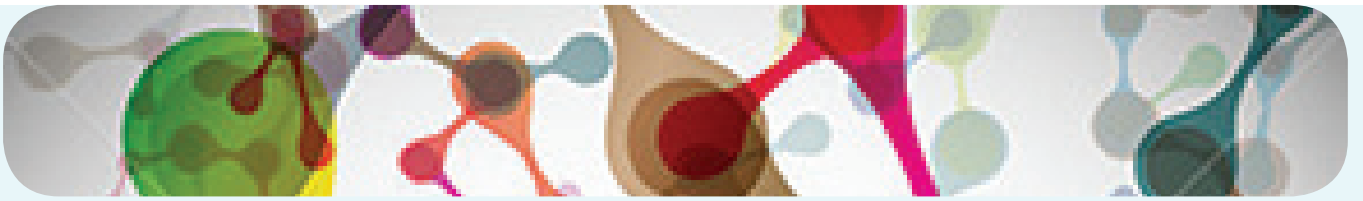
4

Musculoskeletal System

Learning Objectives

Upon completion of this chapter, you will be able to

- Identify and define the combining forms, prefixes, and suffixes introduced in this chapter.
- Correctly spell and pronounce medical terms and major anatomical structures relating to the musculoskeletal system.
- Locate and describe the major organs of the musculoskeletal system and their functions.
- Correctly place bones in either the axial or the appendicular skeleton.
- List and describe the components of a long bone.
- Identify bony projections and depressions.
- Identify the parts of a synovial joint.
- Describe the characteristics of the three types of muscle tissue.
- Use movement terminology correctly.
- Identify and define musculoskeletal system anatomical terms.
- Identify and define selected musculoskeletal system pathology terms.
- Identify and define selected musculoskeletal system diagnostic procedures.
- Identify and define selected musculoskeletal system therapeutic procedures.
- Identify and define selected medications relating to the musculoskeletal system.
- Define selected abbreviations associated with the musculoskeletal system.



Section I: Skeletal System at a Glance

Function

The skeletal system consists of 206 bones that make up the internal framework of the body, called the skeleton. The skeleton supports the body, protects internal organs, serves as a point of attachment for skeletal muscles for body movement, produces blood cells, and stores minerals.

Organs

Here are the primary structures that comprise the skeletal system:

bones **joints**

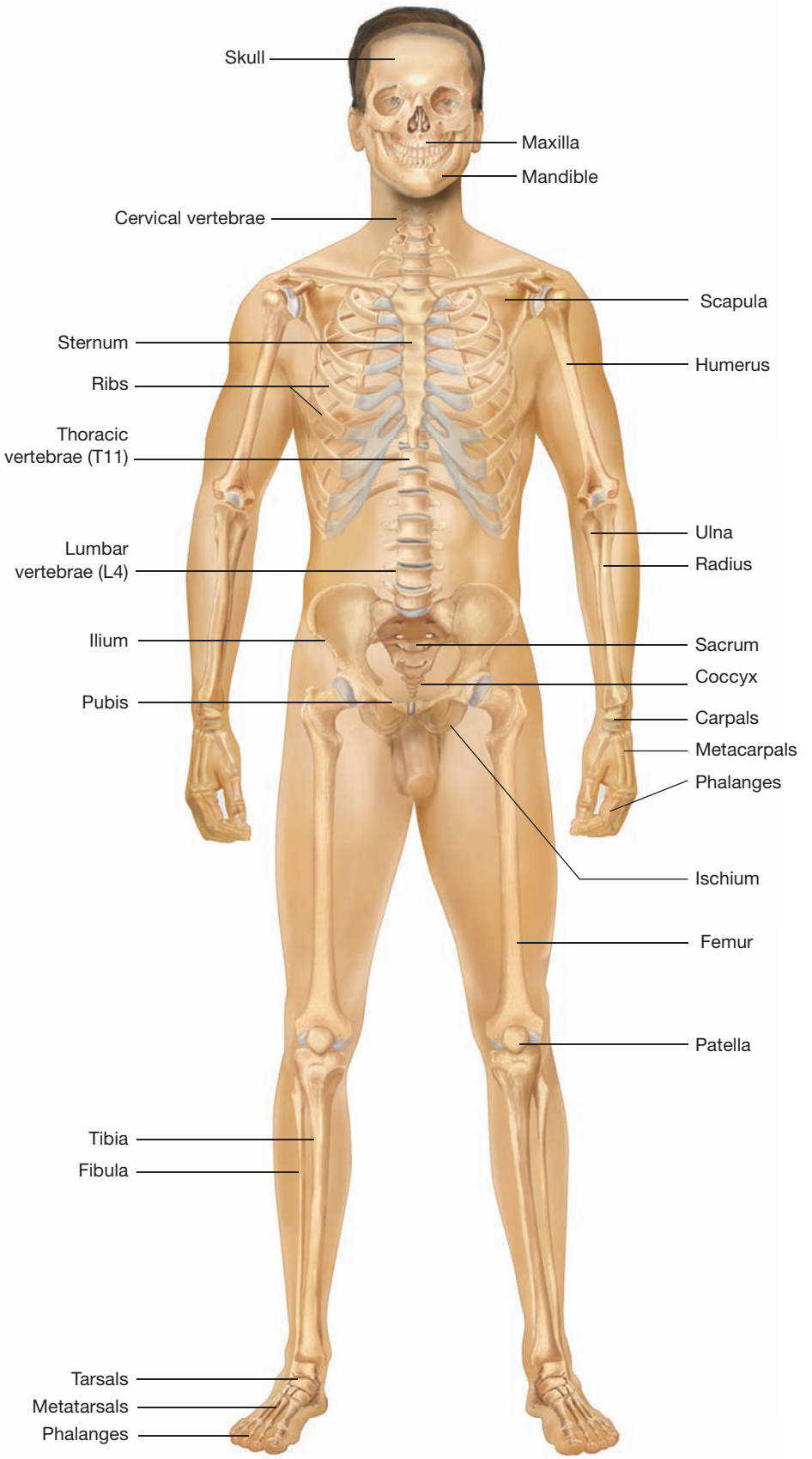
Word Parts

Here are the most common word parts (with their meanings) used to build skeletal system terms. For a more comprehensive list, refer to the Terminology section of this chapter.

Combining Forms

ankyl/o	stiff joint
arthr/o	joint
articul/o	joint
burs/o	sac
carp/o	wrist
cervic/o	neck
chondr/o	cartilage
clavicul/o	clavicle
coccyg/o	coccyx
cortic/o	outer layer
cost/o	rib
crani/o	skull
femor/o	femur
fibul/o	fibula
humer/o	humerus
ili/o	ilium
ischi/o	ischium
kyph/o	hump
lamin/o	lamina (part of vertebra)
lord/o	bent backward
lumb/o	loin (low back between ribs and pelvis)
mandibul/o	mandible
maxill/o	maxilla
medull/o	inner region
metacarp/o	metacarpals
metatars/o	metatarsals
myel/o	bone marrow, spinal cord
orth/o	straight
oste/o	bone
pector/o	chest
patell/o	patella
ped/o	child; foot
pelv/o	pelvis
phalang/o	phalanges
pod/o	foot
prosthet/o	addition
pub/o	pubis
radi/o	radius; ray (X-ray)
sacr/o	sacrum
scapul/o	scapula
scoli/o	crooked
spin/o	spine
spondyl/o	vertebrae
stern/o	sternum
synovi/o	synovial membrane
synov/o	synovial membrane
tars/o	tarsus (ankle)
thorac/o	chest
tibi/o	tibia
uln/o	ulna
vertebr/o	vertebra

Skeletal System Illustrated



Suffixes

-blast	immature	**-listhesis**	slipping
-clasia	to surgically break	**-logic**	pertaining to study of
-desis	to fuse	**-porosis**	porous

Prefixes

dis-	apart
non-	not

Anatomy and Physiology of the Skeletal System

bone marrow
bones
joints
ligaments (LIG-ah-ments)
skeleton

Med Term Tip

The term *skeleton*, from the Greek word *skeltos* meaning "dried up," was originally used in reference to a dried-up mummified body, but over time came to be used for bones.

Each bone in the human body is a unique organ that carries its own blood supply, nerves, and lymphatic vessels. When these **bones** are connected to each other it forms the framework of the body called a **skeleton**. The skeleton protects vital organs and stores minerals. **Bone marrow** is the site of blood cell production. A **joint** is the place where two bones meet and are held together by **ligaments**. This gives flexibility to the skeleton. The skeleton, joints, and muscles work together to produce movement.

Bones

cartilage (CAR-tih-lij)
osseous tissue (OSS-ee-us)
ossification (oss-sih-fih-KAY-shun)
osteoblasts (OSS-tee-oh-blasts)
osteocytes (OSS-tee-oh-sights)

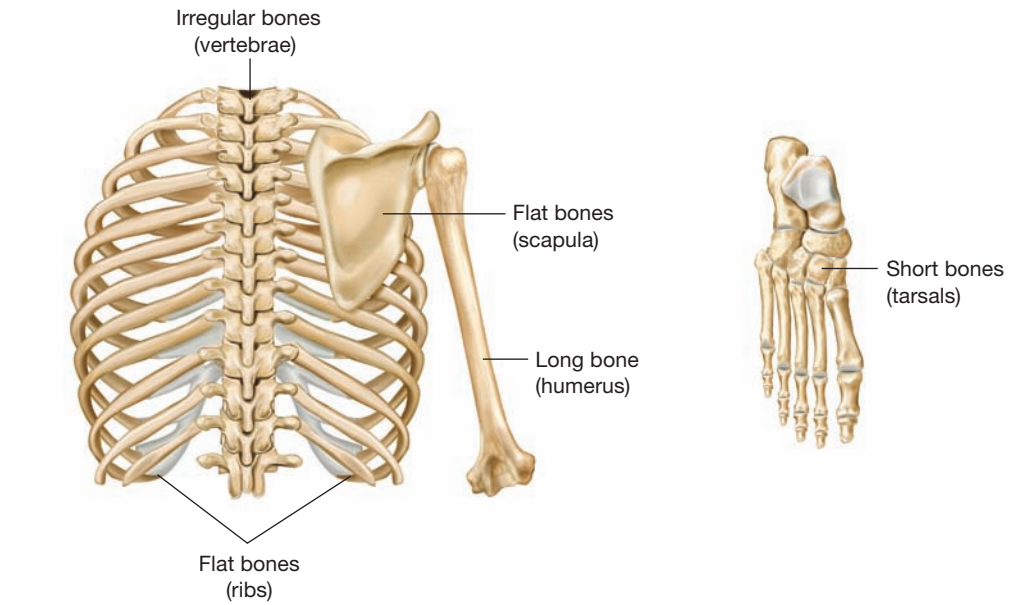
What's In A Name?

Look for these word parts:
oste/o = bone
-blast = immature
-cyte = cell
-ous = pertaining to

Bones, also called **osseous tissue**, are one of the hardest materials in the body. Bones are formed from a gradual process beginning before birth called **ossification**. The first model of the skeleton, made of **cartilage**, is formed in the fetus. **Osteoblasts**, immature bone cells, gradually replace the cartilage with bone. In a fully adult bone, the osteoblasts have matured into **osteocytes** that work to maintain the bone. The formation of strong bones is greatly dependent on an adequate supply of minerals such as calcium (Ca) and phosphorus (P).

Bone Structure

articular cartilage (ar-TIK-yoo-lar)
cancellous bone (CAN-sell-us)
compact bone
cortical bone (KOR-ti-kal)
diaphysis (dye-AFF-ih-sis)
epiphysis (eh-PIFF-ih-sis)
flat bones
irregular bones
long bones
medullary cavity (MED-you-lair-ee)
periosteum (pair-ee-AH-stee-um)
red bone marrow
short bones
spongy bone
yellow bone marrow



■ **Figure 4.1** Classification of bones by shape.

Several different types of bones are found throughout the body and fall into four categories based on their shape: **long bones**, **short bones**, **flat bones**, and **irregular bones** (see Figure 4.1 ■). Long bones are longer than they are wide; examples are the femur and humerus. Short bones are roughly as long as they are wide; examples are the carpals and tarsals. Irregular bones received their name because the shapes of the bones are very irregular; for example, the vertebrae are irregular bones. Flat bones are usually plate-shaped bones such as the sternum, scapulae, and pelvis.

The majority of bones in the human body are long bones. These bones have similar structure with a central shaft or **diaphysis** that widens at each end, which is called an **epiphysis**. Each epiphysis is covered by a layer of cartilage called **articular cartilage** to prevent bone from rubbing directly on bone. The remaining surface of each bone is covered with a thin connective tissue membrane called the **periosteum**, which contains numerous blood vessels, nerves, and lymphatic vessels. The dense and hard exterior surface bone is called **cortical** or **compact bone**. **Cancellous** or **spongy bone** is found inside the bone. As its name indicates, spongy bone has spaces in it, giving it a spongelike appearance. These spaces contain **red bone marrow**, which manufactures most of the blood cells and is found in some parts of all bones.

The center of the diaphysis contains an open canal called the **medullary cavity**. Early in life this cavity also contains red bone marrow, but as we age the red bone marrow of the medullary cavity gradually converts to **yellow bone marrow**, which consists primarily of fat cells. Figure 4.2 ■ contains an illustration of the structure of long bones.

What's In A Name?

Look for these word parts:
articul/o = joint
cortic/o = outer layer
medull/o = inner region
oste/o = bone
peri- = around
-al = pertaining to
-ar = pertaining to
-ary = pertaining to

Med Term Tip

Do not confuse a long bone with a large bone. A long bone is not necessarily a large bone. The bones of your fingers are short in length, but since they are longer than they are wide, they are classified as long bones.

Med Term Tip

The term *diaphysis* comes from the Greek term meaning "to grow between."

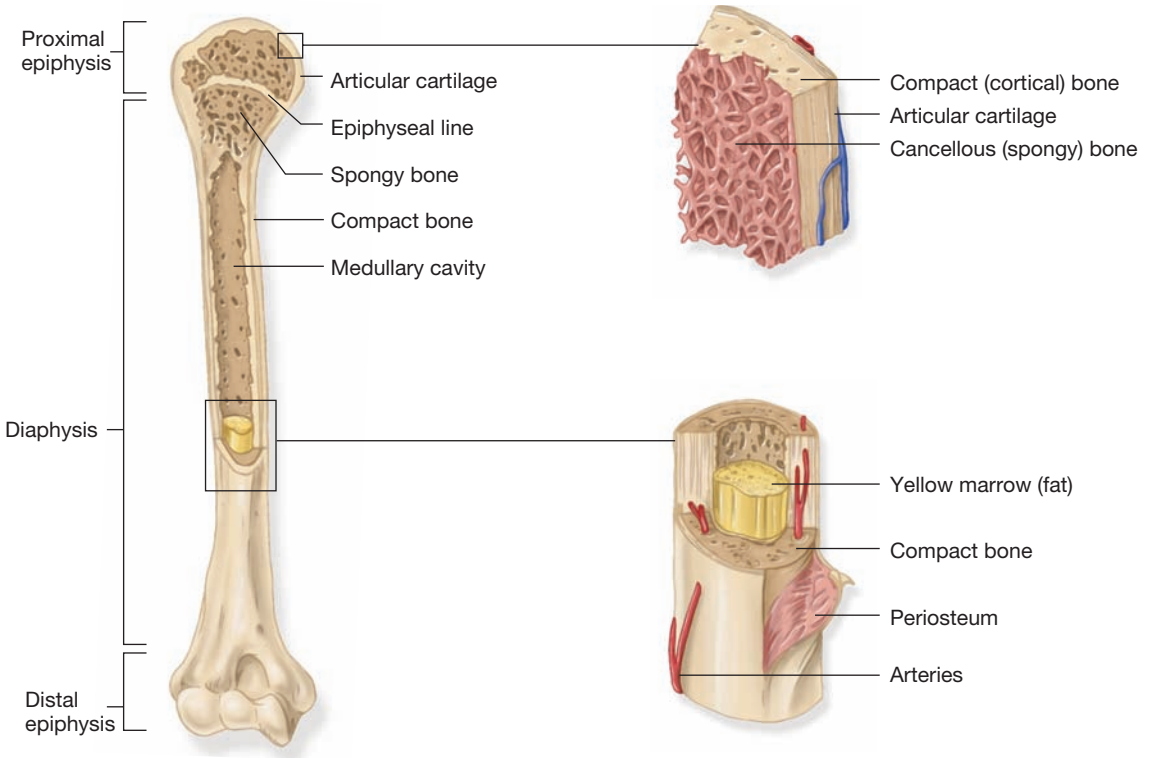
Bone Projections and Depressions

condyle (KON-dile)
epicondyle (ep-ih-KON-dile)
fissure (FISH-er)
foramen (for-AY-men)
fossa (FOSS-ah)
head
neck
process
sinus (SIGH-nus)
trochanter (tro-KAN-ter)
tubercle (TOO-ber-kl)
tuberosity (too-ber-OSS-ih-tee)

Bones have many projections and depressions; some are rounded and smooth in order to articulate with another bone in a joint. Others are rough to provide muscles with attachment points. The general term for any bony

Med Term Tip

The elbow, commonly referred to as the *funny bone*, is actually a projection of the ulna called the olecranon process.



■ **Figure 4.2** Components of a long bone. The entire long bone is on the left side accompanied by a blow-up of the proximal epiphysis and a section of the diaphysis.

projection is a **process**. Then there are specific terms to describe the different shapes and locations of various processes. These terms are commonly used on operative reports and in physicians' records for clear identification of areas on the individual bones. Some of the common bony processes include the following:

1. The **head** is a large, smooth, ball-shaped end on a long bone. It may be separated from the body or shaft of the bone by a narrow area called the **neck**.
2. A **condyle** refers to a smooth, rounded portion at the end of a bone.
3. The **epicondyle** is a projection located above or on a condyle.
4. The **trochanter** refers to a large rough process for the attachment of a muscle.
5. A **tubercle** is a small, rough process that provides the attachment for tendons and muscles.
6. The **tuberosity** is a large, rough process that provides the attachment of tendons and muscles.

What's In A Name?
Look for these word parts:
epi- = above

See Figure 4.3 ■ for an illustration of the processes found on the femur.

Additionally, bones have hollow regions or depressions, the most common of which are the:

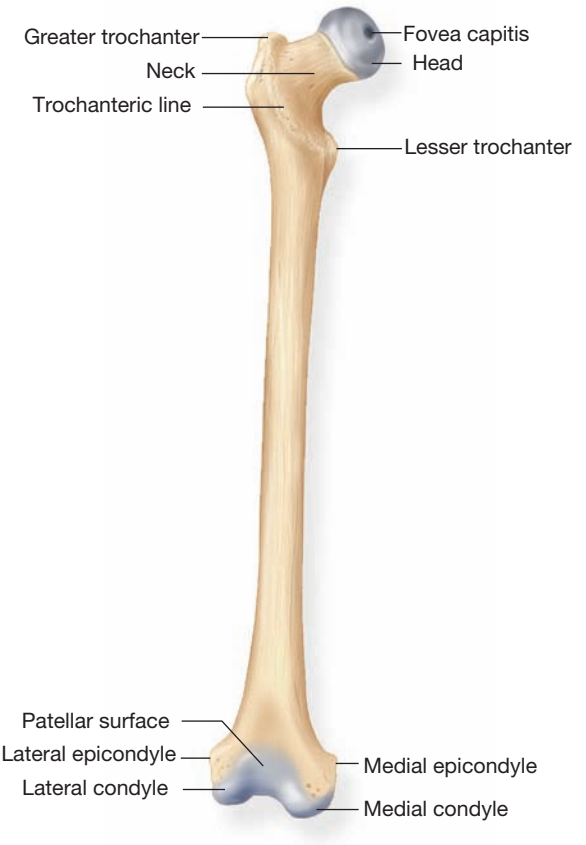
1. **Sinus**: a hollow cavity within a bone.
2. **Foramen**: a smooth, round opening for nerves and blood vessels.
3. **Fossa**: consists of a shallow cavity or depression on the surface of a bone.
4. **Fissure**: a slit-type opening.

Skeleton

appendicular skeleton (app-en-DIK-yoo-lar) **axial skeleton** (AK-see-al)

What's In A Name?
Look for these word parts:
-al = pertaining to
-ar = pertaining to

The human skeleton has two divisions: the **axial skeleton** and the **appendicular skeleton**. Figures 4.4 and 4.8 illustrate these two skeletons.



■ **Figure 4.3** Bony processes found on the femur.

Axial Skeleton

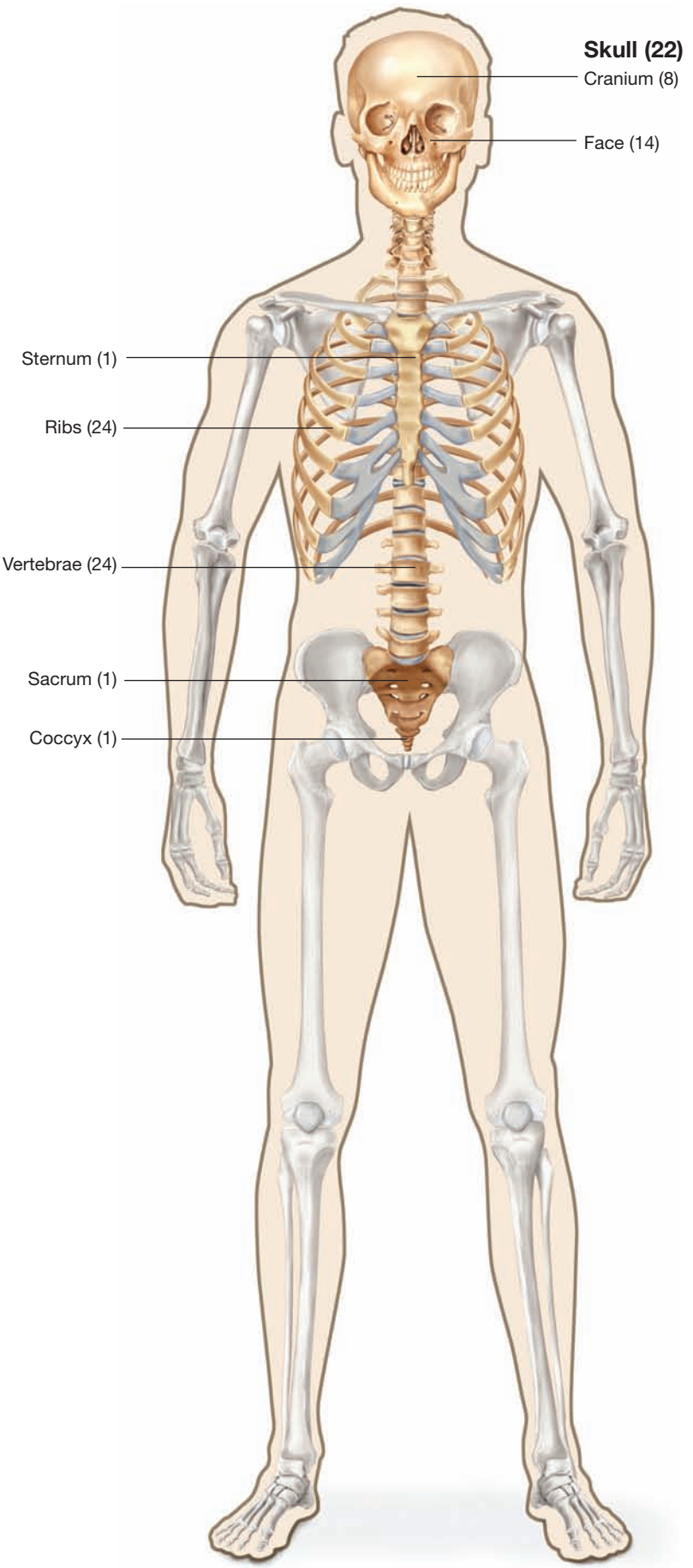
cervical vertebrae
coccyx (COCK-six)
cranium (KRAY-nee-um)
ethmoid bone (ETH-moyd)
facial bones
frontal bone
hyoid bone (HIGH-oyd)
intervertebral disk (in-ter-VER-teh-bral)
lacrimal bone (LACK-rim-al)
lumbar vertebrae
mandible (MAN-dih-bl)
maxilla (mack-SIH-lah)
nasal bone
occipital bone (ock-SIP-eh-tal)
palatine bone (PAL-ah-tine)
parietal bone (pah-RYE-eh-tal)
rib cage
sacrum (SAY-crum)
sphenoid bone (SFEE-noyd)
sternum (STER-num)
temporal bone (TEM-por-al)
thoracic vertebrae
vertebral column (VER-teh-bral)
vomer bone (VOH-mer)
zygomatic bone (zeye-go-MAT-ik)

Med Term Tip

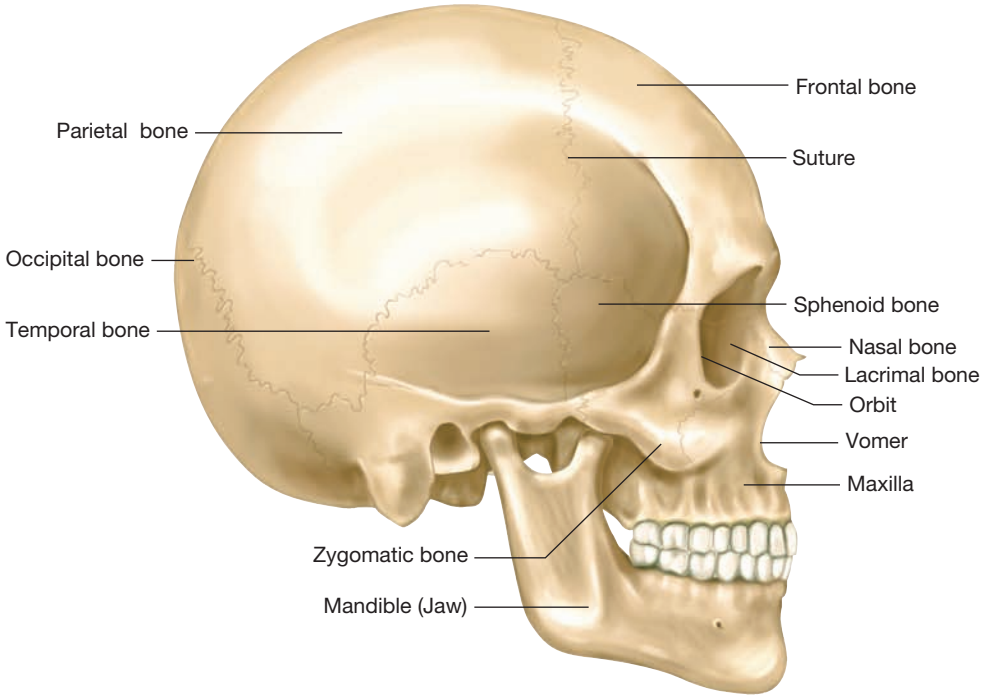
Newborn infants have about 300 bones at birth that will fuse into 206 bones as an adult.

The axial skeleton includes the bones of the head, neck, spine, chest, and trunk of the body (see Figure 4.4 ■). These bones form the central axis for the whole body and protect many of the internal organs such as the brain, lungs, and heart.

The head or skull is divided into two parts consisting of the **cranium** and **facial bones**. These bones surround and protect the brain, eyes, ears, nasal cavity, and oral cavity from injury. The muscles for chewing and moving the head are attached to the cranial bones. The cranium encases the brain and consists of the **frontal**, **parietal**, **temporal**, **ethmoid**, **sphenoid**, and **occipital bones**. The facial bones surround the mouth, nose, and eyes, and include the **mandible**, **maxilla**,



■ **Figure 4.4** Bones of the axial skeleton.



■ **Figure 4.5** Bones of the skull.

zygomatic, **vomer**, **palatine**, **nasal**, and **lacrimal bones**. The cranial and facial bones are illustrated in Figure 4.5 ■ and described in Table 4.1 ■.

The **hyoid bone** is a single U-shaped bone suspended in the neck between the mandible and larynx. It is a point of attachment for swallowing and speech muscles.

The trunk of the body consists of the **vertebral column**, **sternum**, and **rib cage**. The vertebral or spinal column is divided into five sections: **cervical vertebrae**, **thoracic vertebrae**, **lumbar vertebrae**, **sacrum**, and **coccyx** (see Figure 4.6 ■ and Table 4.2 ■). Located between each pair of vertebrae, from the cervical through the lumbar regions, is an **intervertebral disk**. Each disk is composed of fibrocartilage to provide a cushion between the vertebrae. The rib cage has 12 pairs of ribs attached at the back to the vertebral column. Ten of the pairs are also attached to the sternum in the front (see Figure 4.7 ■). The lowest two pairs are called *floating ribs* and

Med Term Tip

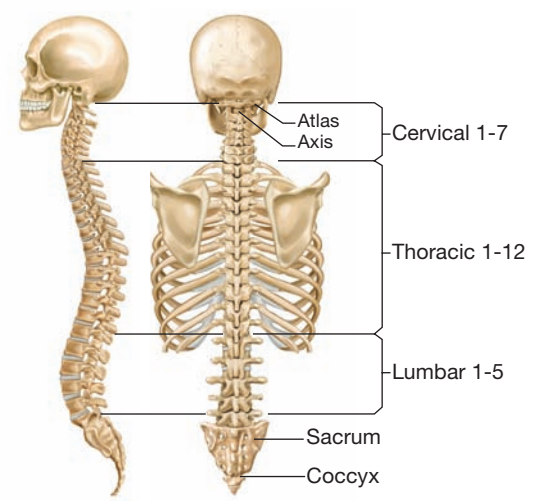
The term *coccyx* comes from the Greek word for the cuckoo because the shape of these small bones extending off the sacrum resembles this bird's bill.

Table 4.1 Bones of the Skull

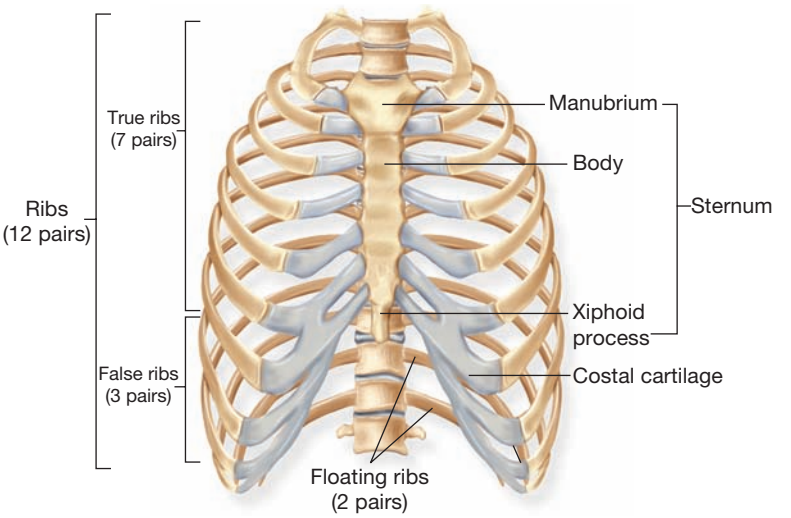
Name	Number	Description
Cranial Bones		
Frontal bone	1	Forehead
Parietal bone	2	Upper sides of cranium and roof of skull
Occipital bone	1	Back and base of skull
Temporal bone	2	Sides and base of cranium
Sphenoid bone	1	Bat-shaped bone that forms part of the base of the skull, floor, and sides of eye orbit
Ethmoid bone	1	Forms part of eye orbit, nose, and floor of cranium
Facial Bones		
Lacrimal bone	2	Inner corner of each eye
Nasal bone	2	Form part of nasal septum and support bridge of nose
Maxilla	1	Upper jaw
Mandible	1	Lower jawbone; only movable bone of the skull
Zygomatic bone	2	Cheekbones
Vomer bone	1	Base of nasal septum
Palatine bone	1	Hard palate (PAH lat) roof of oral cavity and floor of nasal cavity

What's In A Name?

Look for these word parts:
-al = pertaining to
-ar = pertaining to
-oid = resembling
-tic = pertaining to



■ **Figure 4.6** Divisions of the vertebral column.



■ **Figure 4.7** The structure of the rib cage.

Table 4.2 Bones of the Vertebral/Spinal Column

Name	Number	Description
Cervical vertebra	7	Vertebrae in the neck region
Thoracic vertebra	12	Vertebrae in the chest region with ribs attached
Lumbar vertebra	5	Vertebrae in the small of the back, about waist level
Sacrum	1	Five vertebrae that become fused into one triangular-shaped flat bone at the base of the vertebral column
Coccyx	1	Three to five very small vertebrae attached to the sacrum, often become fused

are attached only to the vertebral column. The rib cage serves to provide support for organs, such as the heart and lungs.

Appendicular Skeleton

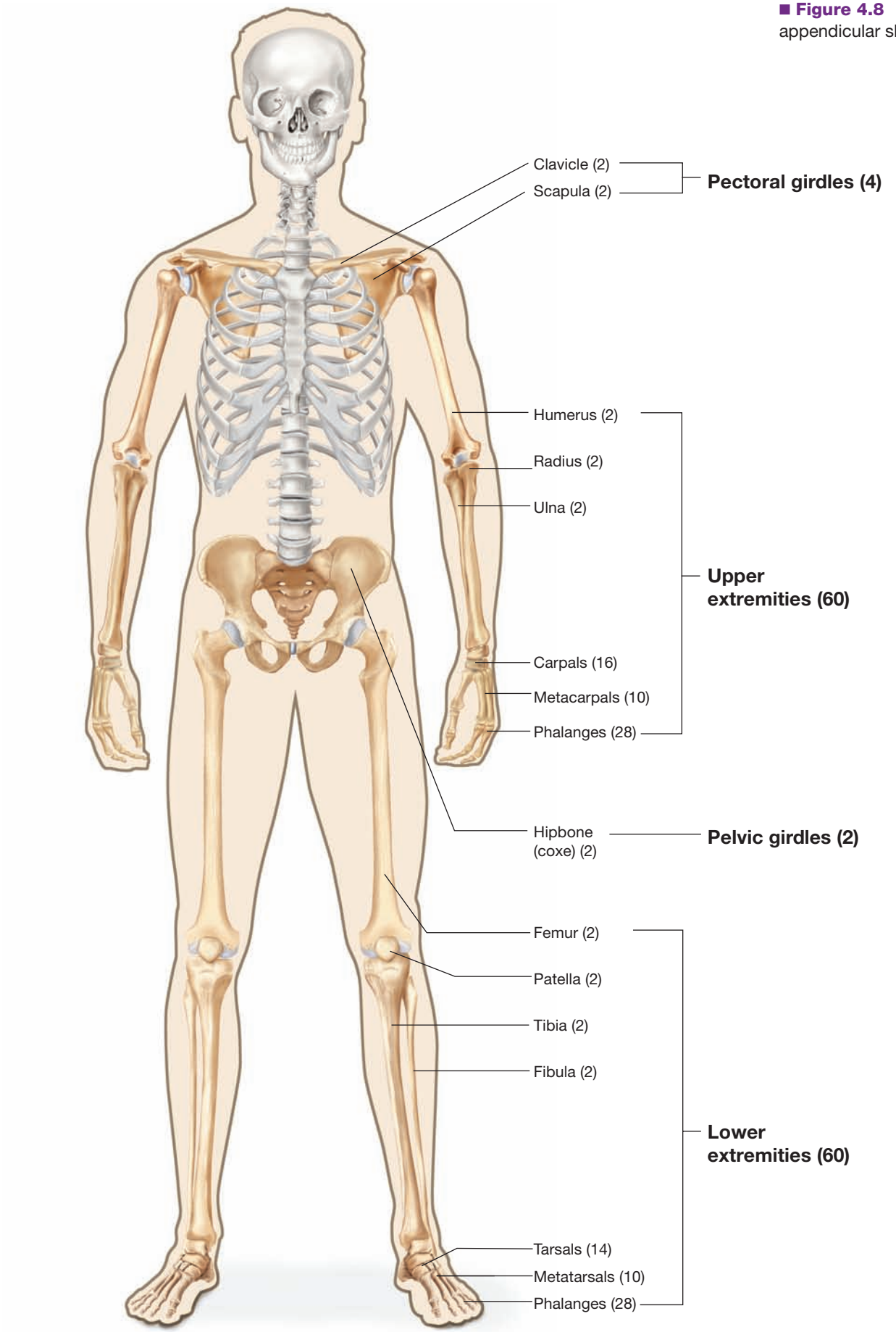
carpals (CAR-pals)
clavicle (CLAV-ih-kl)
femur (FEE-mer)
fibula (FIB-yoo-lah)
humerus (HYOO-mer-us)
ilium (ILL-ee-um)
innominate bone (ih-NOM-ih-nayt)
ischium (ISS-kee-um)
lower extremities
metacarpals (met-ah-CAR-pals)
metatarsals (met-ah-TAHR-sals)
os coxae (OSS / KOK-sigh)
patella (pah-TELL-ah)
pectoral girdle (PEK-toh-ral)
pelvic girdle (PEL-vik)
phalanges (fah-LAN-jeez)
pubis (PYOO-bis)
radius (RAY-dee-us)
scapula (SKAP-yoo-lah)
tarsals (TAHR-sals)
tibia (TIB-ee-ah)
ulna (UHL-nah)
upper extremities

What's In A Name?
Look for these word parts:
pector/o = chest
pelv/o = pelvis
-al = pertaining to
-ic = pertaining to

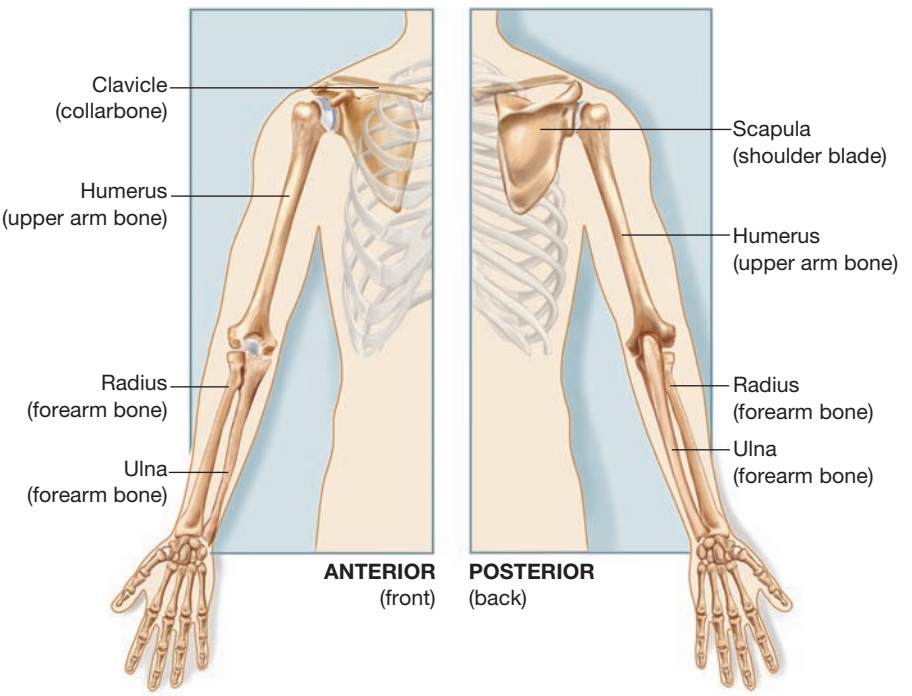
Med Term Tip
The term *girdle*, meaning something that encircles or confines, refers to the entire bony structure of the shoulder and the pelvis. If just one bone from these areas is being discussed, like the ilium of the pelvis, it would be named as such. If, however, the entire pelvis is being discussed, it would be called the pelvic girdle.

.The appendicular skeleton consists of the **pectoral girdle**, **upper extremities**, **pelvic girdle**, and **lower extremities** (see Figure 4.8 ■). These are the bones for our appendages or limbs and along with the muscles attached to them, they are responsible for body movement.

■ **Figure 4.8** Bones of the appendicular skeleton.



The pectoral girdle consists of the **clavicle** and **scapula** bones. It functions to attach the upper extremity, or arm, to the axial skeleton by articulating with the sternum anteriorly and the vertebral column posteriorly. The bones of the upper extremity include the **humerus**, **ulna**, **radius**, **carpals**, **metacarpals**, and **phalanges**. These bones are illustrated in Figure 4.9 ■ and described in Table 4.3 ■.

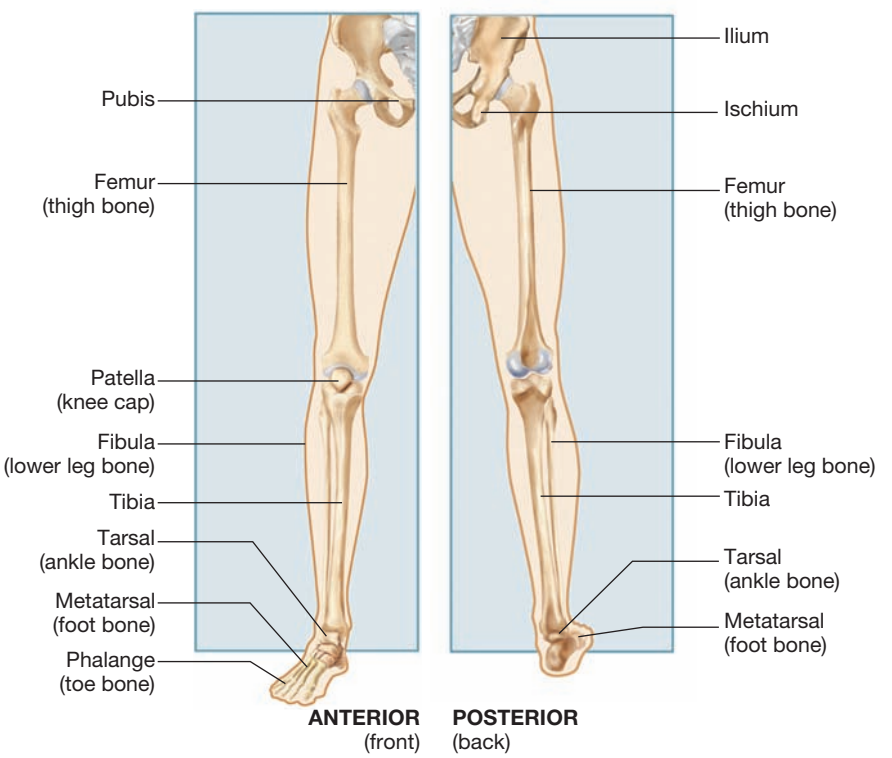


■ **Figure 4.9** Anatomical and common names for the pectoral girdle and upper extremity.

Table 4.3 Bones of the Pectoral Girdle and Upper Extremity

Name	Number	Description
Pectoral Girdle		
Clavicle	2	Collar bone
Scapula	2	Shoulder blade
Upper Extremity		
Humerus	2	Upper arm bone
Radius	2	Forearm bone on thumb side of lower arm
Ulna	2	Forearm bone on little finger side of lower arm
Carpals	16	Bones of wrist
Metacarpals	10	Bones in palm of hand
Phalanges	28	Finger bones; three in each finger and two in each thumb

The pelvic girdle is called the **os coxae** or the **innominate bone** or hipbone. It contains the **ilium**, **ischium**, and **pubis**. It articulates with the sacrum posteriorly to attach the lower extremity, or leg, to the axial skeleton. The lower extremity bones include the **femur**, **patella**, **tibia**, **fibula**, **tarsals**, **metatarsals**, and phalanges. These bones are illustrated in Figure 4.10 ■ and described in Table 4.4 ■



■ **Figure 4.10** Anatomical and common names for the pelvic girdle and lower extremity.

Table 4.4 Bones of the Pelvic Girdle and Lower Extremity

Name	Number	Description
Pelvic Girdle/Os Coxae		
Ilium	2	Part of the hipbone
Ischium	2	Part of the hipbone
Pubis	2	Part of the hipbone
Lower Extremity		
Femur	2	Upper leg bone; thigh bone
Patella	2	Knee cap
Tibia	2	Shin bone; thicker lower leg bone
Fibula	2	Thinner, long bone in lateral side of lower leg
Tarsals	14	Ankle and heel bones
Metatarsals	10	Forefoot bones
Phalanges	28	Toe bones; three in each toe and two in each great toe

Joints

articulation (ar-tik-yoo-LAY-shun)
bursa (BER-sah)
cartilaginous joints (car-tih-LAJ-ih-nus)
fibrous joints (FYE-bruss)
joint capsule
synovial fluid
synovial joint (sin-OH-vee-al)
synovial membrane

Joints are formed when two or more bones meet. This is also referred to as an **articulation**. There are three types of joints based on the amount of movement allowed between the bones: **synovial joints**, **cartilaginous joints**, and **fibrous joints** (see Figure 4.11 ■).

Most joints are freely moving synovial joints (see Figure 4.12 ■), which are enclosed by an elastic **joint capsule**. The joint capsule is lined with **synovial membrane**, which secretes **synovial fluid** to lubricate the joint. As noted earlier, the ends of bones in a synovial joint are covered by a layer of articular cartilage. Cartilage is very tough, but still flexible. It withstands high levels of stress to act as a shock absorber for the joint and prevents bone from rubbing against bone. Cartilage is found in several other areas of the body, such as the nasal septum, external ear, eustachian tube, larynx, trachea, bronchi, and intervertebral disks. One example of a synovial joint is the ball-and-socket joint found at the shoulder and hip. The ball rotating in the socket allows for a wide range of motion. Bands of strong connective tissue called ligaments bind bones together at the joint.

Some synovial joints contain a **bursa**, which is a saclike structure composed of connective tissue and lined with synovial membrane. Most commonly found between bones and ligaments or tendons, bursas function to reduce friction. Some common bursa locations are the elbow, knee, and shoulder joints.

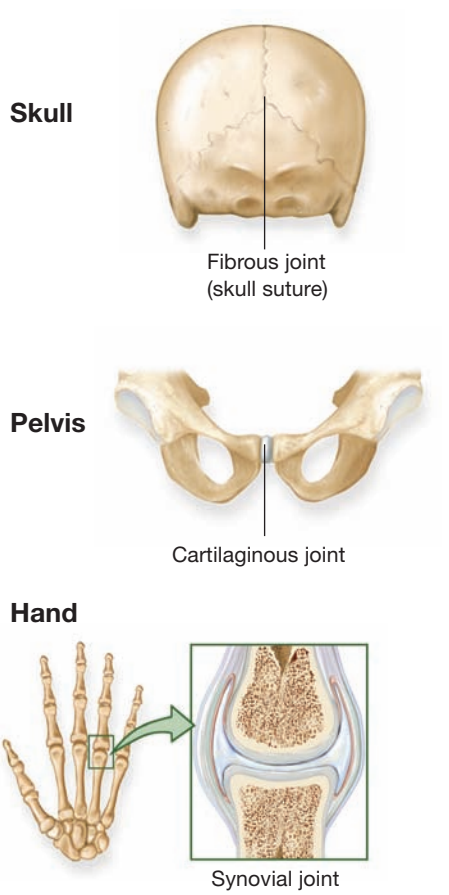
Not all joints are freely moving. Fibrous joints allow almost no movement since the ends of the bones are joined by thick fibrous tissue, which may even fuse into solid bone. The sutures of the skull are an example of a fibrous joint. Cartilaginous joints allow for slight movement but hold bones firmly in place by a solid piece of cartilage. An example of this type of joint is the pubic symphysis, the point at which the left and right pubic bones meet in the front of the lower abdomen.

What's In A Name?

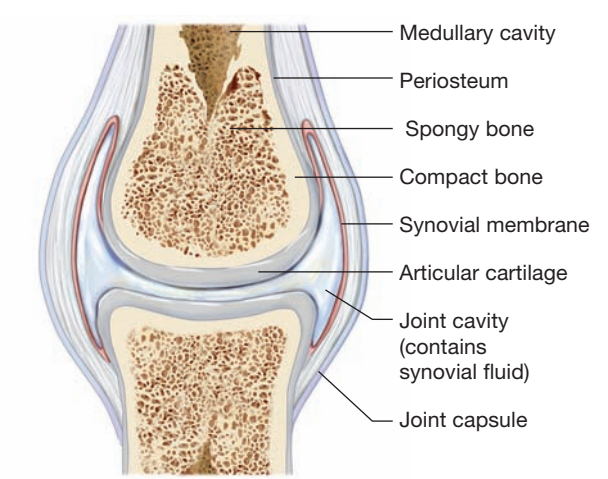
Look for these word parts:
articul/o = joint
fibr/o = fibers
synovi/o = synovial membrane
-al = pertaining to
-ous = pertaining to

Med Term Tip

Bursitis is an inflammation of the bursa located between bony prominences such as at the shoulder. Housemaid's knee, a term thought to have originated from the damage to the knees that occurred when maids knelt to scrub floors, is a form of bursitis and carries the medical name *prepatellar bursitis.*



■ **Figure 4.11** Examples of three types of joints found in the body.



■ **Figure 4.12** Structure of a generalized synovial joint.

Practice As You Go

A. Complete the Statement

1. The two divisions of the human skeleton are the _____ and _____.
2. The five functions of the skeletal system are to _____, _____, _____, _____, and _____.
3. _____ bones are roughly as long as they are wide.
4. The membrane covering bones is called the _____.
5. Another name for spongy bone is _____ bone.
6. _____ joints are the most common joints in the body.
7. A _____ is a smooth, round opening in bones.
8. The _____ is the shaft of a long bone.

Terminology

Word Parts Used to Build Skeletal System Terms

The following lists contain the combining forms, suffixes, and prefixes used to build terms in the remaining sections of this chapter.

Combining Forms

ankyl/o	stiff joint
arthr/o	joint
burs/o	bursa
carp/o	carpus
cervic/o	neck
chondr/o	cartilage
clavicul/o	clavicle
coccyg/o	coccyx
cortic/o	outer layer
cost/o	rib
crani/o	skull
cutane/o	skin
erythr/o	red

femor/o	femur
fibul/o	fibula
humer/o	humerus
ili/o	ilium
ischi/o	ischium
kyph/o	hump
lamin/o	lamina
lord/o	bent backward
lumb/o	loin
mandibul/o	mandible
maxill/o	maxilla
medull/o	inner portion
metacarp/o	metacarpus

metatars/o	metatarsus
myel/o	bone marrow, spinal cord
orth/o	straight
oste/o	bone
patell/o	patella
path/o	disease
ped/o	child; foot
phalang/o	phalanges
pod/o	foot
prosthet/o	addition
pub/o	pubis
radi/o	radius, ray (X-ray)

Terminology (continued)

sacr/o	sacrum
sarc/o	flesh
scapul/o	scapula
scoli/o	crooked
spin/o	spine

spondyl/o	vertebra
stern/o	sternum
synov/o	synovial membrane
system/o	system

tars/o	tarsus
thorac/o	thorax
tibi/o	tibia
uln/o	ulna
vertebr/o	vertebra

Suffixes

-ac	pertaining to
-al	pertaining to
-algia	pain
-ar	pertaining to
-ary	pertaining to
-centesis	puncture to withdraw fluid
-clasia	surgically break
-desis	to fuse
-eal	pertaining to
-ectomy	surgical removal
-genic	producing
-gram	record

-graphy	process of recording
-iatry	medical treatment
-ic	pertaining to
-itis	inflammation
-listhesis	slipping
-logy	study
-malacia	abnormal softening
-metry	process of measuring
-oma	tumor
-ory	pertaining to
-osis	abnormal condition

-otomy	cutting into
-ous	pertaining to
-pathy	disease
-plasty	surgical repair
-porosis	porous
-scope	instrument for viewing
-scopy	process of visually examining
-stenosis	narrowing
-tic	pertaining to
-tome	instrument to cut

Prefixes

anti-	against
bi-	two
dis-	apart

ex-	outward
inter-	between
intra-	within

non-	not
per-	through
sub-	under

Adjective Forms of Anatomical Terms

Term	Word Parts	Definition
carpal (CAR-pal)	carp/o = carpus -al = pertaining to	pertaining to the carpus
cervical (CER-vih-kal)	cervic/o = neck -al = pertaining to	pertaining to the neck
clavicular (cla-VIK-yoo-lar)	clavicul/o = clavicle -ar = pertaining to	pertaining to the clavicle
coccygeal (cock-eh-JEE-all)	coccyg/o = coccyx -eal = pertaining to	pertaining to the coccyx
costal (COAST-all)	cost/o = rib -al = pertaining to	pertaining to the rib

Adjective Forms of Anatomical Terms (continued)

Term	Word Parts	Definition
cranial (KRAY-nee-all)	crani/o = skull -al = pertaining to	pertaining to the skull
femoral (FEM-or-all)	femor/o = femur -al = pertaining to	pertaining to the femur
fibular (FIB-yoo-lar)	fibul/o = fibula -ar = pertaining to	pertaining to the fibula
humeral (HYOO-mer-all)	humer/o = humerus -al = pertaining to	pertaining to the humerus
iliac (ILL-ee-ack)	ili/o = ilium -ac = pertaining to	pertaining to the ilium
intervertebral (in-ter-VER-teh-bral)	inter- = between vertebr/o = vertebra -al = pertaining to	pertaining to between vertebrae
intracranial (in-trah-KRAY-nee-al)	intra- = within crani/o = skull -al = pertaining to	pertaining to within the skull
ischial (ISH-ee-all)	ischi/o = ischium -al = pertaining to	pertaining to the ischium
lumbar (LUM-bar)	lumb/o = low back -ar = pertaining to	pertaining to the low back
mandibular (man-DIB-yoo-lar)	mandibul/o = mandible -ar = pertaining to	pertaining to the mandible
maxillary (mack-sih-LAIR-ree)	maxill/o = maxilla -ary = pertaining to	pertaining to the maxilla
metacarpal (met-ah-CAR-pal)	metacarp/o = metacarpus -al = pertaining to	pertaining to the metacarpus
metatarsal (met-ah-TAHR-sal)	metatars/o = metatarsus -al = pertaining to	pertaining to the metatarsus
patellar (pa-TELL-ar)	patell/o = patella -ar = pertaining to	pertaining to the patella
phalangeal (fay-lan-JEE-all)	phalang/o = phalanges -eal = pertaining to	pertaining to the phalanges
pubic (PYOO-bik)	pub/o = pubis -ic = pertaining to	pertaining to the pubis
radial (RAY-dee-all)	radi/o = radius -al = pertaining to	pertaining to the radius
sacral (SAY-kral)	sacr/o = sacrum -al = pertaining to	pertaining to the sacrum
scapular (SKAP-yoo-lar)	scapul/o = scapula -ar = pertaining to	pertaining to the scapula
sternal (STER-nal)	stern/o = sternum -al = pertaining to	pertaining to the sternum
tarsal (TAHR-sal)	tars/o = tarsus -al = pertaining to	pertaining to the tarsus

Adjective Forms of Anatomical Terms (continued)

Term	Word Parts	Definition
thoracic (tho-RASS-ik)	thorac/o = thorax -ic = pertaining to	pertaining to the thorax
tibial (TIB-ee-all)	tibi/o = tibia -al = pertaining to	pertaining to the tibia
ulnar (UHL-nar)	uln/o = ulna -ar = pertaining to	pertaining to the ulna
vertebral (VER-the-bral)	vertebr/o = vertebra -al = pertaining to	pertaining to a vertebra

Practice As You Go

B. Adjective Form Practice

Give the adjective form for the following bones.

1. femur _____
2. sternum _____
3. clavicle _____
4. coccyx _____
5. maxilla _____
6. tibia _____
7. patella _____
8. phalanges _____
9. humerus _____
10. pubis _____

Pathology

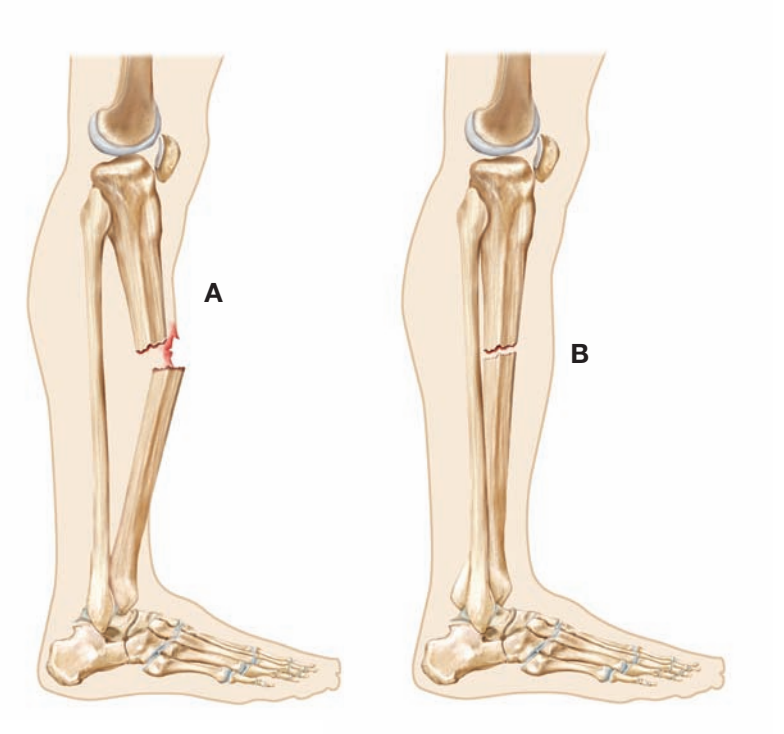
Term	Word Parts	Definition
Medical Specialties		
chiropractic (ki-roh-PRAK-tik)	-tic = pertaining to	Healthcare profession concerned with diagnosis and treatment of malalignment conditions of the spine and musculoskeletal system with the intention of affecting the nervous system and improving health. Healthcare professional is a *chiropractor.*

Pathology (continued)

Term	Word Parts	Definition
orthopedics (Orth, ortho) (or-thoh-PEE-diks)	orth/o = straight ped/o = child, foot -ic = pertaining to	Branch of medicine specializing in the diagnosis and treatment of conditions of the musculoskeletal system; also called *orthopedic surgery.* Physician is an *orthopedist* or *orthopedic surgeon.* Name derived from straightening (*orth/o*) deformities in children (*ped/o*).
orthotics (or-THOT-iks)	orth/o = straight -tic = pertaining to	Healthcare profession specializing in making orthopedic appliances such as braces and splints. Person skilled in making and adjusting these appliances is an *orthotist.*
podiatry (po-DYE-ah-tree)	pod/o = foot -iatry = medical treatment	Healthcare profession specializing in diagnosis and treatment of disorders of the feet and lower legs. Healthcare professional is a *podiatrist.*
prosthetics (pross-THET-iks)	prosthet/o = addition -ic = pertaining to	Healthcare profession specializing in making artificial body parts. Person skilled in making and adjusting prostheses is a *prosthetist.*
Signs and Symptoms		
arthralgia (ar-THRAL-jee-ah)	arthr/o = joint -algia = pain	joint pain
bursitis (ber-SIGH-tis)	burs/o = bursa -itis = inflammation	inflammation of a bursa
callus (KAL-us)		The mass of bone tissue that forms at a fracture site during its healing.
chondromalacia (kon-droh-mah-LAY-she-ah)	chondr/o = cartilage -malacia = abnormal softening	softening of the cartilage
crepitation (krep-ih-TAY-shun)		The noise produced by bones or cartilage rubbing together in conditions such as arthritis. Also called *crepitus.*
ostealgia (oss-tee-AL-jee-ah)	oste/o = bone -algia = pain	bone pain
osteomyelitis (oss-tee-oh-mi-ell-EYE-tis)	oste/o = bone myel/o = bone marrow -itis = inflammation	inflammation of bone and bone marrow
synovitis (sih-no-VI-tis)	synov/o = synovial membrane -itis = inflammation	inflammation of synovial membrane

Pathology (continued)

Term	Word Parts	Definition
Fractures		
closed fracture		Fracture in which there is no open skin wound. Also called a *simple fracture.*
Colles' fracture (COL-eez)		A common type of wrist fracture.
comminuted fracture (kom-ih-NYOOT-ed)		Fracture in which the bone is shattered, splintered, or crushed into many small pieces or fragments.
compound fracture		Fracture in which the skin has been broken through to the fracture. Also called an *open fracture* (see Figure 4.13B ■).

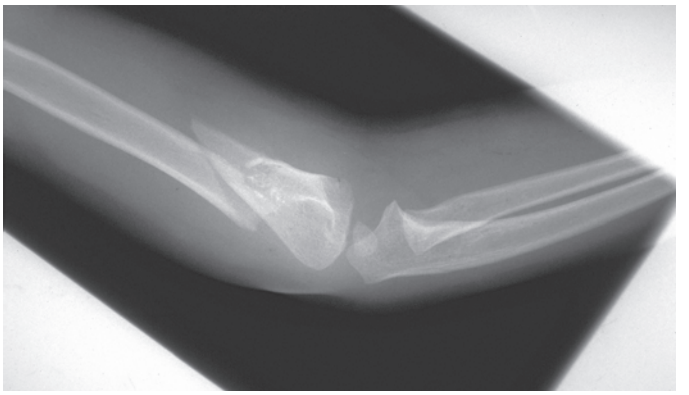


■ **Figure 4.13** A) Closed (or simple) fracture and B) open (or compound) fracture.

■ **Figure 4.14** Colles' fracture. *(Charles Stewart MD FACEP, FAAEM)*

Pathology (continued)

Term	Word Parts	Definition
compression fracture		Fracture involving loss of height of a vertebral body. It may be the result of trauma, but in older people, especially women, it may be caused by conditions like osteoporosis.
fracture (FX, Fx)		A broken bone.
greenstick fracture		Fracture in which there is an incomplete break; one side of bone is broken and the other side is bent. This type of fracture is commonly found in children due to their softer and more pliable bone structure.
impacted fracture		Fracture in which bone fragments are pushed into each other.
oblique fracture (oh-BLEEK)		Fracture at an angle to the bone.
pathologic fracture (path-a-LOJ-ik)	path/o = disease -logic = pertaining to study of -al = pertaining to	Fracture caused by diseased or weakened bone.
spiral fracture		Fracture in which the fracture line spirals around the shaft of the bone. Can be caused by a twisting injury and is often slower to heal than other types of fractures.
stress fracture		A slight fracture caused by repetitive low-impact forces, like running, rather than a single forceful impact.



■ **Figure 4.15** X-ray showing oblique fracture of the humerus. *(Charles Stewart MD FACEP, FAAEM)*

Pathology (continued)

Term	Word Parts	Definition
transverse fracture		Complete fracture that is straight across the bone at right angles to the long axis of the bone.

■ **Figure 4.16** X-ray showing transverse fracture of radius. *(James Stevenson/Science Photo Library/Photo Researchers, Inc.)*

Bones		
chondroma (kon-DROH-mah)	chondr/o = cartilage -oma = tumor	A tumor, usually benign, that forms in cartilage.
Ewing's sarcoma (YOO-wings / sar-KOH-mah)	sarc/o = flesh -oma = tumor	Malignant growth found in the shaft of long bones that spreads through the periosteum. Removal is the treatment of choice because this tumor will metastasize or spread to other organs.
exostosis (eck-sos-TOH-sis)	ex- = outward oste/o = bone -osis = abnormal condition	A bony, outward projection from the surface of a bone; also called a *bone spur*.
myeloma (my-ah-LOH-mah)	myel/o = bone marrow -oma = tumor	A tumor that forms in bone marrow tissue.
osteochondroma (oss-tee-oh-kon-DROH-mah)	oste/o = bone chondr/o = cartilage -oma = tumor	A tumor, usually benign, that consists of both bone and cartilage tissue.
osteogenic sarcoma (oss-tee-oh-GIN-ik / sark-OH-mah)	oste/o = bone -genic = producing sarc/o = flesh -oma = tumor	The most common type of bone cancer. Usually begins in osteocytes found at the ends of long bones.
osteomalacia (oss-tee-oh-mah-LAY-she-ah)	oste/o = bone -malacia = abnormal softening	Softening of the bones caused by a deficiency of calcium. It is thought to be caused by insufficient sunlight and vitamin D in children.
osteopathy (oss-tee-OPP-ah-thee)	oste/o = bone -pathy = disease	A general term for bone disease.

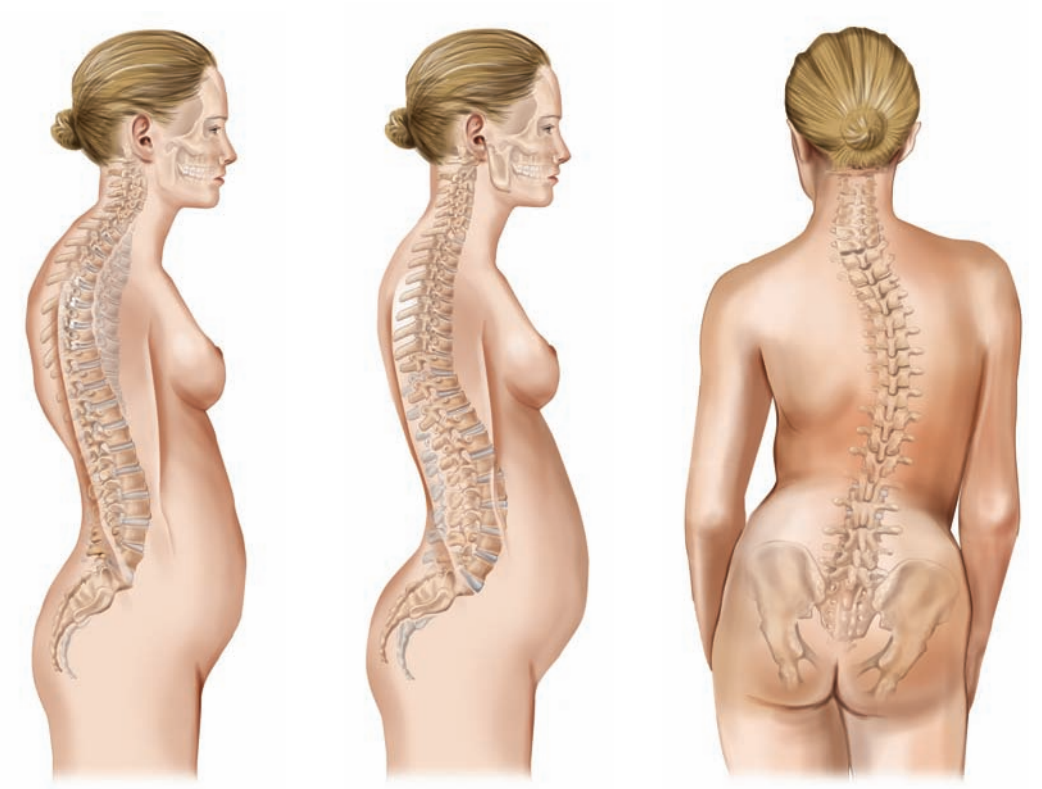
Pathology (continued)

Term	Word Parts	Definition
osteoporosis (oss-tee-oh-por-ROH-sis)	oste/o = bone -porosis = porous	Decrease in bone mass producing a thinning and weakening of the bone with resulting fractures. The bone becomes more porous, especially in the spine and pelvis.
Paget's disease (PAH-jets)		A fairly common metabolic disease of the bone from unknown causes. It usually attacks middle-aged and older adults and is characterized by bone destruction and deformity. Named for Sir James Paget, a British surgeon.
rickets (RIK-ets)		Deficiency in calcium and vitamin D found in early childhood that results in bone deformities, especially bowed legs.
Spinal Column		
ankylosing spondylitis (ang-kih-LOH-sing / spon-dih-LYE-tis)	ankyl/o = stiff joint spondyl/o = vertebra -itis = inflammation	Inflammatory spinal condition resembling rheumatoid arthritis and results in gradual stiffening and fusion of the vertebrae. More common in men than in women.
herniated nucleus pulposus (HNP) (HER-nee-ated / NOO-klee-us / pull-POH-sus)		Herniation or protrusion of an intervertebral disk; also called *herniated disk* or *ruptured disk.* May require surgery.
kyphosis (ki-FOH-sis)	kyph/o = hump -osis = abnormal condition	Abnormal increase in the outward curvature of the thoracic spine. Also known as *hunchback* or *humpback.* See Figure 4.18 ■ for an illustration of abnormal spine curvatures.

■ **Figure 4.17** Magnetic resonance imaging (MRI) image demonstrating a back herniated disc. *(Michelle Milano/ Shutterstock)*

Pathology (continued)

Term	Word Parts	Definition



Kyphosis
(excessive posterior thoracic curvature - hunchback)

Lordosis
(excessive anterior lumbar curvature - swayback)

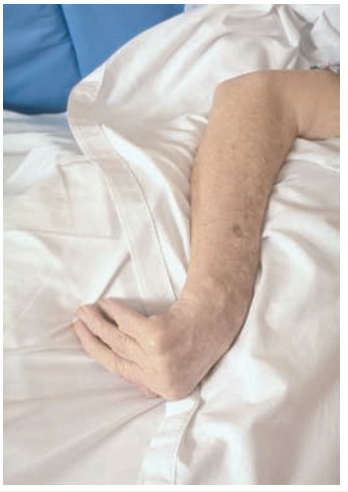
Scoliosis
(lateral curvature)

■ **Figure 4.18**
Abnormal spinal curvatures: kyphosis, lordosis, and scoliosis.

lordosis (lor-DOH-sis)	lord/o = bent backward -osis = abnormal condition	Abnormal increase in the forward curvature of the lumbar spine. Also known as *swayback.* See again Figure 4.18 for an illustration of abnormal spine curvatures.
scoliosis (skoh-lee-OH-sis)	scoli/o = crooked -osis = abnormal condition	Abnormal lateral curvature of the spine. See again Figure 4.18 for an illustration of abnormal spine curvatures.
spina bifida (SPY-nah / BIF-ih-dah)	spin/o = spine bi- = two	Congenital anomaly occurring when a vertebra fails to fully form around the spinal cord.
spinal stenosis (ste-NOH-sis)	spin/o = spine -al = pertaining to **Word Watch** Watch how the term *stenosis* is used in this condition. It most often appears as the suffix ***-stenosis***. However, in this case, it is used as a freestanding word.	Narrowing of the spinal canal causing pressure on the cord and nerves.
spondylolisthesis (spon-dih-loh-liss-THEE-sis)	spondyl/o = vertebra -listhesis = slipping	The forward sliding of a lumbar vertebra over the vertebra below it.
spondylosis (spon-doh-LOH-sis)	spondyl/o = vertebra -osis = abnormal condition	Specifically refers to ankylosing of the spine, but commonly used in reference to any degenerative condition of the vertebral column.

Pathology (continued)

Term	Word Parts	Definition
whiplash		Cervical muscle and ligament sprain or strain as a result of a sudden movement forward and backward of the head and neck. Can occur as a result of a rear-end auto collision.
Joints		
bunion (BUN-yun)		Inflammation of the bursa of the first metatarsophalangeal joint (base of the big toe).
dislocation	dis- = apart	Occurs when the bones in a joint are displaced from their normal alignment and the ends of the bones are no longer in contact.
osteoarthritis (OA) (oss-tee-oh-ar-THRY-tis)	oste/o = bone arthr/o = joint -itis = inflammation	Arthritis resulting in degeneration of the bones and joints, especially those bearing weight. Results in bone rubbing against bone. Also called degenerative joint disease (DJD).
rheumatoid arthritis (RA) (ROO-mah-toyd / ar-THRY-tis)	arthr/o = joint -itis = inflammation	Chronic form of arthritis with inflammation of the joints, swelling, stiffness, pain, and changes in the cartilage that can result in crippling deformities; considered to be an autoimmune disease.



■ **Figure 4.19** Patient with typical rheumatoid arthritis contractures.

Pathology (continued)

Term	Word Parts	Definition
sprain		Damage to the ligaments surrounding a joint due to overstretching, but no dislocation of the joint or fracture of the bone.
subluxation (sub-LUCKS-a-shun)	sub- = under	An incomplete dislocation, the joint alignment is disrupted, but the ends of the bones remain in contact.
systemic lupus erythematosus (SLE) (sis-TEM-ik / LOOP-us / air-ih-them-ah-TOH-sis)	system/o = system -ic = pertaining to erythr/o = red	Chronic inflammatory autoimmune disease of connective tissue affecting many systems that may include joint pain and arthritis. May be mistaken for rheumatoid arthritis.
talipes (TAL-ih-peez)		Congenital deformity causing misalignment of the ankle joint and foot. Also referred to as a *clubfoot*.

Practice As You Go

C. Fracture Type Matching

Match each fracture type to its definition.

1. _____ comminuted
2. _____ greenstick
3. _____ compound
4. _____ simple
5. _____ impacted
6. _____ transverse
7. _____ oblique
8. _____ spiral

a. fracture line is at an angle
b. fracture line curves around the bone
c. bone is splintered or crushed
d. bone is pressed into itself
e. fracture line is straight across bone
f. skin has been broken
g. no open wound
h. bone only partially broken

Diagnostic Procedures

Term	Word Part	Definition
Diagnostic Imaging		
arthrogram (AR-throh-gram)	arthr/o = joint -gram = record	X-ray record of a joint, usually taken after the joint has been injected by a contrast medium.
arthrography (ar-THROG-rah-fee)	arthr/o = joint -graphy = process of recording	Process of X-raying a joint, usually after injection of a contrast medium into the joint space.
bone scan		Nuclear medicine procedure in which the patient is given a radioactive dye and then scanning equipment is used to visualize bones. It is especially useful in identifying stress fractures, observing progress of treatment for osteomyelitis, and locating cancer metastases to the bone.
dual-energy absorptiometry (DXA) (ab-sorp-she-AHM-eh-tree)	-metry = process of measuring	Measurement of bone density using low-dose X-ray for the purpose of detecting osteoporosis.
myelography (my-eh-LOG-rah-fee)	myel/o = spinal cord -graphy = process of recording	Study of the spinal column after injecting opaque contrast material; particularly useful in identifying herniated nucleus pulposus pinching a spinal nerve.
	Med Term Tip The combining form *myel/o* means "marrow" and is used for both the spinal cord and bone marrow. To the ancient Greek philosophers and physicians, the spinal cord appeared to be much like the marrow found in the medullary cavity of a long bone.	
radiography	radi/o = ray -graphy = process of recording	Diagnostic imaging procedure using X-rays to study the internal structure of the body; especially useful for visualizing bones and joints.
Endoscopic Procedures		
arthroscope (AR-throw-skop)	arthr/o = joint -scope = instrument for viewing	Instrument used to view inside a joint.
arthroscopy (ar-THROS-koh-pee)	arthr/o = joint -scopy = process of visually examining	Examination of the interior of a joint by entering the joint with an *arthroscope.* The arthroscope contains a small television camera that allows the physician to view the interior of the joint on a monitor during the procedure. Some joint conditions can be repaired during arthroscopy.

Therapeutic Procedures

Term	Word Part	Definition
Medical Treatments		
arthrocentesis (ar-thro-sen-TEE-sis)	arthr/o = joint -centesis = puncture to withdraw fluid	Involves the insertion of a needle into the joint cavity in order to remove or aspirate fluid. May be done to remove excess fluid from a joint or to obtain fluid for examination.
orthotic (or-THOT-ik)	orth/o = straight -tic = pertaining to	Orthopedic appliance, such as a brace or splint, used to prevent or correct deformities.
prosthesis (pross-THEE-sis)	prosthet/o = addition	Artificial device used as a substitute for a body part that is either congenitally missing or absent as a result of accident or disease. An example would be an artificial leg.
Surgical Procedures		
amputation (am-pew-TAY-shun)		Partial or complete removal of a limb for a variety of reasons, including tumors, gangrene, intractable pain, crushing injury, or uncontrollable infection.
arthroclasia (ar-throh-KLAY-see-ah)	arthr/o = joint -clasia = surgically break	To forcibly break loose a fused joint while the patient is under anesthetic. Fusion is usually caused by the buildup of scar tissue or adhesions.
arthrodesis (ar-throh-DEE-sis)	arthr/o = joint -desis = to fuse	Procedure to stabilize a joint by fusing the bones together.
arthroscopic surgery (ar-throh-SKOP-ic)	arthr/o = joint -scopy = process of visually examining -ic = pertaining to	Performing a surgical procedure while using an arthroscope to view the internal structure, such as a joint.
arthrotomy (ar-THROT-oh-mee)	arthr/o = joint -otomy = cutting into	Surgical procedure that cuts into a joint capsule.
bone graft		Piece of bone taken from the patient used to take the place of a removed bone or a bony defect at another site.
bunionectomy (bun-yun-ECK-toh-mee)	-ectomy = surgical removal	Removal of the bursa at the joint of the great toe.
bursectomy (ber-SEK-toh-mee)	burs/o = bursa -ectomy = surgical removal	Surgical removal of a bursa.
chondrectomy (kon-DREK-toh-mee)	chondr/o = cartilage -ectomy = surgical removal	Surgical removal of cartilage.
chondroplasty (KON-droh-plas-tee)	chondr/o = cartilage -plasty = surgical repair	Surgical repair of cartilage.
craniotomy (kray-nee-OTT-oh-mee)	crani/o = skull -otomy = cutting into	Surgical procedure that cuts into the skull.
laminectomy (lam-ih-NEK-toh-mee)	lamin/o = lamina -ectomy = surgical removal	Removal of the vertebral posterior arch to correct severe back problems and pain caused by compression of a spinal nerve.
osteoclasia (oss-tee-oh-KLAY-see-ah)	oste/o = bone -clasia = surgically break	Surgical procedure involving the intentional breaking of a bone to correct a deformity.
osteotome (OSS-tee-oh-tohm)	oste/o = bone -tome = instrument to cut	Instrument used to cut bone.

Therapeutic Procedures (continued)

Term	Word Part	Definition
osteotomy (oss-tee-OTT-ah-me)	oste/o = bone -otomy = cutting into	Surgical procedure that cuts into a bone.
percutaneous diskectomy (per-kyou-TAY-nee-us / disk-EK-toh-mee)	per- = through cutane/o = skin -ous = pertaining to -ectomy = surgical removal	A thin catheter tube is inserted into the intervertebral disk through the skin and the herniated or ruptured disk material is sucked out or a laser is used to vaporize it.
spinal fusion	spin/o = spine -al = pertaining to	Surgical immobilization of adjacent vertebrae. This may be done for several reasons, including correction for a herniated disk.
synovectomy (sih-no-VEK-toh-mee)	synov/o = synovial membrane -ectomy = surgical removal	Surgical removal of the synovial membrane.
total hip arthroplasty (THA) (ar-thro-PLAS-tee)	arthr/o = joint -plasty = surgical repair	Surgical reconstruction of a hip by implanting a prosthetic or artificial hip joint. Also called *total hip replacement (THR).*
total knee arthroplasty (TKA) (ar-thro-PLAS-tee)	arthr/o = joint -plasty = surgical repair	Surgical reconstruction of a knee joint by implanting a prosthetic knee joint. Also called *total knee replacement (TKR).*
Fracture Care		
cast		Application of a solid material to immobilize an extremity or portion of the body as a result of a fracture, dislocation, or severe injury. It may be made of plaster of Paris or fiberglass.
fixation		Procedure to stabilize a fractured bone while it heals. *External fixation* includes casts, splints, and pins inserted through the skin. *Internal fixation* includes pins, plates, rods, screws, and wires that are applied during an *open reduction.*

■ **Figure 4.20**
Prosthetic hip joint. *(Lawrence Livermore National Library/Science Photo Library/Photo Researchers, Inc.)*

Therapeutic Procedures (continued)

Term	Word Part	Definition
reduction		Correcting a fracture by realigning the bone fragments. *Closed reduction* is doing this manipulation without entering the body. *Open reduction* is the process of making a surgical incision at the site of the fracture to do the reduction. This is necessary when bony fragments need to be removed or *internal fixation* such as plates or pins are required.
traction		Applying a pulling force on a fractured or dislocated limb or the vertebral column in order to restore normal alignment.

Pharmacology

Classification	Word Parts	Action	Examples
bone reabsorption inhibitors		Conditions that result in weak and fragile bones, such as osteoporosis and Paget's disease, are improved by medications that reduce the reabsorption of bones.	alendronate, Fosamax; ibandronate, Boniva
calcium supplements and vitamin D therapy		Maintaining high blood levels of calcium in association with vitamin D helps maintain bone density; used to treat osteomalacia, osteoporosis, and rickets.	calcium carbonate, Oystercal, Tums; calcium citrate, Cal-Citrate, Citracal
corticosteroids	cortic/o = outer layer	A hormone produced by the adrenal cortex that has very strong anti-inflammatory properties. It is particularly useful in treating rheumatoid arthritis.	prednisone; methylprednisolone, Medrol; dexamethasone, Decadron
nonsteroidal anti-inflammatory drugs (NSAIDs)	non- = not -al = pertaining to anti- = against -ory = pertaining to	A large group of drugs (other than corticosteroids) that provide mild pain relief and anti-inflammatory benefits for conditions such as arthritis.	ibuprofen, Advil, Motrin; naproxen, Aleve, Naprosyn; salicylates, Aspirin

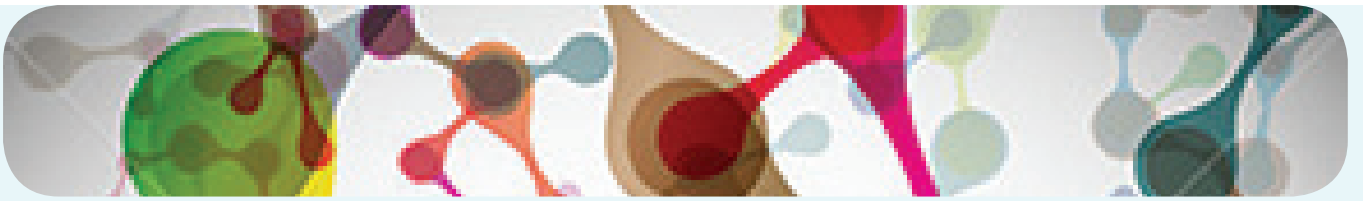
Abbreviations

AE	above elbow	**NSAID**	nonsteroidal anti-inflammatory drug
AK	above knee	**OA**	osteoarthritis
BDT	bone density testing	**ORIF**	open reduction–internal fixation
BE	below elbow	**Orth, ortho**	orthopedics
BK	below knee	**P**	phosphorus
C1, C2, etc.	first cervical vertebra, second cervical vertebra, etc.	**RA**	rheumatoid arthritis
Ca	calcium	**RLE**	right lower extremity
DJD	degenerative joint disease	**RUE**	right upper extremity
DXA	dual-energy absorptiometry	**SLE**	systemic lupus erythematosus
FX, Fx	fracture	**T1, T2, etc.**	first thoracic vertebra, second thoracic vertebra, etc.
HNP	herniated nucleus pulposus	**THA**	total hip arthroplasty
JRA	juvenile rheumatoid arthritis	**THR**	total hip replacement
L1, L2, etc.	first lumbar vertebra, second lumbar vertebra, etc.	**TKA**	total knee arthroplasty
LE	lower extremity	**TKR**	total knee replacement
LLE	left lower extremity	**UE**	upper extremity
LUE	left upper extremity		

Practice As You Go

D. What's the Abbreviation?

1. total knee replacement _____
2. herniated nucleus pulposus _____
3. upper extremity _____
4. fifth lumbar vertebra _____
5. above the knee _____
6. fracture _____
7. nonsteroidal anti-inflammatory drug _____



Section II: Muscular System at a Glance

Function

Muscles are bundles, sheets, or rings of tissue that produce movement by contracting and pulling on the structures to which they are attached.

Organs

Here is the primary structure that comprises the muscular system:

muscles

Word Parts

Here are the most common word parts (with their meanings) used to build muscular system terms. For a more comprehensive list, refer to the Terminology section of this chapter.

Combining Forms

duct/o	to bring
extens/o	to stretch out
fasci/o	fibrous band
fibr/o	fibers
flex/o	to bend
kinesi/o	movement
muscul/o	muscle
my/o	muscle
myos/o	muscle
plant/o	sole of foot
rotat/o	to revolve
ten/o	tendon
tend/o	tendon
tendin/o	tendon
vers/o	to turn

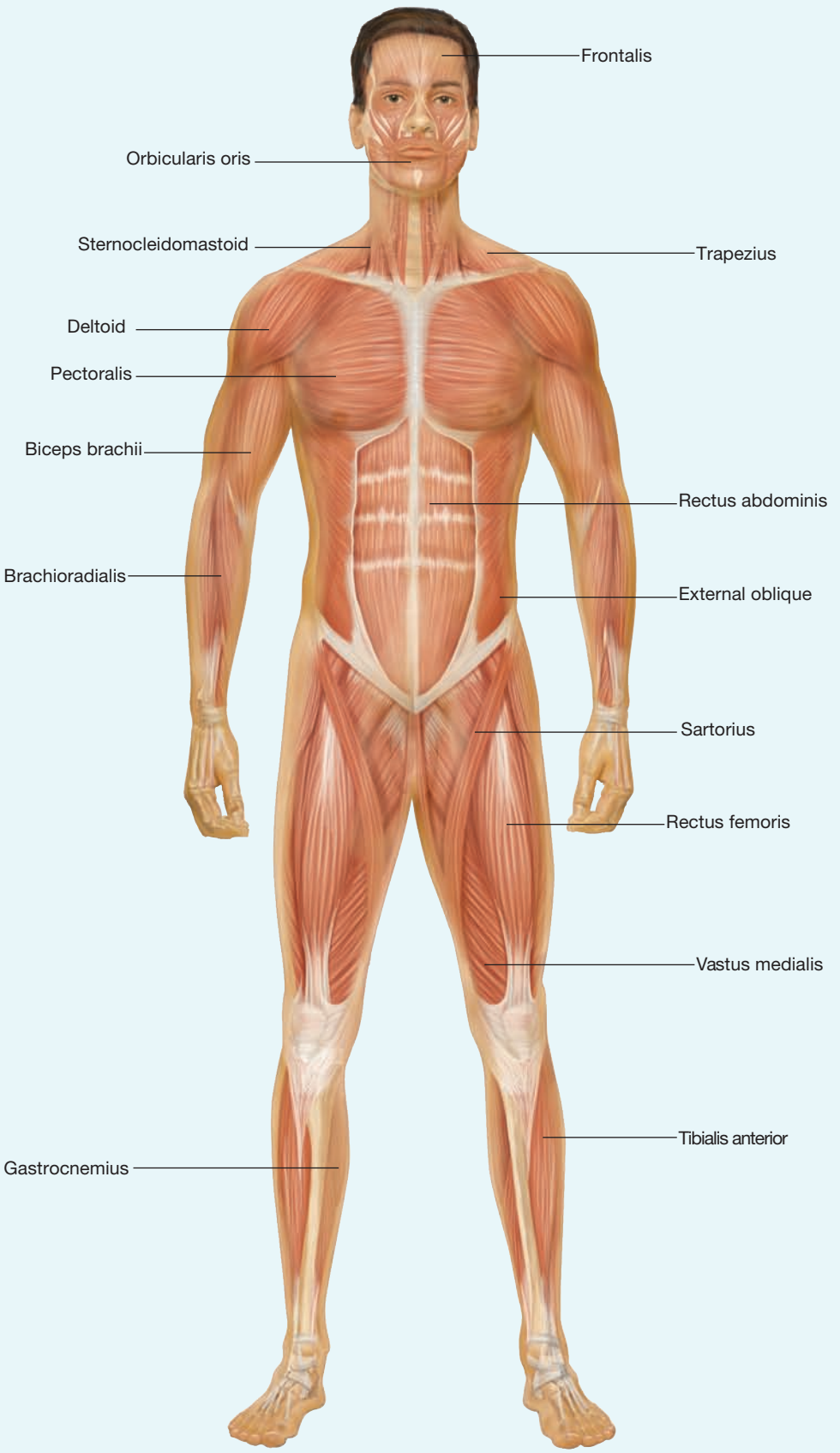
Suffixes

-asthenia	weakness
-ion	action
-kinesia	movement
-tonia	tone
-trophic	pertaining to development

Prefixes

ab-	away from
ad-	toward
circum-	around
e-	outward

Muscular System Illustrated



Anatomy and Physiology of the Muscular System

muscle tissue fibers muscles

Med Term Tip

The term *muscle* is the diminutive form of the Latin word *mus* or "little mouse." This is thought to describe how the skin ripples when a muscle contracts, like a little mouse running.

Muscles are bundles of parallel **muscle tissue fibers**. As these fibers contract (shorten in length) they produce movement of or within the body. The movement may take the form of bringing two bones closer together, pushing food through the digestive system, or pumping blood through blood vessels. In addition to producing movement, muscles also hold the body erect and generate heat.

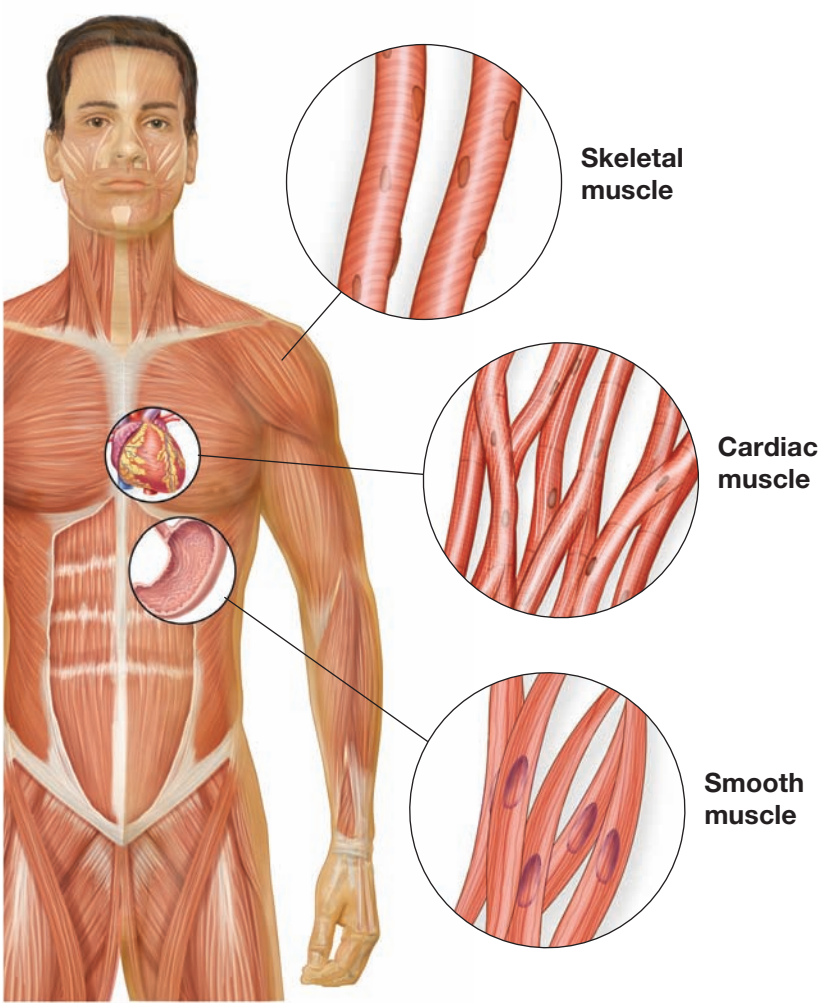
Types of Muscles

cardiac muscle
involuntary muscles
skeletal muscle
smooth muscle
voluntary muscles

What's In A Name?

Look for these word parts:
cardi/o = heart
-ac = pertaining to
in- = not

The three types of muscle tissue are **skeletal muscle**, **smooth muscle**, and **cardiac muscle** (see Figure 4.21 ■). Muscle tissue may be either voluntary or involuntary. **Voluntary muscles** are those muscles for which a person consciously chooses to contract and for how long and how hard to contract them. The skeletal muscles of the arm and leg are examples of this type of muscle. **Involuntary muscles** are the muscles under the control of the subconscious regions of the brain. The smooth muscles found in internal organs and cardiac muscles are examples of involuntary muscle tissue.



■ **Figure 4.21** The three types of muscles: skeletal, smooth, and cardiac.

Skeletal Muscle

fascia (FASH-ee-ah)
motor neurons
myoneural junction (MY-oh-NOO-rall)
striated muscles (stry-a-ted)
tendon (TEN-dun)

A skeletal muscle is directly or indirectly attached to a bone and produces voluntary movement of the skeleton. It is also referred to as a **striated muscle** because of its striped appearance under the microscope (see Figure 4.22 ■). Each muscle is wrapped in layers of fibrous connective tissue called **fascia**. The fascia tapers at each end of a skeletal muscle to form a very strong **tendon**. The tendon then inserts into the periosteum covering a bone to anchor the muscle to the bone. Skeletal muscles are stimulated by **motor neurons** of the nervous system. The point at which the motor nerve contacts a muscle fiber is called the **myoneural junction**.

Med Term Tip
The human body has more than 400 skeletal muscles, which account for almost 50% of the body's weight.

Smooth Muscle

visceral muscle (vis-she-ral)

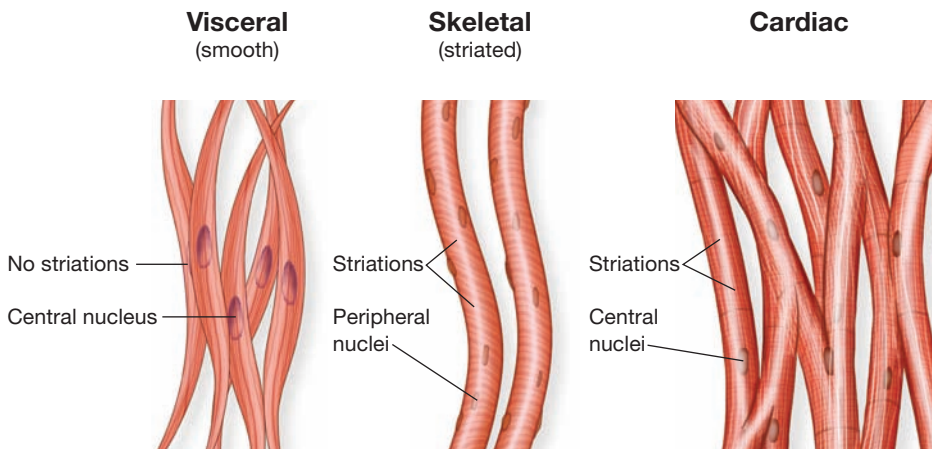
Smooth muscle tissue is found in association with internal organs. For this reason, it is also referred to as **visceral muscle**. The name smooth muscle refers to the muscle's microscopic appearance; it lacks the striations of skeletal muscle (see again Figure 4.22). Smooth muscle is found in the walls of the hollow organs, such as the stomach, tube-shaped organs, such as the respiratory airways, and blood vessels. It is responsible for the involuntary muscle action associated with movement of the internal organs, such as churning food, constricting a blood vessel, and uterine contractions.

What's In A Name?
Look for these word parts:
cardi/o = heart
my/o = muscle
neur/o = nerve
viscer/o = internal organ
-al = pertaining to

Cardiac Muscle

myocardium (my-oh-CAR-dee-um)

Cardiac muscle, or **myocardium**, makes up the wall of the heart (see again Figure 4.22). With each involuntary contraction the heart squeezes to pump blood out of its chambers and through the blood vessels. This muscle is more thoroughly described in Chapter 5, Cardiovascular System.



	Visceral (smooth)	Skeletal (striated)	Cardiac
Contracts	Slowly	Rapidly	Rapidly
Found	Viscera, blood vessels	Trunk, extremities, head and neck	Heart
Control	Involuntary	Voluntary	Involuntary

■ **Figure 4.22**
Characteristics of the three types of muscles.

Practice As You Go

E. Complete the Statement

1. Another name for visceral muscle is _____ muscle.
2. Nerves contact skeletal muscle fibers at the _____ junction.
3. The three types of muscle are _____, _____, and _____.

Naming Skeletal Muscles

biceps (BYE-seps)
extensor carpi
external oblique
flexor carpi
gluteus maximus (GLOO-tee-us / MACKS-ih-mus)
rectus abdominis (REK-tus / ab-DOM-ih-nis)
sternocleidomastoid (STER-noh-KLY-doh MASS-toid)

The name of a muscle often reflects its location, origin and insertion, size, action, fiber direction, or number of attachment points, as illustrated by the following examples:

- **Location:** the term ***rectus abdominis*** means straight (rectus) abdominal muscle.
- **Origin and insertion:** the **sternocleidomastoid** is named for its two origins (stern/o for sternum and cleid/o for clavicle) and single insertion (mastoid process).
- **Size:** when gluteus, meaning rump area, is combined with maximus, meaning large, we have the term **gluteus maximus**.
- **Action:** the **flexor carpi** and **extensor carpi** muscles are named as such because they produce flexion and extension at the wrist.
- **Fiber direction:** the **external oblique** muscle is an abdominal muscle whose fibers run at an oblique angle.
- **Number of attachment points:** the prefix bi-, meaning two, can form the medical term **biceps**, which refers to the muscle in the upper arm that has two heads or connecting points.

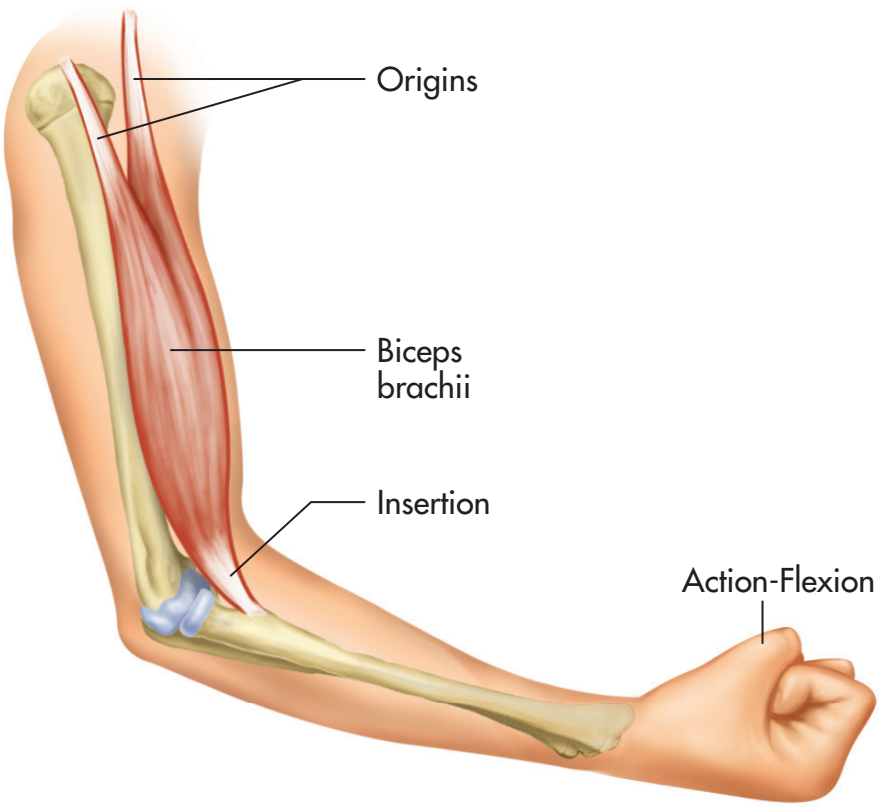
What's In A Name?
Look for these word parts:
cleid/o = clavicle
extens/o = to stretch out
flex/o = to bend
stern/o = sternum
-al = pertaining to
bi- = two
ex- = outward

Skeletal Muscle Actions

action
antagonistic pairs
insertion
origin

Skeletal muscles are attached to two different bones and overlap a joint. When a muscle contracts, the two bones move, but not usually equally. The less movable of the two bones is considered to be the starting point of the muscle and is called the **origin**. The more movable bone is considered to be where the

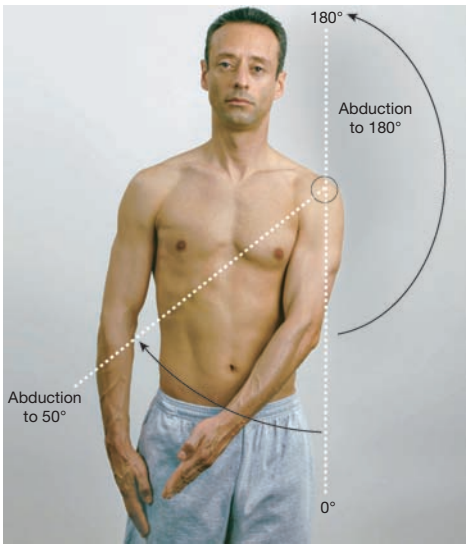
muscle ends and is called the **insertion** (see Figure 4.23 ■). The type of movement a muscle produces is called its **action**. Muscles are often arranged around joints in **antagonistic pairs**, meaning that they produce opposite actions. For example, one muscle will bend a joint while its antagonist is responsible for straightening the joint. Some common terminology for muscle actions are described in Table 4.5 ■.



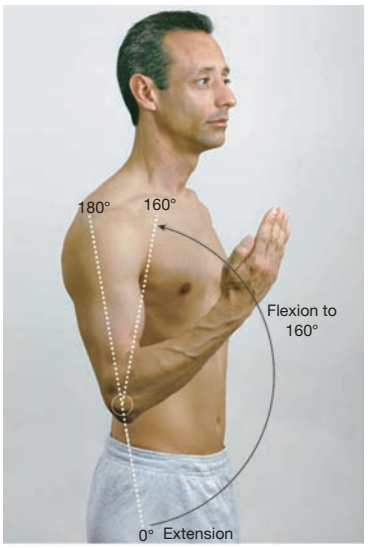
■ **Figure 4.23** Origin and insertion of a muscle

Table 4.5 Muscle Actions Grouped by Antagonistic Pairs

Action	Word Parts	Description
abduction (ab-DUCK-shun)	ab- = away from duct/o = to bring -ion = action	Movement away from midline of the body (see Figure 4.24 ■)
adduction (ah-DUCK-shun)	ad- = toward duct/o = to bring -ion = action	Movement toward midline of the body (see again Figure 4.24)
flexion (FLEK-shun)	flex/o = to bend -ion = action	Act of bending or being bent (see Figure 4.25 ■)

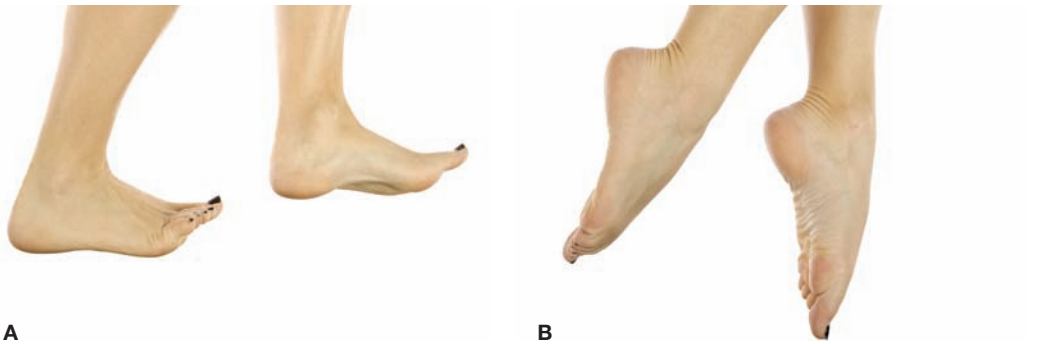


■ **Figure 4.24** Abduction and adduction of the shoulder joint.



■ **Figure 4.25** Flexion and extension of the elbow joint.

extension (eks-TEN-shun)	extens/o = to stretch out -ion = action	Movement that brings limb into or toward a straight condition (see again Figure 4.25)
dorsiflexion (dor-see-FLEK-shun)	dors/o = back of body flex/o = to bend -ion = action	Backward bending, as of hand or foot (see Figure 4.26A ■)
plantar flexion (PLAN-tar / FLEK-shun)	plant/o = sole of foot -ar = pertaining to flex/o = to bend -ion = action	Bending sole of foot; pointing toes downward (see Figure 4.26B ■)

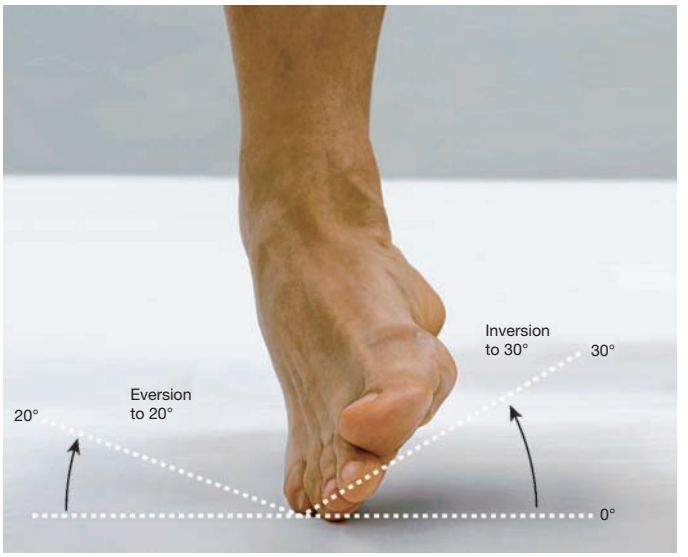


A B

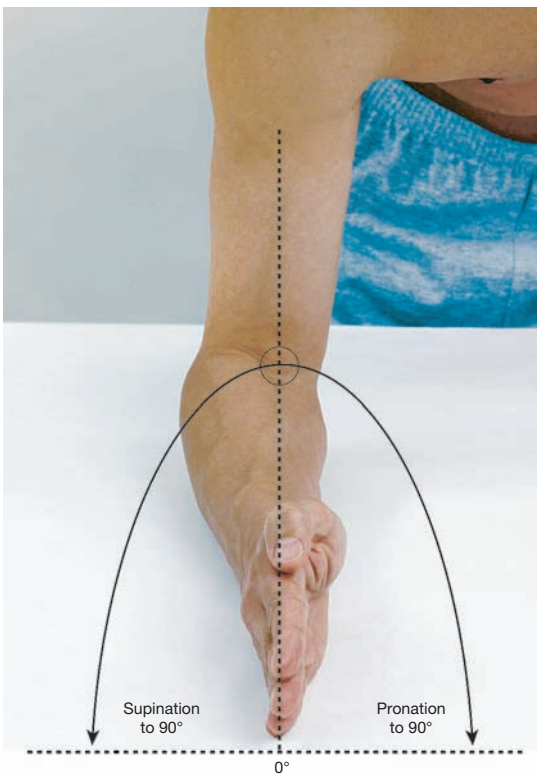
■ **Figure 4.26** Dorsiflexion (A) and plantar flexion (B) of the ankle joint. *(Poulsons Photography/ Shutterstock)*

Table 4.5 Muscle Actions Grouped by Antagonistic Pairs (continued)

Action	Word Parts	Description
eversion (ee-VER-zhun)	e- = outward vers/o = to turn -ion = action	Turning outward (see Figure 4.27 ■)
inversion (in-VER-zhun)	in- = inward vers/o = to turn -ion = action	Turning inward (see again Figure 4.27)
pronation (proh-NAY-shun)		To turn downward or backward as with the hand or foot (see Figure 4.28 ■)
supination (soo-pin-NAY-shun)		Turning the palm or foot upward (see again Figure 4.28)
elevation		To raise a body part, as in shrugging the shoulders
depression		A downward movement, as in dropping the shoulders
The circular actions described below are an exception to the antagonistic pair arrangement.		
circumduction (sir-kum-DUCK-shun)	circum- = around duct/o = to bring -ion = action	Movement in a circular direction from a central point as if drawing a large, imaginary circle in the air
opposition	**Med Term Tip** Primates are the only animals with opposable thumbs.	Moving thumb away from palm; the ability to move the thumb into contact with the other fingers
rotation	rotat/o = to revolve -ion = action	Moving around a central axis



■ **Figure 4.27** Eversion and inversion of the foot.



■ **Figure 4.28** Pronation and supination of the forearm.

Practice As You Go

F. Terminology Matching

Match each term to its definition.

1.	_____ abduction	a.	backward bending of the foot
2.	_____ rotation	b.	bending the foot to point toes toward the ground
3.	_____ plantar flexion	c.	straightening motion
4.	_____ extension	d.	motion around a central axis
5.	_____ dorsiflexion	e.	motion away from the body
6.	_____ flexion	f.	moving the thumb away from the palm
7.	_____ adduction	g.	motion toward the body
8.	_____ opposition	h.	bending motion

Terminology

Word Parts Used to Build Muscular System Terms

The following lists contain the combining forms, suffixes, and prefixes used to build terms in the remaining sections of this chapter.

Combining Forms

bi/o = life	**kinesi/o** = movement	**ten/o** = tendon
carp/o = wrist	**later/o** = side	**tend/o** = tendon
electr/o = electricity	**muscul/o** = muscle	**tendin/o** = tendon
fasci/o = fibrous band	**my/o** = muscle	
fibr/o = fibers	**myos/o** = muscle	

Suffixes

-al = pertaining to	**-desis** = to fuse	**-itis** = inflammation
-algia = pain	**-dynia** = pain	**-kinesia** = movement
-ar = pertaining to	**-gram** = record	**-logy** = study of
-asthenia = weakness	**-graphy** = process of recording	**-opsy** = view of

Suffixes

-otomy = cutting into	**-rrhaphy** = suture	**-trophic** = pertaining to development
-ous = pertaining to	**-rrhexis** = rupture	**-trophy** = development
-pathy = disease	**-tonia** = tone	
-plasty = surgical repair		

Prefixes

a- = without	**epi-** = above	**poly-** = many
brady- = slow	**hyper-** = excessive	**pseudo-** = false
dys- = abnormal; difficult	**hypo-** = insufficient	

Adjective Forms of Anatomical Terms

Term	Word Parts	Definition
fascial (FAS-ee-all)	fasci/o = fibrous band -al = pertaining to	pertaining to fascia
muscular (MUSS-kew-lar)	muscul/o = muscle -ar = pertaining to	pertaining to muscles
musculoskeletal (MUSS-kew-loh-SKEL-eh-tal)	muscul/o = muscle -al = pertaining to	pertaining to the muscles and skeleton
tendinous (TEN-din-us)	tendin/o = tendon -ous = pertaining to	pertaining to tendons

Pathology

Term	Word Parts	Definition
Medical Specialties		
kinesiology (kih-NEE-see-oh-loh-jee)	kinesi/o = movement -logy = study of	The science that studies movement, how it is produced, and the muscles involved.
Signs and Symptoms		
adhesion		Scar tissue forming in the fascia surrounding a muscle, making it difficult to stretch the muscle.
atonia	a- = without -tonia = tone	The lack of muscle tone.
atrophy (AT-rah-fee)	a- = without -trophy = development	Poor muscle development as a result of muscle disease, nervous system disease, or lack of use; commonly referred to as *muscle wasting.*
bradykinesia (brad-ee-kih-NEE-see-ah)	brady- = slow -kinesia = movement	Having slow movements.

Pathology (continued)

Term	Word Parts	Definition
contracture (kon-TRACK-chur)		Abnormal shortening of muscle fibers, tendons, or fascia, making it difficult to stretch the muscle.
dyskinesia (dis-kih-NEE-see-ah)	dys- = difficult, abnormal -kinesia = movement	Having difficult or abnormal movement.
dystonia	dys- = abnormal -tonia = tone	Having abnormal muscle tone.
hyperkinesia (high-per-kih-NEE-see-ah)	hyper- = excessive -kinesia = movement	Having an excessive amount of movement.
hypertonia	hyper- = excessive -tonia = tone	Having excessive muscle tone.
hypertrophy (high-PER-troh-fee)	hyper- = excessive -trophy = development	Increase in muscle bulk as a result of use, as with lifting weights.
hypokinesia (HI-poh-kih-NEE-see-ah)	hypo- = insufficient -kinesia = movement	Having an insufficient amount of movement.
hypotonia	hypo- = insufficient -tonia = tone	Having insufficient muscle tone.
intermittent claudication (klaw-dih-KAY-shun)		Attacks of severe pain and lameness caused by ischemia of the muscles, typically the calf muscles; brought on by walking even very short distances.
myalgia (my-AL-jee-ah)	my/o = muscle -algia = pain	Muscle pain.
myasthenia (my-ass-THEE-nee-ah)	my/o = muscle -asthenia = weakness	Muscle weakness.
myotonia	my/o = muscle -tonia = tone	Muscle tone.
spasm		Sudden, involuntary, strong muscle contraction.
tenodynia (ten-oh-DIN-ee-ah)	ten/o = tendon -dynia = pain	Tendon pain.
Muscles		
fasciitis (fas-ee-EYE-tis)	fasci/o = fibrous band -itis = inflammation	Inflammation of fascia.
fibromyalgia (figh-broh-my-AL-jee-ah)	fibr/o = fibers my/o = muscle -algia = pain	Condition with widespread aching and pain in the muscles and soft tissue.
lateral epicondylitis (ep-ih-kon-dih-LYE-tis)	later/o = side -al = pertaining to epi- = above -itis = inflammation	Inflammation of the muscle attachment to the lateral epicondyle of the elbow. Often caused by strongly gripping. Commonly called *tennis elbow.*
muscular dystrophy (MD) (MUSS-kew-ler / DIS-troh-fee)	muscul/o = muscle -ar = pertaining to dys- = abnormal -trophy = development	Inherited disease causing a progressive muscle degeneration, weakness, and atrophy.
myopathy (my-OPP-ah-thee)	my/o = muscle -pathy = disease	A general term for muscle disease.

Pathology (continued)

Term	Word Parts	Definition
myorrhexis (my-oh-REK-sis)	my/o = muscle -rrhexis = rupture	Tearing a muscle.
polymyositis (pol-ee-my-oh-SIGH-tis)	poly- = many myos/o = muscle -itis = inflammation	The simultaneous inflammation of two or more muscles.
pseudohypertrophic muscular dystrophy (soo-doh-HIGH-per-troh-fic)	pseudo- = false hyper- = excessive -trophic = pertaining to development muscul/o = muscle -ar = pertaining to dys- = abnormal -trophy = development	A type of inherited muscular dystrophy in which the muscle tissue is gradually replaced by fatty tissue, making the muscle look strong. Also called *Duchenne's muscular dystrophy.*
torticollis (tore-tih-KOLL-iss)		Severe neck spasms pulling the head to one side. Commonly called *wryneck* or a *crick in the neck.*
Tendons, Muscles, and/or Ligaments		
carpal tunnel syndrome (CTS)	carp/o = wrist -al = pertaining to	Repetitive motion disorder with pain caused by compression of the finger flexor tendons and median nerve as they pass through the carpal tunnel of the wrist.
ganglion cyst (GANG-lee-on)		Cyst that forms on tendon sheath, usually on hand, wrist, or ankle.
repetitive motion disorder		Group of chronic disorders involving the tendon, muscle, joint, and nerve damage, resulting from the tissue being subjected to pressure, vibration, or repetitive movements for prolonged periods.
rotator cuff injury		The rotator cuff consists of the joint capsule of the shoulder joint reinforced by the tendons from several shoulder muscles. The high degree of flexibility at the shoulder joint puts the rotator cuff at risk for strain and tearing.
strain		Damage to the muscle, tendons, or ligaments due to overuse or overstretching.
tendinitis (ten-dih-NIGH-tis)	tendin/o = tendon -itis = inflammation	Inflammation of a tendon.

Diagnostic Procedures

Term	Word Parts	Definition
Clinical Laboratory Test		
creatine phosphokinase (CPK) (KREE-ah-teen / foss-foe-KYE-nase)		Muscle enzyme found in skeletal muscle and cardiac muscle. Blood levels become elevated in disorders such as heart attack, muscular dystrophy, and other skeletal muscle pathologies.

Diagnostic Procedures (continued)

Term	Word Parts	Definition
Additional Diagnostic Procedures		
deep tendon reflexes (DTR)		Muscle contraction in response to a stretch caused by striking the muscle tendon with a reflex hammer. Test used to determine if muscles are responding properly.
electromyogram (EMG) (ee-lek-troh-MY-oh-gram)	electr/o = electricity my/o = muscle -gram = record	The hardcopy record produced by electromyography.
electromyography (EMG) (ee-lek-troh-my-OG-rah-fee)	electr/o = electricity my/o = muscle -graphy = process of recording	Study and record of the strength and quality of muscle contractions as a result of electrical stimulation.
muscle biopsy (BYE-op-see)	bi/o = life -opsy = view of	Removal of muscle tissue for pathological examination.

Therapeutic Procedures

Term	Word Parts	Definition
Surgical Procedures		
carpal tunnel release	carp/o = wrist -al = pertaining to	Surgical cutting of the ligament in the wrist to relieve nerve pressure caused by carpal tunnel syndrome, which can result from repetitive motion such as typing.
fasciotomy (fas-ee-OT-oh-mee)	fasci/o = fibrous band -otomy = cutting into	A surgical procedure that cuts into fascia.
myoplasty (MY-oh-plas-tee)	my/o = muscle -plasty = surgical repair	A surgical procedure to repair a muscle.
myorrhaphy (MY-or-ah-fee)	my/o = muscle -rrhaphy = suture	To suture a muscle.
tendoplasty (TEN-doh-plas-tee)	tend/o = tendon -plasty = surgical repair	A surgical procedure to repair a tendon.
tendotomy (tend-OT-oh-mee)	tend/o = tendon -otomy = cutting into	A surgical procedure that cuts into a tendon.
tenodesis (ten-oh-DEE-sis)	ten/o = tendon -desis = fuse	Surgical procedure to stabilize a joint by anchoring down the tendons of the muscles that move the joint.
tenoplasty (TEN-oh-plas-tee)	ten/o = tendon -plasty = surgical repair	A surgical procedure to repair a tendon.
tenorrhaphy (tah-NOR-ah-fee)	ten/o = tendon -rrhaphy = suture	To suture a tendon.

Pharmacology

Classification	Word Parts	Action	Examples
skeletal muscle relaxants	-al = pertaining to	Medication to relax skeletal muscles in order to reduce muscle spasms. Also called *antispasmodics.*	cyclobenzaprine, Flexeril; carisoprodol, Soma

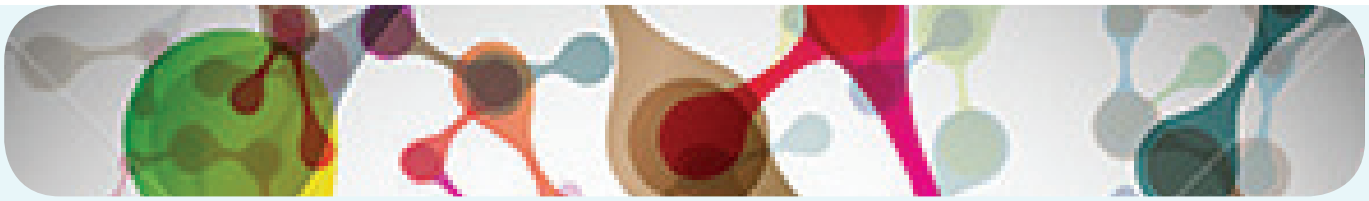
Abbreviations

CTS	carpal tunnel syndrome	**EMG**	electromyogram
CPK	creatine phosphokinase	**IM**	intramuscular
DTR	deep tendon reflex	**MD**	muscular dystrophy

Practice As You Go

G. What's the Abbreviation?

1. intramuscular _____
2. deep tendon reflex _____
3. muscular dystrophy _____
4. electromyogram _____
5. carpal tunnel syndrome _____



Chapter Review

Real-World Applications

Medical Record Analysis

This Discharge Summary contains 10 medical terms. Underline each term and write it in the list below the report. Then define each term. You will find Chapter 14 of your textbook helpful with the rehabilitation terms.

Discharge Summary

Admitting Diagnosis:	Osteoarthritis bilateral knees.
Final Diagnosis:	Osteoarthritis bilateral knees with right TKA
History of Present Illness:	Patient is a 68-year-old male. He reports he has experienced occasional knee pain and swelling since he injured his knees playing football in high school. These symptoms became worse while he was in his 50s and working on a concrete surface. The right knee has always been more painful than the left. He saw his orthopedic surgeon six months ago because of constant knee pain and swelling severe enough to interfere with sleep and all activities. He required a cane to walk. CT scan indicated severe bilateral osteoarthritis. He is admitted to the hospital at this time for TKR right knee.
Summary of Hospital Course:	Patient tolerated the surgical procedure well. He began intensive physical therapy for lower extremity ROM and strengthening exercises and gait training with a walker. He received occupational therapy instruction in ADLs, especially dressing and personal care. He was able to transfer himself out of bed by the third post-op day and was able to ambulate 150 ft with a walker and dress himself on the fifth post-op day.
Discharge Plans:	Patient was discharged home with his wife one week post-op. He will continue rehabilitation as an outpatient. Return to office for post-op checkup in one week.

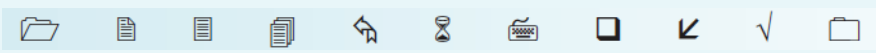
	Term	Definition
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____
7.	_____	_____
8.	_____	_____
9.	_____	_____
10.	_____	_____

Chart Note Transcription

The chart note below contains 11 phrases that can be reworded with a medical term that you learned in this chapter. Each phrase is identified with an underline. Determine the medical term and write your answers in the space provided.

Pearson General Hospital Emergency Room Record

Task Edit View Time Scale Options Help Download Archive Date: 17 May 2015



Current Complaint:	An 82-year-old female was transported to the Emergency Room via ambulance with severe left hip pain following a fall on the ice.
Past History:	Patient suffered a broken wrist bone **1** 2 years earlier that required immobilization by solid material. **2** Following this broken bone, **3** her physician who specializes in treatment of bone conditions **4** diagnosed her with moderate porous bones **5** on the basis of a computer-assisted X-ray. **6**
Signs and Symptoms:	Patient reported severe left hip pain, rating it as 8 on a scale of 1 to 10. She held her hip in a bent position **7** and could not tolerate movement toward a straight position. **8** X-rays of the left hip and leg were taken.
Diagnosis:	Shattered broken bone **9** in the neck of the left thigh bone. **10**
Treatment:	Implantation of an artificial hip joint **11** on the left.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

Case Study

Below is a case study presentation of a patient with a condition covered by this chapter. Read the case study and answer the questions below. Some questions will ask for information not included within this chapter. Use your text, a medical dictionary, or any other reference material you choose to answer these questions.

(Monkey Business Images/Shutterstock)

Mary Pearl, age 60, has come into the physician's office complaining of swelling, stiffness, and arthralgia, especially in her elbows, wrists, and hands. A bone scan revealed acute inflammation in multiple joints with damaged articular cartilage and an erythrocyte sedimentation rate blood test indicated a significant level of acute inflammation in the body. A diagnosis of acute episode of rheumatoid arthritis was made. The physician ordered nonsteroidal anti-inflammatory medication and physical therapy. The therapist initiated a treatment program of hydrotherapy and AROM exercises.

Questions

1. What pathological condition does this patient have? Look this condition up in a reference source and include a short description of it.

_____

_____

2. What type of long-term damage may occur in a patient with rheumatoid arthritis?

_____

_____

3. Describe the other major type of arthritis mentioned in your textbook.

_____

_____

4. What two diagnostic procedures did the physician order? Describe them in your own words. What were the results? (One of these procedures is described in Chapter 6 of your text.)

_____

_____

5. What treatments were ordered? Explain what the physical therapy procedures involve (refer to Chapter 14).

_____

_____

6. This patient is experiencing an acute episode. Explain what this phrase means and contrast it with chronic.

_____

_____

Practice Exercises

A. Word Building Practice

The combining form **oste/o** refers to bone. Use it to write a term that means:

1. bone cell _____
2. immature bone cell _____
3. porous bone _____
4. disease of the bone _____
5. cutting into a bone _____
6. instrument to cut bone _____
7. inflammation of the bone and bone marrow _____
8. abnormal softening of bone _____
9. bone and cartilage tumor _____

The combining form **my/o** refers to muscle. Use it to write a term that means:

10. muscle disease _____
11. surgical repair of muscle _____
12. suture of muscle _____
13. record of muscle electricity _____
14. muscle weakness _____

The combining form **ten/o** refers to tendons. Use it to write a term that means:

15. tendon pain _____
16. tendon suture _____

The combining form **arthr/o** refers to the joints. Use it to write a term that means:

17. to fuse a joint _____
18. surgical repair of a joint _____
19. cutting into a joint _____
20. inflammation of a joint _____
21. puncture to withdraw fluid from a joint _____
22. pain in the joints _____

The combining form **chondr/o** refers to cartilage. Use it to write a term that means:

23. surgical removal of cartilage _____
24. cartilage tumor _____
25. abnormal softening of cartilage _____

B. Name That Suffix

	Suffix	Example from Chapter
1. to fuse		
2. weakness		
3. slipping		
4. to surgically break		
5. movement		
6. porous		

C. Spinal Column Practice

Name the five regions of the spinal column and indicate the number of bones in each area.

	Name	Number of Bones
1.		
2.		
3.		
4.		
5.		

D. Prefix and Suffix Practice

Circle the prefix and/or suffix. Place a *P* for prefix or an *S* for suffix over these word parts, then define the term.

1. arthroscopy_____
2. intervertebral_____
3. chondromalacia_____
4. diskectomy_____
5. intracranial_____
6. spondylosis_____

E. Define the Combining Form

	Definition	Example from Chapter
1. **lamin/o**		
2. **ankyl/o**		
3. **chondr/o**		

	Definition	Example from Chapter
4. **spondyl/o**		
5. **my/o**		
6. **orth/o**		
7. **kyph/o**		
8. **tend/o**		
9. **myel/o**		
10. **articul/o**		

F. Fill in the Blank

carpal tunnel syndrome	rickets	lateral epicondylitis	systemic lupus erythematosus
scoliosis	osteogenic sarcoma	pseudohypertrophic muscular dystrophy	
herniated nucleus pulposus	osteoporosis		
	spondylolisthesis		

1. Mrs. Lewis, age 84, broke her hip. Her physician will be running tests for what potential ailment? _____
2. Jamie, age six months, is being given orange juice and vitamin supplements to avoid what condition? _____
3. George has severe elbow pain after playing tennis four days in a row. He may have _____.
4. Marshall's doctor told him that he had a ruptured disk. The medical term for this is _____.
5. Mr. Jefferson's physician has discovered a tumor at the end of his femur. He has been admitted to the hospital for a biopsy to rule out what type of bone cancer? _____
6. The school nurse has asked Janelle to bend over so that she may examine her back to see if she is developing a lateral curve. What is the nurse looking for? _____
7. Gerald has experienced a gradual loss of muscle strength over the past five years even though his muscles look large and healthy. The doctors believe he has an inherited muscle disease. What is that disease? _____
8. Roberta has suddenly developed arthritis in her hands and knees. Rheumatoid arthritis had been ruled out, but what other autoimmune disease might Roberta have? _____
9. Mark's X-ray demonstrated forward sliding of a lumbar vertebra; the radiologist diagnosed _____.
10. The orthopedist determined that Marcia's repetitive wrist movements at work caused her to develop _____

G. Name That Anatomical Name

1. knee cap _____
2. ankle bones _____
3. collar bone _____
4. thigh bone _____

5. toe bones _____
6. wrist bones _____
7. shin bone _____
8. shoulder blade _____
9. finger bones _____

H. What Does it Stand For?

1. DJD_____
2. EMG_____
3. C1_____
4. T6_____
5. IM_____
6. DTR_____
7. JRA_____
8. LLE_____
9. ortho_____
10. CTS_____

I. Define the Term

1. chondroplasty_____
2. bradykinesia_____
3. osteoporosis_____
4. lordosis_____
5. atrophy_____
6. myeloma_____
7. prosthesis_____
8. craniotomy_____
9. arthrocentesis_____
10. bursitis_____

J. Pharmacology Challenge

Fill in the classification for each drug description, then match the brand name.

	Drug Description	Classification	Brand Name
1.	_____ Treats mild pain and is an anti-inflammatory	_____	a. Flexeril
2.	_____ Hormone with anti-inflammatory properties	_____	b. Aleve
3.	_____ Reduces muscle spasms	_____	c. Fosamax
4.	_____ Treats conditions of weakened bones	_____	d. Oystercal
5.	_____ Maintains blood calcium levels	_____	e. Medrol

Labeling Exercise

Image A

Write the labels for this figure on the numbered lines provided.

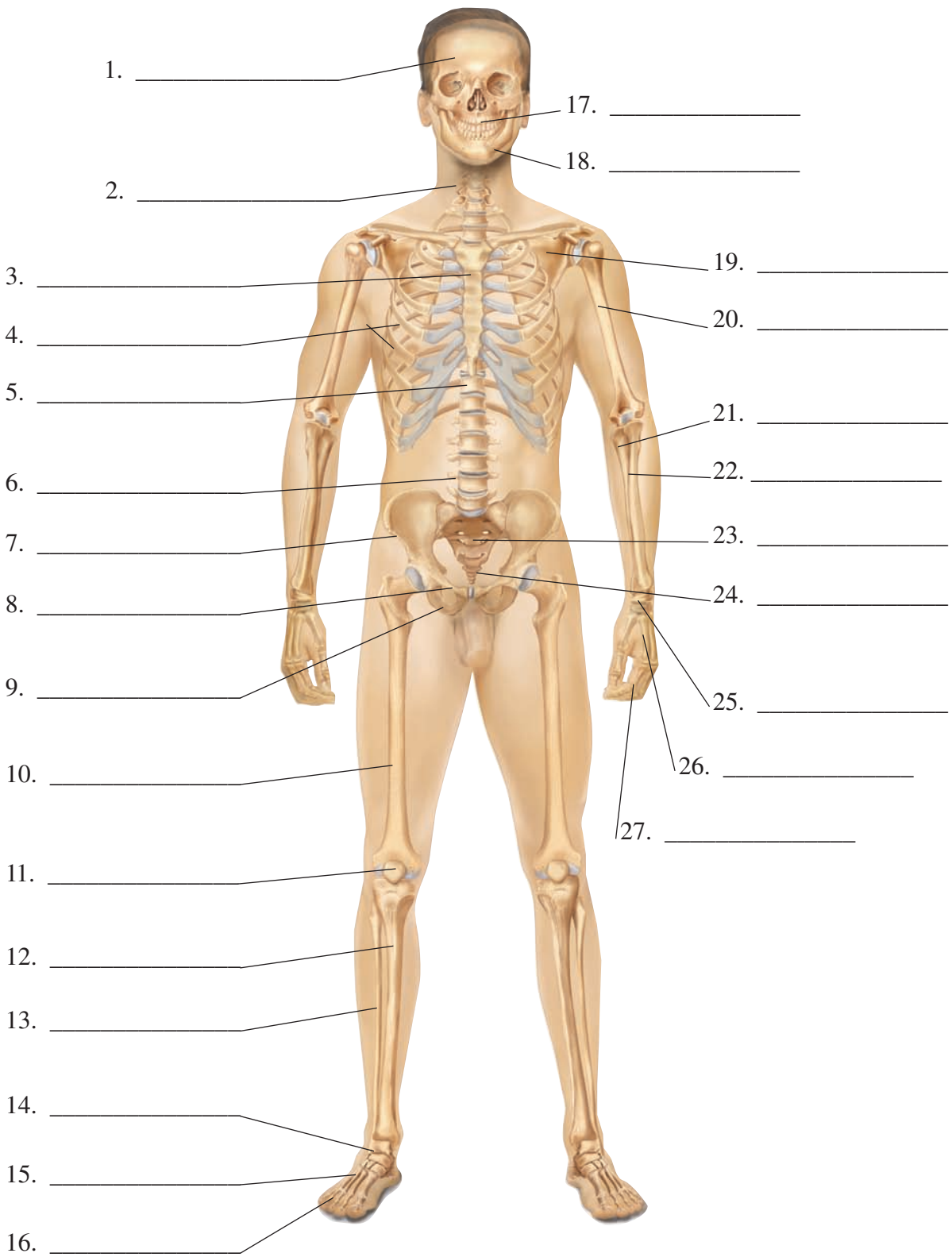


Image B

Write the labels for this figure on the numbered lines provided.

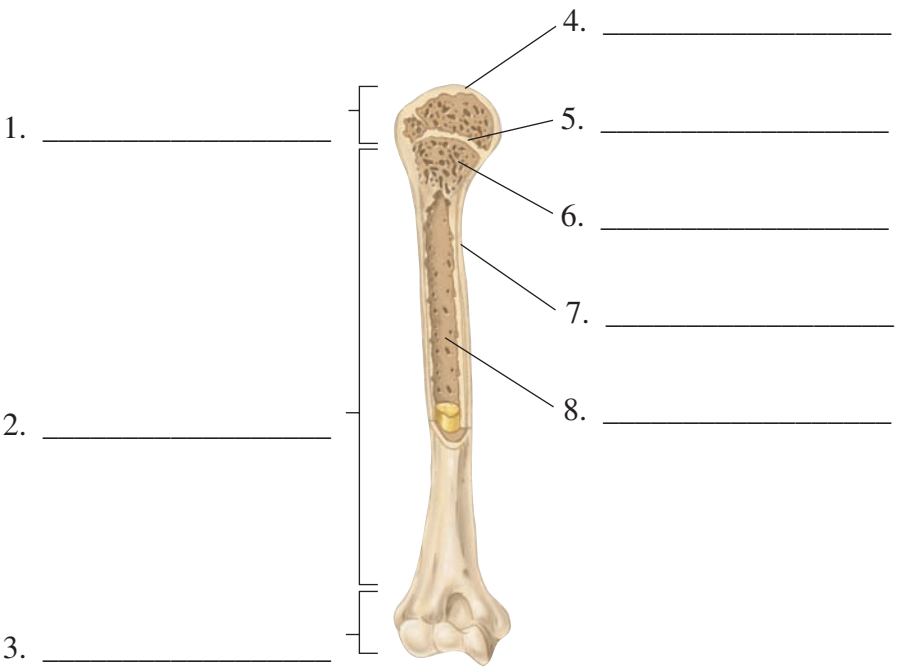


Image C

Write the labels for this figure on the numbered lines provided.