular}	
musculoskeletal [MŬS-kyū-lō-SKĔL-ĕ-tăl] {musculoesquelético} system	
~~my(o)~~	

Word	Definition
myalgia [mī-ĂL-jē-ă] {mialgia}	
myel(o)	
myelography [MĪ-ĕ-LŎG-ră-fē] {mielografia}	
myeloma [mī-ĕ-LŌ-mă] {mieloma}	
myodynia [MĪ-ō-DĬN-ē-ă] {miodinia}	
myoma [mī-Ō-mă] {mioma}	
myoplasty [MĪ-ō-plăs-tē]	
myositis [mī-ō-SĪ-tĭs] {miositis}	
nasal bones	
neural [NŪR-ăl] canal	
nucleus pulposus [NŪ-klē-ŭs pŭl-PŌ-sŭs]	
occipital [ŏk-SĬP-ĭ-tăl] bone	
olecranon [ō-LĔK-ră-nŏn] {olecranon}	
open fracture	
origin {origen}	
orthopedist [ōr-thō-PĒ-dĭst], orthopedic [ōr-thō-PĒ-dĭk] {ortopedista} surgeon	
orthosis [ōr-THŌ-sĭs], orthotic [ōr-THŎT-ĭk] {ortosis, ortótica}	
osseus [ŎS-ē-ŭs] tissue	
ossification [ŎS-ĭ-fĭ-KĀ-shŭn] {ossificación}	
oste(o)	
ostealgia [ŏs-tĕ-ĂL-jē-ă] {ostealgia}	
osteoarthritis [ŎS-tē-ō-ăr-THRĪ-tĭs] {osteoartritis}	
osteoblast [ŎS-tē-ō-blăst] {osteoblasto}	
osteoclasis [ŎS-tē-ŎK-lā-sĭs] {osteoclasia}	
osteoclast [ŎS-tē-ō-klăst] {osteoclasto}	
osteocyte [ŎS-tē-ō-sīt] {osteocito}	
osteodynia [ŏs-tē-ō-DĬN-ē-ă] {osteodinia}	
osteoma [ŏs-tē-Ō-mă] {osteoma}	

Word	Definition
osteomyelitis [ŎS-tē-ō-mī̆-ĕ-LĪ-tĭs] {osteomielitis}	
osteopath [ŎS-tē-ō-păth] {osteópata}	
osteoplasty [ŎS-tē-ō-plăs-tē] {osteoplastia}	
osteoporosis [ŎS-tē-ō-pō-RŌ-sĭs] {osteoporosis}	
osteosarcoma [ŎS-tē-ō-săr-KŌ-mă] {osteosarcoma}	
osteotomy [ŏs-tē-ŎT-ō-mē] {osteotomía}	
palatine [PĂL-ă-tīn] bone	
parietal [pă-RĪ-ĕ-tăl] bone	
patell(o)	
patella [pă-TĔL-ă] {rótula}	
pathological fracture	
ped(i), ped(o)	
pelv(i)	
pelvic [PĔL-vĭk] cavity	
pelvic girdle	
pelvis [PĔL-vĭs] {pelvis}	
periosteum [pĕr-ē-ŎS-tē-ŭm] {periostio}	
phalang(o)	
phalanges (*sing.*, phalanx) [fă-LĂN-jēz (FĀ-lăngks)] {falangeo}	
phantom limb; phantom pain	
physical therapy	
pod(o)	
podagra [pō-DĂG-ră] {podagra}	
podiatrist [pō-DĪ-ă-trĭst] {podiatra}	
process [PRŌS-sĕs, PRŎS-ĕs]	
prosthetic [prŏs-THĔT-ĭk] device	
pub(o)	
pubes [PYŪ-bĭs] {pubis}	
pubic symphysis [PYŪ-bĭk SĬM-fĭ-sĭs]	
rachi(o)	
radi(o)	
radius [RĀ-dē-ŭs] {radio}	

Word	Definition
reduction {reducción}	
rhabd(o)	
rhabdomy(o)	
rhabdomyoma [RĂB-dō-mī-Ō-mă] {rabdomioma}	
rhabdomyosarcoma [RĂB-dō-mī-ō-săr-KŌ-mă] {rabdomiosarcoma}	
rheumatoid arthritis	
rheumatoid factor test	
rheumatologist [rū-mă-TŎL-ō-jĭst] {reumatólogo}	
rib {costilla}	
rickets [RĬK-ĕts] {raquitismo}	
rigidity {rigidez}	
rigor [RĬG-ōr] {rigor}	
sacrum [SĀ-krŭm] {sacro}	
scapul(o)	
scapula [SKĂP-yū-lă] {escápula}	
sciatica [sī-ĂT-ĭ-kă] {ciática}	
scoli(o)	
scoliosis [skō-lē-Ō-sĭs] {escolisis}	
sella turcica [SĔL-ă-TŬR-sĭ-kă] {silla turcica}	
serum calcium	
serum creatine phosphokinase [SĒR-ŭm KRĒ-ă-tēn fŏs-fō-KĪ-nās]	
serum phosphorus	
sesamoid [SĔS-ă-mŏyd] bone	
shin [shĭn] {espinilla}	
short bones	
simple fracture	
sinus [SĪ-nŭs] {seno}	
skeleton [SKĔL-ĕ-tŏn] {esqueleto}	
smooth muscle	
spasm [spăzm] {espasmo}	
spastic [SPĂS-tĭk] {espástico}	
sphenoid [SFĒ-nŏyd] bone	

Word	Definition
sphenoid sinus	
spina bifida [SPĪ-nă BĬF-ĭ-dă] {espina bífido}	
spinal column	
spinal curvature	
spinous [SPĪ-nŭs] process	
splinting {ferulización}	
spondyl(o)	
spondylolisthesis [SPŎN-dĭ-lō-lĭs-THĒ-sĭs] {espondilolistesis}	
spongy bone	
sprain [sprān]	
spur [spŭr]	
stern(o)	
sternum [STĔR-nŭm] {esternón}	
strain [strān] {distender}	
striated [strī-ĀT-ĕd] muscle	
styloid [STĪ-lŏyd] process	
subluxation [sŭb-lŭk-SĀ-shŭn] {subluxación}	
sulcus (pl., sulci) [SŬL-kŭs, [SŬL-sī] {surco}	
suture [SŪ-chūr] {sutura}	
symphysis [SĬM-fĭ-sĭs] {sinfisis}	
synarthrosis [SĬN-ăr-THRŌ-sĭs] {sinartrosis}	
synov(o)	
synovectomy [sĭn-ō-VĔK-tō-mē] {sinovectomi}	
synovial [sĭ-NŌ-vē-ăl] fluid	
synovial joint	
synovial membrane	
tars(o)	
tarsus, tarsal [TĂR-sŭs, TĂR-săl] bones	
temporal [TĔM-pō-RĂL] bone	
temporomandibular [TĔM-pō-rō-măn-DĬB-yū-lăr] joint	

Word	Definition
ten(o), tend(o), tendin(o)	
tendinitis, tendonitis {tendonitis}	
tendon [TĚN-dŏn] {tendon}	
tenotomy [tĕ-NŎT-ō-mē] {tenotomía}	
thorac(o)	
thoracic [thō-RĂS-ĭk] vertebrae	
thorax [THŌ-răks] {tórax}	
tibi(o)	
tibia [TĬB-ē-ă] {tibia}	
Tinel's [tĭ-NĚLZ] sign	
traction [TRĂK-shŭn] {tracción}	
transverse process	
trochanter [trō-KĂN-tĕr] {trocánter}	
true ribs	
tubercle [TŪ-bĕr-kl] {tubérculo}	
tuberosity [TŪ-bĕr-ŏs-ĭ-tē] {tuberosidad}	
uln(o)	
ulna [ŬL-nă] {ulna}	
uric [YŪR-ĭk] acid test	
vertebr(o)	
vertebra (*pl.*, vertebrae) [VĚR-tĕ-bră (VĚR-tĕ-brē)] {vertebra}	
vertebral [vĕr-TĚ-brăl, VĚR-tĕ-brăl] body	
vertebral column	
visceral [VĬS-ĕr-ăl] muscle	
voluntary muscle	
vomer [VŌ-mĕr] {vómer}	
zygomatic [ZĪ-gō-MĂT-ĭk] bone	

Answers to Chapter Exercises

1. Synovial fluid lubricates joints.
2. Yes, exercise can increase breathing and heart rate which can exercise certain involuntary muscles. Voluntary muscles may be exercised at will.
3. long
4. compact bone
5. marrow
6. fontanelles
7. nucleus pulposus
8. acromion
9. true ribs
10. patella
11. calcaneus
12. cardiac
13. F
14. F
15. F
16. T
17. T
18. arthro
19. cranio
20. maxillo
21. ilio
22. tarso
23. thoracic
24. fibro
25. pod
26. rachio
27. sterno
28. fibromyalgia, pain in the fibrous tissue of muscles; osteoarthritis, arthritis of the bone
29. CTS, carpel tunnel syndrome
30. arthralgia, arthrodynia
31. bursectomy
32. chondritis
33. spondylectomy
34. osteoblast
35. osteosclerosis
36. cervicoplasty
37. myelitis
38. podospasm
39. ulnocarpal
40. synovo-, synovial fluid; synovial membrane
41. myelo-, spinal cord; bone marrow
42. -dynia, pain
43. osteo-, bone
44. rachio-, spine
45. Porous bone can result in breakage.
46. alternative treatment plans, side effects, potential benefits, potential risks, and the negative effect of not taking the medicine
47. These elements are crucial to bone formation.
48. No. Chiropractors are concerned with spinal manipulation.
49. Yes, the picture of the bone should show abnormalities.
50. Both believe in spinal manipulation.
51. A goniometer can measure range of motion of a joint.
52. It may help ease pain by loosening and realigning.
53. Because the pain may be due to a condition other than back misalignment.
54. f.
55. e.
56. c.
57. a.
58. d.
59. b.
60. f
61. d
62. c
63. a
64. b
65. g
66. h
67. e
68. arthritis
69. greenstick
70. older
71. tendinitis (tendonitis)
72. carpal tunnel syndrome
73. myoma
74. spondylolisthesis
75. open
76. joint
77. spinal cord
78. The x-rays showed no fractures; therefore, no area needed to be held in place for a long period of time to allow the bone to heal.
79. No, not if there are certain kinds of fractures that must heal before movement is attempted.

Answers to 80–83 may vary. Sample answers are shown below.

80. osteotomy, osteoplasty, osteoclasis
81. arthroplasty, arthrotomy
82. myotomy, myoplasty
83. e
84. a
85. g
86. i
87. b
88. h
89. c
90. f
91. d
92. j