

Musculoskeletal System

CHAPTER

10

Chapter Outline

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Learning Activities

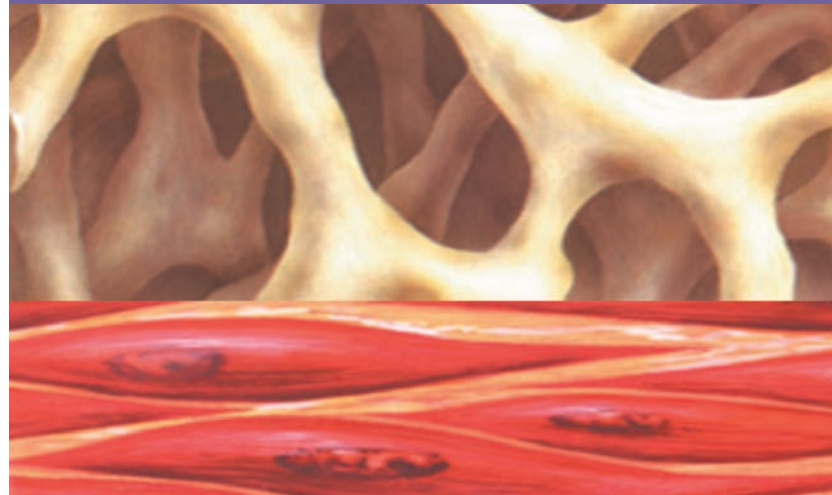
Medical Record Activities

- Operative report: Right knee arthroscopy and medial meniscectomy
- Radiographic consultation: Tibial diaphysis nuclear scan

Objectives

Upon completion of this chapter, you will be able to:

- Locate and describe the structures of the musculoskeletal system.
- Recognize, pronounce, spell, and build words related to the musculoskeletal system.
- Describe pathological conditions, diagnostic and therapeutic procedures, and other terms related to the musculoskeletal system.
- Explain pharmacology related to the treatment of musculoskeletal disorders.
- Demonstrate your knowledge of this chapter by completing the learning and medical record activities.



Anatomy and Physiology

The musculoskeletal system includes muscles, bones, joints, and related structures, such as the tendons and connective tissue that function in support and movement of body parts and organs.

Muscles

Muscle tissue is composed of contractile cells or fibers that provide movement of an organ or body part. Muscles contribute to posture, produce body heat, and act as a protective covering for internal organs. Muscles make up the bulk of the body. They have the ability to be excited by a stimulus, contract, relax, and return to their original size and shape. Whether muscles are attached to bones or to internal organs and blood vessels, their primary responsibility is movement. (See Table 10–1.) Apparent motion provided by muscles include walking and talking. Less apparent motions include the passage and elimination of food through the digestive system, propulsion of blood through the arteries, and contraction of the bladder to eliminate urine. (See Figure 10–1.)

There are three types of muscle tissue in the body:

- **Skeletal muscles**, also called *voluntary* or *striated muscles*, are muscles whose action is under voluntary control. Some examples of voluntary muscles are muscles that move the eyeballs, tongue, and bones.
- **Cardiac muscle** is found only in the heart. It is unique for its branched interconnections, and makes up most of the wall of the heart. Cardiac muscle shares similarities with both skeletal and smooth muscles. Like skeletal muscle, it is striated, but it produces rhythmic involuntary contractions like smooth muscle.
- **Smooth muscles**, also called *involuntary* or *visceral muscles*, are muscles whose actions are involuntary. They are found principally in the visceral organs, walls of arteries and respiratory passages, and urinary and reproductive ducts. The contraction of smooth muscle is controlled by the autonomic (involuntary) nervous system. (See Figure 10–2.)

Anatomy and Physiology Key Terms

This section introduces important terms along with their definitions and pronunciations. Word analyses are also provided.

Term	Definition
appendage ă-PĔN-dĭj	Any body part attached to a main structure <i>Examples of appendages include the arms and legs.</i>
articulation ăr-tĭk-ŭ-LĀ-shŭn	Place of union between two or more bones; also called <i>joint</i>
cancellous	Spongy or porous structure, as found at the ends of long bones
cruciate ligaments KROO-shĕ-ăt <i>cruci</i> : cross <i>-ate</i> : having the form of; possessing	Ligaments that cross each other forming an X within the notch between the femoral condyles <i>Along with other structures, the cruciate ligaments help secure and stabilize the knee.</i>
hematopoiesis hĕm-ă-tō-poy-Ē-sĭs <i>hemat/o</i> : blood <i>-poiesis</i> : formation, production	Production and development of blood cells, normally in the bone marrow
Pronunciation Help	Long Sound ă—rate ĕ—rebirth ĭ—isle ō—over ŭ—unite Short Sound ă—alone ě—ever ĭ—it ō—not ŭ—cut

Table 10-1 Body Movements Produced by Muscle Action

This chart lists body movements and the resulting muscle action. With the exception of rotation, these movements are in pairs of opposing functions.

Motion	Action
Adduction	Moves closer to the midline
Abduction	Moves away from the midline
Flexion	Decreases the angle of a joint
Extension	Increases the angle of a joint
Rotation	Moves a bone around its own axis
Pronation	Turns the palm down
Supination	Turns the palm up
Inversion	Moves the sole of the foot inward
Eversion	Moves the sole of the foot outward
Dorsiflexion	Elevates the foot
Plantar flexion	Lowers the foot (points the toes)



Figure 10-1. Selected muscles of the body.

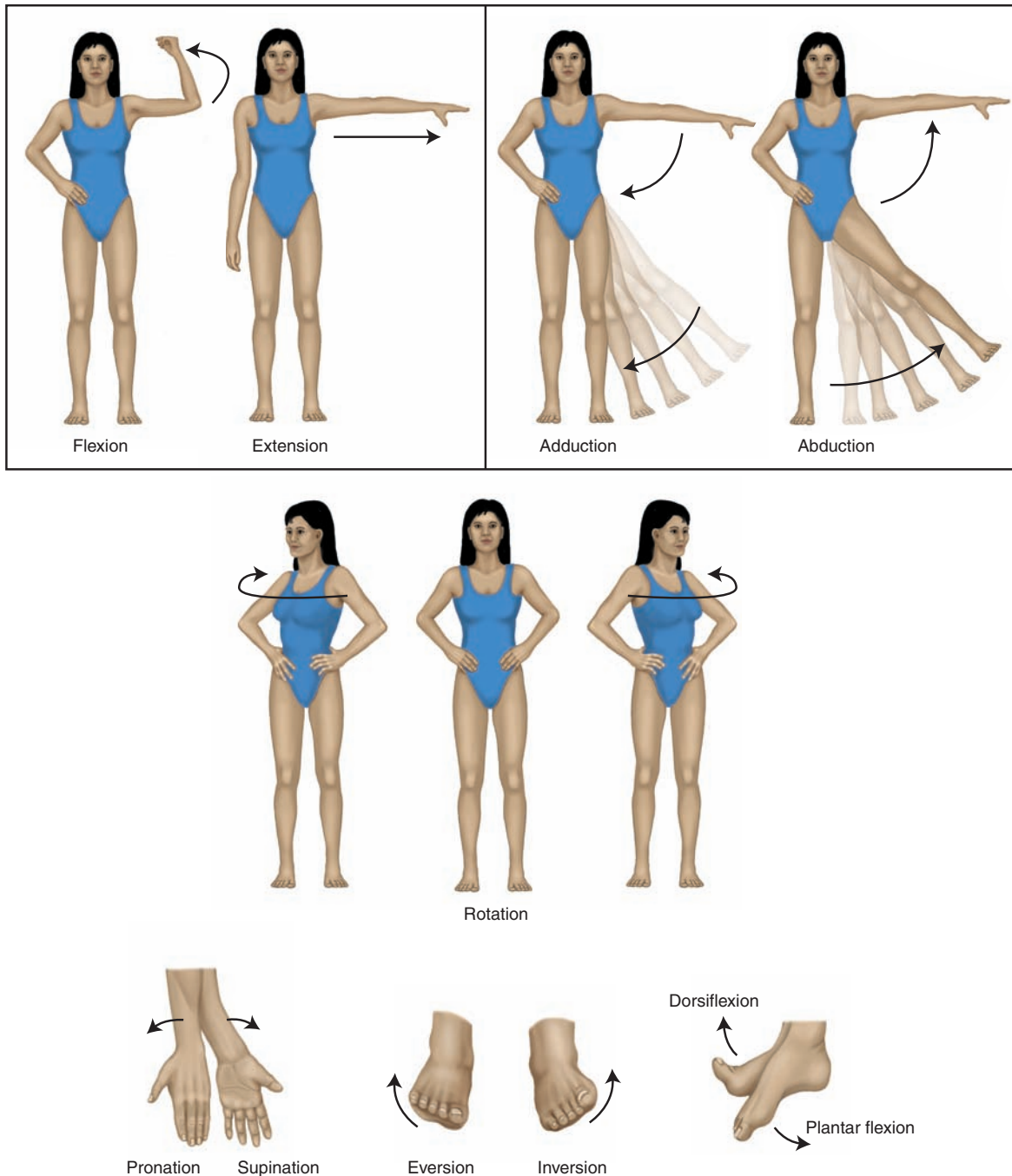


Figure 10-2. Body movements produced by muscle action.

Attachments

Muscles attach to bones by fleshy or fibrous attachments. In **fleshy attachments**, muscle fibers arise directly from bone. Although these fibers distribute force over wide areas, they are weaker than a fibrous attachment. In **fibrous attachments**, the connective tissue converges at the end of the muscle to become continuous and indistinguishable from the periosteum. When the fibrous attachment spans a

large area of a particular bone, the attachment is called an **aponeurosis**. Such attachments are found in the lumbar region of the back. In some instances, this connective tissue penetrates the bone itself. When connective tissue fibers form a cord or strap, it is referred to as a **tendon**. This arrangement localizes a great deal of force in a small area of bone. **Ligaments** are flexible bands of fibrous tissue that are highly adapted for resisting strains and are one

of the principal mechanical factors that hold bones close together in a synovial joint. An example are the **cruciate ligaments** of the knee that help to

prevent anterior-posterior displacement of the articular surfaces and to secure articulating bones when we stand.



It is time to review muscle structures by completing Learning Activity 10–1.

Bones

Bones provide the framework of the body, protect internal organs, store calcium and other minerals, and produce blood cells within bone marrow (**hematopoiesis**). Together with soft tissue, most vital organs are enclosed and protected by bones. For example, bones of the skull protect the brain; the rib cage protects the heart and lungs. In addition to support and protection, the skeletal system carries out a number of other important functions. Movement is possible because bones provide points of attachment for muscles, tendons, and ligaments. As muscles contract, tendons and ligaments pull on bones and cause skeletal movement. Bone marrow, found within the larger bones, is responsible for hematopoiesis, continuously producing millions of blood cells to replace those that have been destroyed. Bones serve as a storehouse for minerals, particularly phosphorus and calcium. When the body experiences a need for a certain mineral, such as calcium during pregnancy, and a sufficient dietary supply is not available, calcium is withdrawn from the bones.

Bone types

There are four principal types of bone:

- **Short bones** are somewhat cube shaped. They consist of a core of spongy bone, also known as **cancellous bone**, enclosed in a thin surface layer of compact bone. Examples of short bones include the bones of the ankles, wrists, and toes.
- **Irregular bones** include the bones that cannot be classified as short or long because of their complex shapes. Examples of irregular bones include vertebrae and the bones of the middle ear.
- **Flat bones** are exactly what their name suggests. They provide broad surfaces for muscular attachment or protection for internal organs. Examples of flat bones include bones of the skull, shoulder blades, and sternum.
- **Long bones** are found in the **appendages** (extremities) of the body, such as the legs,

arms, and fingers. (See Figure 10–3.) The parts of a long bone include:

- The (1) **diaphysis** is the shaft or long, main portion of a bone. It consists of (2) **compact bone** that forms a cylinder and surrounds a central canal called the (3) **medullary cavity**. The medullary cavity, also called **marrow cavity**, contains fatty yellow marrow in adults and consists primarily of fat cells and a few scattered blood cells.
- The (4) **distal epiphysis** and (5) **proximal epiphysis** (plural, *epiphyses*) are the two ends of the bones. Both ends have a somewhat bulbous shape to provide space for muscle and ligament attachments near the joints. The epiphyses are covered with (6) **articular cartilage**, a type of elastic connective tissue that provides a smooth surface for movement of joints. It also reduces friction and absorbs shock at the freely movable joints. In addition, the epiphyses are made up largely of a porous chamber of (7) **spongy bone** surrounded by a layer of compact bone. Within spongy bone is red bone marrow, which is richly supplied with blood and consists of immature and mature blood cells in various stages of development. In an adult, production of red blood cells (**erythropoiesis**) occurs in red bone marrow. Red bone marrow is also responsible for the formation of white blood cells (**leukopoiesis**) and platelets.
- The (8) **periosteum**, a dense, white, fibrous membrane, covers the remaining surface of the bone. It contains numerous blood and lymph vessels and nerves. In growing bones, the inner layer contains the bone-forming cells known as **osteoblasts**. Because blood vessels and osteoblasts are located here, the periosteum provides a means for bone repair and general bone nutrition. Bones that lose periosteum through injury or disease usually scale or die. The periosteum also serves as a point of attachment for muscles, ligaments, and tendons.



It is time to review bone structures by completing Learning Activity 10–2.

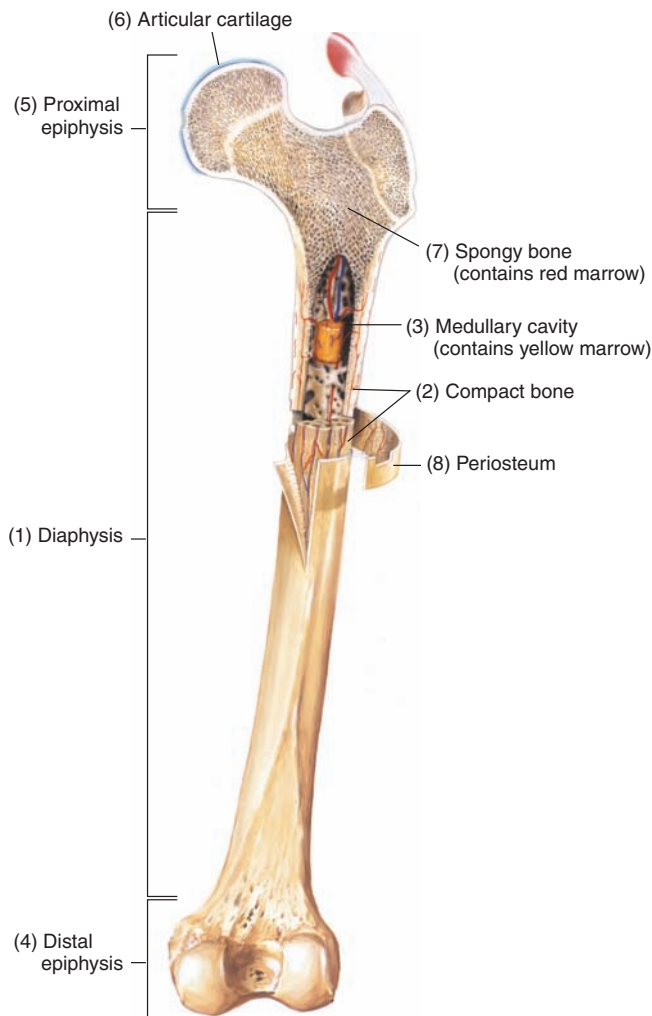


Figure 10-3. Longitudinal structure of a long bone.

Surface Features of Bones

Surfaces of bones are rarely smooth but rather consist of projections, depressions, and openings that provide sites for muscle and ligament attachment. They also provide pathways and openings for blood vessels, nerves, and ducts. Various types of projections are evident in bones, some of which serve as points of **articulation**. Surfaces of bones may be rounded, sharp, or narrow or have a large ridge. Depressions and openings are cavities and holes in a bone. They provide pathways and openings for blood vessels, nerves, and ducts. (See Table 10–2.)

Divisions of the Skeletal System

The skeletal system of a human adult consists of 206 individual bones. However, only the major bones are discussed. For anatomical purposes, the human skeleton is divided into the axial skeleton and appendicular skeleton. (See Figure 10–4.)

Axial Skeleton

The axial skeleton is divided into three major regions: skull, rib cage, and vertebral column. It contributes to the formation of body cavities and provides protection for internal organs, such as the brain, spinal cord, and organs enclosed in the thorax. The axial skeleton is distinguished with bone color in Figure 10–4.

Skull

The bony structure of the skull consists of cranial bones and facial bones. (See Figure 10–5.) With the exception of one facial bone, all other bones of the skull are joined together by sutures. Sutures are

Table 10-2 Surface Features of Bones

This chart lists the most common types of projections, depressions, and openings along with the bones involved, descriptions, and examples for each. Becoming familiar with these terms will help you identify parts of individual bones described in medical reports related to orthopedics.

Surface Type	Bone Marking	Description	Example
Projections			
• Nonarticulating surfaces	• Trochanter	• Very large, irregularly shaped process found only on the femur	• Greater trochanter of the femur
• Sites of muscle and ligament attachment	• Tubercle	• Small, rounded process	• Tubercle of the femur
	• Tuberosity	• Large, rounded process	• Tuberosity of the humerus

Table 10-2 Surface Features of Bones—cont'd

Surface Type	Bone Marking	Description	Example
Articulating surfaces			
• Projections that form joints	• Condyle	• Rounded, articulating knob	• Condyle of the humerus
	• Head	• Prominent, rounded, articulating end of a bone	• Head of the femur
Depressions and openings			
• Sites for blood vessel, nerve, and duct passage	• Foramen	• Rounded opening through and nerves a bone to accommodate blood vessels	• Foramen of the skull through which cranial nerves pass
	• Fissure	• Narrow, slitlike opening	• Fissure of the sphenoid bone
	• Meatus	• Opening or passage into a bone	• External auditory meatus of the temporal bone
	• Sinus	• Cavity or hollow space in a bone	• Cavity of the frontal sinus containing a duct that carries secretions to the upper part of the nasal cavity

the lines of junction between two bones, especially of the skull, and are usually immovable.

Cranial Bones

Eight bones, collectively known as the **cranium (skull)**, enclose and protect the brain and the organs of hearing and equilibrium. Cranial bones are connected to muscles to provide head movements, chewing motions, and facial expressions.

An infant's skull contains an unossified membrane, or soft spot (incomplete bone formation), lying between the cranial bones called a **fontanel**. The pulse of blood vessels can be felt under the skin in those areas. The chief function of the fontanels is to allow the bones to move as the fetus passes through the birth canal during the delivery process. With age, the fontanels begin to fuse together and become immobile in early childhood.

The (1) **frontal bone** forms the anterior portion of the skull (**forehead**) and the roof of the bony cavities that contain the eyeballs. One (2) **parietal bone** is situated on each side of the skull just behind the frontal bone. Together they form the upper sides and roof of the cranium. Each parietal bone meets the frontal bone along the (3) **coronal suture**. A single (4) **occipital bone** forms the back and base of the skull. It contains an opening in its base through which the spinal cord passes. Two (5) **temporal bone(s)**, one on each side of the skull, form part of the lower cranium. Each temporal bone has a complicated shape that contains

various cavities and recesses associated with the internal ear, the essential part of the organ of hearing. The temporal bone projects downward to form the **mastoid process**, which provides a point of attachment for several neck muscles. The (6) **sphenoid bone**, located at the middle part of the base of the skull, forms a central wedge that joins with all other cranial bones, holding them together. A very light and spongy bone, the (7) **ethmoid bone**, forms most of the bony area between the nasal cavity and parts of the orbits of the eyes.

Facial Bones

All facial bones, with the exception of the (8) **mandible** (lower jaw bone), are joined together by sutures and are immovable. Movement of the mandible is needed for speaking and chewing (**mastication**). The (9) **maxillae**, paired upper jawbones, are fused in the midline by a suture. They form the upper jaw and **hard palate** (roof of the mouth). If the maxillary bones do not fuse properly before birth, a congenital defect called **cleft palate** results. The maxillae (singular, *maxilla*) and the mandible contain sockets for the roots of the teeth. Two thin, nearly rectangular bones, the (10) **nasal bones**, lie side-by-side and are fused medially, forming the shape and the bridge of the nose. Two paired (11) **lacrimal bones** are located at the corner of each eye. These thin, small bones unite to form the groove for the lacrimal sac and canals through which the tear ducts pass into the nasal cavity. The

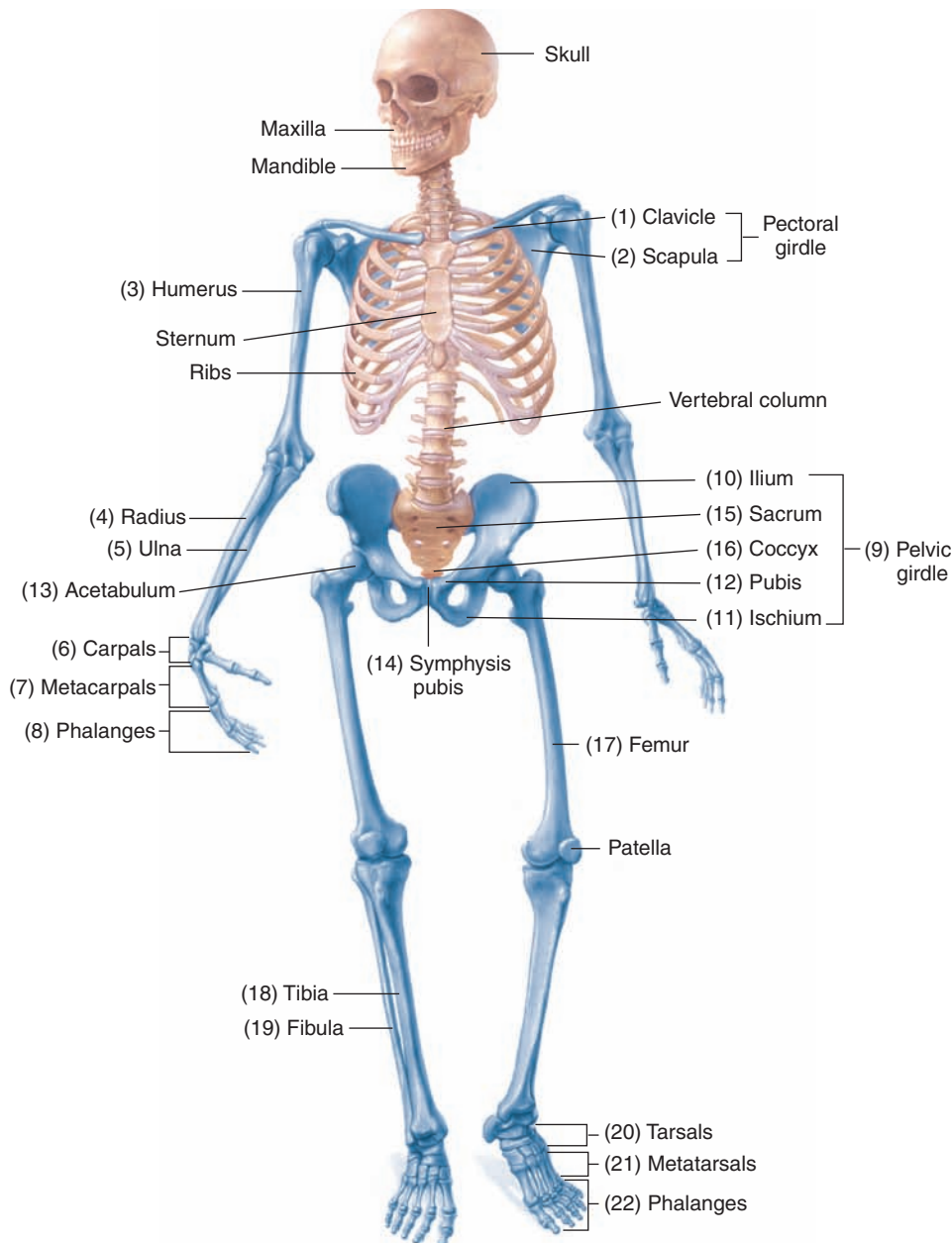


Figure 10-4. Anterior view of the axial (bone colored) and appendicular (blue colored) skeleton.

paired (12) **zygomatic bones** are located on the side of the face below the eyes and form the higher portion of the cheeks below and to the sides of the eyes. The zygomatic bone is commonly referred to as the **cheekbone**. The (13) **vomer** is a single, thin bone that forms the lower part of the nasal septum.

Other important structures, the **paranasal sinuses**, are cavities located within the cranial and facial bones. As their name implies, the frontal, ethmoidal, sphenoidal, and maxillary sinuses are named after the bones in which they are located.

(See Figure 10–6.) The paranasal sinuses open into the nasal cavities and are lined with **ciliary epithelium** that is continuous with the mucosa of the nasal cavities. When sinuses are unable to drain properly, a feeling of being “stuffed up” ensues. This commonly occurs during upper respiratory infections (URI) or with allergies.

Thorax

The internal organs of the chest (**thorax**), including the heart and lungs, are enclosed and protected by a bony rib cage. The thorax consists

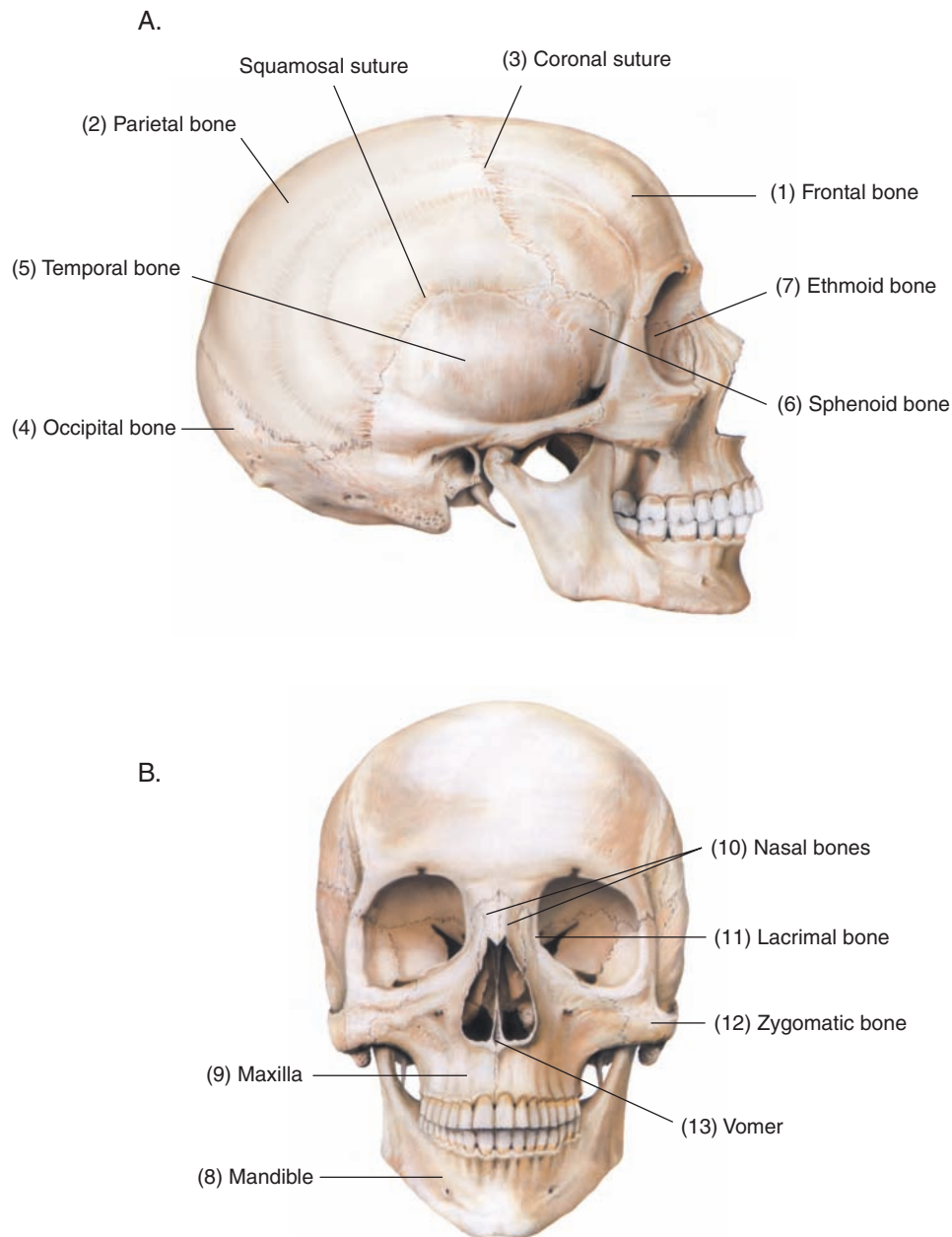


Figure 10-5. Bony structures of the skull. (A) Cranial bones. (B) Facial bones.

of 12 pairs of ribs, all attached to the spine. (See Figure 10–7.) The first seven pairs, the (1) **true ribs**, are attached directly to the (2) **sternum** by a strip of (3) **costal cartilage**. The costal cartilage of the next five pairs of ribs is not fastened directly to the sternum, so these ribs are known as (4) **false ribs**. The last two pairs of false ribs are not joined, even indirectly, to the sternum but attach posteriorly to the thoracic vertebrae. These last two pairs of false ribs are known as (5) **floating ribs**.

Vertebral Column

The vertebral column of the adult is composed of 26 bones called *vertebrae* (singular, *vertebra*). The vertebral column supports the body and provides a protective bony canal for the spinal cord. A healthy, normal spine has four curves that help make it resilient and maintain balance. The cervical and lumbar regions curve forward, whereas the thoracic and sacral regions curve backward. Abnormal curves may be due to a congenital defect, poor posture, or bone disease. (See Figure 10–8.)

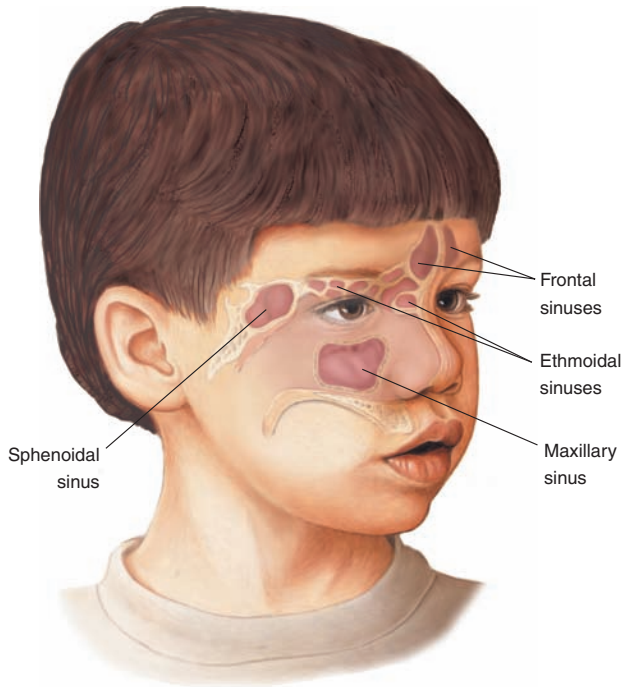


Figure 10-6. Paranasal sinuses.

The vertebral column consists of five regions of bones, each deriving its name from its location within the spinal column. The seven (1) **cervical vertebrae** form the skeletal framework of the neck. The first cervical vertebra, the (2) **atlas**, supports the skull. The second cervical vertebra, the (3) **axis**, makes possible the rotation of the skull on the neck. Under the seventh cervical vertebra are 12 (4) **thoracic vertebrae**, which support the chest and serve as a point of articulation for the ribs. The next five vertebrae, the (5) **lumbar vertebrae**, are situated in the lower back area and carry most of the weight of the torso. Below this area are five sacral vertebrae, which are fused into a single bone in the adult and are referred to as the (6) **sacrum**. The tail of the vertebral column consists of four or five fragmented fused vertebrae referred to as the (7) **coccyx**.

Vertebrae are separated by flat, round structures, the (8) **intervertebral disks**, which are composed of a fibrocartilaginous substance with a gelatinous mass in the center (*nucleus pulposus*). When disk material protrudes into the neural canal, pressure on the adjacent spinal root nerve causes pain. This condition occurs most commonly in the lower

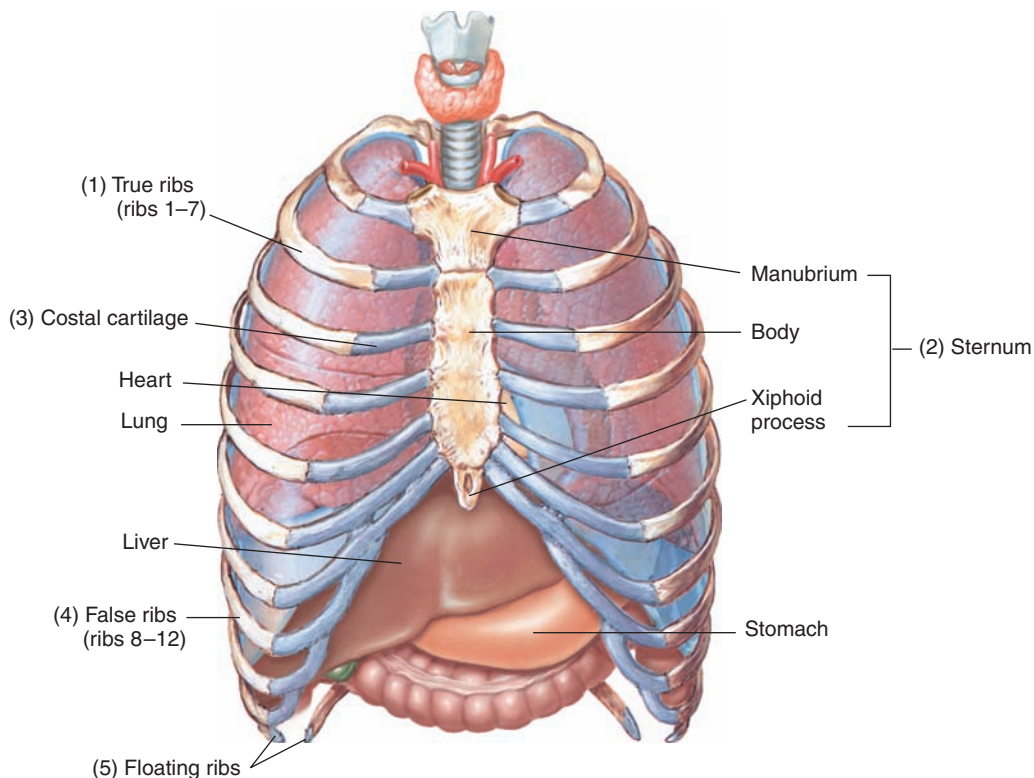


Figure 10-7. Thorax.

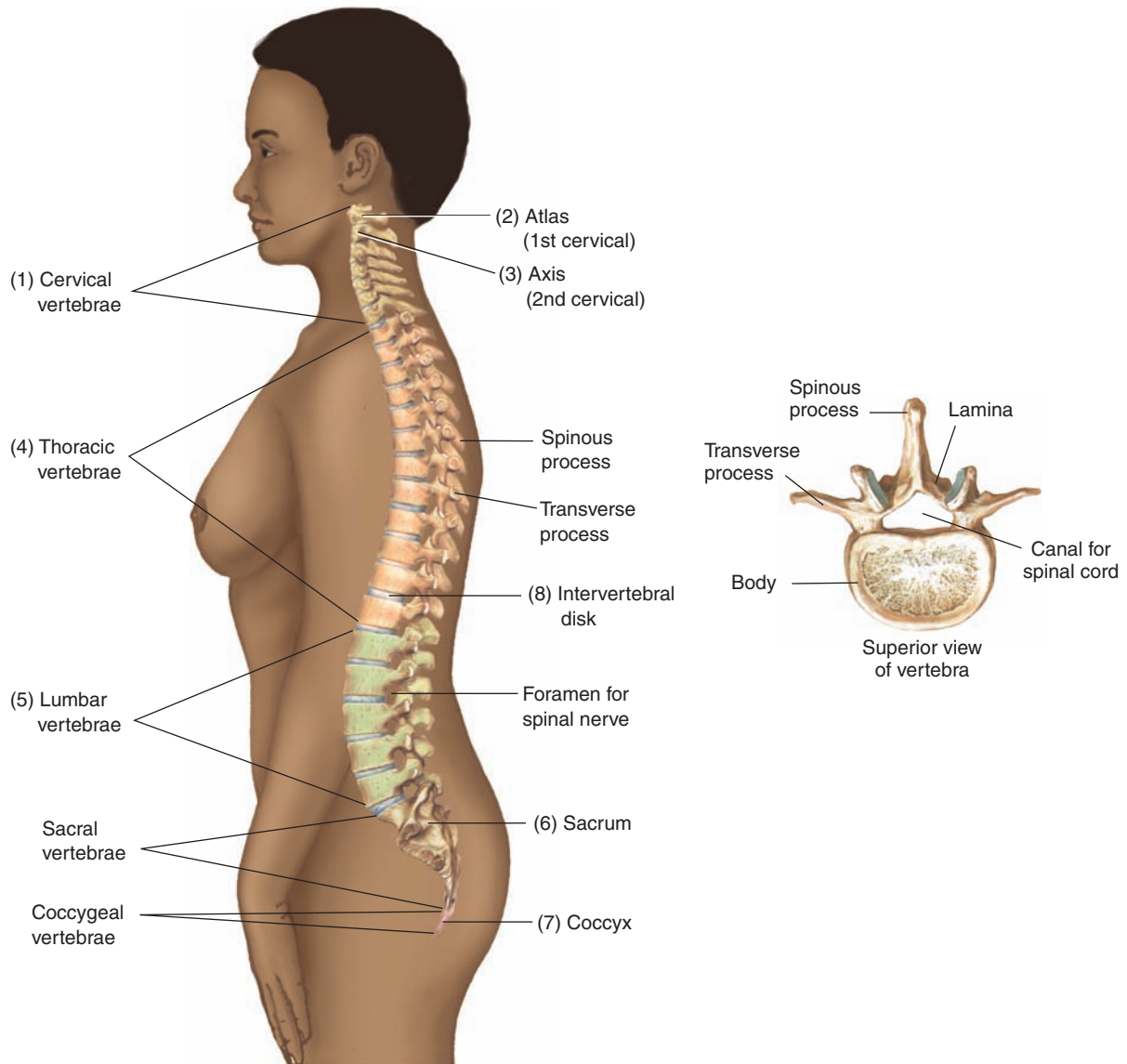


Figure 10-8. Lateral view of the vertebral column.

spine and is referred to as *herniation of an intervertebral disk*, *herniated nucleus pulposus (HNP)*, *ruptured disk*, *prolapsed disk*, or *slipped disk*. (See Figure 10–9.)

Appendicular Skeleton

The appendicular skeleton consists of bones of the upper and lower limbs and their girdles that attach the limbs to the axial skeleton. The appendicular skeleton is distinguished with a blue color in Figure 10–4. The difference between the axial and appendicular skeletons is that the axial skeleton protects internal organs and provides central support for the body; the appendicular skeleton enables the body

to move. The ability to walk, run, or catch a ball is possible because of the movable joints of the limbs that make up the appendicular skeleton.

Pectoral (Shoulder) Girdle

The pectoral girdle consists of two bones, the anterior (1) **clavicle** (collar bone) and the posterior (2) **scapula** (triangular shoulder blade). The primary function of the pectoral girdle is to attach the bones of the upper limbs to the axial skeleton and provide attachments for muscles that aid upper limb movements. The paired pectoral structures and their associated muscles form the shoulders of the body.

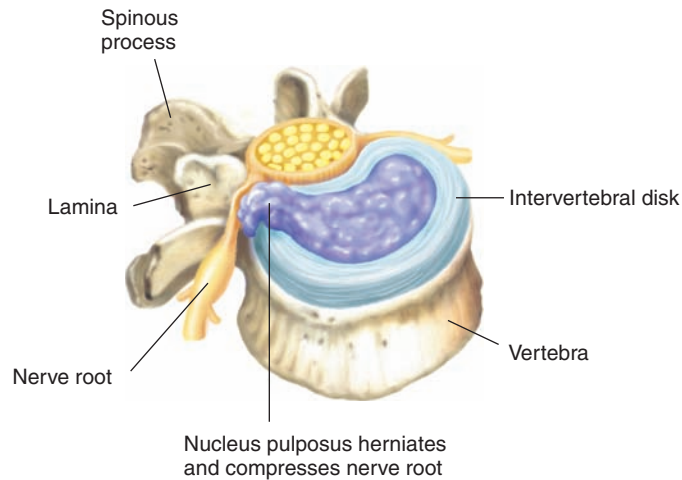


Figure 10-9. Herniated disk.

Upper Limbs

The skeletal framework of each upper limb includes the arm, forearm, and hand. Anatomically speaking, the arm is only that part of the upper limb between the shoulder and elbow. Each appendage consists of a (3) **humerus** (upper arm bone), which articulates with the (4) **radius** and (5) **ulna** at the elbow. The radius and ulna form the skeleton of the forearm. The bones of the hand include eight (6) **carpals** (wrist); five radiating (7) **metacarpals** (palm); and ten radiating (8) **phalanges** (fingers).

Pelvic (Hip) Girdle

The (9) **pelvic girdle** is a basin-shaped structure that attaches the lower limbs to the axial skeleton. Along with its associated ligaments, it supports the trunk of the body and provides protection for the visceral organs of the pelvis (lower organs of digestion and urinary and reproductive structures).

Male and female **pelves** (singular, *pelvis*) differ considerably in size and shape but share the same basic structures. Some of the differences are attributable to the function of the female pelvis during childbearing. The female pelvis is shallower than the male pelvis but wider in all directions. The female pelvis not only supports the enlarged uterus as the fetus matures but also provides a large opening to allow the infant to pass through during birth. Even so, female and male pelves are divided into the (10) **ilium**, (11) **ischium**, and (12) **pubis**. These three bones are fused together in the adult to form a single bone called the **innominate (hip) bone**. The ilium travels inferiorly to form part of the (13) **acetabulum** (the deep socket of the hip joint) and medially to join the pubis. The bladder is locat-

ed behind the (14) **symphysis pubis**; the rectum is in the curve of the (15) **sacrum** and (16) **coccyx**. In the female, the uterus, fallopian tubes, ovaries, and vagina are located between the bladder and the rectum.

Lower Limbs

The lower limbs support the complete weight of the erect body and are subjected to exceptional stresses, especially in running or jumping. To accommodate for these types of forces, the lower limb bones are stronger and thicker than comparable bones of the upper limbs. The difference between the upper and lower limb bones is that the lighter bones of the upper limbs are adapted for mobility and flexibility; the massive bones of the lower limbs are specialized for stability and weight bearing.

There are three parts of each lower limb: the thigh, the leg, and the foot. The thigh consists of a single bone called the (17) **femur**. It is the largest, longest, and strongest bone in the body. The leg is formed by two parallel bones: the (18) **tibia** and the (19) **fibula**. The seven (20) **tarsals** (ankle bones) resemble metacarpals (wrist bones) in structure. Lastly, the bones of the foot include the (21) **metatarsals**, which consists of five small long bones numbered 1 to 5 beginning with the great toe on the medial side of the foot, and the much smaller (22) **phalanges** (toes).

Joints or Articulations

To allow for body movements, bones must have points where they meet (**articulate**). These articulating points form joints that have various degrees of mobility. Some are freely movable (**diarthroses**),

others are only slightly movable (**amphiarthroses**), and the remaining are immovable (**synarthroses**). All three types are necessary for smooth, coordinated body movements.

Joints that allow movement are called **synovial joints**. The ends of the bones that comprise these joints are encased in a sleeve-like extension of the periosteum called the **joint capsule**. This capsule binds the articulating bones to each other. In

most synovial joints, the capsule is strengthened by ligaments that lash the bones together, providing additional strength to the joint capsule. A membrane called the **synovial membrane** surrounds the inside of the capsule. It secretes a lubricating fluid (**synovial fluid**) within the entire joint capsule. The ends of each of the bones are covered with a smooth layer of cartilage that serves as a cushion.



It is time to review skeletal structures by completing Learning Activity 10–3.

Connecting Body Systems—Musculoskeletal System

The main function of the musculoskeletal system is to provide support, protection, and movement of body parts. Specific functional relationships between the musculoskeletal system and other body systems are summarized below.



Blood, lymph, and immune

- Muscle action pumps lymph through lymphatic vessels.
- Bone marrow provides a place for cells of the immune system to develop.



Cardiovascular

- Bone helps regulate blood calcium levels, important to heart function.



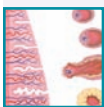
Digestive

- Muscles play an important role in swallowing and propelling food through the digestive tract.
- Muscles of the stomach mechanically break down food to prepare it for chemical digestion.



Endocrine

- Exercising skeletal muscles stimulate release of hormones to increase blood flow.



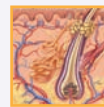
Female reproductive

- Skeletal muscles are important in sexual activity and during delivery of the fetus.



Genitourinary

- Skeletal muscles are important in sexual activity.
- Bones work in conjunction with the kidneys to help regulate blood calcium levels.
- Skeletal muscles help control urine elimination.



Integumentary

- Involuntary muscle contractions (shivering) help regulate body temperature.



Nervous

- Bones protect the brain and spinal cord.



Respiratory

- Muscles and ribs work together in the breathing process.

Medical Word Elements

This section introduces combining forms, suffixes, and prefixes related to the musculoskeletal system. Word analyses are also provided.

Element	Meaning	Word Analysis
Combining Forms		
Skeletal System		
General		
ankyl/o	stiffness; bent, crooked	ankyl/osis (äng-kĭ-LŌ-sĭs): abnormal condition of stiffness -osis: abnormal condition; increase (used primarily with blood cells) <i>Ankylosis results in immobility and stiffness of a joint. It may be the result of trauma, surgery, or disease and most commonly occurs in rheumatoid arthritis.</i>
arthr/o	joint	arthr/itis (är-THRĪ-tĭs): inflammation of a joint -itis: inflammation
kyph/o	humpback	kyph/osis (kĭ-FŌ-sĭs): abnormal condition of a humpback posture -osis: abnormal condition; increase (used primarily with blood cells)
lamin/o	lamina (part of vertebral arch)	lamin/ectomy (läm-ĭ-NĚK-tŏ-mĕ): excision of the lamina -ectomy: excision, removal <i>Laminectomy is usually performed to relieve compression of the spinal cord or to remove a lesion or herniated disk.</i>
lord/o	curve, swayback	lord/osis (lor-DŌ-sĭs): abnormal condition of a swayback posture -osis: abnormal condition; increase (used primarily with blood cells)
myel/o	bone marrow; spinal cord	myel/o/cyte (MĪ-ĕl-ŏ-sĭt): bone marrow cell -cyte: cell
orth/o	straight	orth/o/ped/ist (or-thŏ-PĔ-dĭst): specialist in treatment of musculoskeletal disorders <i>ped</i> : foot; child <i>-ist</i> : specialist <i>Initially, an orthopedist corrected deformities and straightened children's bones. In today's medical practice, however, the orthopedist treats musculoskeletal disorders and associated structures in persons of all ages.</i>
oste/o	bone	oste/oma (ŏs-tĕ-Ō-mă): tumor composed of bone -oma: tumor <i>Osteomas are benign bony tumors.</i>
ped/o	foot; child	ped/o/graph (PĔD-ŏ-grăf): instrument for recording the foot -graph: instrument for recording <i>A pedograph is an instrument for recording an imprint of the foot on paper, and the gait (manner of walking).</i>
ped/i		ped/i/cure (PĔD-ĭ-kūr): care of feet
scoli/o	crooked, bent	scoli/osis (skŏ-lĕ-Ō-sĭs): abnormal bending of the spine -osis: abnormal condition; increase (used primarily with blood cells)
thorac/o	chest	thorac/o/dynia (thŏ-räk-ŏ-DĪN-ĕ-ă): pain in the chest -dynia: pain

Medical Word Elements—cont'd		
Element	Meaning	Word Analysis
Specific Bones		
acromi/o	acromion (projection of scapula)	acromi/al (āk-RŌ-mē-āl): pertaining to the acromion -al: pertaining to
brachi/o	arm	brachi/algia (brā-kē-ĀL-jē-ă): pain in the arm -algia: pain
calcane/o	calcaneum (heel bone)	calcane/o/dynia (kāl-kān-ō-DĪN-ē-ă): pain in the heel -dynia: pain
carp/o	carpus (wrist bone)	carp/o/ptosis (kār-pōp-TŌ-sīs): wrist drop -ptosis: prolapse, downward displacement
cephal/o	head	cephal/ad (SĔF-ă-lăd): toward the head -ad: toward
cervic/o	neck; cervix uteri (neck of uterus)	cervic/o/dynia (sēr-vī-kō-DĪN-ē-ă): pain in the neck; also called <i>cervical neuralgia</i> -dynia: pain
clavicul/o	clavicle (collar bone)	clavicul/ar (klă-VĪK-ū-lār): pertaining to the clavicle -ar: pertaining to
cost/o	Ribs	cost/ectomy (kōs-TĔK-tō-mē): excision of a rib -ectomy: excision, removal
crani/o	cranium (skull)	crani/o/tomy (krā-nē-ŌT-ō-mē): incision of the cranium -tomy: incision
dactyl/o	fingers; toes	dactyl/itis (dāk-tīl-Ī-tīs): inflammation of fingers or toes -itis: inflammation
femor/o	femur (thigh bone)	femor/al (FĔM-or-āl): pertaining to the femur -al: pertaining to
fibul/o	fibula (smaller bone of lower leg)	fibul/o/calcane/al (fīb-ū-lō-kāl-KĀ-nē-āl): pertaining to the fibula and calcaneus <i>calcane</i> : calcaneum (heel bone) -al: pertaining to
humer/o	humerus (upper arm bone)	humer/o/scapul/ar (hū-mēr-ō-SKĀP-ū-lār): relating to the humerus and scapula <i>scapul</i> : scapula (shoulder blade) -ar: pertaining to
ili/o	ilium (lateral, flaring portion of hip bone)	ili/o/pelv/ic (īl-ē-ō-PĔL-vīk): pertaining to the iliac area of the pelvis <i>pelv</i> : pelvis -ic: pertaining to
ischi/o	ischium (lower portion of hip bone)	ischi/o/dynia (īs-kē-ō-DĪN-ē-ă): pain in the ischium -dynia: pain

(continued)

Medical Word Elements—cont'd		
Element	Meaning	Word Analysis
lumb/o	loins (lower back)	lumb/o /dynia (lŭm-bō-DĪN-ē-ă): pain in lumbar region of the back; also called <i>lumbago</i> -dynia: pain
metacarp/o	metacarpus (hand bones)	metacarp /ectomy (mēt-ă-kăr-PĚK-tō-mē): excision of metacarpal bone(s) -ectomy: excision, removal
metatars/o	metatarsus (foot bones)	metatars /algia (mēt-ă-tăr-SĂL-jē-ă): pain in the metatarsus -algia: pain <i>Metatarsalgia emanates from the heads of the metatarsus and worsens with weight bearing or palpation.</i>
patell/o	patella (kneecap)	patell /ectomy (păt-ĕ-LĚK-tō-mē): removal of the patella -ectomy: excision, removal
pelv/i	pelvis	pelv/i /metry* (pĕl-VĪM-ĕt-rē): act of measuring the pelvis -metry: act of measuring <i>Pelvimetry is routinely performed in obstetrical management.</i>
pelv/o		pelv /ic (PĚL-vĭk): pertaining to the pelvis -ic: pertaining to
phalang/o	phalanges (bones of the fingers and toes)	phalang /ectomy (făl-ăn-JĚK-tō-mē): excision of phalanges -ectomy: excision, removal
pod/o	foot	pod /iatry (pō-DĪ-ă-trē): treatment of the feet -iatry: medicine, treatment
pub/o	pelvis bone (anterior part of pelvic bone)	pub/o /coccyg/eal (pŭ-bō-kōk-SĪJ-ē-ăl): pertaining to the pubis and the coccyx <i>coccyg</i> : coccyx (tailbone) -eal: pertaining to
radi/o	radiation, x-ray; radius (lower arm bone on thumb side)	radi /al (RĀ-dē-ăl): pertaining to the radius -al: pertaining to
spondyl/o	vertebrae (backbone)	spondyl /itis (spŏn-dĭl-Ī-tĭs): inflammation of the vertebrae -itis: inflammation <i>The combining form spondyl/o is used to describe diseases and conditions.</i>
vertebr/o		inter/ vertebr /al (ĭn-tĕr-VĚRT-ĕ-brĕl): relating to the area between two vertebrae <i>inter-</i> : between -al: pertaining to <i>The combining form vertebr/o is used to indicate anatomical terms.</i>
stern/o	sternum (breastbone)	stern /ad (STĚR-năd): toward the sternum -ad: toward

*The *i* in *pelvii*/metry is an exception to the rule of using the connecting vowel *o*.

Medical Word Elements—cont'd		
Element	Meaning	Word Analysis
tibi/o	tibia (larger bone of lower leg)	tibi/o/femor/al (tĭb-ĕ-ō-FĔM-or-āl) pertaining to the tibia and femur <i>femor</i> : femur <i>-al</i> : pertaining to
Muscular System		
leiomy/o	smooth muscle (visceral)	leiomy/oma (lĭ-ō-mī-Ō-mă): tumor of smooth muscle <i>-oma</i> : tumor
muscul/o	muscle	muscul/ar (MŪS-kū-lār): pertaining to muscles <i>-ar</i> : pertaining to
my/o		my/oma (mī-Ō-mă): tumor of muscle (tissue) <i>-oma</i> : tumor
rhabd/o	rod-shaped (striated)	rhabd/oid (RĀB-doyd): resembling a rod <i>-oid</i> : resembling
rhabdomy/o	rod-shaped (striated) muscle	rhabdomy/oma (răb-dō-mī-Ō-mă): tumor composed of striated muscular tissue <i>-oma</i> : tumor
Related Structures		
chondr/o	cartilage	chondr/itis (kŏn-DRĪ-tĭs): inflammation of cartilage <i>-itis</i> : inflammation
fasci/o	band, fascia (fibrous membrane supporting and separating muscles)	fasci/o/plasty (FĀSH-ĕ-ō-plăs-tĕ): surgical repair of fascia <i>-plasty</i> : surgical repair
fibr/o	fiber, fibrous tissue	fibr/oma (fĭ-BRŌ-mă): tumor of fibrous tissue <i>-oma</i> : tumor
synov/o	synovial membrane, synovial fluid	synov/ectomy (sĭn-ō-VĔK-tō-mĕ): removal of a synovial membrane <i>-ectomy</i> : excision, removal
ten/o	tendon	ten/o/desis (tĕn-ŌD-ĕ-sĭs): surgical binding or fixation of a tendon <i>-desis</i> : binding, fixation (of a bone or joint)
tend/o		tend/o/plasty (TĔN-dō-plăs-tĕ): surgical repair of a tendon <i>-plasty</i> : surgical repair
tendin/o		tendin/itis (tĕn-dĭn-Ī-tĭs): inflammation of a tendon <i>-itis</i> : inflammation
Suffixes		
-asthenia	weakness, debility	my/asthenia (mī-ăs-THĔ-nĕ-ă): weakness of muscle (and abnormal fatigue) <i>my</i> : muscle

(continued)

Medical Word Elements—cont'd		
Element	Meaning	Word Analysis
-blast	embryonic cell	my/o/ blast (MĪ-ō-blāst): embryonic cell that develops into muscle <i>my/o</i> : muscle
-clasia	to break; surgical fracture	oste/o/ clasia (ōs-tē-ō-KLĀ-zē-ă): surgical fracture of a bone <i>oste/o</i> : bone <i>Osteoclasia is the intentional fracture of a bone to correct a deformity and is also called osteoclasia.</i>
-clast	to break	oste/o/ clast (ŌS-tē-ō-klāst): cell that breaks down bone <i>oste/o</i> : bone <i>An osteoclast destroys the matrix of bone. Osteoblasts and osteoclasts work together to maintain a constant bone size in adults.</i>
-desis	binding, fixation (of a bone or joint)	arthr/o/ desis (ār-thrō-DE-sīs): binding together of a joint <i>arthr/o</i> : joint
-malacia	softening	chondr/o/ malacia (kōn-drō-māl-Ā-shē-ă): softening of cartilage <i>chondr/o</i> : cartilage <i>Chondromalacia is a softening of the articular cartilage, usually involving the patella.</i>
-physis	growth	epi/ physis (ē-PĪF-ī-sīs): growth upon (the end of a long bone) <i>epi-</i> : above, upon <i>The epiphyses are the enlarged proximal and distal ends of a long bone.</i>
-porosis	porous	oste/o/ porosis (ōs-tē-ō-pō-RŌ-sīs): porous bone <i>oste/o</i> : bone <i>Osteoporosis is a disorder characterized by loss of bone density. It may cause pain, especially in the lower back; pathological fractures; loss of stature; and hairline fractures.</i>
-scopy	visual examination	arthr/o/ scopy (ār-THRŌS-kō-pē): visual examination of a joint <i>arthr/o</i> : joint <i>Arthroscopy is an endoscopic examination of the interior of a joint. It is performed by inserting small surgical instruments to remove and repair damaged tissue, such as cartilage fragments or torn ligaments.</i>
Prefixes		
a-	without, not	a /trophy (ĀT-rō-fē): without nourishment <i>-trophy</i> : development, nourishment <i>Atrophy is a wasting or decrease in size or physiological activity of a part of the body because of disease or other influences.</i>
dys-	bad; painful; difficult	dys /trophy (DĪS-trō-fē): disorder caused by defective nutrition or metabolism <i>-trophy</i> : development, nourishment
sub-	under, below	sub /patell/ar (sūb-pā-TĒL-ār): pertaining to below the patella <i>patell</i> : patella (kneecap) <i>-ar</i> : pertaining to

Medical Word Elements—cont'd		
Element	Meaning	Word Analysis
supra-	above; excessive; superior	supra /cost/al (soo-pră-KŌS-tăl): pertaining to above the ribs <i>cost</i> : ribs <i>-al</i> : pertaining to
syn-	union, together, joined	syn /dactyl/ism (sĭn-DĀK-tĭl-ĭzm): condition of joined fingers or toes <i>dactyl</i> : fingers, toes <i>-ism</i> : condition <i>Syndactylism is a fusion of two or more fingers or toes.</i>



It is time to review medical word elements by completing Learning Activity 10–4. For audio pronunciations of the above-listed key terms, you can visit www.davisplus.fadavis.com/gyls/systems to download this chapter's Listen and Learn! exercises or use the book's audio CD (if included).

Pathology

Joints are especially vulnerable to constant wear and tear. Repeated motion, disease, trauma, and aging affect joints as well as muscles and tendons. Overall, disorders of the musculoskeletal system are more likely to be caused by injury than disease. Other disorders of structure and bone strength—such as osteoporosis, which occurs primarily in elderly women—affect the health of the musculoskeletal system.

For diagnosis, treatment, and management of musculoskeletal disorders, the medical services of a specialist may be warranted. **Orthopedics** is the branch of medicine concerned with prevention, diagnosis, care, and treatment of musculoskeletal disorders. The physician who specializes in the diagnoses and treatment of musculoskeletal disorders is known as an **orthopedist**. These physicians employ medical, physical, and surgical methods to restore function that has been lost as a result of musculoskeletal injury or disease. Another physician who specializes in treating joint disease is the **rheumatologist**. Still another physician, a **Doctor of Osteopathy (DO)**, maintains that good health requires proper alignment of bones, muscles, ligaments, and nerves. Like the medical doctor, osteopathic physicians combine manipulative procedures with state-of-the-art methods of medical treatment, including prescribing drugs and performing surgeries.

Bone Disorders

Disorders involving the bones include fractures, infections, osteoporosis, and spinal curvatures.

Fractures

A broken bone is called a **fracture**. The different types of fractures are classified by extent of damage. (See Figure 10–10.) A (1) **closed (simple) fracture** is one in which the bone is broken but no external wound exists. An (2) **open (compound) fracture** involves a broken bone and an external wound that leads to the site of fracture. Fragments of bone commonly protrude through the skin. A (3) **complicated fracture** is one in which a broken bone has injured an internal organ, such as when a broken rib pierces a lung. In a (4) **comminuted fracture**, the bone has broken or splintered into pieces. An (5) **impacted fracture** occurs when the bone is broken and one end is wedged into the interior of another bone. An (6) **incomplete fracture** occurs when the line of fracture does not completely transverse the entire bone. A (7) **greenstick fracture** is when the broken bone does not extend through the entire thickness of the bone; that is, one side of the bone is broken and one side of the bone is bent. It occurs most often in children as part of the bone is still composed of flexible cartilage. The term *greenstick* refers to new branches on a tree that bend rather than break. A greenstick fracture is also known as an incomplete fracture. A (8) **Colles fracture**, a break at the lower end of the radius, occurs just above the wrist. It causes displacement of the hand and usually occurs as a result of flexing a hand to cushion a fall. A **hairline fracture** is a minor fracture in which all portions of the bone are in perfect alignment. The fracture is seen on radiographic examination as a very thin hairline between the two segments but not extending entirely through the bone. **Pathological (spontaneous)**

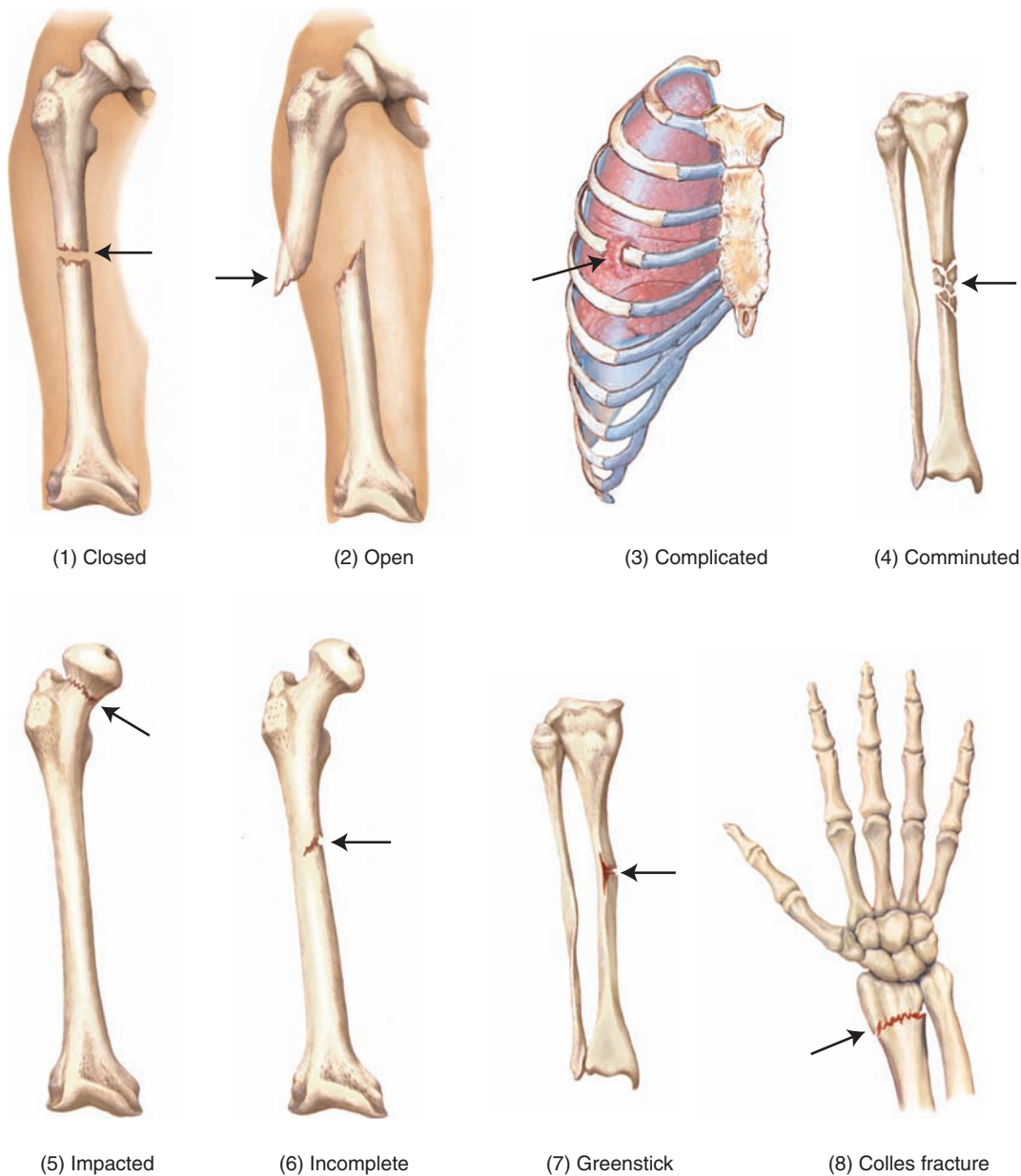


Figure 10-10. Types of fractures.

fractures are usually caused by a disease process such as a neoplasm or osteoporosis.

Unlike other repairs of the body, bones sometimes require months to heal. Several factors influence the rate at which fractures heal. Some fractures need to be immobilized to ensure that bones unite soundly in their proper position. In most cases, this is achieved with bandages, casts, traction, or a fixation device. Certain fractures, particularly those with bone fragments, require surgery to reposition and fix bones securely, so that surrounding tissues heal. In addition to promoting healing, immobilization prevents further injury and reduces pain.

Some bones have a natural tendency to heal more rapidly than others. For instance, the long bones of the arms usually mend twice as fast as those of the legs. Age also plays an important role in bone fracture healing rate; older patients require more time for healing. In addition, an adequate blood supply to the injured area and the nutritive state of the individual are crucial to the healing process.

Infections

Infection of the bone and bone marrow is called **osteomyelitis**. It may be acute or chronic. Bone infections are primarily caused by pus-forming

(**pyogenic**) bacteria. The disease usually begins with local trauma to the bone causing a blood clot (**hematoma**). Bacteria from an acute infection in another area of the body find their way to the injured bone and establish the infection.

Most bone infections are more difficult to treat effectively than soft tissue infections. Eventually, some bone infections result in destruction (**necrosis**) of the bone and stiffening or freezing of the joints (**ankylosis**). Osteomyelitis may be acute or chronic. With early treatment, prognosis for acute osteomyelitis is good; prognosis for the chronic form of the disease is poor.

Paget disease, also known as *osteitis deformans*, is a chronic inflammation of bones resulting in thickening and softening of bones. It can occur in any bone but most commonly affects the long bones of the legs, the lower spine, the pelvis, and the skull. This disease is found in persons over age 40. Although a variety of causes have been proposed, a slow virus (not yet isolated) is currently thought to be the most likely cause.

Osteoporosis

Osteoporosis is a common metabolic bone disorder in the elderly, particularly in postmenopausal women and especially women older than age 60. It is characterized by decreased bone density that occurs when the rate of bone resorption (loss of

substance) exceeds the rate of bone formation. Among the many causes of osteoporosis are disturbances of protein metabolism, protein deficiency, disuse of bones due to prolonged periods of immobilization, estrogen deficiencies associated with menopause, a diet lacking vitamins or calcium, and long-term administration of high doses of corticosteroids.

Patients with osteoporosis commonly complain of bone pain, typically in the back, which may be caused by repeated microscopic fractures. Thin areas of porous bone are also evident. Deformity associated with osteoporosis is usually the result of pathological fractures.

Spinal Curvatures

Any persistent, abnormal deviation of the vertebral column from its normal position may cause an abnormal spinal curvature. Three common deviations are **scoliosis**, **kyphosis**, and **lordosis**. (See Figure 10–11.)

An abnormal lateral curvature of the spine, either to the right or left, is called **scoliosis**. Some rotation of a portion of the vertebral column may also occur. Scoliosis, or **C-shaped curvature of the spine**, may be congenital, caused by chronic poor posture during childhood while the vertebrae are still growing, or the result of one leg being longer than the other. Treatment depends on the severity of the curvature and may vary from exercises,

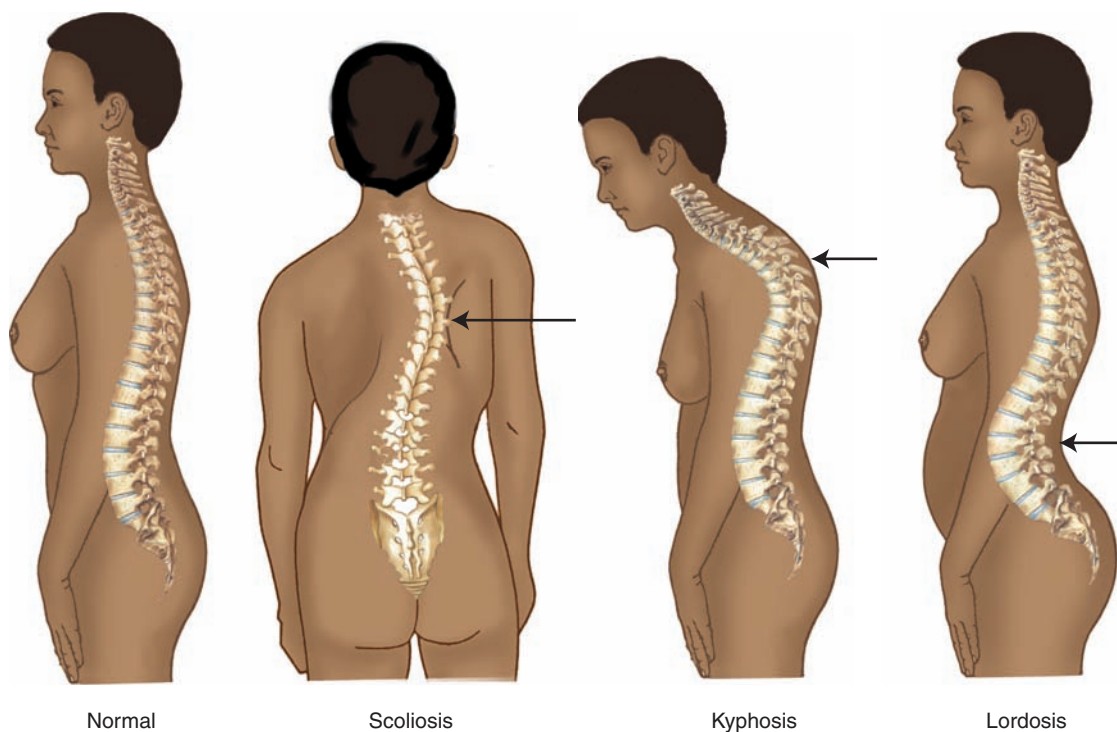


Figure 10-11. Spinal curvatures.

physical therapy, and back braces to surgical intervention. Untreated scoliosis may result in pulmonary insufficiency (curvature may decrease lung capacity), back pain, sciatica, disk disease, or even degenerative arthritis.

An abnormal curvature of the upper portion of the spine is called **kyphosis**, more commonly known as **humpback** or **hunchback**. Rheumatoid arthritis, rickets, poor posture, or chronic respiratory diseases may cause kyphosis. Treatment consists of spine-stretching exercises, sleeping with a board under the mattress, and wearing a brace to straighten the kyphotic curve; surgery is rarely required.

An abnormal, inward curvature of a portion of the lower portion of the spine is called **lordosis**, more commonly known as **swayback**. It may be caused by increased weight of the abdominal contents, resulting from obesity or excessive weight gain during pregnancy. Kyphosis and lordosis also occur in combination with scoliosis.

Joint Disorders

Arthritis, a general term for many joint diseases, is an inflammation of a joint usually accompanied by pain, swelling and, commonly, changes in structure. Because of their location and constant use, joints are prone to stress injuries and inflammation. The main types of arthritis include rheumatoid arthritis, osteoarthritis, and gouty arthritis, or gout.

Rheumatoid arthritis (RA), a systemic disease characterized by inflammatory changes in joints and their related structures, results in crippling deformities. (See Figure 10–12.) This form of arthritis is believed to be caused by an autoimmune reaction of

joint tissue. It occurs most commonly in women between ages 23 and 35 but can affect people of any age group. Intensified aggravations (**exacerbations**) of this disease are commonly associated with periods of increased physical or emotional stress. In addition to joint changes, muscles, bones, and skin adjacent to the affected joint atrophy. There is no specific cure, but nonsteroidal anti-inflammatory drugs (NSAIDs), physical therapy, and orthopedic measures are used in treatment of less severe cases.

Osteoarthritis, also called **degenerative joint disease (DJD)**, is the most common type of connective tissue disease. Cartilage destruction and new bone formation at the edges of joints (**spurs**) are the most common pathologies seen with osteoarthritis. Even though osteoarthritis is less crippling than rheumatoid arthritis, it may result in fusion of two bone surfaces, thereby completely immobilizing the joint. In addition, small, hard nodules may form at the distal interphalangeal joints of the fingers (**Heberden nodes**).

Gouty arthritis, also called **gout**, is a metabolic disease caused by the accumulation of uric acid crystals in the blood. These crystals may become deposited in joints and soft tissue near joints, causing painful swelling and inflammation. Although the joint chiefly affected is the big toe, any joint may be involved. Sometimes, renal calculi (**nephroliths**) form because of uric acid crystals collecting in the kidney.

Muscle Disorders

Disorders involving the muscles include muscular dystrophy and myasthenia gravis.

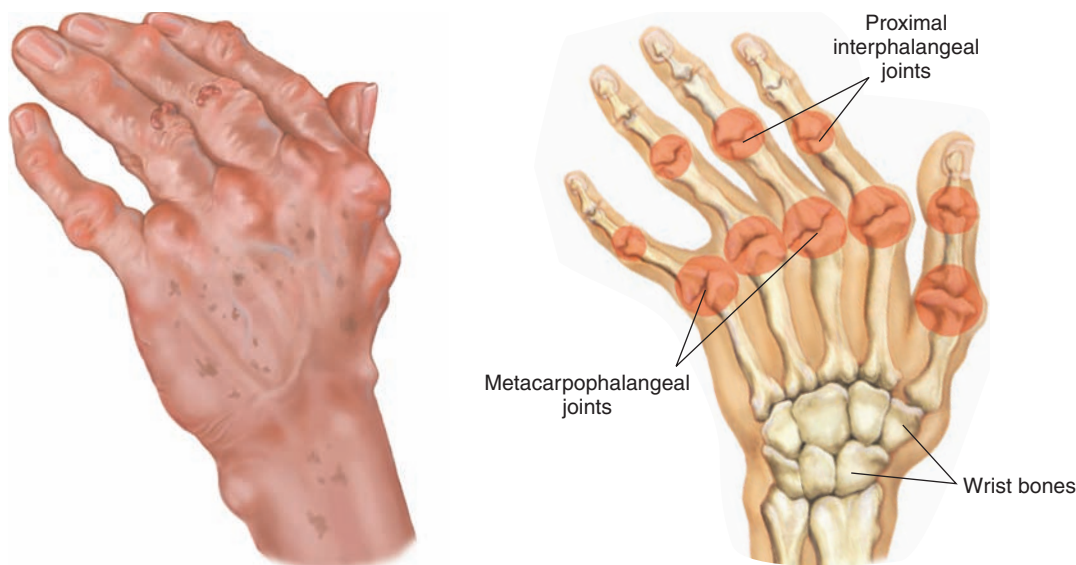


Figure 10-12. Rheumatoid arthritis.

Muscular Dystrophy

Muscular dystrophy, a genetic disease, is characterized by gradual **atrophy** and weakening of muscle tissue. There are several types of muscular dystrophy. The most common type, **Duchenne dystrophy**, affects children; boys more commonly than girls. It is transmitted as a sex-linked disease passed from mother to son. As muscular dystrophy progresses, the loss of muscle function affects not only skeletal muscle but also cardiac muscle. At present, there is no cure for this disease, and most children with muscular dystrophy die before age 30.

Myasthenia Gravis

Myasthenia gravis (MG), a neuromuscular disorder, causes fluctuating weakness of certain skeletal muscle groups (of the eyes, face and, sometimes, limbs). It is characterized by destruction of the receptors in the synaptic region that respond to acetylcholine, a substance that transmits nerve impulses (**neurotransmitter**). As the disease progresses, the muscle becomes increasingly weak and may eventually cease to function altogether. Women tend to be affected more often than men. Initial symptoms include a weakness of the eye muscles and difficulty swallowing (**dysphagia**). Later, the individual has difficulty chewing and talking. Eventually, the muscles of the limbs may become involved. Myasthenia gravis can be controlled, and medical management is the usual form of treatment.

Oncology

The two major types of malignancies that affect bone are those that arise directly from bone or bone tissue, called **primary bone cancer**, and those

that arise in another region of the body and spread (**metastasize**) to bone, called **secondary bone cancer**. Primary bone cancers are rare, but secondary bone cancers are quite prevalent. They are usually caused by malignant cells that have metastasized to the bone from the lungs, breast, or prostate.

Malignancies that originate from bone, fat, muscle, cartilage, bone marrow, and cells of the lymphatic system are called **sarcomas**. Three major types of sarcomas include fibrosarcoma, osteosarcoma, and Ewing sarcoma. **Fibrosarcoma** develops in cartilage and generally affects the pelvis, upper legs, and shoulders. Patients with fibrosarcoma are usually between ages 50 and 60. **Osteosarcoma** develops from bone tissue and generally affects the knees, upper arms, and upper legs. Patients with osteosarcoma are usually between ages 20 and 25. **Ewing sarcoma** develops from primitive nerve cells in bone marrow. It usually affects the shaft of long bones but may occur in the pelvis or other bones of the arms or legs. This disease usually affects young boys between ages 10 and 20.

Signs and symptoms of sarcoma include swelling and tenderness, with a tendency toward fractures in the affected area. Magnetic resonance imaging (MRI), bone scan, and computed tomography (CT) scan are diagnostic tests that assist in identifying bone malignancies. All malignancies, including Ewing sarcoma, are staged and graded to determine the extent and degree of malignancy. This staging helps the physician determine an appropriate treatment modality. Generally, combination therapy is used, including chemotherapy for management of metastasis and radiation when the tumor is radiosensitive. In some cases, amputation is required.

Diagnostic, Symptomatic, and Related Terms

This section introduces diagnostic, symptomatic, and related terms and their meanings. Word analyses for selected terms are also provided.

Term	Definition
ankylosis ǎng-kī-LŌ-sīs <i>ankyl</i> : stiffness, bent, crooked <i>-osis</i> : abnormal condition, increase (used primarily with blood cells)	Stiffening and immobility of a joint as a result of disease, trauma, surgery, or abnormal bone fusion
carpal tunnel syndrome (CTS) KĀR-pāl	Painful condition resulting from compression of the median nerve within the carpal tunnel (wrist canal through which the flexor tendons and the median nerve pass)

(continued)

Diagnostic, Symptomatic, and Related Terms—cont'd	
Term	Definition
claudication klāw-dī-KĀ-shŭn	Lameness, limping
contracture kōn-TRĀK-chūr	Fibrosis of connective tissue in the skin, fascia, muscle, or joint capsule that prevents normal mobility of the related tissue or joint
crepitation krĕp-ĭ-TĀ-shŭn	Dry, grating sound or sensation caused by bone ends rubbing together, indicating a fracture or joint destruction
electromyography ē-lĕk-trō-mī-ŌG-ră-fĕ <i>electr/o</i> : electric <i>my/o</i> : muscle <i>-graphy</i> : process of recording	Use of electrical stimulation to record the strength of muscle contraction
exacerbation ĕks-ăs-ĕr-BĀ-shŭn	Increase in severity of a disease or any of its symptoms
ganglion cyst GĀNG-lĕ-ōn SĪST	Tumor of tendon sheath or joint capsule, commonly found in the wrist <i>To treat a ganglion cyst, the cyst is aspirated and injected with an anti-inflammatory agent.</i>
hemarthrosis hĕm-ār-THRŌ-sĭs <i>hem</i> : blood <i>arthr</i> : joint <i>-osis</i> : abnormal condition; increase (used primarily with blood cells)	Effusion of blood into a joint cavity
hypotonia hī-pō-TŌ-nĕ-ă <i>hypo-</i> : under, below, deficient <i>ton</i> : tension <i>-ia</i> : condition	Loss of muscular tone or a diminished resistance to passive stretching
multiple myeloma mī-ĕ-LŌ-mă <i>myel</i> : bone marrow; spinal cord <i>-oma</i> : tumor	Primary malignant tumor that infiltrates the bone and red bone marrow <i>Multiple myeloma is a progressive, typically fatal disease that causes multiple tumor masses and bone fractures.</i>
osteophyte ŌS-tĕ-ō-fit	Bony outgrowth that occasionally develops on the vertebra and may exert pressure on the spinal cord also called <i>bone spur</i> .
phantom limb FĀN-tŭm	Perceived sensation, following amputation of a limb, that the limb still exists <i>The sensation that pain exists in the removed part is known as phantom limb pain.</i>
prosthesis prōs-THĒ-sĭs	Replacement of a missing part by an artificial substitute, such as an artificial extremity
rickets RĪK-ĕts	Form of osteomalacia in children caused by vitamin D deficiency; also called <i>rachitis</i>

Diagnostic, Symptomatic, and Related Terms—cont'd

Term	Definition
sequestrum sē-KWĒS-trūm <i>sequestr.</i> : separation <i>-um.</i> : structure, thing	Fragment of necrosed bone that has become separated from surrounding tissue
spondylolisthesis spōn-dī-lō-līs-THĒ-sīs <i>spondyl/o.</i> : vertebrae (backbone) <i>-listhesis</i> : slipping	Any slipping (subluxation) of a vertebra from its normal position in relationship to the one beneath it
spondylosis spōn-dī-LŌ-sīs <i>spondyl.</i> : vertebrae (backbone) <i>-osis</i> : abnormal condition; increase (used primarily with blood cells)	Degeneration of the cervical, thoracic, and lumbar vertebrae and related tissues <i>Spondylosis may cause pressure on nerve roots with subsequent pain or paresthesia in the extremities.</i>
sprain sprān	Tearing of ligament tissue that may be slight, moderate, or complete <i>A complete tear of a major ligament is especially painful and disabling. Ligamentous tissue does not heal well because of poor blood supply. Treatment usually consists of surgical reconstruction of the severed ligament.</i>
strain strān	To exert physical force in a manner that may result in injury, usually muscular
subluxation sūb-lūk-SĀ-shūn	Partial or incomplete dislocation
talipes equinovarus TĀL-ī-pēz ē-kwī-nō-VĀ-rūs	Congenital deformity of one or both feet in which the foot is pulled downward and laterally to the side; also called <i>clubfoot</i> (See Figure 10–13.) <i>In talipes, the heel never rests on the ground. Treatment consists of applying casts to progressively straighten the foot and surgical correction for severe cases.</i>



Figure 10-13. Talipes equinovarus.



It is time to review pathological, diagnostic, symptomatic, and related terms by completing Learning Activity 10–5.

Diagnostic and Therapeutic Procedures

This section introduces procedures used to diagnose and treat musculoskeletal disorders. Descriptions are provided as well as pronunciations and word analyses for selected terms.

Procedure	Description
Diagnostic Procedures	
Radiographic	
arthrography ăR-THRŌG-ră-fē <i>arthr/o:</i> joint <i>-graphy:</i> process of recording	Series of radiographs taken after injection of contrast material into a joint cavity, especially the knee or shoulder, to outline the contour of the joint
bone density tests	Radiographic procedures that use low-energy x-ray absorption to measure bone mineral density (BMD) <i>Bone density tests are used to determine if demineralization from osteoporosis has occurred. The areas of decreased density indicate osteopenia and osteoporosis. There are two types of bone density tests, dual-energy x-ray absorptiometry (DEXA or DXA) scan, also known as bone densitometry, and computed tomography (CT).</i>
computed tomography (CT) kŏm-PŪ-tĕd tŏ-MŌG-ră-fē <i>tom/o:</i> to cut <i>-graphy:</i> process of recording	Imaging technique that uses an x-ray beam and a computer to make a series of cross-sectional images of a body part, which together make up a three-dimensional view of the area scanned; formerly called <i>computerized axial tomography (CAT)</i> <i>The CT scan identifies various types of tissue abnormalities, but bony structures appear particularly clear. Thus, CT scan is one of the most sensitive studies for early detection of joint disease.</i>
discography dĭs-KŌG-ră-fē	Radiological examination of the intervertebral disk structures by injecting a contrast medium <i>Discography is used to diagnose suspected cases of herniated disk.</i>
lumbosacral spinal radiography LŪM-bŏ-sā-krăl SPĪ-năl rā-dē-ŌG-ră-fē <i>lumb/o:</i> loins (lower back) <i>sacr:</i> sacrum <i>-al:</i> pertaining to, relating to <i>radi/o:</i> radiation, x-ray, radius (lower arm bone on thumb side) <i>-graphy:</i> process of recording	Radiography of the five lumbar vertebrae and the fused sacral vertebrae, including anteroposterior, lateral, and oblique views of the lower spine <i>The most common indication for lumbosacral (LS) spinal radiography is lower back pain. It is used to identify or differentiate traumatic fractures, spondylosis, spondylolisthesis, and metastatic tumor.</i>
myelography mĭ-ĕ-LŌG-ră-fē <i>myel/o:</i> bone marrow, spinal cord <i>-graphy:</i> process of recording	Radiography of the spinal cord after injection of a contrast medium to identify and study spinal distortions caused by tumors, cysts, herniated intervertebral disks, or other lesions
scintigraphy sĭn-TĪG-ră-fē	Nuclear medicine procedure that visualizes various tissues and organs after administration of a radionuclide <i>After absorption of the radioactive substance, a scanner detects the radioactive tracer and makes a photographic recording (scintigram) of radionuclide distribution using a gamma camera to detect areas of uptake, called hotspots.</i>

Diagnostic and Therapeutic Procedures—cont'd

Procedure	Description
bone	<p>Scintigraphy procedure in which radionuclide is injected intravenously and taken up into the bone</p> <p><i>Bone scintigraphy is used to detect bone disorders, especially arthritis, fractures, osteomyelitis, bone cancers, or areas of bony metastases. Areas of increased uptake (hot spots) are abnormal and may be infection or cancer.</i></p>
Therapeutic Procedures	
reduction	<p>Procedure that restores a bone to its normal position</p> <p><i>Following reduction, the bone is immobilized with an external device to maintain proper alignment during the healing process.</i></p>
closed	Reduction procedure where fractured bones are realigned by manipulation rather than surgery.
open	<p>Reduction procedure that treats bone fractures by placing the bones in their proper position using surgery</p> <p><i>In open reduction of a complicated fracture, an incision is made at the fracture site and the fracture is reduced. Often internal fixation devices such as nails, screws, or plates are required to fix the fracture fragments in their correct anatomical position.</i></p>
casting	Application of a solid, stiff dressing formed with plaster of Paris or other material to a body part to immobilize it during the healing process
splinting	<p>Application of an orthopedic device to an injured body part for immobilization, stabilization, and protection during the healing process</p> <p><i>A splint is constructed from wood, metal, or plaster of Paris and may be moveable or immovable.</i></p>
traction	Use of weights and pulleys to align or immobilize a fracture and facilitate the healing process
Surgical	
amputation ăm-pŭ-TĀ-shŭn	<p>Partial or complete removal of an extremity due to trauma or circulatory disease</p> <p><i>After the extremity is removed, the surgeon cuts a shaped flap from muscle and cutaneous tissue to cover the end of the bone and provide cushion and support for a prosthesis. The most common reason for limb loss is peripheral vascular disease caused by a blood flow blockage from cigarette smoking, physical inactivity, or uncontrolled diabetes mellitus.</i></p>
arthrocentesis ăr-thrō-sĕn-TĒ-sĭs arthr/o: joint -centesis: surgical puncture	Puncture of a joint space using a needle to remove accumulated fluid
arthroclasia ăr-thrō-KLĀ-zĕ-ă arthr/o: joint -clasia: to break; surgical fracture	Surgical breaking of an ankylosed joint to provide movement

(continued)

Diagnostic and Therapeutic Procedures—cont'd

Procedure	Description
<p>arthroscopy ăR-THRŌS-kō-pē <i>arthr/o:</i> joint <i>-scopy:</i> visual examination</p>	<p>Visual examination of the interior of a joint and its structures using a thin, flexible fiberoptic scope called an <i>arthroscope</i> that contains a magnifying lens, fiberoptic light, and miniature camera that projects images on a monitor (See Figure 10-14.)</p> <p><i>Instruments are introduced into the joint space through a small incision in order to carry out diagnostic and treatment procedures. Arthroscopy is also performed to correct defects, excise tumors, and obtain biopsies.</i></p>
<p>Figure 10-14. Arthroscopy.</p>	
<p>bone grafting BŌN GRĀFT-īng</p>	<p>Implanting or transplanting bone tissue from another part of the body or from another person to serve as replacement for damaged or missing bone tissue</p>
<p>bursectomy bĕr-SĔK-tō-mē</p>	<p>Excision of bursa (padlike sac or cavity found in connective tissue, usually in the vicinity of joints)</p>
<p>laminectomy lām-ī-NĔK-tō-mē <i>lamin:</i> lamina (part of vertebral arch) <i>-ectomy:</i> excision, removal</p>	<p>Excision of the posterior arch of a vertebra</p> <p><i>Laminectomy is most commonly performed to relieve the symptoms of a ruptured intervertebral (slipped) disk.</i></p>
<p>revision surgery</p> <p>bone</p>	<p>Surgery repeated to correct problems of a previously unsuccessful surgery or to replace a worn out prosthesis</p> <p><i>Revision surgery is usually more complicated than the original surgery.</i></p> <p>Revision surgery are often required to correct bone infection, misalignments of bones, broken prosthesis, and fractures of the bone around the prostheses.</p>

Diagnostic and Therapeutic Procedures—cont'd

Procedure	Description
sequestrectomy sē-kwēs-TRĔK-tō-mē <i>sequestr</i> : separation <i>-ectomy</i> : excision, removal	Excision of a sequestrum (segment of necrosed bone)
synovectomy sīn-ō-VĔK-tō-mē <i>synov</i> : synovial membrane, synovial fluid <i>-ectomy</i> : excision, removal	Excision of a synovial membrane
total hip replacement	Surgical procedure to replace a hip joint damaged by a degenerative disease, commonly arthritis (See Figure 10-15.) <i>In a total hip replacement (THR), the femoral head and the acetabulum are replaced with a metal ball and stem (prosthesis). The acetabulum is plastic coated to avoid metal-to-metal contact on articulating surfaces; the stem is anchored into the central core of the femur to achieve a secure fit.</i>

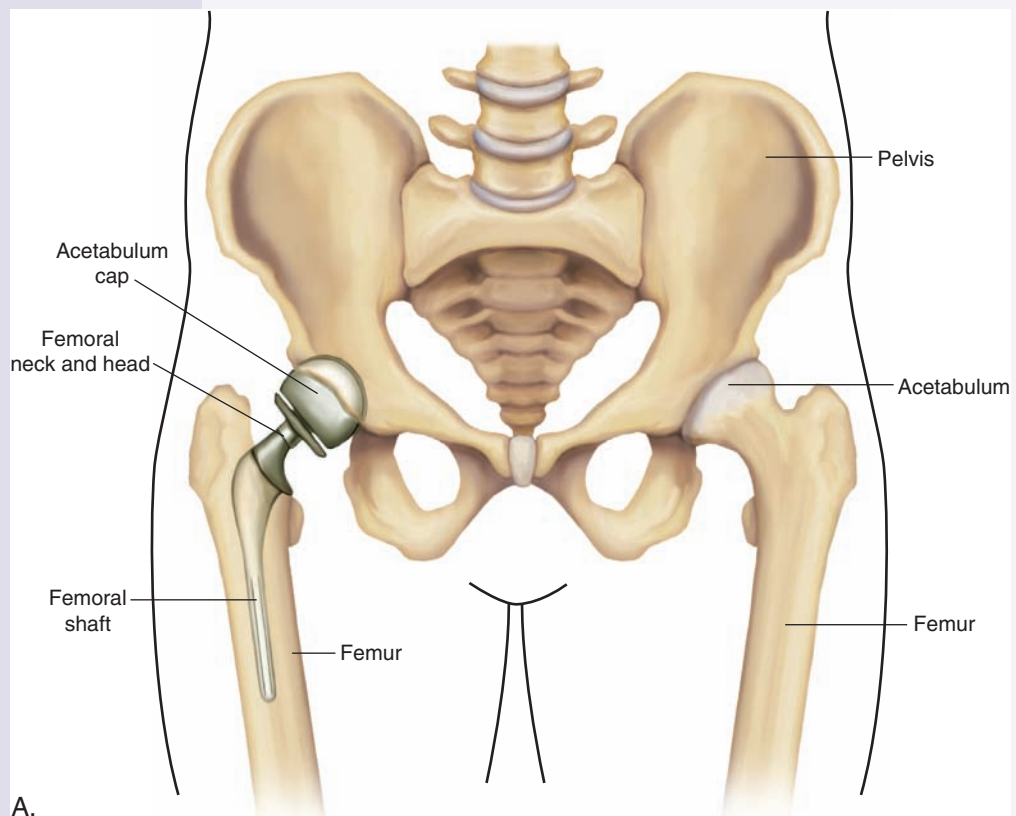


Figure 10-15. Total hip replacement. (A) Right total hip replacement. (B) Radiograph showing total hip replacement of arthritic hip. From McKinnis: *Fundamentals of Musculoskeletal Imaging*, 2nd. Ed. FA Davis, Philadelphia, 2005, p. 314, with permission.

(continued)

Diagnostic and Therapeutic Procedures—cont'd

Procedure

Description



Figure 10-15 cont'd

Pharmacology

Unlike other medications that treat specific disease, most pharmacological agents for musculoskeletal disorders are used to treat symptoms. (See Table 10-3.) Acute musculoskeletal conditions, such as strains, sprains, and “pulled” muscles, are treated with analgesics and anti-inflammatory

drugs. Nonsteroidal anti-inflammatory drugs (NSAIDs), salicylates, muscle relaxants, opioid analgesics, or narcotics are commonly used to treat pain by anesthetizing (numbing) the area or decreasing the inflammation. NSAIDs and salicylates are also used to treat arthritis, in addition to gold salts. Calcium supplements are used to treat hypocalcemia.

Table 10-3 Drugs Used to Treat Musculoskeletal Disorders

This table lists common drug classifications used to treat musculoskeletal disorders, their therapeutic actions, and selected generic and trade names.

Classification	Therapeutic Action	Generic and Trade Names
calcium supplements	Treat and prevent hypocalcemia. <i>Over-the-counter calcium supplements are numerous and are contained in many antacids as a secondary therapeutic effect. They are used to prevent osteoporosis when normal diet is lacking adequate amounts of calcium.</i>	calcium carbonate KĀL-sē-ŭm KĀR-bŏn-āt Calci-Mix, Tums calcium citrate KĀL-sē-ŭm SĪT-rāt Cal-Citrate 250, Citracal

Table 10-3 Drugs Used to Treat Musculoskeletal Disorders—cont'd

Classification	Therapeutic Action	Generic and Trade Names
gold salts	Treat rheumatoid arthritis by inhibiting activity within the immune system. <i>Gold salts contain actual gold in capsules or in solution for injection. This agent prevents further disease progression but cannot reverse past damage.</i>	auranofin aw-RĀN-ō-fĭn Ridaura aurothioglucose aw-rō-thī-ō-GLOO-kōs Solganal
nonsteroidal anti-inflammatory drugs	Decrease pain and suppress inflammation <i>Nonsteroidal anti-inflammatory drugs (NSAIDs) are used to treat acute musculoskeletal conditions, such as sprains and strains, and inflammatory disorders, including rheumatoid arthritis, osteoarthritis, bursitis, gout, and tendinitis.</i>	ibuprofen ī-bū-PRŌ-fĕn Advil, Motrin naproxen nā-PRŌK-sĕn Aleve, Naprosyn
salicylates	Relieve mild to moderate pain and reduce inflammation <i>Salicylates have anti-inflammatory abilities and alleviate pain. Aspirin (acetylsalicylic acid) is the oldest drug in this classification that is used to treat arthritis.</i>	aspirin ĀS-pĕr-ĭn Acuprin, Aspergum, Bayer Aspirin magnesium salicylate māg-NĒ-zē-ŭm sā-LĪS-ĭ-lāt Magan, Mobidin
skeletal muscle relaxants	Relieve muscle spasms and stiffness <i>These drugs are also prescribed for muscle spasms due to multiple sclerosis, spinal cord injury, cerebral palsy, and stroke.</i>	cyclobenzaprine sī-klō-BĒN-zā-prĕn Flexeril methocarbamol and aspirin mĕth-ō-KĀR-bā-mōl Robaxin

Abbreviations

This section introduces musculoskeletal-related abbreviations and their meanings.

Abbreviation	Meaning	Abbreviation	Meaning
ACL	anterior cruciate ligament	Ca	calcium; cancer
AE	above the elbow	CDH	congenital dislocation of the hip
AK	above the knee	CTS	carpal tunnel syndrome
BE	barium enema; below the elbow	CT	computed tomography
BK	below the knee	DEXA, DXA	dual energy x-ray absorptiometry
C1, C2, and so on	first cervical vertebra, second cervical vertebra, and so on	DJD	degenerative joint disease

(continued)

Abbreviations—cont'd			
Abbreviation	Meaning	Abbreviation	Meaning
EMG	electromyography	MS	musculoskeletal; multiple sclerosis; mental status; mitral stenosis
Fx	fracture	NSAIDs	nonsteroidal anti-inflammatory drugs
MG	myasthenia gravis	ORTH, ortho	orthopedics
HD	hemodialysis; hip disarticulation; hearing distance	P	phosphorus; pulse
HNP	herniated nucleus pulposus (herniated disk)	PCL	posterior cruciate ligament
HP	hemipelvectomy	RA	rheumatoid arthritis; right atrium
IS	intracostal space	RF	rheumatoid factor; radio frequency
IM	intramuscular; infectious mononucleosis	ROM	range of motion
IV	intravenous	SD	shoulder disarticulation
KD	knee disarticulation	THA	total hip arthroplasty
L1, L2, and so on	first lumbar vertebra, second lumbar vertebra, and so on	THR	total hip replacement
LS	lumbosacral spine	TKA	total knee arthroplasty
MG	myasthenia gravis	TKR	total knee replacement
MRI	magnetic resonance imaging	TRAM	transverse rectus abdominis muscle



It is time to review procedures, pharmacology, and abbreviations by completing Learning Activity 10–6.

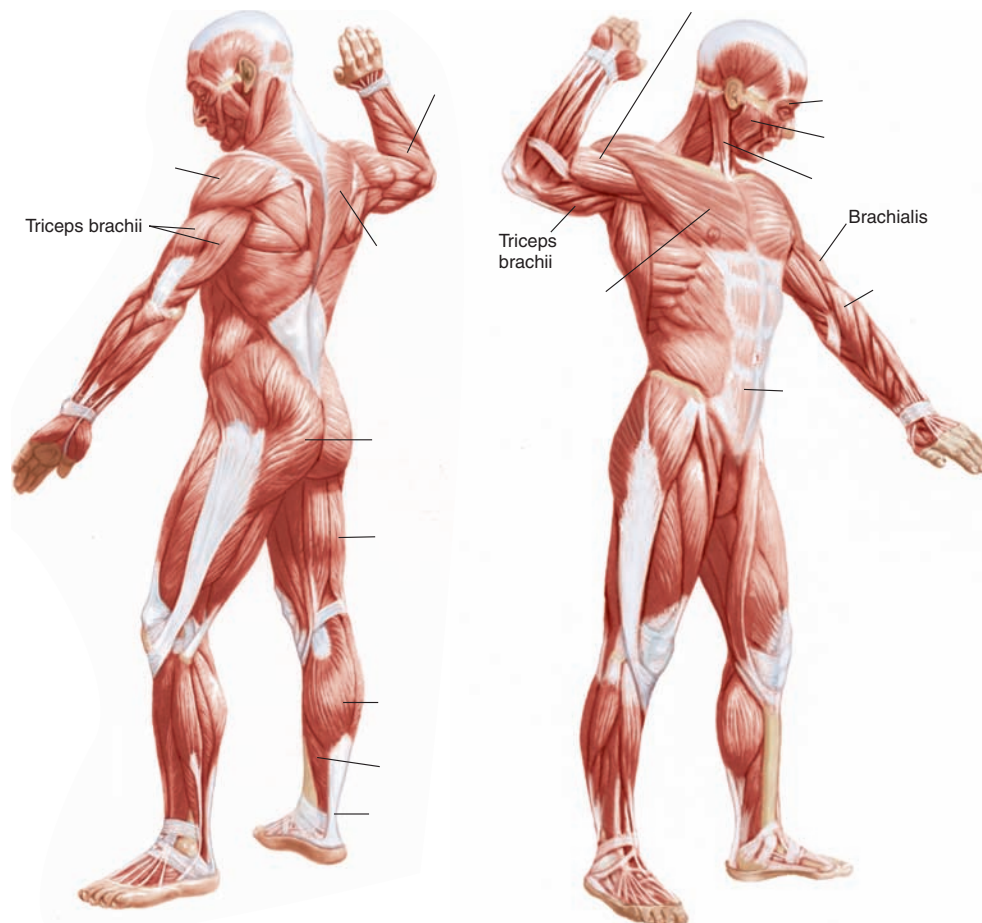
LEARNING ACTIVITIES

The following activities provide review of the musculoskeletal system terms introduced in this chapter. Complete each activity and review your answers to evaluate your understanding of the chapter.

Learning Activity 10-1

Identifying Muscle Structures

Label the following illustration using the terms listed below.



<i>Achilles tendon</i>	<i>gastrocnemius</i>	<i>rectus abdominus</i>
<i>biceps brachii</i>	<i>gluteus maximus</i>	<i>soleus</i>
<i>biceps femoris</i>	<i>masseter</i>	<i>sternocleidomastoid</i>
<i>brachioradialis</i>	<i>orbicularis oculi</i>	<i>trapezius</i>
<i>deltoid</i>	<i>pectoralis major</i>	



Check your answers by referring to Figure 10–1 on page 267. Review material that you did not answer correctly.

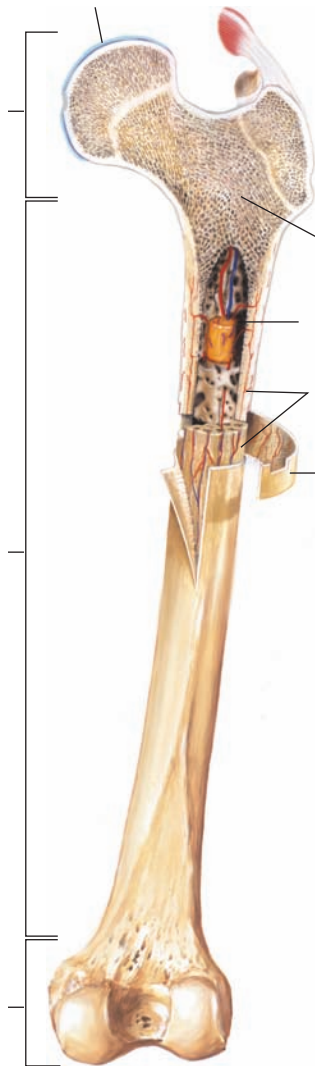
Learning Activity 10-2**Identifying Sections of a Typical Long Bone (Femur)**

Label the following illustration using the terms listed below.

articular cartilage distal epiphysis proximal epiphysis

compact bone medullary cavity spongy bone

diaphysis periosteum



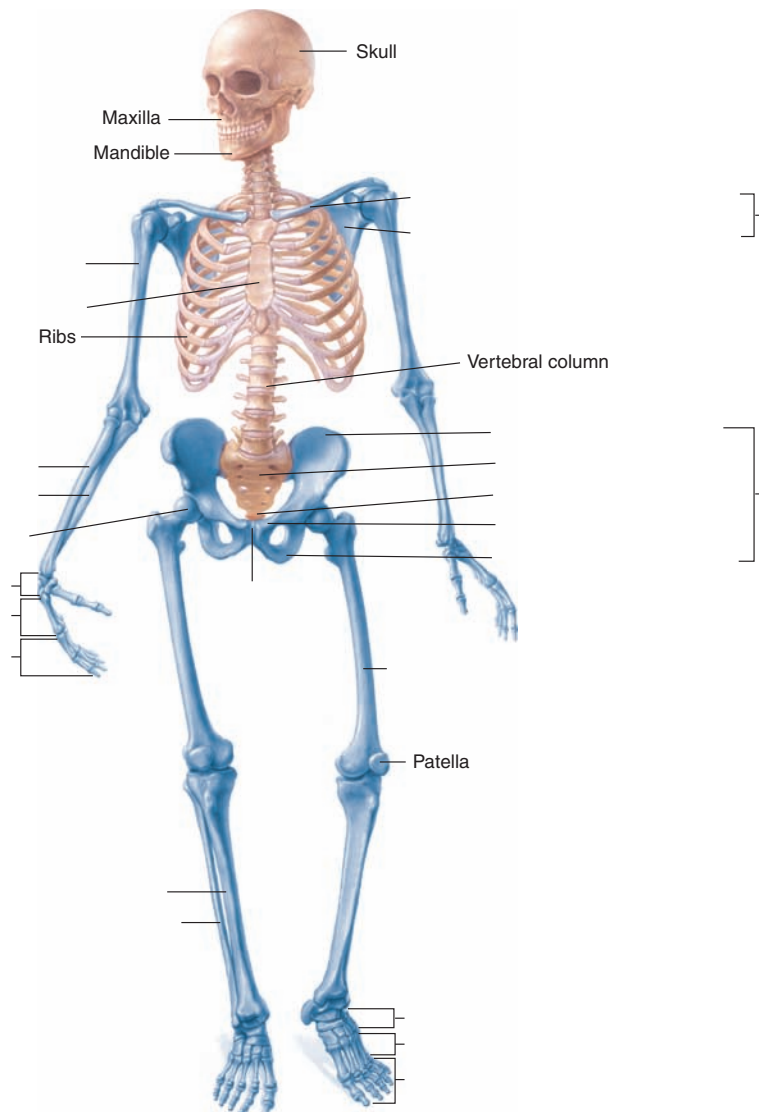
Check your answers by referring to Figure 10–3 on page 270. Review material that you did not answer correctly.

Learning Activity 10-3

Identifying Skeletal Structures

Label the following illustration using the terms listed below.

acetabulum	fibula	metatarsals	radius	tarsals
carpals	humerus	pectoral girdle	sacrum	tibia
clavicle	ilium	pelvic girdle	scapula	ulna
coccyx	ischium	phalanges	sternum	
femur	metacarpals	pubis	symphysis pubis	



Check your answers by referring to Figure 10-4 on page 272. Review material that you did not answer correctly.



[DavisPlus.fadavis.com](http://www.davisplus.fadavis.com)

Enhance your study and reinforcement of word elements with the power of DavisPlus. Visit www.davisplus.fadavis.com/gylys/systems for this chapter's flash-card activity. We recommend you complete the flash-card activity before completing activity 10-4 below.

Learning Activity 10-4

Building Medical Words

Use *oste/o* (bone) to build words that mean:

1. bone cells _____
2. pain in bones _____
3. disease of bones and joints _____
4. beginning or formation of bones _____

Use *cervic/o* (neck) to build words that mean:

5. pertaining to the neck _____
6. pertaining to the neck and arm _____
7. pertaining to the neck and face _____

Use *myel/o* (bone marrow; spinal cord) to build words that mean:

8. tumor of bone marrow _____
9. sarcoma of bone marrow (cells) _____
10. bone marrow cell _____
11. resembling bone marrow _____

Use *stern/o* (sternum) to build words that mean:

12. pertaining to above the sternum _____
13. resembling the breastbone _____

Use *arthr/o* (joint) or *chondr/o* (cartilage) to build words that mean:

14. embryonic cell that forms cartilage _____
15. inflammation of a joint _____
16. inflammation of bones and joints _____

Use *pelv/i* (pelvis) to build a word that means:

17. instrument for measuring the pelvis _____

Use *my/o* (muscle) to build words that mean:

18. twitching of a muscle _____
19. any disease of muscle _____
20. rupture of a muscle _____

Build surgical words that mean:

21. excision of one or more of the phalanges (bones of a finger or toe) _____
22. incision of the thorax (chest wall) _____
23. excision of a vertebra _____
24. binding of a joint _____
25. repair of muscle (tissue) _____



Check your answers in Appendix A. Review material that you did not answer correctly.

Correct Answers _____ × 4 = _____ % Score

Learning Activity 10-5

Matching Pathological, Diagnostic, Symptomatic, and Related Terms

Match the following terms with the definitions in the numbered list.

<i>ankylosis</i>	<i>ganglion cyst</i>	<i>kyphosis</i>	<i>phantom limb</i>	<i>sequestrum</i>
<i>chondrosarcoma</i>	<i>gout</i>	<i>muscular dystrophy</i>	<i>prosthesis</i>	<i>spondylitis</i>
<i>claudication</i>	<i>greenstick fracture</i>	<i>myasthenia gravis</i>	<i>pyogenic</i>	<i>spondylolisthesis</i>
<i>comminuted fracture</i>	<i>hematopoiesis</i>	<i>necrosis</i>	<i>rickets</i>	<i>subluxation</i>
<i>Ewing sarcoma</i>	<i>hypotonia</i>	<i>osteoporosis</i>	<i>scoliosis</i>	<i>talipes</i>

1. _____ incomplete or partial dislocation
2. _____ softening of the bones caused by vitamin D deficiency
3. _____ slipped vertebrae
4. _____ limping
5. _____ disease causing degeneration of muscles
6. _____ congenital deformity of the foot, which is twisted out of shape or position
7. _____ part of dead or necrosed bone that has become separated from surrounding tissue
8. _____ chronic neuromuscular disorder characterized by weakness manifested in ocular muscles
9. _____ artificial part used for replacement of a missing limb
10. _____ tendon sheath or joint capsule tumor; commonly found in the wrist
11. _____ loss of muscular tonicity; diminished resistance of muscles to passive stretching
12. _____ type of sarcoma that attacks the shafts rather than the ends of long bones
13. _____ bone that is partially bent and partially broken; occurs in children
14. _____ exaggeration of the thoracic curve of the vertebral column; hunchback
15. _____ disease caused by a decrease in bone density; occurs in the elderly
16. _____ deviation of the spine to the right or left
17. _____ cartilaginous sarcoma
18. _____ describes a bone that has splintered into pieces
19. _____ inflammation of the vertebrae
20. _____ metabolic disease caused by accumulation of uric acid, usually in the big toe
21. _____ development and production of blood cells, normally in the bone marrow
22. _____ formation of pus
23. _____ death of cells, tissues, or organs
24. _____ stiffening and immobility of a joint
25. _____ perceived sensation, following amputation, that the limb still exists



Check your answers in Appendix A. Review material that you did not answer correctly.

Correct Answers _____ × 4 = _____ % Score

Learning Activity 10-6

Matching Procedures, Pharmacology, and Abbreviations

Match the following terms with the definitions in the numbered list.

ACL	closed reduction	myelography
amputation	CTS	open reduction
arthrodesis	gold salts	relaxants
arthrography	HNP	salicylates
arthroscopy	laminectomy	sequestrectomy

1. _____ radiograph of spinal cord after injection of a contrast medium
2. _____ treatment of bone fractures by use of surgery to place bones in normal position
3. _____ used to treat rheumatoid arthritis by inhibiting activity with the immune system
4. _____ painful disorder of the wrist and hand due to compression of the median nerve as it passes through the carpal tunnel
5. _____ excision of the posterior arch of a vertebra
6. _____ series of joint radiographs preceded by injection of a radiopaque substance or air into the joint cavity
7. _____ surgical binding or immobilizing of a joint
8. _____ partial or complete removal of a limb
9. _____ herniated nucleus pulposus
10. _____ relieve mild to moderate pain and reduce inflammation
11. _____ visual examination of a joint's interior, especially the knee
12. _____ excising a segment of necrosed bone
13. _____ anterior cruciate ligament
14. _____ relieve muscle spasms and stiffness
15. _____ manipulative treatment of bone fractures by placing the bones in normal position without incision



Check your answers in Appendix A. Review any material that you did not answer correctly.

Correct Answers _____ $\times 6.67 =$ _____ % Score

MEDICAL RECORD ACTIVITIES

The two medical records included in the activities that follow use common clinical scenarios to show how medical terminology is used to document patient care. Complete the terminology and analysis sections for each activity to help you recognize and understand terms related to the musculoskeletal system.

Medical Record Activity 10-1

Operative Report: Right Knee Arthroscopy and Medial Meniscectomy

Terminology

Terms listed below come from the medical record *Operative Report: Right Knee Arthroscopy and Medial Meniscectomy* that follows. Use a medical dictionary such as *Taber's Cyclopedic Medical Dictionary*, the appendices of this book, or other resources to define each term. Then review the pronunciations for each term and practice by reading the medical record aloud.

Term	Definition
ACL	
arthroscopy ă-r-THRŌS-kō-pē	
effusions ĕ-FŪ-zhŭnz	
intracondylar ĭn-tră-KŌN-dĭ-lăr	
Lachman test	
McMurray sign test	
meniscectomy mĕn-ĭ-SĔK-tō-mē	
MRI	
PCL	
synovitis sĭn-ŏ-VĪ-tĭs	



Listen and Learn Online! *will help you master the pronunciation of selected medical words from this medical record activity. Visit www.davisplus.com/gyls/systems to find instructions on completing the Listen and Learn Online! exercise for this section and to practice pronunciations.*

OPERATIVE REPORT: RIGHT KNEE ARTHROSCOPY AND MEDIAL MENISCECTOMY

General Hospital

1511 Ninth Avenue ■■ Sun City, USA 12345 ■■ (555) 8022-1887

OPERATIVE REPORT

Date: August 14, 20xx

Physician: Robert L. Mead, MD

Patient: Jay, Elizabeth

Patient ID#: 20798

PREOPERATIVE DIAGNOSIS: Tear, medial meniscus, right knee.

POSTOPERATIVE DIAGNOSIS: Tear, medial meniscus, right knee.

CLINICAL HISTORY: This 42-year-old woman has jogged for the past 10 years, an average of 25 miles each week. She has persistent posteromedial right knee pain with occasional effusions. The patient has MRI-documented medial meniscal tear.

PROCEDURE: Right knee arthroscopy and medial meniscectomy.

ANESTHESIA: General.

COMPLICATIONS: None.

OPERATIVE SUMMARY: Examination of the knee under anesthesia showed a full range of motion, no effusion, no instability, and negative Lachman and negative McMurray sign tests. Arthroscopic evaluation showed a normal patellofemoral groove and normal intracondylar notch with normal ACL and PCL, some anterior synovitis, and a normal lateral meniscus and lateral compartment to the knee. The medial compartment of the knee showed an inferior surface, posterior and mid-medial meniscal tear that was flipped up on top of itself. This was resected, and then the remaining meniscus contoured back to a stable rim. A sterile dressing was applied.

Patient was taken to the post anesthesia care unit in stable condition.

Robert L. Mead, MD
Robert L. Mead, MD

rlm:bg

D: 8-14-20xx

T: 8-14-20xx

Analysis

Review the medical record *Operative report: Right knee arthroscopy and medial meniscectomy* to answer the following questions.

1. Describe the meniscus and identify its location.

2. What is the probable cause of the tear in the patient's meniscus?

3. What does normal ACL and PCL refer to in the report?

4. Explain the McMurray sign test.

5. Because Lachman and McMurray tests were negative (normal), why was the surgery performed?

Medical Record Activity 10-2

Radiographic Consultation: Tibial Diaphysis Nuclear Scan

Terminology

Terms listed below come from the medical record *Radiographic Consultation: Tibial Diaphysis Nuclear Scan*. Use a medical dictionary such as *Taber's Cyclopedic Medical Dictionary*, the appendices of this book, or other resources to define each term. Then review the pronunciations for each term and practice by reading the medical record aloud.

Term	Definition
buttressing BŪ-trēs-īng	
cortical KOR-tī-kāl	
diaphysis dī-ĀF-ī-sīs	
endosteal ĕn-DŌS-tē-āl	
focal FŌ-kāl	
fusiform FŪ-zī-form	
NSAIDs	
nuclear scan NŪ-klē-ār	
periosteal pĕr-ē-ŌS-tē-āl	
resorption rē-SORP-shŭn	
tibial TĪB-ē-āl	



Listen and Learn Online! will help you master the pronunciation of selected medical words from this medical record activity. Visit www.davisplus.com/gyls/systems to find instructions on completing the Listen and Learn Online! exercise for this section and to practice pronunciations.

RADIOGRAPHIC CONSULTATION: TIBIAL DIAPHYSIS NUCLEAR SCAN

Physician Center

2422 Rodeo Drive ■■ Sun City, USA 12345 ■■ (555)333-2427

September 3, 20xx

Grant Hammuda, MD
1115 Forest Ave
Sun City, USA 12345

Dear Doctor Hammuda:

We are pleased to provide the following in response to your request for consultation.

This is an 18-year-old male cross-country runner. He complains of pain of more than 1 month's duration, with persistent symptoms over middle one third of left tibia with resting. He finds no relief with NSAIDs.

FINDINGS: Nuclear scan reveals the following: There is focal increased blood flow, blood pool, and delayed radiotracer accumulation within the left mid posterior tibial diaphysis. The delayed spot planar images demonstrate focal fusiform uptake involving 50% to 75% of the tibial diaphysis width.

It is our opinion that with continued excessive, repetitive stress, the rate of resorption will exceed the rate of bone replacement. This will lead to weakened cortical bone with buttressing by periosteal and endosteal new bone deposition. If resorption continues to exceed replacement, a stress fracture will occur.

Please let me know if I can be of any further assistance.

Sincerely yours,

Adrian Jones, MD
Adrian Jones, MD

aj:bg

Analysis

Review the medical record *Radiographic Consultation: Tibial Diaphysis Nuclear Scan* to answer the following questions.

1. Where was the pain located?

2. What medication was the patient taking for pain and did it provide relief?

3. How was the blood flow to the affected area described by the radiologist?

4. How was the radiotracer accumulation described?

5. What will be the probable outcome with continued excessive repetitive stress?

6. What will happen if resorption continues to exceed replacement?
