The Musculoskeletal System

After studying this chapter, you will be able to:

5.1 Name the parts of the musculoskeletal system and discuss the function of each part
5.2 Define combining forms used in building words that relate to the musculoskeletal system
5.3 Identify the meaning of related abbreviations
5.4 Name the common diagnoses, laboratory tests, and clinical procedures used in treating disorders of the musculoskeletal system
5.5 List and define the major pathological conditions of the musculoskeletal system
5.6 Define surgical terms related to the musculoskeletal system
5.7 List common pharmacological agents used in treating disorders of 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. This system includes bones, joints, and muscles. Figure 5-1 shows the musculoskeletal system.

Bones are made of osseous tissue and include a rich network of blood vessels and nerves. The cells of bone, called osteocytes, are part of a dense network of connective tissue. The cells themselves are surrounded by calcium salts. During fetal development, bones are softer and flexible and are composed of cartilage until the hardening process begins.

Bone-forming cells are called osteoblasts. As bone tissue develops, some of it dies and is reabsorbed by osteoclasts (also called bone phagocytes). The reabsorption of dead bone cells prevents the bone from becoming overly thick and heavy. Later, if a bone breaks, osteoblasts will add new mineral matter to repair the break and the osteoclasts will remove any bone debris, thereby smoothing over the break. The hardening process and development of the osteocytes is called ossification. This process is largely dependent on calcium, phosphorus, and vitamin D.

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. The axial portion of the skeleton includes the trunk and head. The appendicular portion of the skeleton includes the limbs.

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.
Bones

There are many types of bones. The five most common categories include:

1. The **long bones** form the extremities of the body. The legs and arms include this type of bone. The longest portion of a long bone is called the shaft. The outer portion is **compact bone**, solid bone that does not bend easily. Compact bone is where oxygen and nutrients are brought from the bloodstream to the bone. This shaft is also called the **diaphysis** or place where bone growth occurs first.

   Each end of the shaft has an area shaped to connect to other bones by means of ligaments and muscle. These ends are called the **proximal epiphysis** and the **distal epiphysis**. As long bones grow, the **metaphysis**, the space between the diaphysis and the two epiphyses, develops. The **epiphyseal plate** is cartilaginous tissue that is replaced during growth years, but eventually calcifies and disappears when growth has stopped. The epiphysis is covered by **articular cartilage**, a thin, flexible substance that provides protection at movable points.

   Inside the compact bone is **cancellous bone** (which has a latticelike structure and is also called **spongy bone**) that covers the **medullary cavity**. The medullary contains yellow bone marrow or red bone marrow. Spongy bone is also in the epiphyses. The medullary cavity has a lining called the **endosteum**. The outside of the bone is covered by a fibrous membrane called the **periosteum**. Figure 5-2 shows the parts of long bones.
2. **Short bones** are the small, cube-shaped bones of the wrists, ankles, and toes. Short bones consist of an outer layer of compact bone with an inner layer of cancellous bone.

3. **Flat bones** generally have large, somewhat flat surfaces that cover organs or that provide a surface for large areas of muscle. The bones of the ears, vertebrae, and face are irregular bones.

4. **Irregular bones** are specialized bones with specific shapes. The bones of the ears, vertebrae, and face are irregular bones.

5. **Sesamoid bones** are bones formed in a tendon near joints. The patella (kneecap) is a sesamoid bone. Sesamoid bones are also found in the hands and feet.

Commonly, bones have various extensions and depressions that serve as sites for attaching muscles and tendons. Bone extensions are enlargements usually at the ends of bones. Muscles, tendons, and other bones are attached at these extensions. 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, usually where (covered with cartilage) it articulates with another bone. The *epiondyle* projects from the condyle.

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.

Figure 5-4 shows the types of bone depressions.

**Marrow** is soft connective tissue and serves important functions in the production of blood cells. *Red bone marrow* can be found in the cancellous bone of the epiphysis and in flat bones. In infants and young children, all bone marrow is red, allowing much opportunity for red blood cells to develop. As people age, most of the red bone marrow decreases and is replaced by *yellow bone marrow*. Yellow bone marrow is found in most other adult bones and is made up of connective tissue filled with fat.

**Bones of the Head**

Cranial bones form the skull, which protects the brain and the structures inside the skull. The skull or cranial bones join at points called *sutures*. 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).
The skull of a newborn is not completely joined and has soft spots, called **fontanelles**.

The skull contains the **frontal bone** (the forehead and roof of the eye sockets), the **ethmoid bone** (the nasal cavity and the orbits of the eyes), the **parietal bone** (top and upper parts of the sides of the skull), and the **temporal bone** (lower part of the skull and the lower sides, including the openings for the ears). The **temporomandibular joint (TMJ)** is the connection point for the temporal bone and the mandible (lower jawbone). A round extension behind the temporal bone is the **mastoid process**. It sits behind the ear. The **styloid process** is a peg-shaped protrusion from a bone, as the one that extends down from the temporal bone. The back and base of the skull are covered by the **occipital bone**. An opening in the occipital bone, the **foramen magnum**, is the structure through which the spinal cord passes. The skull bones are held together by the **sphenoid bone**, which joins the frontal, occipital, and ethmoid bones and forms the base of the cranium. The pituitary gland sits in the **sella turcica**, a depression in the sphenoid bone.

The skull has sinuses, specific cavities that reduce its weight. The **frontal sinuses** are above the eyes. The **sphenoid sinus** is above and behind the nose. The **ethmoid sinuses** are a group of small sinuses on both sides of the nasal cavities, between each eye and the sphenoid sinus. The **maxillary sinuses** are on either side of the **nasal cavity** below the eyes. Figure 5-5 shows the bones of the skull and the location of the sinuses.

The head also has facial bones, each with a specific function:

1. **Nasal bones** form the bridge of the nose.
2. **Lacrimal bones** hold the lacrimal gland and the canals for the tear ducts.
3. The **mandibular bone** or **mandible** is the lower jawbone and contains the sockets for the lower teeth. The mandible is the only movable bone in the face.
4. **Maxillary bones** form the upper jawbone and contain the sockets for the upper teeth.
5. The **vomer** is a flat bone that joins with the ethmoid bone to form the nasal septum.
6. **Zygomatic bones** form the prominent shape of the cheek.
7. The palatine bone sits behind the maxillary bones and helps to form the nasal cavity and the hard palate.

Figure 5-6 shows the bones of the face.

**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 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. Figure 5-7 shows two vertebrae.

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, consisting of five separate bones at birth that fuse together in early childhood.
5. The coccyx, the tailbone, formed from four bones fused together.

Figure 5-8 shows the divisions of the spinal column.

Bones of the Chest

At the top of the thorax (chest cavity) are the clavicle (anterior collar bone) and scapula (posterior shoulder bone). The scapula joins with the clavicle at a point called the acromion. There are two weight-transferring sections of bones. The upper is the group formed by the clavicle and scapula, which transfers the weight of the upper body to distribute it evenly to the spine. Any additional weight carried by one arm, such as a person holding a child, will be distributed evenly to the spine. The second weight-transferring transverse section is formed by the pelvic girdle (see Bones of the Pelvis below).

Next is the sternum (breastbone), which extends down the middle of the chest. Extending out from the sternum are the twelve pairs of ribs. The first seven pairs of ribs, the true ribs, are joined both to the vertebral column and to the sternum by costal cartilage. The next three pairs of ribs, called false ribs, attach to the vertebral column but not to the sternum. Instead, they join the seventh rib. The last two ribs, which are also called false ribs, are known as floating ribs because they do not attach to the sternum anteriorly. Figure 5-9 on page 111 shows the ribs of the chest.

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

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”).

FIGURE 5-8 The divisions of the spinal column.
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. This is the second weight-transferring transverse section of bone. The pelvic girdle easily transfers weight of the body from one leg to the other during running, walking, or any movement.

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. Figure 5-10 shows the bones of the pelvis.

**Bones of the Extremities**

The upper arm bone, the humerus, attaches to the scapula and clavicle. The two lower arm bones are the ulna, which has a bony protrusion called the olecranon (elbow), and the radius, which attaches to the eight carpal bones of the wrist (carpus). The metacarpals are the five bones of the palm that radiate out to the finger bones, the phalanges. Each phalanx (except for the thumbs and great toes) has a distal (furthest from the body), middle, and proximal (nearest to the body) segment. Figure 5-11 shows the bones of the arm and hand.

The hip bone has a cup-shaped depression or socket called the acetabulum into which the femur (thigh bone) fits. The femur is the longest bone in the body. It meets the two bones of the lower leg, the tibia (also called the shin) and fibula, at the kneecap or patella. The tibia and fibula have bony protrusions near the foot called the malleoli (singular, malleolus). The protrusion of the tibia is called the medial malleolus. The protrusion of the fibula is called the lateral malleolus. The malleoli and the tarsal bones (seven small bones of the tarsus or instep) form the ankle. The largest tarsal is the calcaneus (heel). The metatarsals connect to the phalanges of the toes. Figure 5-12 shows the bones of the lower extremities.

**Joints**

Joints are also called articulations, points where bones connect. The movement at a particular joint varies depending on the body’s needs. 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.

Joints are also described by the type of movement they allow. Ball-and-socket joints (the hip and shoulder joints for example) are set up like a ball sitting in a socket. A hinge joint (the elbow or knee, for example) moves as though swinging like a hinge. The joints and muscles allow the parts of the body to move in specific ways.

Bones are connected to other bones with ligaments, bands of fibrous tissue. Tendons are bands of fibrous tissue that connect muscles to bone. Movement takes place at the joints using the muscles, ligaments, and tendons. Synovial joints are covered with a synovial membrane, which secretes synovial fluid, a joint lubricant, and which helps the joint move easily. The hip joint is an example of a synovial joint. Some spaces between tendons and joints have a bursa, a sac lined with a synovial membrane. Bursae help the movement of hands and feet. Figure 5-13 shows the three types of joints and the parts of a joint.
Chapter 5 The Musculoskeletal System

Muscles

Muscles contract and extend to provide body movement. The voluntary (striated) muscles can be contracted at will. These muscles are called skeletal muscles, as they are responsible for the movement of all skeletal bones, including facial bones, such as the mandible. The involuntary (smooth or visceral) muscles control movement that is not controlled by will, such as respiration, urination, and digestion. Involuntary muscles move the internal organs and systems, such as the digestive system and the blood. Cardiac muscle, which controls the contractions of the heart, is the only involuntary muscle that is also striated.

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 5-13 Types of and parts of a joint.
Most muscles are covered by fascia, a band of connective tissue that supports and covers the muscle. Muscles attach to a stationary bone at a point called the origin. They attach to a movable bone at a point called the insertion. During movement, the muscle contracts and extends and the moveable bone moves in a specific direction. Different muscles have different functions. For example, the deltoid muscles are used to extend the arms, the biceps of the arm flex the forearms, and the masticatory muscles close and open the jaw for chewing. Figure 5-14 shows the various types of muscle.

FIGURE 5-14 Types and parts of muscle.

Most muscles are covered by fascia, a band of connective tissue that supports and covers the muscle. Muscles attach to a stationary bone at a point called the origin. They attach to a movable bone at a point called the insertion. During movement, the muscle contracts and extends and the moveable bone moves in a specific direction. Different muscles have different functions. For example, the deltoid muscles are used to extend the arms, the biceps of the arm flex the forearms, and the masticatory muscles close and open the jaw for chewing. Figure 5-14 shows the various types of muscle.

Vocabulary Review

In the previous section, you learned terms relating to the musculoskeletal system. Before going on to the exercises, review the terms below and refer to the previous chapters if you have any questions. Pronunciations are provided for
certain terms. Sometimes information about where the word came from is included after the term. These etymologies (word histories) are for your information only. You do not need to memorize them.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>acetabulum [äs-ē-TĀB-yū-lūm]</td>
<td>Cup-shaped depression in the hip bone into which the top of the femur fits.</td>
</tr>
<tr>
<td>acromion [ä-KRŌ-mē-oñ]</td>
<td>Part of the scapula that connects to the clavicle.</td>
</tr>
<tr>
<td>amphiarthrosis (pl., amphiarthoses) [ĀM-fi-är-THRŌ-sīs (ĀM-fi-är-THRŌ-sēs)] Greek amphi-, both + arthrosis, joint</td>
<td>Cartilaginous joint having some movement at the union of two bones.</td>
</tr>
<tr>
<td>ankle [ĀNG-k]</td>
<td>Hinged area between the lower leg bones and the bones of the foot.</td>
</tr>
<tr>
<td>articular [år-TĪ-k-yū-lār] cartilage</td>
<td>Cartilage at a joint.</td>
</tr>
<tr>
<td>articulation [år-tīk-yū-LĀ-shūn]</td>
<td>Point at which two bones join together to allow movement.</td>
</tr>
<tr>
<td>bone</td>
<td>Hard connective tissue that forms the skeleton of the body.</td>
</tr>
<tr>
<td>bone head</td>
<td>Upper, rounded end of a bone.</td>
</tr>
<tr>
<td>bone phagocyte [FÅG-o-sīt]</td>
<td>Bone cell that ingests dead bone and bone debris.</td>
</tr>
<tr>
<td>bursa (pl., bursae) [BŪR-sā(BŪR-sē)]</td>
<td>Sac lined with a synovial membrane that fills the spaces between tendons and joints.</td>
</tr>
<tr>
<td>cancellous [KĀN-sē-lūs] bone</td>
<td>Spongy bone with a latticelike structure.</td>
</tr>
<tr>
<td>cardiac [KĀR-de-āk] muscle</td>
<td>Striated involuntary muscle of the heart.</td>
</tr>
<tr>
<td>carpus, carpal [KĀR-pūs, KĀR-pāl] bone</td>
<td>Wrist; wrist bone.</td>
</tr>
<tr>
<td>cartilage [KĀR-tī-lāj]</td>
<td>Flexible connective tissue found in joints, fetal skeleton, and the lining of various parts of the body.</td>
</tr>
<tr>
<td>cartilaginous [kār-tī-LĀ-jī-nūs] disk</td>
<td>Thick, circular mass of cartilage between the vertebrae of the spinal column.</td>
</tr>
<tr>
<td>cervical [SĒR-vi-k] vertebrae</td>
<td>Seven vertebrae of the spinal column located in the neck.</td>
</tr>
<tr>
<td>clavicle [KLĀV-i-k]</td>
<td>Curved bone of the shoulder that joins to the scapula; collar bone.</td>
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<td>Term</td>
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<tr>
<td>coccyx [KÖK-siks]</td>
<td>Small bone consisting of four fused vertebrae at the end of the spinal column; tailbone.</td>
</tr>
<tr>
<td>compact bone</td>
<td>Hard bone with a tightly woven structure.</td>
</tr>
<tr>
<td>condyle [KÖN-dīl]</td>
<td>Rounded surface at the end of a bone.</td>
</tr>
<tr>
<td>crest</td>
<td>Bony ridge.</td>
</tr>
<tr>
<td>diaphysis [dī-ÄF-ī-sis]</td>
<td>Greek, a growing between</td>
</tr>
<tr>
<td></td>
<td>Long middle section of a long bone; shaft.</td>
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<tr>
<td>diarthroses (sing., diarthrosis) [dī-ār-THRŌ-sēz (dī-ār-THRŌ-sīs)] Greek, articulations</td>
<td>Freely movable joints.</td>
</tr>
<tr>
<td>disk [disk] Latīn discus</td>
<td>See cartilaginous disk.</td>
</tr>
<tr>
<td>dorsal vertebrae</td>
<td>Thoracic vertebrae.</td>
</tr>
<tr>
<td>elbow [ĒL-bō]</td>
<td>Joint between the upper arm and the forearm.</td>
</tr>
<tr>
<td>endostēum [ɛn-DŌS-tē-ām] end(o)-, within + Greek osteon, bone</td>
<td>Lining of the medullary cavity.</td>
</tr>
<tr>
<td>epiphyseal [ēp-i-FĬZ-e-āl] plate</td>
<td>Cartilaginous tissue that is replaced during growth years, but eventually calcifies and disappears when growth stops.</td>
</tr>
<tr>
<td>ethmoid [ĒTH-mōyd] bone</td>
<td>Irregular bone of the face attached to the sphenoid bone.</td>
</tr>
<tr>
<td>ethmoid sinuses</td>
<td>Sinuses on both sides of the nasal cavities between each eye and the sphenoid sinus.</td>
</tr>
<tr>
<td>fascia (pl., fasciae) [FĀSH-e-ā (FĀSH-e-e)]</td>
<td>Sheet of fibrous tissue that encloses muscles.</td>
</tr>
<tr>
<td>femur [FĒ-mūr]</td>
<td>Long bone of the thigh.</td>
</tr>
<tr>
<td>fibula [FĪb-yū-lā]</td>
<td>Smallest long bone of the lower leg.</td>
</tr>
<tr>
<td>fissure [FĪSH-ūr]</td>
<td>Deep furrow or slit.</td>
</tr>
<tr>
<td>flat bones</td>
<td>Thin, flattened bones that cover certain areas, as of the skull.</td>
</tr>
<tr>
<td>fontanelle [FŎN-tā-nēl]</td>
<td>Soft, membranous section on top of an infant’s skull.</td>
</tr>
<tr>
<td>foramen [fō-RĀ-mēn]</td>
<td>Opening or perforation through a bone.</td>
</tr>
<tr>
<td>foramen magnum [MĀG-nūm]</td>
<td>Opening in the occipital bone through which the spinal cord passes.</td>
</tr>
<tr>
<td>fossa (pl., fossae) [FŌS-ā (FŌS-ē)]</td>
<td>Depression, as in a bone.</td>
</tr>
<tr>
<td>frontal [FRŪN-tāl] bone</td>
<td>Large bone of the skull that forms the top of the head and forehead.</td>
</tr>
<tr>
<td>frontal sinuses</td>
<td>Sinuses above the eyes.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>-------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>heel [hēl]</td>
<td>Back, rounded portion of the foot.</td>
</tr>
<tr>
<td>humerus [HYŬ-mēr-ūs]</td>
<td>Long bone of the arm connecting to the scapula on top and the radius and ulna at the bottom.</td>
</tr>
<tr>
<td>insertion</td>
<td>Point at which a muscle attaches to a movable bone.</td>
</tr>
<tr>
<td>intervertebral [ĭn-tĕr-VER-tĕ-brăl] disk</td>
<td>See cartilaginous disk.</td>
</tr>
<tr>
<td>involuntary muscle</td>
<td>Muscle not movable at will.</td>
</tr>
<tr>
<td>irregular bones</td>
<td>Any of a group of bones with a special shape to fit into certain areas of the skeleton, such as the skull.</td>
</tr>
<tr>
<td>ischium [ĬS-kĕ-ŭm]</td>
<td>One of three fused bones that form the pelvic girdle.</td>
</tr>
<tr>
<td>joint [jōynt]</td>
<td>Place of joining between two or more bones.</td>
</tr>
<tr>
<td>lacrimal [LĀK-rĭ-māl] bone</td>
<td>Thin, flat bone of the face.</td>
</tr>
<tr>
<td>lamina (pl., laminae) [LĀM-ĭ-nā (LĀM-ĭ-nē)]</td>
<td>Thin, flat part of either side of the arch of a vertebra.</td>
</tr>
<tr>
<td>ligament [LĬG-ă-mĕnt]</td>
<td>Sheet of fibrous tissue connecting and supporting bones; attaches bone to bone.</td>
</tr>
<tr>
<td>long bone</td>
<td>Any bone of the extremities with a shaft.</td>
</tr>
<tr>
<td>lumbar [LŬM-bār] vertebrae</td>
<td>Five vertebrae of the lower back.</td>
</tr>
<tr>
<td>malleolus (pl., malleoli) [mă-LĔ-ŏ-lūs (mă-LĔ-ŏ-lī)]</td>
<td>Rounded protrusion of the tibia or fibula on either side of the ankle.</td>
</tr>
<tr>
<td>marrow [MĂR-ŏ]</td>
<td>Connective tissue filling the medullary cavity, often rich in nutrients.</td>
</tr>
<tr>
<td>mastoid [MĀS-tōyŏd] process</td>
<td>Protrusion of the temporal bone that sits behind the ear.</td>
</tr>
<tr>
<td>maxillary [MĂK-sĭ-lăr-ĕ] bone</td>
<td>Bone of the upper jaw.</td>
</tr>
<tr>
<td>maxillary sinus</td>
<td>Sinus on either side of the nasal cavity below the eyes.</td>
</tr>
<tr>
<td>medullary [MĔD-ŭ-lăr-ĕ] cavity</td>
<td>Soft center cavity in bone that often holds marrow.</td>
</tr>
<tr>
<td>metacarpal [MĔT-ă-KĂR-păl] meta-, behind + carpal, of the wrist</td>
<td>One of five bones of the hand between the wrist and the fingers.</td>
</tr>
<tr>
<td>metaphysis [mĕ-TĂF-ĭ-sĭs] meta-, behind + Greek  physis, growth</td>
<td>Section of a long bone between the epiphysis and diaphysis.</td>
</tr>
<tr>
<td>metatarsal [MĔT-ă-TĂR-săl] bones meta-, behind + tarsus</td>
<td>Bones of the foot between the instep (arch) and the toes.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>muscle [MǆS-ēl]</td>
<td>Contractile tissue that plays a major role in body movement.</td>
</tr>
<tr>
<td>musculoskeletal [MǆS-kyū-lō-SKĒL-ē-tál] system</td>
<td>System of the body including the muscles and skeleton.</td>
</tr>
<tr>
<td>nasal bones</td>
<td>Bones that form the bridge of the nose.</td>
</tr>
<tr>
<td>nasal cavity</td>
<td>Cavity on either side of the nasal septum.</td>
</tr>
<tr>
<td>neural [NÚR-āl] canal</td>
<td>Space through which the spinal cord passes.</td>
</tr>
<tr>
<td>nucleus pulposus [NÚ-klē-ūs pūl-PŌ-sūs]</td>
<td>Fibrous mass in the center portion of the intervertebral disk.</td>
</tr>
<tr>
<td>occipital [æk-SĪP-ĭ-tāl] bone</td>
<td>Bone that forms the lower back portion of the skull.</td>
</tr>
<tr>
<td>olecranon [ō-LĒK-rā-nŏn]</td>
<td>Curved end of the ulna to which tendons of the arm muscles attach; bony prominence of the elbow.</td>
</tr>
<tr>
<td>origin</td>
<td>Point at which muscles attach to stationary bone.</td>
</tr>
<tr>
<td>osseous [ŌS-ē-ūs] tissue</td>
<td>Connective tissue into which calcium salts are deposited.</td>
</tr>
<tr>
<td>osteoblast [ŌS-tē-ō-blăst]</td>
<td>Cell that forms bone.</td>
</tr>
<tr>
<td>osteoclast [ŌS-tē-ō-klăst]</td>
<td>Large cell that reabsorbs and removes osseous tissue.</td>
</tr>
<tr>
<td>osteocyte [ŌS-tē-ō-sīt]</td>
<td>Bone cell.</td>
</tr>
<tr>
<td>palatine [PĀL-ă-tīn] bone</td>
<td>Bone that helps form the hard palate and nasal cavity; located behind the maxillary bones.</td>
</tr>
<tr>
<td>parietal [pā-RI-ē-tāl] bone</td>
<td>Flat, curved bone on either side of the upper part of the skull.</td>
</tr>
<tr>
<td>patella [pā-TĒL-ă]</td>
<td>Large, sesamoid bone that forms the kneecap.</td>
</tr>
<tr>
<td>pelvic [PĒL-vĭk] cavity</td>
<td>Cup-shaped cavity formed by the large bones of the pelvic girdle; contains female reproductive organs, sigmoid colon, bladder, and rectum.</td>
</tr>
<tr>
<td>pelvic girdle</td>
<td>Hip bones.</td>
</tr>
<tr>
<td>pelvis [PĒL-vĭs]</td>
<td>Cup-shaped ring of bone and ligaments at the base of the trunk.</td>
</tr>
<tr>
<td>periosteum [pēr-ē-ŌS-tē-ŭm]</td>
<td>Fibrous membrane covering the surface of bone.</td>
</tr>
<tr>
<td>phalanges (sing., phalanx) [fā-LĀN-jēz (FĀ-lāngks)]</td>
<td>Long bones of the fingers and toes.</td>
</tr>
<tr>
<td>phosphorus [FŌS-fŏr-ūs]</td>
<td>Mineral important to the formation of bone.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>------</td>
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</tr>
<tr>
<td>process [PRÔ-sēs, PRÔS-ēs]</td>
<td>Bony outgrowth or projection.</td>
</tr>
<tr>
<td>pubes [PYŪ-bris]</td>
<td>Anteroinferior portion of the hip bone.</td>
</tr>
<tr>
<td>public symphysis [PYŪ-hîk SĬM-fâ-sîs]</td>
<td>Joint between the two public bones.</td>
</tr>
<tr>
<td>radius [RĀ-dē-ūs]</td>
<td>Shorter bone of the forearm.</td>
</tr>
<tr>
<td>rib</td>
<td>One of twenty-four bones that form the chest wall.</td>
</tr>
<tr>
<td>sacrum [SĀ-krûm]</td>
<td>Next-to-last spinal vertebra made up of five fused bones; vertebra that forms part of the pelvis.</td>
</tr>
<tr>
<td>scapula [SKĀP-yû-lâ]</td>
<td>Large flat bone that forms the shoulder blade.</td>
</tr>
<tr>
<td>sella turcica [SĔL-ā TŬR-sĭ-kâ]</td>
<td>Bony depression in the sphenoid bone where the pituitary gland is located.</td>
</tr>
<tr>
<td>sesamoid [SĔS-ā-môyd] bone</td>
<td>Bone formed in a tendon over a joint.</td>
</tr>
<tr>
<td>shin [shîn]</td>
<td>Anterior ridge of the tibia.</td>
</tr>
<tr>
<td>short bones</td>
<td>Square-shaped bones with approximately equal dimensions on all sides.</td>
</tr>
<tr>
<td>sinus [SĬ-nûs]</td>
<td>Hollow cavity, especially either of two cavities on the sides of the nose.</td>
</tr>
<tr>
<td>skeleton [SKĔL-ĕ-tŏn]</td>
<td>Bony framework of the body.</td>
</tr>
<tr>
<td>smooth muscle</td>
<td>Fibrous muscle of internal organs that acts involuntarily.</td>
</tr>
<tr>
<td>sphenoid [SFĔ-nôyd] bone</td>
<td>Bone that forms the base of the skull.</td>
</tr>
<tr>
<td>sphenoid sinus</td>
<td>Sinus above and behind the nose.</td>
</tr>
<tr>
<td>spinal column</td>
<td>Column of vertebrae at the posterior of the body, from the neck to the coccyx.</td>
</tr>
<tr>
<td>spinous [SPĬ-nûs] process</td>
<td>Protrusion from the center of the vertebral arch.</td>
</tr>
<tr>
<td>spongy bone</td>
<td>Bone with an open latticework filled with connective tissue or marrow.</td>
</tr>
<tr>
<td>sternum [STĔ-rûm]</td>
<td>Long, flat bone that forms the midline of the anterior of the thorax.</td>
</tr>
<tr>
<td>striated [strī-ĂT-ĕd] muscle</td>
<td>Muscle with a ribbed appearance that is controlled at will.</td>
</tr>
<tr>
<td>styloid [STĬ-lŏyd] process</td>
<td>Peg-shaped protrusion from a bone.</td>
</tr>
<tr>
<td>sulcus (pl., sulci) [SŬL-kŭs (SŬL-sĭ)] Latin, furrow</td>
<td>Groove or furrow in the surface of bone.</td>
</tr>
<tr>
<td>suture [SŬ-chûr]</td>
<td>Joining of two bone parts with a fibrous membrane.</td>
</tr>
<tr>
<td>symphysis [SĬM-fĭ-sîs] Greek, from sym-, together + physis, joint</td>
<td>Type of cartilaginous joint uniting two bones.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>synarthrosis [SIN-är-THRÖ-sis] Greek, from syn-, together + arthrosis, articulation</td>
<td>Fibrous joint with no movement.</td>
</tr>
<tr>
<td>synovial [sī-NÖ-vē-āl] fluid</td>
<td>Fluid that serves to lubricate joints.</td>
</tr>
<tr>
<td>synovial joint</td>
<td>A joint that moves.</td>
</tr>
<tr>
<td>synovial membrane</td>
<td>Connective tissue lining the cavity of joints and producing the synovial fluid.</td>
</tr>
<tr>
<td>tarsus, tarsal [TÄR-sūs, TÄR-sāl] bones</td>
<td>Seven bones of the instep (arch of the foot).</td>
</tr>
<tr>
<td>temporal [TEM-pō-rāl] bone</td>
<td>Large bone forming the base and sides of the skull.</td>
</tr>
<tr>
<td>tendon [TĒN-dōn]</td>
<td>Fibrous band that connects muscle to bone or other structures.</td>
</tr>
<tr>
<td>thoracic [thō-RĀS-īk] vertebrae</td>
<td>Twelve vertebrae of the chest area.</td>
</tr>
<tr>
<td>thorax [THÔ-rāks]</td>
<td>Part of the trunk between the neck and the abdomen; chest.</td>
</tr>
<tr>
<td>tibia [TĪ-bē-ā]</td>
<td>Larger of the two lower leg bones.</td>
</tr>
<tr>
<td>transverse process</td>
<td>Protrusion on either side of the vertebral arch.</td>
</tr>
<tr>
<td>trochanter [trō-KĀN-tēr]</td>
<td>Bony protrusion at the upper end of the femur.</td>
</tr>
<tr>
<td>true ribs</td>
<td>Seven upper ribs of the chest that attach to the sternum.</td>
</tr>
<tr>
<td>tubercle [TŬ-bēr-kl]</td>
<td>Slight bony elevation to which a ligament or muscle may be attached.</td>
</tr>
<tr>
<td>tuberosity [TŬ-bēr-ÖS-ĭ-tē]</td>
<td>Large elevation in the surface of a bone.</td>
</tr>
<tr>
<td>ulna [ŬL-nā]</td>
<td>Larger bone of the forearm.</td>
</tr>
<tr>
<td>vertebra (pl., vertebrae) [VĒR-tē-brā (VĒR-tē-brē)]</td>
<td>One of the bony segments of the spinal column.</td>
</tr>
<tr>
<td>vertebral body</td>
<td>Main portion of the vertebra, separate from the arches of the vertebra.</td>
</tr>
<tr>
<td>vertebral column</td>
<td>Spinal column.</td>
</tr>
<tr>
<td>vitamin D</td>
<td>Vitamin important to the formation of bone.</td>
</tr>
<tr>
<td>voluntary muscle</td>
<td>Striated muscle.</td>
</tr>
<tr>
<td>vomer [VŎ-mĕr]</td>
<td>Flat bone forming the nasal septum.</td>
</tr>
<tr>
<td>zygomatic [ZĬ-gō-MĀT-ĭk] bone</td>
<td>Bone that forms the cheek.</td>
</tr>
</tbody>
</table>
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. A mature adult has a total of ____________ bones.
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 both the vertebral column and 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.
13. The first two cervical vertebrae are known as the ____________ and the ____________.
14. The longest bone in the body is the ____________.
15. Bones are connected to bones by ____________.
16. Muscles connect to bones by ____________.
17. The ____________ is the connection point for the temporal bone and the mandible (lower jawbone).
18. Joints are also called ____________, points where bones connect.
19. Joints are described by the type of ____________ they allow.

Circle T for true or F for false.

20. Compact bone is another name for cancellous bone. T F
21. Yellow bone marrow is found in adults. T F
22. The mandible is the upper jawbone. T F
23. The twelve vertebrae that connect to the ribs are the dorsal vertebrae. T F

Match the Movement
Put the letter of the correct movement in the space provided.

24. __________ extension  a. a bending down, as of the ankle
25. __________ rotation  b. movement toward the body
26. __________ abduction  c. the straightening of a limb
27. __________ adduction  d. a bending up, as of the ankle
28. __________ supination  e. the bending of a limb
29. __________ pronation  f. the circular movement of a part, such as the neck
30. __________ flexion  g. movement away from the body
31. __________ dorsiflexion  h. a turning up as of the hand
32. __________ plantar flexion  i. a turning down, as of the hand

Match the Terms
Put the letter of the correct definition in the space provided.

33. __________ articulation  a. bony prominence of the elbow
34. __________ atlas  b. point at which muscles attach to stationary bone
35. __________ axis  c. wrist, wrist bone
36. __________ carpal bone  d. tailbone
37. __________ clavicle  e. first cervical vertebrae
38. __________ coccyx  f. second cervical vertebra
39. __________ olecranon  g. collar bone
40. __________ origin  h. bones of the instep (arch) of the foot
41. __________ insertion  i. point at which two bones join together
42. __________ sternum  j. point at which muscle attaches to moveable bone
43. __________ tarsal bones  k. breast bone

Combining Forms and Abbreviations
The lists below include combining forms and abbreviations that relate specifically to the musculoskeletal system. Pronunciations are provided for the examples.
<table>
<thead>
<tr>
<th>COMBINING FORM</th>
<th>MEANING</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>acetabul(o)</td>
<td>acetabulum</td>
<td>acetabulectomy [ÁS-ē-tāb-yū-LĒK-tō-mē], excision of the acetabulum</td>
</tr>
<tr>
<td>acromi(o)</td>
<td>end point of the scapula</td>
<td>acromioscapular [ā-KRÖ-mē-o-SKĀP-yū-lār], relating to the acromion and the body of the scapula</td>
</tr>
<tr>
<td>ankyl(o)</td>
<td>bent, crooked</td>
<td>ankylosis [ĀNG-kī-LŌ-sīs], fixation of a joint in a bent position, usually resulting from a disease</td>
</tr>
<tr>
<td>arthr(o)</td>
<td>joint</td>
<td>arthrogram [ÄR-thrä-grām], x-ray of a joint</td>
</tr>
<tr>
<td>brachi(o)</td>
<td>arm</td>
<td>brachiocephalic [BRÄ-kē-ō-śě-FĀL-īk], relating to both the arm and head</td>
</tr>
<tr>
<td>burs(o)</td>
<td>bursa</td>
<td>bursitis [būr-Sī-tīs], inflammation of a bursa</td>
</tr>
<tr>
<td>calcane(o)</td>
<td>heel</td>
<td>calcaneodynia [kāl-KÄ-nē-ō-DĪN-e-ā], heel pain</td>
</tr>
<tr>
<td>calci(o)</td>
<td>calcium</td>
<td>calciokinesis [KĀL-sē-ō-kī-NĒ-sīs], mobilization of stored calcium in the body</td>
</tr>
<tr>
<td>carp(o)</td>
<td>wrist</td>
<td>carpopedal [KÄR-pō-PĒD-āl], relating to the wrist and foot</td>
</tr>
<tr>
<td>cephal(o)</td>
<td>head</td>
<td>cephalomegaly [SĒF-ā-lo-MĒG-ā-lē], abnormally large head</td>
</tr>
<tr>
<td>cervic(o)</td>
<td>neck</td>
<td>cervicodynia [SĒR-vē-kō-DĪN-e-ā], neck pain</td>
</tr>
<tr>
<td>chondr(o)</td>
<td>cartilage</td>
<td>chondroplasty [KŌN-drō-plās-tē], surgical repair of cartilage</td>
</tr>
<tr>
<td>condyl(o)</td>
<td>knob, knuckle</td>
<td>condylectomy [kōn-dī-LĒK-tō-mē], excision of a condyle</td>
</tr>
<tr>
<td>cost(o)</td>
<td>rib</td>
<td>costiform [KÕS-tī-form], rib-shaped</td>
</tr>
<tr>
<td>crani(o)</td>
<td>skull</td>
<td>craniotomy [kra-nē-ŌT-ō-mē], incision into the skull</td>
</tr>
<tr>
<td>dactyl(o)</td>
<td>fingers, toes</td>
<td>dactylitis [dāk-tī-LĪ-tīs], inflammation of the finger(s) or toe(s)</td>
</tr>
<tr>
<td>fasci(o)</td>
<td>fascia</td>
<td>fasciotomy [fāsh-ē-ŌT-ō-mē], incision through a fascia</td>
</tr>
<tr>
<td>femor(o)</td>
<td>femur</td>
<td>femorocele [FĒM-ō-tō-sēl], hernia in the femur</td>
</tr>
<tr>
<td>fibr(o)</td>
<td>fiber</td>
<td>fibroma [fī-BRŌ-mā], benign tumor in fibrous tissue</td>
</tr>
<tr>
<td>COMBINING FORM</td>
<td>MEANING</td>
<td>EXAMPLE</td>
</tr>
<tr>
<td>----------------</td>
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</tr>
<tr>
<td>humer(o)</td>
<td>humerus</td>
<td>humeroscapular [HYU-mēr-ō-SKAP-yu-lär], relating to both the humerus and the scapula</td>
</tr>
<tr>
<td>ili(o)</td>
<td>ilium</td>
<td>iliofemoral [IL-e-ō-FEM-ō-rāl], relating to the ilium and the femur</td>
</tr>
<tr>
<td>ischi(o)</td>
<td>ischium</td>
<td>ischiodynia [IS-kē-ō-DĪN-ē-ā], pain in the ischium</td>
</tr>
<tr>
<td>kyph(o)</td>
<td>hump; bent</td>
<td>kyphoscoliosis [KY-fō-skō-lē-ō-sīs], kyphosis and scoliosis combined</td>
</tr>
<tr>
<td>lamin(o)</td>
<td>lamina</td>
<td>laminectomy [LĀM-i-NEK-tō-mē], removal of part of one or more of the thick cartilaginous disks between the vertebrae</td>
</tr>
<tr>
<td>leiomy(o)</td>
<td>smooth muscle</td>
<td>leiomyosarcoma [LE-ō-MĪ-sār-KŌ-mā], malignant tumor of smooth muscle</td>
</tr>
<tr>
<td>lumb(o)</td>
<td>lumbar</td>
<td>lumboabdominal [LŪM-bo-āb-DŌM-ī-nāl], relating to the lumbar and abdominal regions</td>
</tr>
<tr>
<td>maxill(o)</td>
<td>upper jaw</td>
<td>maxillofacial [māk-SĪL-ō-FĀ-shēl], pertaining to the jaws and face</td>
</tr>
<tr>
<td>metacarp(o)</td>
<td>metacarpal</td>
<td>metacarpectomy [MET-ā-kār-PỆK-tō-mē], excision of a metacarpal</td>
</tr>
<tr>
<td>my(o)</td>
<td>muscle</td>
<td>myocardium [mī-ō-KĀR-de-ūm], cardiac muscle in the middle layer of the heart</td>
</tr>
<tr>
<td>myel(o)</td>
<td>spinal cord; bone marrow</td>
<td>myelocyst [MĪ-ē-lō-sīst], cyst that develops in bone marrow</td>
</tr>
<tr>
<td>oste(o)</td>
<td>bone</td>
<td>osteoarthritis [ŌS-tō-ō-ār-THRĪ-tīs], arthritis characterized by erosion of cartilage and bone and joint pain</td>
</tr>
<tr>
<td>patell(o)</td>
<td>knee</td>
<td>patellectomy [PĀT-ē-LĒK-tō-mē], excision of the patella</td>
</tr>
<tr>
<td>ped(i), ped(o)</td>
<td>foot</td>
<td>pedometer [pē-DŌM-ē-tēr], instrument for measuring walking distance</td>
</tr>
<tr>
<td>pelv(i)</td>
<td>pelvis</td>
<td>pelviscope [PĒL-vī-skōp], instrument for viewing the pelvic cavity</td>
</tr>
<tr>
<td>phalang(o)</td>
<td>finger or toe bone</td>
<td>phalangectomy [fāl-an-JĒK-tō-mē], removal of a finger or toe</td>
</tr>
<tr>
<td>pod(o)</td>
<td>foot</td>
<td>podalgia [pō-DĀL-jē-ā], foot pain</td>
</tr>
<tr>
<td>Combining Form</td>
<td>Meaning</td>
<td>Example</td>
</tr>
<tr>
<td>----------------</td>
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<td>---------</td>
</tr>
<tr>
<td>pub(o)</td>
<td>pubis</td>
<td><em>puborectal</em> [PYU-bō-RĒK-tāl], relating to the pubis and the rectum</td>
</tr>
<tr>
<td>rachi(o)</td>
<td>spine</td>
<td><em>rachiometer</em> [rā-kē-ŌM-e-tēr], instrument for measuring spine curvature</td>
</tr>
<tr>
<td>radi(o)</td>
<td>forearm bone</td>
<td><em>radiomuscular</em> [RĀ-de-ō-MŪS-kyū-lār], relating to the radius and nearby muscles</td>
</tr>
<tr>
<td>rhabd(o)</td>
<td>rod-shaped</td>
<td><em>rhabdosphincter</em> [RĀB-dō-SFINGK-tēr], striated muscular sphincter</td>
</tr>
<tr>
<td>rhabdomy(o)</td>
<td>striated muscle</td>
<td><em>rhabdomyolysis</em> [RĀB-dō-mī-ŌL-i-sīs], acute disease that includes destruction of skeletal muscle</td>
</tr>
<tr>
<td>scapul(o)</td>
<td>scapula</td>
<td><em>scapulodynia</em> [SKĀP-yū-lō-DĪN-e-ā], scapula pain</td>
</tr>
<tr>
<td>scoli(o)</td>
<td>curved</td>
<td><em>scoliokyphosis</em> [SKŌ-lē-ō-kī-FŌ-sīs], lateral and posterior curvature of the spine</td>
</tr>
<tr>
<td>spondyl(o)</td>
<td>vertebra</td>
<td><em>spondylitis</em> [spōn-dī-LĪ-tīs], inflammation of a vertebra</td>
</tr>
<tr>
<td>stern(o)</td>
<td>sternum</td>
<td><em>sternodynia</em> [stēr-nō-DĪN-e-ā], sternum pain</td>
</tr>
<tr>
<td>synov(o)</td>
<td>synovial membrane</td>
<td><em>synovitis</em> [sīn-ō-VĪ-tīs], inflammation of a synovial joint</td>
</tr>
<tr>
<td>tars(o)</td>
<td>tarsus</td>
<td><em>tarsomegaly</em> [tār-sō-MĒG-ā-lē], congenital abnormality with overgrowth of a tarsal bone</td>
</tr>
<tr>
<td>ten(o), tend(o), tendin(o)</td>
<td>tendon</td>
<td><em>tenodynia</em> [tēn-ō-DĪN-e-ā], tendon pain; <em>tendoplasty</em> [TĒN-dō-plās-tē], surgical repair of a tendon; <em>tendinitis</em> [tēn-dī-NĪ-tīs], tendon inflammation</td>
</tr>
<tr>
<td>thorac(o)</td>
<td>thorax</td>
<td><em>thoracoabdominal</em> [THŌR-ā-kō-āb-DŌM-i-nāl], relating to the thorax and the abdomen</td>
</tr>
<tr>
<td>tibi(o)</td>
<td>tibia</td>
<td><em>tibiotalar</em> [tīb-ē-ō-TĀR-sāl], relating to the tarsal and tibia bones</td>
</tr>
<tr>
<td>uln(o)</td>
<td>ulna</td>
<td><em>ulnocarpal</em> [UL-nō-KĀR-pāl], relating to the ulna and the wrist</td>
</tr>
<tr>
<td>vertebr(o)</td>
<td>vertebra</td>
<td><em>vertebroarterial</em> [VĒR-tē-brō-ār-TĒR-e-āl], relating to a vertebral artery or to a vertebra and an artery</td>
</tr>
</tbody>
</table>
Build Your Medical Vocabulary

Complete the words using combining forms listed in this chapter.

44. Joint pain: ____________ dynia
45. Plastic surgery of the skull: ____________ plasty
46. Of the upper jaw and its teeth: ____________ dental
47. Relating to the large area of the hip bone and the tibia: ____________ tibial
48. Operation on the instep of the foot: ____________ tomy
49. Relating to the head and chest: cephalo ____________
50. Production of fibrous tissue: ____________ plasia
51. Inflammation of the foot: ____________ itis
52. Instrument for measuring spine curvature: ____________ meter
53. Incision through the sternum: ____________ tomy
Chapter 5 The Musculoskeletal System

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.

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

54. 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.

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

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

Alana Wolf, M.D.
Find the Word Parts

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.

56. Joint pain ____________
57. Removal of a bursa ____________
58. Inflammation of cartilage ____________
59. Removal of a vertebra ____________
60. Bone-forming cell ____________
61. Abnormal bone hardening ____________
62. Plastic surgery on the neck ____________
63. Inflammation of the spinal cord ____________
64. Foot spasm ____________
65. Of the ulna and the carpus ____________

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

66. sinovotomy ____________
67. myellogram ____________
68. arthrodunia ____________
69. ostiomyelitis ____________
70. takiometer ____________

Know the Word Parts

Write the meaning of the following word parts in the space provided. As additional practice, use your dictionary to find at least two words for each word part listed below. Learn the meanings of each word you find.

71. arthr(o) _____________________________________________________________________________
72. ankyl(o) _____________________________________________________________________________
73. brachi(o) _____________________________________________________________________________
74. calcane(o) _____________________________________________________________________________
75. cephal(o) _____________________________________________________________________________
76. cervic(o) _____________________________________________________________________________
77. chondr(o) _____________________________________________________________________________
78. cost(o) _____________________________________________________________________________
79. crani(o) _____________________________________________________________________________
80. fasci(o) _____________________________________________________________________________
81. kyph(o) _____________________________________________________________________________
82. my(o) _____________________________________________________________________________
83. myel(o) _____________________________________________________________________________
84. oste(o) _____________________________________________________________________________
85. patell(o) _____________________________________________________________________________
86. rachi(o) _____________________________________________________________________________
87. scoli(o) _____________________________________________________________________________

Diagnostic, Procedural, and Laboratory Terms

The musculoskeletal system is often the site of pain caused by conditions in the system itself or by symptoms of other systemic conditions. Specialists in
the musculoskeletal system include **orthopedists** or **orthopedic surgeons**, physicians who treat disorders of the musculoskeletal system; **osteopaths**, physicians who combine manipulative procedures with conventional treatment; **rheumatologists**, physicians who treat disorders of the joints, specifically, and of the musculoskeletal system generally; **podiatrists**, medical specialists who treat disorders of the foot; and **chiropractors**, health care professionals who manipulate the spine to treat certain ailments.

Diagnosing bone and muscle ailments often involves taking x-rays (Figure 5-15), scans, or radiographs or performing internal examinations to determine if an abnormality is present. **Arthrography** is the examination of joints using radiography. **Arthroscopy** is the examination of a joint internally using a lighted instrument capable of direct viewing, cutting, irrigation, obtaining biopsy material, and more, through a small incision. **Diskography** is the examination of disks by injecting a contrast medium and using radiography. Computed tomography (CT) scans (Figure 5-16) can reveal joint, bone, or connective tissue disease. **Myelography** is the use of radiography of the spinal cord to identify spinal cord conditions. An **electromyogram** is a graphic image of the electrical activity of muscles. Magnetic resonance imaging (MRI) may be used to detect disorders of the musculoskeletal system, especially of soft tissue (see Figure 5-17). A **bone scan** is used to detect tumors.

Physicians examine bones and joints externally, often using small rubber mallets to provoke responses. **Tinel’s sign** is a “pins and needles” sensation felt when an injured nerve site is tapped. The sign indicates a partial lesion in a nerve and is a common test for carpal tunnel syndrome.

Laboratory tests measure the levels of substances found in some musculoskeletal disorders. Rheumatoid arthritis may be confirmed by a **rheumatoid factor test**. High levels of **serum creatine phosphokinase (CPK)** appear in some disorders such as a skeletal injury. The measurement of **serum calcium** and **serum phosphorus** in the blood indicates the body’s incorporation of those substances in the bones. **Uric acid tests** can detect gout.

Tests for range of motion (ROM) in certain joints can indicate movement or joint disorders. A **goniometer** is used to measure motion in the joints (Figure 5-18). A **densitometer** uses light and x-ray images to measure bone density for osteoporosis, a disease with bone fractures that is most common in post-menopausal women.
In the previous section, you learned terms relating to diagnosis, clinical procedures, and laboratory tests. Before going on to the exercises, review the terms below and refer to the previous section if you have any questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. These etymologies (word histories) are for your information only. You do not need to memorize them.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>arthrography</td>
<td>Radiography of a joint.</td>
</tr>
<tr>
<td>arthroscopy</td>
<td>Examination with an instrument that explores the interior of a joint.</td>
</tr>
<tr>
<td>bone scan</td>
<td>Radiographic or nuclear medicine image of a bone.</td>
</tr>
<tr>
<td>chiropractor</td>
<td>Health care professional who works to align the spinal column so as to treat certain ailments.</td>
</tr>
<tr>
<td>densitometer</td>
<td>Device that measures bone density using light and x-rays.</td>
</tr>
<tr>
<td>diskography</td>
<td>Radiographic image of an intervertebral disk by injection of a contrast medium into the center of the disk.</td>
</tr>
<tr>
<td>electromyogram</td>
<td>A graphic image of muscular action using electrical currents.</td>
</tr>
<tr>
<td>goniometer</td>
<td>Instrument that measures angles or range of motion in a joint.</td>
</tr>
<tr>
<td>myelography</td>
<td>Radiographic imaging of the spinal cord.</td>
</tr>
<tr>
<td>orthopedist</td>
<td>Physician who examines, diagnoses, and treats disorders of the musculoskeletal system.</td>
</tr>
<tr>
<td>orthopedic surgeon</td>
<td>orthopedist</td>
</tr>
<tr>
<td>osteopath</td>
<td>Physician who combines manipulative treatment with conventional therapeutic measures.</td>
</tr>
<tr>
<td>podiatrist</td>
<td>Medical specialist who examines, diagnoses, and treats disorders of the foot.</td>
</tr>
<tr>
<td>rheumatoid factor test</td>
<td>Test used to detect rheumatoid arthritis.</td>
</tr>
<tr>
<td>rheumatologist</td>
<td>Physician who examines, diagnoses, and treats disorders of the joints and musculoskeletal system.</td>
</tr>
<tr>
<td>serum calcium</td>
<td>Test for calcium in the blood.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<td>-------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>serum creatine phosphokinase [KRÊ-ä-tên fôs-fô-KI-näs]</td>
<td>Enzyme active in muscle contraction; usually phosphokinase is elevated after a myocardial infarction and in the presence of other degenerative muscle diseases.</td>
</tr>
<tr>
<td>serum phosphorus [FÔS-fôr-ûs]</td>
<td>Test for phosphorus in the blood.</td>
</tr>
<tr>
<td>Tinel’s [tî-NELZ] sign</td>
<td>“Pins and needles” sensation felt when an injured nerve site is tapped.</td>
</tr>
<tr>
<td>uric [YÜR-îk] acid test</td>
<td>Test for acid content in urine; elevated levels may indicate gout.</td>
</tr>
</tbody>
</table>

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**

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

89. 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.

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

__________________________________________________________________________________________

__________________________________________________________________________________________

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

__________________________________________________________________________________________
92. Would a bone scan be likely to show bone cancer? ________________________________________________

93. How is an osteopath like a chiropractor? ________________________________________________________
_________________________________________________________________________________________

94. What might a goniometer show about a muscle’s action? ___________________________________________
_________________________________________________________________________________________

True or False
For each of the following statements, circle T for true or F for false.

95. A diskography is used to check bone density. T F

96. An electromyogram uses a contrast medium to check for range of motion in a joint. T F

97. A chiropractor can perform surgery. T F

98. A rheumatologist examines, diagnoses, and treats disorders of the joints and musculoskeletal system. T F

99. A podiatrist is a medical specialist who examines, diagnoses, and treats disorders of the foot. T F

Check Your Spelling
For each of the following terms, place a C if the spelling is correct. If it is not, write the correct spelling in the space provided.

100. chiropractor _________________
101. densitometer _________________
102. electromyogram _______________
103. rheumatoid _________________
104. goniometer _________________
105. orthopedist _________________
106. Tenil’s sign _________________

Pathological Terms
Musculoskeletal disorders arise from congenital conditions, injury, degenerative disease, or other systemic disorders. Birth defects, such as spina bifida, affect the development of the spinal cord. Injuries to the spinal cord may produce paralysis. In some situations, surgery on the fetus while it is in utero can alleviate some of the effects of spina bifida. In such surgery, the abnormal spinal cord opening is repaired.

A herniated disk, in which the center of the disk is compressed and presses on nerves in the neural canal, can lead to sciatica, pain radiating down the leg from the lower back. Some diseases, such as rickets, which causes deformities in the legs, may result from a vitamin D deficiency.

Foot deformities may occur in or involve the ankle joint. Talipes calcaneus is a deformity of the heel due to weakened calf muscles; talipes valgus is eversion (a turning outward) of the foot; and talipes varus is inversion (a turning inward) of the foot. A calcaneal spur is a bony projection growing out of a bone.
Fractures are breaks or cracks in bones (see Figure 5-19). 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. Compression fractures often result from loss of bone density as in osteoporosis.

There are many other types of fractures; for example, an avulsion fracture is one caused by the pulling of a ligament and an intracapsular fracture is one within the capsule of a joint.

Figure 5-20 shows various types of fractures.
Injury or trauma to a ligament may cause a sprain. Overuse or improper use of a muscle may cause a strain. Overworking a joint may cause tendinitis (tendonitis), an inflammation of a tendon. Dislocation may result from an injury or from a strenuous, sudden movement. A subluxation is a partial dislocation. Bones may lose their density (osteoporosis). Figure 5-21 shows the damage caused by osteoporosis. Contracture, extreme resistance to stretching of a muscle, usually results from diseases of the muscle fibers or from an injury.

Pain in the musculoskeletal system may appear in the bones (ostealgia, osteodynia), muscles (myalgia, myodynia), or joints (arthralgia). Stiffness of the joints (ankylosis) may be an indicator of several diseases. Spastic muscles have abnormal contractions (spasms) in diseases such as multiple sclerosis. An abnormal increase in muscle size is hyper-trophy. Flaccid muscles are flabby in tone. Hypotonia is abnormally reduced muscle tension.
and rigor (also called rigidity) is abnormal muscle stiffness as seen in lock-jaw. Dystonia is abnormal tone (tension) in a muscle. A painfully long muscle contraction is tetany. Shaking (tremors) appears in a number of diseases such as Parkinson’s Disease. Some muscles atrophy (shrink) as a result of disuse or specific diseases such as muscular dystrophy, a progressive, degenerative disorder affecting skeletal muscles. A muscle inflammation is myositis.

Some bone tissue dies (bony necrosis, sequestrum), often as a result of loss of blood supply. Abnormal bone growths may be capped with cartilage, as in exostosis. The bursa may become inflamed, causing bursitis. Inflammation of the bursa in the big toe causes a bunion. The epiphyses may also become inflamed, causing epiphysitis.

A common inflammation of the joints is arthritis (Figure 5-22). Arthritis is a name for many different joint diseases, such as osteoarthritis or degenerative arthritis (arthritis characterized by erosion of joint cartilage), rheumatoid arthritis (a systemic disease affecting connective tissue), and gouty arthritis or gout (a disease characterized by joint pain, as in podagra, pain in the big toe). Certain types of arthritis may cause crepitation (also called crepitus), noise made when affected surfaces rub together. Infections in the bone may cause osteomyelitis.

Cartilage may soften (chondromalacia) or become fragmented, as in a herniated disk. Disks may also slip or become misaligned with other vertebrae (spondylolisthesis) or become stiff (spondylosis). Various tumors may develop in the muscle, bone, bone marrow, and joints. Myeloma, myoma, leiomyoma, leiomyosarcoma, rhabdomyoma, rhabdomyosarcoma, osteoma, and osteosarcoma are types of musculoskeletal tumors.

Some abnormal posture conditions (spinal curvature, kyphosis, lordosis, and scoliosis) may cause pain (see Figure 5-23). Pain may even be felt in limbs that have been paralyzed or amputated. Phantom limb or phantom pain afflicts many who are paralyzed or are missing a limb. Repetitive motion of the hand may cause carpal tunnel syndrome, which is signaled by pain and paresthesia (numbness or tingling) of the hand. Chiropractors treat some spinal conditions by manipulation. Physical therapy is movement therapy to restore use of damaged areas of the body.

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.

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

FIGURE 5-22 An arthritic hand.

FIGURE 5-23 The three types of spinal curvature.
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, review the terms below and refer to the previous section if you have any questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. These etymologies (word histories) are for your information only. You do not need to memorize them.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ankylosis [ÂNG-kí-LÔ-sís]</td>
<td>Stiffening of a joint, especially as a result of disease.</td>
</tr>
<tr>
<td>arthritis [âr-THRĪ-tēs]</td>
<td>Any of various conditions involving joint inflammation</td>
</tr>
<tr>
<td>atrophy [ÂT-ro-fē]</td>
<td>Wasting away of tissue, organs, and cells, usually as a result of disease or loss of blood supply.</td>
</tr>
<tr>
<td>bony necrosis [nê-KRÔ-sís]</td>
<td>Death of portions of bone.</td>
</tr>
<tr>
<td>bunion [BŪN-yûn]</td>
<td>An inflamed bursa at the foot joint, between the big toe and the first metatarsal bone.</td>
</tr>
<tr>
<td>bursitis [bûr-SÎ-tîs]</td>
<td>Inflammation of a bursa.</td>
</tr>
<tr>
<td>calcar [KÂL-kâr]</td>
<td>Spur.</td>
</tr>
<tr>
<td>carpal [KÄR-pâl] tunnel syndrome</td>
<td>Pain and paresthesia in the hand due to repetitive motion injury of the median nerve.</td>
</tr>
<tr>
<td>closed fracture</td>
<td>Fracture with no open skin wound.</td>
</tr>
<tr>
<td>Colles’ [kölz] fracture</td>
<td>Fracture of the lower end of the radius.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
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</tr>
<tr>
<td>complex fracture</td>
<td>Fracture with part of the bone displaced.</td>
</tr>
<tr>
<td>complicated fracture</td>
<td>Fracture involving extensive soft tissue injury.</td>
</tr>
<tr>
<td>compound fracture</td>
<td>Fracture with an open skin wound; open fracture.</td>
</tr>
<tr>
<td>compression fracture</td>
<td>Fracture of one or more vertebrae caused by compressing of the space between the vertebrae.</td>
</tr>
<tr>
<td>contracture</td>
<td>Extreme resistance to the stretching of a muscle.</td>
</tr>
<tr>
<td>crepitation, crepitus</td>
<td>Noise made by rubbing together of bones.</td>
</tr>
<tr>
<td>degenerative arthritis</td>
<td>Arthritis with erosion of the cartilage.</td>
</tr>
<tr>
<td>dislocation</td>
<td>Movement of a joint out of its normal position as a result of an injury or sudden, strenuous movement.</td>
</tr>
<tr>
<td>dystonia</td>
<td>Abnormal tone in tissues.</td>
</tr>
<tr>
<td>epiphysitis</td>
<td>Inflammation of the epiphysis.</td>
</tr>
<tr>
<td>exostosis</td>
<td>Abnormal bone growth capped with cartilage.</td>
</tr>
<tr>
<td>flaccid</td>
<td>Without tone; relaxed.</td>
</tr>
<tr>
<td>fracture</td>
<td>A break, especially in a bone.</td>
</tr>
<tr>
<td>gouty arthritis, gout</td>
<td>Inflammation of the joints, present in gout; usually caused by uric acid crystals.</td>
</tr>
<tr>
<td>greenstick fracture</td>
<td>Fracture with twisting or bending of the bone but no breaking; usually occurs in children.</td>
</tr>
<tr>
<td>hairline fracture</td>
<td>Fracture with no bone separation or fragmentation.</td>
</tr>
<tr>
<td>herniated disk</td>
<td>Protrusion of an intervertebral disk into the neural canal.</td>
</tr>
<tr>
<td>hypertrophy</td>
<td>Abnormal increase as in muscle size.</td>
</tr>
<tr>
<td>hypotonia</td>
<td>Abnormally reduced muscle tension.</td>
</tr>
<tr>
<td>impacted fracture</td>
<td>Fracture in which a fragment from one part of the fracture is driven into the tissue of another part.</td>
</tr>
<tr>
<td>incomplete fracture</td>
<td>Fracture that does not go entirely through a bone.</td>
</tr>
<tr>
<td>kyphosis</td>
<td>Abnormal posterior spine curvature.</td>
</tr>
<tr>
<td>leiomyoma</td>
<td>Benign tumor of smooth muscle.</td>
</tr>
<tr>
<td>leiomyosarcoma</td>
<td>Malignant tumor of smooth muscle.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>lordosis [lôr-DÔ-sîs]</td>
<td>Abnormal anterior spine curvature resulting in a sway back.</td>
</tr>
<tr>
<td>muscular dystrophy [MÜS-kyû-lâr DÎS-trô-fê]</td>
<td>Progressive degenerative disorder affecting the musculoskeletal system and, later, other organs.</td>
</tr>
<tr>
<td>myeloma [mî-ê-LÔ-mâ] myel(o)-, bone marrow + -oma, tumor</td>
<td>Bone marrow tumor.</td>
</tr>
<tr>
<td>myoma [mî-Ô-mâ] my(o)-, muscle + -oma, tumor</td>
<td>Benign muscle tumor.</td>
</tr>
<tr>
<td>open fracture</td>
<td>Fracture with an open skin wound; compound fracture.</td>
</tr>
<tr>
<td>osteoma [ôs-tê-Ô-mâ] osteo-, bone + -oma, tumor</td>
<td>Benign bone tumor, usually on the skull or mandible.</td>
</tr>
<tr>
<td>osteomyelitis [ÖS-tê-ô-mî-ê-LÎ-tîs] osteo-, bone + myel(o)-, bone marrow + -itis, inflammation</td>
<td>Inflammation of the bone marrow and surrounding bone.</td>
</tr>
<tr>
<td>osteoporosis [ÖS-tê-ô-pô-RÔ-sîs] osteo-, bone + por(e) + -osis, condition</td>
<td>Degenerative thinning of bone.</td>
</tr>
<tr>
<td>pathological fracture</td>
<td>Fracture occurring at the site of already damaged bone.</td>
</tr>
<tr>
<td>phantom limb; phantom pain</td>
<td>Pain felt in a paralyzed or amputated limb.</td>
</tr>
<tr>
<td>physical therapy</td>
<td>Movement therapy to restore use of damaged areas of the body.</td>
</tr>
<tr>
<td>podagra [pô-DÅG-râ]</td>
<td>Pain in the big toe, often associated with gout.</td>
</tr>
<tr>
<td>rhabdomyoma [RÂB-dô-mî-Ô-mâ] rhabd(o)-, rod-shaped + my(o)-, muscle + -oma, tumor</td>
<td>Benign tumor in striated muscle.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>rhabdomyosarcoma</td>
<td>Malignant tumor in striated muscle.</td>
</tr>
<tr>
<td>rheumatoid</td>
<td>Autoimmune disorder affecting connective tissue.</td>
</tr>
<tr>
<td>rickets</td>
<td>Disease of the skeletal system, usually caused by vitamin D deficiency.</td>
</tr>
<tr>
<td>rigidity</td>
<td>Stiffness.</td>
</tr>
<tr>
<td>rigor</td>
<td>Stiffening.</td>
</tr>
<tr>
<td>sciatica</td>
<td>Pain in the lower back, usually radiating down the leg, from a herniated disk or other injury or condition.</td>
</tr>
<tr>
<td>scoliosis</td>
<td>Abnormal lateral curvature of the spinal column.</td>
</tr>
<tr>
<td>sequestrum</td>
<td>Piece of dead tissue or bone separated from the surrounding area.</td>
</tr>
<tr>
<td>simple fracture</td>
<td>Fracture with no open skin wound.</td>
</tr>
<tr>
<td>spasm</td>
<td>Sudden, involuntary muscle contraction.</td>
</tr>
<tr>
<td>spastic</td>
<td>Tending to have spasms.</td>
</tr>
<tr>
<td>spina bifida</td>
<td>Congenital defect with deformity of the spinal column.</td>
</tr>
<tr>
<td>spinal curvature</td>
<td>Abnormal curvature of the spine.</td>
</tr>
<tr>
<td>spondylolisthesis</td>
<td>Degenerative condition in which one vertebra misaligns with the one below it; slipped disk.</td>
</tr>
<tr>
<td>spondylolysis</td>
<td>Degenerative condition of the moving part of a vertebra.</td>
</tr>
<tr>
<td>sprain</td>
<td>Injury to a joint without dislocation or fracture. (can involve a ligament). This is worse than a strain and often takes longer to heal than does a fracture and can be more painful.</td>
</tr>
<tr>
<td>spur</td>
<td>Bony projection growing out of a bone; calcar.</td>
</tr>
<tr>
<td>strain</td>
<td>Injury to a muscle as a result of improper use or overuse.</td>
</tr>
<tr>
<td>subluxation</td>
<td>Partial dislocation, as between joint surfaces.</td>
</tr>
<tr>
<td>talipes calcaneus</td>
<td>Deformity of the heel resulting from weakened calf muscles.</td>
</tr>
<tr>
<td>talipes valgus</td>
<td>Foot deformity characterized by eversion of the foot.</td>
</tr>
<tr>
<td>talipes varus</td>
<td>Foot deformity characterized by inversion of the foot.</td>
</tr>
<tr>
<td>tendinitis, tendonitis</td>
<td>Inflammation of a tendon.</td>
</tr>
<tr>
<td>tetany</td>
<td>Painfully long muscle contraction.</td>
</tr>
<tr>
<td>tremor</td>
<td>Abnormal, repetitive muscle contractions.</td>
</tr>
</tbody>
</table>
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
107. Chiropractic is one way for some people to manage pain. Why might spinal manipulation help?
108. 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.

109. ___ myo-  
110. ___ myelo-  
111. ___ rhabdo-  
112. ___ osteo-  
113. ___ arthro-  
114. ___ chiro-

a. bone  
b. hand  
c. rod-shaped  
d. joint  
e. bone marrow  
f. muscle

Know the Word Parts
Match the following terms with the letter that gives the best definition.

115. ___ myeloma  
116. ___ myoma  
117. ___ leiomyoma  
118. ___ leiomyosarcoma  
119. ___ rhabdomyoma  
120. ___ rhabdomyosarcoma  
121. ___ osteoma  
122. ___ osteosarcoma

a. malignant tumor of smooth muscle  
b. benign tumor in striated muscle  
c. benign tumor of smooth muscle  
d. benign muscle tumor  
e. malignant bone tumor  
f. bone marrow tumor  
g. malignant tumor in striated muscle  
h. benign tumor, usually on the skull or mandible

Check Your Knowledge
Complete the sentences below by filling in the blanks.

123. A patient with painful joints and bulges around the knuckles probably has _________.

124. Fractures that are most likely to occur in young children are called _________. fractures.
125. Osteoporosis is usually a disease found in ___________ women.
126. Playing tennis too vigorously may cause ___________ of the elbow.
127. Underworked muscles may become ___________.
128. A muscle tumor is a(n) ___________.
129. A slipped disk is called ___________.
130. A compound fracture is a break accompanied by a(n) ___________ wound.
131. Arthritis is a general term for a number of ___________ diseases.
132. Paralysis may be caused by an injury to the ___________.
133. A break in soft bone is a(n) ___________ fracture.
134. A strain is a(n) ___________ of the muscle, while a(n) ___________ is a torn or damaged ligament or damaged muscle due to trauma or injury.
135. An injury or a strenuous, sudden movement of a joint may result in ___________.
136. A partial dislocation is called a(n) ___________.
137. Pain in the muscle is called ___________ or ___________.
138. Pain in the bone is called ___________.
139. Pain in the joints is called ___________.
140. The suffix–desis means fixation or fusion, so the fixing of a joint so it does not move it is called ___________ desis.
141. Hypertrophy is an increase in muscle ___________, while hypertonia is an increase in muscle ___________.
142. Abnormal muscle tone is called ___________.
143. An infection in the bone is ___________.
144. Repetitive motion of the hand may cause ___________.

Know the Fractures
Write the letter of the correct fracture description in the space provided.

145. ____ closed fracture  
146. ____ open fracture  
147. ____ simple fracture  
148. ____ greenstick fracture  
149. ____ comminuted fracture  
150. ____ impacted fracture  
151. ____ pathological fracture  
152. ____ compression fracture

a. break with shattered bones  
b. break that does not move the bone out of place  
c. break with no open wound  
d. break with an open wound  
e. incomplete break of a soft bone  
f. break in a vertebrae caused by compression  
g. fragment from one part of the bone driven into the tissue of another part  
h. break in bone due to disease (bone may be already diseased in that area)
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. In some situations (as with loss of circulation in diabetes, cancer of a limb, or severe infection), amputation may be necessary. Prosthetic devices now routinely replace knees and hips, as when injury or degenerative disease has worn down joints. Bone grafting can be used to repair a defect. An orthosis or orthotic may be used to provide support and prevent movement during treatment.

Fractures are treated by casting, splinting, surgical manipulation, or placement in traction. Casts and splints are considered external fixation devices—devices that surround a fractured body part to hold the bones in place while healing (see Figure 5-24). They may be used in combination with an internal fixation device, such as a pin placed internally to hold bones together (see Figure 5-25). Pins for internal fixation are usually metal or hard plastic. A pin may be placed permanently or it may be removed after the bone has healed. Reduction is the return of a part to its normal position. An open reduction is done surgically to repair either fractured or dislocated bones; a closed reduction is external manipulation used for dislocated bones, such as a shoulder bone. In some surgeries, artificial bone is now being used. Some products in development may actually replace injured or diseased bone and allow for new bone growth while gradually dissolving as it is not needed.

Osteoplasty is repair of a bone. Osteoclasis is the breaking of bone for the purpose of repairing it (as when a fracture has not healed properly). 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. This operation it usually performed on the great toe. Other types of toe repair may correct such things as hammer toe, where one or more toes are permanently flexed to one side. Some musculoskeletal surgery is done by arthroscopy. Laminectomy or removal of part of a spinal disk may alleviate the pain of a herniated disk.

**VOCABULARY REVIEW**

In the previous section, you learned terms relating to surgery. Before going on to the exercises, review the terms below and refer to the previous section if you have questions. Pronunciations are provided for certain terms. Sometimes information about where the word came from is included after the term. These etymologies (word histories) are for your information only. You do not need to memorize them.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>amputation [ĀM-pyū-TĀ-shûn]</td>
<td>Cutting off of a limb or part of a limb.</td>
</tr>
<tr>
<td>arthrodesis [ār-thrō-DĒ-sīs]</td>
<td>Surgical fusion of a joint to stiffen it.</td>
</tr>
<tr>
<td>arthroplasty [ĀR-thrō-plās-tē]</td>
<td>Surgical replacement or repair of a joint.</td>
</tr>
<tr>
<td>bone grafting</td>
<td>Transplantation of bone from one site to another.</td>
</tr>
<tr>
<td>casting</td>
<td>Forming of a cast in a mold; placing of fiberglass or plaster over a body part to prevent its movement.</td>
</tr>
<tr>
<td>external fixation device</td>
<td></td>
</tr>
<tr>
<td>internal fixation device</td>
<td></td>
</tr>
<tr>
<td>myoplasty [MĪ-ō-plās-tē]</td>
<td>Surgical repair of muscle tissue.</td>
</tr>
<tr>
<td>orthosis, orthotic [ōr-THÔ-sīs, ōr-THÔT-īk]</td>
<td>External appliance used to immobilize or assist the movement of the spine or limbs.</td>
</tr>
<tr>
<td>osteoclasis [ŌS-tē-ŌK-lā-sīs]</td>
<td>Breaking of a bone in order to repair or reposition it.</td>
</tr>
<tr>
<td>osteoplasty [ŌS-tē-ō-plās-tē]</td>
<td>Surgical replacement or repair of bone.</td>
</tr>
<tr>
<td>prosthetic [prōs-THĒT-īk] device</td>
<td>Artificial device used as a substitute for a missing or diseased body part.</td>
</tr>
<tr>
<td>reduction</td>
<td>Return of a part to its normal position.</td>
</tr>
<tr>
<td>splinting</td>
<td>Applying a splint to immobilize a body part.</td>
</tr>
<tr>
<td>spondylosyndesis [SPŌN-dī-lō-śīn-DĒ-sīs]</td>
<td>Fusion of two or more spinal vertebrae.</td>
</tr>
<tr>
<td>synovectomy [śīn-ō-VĒK-tō-mē]</td>
<td>Removal of part or all of a joint's synovial membrane.</td>
</tr>
<tr>
<td>traction [TRĀK-shûn]</td>
<td>Dragging or pulling or straightening of something, as a limb, by attachment of elastic or other devices.</td>
</tr>
</tbody>
</table>
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

153. 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?

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

SURGICAL TERMS EXERCISES

Build Your Medical Vocabulary

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

155. osteo- __________
156. arthro-__________
157. myo- ___________
158. spondylo- _______

Find a Match

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

159. _______ amputation a. replacement device
160. _______ prosthesis b. molding
161. _______ orthosis, orthotic c. muscle repair
162. _______ traction d. bone cutting
163. _______ casting e. limb removal
164. _______ splinting f. bone repair
165. _______ myoplasty g. external supporting or immobilizing device
166. _______ osteoplasty h. wrapping to immobilize
167. _______ osteotomy i. pulling to straighten
168. _______ arthroplasty j. joint repair
Understanding Surgical Procedures

Explain the following surgical terms in simple words.

169. reduction (of a bone) _______________________________________________________________________
170. synovectomy ______________________________________________________________________________
171. arthrodesis ________________________________________________________________________________
172. bunionectomy ______________________________________________________________________________
173. laminectomy ______________________________________________________________________________
174. orthotic ___________________________________________________________________________________
175. arthrocentesis ______________________________________________________________________________

Pharmacological Terms

Most medications for treatment of the musculoskeletal system treat symptoms, not causes. Pain medications, such as analgesics, narcotics, anti-inflammatories (corticosteroids), muscle relaxants, and nonsteroidal anti-inflammatory drugs (NSAIDs), all relieve or relax the area of pain either by numbing the area or by reducing the inflammation. Table 5-1 shows some common medications.

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>Purpose</th>
<th>Generic</th>
<th>Trade Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>analgesic</td>
<td>to relieve pain</td>
<td>aspirin acetaminophen (NSAIDs are also analgesics.)</td>
<td>Bayer, Excedrin, and various Tylenol and various</td>
</tr>
<tr>
<td>anti-inflammatory</td>
<td>to reduce inflammation</td>
<td>prednisone (Aspirin and NSAIDs also reduce inflammation.)</td>
<td>Deltasone, Orasone, Cortan</td>
</tr>
<tr>
<td>corticosteroids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>muscle relaxant</td>
<td>to relieve stiffness</td>
<td>carisoprodol cyclobenzaprine methocarbamol</td>
<td>Soma Flexeril Delaxin, Robaxin</td>
</tr>
<tr>
<td>NSAIDs</td>
<td>to reduce inflammation</td>
<td>ibuprofen naproxen ketorolac, tromethamine nabutemone</td>
<td>Advil, Motrin, Nuprin Naproxyn Toradon (IV) Relafen</td>
</tr>
</tbody>
</table>

VOCABULARY REVIEW

In the previous section, you learned terms relating to pharmacology. Before going on to the exercises, review the terms below and refer to the previous section if you have questions. Pronunciations are provided for certain terms.
Sometimes information about where the word came from is included after the term. These etymologies (word histories) are for your information only. You do not need to memorize them.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>anti-inflammatory (corticosteroid)</td>
<td>Agent that reduces inflammation.</td>
</tr>
<tr>
<td>muscle relaxant</td>
<td>Agent that relieves muscle stiffness.</td>
</tr>
<tr>
<td>narcotic</td>
<td>Agent that relieves pain by affecting the body in ways that are similar to opium.</td>
</tr>
<tr>
<td>nonsteroidal [nön-STÉR-ô-y-däl] anti-inflammatory drug (NSAID)</td>
<td>Agent that reduces inflammation without the use of steroids.</td>
</tr>
</tbody>
</table>

**CASE STUDY**

**Treating the Symptoms**

In her follow-up letter on Laura Spinoza’s visit, Dr. Wolf listed a number of medications to treat the symptoms of fibromyalgia. Part of the difficulty in treating musculoskeletal disorders is that many of the diseases are degenerative, and damage cannot be reversed. Some of these diseases, such as muscular dystrophy, currently have no cure. Many forms of arthritis are degenerative and, short of replacing joints, cannot be improved significantly. Alleviating the pain is the only available course of treatment in many instances.

**Critical Thinking**

176. Narcotics can be addictive. The long-term use of steroids can cause other health problems. What does Dr. Wolf prescribe to avoid these two problems?

177. Many athletes use anabolic steroids illegally for strength and endurance building. (Corticosteroids are not used for this purpose.) Anabolic-steroid use can cause heart damage and many other serious health problems. What are some ways to increase strength and endurance without the use of dangerous drugs?

**PHARMACOLOGICAL TERMS EXERCISES**

**Fill in the Blank**

Choose one or more of the following terms to fill in each blank. Each term may be used more than once.

analgesic     anti-inflammatory     antibiotic

178. Treatment for bursitis ________________________________.

179. Treatment for myalgia ________________________________.

180. Treatment for bone infection __________________________.
181. Treatment for arthritis .................................................................
182. Treatment for arthralgia .........................................................

**Challenge Section**

The notes of Janet Azrah’s examination give the results of all observations and tests. The treatment protocol is described.

**Critical Thinking**

183. The notes in this section indicate a probable diagnosis of rheumatoid arthritis. Was the musculoskeletal examination normal?
184. Why might a physician perform a general examination on a patient who only shows symptoms related to the musculoskeletal system?

**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.

Explain the Terms

Write out the following sentences in lay terms.

185. The pt had a Fx of L1.
186. The ROM was decreased in the right shoulder due to myalgia.
187. The pt was placed on an NSAID due to OA.
188. The pt has CTS, it is B.
189. The pt has severe RA, which has caused arthrodynia and hypertonic muscles in the R leg.
190. On review of the medical history, the pt has TMJ, CTS, has had a Fx of the R wrist, has some DJD.
191. On examination it was found the DTR of the R leg was decreased. The ROM was also decreased on the R side of the body. The muscles in the R leg were flaccid and hypotonic.

Know the Medical Terms

Rewrite the following sentences to include proper medical terminology and abbreviations.

192. The patient came in today for a test that uses electricity to check muscle activity.
193. The pt will have a below the knee amputation on his right leg due to severe frostbite.
194. The child's break needs to be set.

True or False

For each of the following statements, circle T for true or F for false.

195. The clavicle is the posterior shoulder bone. T F
196. The femur is the upper arm bone. T F
197. The tibia is a flat bone on the front of the leg. T F
198. The sternum is also known as the breastbone. T F
199. The coccyx is also known as the tailbone. T F
200. The cervical vertebrae attach to ribs. T F
201. The false ribs do not attach to the sternum. T F
202. A tight muscle could be considered hypotonic. T F
203. A massage therapist would help someone with subluxations. T F
204. A chiropractor works only on the spine. T F
205. The radius is a bone in the leg. T F
206. The patella is another name for kneecap. T F
207. A fracture is considered a break in the continuity of the bone. T F
208. There are many types of fractures. T F
209. A fracture always goes completely through the bone. T F
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 the student Web site (www.mhhe.com/medterm3e).

**Word**

210. acetabulum [äs-ē-TÄB-yū-lām] \{acetábulo\}
211. acetabulum \{acromion\}
212. acromion [ā-KRŌ-mē-ōn]
213. amputation \{amputación\}
214. ankylosis [āNK-ki-LŌ-sēs] \{anquilosis\}
215. anti-inflammatory
216. arthritis [ār-THRĪ-tēs] \{artritis\}
217. articular \{articular\}
218. ankle \{tibio\}
219. ankyl(o)
220. ankle \{tibio\}
221. ankle \{tibio\}
222. arthroplasty \{arthroplastía\}
223. arthroscopy \{arthroscopia\}
224. articular \{articulación\}
225. articular \{articulación\}
226. articulation \{articulación\}
227. atlas \{cervical\}
228. axis \{axial\}
229. axis \{axis\}
230. atlas \{atlas\}
231. axis \{axis\}
232. atrophy \{atrofia\}
233. axis \{axis\}
234. axis \{axis\}
235. bone \{hueso\}
236. bone grafting
237. bone head
238. bone phagocyte [FAG-ō-sēt]
239. bone scan
240. bone necrosis [nē-KRŌ-sēs]
241. brachi(o)
242. bunion [BŪN-yūn] \{bunion\}
243. bursa \{bursa\}
244. bursa \{bursa\}
245. bursa \{bursa\}
246. bursitis \{bursitis\}
247. bursitis \{bursitis\}
248. calcane(o)
249. calcaneus [kāl-KĀ-nē-ūs] \{calcáneo\}
250. calcaneus [kāl-KĀ-nē-ūs] \{calcáneo\}
251. calcaneus [kāl-KĀ-nē-ūs] \{calcáneo\}
252. calcium [KĀL-sē-ūm] \{calcio\}
253. cancellous \{cancelloso\} bone
254. cardiac \{cardiac\}
255. carp(o)
256. carpal \{carpal\}
257. carpal \{carpal\}
258. cartilage \{cartílago\}
259. cartilage \{cartílago\}
260. casting \{colado\}
261. cephal(o)
262. cervic(o)
263. cervical \{cervical\}
264. chiropactor \{kīrō-PRĀK-tēr\} \{quirópráctico\}
265. chondr(o)
266. chondromalacia [KON-drō-mā-LĀ-shē-ā] \{condromalacia\}
267. clavicle \{KLĀV-ī-kī\} \{clavicula\}
268. closed fracture
269. coccyx \{kōK-sīks\} \{cóccix\}
270. Colles' \{kölz\} fracture
271. comminuted \{KO-M-ī-nū-tēd\} fracture
272. compact bone
273. complex fracture
274. complicated fracture
275. compound fracture
276. compression fracture
277. condyl(o)
278. condyle \{kōn-dīl\}
279. contracture \{kōn-TRĀK-chūr\}
280. corticosteroid
281. cost(o)
282. crani(o)
283. crepitation \{krē-pī-TĀ-shē-ūn\}, crepitus \{KRĒP-ī-ūs\}
284. crest \{cresta\}
285. dactyl(o)
286. degenerative arthritis
287. densitometer \{dēn-sī-TŌM-ē-ē-tēr\}
288. diaphysis \{di-AF-ī-sīs\} \{diáfisis\}
289. diarthroses \{di-ar-thRŌ-sēz\}
290. disk \{diśk\} \{disco\}
291. diskography \{diś-KŌG-rā-fe\} \{dis مج grafiā\}
292. dislocation \{dislocación\}
293. dorsal vertebrae
294. dystonia \{dīs-TŌ-nē-ā\} \{distoria\}
295. elbow \{ÉL-bō\} \{codo\}
WORD

296. electromyogram [ē-lēk-trō-MĪ-ō-grām] [electromiógrafo]
297. endosteum [ēn-DŌS-tē-ūm] [endostio]
298. epiphyseal [ēp-ī-FĪZ-ē-āl] plate
299. epiphysis [ē-pī-fī-sis] [epifisitis]
300. ethmoid [ĒTH-mōy-d] bone
301. ethmoid sinuses
302. exostosis [ēks-ōs-TŌ-sīs] [exostosis]
303. external fixation device
304. fasci(o)
305. fascia (pl., fasciae [FĀSH-ē-ā] [FASH-ē-e]) [fascia]
306. femor(o)
307. femur [FĒ-mūr] [fémur]
308. fibr(o)
309. fibula [FĪB-yū-lā] [peroné]
310. fissure [FĪSH-ūr] [fisura]
311. flaccid [FLĀK-sīd] [flácido]
312. flat bones
313. fontanelle [FŌN-tā-nēl] [fontanela]
314. foramen [fō-RĀ-mēn] [agujero]
315. foramen magnum [MĀG-nūm]
316. fossa (pl., fossae) [FŌS-ā] [FOS-ē] [fosa]
317. fracture [FRĀK-chūr] [fractura]
318. frontal [FRŪN-tāl] bone
319. frontal sinuses
320. goniometer [gō-nē-ŌM-ē-tēr] [goniometro]
321. gouty arthritis, gout [GŌWT-e, göwt]
322. greenstick fracture
323. hairline fracture
324. heel [hēl] [talon]
325. herniated [HĒR-nē-ā-tēd] disk
326. humer(o)
327. humerus [HYU-mēr-ūs] [húmero]
328. hypertrophy [hī-PĒR-trō-fē]
329. hypotonia [HĪ-pō-TŌ-nē-ā]
330. ili(o)
331. ilium [ĪL-ē-ūm] [ilium]
332. impacted fracture
333. incomplete fracture
334. insertion [insertiōn]
335. internal fixation device
336. intervertebral [in-tēr-VĒR-tē-brāl] disk
337. involuntary muscle
338. irregular bones
339. ischi(o)
340. ischium [ĪS-kē-ūm] [isquiōn]
341. joint [jōynt] [empalme]
342. kyph(o)
343. kyphosis [kī-FŌ-sīs] [cifosis]
344. lacrimal [LĀK-ri-māl] bone
345. lamin(o)
346. lamina (pl., laminae) [LĀM-ī-nā(LĀM-i-nē)] [lamina]
347. laminectomy [LĀM-ī-NĒK-tō-mē]
348. leioy(m)ia(o)
349. leiomyma [LĪ-ō-mī-Ō-mā]
350. leiomysisarcoma [LĪ-ō-MĪ-ō-sār-KŌmā]
351. ligament [LİG-ā-mēnt] [ligamento]
352. long bone
353. lordosis [lōr-DŌ-sīs] [lordosis]
354. lumb(o)
355. lumbar [LŪM-bār] vertebrae
356. malleolus (pl., malleoli) [mā-LĒ-ō-lūs (mā-LĒ-ō-ī)]
357. mandible [MĀN-dī-bl] [mandíbula]
358. mandibular (mān-DĪB-yū-lār]
359. marrow [MĀR-tō] [médula]
360. mastoid [MĀS-tōy-d] process
361. maxill(o)
362. maxillary [MĀK-sī-lār-ē] bone
363. maxillary sinus
364. medullary [MĒD-ū-lār-ē] cavity
365. metacarp(o)
366. metacarpal [MĒT-ā-KĀR-pāl] [metacarpiano]
367. metaphysis [mē-TAF-ī-sīs] [metafisis]
368. metatarsal [MĒT-ā-tār-sāl] bones
369. muscle [MŪS-ēl] [músculo]
370. muscle relaxant
380. muscular dystrophy [MŪS-kyū-lār DIS-trō-fē] [distrofia muscular]
381. musculoskeletal [MŪS-kyū-lō-SKĒL-ē-tāl] [musculoesquelético] system
382. my(o)
383. myalgia [mī-ĀL-jē-ā] [mialgia]
384. myel(o)
385. myelography [MĪ-ē-LŌG-rā-fē] [mielografía]
386. myeloma [mī-ē-LŌ-mā] [mieloma]
387. myodynia [MĪ-ō-DĪN-ē-ā] [miodinia]
388. myoma [mī-Ō-mā] [mioma]
389. myoplasty [MĪ-ō-plās-tē] [miositis]
390. myositis [mī-ō-SĪ-tīs] [miositis]
391. narcotic
392. nasal bones
393. nasal cavity
394. neural [NŪR-āl] canal
395. nonsteroidal [nōn-STĒR-ōy-dāl] anti-inflammatory drug (NSAID)
396. nucleus pulposus [NŪ-kle-ē-ūs pūl-PŌ-sūs]
397. occipital [ōk-SĪP-ī-tāl] bone
WORD

398. olecranon [ö-LEK-rä-nön] [olecranon]
399. open fracture
400. origin [örijen]
401. orthopedist [ör-thö-PE-dist], orthopedic [ör-thö-PE-dik] [ortopedista] surgeon
402. orthosis [ör-THÖ-sis], orthotic [ör-THÖT-ik] [ortosis, ortótica]
403. osseus [ÖS-e-üs] tissue
404. ossification [ÖS-í-fi-KÄ-shün] [ossificación]
405. oste(o)
406. ostealgia [ö-stè-ÅL-jë-ä] [ostealgia]
407. osteoarthritis [ÖS-te-ö-ar-THRI-tis] [osteoarthritis]
408. osteoblast [ÖS-te-ö-bläst] [osteoblasto]
409. osteoclasia [ÖS-te-ÖK-lä-sis] [ostoeclasia]
410. osteoclast [ÖS-te-ö-kläst] [osteoclasto]
411. osteocyte [ÖS-te-ö-sit] [osteocito]
412. osteodynia [ö-stè-ö-DÎN-e-ä] [osteodinia]
413. osteoma [ö-stè-Ö-mà] [osteoma]
414. osteomyelitis [ÖS-te-ö-mî-ë-LÎ-tis] [osteomielitis]
415. osteopath [ÖS-te-ö-påth] [osteópata]
416. osteoplasty [ÖS-te-ö-pläst-të] [osteoplastia]
417. osteoporosis [ÖS-te-ö-pö-RÖ-sís] [osteooporosis]
418. osteosarcoma [ÖS-te-ö-sär-KÖ-mäl] [osteosarcoma]
419. osteotomy [ö-stè-ÖT-ö-më] [osteotomía]
420. palatine [PÄL-å-tin] bone
421. parietal [pä-RI-ë-tä] bone
422. patell(o)
423. patella [pä-TEL-ä] [rótula]
424. pathological fracture
425. ped(1), ped(o)
426. pelv(i)
427. pelvic [PEL-vik] cavity
428. pelvic girdle
429. pelvis [PEL-vís] [pelvis]
430. periosteum [për-ë-ÖS-të-üm] [periostio]
431. phalan(g)on)
432. phalanges (sing., phalanx) [fà-LÁN-jëz (FÁ-längks)] [fálangeo]
433. phantom limb; phantom pain
434. phosphorus [FÖS-fö-rûs] [fósforo]
435. physical therapy
436. pod(o)
437. podagra [pö-DÄG-rà] [podagra]
438. podiatrist [pö-DI-ät-trist] [podiatra]
439. process [PRÖS-sës, PRÖS-ës]
440. prosthetic [prös-THÉT-ïk] device
441. pub(o)
442. pubes [PYÜ-bës] [pubis]
443. pubic symphysis [PYÜ-bîk SIM-fi-sís]
444. rachi(o)
445. radi(o)
446. radius [RA-de-ûs] [radio]
447. reduction [reducção]
448. rhabd(o)
449. rhabdomy(o)
450. rhabdomyoma [RÄB-dö-mî-Ö-mâ] [rabdomioma]
451. rhabdomyosarcoma [RÄB-dö-mî-sär-KÖ-mâ] [rabdomiosarcoma]
452. rheumatoid arthritis
453. rheumatoid factor test
454. rheumatologist [ru-mâ-TÖL-ô-jist] [reumatólogo]
455. rib [costîla]
456. rickets [RÎK-ëts] [raquitismo]
457. rigidità [rigidez]
458. rigor [RÎG-ö] [rigor]
459. sacrum [SÄ-krüm] [sacro]
460. scapul(o)
461. scapula [SKÄP-yû-là] [escápula]
462. sciatica [sî-ÄT-î-kâ] [ciática]
463. scol(o)
464. scoliosis [skö-lë-Ö-sí-s] [escolisis]
465. sella turcica [SÊL-ä-TÜR-sî-kâ] [sîlla turcica]
466. sequestrum [sê-KWÈS-trûm] [secuestro]
467. serum calcium
468. serum phosophorus
469. sesamoid [SÊS-ä-möyd] bone
470. shin [shîn] [espinilla]
471. short bones
472. simple fracture
473. sinuses [SÎ-nûs] [seno]
474. skeleton [SKÉL-ë-tôn] [esqueleto]
475. smooth muscle
476. spasm [späzm] [espasmo]
477. spastic [SPÂS-tîk] [espástico]
478. sphenoïd [SFÉ-nöyd] bone
479. shin [shîn] [espinilla]
480. spinous [SPÎ-nûs] process
481. spina bifida [SPÎ-nà BÎF-î-dä] [espinosa bifida]
482. spinal column
483. spinal curvature
484. spine [spîn] [espinho]
485. splinting [ferulización]
486. spondyli(o)
487. spondylolisthesis [SPÔN-di-lö-ës-THÉ-sís] [espondilolistesis]
488. spondylosis [spôn-di-LÖL-î-sis] [espodilosis]
Word

490. spondylosyndesisis [SPON-di-lō
sin-DÉ-sis] [espondilosindestis]
491. spongy bone
492. sprain [sprän]
493. spur [spūr]
494. stern(o)
495. sternum [STĚR-nüm] [esternón]
496. strain [strän] [distender]
497. striated [strī-ĂT-ēd] muscle
498. styloid [STĪ-löyd] process
499. subluxation [sūb-lūk-SĀ-
shūn] [subluxación]
500. sulcus (pl., sulci) [SŪL-kūs, [SŪL-sí] [surco]
501. suture [SŪ-chūr] [sutura]
502. symphysis [SĪM-fī-sīs] [sinfisis]
503. synarthrosis [SIN-ăr-THRŌ-
sís] [sinartrosis]
504. synov(o)
505. synovectomy [sīn-ō-VĒK-
tō-mē] [sinovectomi]
506. synovial [sī-NŌ-vē-āl] fluid
507. synovial joint
508. synovial membrane
509. talipes calcaneus [TĀL-ī-pěz
kāl-KĀ-nē-ūs]
510. talipes valgus [TĀL-ī-pěz
VĀL-gūs]
511. talipes varus [TĀL-ī-pěz
VĀ-rūs]
512. tars(o)
513. tarsus, tarsal [TĀR-sūs, TĀR-
sāl] bones
514. temporal [TĒM-pō-RĀL] bone
515. temporomandibular [TĒM-pō-
rō-măn-DĪ-b-yū-lār] joint
516. ten(o), tend(o), tendin(o)
517. tendinitis, tendonitis
{tendonitis}
518. tendon [TĒN-dōn] {tendon}
519. tenotomy [tē-NŌT-ō-mē]
{tenotomía}
520. tetany [TET-ă-nē] {tetania}
521. thorac(o)
522. thoracic [thō-RĀS-īk]
vertebrae
523. thorax [THŌ-rāks] [tórax]
524. tibi(o)
525. tibia [TĪB-ē-ā] {tibia}
526. Tinel’s [tī-NĒLZ] sign
527. traction [TRĀK-shūn]
{tracción}
528. transverse process
529. tremor [TRĒM-ōr] {temblor}
530. trochanter [trō-KĀN-tēr]
{trocánter}
531. true ribs
532. tubercle [TŪ-bēr-kl]
{tubérculo}
533. tuberosity [TŪ-bēr-ōs-ĭ-tē]
{tuberosidad}
534. uln(o)
535. ulna [ŬL-nā] {ulna}
536. uric [ŬR-ĭk] acid test
537. vertebr(o)
538. vertebra (pl., vertebrae)
[VĒR-tē-brā (VĒR-tē-brē)]
{vertebra}
539. vertebral [vēr-TĒ-brāl, VĒR-tē-brāl] body
540. vertebral column
541. visceral [VĪS-ĕr-āl] muscle
542. vitamin D
543. voluntary muscle
544. vomer [VŌ-mēr] {vómer}
545. zygomatic [ZĪ-gō-MĀT-ĭk]
bone

Abbreviations

Write out the full meaning of each abbreviation.

Abbreviation

546. A-K
547. ASIS
548. B-K
549. C₁, C₂, etc.
550. Ca
551. CTS
552. D₁, D₂, etc.
553. DJD
554. DTR
555. EMG
556. Fx
557. IM
558. L
559. L₁, L₂, etc.
560. MCP
561. NSAID
562. OA
563. P
564. PIP
565. PSISRRA
566. ROM
567. T₁, T₂, etc.
568. TMJ
Chapter 5: Word-Building (20 questions—1 pts. each)

Using the following combining forms, complete the word that best fits the definition of each word relating to the musculoskeletal system listed below. Combining forms may be used more than once.

acetabul(o)  cost(o)  lamin(o)  radi(o)  
brachi(o)  dactyl(o)  lumb(o)  scapul(o)  
burs(o)  femor(o)  myel(o)  stern(o)  
calci(o)  fibr(o)  patell(o)  synov(o)  
cervic(o)  kyph(o)  ped(i)  uln(o)

1. Formation of bone marrow tissue: _______________ poiesis
2. Relating to the arm and head: _______________ cephalic
3. Toward the ulna: _______________ ad
4. Repair of part of the hip: _______________ plasty
5. Condition with insufficient calcium: _______________ penia
6. Inflammation of a lamina: _______________ itis
7. Surgical fixing of the scapula: _______________ pexy
8. Cyst with fibrous tissue: _______________ cyst
9. Patella pain: _______________ algia
10. Of the sternum and pericardium: _______________ pericardial
11. Swelling of the finger: _______________ edema
12. Of the lumbar vertebrae and the ribs: _______________ costal
13. Relating to the neck and arm: _______________ brachial
14. Of the radius and humerus: _______________ humeral
15. Brace used for the spine: _______________ tone
16. Care of the feet: _______________ cure
17. Inflammation of the synovial membrane: _______________ itis
18. Spasm of the fingers: _______________ spasm
19. Of the upper ribs: _______________ superior
20. Neck pain: _______________ dynia