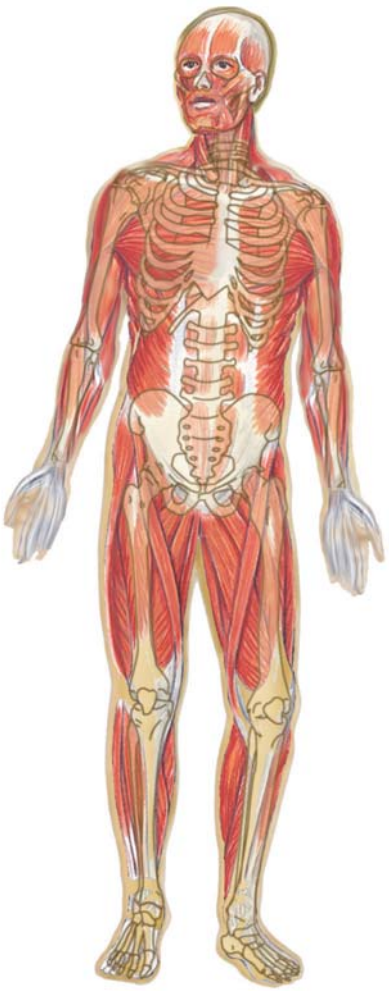
CHAPTER 5

The Musculoskeletal System

▶ ORTHOPEDICS, RHEUMATOLOGY

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



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.

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.

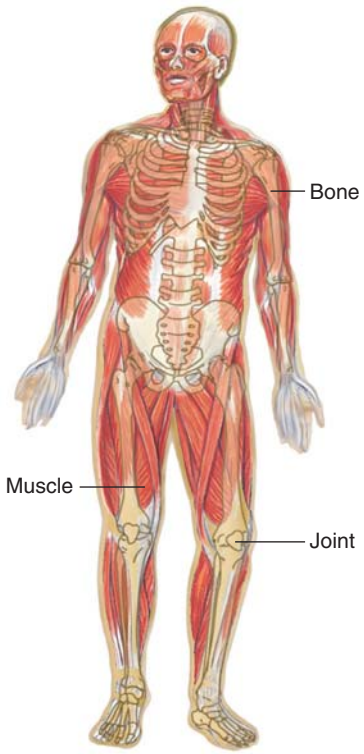


FIGURE 5-1 Muscles and bones hold the body together, enable it to move, and protect and support the internal organs.

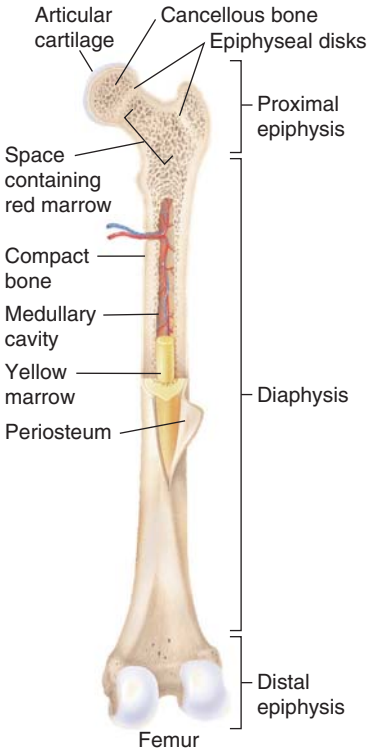


FIGURE 5-2 Parts of a long bone. The legs and arms are made up of long bones.

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 shoulder blades, pelvis, and skull include flat 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.

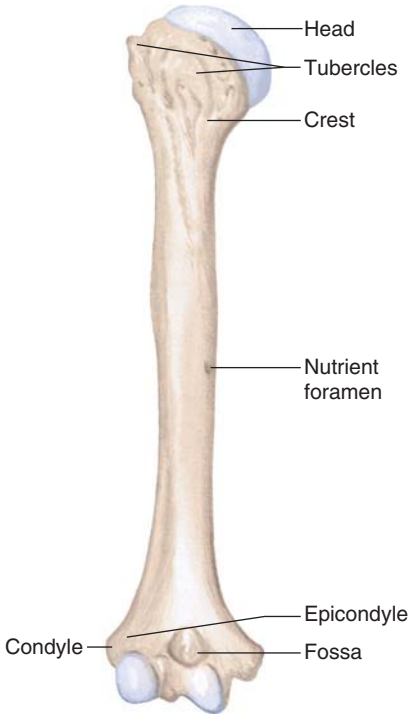


FIGURE 5-3 Bone extensions on a long bone.

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).

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.**

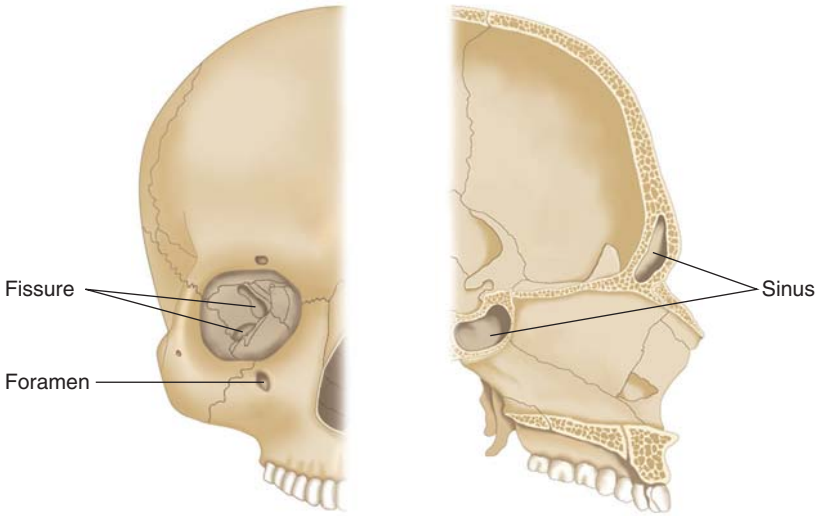


FIGURE 5-4 Types of bone depressions.

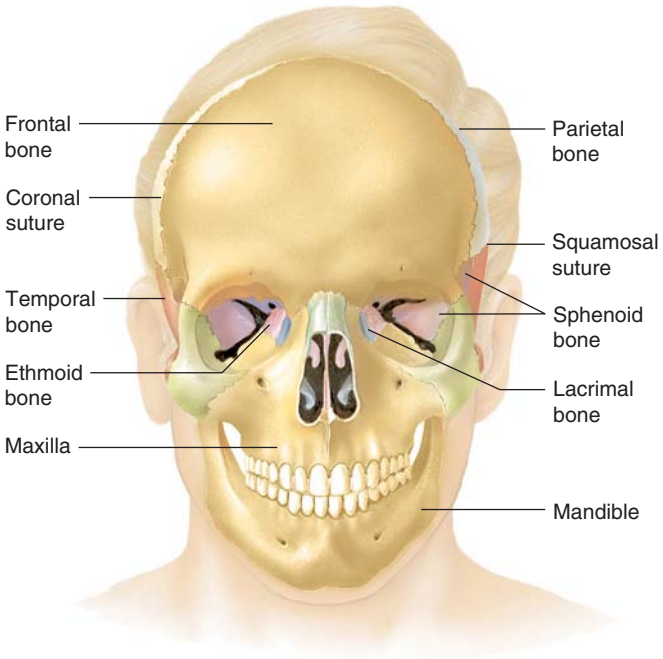
The skull of a newborn is not completely joined and has soft spots, called **fontanelles.**

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.



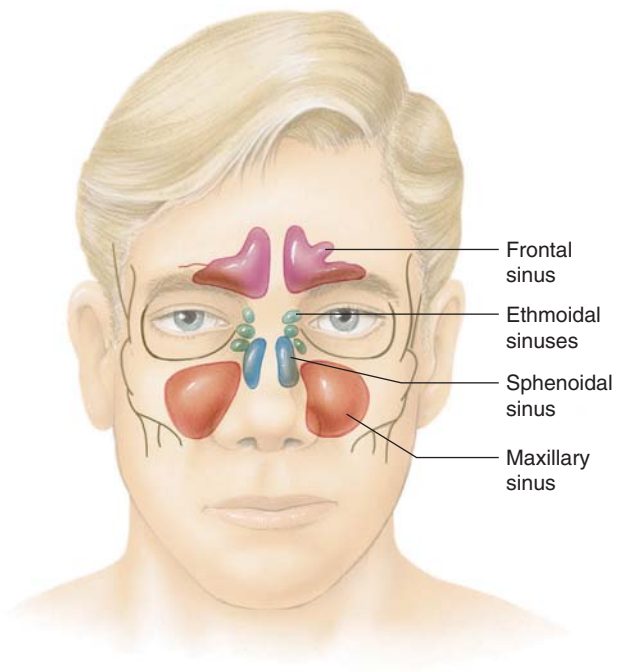
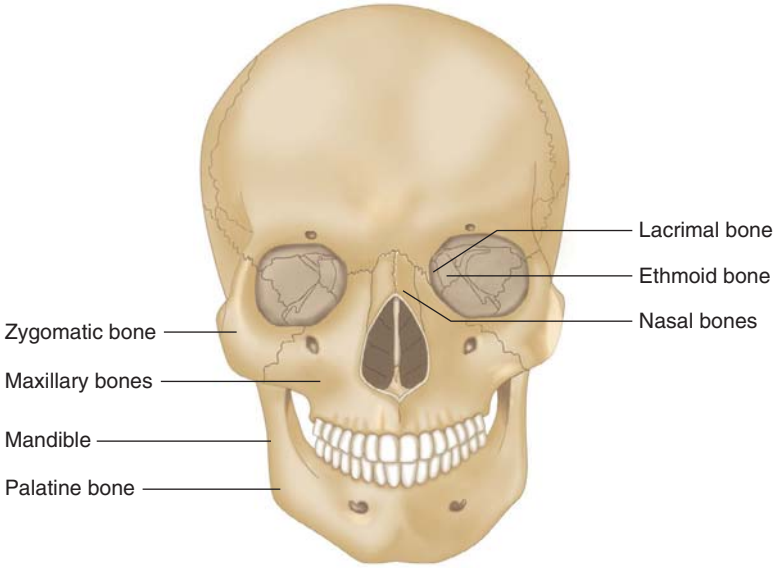


FIGURE 5-5 The bones of the skull and the sinus cavities.

FIGURE 5-6 The bones of the face.



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

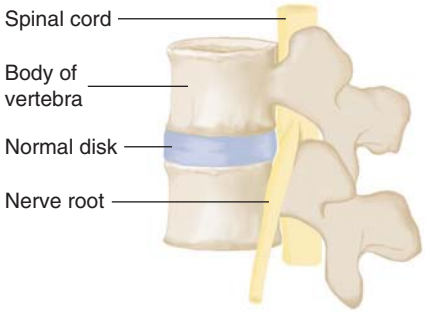


FIGURE 5-7 Details of two vertebrae.

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").

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.

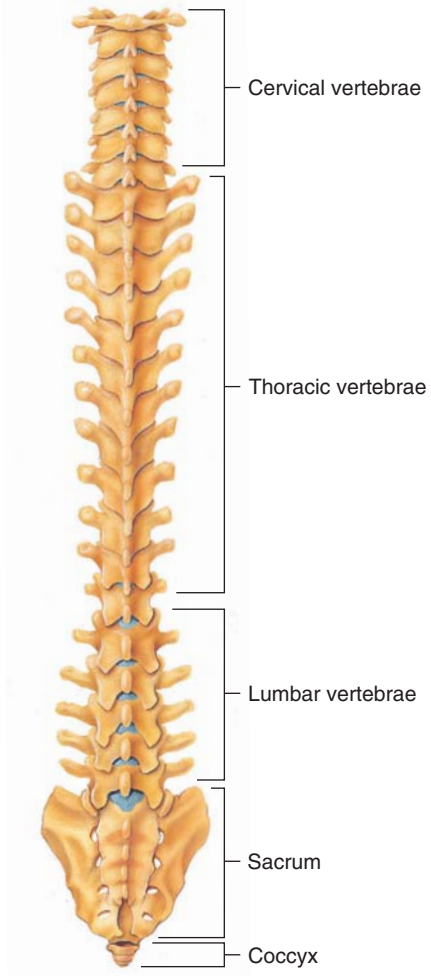


FIGURE 5-8 The divisions of the spinal column.

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

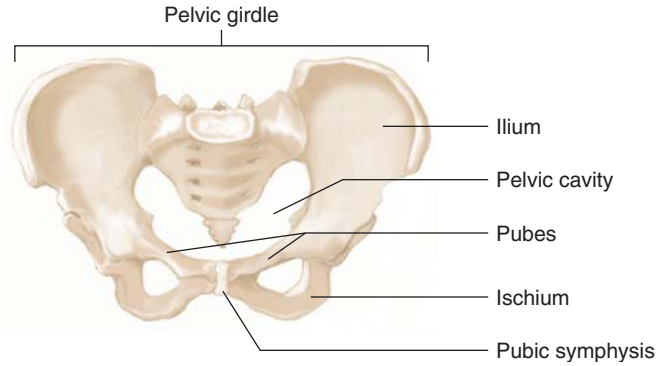


FIGURE 5-10 Bones of the pelvis.

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.

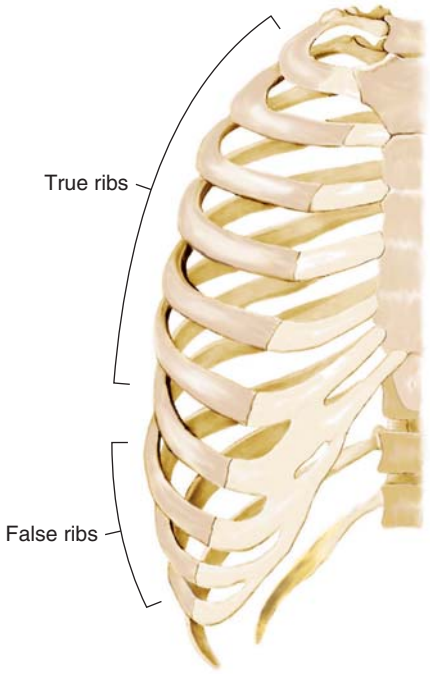


FIGURE 5-9 Ribs of the chest.

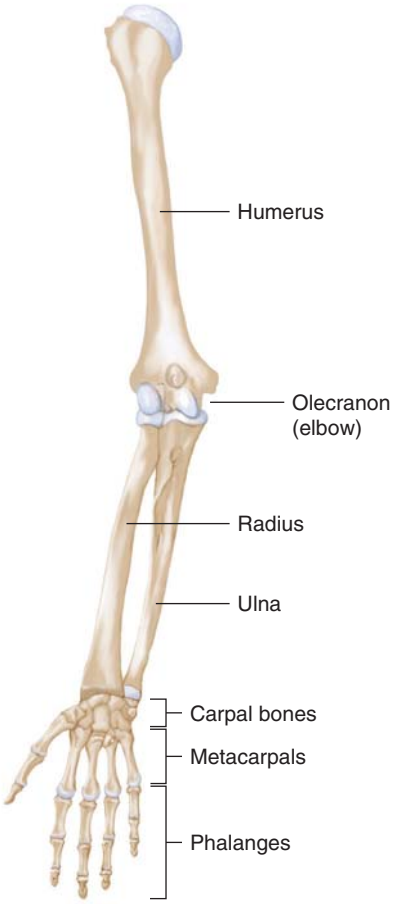


FIGURE 5-11 Bones of the arm and hand.

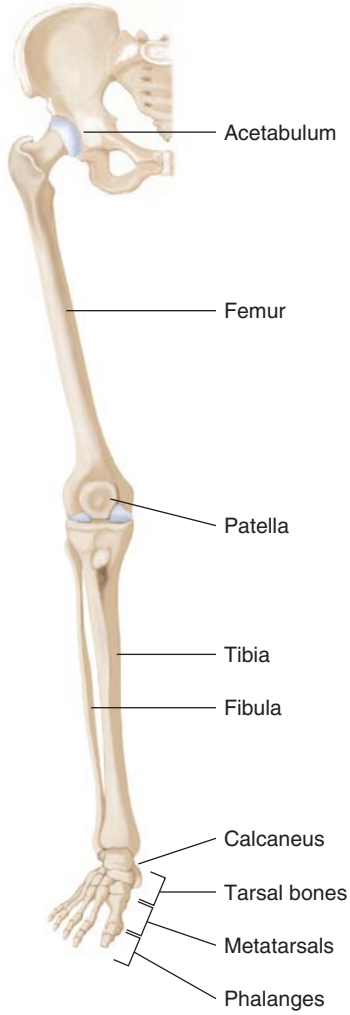


FIGURE 5-12 Bones of the leg and foot.

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.

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.

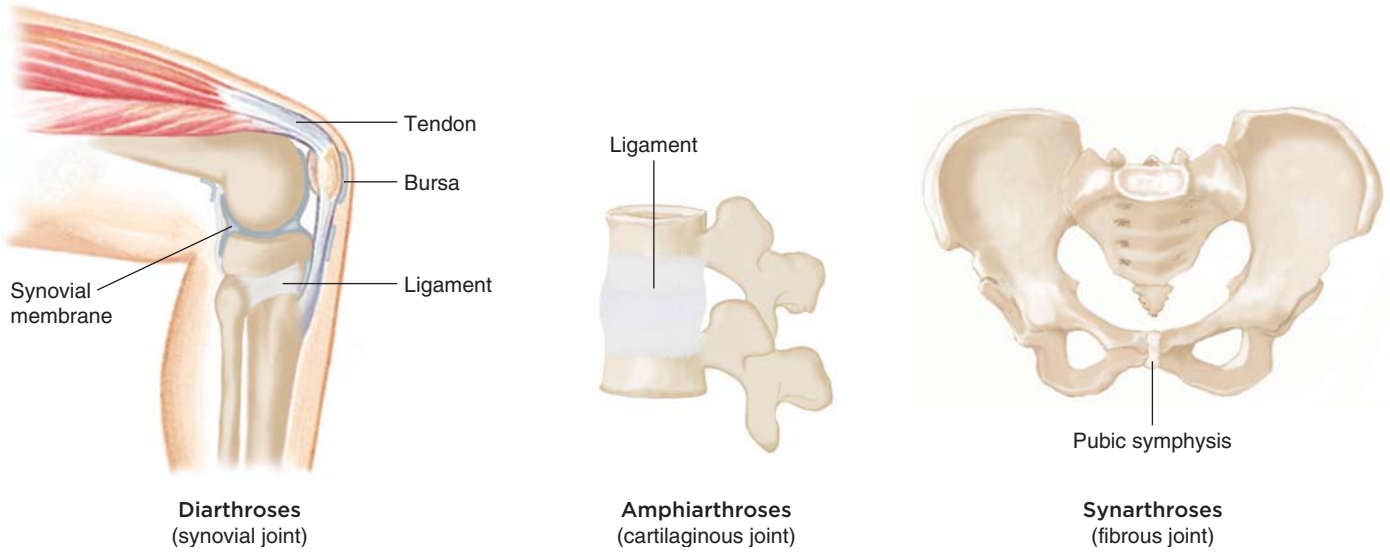


FIGURE 5-13 Types of and parts of a joint.

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 . . .

Muscles

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

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

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

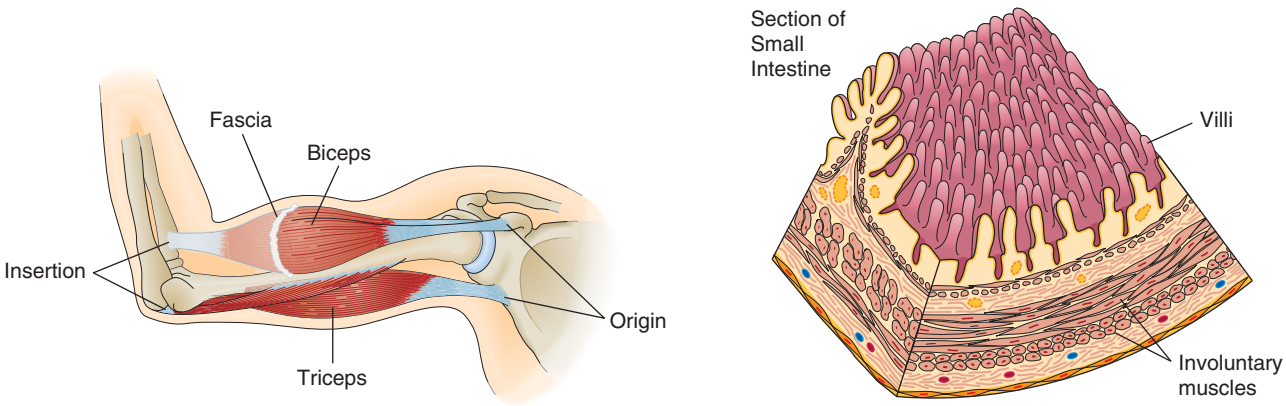


FIGURE 5-14 Types and parts of muscle.

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.

Term	Definition
acetabulum [ăs-ĕ-TĂB-yū-lŭm]	Cup-shaped depression in the hip bone into which the top of the femur fits.
acromion [ă-KRŌ-mē-oñ]	Part of the scapula that connects to the clavicle.
amphiarthrosis *(pl.,* amphiarthoses) [ĂM-fĭ-ăr-THRŌ-sĭs (ĂM-fĭ-ăr-THRŌ-sēs)] Greek *amphi-*, both + *arthrosis*, joint	Cartilaginous joint having some movement at the union of two bones.
ankle [ĂNG-kl]	Hinged area between the lower leg bones and the bones of the foot.
articular [ăr-TĬK-yū-lăr] **cartilage**	Cartilage at a joint.
articulation [ăr-tĭk-yū-LĀ-shŭn]	Point at which two bones join together to allow movement.
atlas [ĂT-lăs]	First cervical vertebra.
axis [ĂK-sĭs]	Second cervical vertebra.
bone	Hard connective tissue that forms the skeleton of the body.
bone head	Upper, rounded end of a bone.
bone phagocyte [FĂG-ō-sīt]	Bone cell that ingests dead bone and bone debris.
bursa *(pl.,* bursae) [BŬR-să(BŬR-sē)]	Sac lined with a synovial membrane that fills the spaces between tendons and joints.
calcaneus [kăl-KĀ-nē-ŭs]	Heel bone.
calcium [KĂL-sē-ŭm]	Mineral important in the formation of bone.
cancellous [KĂN-sĕ-lŭs] **bone**	Spongy bone with a latticelike structure.
cardiac [KĂR-dē-ăk] **muscle**	Striated involuntary muscle of the heart.
carpus, carpal [KĂR-pŭs, KĂR-păl] **bone**	Wrist; wrist bone.
cartilage [KĂR-tĭ-lăj]	Flexible connective tissue found in joints, fetal skeleton, and the lining of various parts of the body.
cartilaginous [kăr-tĭ-LĂJ-ĭ-nŭs] **disk**	Thick, circular mass of cartilage between the vertebrae of the spinal column.
cervical [SĔR-vĭ-kl] **vertebrae**	Seven vertebrae of the spinal column located in the neck.
clavicle [KLĂV-ĭ-kl]	Curved bone of the shoulder that joins to the scapula; collar bone.

Term	Definition
coccyx [KŎK-sĭks]	Small bone consisting of four fused vertebrae at the end of the spinal column; tailbone.
compact bone	Hard bone with a tightly woven structure.
condyle [KŎN-dīl]	Rounded surface at the end of a bone.
crest	Bony ridge.
diaphysis [dī-ĂF-ĭ-sĭs] Greek, a growing between	Long middle section of a long bone; shaft.
diarthroses (*sing.*, diarthrosis) [dī-ăr-THRŌ-sēz (dī-ăr-THRŌ-sĭs] Greek, articulations	Freely movable joints.
disk [dĭsk] Latin *discus*	*See* cartilaginous disk.
dorsal vertebrae	Thoracic vertebrae.
elbow [ĔL-bō]	Joint between the upper arm and the forearm.
endosteum [ĕn-DŎS-tē-ŭm] end(o)-, within + Greek *osteon*, bone	Lining of the medullary cavity.
epiphyseal [ĕp-ĭ-FĬZ-ē-ăl] **plate**	Cartilaginous tissue that is replaced during growth years, but eventually calcifies and disappears when growth stops.
ethmoid [ĔTH-mŏyd] **bone**	Irregular bone of the face attached to the sphenoid bone.
ethmoid sinuses	Sinuses on both sides of the nasal cavities between each eye and the sphenoid sinus.
fascia (*pl.*, fasciae) [FĂSH-ē-ă (FĂSH-ē-ē)]	Sheet of fibrous tissue that encloses muscles.
femur [FĒ-mūr]	Long bone of the thigh.
fibula [FĬB-yū-lă]	Smallest long bone of the lower leg.
fissure [FĬSH-ŭr]	Deep furrow or slit.
flat bones	Thin, flattened bones that cover certain areas, as of the skull.
fontanelle [FŎN-tă-nĕl]	Soft, membranous section on top of an infant's skull.
foramen [fō-RĀ-mĕn]	Opening or perforation through a bone.
foramen magnum [MĂG-nŭm]	Opening in the occipital bone through which the spinal cord passes.
fossa (*pl.*, fossae) [FŎS-ă (FŎS-ē)]	Depression, as in a bone.
frontal [FRŬN-tăl] **bone**	Large bone of the skull that forms the top of the head and forehead.
frontal sinuses	Sinuses above the eyes.

Term	Definition
heel [hēl]	Back, rounded portion of the foot.
humerus [HYŪ-mĕr-ŭs]	Long bone of the arm connecting to the scapula on top and the radius and ulna at the bottom.
ilium [ĬL-ē-ŭm]	Wide portion of the hip bone.
insertion	Point at which a muscle attaches to a movable bone.
intervertebral [ĭn-tĕr-VĔR-tĕ-brăl] **disk**	*See* cartilaginous disk.
involuntary muscle	Muscle not movable at will.
irregular bones	Any of a group of bones with a special shape to fit into certain areas of the skeleton, such as the skull.
ischium [ĬS-kē-ŭm]	One of three fused bones that form the pelvic girdle.
joint [jŏynt]	Place of joining between two or more bones.
lacrimal [LĂK-rĭ-măl] **bone**	Thin, flat bone of the face.
lamina (*pl.*, laminae) [LĂM-ĭ-nă (LĂM-ĭ-nē)]	Thin, flat part of either side of the arch of a vertebra.
ligament [LĬG-ă-mĕnt]	Sheet of fibrous tissue connecting and supporting bones; attaches bone to bone.
long bone	Any bone of the extremities with a shaft.
lumbar [LŬM-băr] **vertebrae**	Five vertebrae of the lower back.
malleolus (*pl.*, malleoli) [mă-LĒ-ō-lŭs (mă-LĒ-ō-lī)]	Rounded protrusion of the tibia or fibula on either side of the ankle.
mandible [MĂN-dĭ-bl]	U-shaped bone of the lower jaw.
mandibular [măn-DĬB-yū-lăr] **bone**	Mandible.
marrow [MĂR-ō]	Connective tissue filling the medullary cavity, often rich in nutrients.
mastoid [MĂS-tŏyd] **process**	Protrusion of the temporal bone that sits behind the ear.
maxillary [MĂK-sĭ-lār-ē] **bone**	Bone of the upper jaw.
maxillary sinus	Sinus on either side of the nasal cavity below the eyes.
medullary [MĔD-ū-lār-ē] **cavity**	Soft center cavity in bone that often holds marrow.
metacarpal [MĔT-ă-KĂR-păl] meta-, behind + carpal, of the wrist	One of five bones of the hand between the wrist and the fingers.
metaphysis [mĕ-TĂF-ĭ-sĭs] meta-, behind + Greek *physis*, growth	Section of a long bone between the epiphysis and diaphysis.
metatarsal [MĔT-ă-TĂR-săl] **bones** meta-, behind + tarsus	Bones of the foot between the instep (arch) and the toes.

Term	Definition
muscle [MŬS-ĕl]	Contractile tissue that plays a major role in body movement.
musculoskeletal [MŬS-kyū-lō-SKĔL-ĕ-tăl] **system** musculo-, muscle + skeletal	System of the body including the muscles and skeleton.
nasal bones	Bones that form the bridge of the nose.
nasal cavity	Cavity on either side of the nasal septum.
neural [NŪR-ăl] **canal**	Space through which the spinal cord passes.
nucleus pulposus [NŪ-klē-ŭs pŭl-PŌ-sŭs]	Fibrous mass in the center portion of the intervertebral disk.
occipital [ŏk-SĬP-ĭ-tăl] **bone**	Bone that forms the lower back portion of the skull.
olecranon [ō-LĔK-ră-nŏn]	Curved end of the ulna to which tendons of the arm muscles attach; bony prominence of the elbow.
origin	Point at which muscles attach to stationary bone.
osseous [ŎS-ē-ŭs] **tissue**	Connective tissue into which calcium salts are deposited.
ossification [ŎS-ĭ-fĭ-KĀ-shŭn]	Hardening into bone.
osteoblast [ŎS-tē-ō-blăst] osteo-, bone + -blast, forming	Cell that forms bone.
osteoclast [ŎS-tē-ō-klăst] osteo-, bone + -clast, breaking	Large cell that reabsorbs and removes osseous tissue.
osteocyte [ŎS-tē-ō-sīt] osteo-, bone + -cyte, cell	Bone cell.
palatine [PĂL-ă-tīn] **bone**	Bone that helps form the hard palate and nasal cavity; located behind the maxillary bones.
parietal [pă-RĪ-ĕ-tăl] **bone**	Flat, curved bone on either side of the upper part of the skull.
patella [pă-TĔL-ă]	Large, sesamoid bone that forms the kneecap.
pelvic [PĔL-vĭk] **cavity**	Cup-shaped cavity formed by the large bones of the pelvic girdle; contains female reproductive organs, sigmoid colon, bladder, and rectum.
pelvic girdle	Hip bones.
pelvis [PĔL-vĭs]	Cup-shaped ring of bone and ligaments at the base of the trunk.
periosteum [pĕr-ē-ŎS-tē-ŭm]	Fibrous membrane covering the surface of bone.
phalanges (*sing.*, phalanx) [fă-LĂN-jēz (FĀ-lăngks)]	Long bones of the fingers and toes.
phosphorus [FŎS-fōr-ŭs]	Mineral important to the formation of bone.

Term	Definition
process [PRŌ-sĕs, PRŎS-ĕs]	Bony outgrowth or projection.
pubes [PYŪ-bĭs]	Anteroinferior portion of the hip bone.
pubic symphysis [PYŪ-bĭk SĬM-fă-sĭs]	Joint between the two public bones.
radius [RĀ-dē-ŭs]	Shorter bone of the forearm.
rib	One of twenty-four bones that form the chest wall.
sacrum [SĀ-krŭm]	Next-to-last spinal vertebra made up of five fused bones; vertebra that forms part of the pelvis.
scapula [SKĂP-yū-lă]	Large flat bone that forms the shoulder blade.
sella turcica [SĔL-ă TŬR-sĭ-kă]	Bony depression in the sphenoid bone where the pituitary gland is located.
sesamoid [SĔS-ă-mŏyd] **bone**	Bone formed in a tendon over a joint.
shin [shĭn]	Anterior ridge of the tibia.
short bones	Square-shaped bones with approximately equal dimensions on all sides.
sinus [SĪ-nŭs]	Hollow cavity, especially either of two cavities on the sides of the nose.
skeleton [SKĔL-ĕ-tŏn]	Bony framework of the body.
smooth muscle	Fibrous muscle of internal organs that acts involuntarily.
sphenoid [SFĒ-nŏyd] **bone**	Bone that forms the base of the skull.
sphenoid sinus	Sinus above and behind the nose.
spinal column	Column of vertebrae at the posterior of the body, from the neck to the coccyx.
spinous [SPĪ-nŭs] **process**	Protrusion from the center of the vertebral arch.
spongy bone	Bone with an open latticework filled with connective tissue or marrow.
sternum [STĔR-nŭm]	Long, flat bone that forms the midline of the anterior of the thorax.
striated [strī-ĀT-ĕd] **muscle**	Muscle with a ribbed appearance that is controlled at will.
styloid [STĪ-lŏyd] **process**	Peg-shaped protrusion from a bone.
sulcus *(pl.,* sulci) [SŬL-kŭs (SŬL-sī)] Latin, furrow	Groove or furrow in the surface of bone.
suture [SŪ-chūr]	Joining of two bone parts with a fibrous membrane.
symphysis [SĬM-fĭ-sĭs] Greek, from *sym-*, together + *physis*, joint	Type of cartilaginous joint uniting two bones.

Term	Definition
synarthrosis [SĬN-ăr-THRŌ-sĭs] Greek, from *syn-*, together + *arthrosis*, articulation	Fibrous joint with no movement.
synovial [sĭ-NŌ-vē-ăl] **fluid**	Fluid that serves to lubricate joints.
synovial joint	A joint that moves.
synovial membrane	Connective tissue lining the cavity of joints and producing the synovial fluid.
tarsus, tarsal [TĂR-sŭs, TĂR-săl] **bones**	Seven bones of the instep (arch of the foot).
temporal [TĔM-pō-răl] **bone**	Large bone forming the base and sides of the skull.
temporomandibular [TĔM-pō-rō-măn-DĬB-yū-lăr] **joint (TMJ)**	Joint of the lower jaw between the temporal bone and the mandible.
tendon [TĔN-dŏn]	Fibrous band that connects muscle to bone or other structures.
thoracic [thō-RĂS-ĭk] **vertebrae**	Twelve vertebrae of the chest area.
thorax [THŌ-răks]	Part of the trunk between the neck and the abdomen; chest.
tibia [TĬB-ē-ă]	Larger of the two lower leg bones.
transverse process	Protrusion on either side of the vertebral arch.
trochanter [trō-KĂN-tĕr]	Bony protrusion at the upper end of the femur.
true ribs	Seven upper ribs of the chest that attach to the sternum.
tubercle [TŪ-bĕr-kl]	Slight bony elevation to which a ligament or muscle may be attached.
tuberosity [TŪ-bĕr-ŎS-ĭ-tē]	Large elevation in the surface of a bone.
ulna [ŬL-nă]	Larger bone of the forearm.
vertebra (*pl.*, vertebrae) [VĔR-tĕ-bră (VĔR-tĕ-brē)]	One of the bony segments of the spinal column.
vertebral body	Main portion of the vertebra, separate from the arches of the vertebra.
vertebral column	Spinal column.
visceral [VĬS-ĕr-ăl] **muscle**	Smooth muscle.
vitamin D	Vitamin important to the formation of bone.
voluntary muscle	Striated muscle.
vomer [VŌ-mĕr]	Flat bone forming the nasal septum.
zygomatic [ZĪ-gō-MĂT-ĭk] **bone**	Bone that forms the cheek.

CASE STUDY

Seeing a Specialist

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

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

Critical Thinking

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

STRUCTURE AND FUNCTION EXERCISES

Check Your Knowledge

Fill in the blanks.

3. The extremities of the body include mostly _____ bones.
4. 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.

Combining Form	Meaning	Example
acetabul(o)	acetabulum	*acetabulectomy* [ĂS-ĕ-tăb-yū-LĔK-tō-mē], excision of the acetabulum
acromi(o)	end point of the scapula	*acromioscapular* [ă-KRŌ-mē-ō-SKĂP-yū-lăr], relating to the acromion and the body of the scapula
ankyl(o)	bent, crooked	*ankylosis* [ĂNG-kĭ-LŌ-sĭs], fixation of a joint in a bent position, usually resulting from a disease
arthr(o)	joint	*arthrogram* [ĂR-thrō-grăm], x-ray of a joint
brachi(o)	arm	*brachiocephalic* [BRĀ-kē-ō-sĕ-FĂL-ĭk], relating to both the arm and head
burs(o)	bursa	*bursitis* [bŭr-SĪ-tĭs], inflammation of a bursa
calcane(o)	heel	*calcaneodynia* [kăl-KĀ-nē-ō-DĬN-ē-ă], heel pain
calci(o)	calcium	*calciokinesis* [KĂL-sē-ō-kĭ-NĒ-sĭs], mobilization of stored calcium in the body
carp(o)	wrist	*carpopedal* [KĂR-pō-PĔD-ăl], relating to the wrist and foot
cephal(o)	head	*cephalomegaly* [SĔF-ă-lō-MĔG-ă-lē], abnormally large head
cervic(o)	neck	*cervicodynia* [SĔR-vĭ-kō-DĬN-ē-ă], neck pain
chondr(o)	cartilage	*chondroplasty* [KŎN-drō-plăs-tē], surgical repair of cartilage
condyl(o)	knob, knuckle	*condylectomy* [kŏn-dĭ-LĔK-tō-mē], excision of a condyle
cost(o)	rib	*costiform* [KŎS-tĭ-fŏrm], rib-shaped
crani(o)	skull	*craniotomy* [krā-nē-ŎT-ō-mē], incision into the skull
dactyl(o)	fingers, toes	*dactylitis* [dăk-tĭ-LĪ-tĭs], inflammation of the finger(s) or toe(s)
fasci(o)	fascia	*fasciotomy* [făsh-ē-ŎT-ō-mē], incision through a fascia
femor(o)	femur	*femorocele* [FĔM-ō-rō-sēl], hernia in the femur
fibr(o)	fiber	*fibroma* [fī-BRŌ-mă], benign tumor in fibrous tissue

Combining Form	Meaning	Example
humer(o)	humerus	*humeroscapular* [HYŪ-mĕr-ō-SKĂP-yū-lăr], relating to both the humerus and the scapula
ili(o)	ilium	*iliofemoral* [ĬL-ē-ō-FĔM-ō-răl], relating to the ilium and the femur
ischi(o)	ischium	*ischiodynia* [ĬS-kē-ō-DĬN-ē-ă], pain in the ischium
kyph(o)	hump; bent	*kyphoscoliosis* [KĪ-fō-skō-lē-Ō-sĭs], kyphosis and scoliosis combined
lamin(o)	lamina	*laminectomy* [LĂM-ĭ-NĔK-tō-mē], removal of part of one or more of the thick cartilaginous disks between the vertebrae
leiomy(o)	smooth muscle	*leiomyosarcoma* [LĪ-ō-MĪ-ō-săr-KŌ-mă], malignant tumor of smooth muscle
lumb(o)	lumbar	*lumboabdominal* [LŬM-bō-ăb-DŎM-ĭ-năl], relating to the lumbar and abdominal regions
maxill(o)	upper jaw	*maxillofacial* [măk-SĬL-ō-FĀ-shăl], pertaining to the jaws and face
metacarp(o)	metacarpal	*metacarpectomy* [MĔT-ă-kăr-PĔK-tō-mē], excision of a metacarpal
my(o)	muscle	*myocardium* [mī-ō-KĂR-dē-ŭm], cardiac muscle in the middle layer of the heart
myel(o)	spinal cord; bone marrow	*myelocyst* [MĪ-ĕ-lō-sĭst], cyst that develops in bone marrow
oste(o)	bone	*osteoarthritis* [ŎS-tē-ō-ăr-THRĪ-tĭs], arthritis characterized by erosion of cartilage and bone and joint pain
patell(o)	knee	*patellectomy* [PĂT-ĕ-LĔK-tō-mē], excision of the patella
ped(i), ped(o)	foot	*pedometer* [pĕ-DŎM-ĕ-tĕr], instrument for measuring walking distance
pelv(i)	pelvis	*pelviscope* [PĔL-vĭ-skōp], instrument for viewing the pelvic cavity
phalang(o)	finger or toe bone	*phalangectomy* [făl-ăn-JĔK-tō-mē], removal of a finger or toe
pod(o)	foot	*podalgia* [pō-DĂL-jē-ă], foot pain

Combining Form	Meaning	Example
pub(o)	pubis	*puborectal* [PYŪ-bō-RĔK-tăl], relating to the pubis and the rectum
rachi(o)	spine	*rachiometer* [rā-kē-ŎM-ĕ-tĕr], instrument for measuring spine curvature
radi(o)	forearm bone	*radiomuscular* [RĀ-dē-ō-MŬS-kyū-lăr], relating to the radius and nearby muscles
rhabd(o)	rod-shaped	*rhabdosphincter* [RĂB-dō-SFĬNGK-tĕr], striated muscular sphincter
rhabdomy(o)	striated muscle	*rhabdomyolysis* [RĂB-dō-mī-ŎL-ĭ-sĭs], acute disease that includes destruction of skeletal muscle
scapul(o)	scapula	*scapulodynia* [SKĂP-yū-lō-DĬN-ē-ă], scapula pain
scoli(o)	curved	*scoliokyphosis* [SKŌ-lē-ō-kī-FŌ-sĭs], lateral and posterior curvature of the spine
spondyl(o)	vertebra	*spondylitis* [spŏn-dĭ-LĪ-tĭs], inflammation of a vertebra
stern(o)	sternum	*sternodynia* [stĕr-nō-DĬN-ē-ă], sternum pain
synov(o)	synovial membrane	*synovitis* [sĭn-ō-VĪ-tĭs], inflammation of a synovial joint
tars(o)	tarsus	*tarsomegaly* [tăr-sō-MĔG-ă-lē], congenital abnormality with overgrowth of a tarsal bone
ten(o), tend(o), tendin(o)	tendon	*tenodynia* [tĕn-ō-DĬN-ē-ă], tendon pain; *tendoplasty* [TĔN-dō-plăs-tē], surgical repair of a tendon; *tendinitis* [tĕn-dĭ-NĪ-tĭs], tendon inflammation
thorac(o)	thorax	*thoracoabdominal* [THŌR-ă-kō-ăb-DŎM-ĭ-năl], relating to the thorax and the abdomen
tibi(o)	tibia	*tibiotarsal* [tĭb-ē-ō-TĂR-săl], relating to the tarsal and tibia bones
uln(o)	ulna	*ulnocarpal* [ŬL-nō-KĂR-păl], relating to the ulna and the wrist
vertebr(o)	vertebra	*vertebroarterial* [VĔR-tĕ-brō-ăr-TĒR-ē-ăl], relating to a vertebral artery or to a vertebra and an artery

Abbreviation	Meaning
A-K	above the knee (amputation)
ASIS	anterior superior iliac spine
B	bilateral
B-K	below the knee (amputation)
C_1, C_2, etc.	first cervical vertebra, second cervical vertebra, etc.
Ca	calcium
CTS	carpal tunnel syndrome
D_1, D_2, etc.	first dorsal vertebra, second dorsal vertebra, etc. (now referred to as first thoracic vertebra, second thoracic vertebra, etc.)
DJD	degenerative joint disease
DTR	deep tendon reflex
EMG	electromyogram
Fx	fracture
IM	intramuscularly

Abbreviation	Meaning
L	left
L_1, L_2, etc.	first lumbar vertebra, second lumbar vertebra, etc.
MCP	metacarpophalangeal
NSAID	nonsteroidal anti-inflammatory drug
OA	osteoarthritis
P	phosphorus
PIP	proximal interphalangeal joints
PSIS	posterior superior iliac spine
R	right
RA	rheumatoid arthritis
ROM	range of motion
T_1, T_2, etc.	first thoracic vertebra, second thoracic vertebra, etc.
TMJ	temporomandibular joint

Combining Forms and Abbreviations Exercises

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

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.

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

March 12, 20XX

Dr. Robert Johnson
16 Tyler Court
Newtown, MI 09990

Dear Dr. Johnson

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

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

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

Alana Wolf, MD

Alana Wolf, M.D.

Find the Word Parts

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 carpel 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.

FIGURE 5-15 An x-ray of the hand showing arthritis in most of the joints

FIGURE 5-16 CT scans are valuable diagnostic tools.

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

FIGURE 5-18 A goniometer is used to measure the range of motion of a joint.

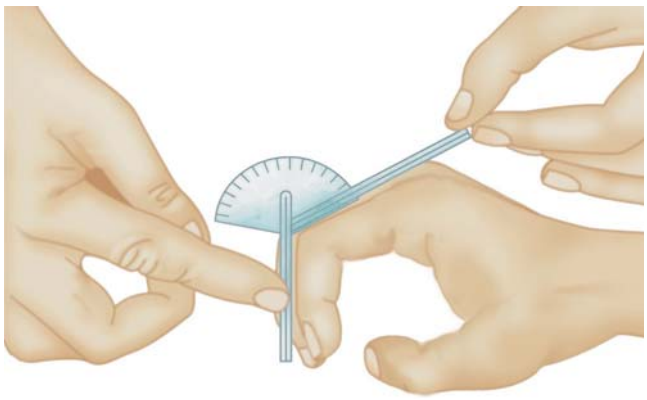


FIGURE 5-17 A radiologist examining MRI scans to see if there are any abnormalities.

Vocabulary Review

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.

Term	Definition
arthrography [ăr-THRŎG-ră-fē] arthro-, joint + -graphy, process of recording	Radiography of a joint.
arthroscopy [ăr-THRŎS-kō-pē] arthro-, joint + -scopy, a viewing with an instrument	Examination with an instrument that explores the interior of a joint.
bone scan	Radiographic or nuclear medicine image of a bone.
chiropractor [kī-rō-PRĂK-tōr] chiro-, hand + Greek praktikos, efficient	Health care professional who works to align the spinal column so as to treat certain ailments.
densitometer [dĕn-sĭ-TŎM-ĕ-tĕr]	Device that measures bone density using light and x-rays.
diskography [dĭs-KŎG-ră-fē]	Radiographic image of an intervertebral disk by injection of a contrast medium into the center of the disk.
electromyogram [ē-lĕk-trō-MĪ-ō-grăm] electro-, electrical + myo-, muscle + -gram, recording	A graphic image of muscular action using electrical currents.
goniometer [gō-nē-ŎM-ĕ-tĕr] Greek *gonia*, angle + -meter, measuring device	Instrument that measures angles or range of motion in a joint.
myelography [MĪ-ĕ-LŎG-ră-fē] myelo-, spinal cord + -graphy, process of recording	Radiographic imaging of the spinal cord.
orthopedist [ōr-thō-PĒ-dĭst]**, orthopedic** [ōr-thō-PĒD-ĭk] **surgeon** ortho-, straight + Greek *pais (paid-)*, child	Physician who examines, diagnoses, and treats disorders of the musculoskeletal system.
osteopath [ŎS-tē-ō-păth] osteo-, bone + -path(y), disease	Physician who combines manipulative treatment with conventional therapeutic measures.
podiatrist [pō-DĪ-ă-trĭst]	Medical specialist who examines, diagnoses, and treats disorders of the foot.
rheumatoid factor test	Test used to detect rheumatoid arthritis.
rheumatologist [rū-mă-TŎL-ō-jĭst]	Physician who examines, diagnoses, and treats disorders of the joints and musculoskeletal system.
serum calcium [SĒR-ŭm KĂL-sī-ŭm]	Test for calcium in the blood.

Term	Definition
serum creatine phosphokinase [KRĒ-ă-tēn fŏs-fō-KĪ-nās]	Enzyme active in muscle contraction; usually phosphokinase is elevated after a myocardial infarction and in the presence of other degenerative muscle diseases.
serum phosphorus [FŎS-fōr-ŭs]	Test for phosphorus in the blood.
Tinel's [tĭ-NĔLZ] **sign**	"Pins and needles" sensation felt when an injured nerve site is tapped.
uric [YŪR-ĭk] **acid test**	Test for acid content in urine; elevated levels may indicate gout.

CASE STUDY

Preventing Disease

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

Critical Thinking

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. densitiometer _____

102. electromelogram _____

103. rhuematoid _____

104. goniometer _____

105. orthepodist _____

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 **calcar** or **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.

FIGURE 5-19 An x-ray of a complex fracture.

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

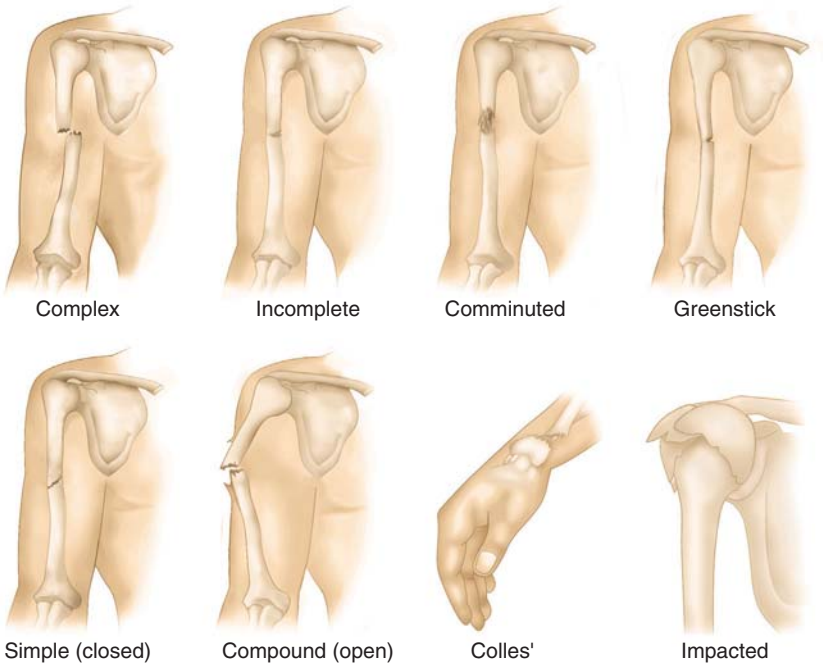


FIGURE 5-20 Some different types of fractures.

MORE ABOUT . . .

Fractures

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

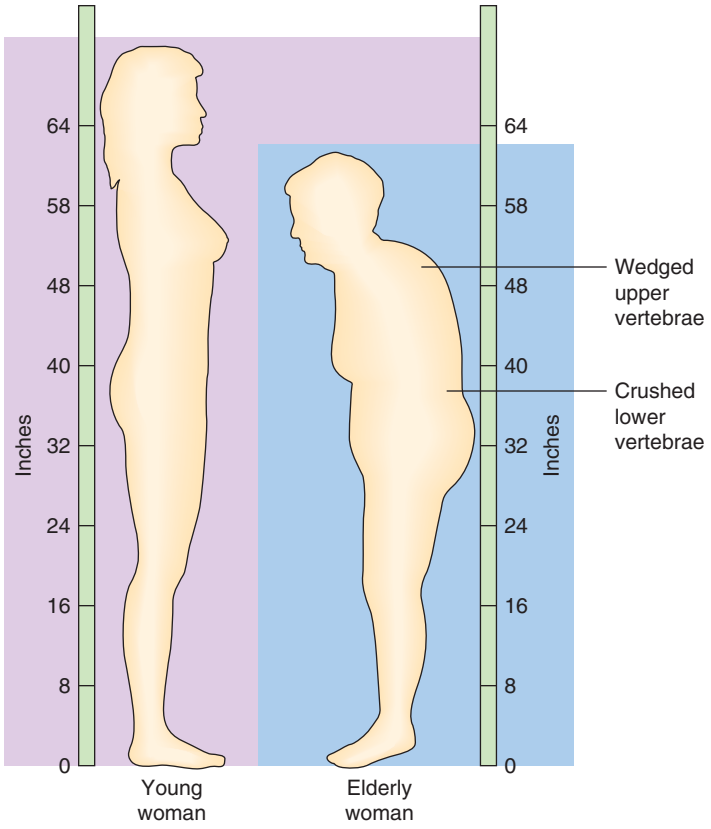


FIGURE 5-21 The damage caused to the spine by osteoporosis.

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 lockjaw. **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.

FIGURE 5-22 An arthritic hand.

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.

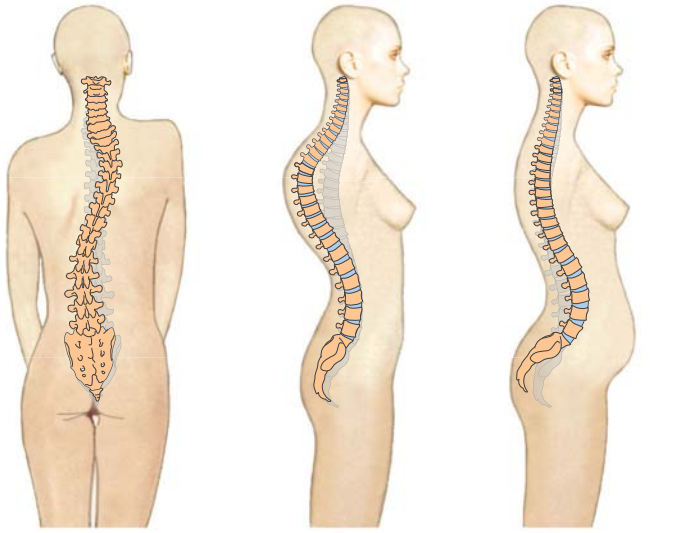


FIGURE 5-23 The three types of spinal curvature.

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.

Term	Definition
ankylosis [ĂNG-kĭ-LŌ-sĭs]	Stiffening of a joint, especially as a result of disease.
arthralgia [ăr-THĂL-jē-ă] arthro-, joint + -algia, pain	Severe joint pain.
arthritis [ăr-THRĪ-tĭs] Greek, from arthro-, joint + -itis, inflammation	Any of various conditions involving joint inflammation.
atrophy [ĂT-rō-fē] Greek *atrophia*, without nourishment	Wasting away of tissue, organs, and cells, usually as a result of disease or loss of blood supply.
bony necrosis [nĕ-KRŌ-sĭs]	Death of portions of bone.
bunion [BŬN-yŭn]	An inflamed bursa at the foot joint, between the big toe and the first metatarsal bone.
bursitis [bŭr-SĪ-tĭs] burs(a) + -itis, inflammation	Inflammation of a bursa.
calcar [KĂL-kăr]	Spur.
carpal [KĂR-păl] **tunnel syndrome**	Pain and paresthesia in the hand due to repetitive motion injury of the median nerve.
chondromalacia [KŎN-drō-mă-LĀ-shē-ă] chondro-, cartilage + malacia, softening	Softening of cartilage.
closed fracture	Fracture with no open skin wound.
Colles' [kŏlz] **fracture**	Fracture of the lower end of the radius.
comminuted [KŎM-ĭ-nū-tĕd] **fracture**	Fracture with shattered bones.

Term	Definition
complex fracture	Fracture with part of the bone displaced.
complicated fracture	Fracture involving extensive soft tissue injury.
compound fracture	Fracture with an open skin wound; open fracture.
compression fracture	Fracture of one or more vertebrae caused by compressing of the space between the vertebrae.
contracture [kŏn-TRĂK-chūr]	Extreme resistance to the stretching of a muscle.
crepitation, crepitus [krĕp-ĭ-TĀ-shŭn, KRĔP-ĭ-tŭs]	Noise made by rubbing together of bones.
degenerative arthritis	Arthritis with erosion of the cartilage.
dislocation	Movement of a joint out of its normal position as a result of an injury or sudden, strenuous movement.
dystonia [dĭs-TŌ-nē-ă]	Abnormal tone in tissues.
epiphysitis [ĕ-pĭf-ĭ-SĪ-tĭs]	Inflammation of the epiphysis.
exostosis [ĕks-ŏs-TŌ-sĭs] ex-, out of + ost(eo)-, bone + -osis, condition	Abnormal bone growth capped with cartilage.
flaccid [FLĂK-sĭd]	Without tone; relaxed.
fracture [FRĂK-chŭr]	A break, especially in a bone.
gouty arthritis, gout [GŎWT-ē, gŏwt]	Inflammation of the joints, present in gout; usually caused by uric acid crystals.
greenstick fracture	Fracture with twisting or bending of the bone but no breaking; usually occurs in children.
hairline fracture	Fracture with no bone separation or fragmentation.
herniated [HĔR-nē-ā-tĕd] **disk**	Protrusion of an intervertebral disk into the neural canal.
hypertrophy [hī-PĔR-trō-fē] hyper-, excessive + -trophy, growth	Abnormal increase as in muscle size.
hypotonia [HĪ-pō-TŌ-nē-ă] hypo-, subnormal + Greek *tonos,* tone	Abnormally reduced muscle tension.
impacted fracture	Fracture in which a fragment from one part of the fracture is driven into the tissue of another part.
incomplete fracture	Fracture that does not go entirely through a bone.
kyphosis [kī-FŌ-sĭs]	Abnormal posterior spine curvature.
leiomyoma [LĪ-ō-mī-Ō-mă] leio-, smooth + my(o)-, muscle + -oma, tumor	Benign tumor of smooth muscle.
leiomyosarcoma [LĪ-ō-MĪ-ō-săr-KŌ-mă] leio-, smooth + myo-, muscle + sarcoma	Malignant tumor of smooth muscle.

Term	Definition
lordosis [lōr-DŌ-sĭs]	Abnormal anterior spine curvature resulting in a sway back.
muscular dystrophy [MŬS-kyū-lăr DĬS-trō-fē]	Progressive degenerative disorder affecting the musculoskeletal system and, later, other organs.
myalgia [mī-ĂL-jē-ă] my(o)-, muscle + -algia, pain	Muscle pain.
myeloma [mī-ĕ-LŌ-mă] myel(o)-, bone marrow + -oma, tumor	Bone marrow tumor.
myodynia [MĪ-ō-DĬN-ē-ă] myo-, muscle + -dynia, pain	Muscle pain.
myoma [mī-Ō-mă] my(o)-, muscle + -oma, tumor	Benign muscle tumor.
myositis [mī-ō-SĪ-tĭs] myo-, muscle + -itis, inflammation	Inflammation of a muscle.
open fracture	Fracture with an open skin wound; compound fracture.
ostealgia [ŏs-tē-ĂL-jē-ă] oste(o)-, bone + -algia, pain	Bone pain.
osteoarthritis [ŎS-tē-ō-ăr-THRĪ-tĭs] osteo-, bone + arthritis	Arthritis with loss of cartilage.
osteodynia [ŏs-tē-ō-DĬN-ē-ă] osteo-, bone + -dynia, pain	Bone pain.
osteoma [ŏs-tē-Ō-mă] osteo-, bone + -oma, tumor	Benign bone tumor, usually on the skull or mandible.
osteomyelitis [ŎS-tē-ō-mī-ĕ-LĪ-tĭs] osteo-, bone + myel(o)-, bone marrow + -itis, inflammation	Inflammation of the bone marrow and surrounding bone.
osteoporosis [ŎS-tē-ō-pō-RŌ-sĭs] osteo-, bone + por(e) + -osis, condition	Degenerative thinning of bone.
osteosarcoma [ŎS-tē-ō-săr-KŌ-mă] osteo-, bone + sarcoma	Malignant tumor of bone.
pathological fracture	Fracture occurring at the site of already damaged bone.
phantom limb; phantom pain	Pain felt in a paralyzed or amputated limb.
physical therapy	Movement therapy to restore use of damaged areas of the body.
podagra [pō-DĂG-ră]	Pain in the big toe, often associated with gout.
rhabdomyoma [RĂB-dō-mī-Ō-mă] rhadbdo-, rod-shaped + my(o)-, muscle + -oma, tumor	Benign tumor in striated muscle.

Term	Definition
rhabdomyosarcoma [RĂB-dō-mī̆-ō-săr-KŌ-mă] rhabdo-, rod-shaped + myo-, muscle + sarcoma	Malignant tumor in striated muscle.
rheumatoid [RŪ-mă-tŏyd] **arthritis**	Autoimmune disorder affecting connective tissue.
rickets [RĬK-ĕts]	Disease of the skeletal system, usually caused by vitamin D deficiency.
rigidity	Stiffness.
rigor [RĬG-ōr]	Stiffening.
sciatica [sī-ĂT-ĭ̆-kă]	Pain in the lower back, usually radiating down the leg, from a herniated disk or other injury or condition.
scoliosis [skō-lē-Ō-sĭs]	Abnormal lateral curvature of the spinal column.
sequestrum [sē-KWĔS-trŭm]	Piece of dead tissue or bone separated from the surrounding area.
simple fracture	Fracture with no open skin wound.
spasm [spăzm]	Sudden, involuntary muscle contraction.
spastic [SPĂS-tĭk]	Tending to have spasms.
spina bifida [SPĪ-nă BĬF-ĭ̆-dă]	Congenital defect with deformity of the spinal column.
spinal curvature	Abnormal curvature of the spine.
spondylolisthesis [SPŎN-dĭ̆-lō-lĭs-THĒ-sĭs] spondyl(o)-, vertebrae + Greek *olisthesis,* slipping	Degenerative condition in which one vertebra misaligns with the one below it; slipped disk.
spondylolysis [spŏn-dĭ̆-LŌL-ĭ̆-sĭs] spondylo-, vertebrae + -lysis, destruction of	Degenerative condition of the moving part of a vertebra.
sprain [sprān]	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.
spur [spŭr]	Bony projection growing out of a bone; calcar.
strain [strān]	Injury to a muscle as a result of improper use or overuse.
subluxation [sŭb-lŭk-SĀ-shŭn]	Partial dislocation, as between joint surfaces.
talipes calcaneus [TĂL-ĭ̆-pēz kăl-KĀ-nē-ŭs]	Deformity of the heel resulting from weakened calf muscles.
talipes valgus [VĂL-gŭs]	Foot deformity characterized by eversion of the foot.
talipes varus [VĀ-rŭs]	Foot deformity characterized by inversion of the foot.
tendinitis, tendonitis [tĕn-dĭ̆n-ĪT-ĭ̆s]	Inflammation of a tendon.
tetany [TĔT-ă-nē]	Painfully long muscle contraction.
tremor [TRĔM-ōr]	Abnormal, repetitive muscle contractions.

CASE STUDY

Making a Referral

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

Critical Thinking

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)

FIGURE 5-24 A cast is an external fixation device.

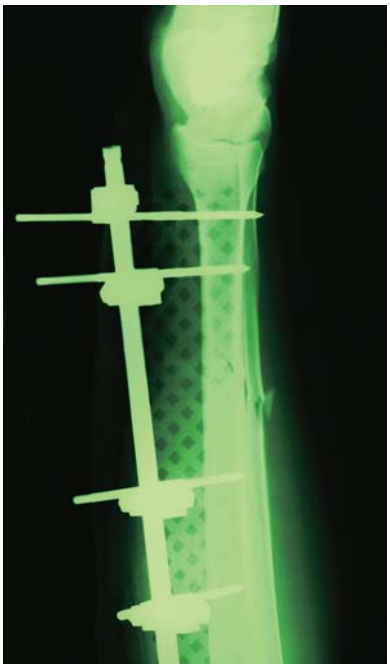


FIGURE 5-25 Surgery is required to place internal fixation devices.

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

Surgical Terms

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

Term	Definition
amputation [ĂM-pyū-TĀ-shŭn]	Cutting off of a limb or part of a limb.
arthrocentesis [ĂR-thrō-sĕn-TĒ-sĭs] arthro-, joint + Greek *kentesis*, puncture	Removal of fluid from a joint with use of a puncture needle.
arthrodesis [ăr-thrō-DĒ-sĭs] arthro-, + Greek *desis*, a binding	Surgical fusion of a joint to stiffen it.
arthroplasty [ĂR-thrō-plăs-tē] arthro- + -plasty, repair	Surgical replacement or repair of a joint.
bone grafting	Transplantation of bone from one site to another.
bunionectomy [bŭn-yŭn-ĔK-tō-mē] bunion + -ectomy, removal	Removal of a bunion.
bursectomy [bŭr-SĔK-tō-mĕ] burs(a) + -ectomy, removal	Removal of a bursa.
casting	Forming of a cast in a mold; placing of fiberglass or plaster over a body part to prevent its movement.
external fixation device	Device applied externally to hold a limb in place.
internal fixation device	Device, such as a pin, inserted in bone to hold it in place.
laminectomy [LĂM-ĭ-NĔK-tō-mē] lamin(a) + -ectomy, removal	Removal of part of an intervertebral disk.
myoplasty [MĪ-ō-plăs-tē] myo-, muscle + -plasty, repair	Surgical repair of muscle tissue.
orthosis, orthotic [ōr-THŌ-sĭs, ōr-THŎT-ĭk]	External appliance used to immobilize or assist the movement of the spine or limbs.
osteoclasis [ŎS-tē-ŎK-lā-sĭs] osteo-, bone + -clasis, breaking	Breaking of a bone in order to repair or reposition it.
osteoplasty [ŎS-tē-ō-plăs-tē] osteo-, bone + -plasty, repair	Surgical replacement or repair of bone.
osteotomy [ŏs-tē-ŎT-ō-mē] osteo-, bone + -tomy, cutting	Cutting of bone.
prosthetic [prŏs-THĔT-ĭk] **device**	Artificial device used as a substitute for a missing or diseased body part.
reduction	Return of a part to its normal position.
splinting	Applying a splint to immobilize a body part.
spondylosyndesis [SPŎN-dĭ-lō-sĭn-DĒ-sĭs] spondylo-, vertebrae + Greek *syndesis*, a binding together	Fusion of two or more spinal vertebrae.
synovectomy [sĭn-ō-VĔK-tō-mē] synovi(o)-, synovial fluid + -ectomy, removal	Removal of part or all of a joint's synovial membrane.
tenotomy [tĕ-NŎT-ō-mē] teno-, tendon + -tomy, cutting	Surgical cutting of a tendon.
traction [TRĂK-shŭn]	Dragging or pulling or straightening of something, as a limb, by attachment of elastic or other devices.

CASE STUDY

Musculoskeletal Injury

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

Critical Thinking

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

160. _____ prosthesis

161. _____ orthosis, orthotic

162. _____ traction

163. _____ casting

164. _____ splinting

165. _____ myoplasty

166. _____ osteoplasty

167. _____ osteotomy

168. _____ arthroplasty

a. replacement device

b. molding

c. muscle repair

d. bone cutting

e. limb removal

f. bone repair

g. external supporting or immobilizing device

h. wrapping to immobilize

i. pulling to straighten

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 5-1 Some Medications for the Musculoskeletal System

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

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.

Term	Definition
analgesic [ăn-ăl-JĒ-zĭk]	Agent that relieves pain.
anti-inflammatory (corticosteroid)	Agent that reduces inflammation.
muscle relaxant	Agent that relieves muscle stiffness.
narcotic	Agent that relieves pain by affecting the body in ways that are similar to opium.
nonsteroidal [nŏn-STĔR-ŏy-dăl] **anti-inflammatory drug (NSAID)**	Agent that reduces inflammation without the use of steroids.

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

Definitions

Define the following terms and combining forms. Review the chapter before starting. Make sure you know how to pronounce each term as you define it. The blue words in curly brackets are references to the Spanish glossary the student Web site (www.mhhe.com/medterm3e).

Word

210. acetabul(o)
211. acetabulum [ăs-ĕ-TĂB-yū-lŭm] {acetábulo}
212. acromi(o)
213. acromion [ă-KRŌ-mē-ŏn] {acromion}
214. amphiarthrosis [ĂM-fĭ-ăr-THRŌ-sĭs] {anfiartrosis}
215. amputation [ĂM-pyū-TĀ-shŭn] {amputación}
216. analgesic [ăn-ăl-JĒ-zĭk]
217. ankle [ĂNG-kl] {tobillo}
218. ankyl(o)
219. ankylosis [ĂNG-kĭ-LŌ-sĭs] {anquilosis}
220. anti-inflammatory
221. arthr(o)
222. arthralgia [ăr-THRĂL-jē-ă] {artralgia}
223. arthritis [ăr-THRĪ-tĭs] {artritis}
224. arthrocentesis [ĂR-thrō-sĕn-TĒ-sĭs] {artrocentesis}
225. arthrodesis [ăr-thrō-DĒ-sĭs]
226. arthrography [ăr-THRŎG-ră-fē]
227. arthroplasty [ĂR-thrō-plăs-tē]
228. arthroscopy [ăr-THRŌS-kŏ-pē]
229. articular [ăr-TĬK-yū-lăr] cartilage
230. articulation [ăr-tĭk-yū-LĀ-shŭn] {articulación}
231. atlas [ĂT-lăs] {atlas}
232. atrophy [ĂT-rō-fē] {atrofia}
234. axis [ĂK-sĭs] {axis}
235. bone {hueso}
236. bone grafting
237. bone head
238. bone phagocyte [FĂG-ō-sīt]
239. bone scan
240. bony necrosis [nĕ-KRŌ-sĭs]
241. brachi(o)
242. bunion [BŬN-yŭn] {bunio}
243. bunionectomy [bŭn-yŭn-ĔK-tō-mē] {bunionectomía}
244. burs(o)
245. bursa (*pl.*, bursae) [BŬR-să (BŬR-sē)] {bursa}
246. bursectomy [bŭr-SĔK-tō-mē] {bursectomía}
247. bursitis [bŭr-SĪ-tĭs] {bursitis}
248. calcane(o)
249. calcaneus [kăl-KĀ-nē-ŭs] {calcáneo}
250. calcar [KĂL-kăr] {calcar}
251. calci(o)
252. calcium [KĂL-sē-ŭm] {calcio}
253. cancellous [KĂN-sĕ-lŭs] {canceloso} bone
254. cardiac [KĂR-dē-ăk] muscle
255. carp(o)
256. carpal [KĂR-păl] tunnel syndrome
257. carpus [KĂR-pŭs], carpal bone
258. cartilage [KĂR-tĭ-lăj] {cartílago}
259. cartilaginous [kăr-tĭ-LĂJ-ĭ-nŭs] disk
260. casting {colado}
261. cephal(o)
262. cervic(o)
263. cervical [SĔR-vĭ-kăl] vertebrae
264. chiropractor [kī-rō-PRĂK-tĕr] {quiropráctico}
265. chondr(o)
266. chondromalacia [KŎN-drō-mă-LĀ-shē-ă] {condromalacia}
267. clavicle [KLĂV-ĭ-kl] {clavícula}
268. closed fracture
269. coccyx [KŎK-sĭks] {cóccix}
270. Colles' [kōlz] fracture
271. comminuted [KŎM-ĭ-nū-tĕd] fracture
272. compact bone
273. complex fracture
274. complicated fracture
275. compound fracture
276. compression fracture
277. condyl(o)
278. condyle [KŎN-dīl]
279. contracture [kŏn-TRĂK-chŭr]
280. corticosteroid
281. cost(o)
282. crani(o)
283. crepitation [krĕ-pĭ-TĀ-shŭn], crepitus [KRĔP-ĭ-tŭs]
284. crest {cresta}
285. dactyl(o)
286. degenerative arthritis
287. densitometer [dĕn-sĭ-TŎM-ĕ-tĕr]
288. diaphysis [dī-ĂF-ĭ-sĭs] {diáfisis}
289. diarthroses [dī-ăr-THRŌ-sēz]
290. disk [dĭsk] {disco}
291. diskography [dĭs-KŎG-ră-fē] {discografía}
292. dislocation {dislocación}
293. dorsal vertebrae
294. dystonia [dĭs-TŌ-nē-ă] {distonia}
295. elbow [ĔL-bō] {codo}

WORD

296. electromyogram [ē-lĕk-trō-MĪ-ō-grăm] {electromiógrafo}
297. endosteum [ĕn-DŎS-tē-ŭm] {endostio}
298. epiphyseal [ĕp-ĭ-FĬZ-ē-ăl] plate
299. epiphysitis [ĕ-pĭf-ĭ-SĪ-tĭs] {epifisitis}
300. ethmoid [ĔTH-mŏyd] bone
301. ethmoid sinuses
302. exostosis [ĕks-ŏs-TŌ-sĭs] {exostosis}
303. external fixation device
304. fasci(o)
305. fascia (*pl.*, fasciae [FĂSH-ē-ă (FĂSH-ē-ē)] {fascia}
306. femor(o)
307. femur [FĒ-mūr] {fémur}
308. fibr(o)
309. fibula [FĬB-yū-lă] {peroné}
310. fissure [FĬSH-ŭr] {fisura}
311. flaccid [FLĂK-sĭd] {fláccido}
312. flat bones
313. fontanelle [FŎN-tă-nĕl] {fontanela}
314. foramen [fō-RĀ-mĕn] {agujero}
315. foramen magnum [MĂG-nŭm]
316. fossa (*pl.*, fossae) [FŎS-ă (FŎS-ē)] {fosa}
317. fracture [FRĂK-chŭr] {fractura}
318. frontal [FRŬN-tăl] bone
319. frontal sinuses
320. goniometer [gō-nē-ŎM-ĕ-tĕr] {goniómetro}
321. gouty arthritis, gout [GŎWT-ē, gŏwt]
322. greenstick fracture
323. hairline fracture
324. heel [hēl] {talon}
325. herniated [HĔR-nē-ā-tĕd] disk
326. humer(o)
327. humerus [HYŪ-mĕr-ŭs] {húmero}
328. hypertrophy [hī-PĔR-trō-fē]
329. hypotonia [HĪ-pō-TŌ-nē-ă]
330. ili(o)
331. ilium [ĬL-ē-ŭm] {ilium}
332. impacted fracture
333. incomplete fracture
334. insertion {inserción}
335. internal fixation device
336. intervertebral [ĭn-tĕr-VĔR-tĕ-brăl] disk
337. involuntary muscle
338. irregular bones
339. ischi(o)
340. ischium [ĬS-kē-ŭm] {isquión}
341. joint [jŏynt] {empalme}
342. kyph(o)
343. kyphosis [kī-FŌ-sĭs] {cifosis}
344. lacrimal [LĂK-rĭ-măl] bone
345. lamin(o)
346. lamina (*pl.*, laminae) [LĂM-ĭ-nă(LĂM-ĭ-nē)] {lamina}
347. laminectomy [LĂM-ĭ-NĔK-tō-mē]
348. leiomy(o)
349. leiomyoma [LĪ-ō-mī-Ō-mă]
350. leiomyosarcoma [LĪ-ō-MĪ-ō-săr-KŌmă]
351. ligament [LĬG-ă-mĕnt] {ligamento}
352. long bone
353. lordosis [lōr-DŌ-sĭs] {lordosis}
354. lumb(o)
355. lumbar [LŬM-băr] vertebrae
356. malleolus (*pl.*, malleoli) [mă-LĒ-ō-lŭs (mă-LĒ-ō-lī)]
357. mandible [MĂN-dĭ-bl] {mandíbula}
358. mandibular [măn-DĬB-yū-lăr]
359. marrow [MĂR-ō] {médula}
360. mastoid [MĂS-tŏyd] process
361. maxill(o)
362. maxillary [MĂK-sĭ-lār-ē] bone
363. maxillary sinus
364. medullary [MĔD-ū-lār-ē] cavity
265. metacarp(o)
366. metacarpal [MĔT-ă-KĂR-păl] {metacarpiano}
367. metaphysis [mĕ-TĂF-ĭ-sĭs] {metáfisis}
368. metatarsal [MĔT-ă-tăr-săl] bones
369. muscle [MŬS-ĕl] {músculo}
370. muscle relaxant
380. muscular dystrophy [MŬS-kyū-lăr DĬS-trō-fē] {distrofia muscular}
381. musculoskeletal [MŬS-kyū-lō-SKĔL-ĕ-tăl] {musculoesquelético} system
382. my(o)
383. myalgia [mī-ĂL-jē-ă] {mialgia}
384. myel(o)
385. myelography [MĪ-ĕ-LŎG-ră-fē] {mielografia}
386. myeloma [mī-ĕ-LŌ-mă] {mieloma}
387. myodynia [MĪ-ō-DĬN-ē-ă] {miodinia}
388. myoma [mī-Ō-mă] {mioma}
389. myoplasty [MĪ-ō-plăs-tē]
390. myositis [mī-ō-SĪ-tĭs] {miositis}
391. narcotic
392. nasal bones
393. nasal cavity
394. neural [NŪR-ăl] canal
395. nonsteroidal [nŏn-STĔR-ŏy-dăl] anti-inflammatory drug (NSAID)
396. nucleus pulposus [NŪ-klē-ŭs pŭl-PŌ-sŭs]
397. occipital [ŏk-SĬP-ĭ-tăl] bone

Word

398. olecranon [ō-LĒK-ră-nŏn] {olecranon}
399. open fracture
400. origin {origen}
401. orthopedist [ōr-thō-PĒ-dĭst], orthopedic [ōr-thō-PĒ-dĭk] {ortopedista} surgeon
402. orthosis [ōr-THŌ-sĭs], orthotic [ōr-THŎT-ĭk] {ortosis, ortótica}
403. osseus [ŎS-ē-ŭs] tissue
404. ossification [ŎS-ĭ-fĭ-KĀ-shŭn] {ossificación}
405. oste(o)
406. ostealgia [ŏs-tĕ-ĂL-jē-ă] {ostealgia}
407. osteoarthritis [ŎS-tē-ō-ăr-THRĪ-tĭs] {osteoartritis}
408. osteoblast [ŎS-tē-ō-blăst] {osteoblasto}
409. osteoclasis [ŎS-tē-ŎK-lā-sĭs] {osteoclasia}
410. osteoclast [ŎS-tē-ō-klăst] {osteoclasto}
411. osteocyte [ŎS-tē-ō-sīt] {osteocito}
412. osteodynia [ŏs-tē-ō-DĬN-ē-ă] {osteodinia}
413. osteoma [ŏs-tē-Ō-mă] {osteoma}
414. osteomyelitis [ŎS-tē-ō-mī-ĕ-LĪ-tĭs] {osteomielitis}
415. osteopath [ŎS-tē-ō-păth] {osteópata}
416. osteoplasty [ŎS-tē-ō-plăs-tē] {osteoplastia}
417. osteoporosis [ŎS-tē-ō-pō-RŌ-sĭs] {osteoporosis}
418. osteosarcoma [ŎS-tē-ō-săr-KŌ-mă] {osteosarcoma}
420. osteotomy [ŏs-tē-ŎT-ō-mē] {osteotomía}
421. palatine [PĂL-ă-tīn] bone
422. parietal [pă-RĪ-ĕ-tăl] bone
423. patell(o)
424. patella [pă-TĔL-ă] {rótula}
425. pathological fracture
426. ped(i), ped(o)
427. pelv(i)
428. pelvic [PĔL-vĭk] cavity
429. pelvic girdle
430. pelvis [PĔL-vĭs] {pelvis}
431. periosteum [pĕr-ē-ŎS-tē-ŭm] {periostio}
432. phalang(o)
433. phalanges (*sing.*, phalanx) [fă-LĂN-jēz (FĀ-lăngks)] {falangeo}
434. phantom limb; phantom pain
435. phosphorus [FŎS-fōr-ŭs] {fósforo}
436. physical therapy
437. pod(o)
438. podagra [pō-DĂG-ră] {podagra}
439. podiatrist [pō-DĪ-ă-trĭst] {podiatra}
440. process [PRŌS-sĕs, PRŎS-ĕs]
441. prosthetic [prŏs-THĔT-ĭk] device
442. pub(o)
443. pubes [PYŪ-bĭs] {pubis}
444. pubic symphysis [PYŪ-bĭk SĬM-fĭ-sĭs]
445. rachi(o)
446. radi(o)
447. radius [RĀ-dē-ŭs] {radio}
448. reduction {reducción}
449. rhabd(o)
450. rhabdomy(o)
451. rhabdomyoma [RĂB-dō-mī-Ō-mă] {rabdomioma}
452. rhabdomyosarcoma [RĂB-dō-mī-ō-săr-KŌ-mă] {rabdomiosarcoma}
453. rheumatoid arthritis
454. rheumatoid factor test
455. rheumatologist [rū-mă-TŎL-ō-jĭst] {reumatólogo}
456. rib {costilla}
457. rickets [RĬK-ĕts] {raquitismo}
458. rigidity {rigidez}
459. rigor [RĬG-ōr] {rigor}
460. sacrum [SĀ-krŭm] {sacro}
461. scapul(o)
462. scapula [SKĂP-yū-lă] {escápula}
463. sciatica [sī-ĂT-ĭ-kă] {ciática}
464. scoli(o)
465. scoliosis [skō-lē-Ō-sĭs] {escolisis}
466. sella turcica [SĔL-ă-TŬR-sĭ-kă] {silla turcica}
467. sequestrum [sĕ-KWĔS-trŭm] {secuestro}
468. serum calcium
469. serum creatine phosphokinase [SĒR-ŭm KRĒ-ă-tēn fŏs-fō-KĪ-nās]
470. serum phosphorus
471. sesamoid [SĔS-ă-mŏyd] bone
472. shin [shĭn] {espinilla}
473. short bones
474. simple fracture
475. sinus [SĪ-nŭs] {seno}
476. skeleton [SKĔL-ĕ-tŏn] {esqueleto}
477. smooth muscle
478. spasm [spăzm] {espasmo}
479. spastic [SPĂS-tĭk] {espástico}
480. sphenoid [SFĒ-nŏyd] bone
481. sphenoid sinus
482. spina bifida [SPĪ-nă BĬF-ĭ-dă] {espina bífido}
483. spinal column
484. spinal curvature
485. spinous [SPĪ-nŭs] process
486. splinting {ferulización}
487. spondyl(o)
488. spondylolisthesis [SPŎN-dĭ-lō-lĭs-THĒ-sĭs] {espondilolistesis}
489. spondylolysis [spŏn-dĭ-LŎL-ĭ-sĭs] {espodilolisis}

Word

490. spondylosyndesis [SPON-di-lō-sin-DĒ-sĭs] {espondilosindesis}
491. spongy bone
492. sprain [sprān]
493. spur [spŭr]
494. stern(o)
495. sternum [STĔR-nŭm] {esternón}
496. strain [strān] {distender}
497. striated [strī-ĀT-ĕd] muscle
498. styloid [STĪ-lŏyd] process
499. subluxation [sŭb-lŭk-SĀ-shŭn] {subluxación}
500. sulcus (pl., sulci) [SŬL-kŭs, [SŬL-sī] {surco}
501. suture [SŪ-chūr] {sutura}
502. symphysis [SĬM-fĭ-sĭs] {sinfisis}
503. synarthrosis [SĬN-ăr-THRŌ-sĭs] {sinartrosis}
504. synov(o)
505. synovectomy [sĭn-ō-VĔK-tō-mē] {sinovectomi}
506. synovial [sĭ-NŌ-vē-ăl] fluid
507. synovial joint
508. synovial membrane
509. talipes calcaneus [TĂL-ĭ-pēz kăl-KĀ-nē-ŭs]
510. talipes valgus [TĂL-ĭ-pēz VĂL-gŭs]
511. talipes varus [TĂL-ĭ-pēz VĀ-rŭs]
512. tars(o)
513. tarsus, tarsal [TĂR-sŭs, TĂR-săl] bones
514. temporal [TĔM-pō-RĂL] bone
515. temporomandibular [TĔM-pō-rō-măn-DĬB-yū-lăr] joint
516. ten(o), tend(o), tendin(o)
517. tendinitis, tendonitis {tendonitis}
518. tendon [TĔN-dŏn] {tendon}
519. tenotomy [tĕ-NŎT-ō-mē] {tenotomía}
520. tetany [TĔT-ă-nē] {tetania}
521. thorac(o)
522. thoracic [thō-RĂS-ĭk] vertebrae
523. thorax [THŌ-răks] {tórax}
524. tibi(o)
525. tibia [TĬB-ē-ă] {tibia}
526. Tinel's [tĭ-NĔLZ] sign
527. traction [TRĂK-shŭn] {tracción}
528. transverse process
529. tremor [TRĔM-ōr] {temblor}
530. trochanter [trō-KĂN-tĕr] {trocánter}
531. true ribs
532. tubercle [TŪ-bĕr-kl] {tubérculo}
533. tuberosity [TŪ-bĕr-ŏs-ĭ-tē] {tuberosidad}
534. uln(o)
535. ulna [ŬL-nă] {ulna}
536. uric [YŪR-ĭk] acid test
537. vertebr(o)
538. vertebra (*pl.*, vertebrae) [VĔR-tĕ-bră (VĔR-tĕ-brē)] {vertebra}
539. vertebral [vĕr-TĔ-brăl, VĔR-tĕ-brăl] body
540. vertebral column
541. visceral [VĬS-ĕr-ăl] muscle
542. vitamin D
543. voluntary muscle
544. vomer [VŌ-mĕr] {vómer}
545. zygomatic [ZĪ-gō-MĂT-ĭk] bone

Abbreviations

Write out the full meaning of each abbreviation.

Abbreviation

546. **A-K**
547. **ASIS**
548. **B-K**
549. **C_1, C_2, etc.**
550. **Ca**
551. **CTS**
552. **D_1, D_2, etc.**
553. **DJD**
554. **DTR**
555. **EMG**
556. **Fx**
557. **IM**
558. **L**
559. **L_1, L_2, etc.**
560. **MCP**
561. **NSAID**
562. **OA**
563. **P**
564. **PIP**
565. **PSISRRA**
566. **ROM**
567. **T_1, T_2, etc.**
568. **TMJ**

Name _____ Date _____

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