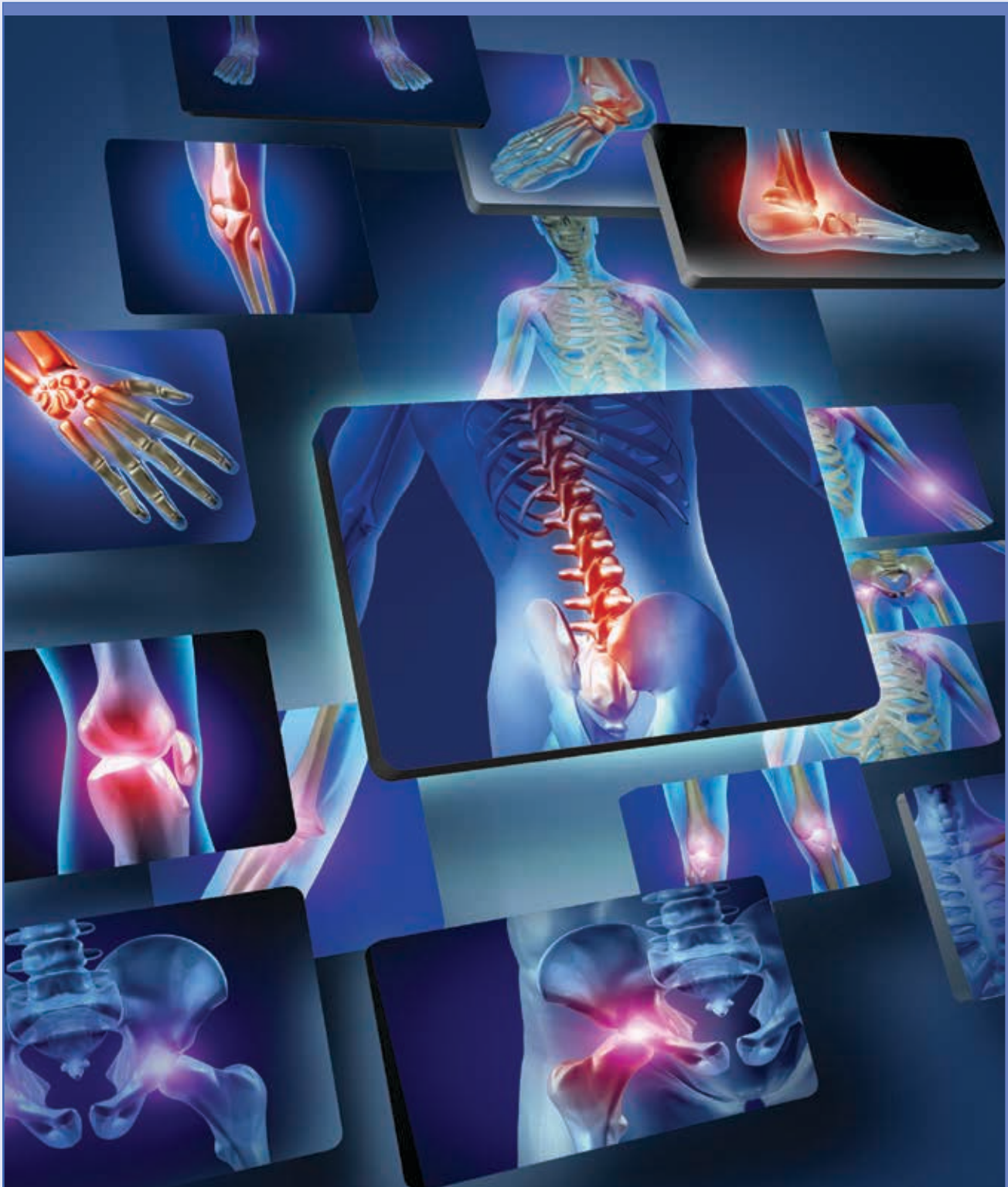


# Chapter 5

## Visiting the Orthopedic Specialties

*No bones about it*



# Learning Outcomes

Level 1

**Know**

Define word parts, abbreviations and medical terminology related to muscles, bones, and joints.

Level 2

**Comprehend**

Identify common orthopedic diagnostic assessments and diseases.

Level 3

**Apply**

Relate the components of the skeletal muscular system.

Level 4

**Analyze**

Analyze medical terms and abbreviations related to orthopedic specialties in relation to their meanings and usages.

Level 5

**Synthesize**

Combine your knowledge of medical terms and abbreviations to better understand orthopedic diseases and care.

Level 6

**Evaluate**

Gauge your understanding of orthopedic terminology through the interpretation of medical case studies.

## Introduction

Why would you need to visit an orthopedic specialist? Keep in mind that *ortho* means “to straighten” and that is exactly what this specialist will hopefully do—straighten you back up. The medical terms in parenthesis in the next few paragraphs are just a hint of the orthopedic terms that will be covered in this chapter.

When you were young, you might have broken (fractured) an arm bone. If you had broken a bone, it is likely the injury needed to be immobilized with the use of a cast to allow the bones to grow back together. Once the cast was removed, you may have noticed how weak and underdeveloped (atrophied) the muscle became from disuse. Maybe once you healed, you began to play a sport such as tennis and through repetitive use of your arm got tennis elbow (tendinitis). You might also have suffered muscle *spasms* or even strained a *ligament*. In this chapter, you’ll learn exactly what that means.

As you grew older, through wear and tear you might have developed inflamed joints (arthritis) and bone deterioration (osteoarthritis). As you age, due to calcium loss, your bones might become brittle due to holes or pores within them (osteoporosis). Again, these are just a few of the orthopedic terms we will cover in this chapter.



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## 5.1 Basic Anatomy and Associated Terms of the Musculoskeletal System

As mentioned in the previous chapters, be sure to check out the *Medical Clipboard* to get a preview of the word parts that will be covered in the section. Again, try to determine how many you already know and use that as a starting point to build on any existing knowledge. Do this for each of this chapter's three sections. At the end of the chapter is a master list of key terms and abbreviations for easy reference.

### Medical Clipboard 5-1

Use the provided checkboxes to check off any prefixes, combining forms, suffixes, or abbreviations you already know. Continue to check them off as you study the chapter until you have learned them all.

**Prefixes** Placed in the beginning of a term to change its meaning

<input checked="" type="checkbox"/>	Prefix	Meaning
<input type="checkbox"/>	Endo-	Within
<input type="checkbox"/>	Hyper-	Above, excessive
<input type="checkbox"/>	Peri-	Around, surrounding

**Combining Forms** Consists of a word root with a combining vowel (usually "o") so you can add other word parts

<input checked="" type="checkbox"/>	Combining form	Meaning
<input type="checkbox"/>	Arthr/o	Joints
<input type="checkbox"/>	Brachi/o	Arm
<input type="checkbox"/>	Card/i	Heart
<input type="checkbox"/>	Carp/o	Wrist
<input type="checkbox"/>	Chir/o	Hand
<input type="checkbox"/>	Chondr/o	Cartilage
<input type="checkbox"/>	Clavicul/o	Clavicle
<input type="checkbox"/>	Cost/o	Ribs
<input type="checkbox"/>	Crani/o	Skull
<input type="checkbox"/>	Fasci/o	Fascia
<input type="checkbox"/>	Femor/o	Femur
<input type="checkbox"/>	Fibr/o	Fiber
<input type="checkbox"/>	Fibul/o	Fibula
<input type="checkbox"/>	Hem/o	Blood
<input type="checkbox"/>	Ligament/o	Ligaments
<input type="checkbox"/>	Lumb/o	Lower back

<input checked="" type="checkbox"/>	Combining form	Meaning
<input type="checkbox"/>	Mandibul/o, Submaxill/o	Mandible
<input type="checkbox"/>	Maxill/o	Maxilla
<input type="checkbox"/>	Medull/o	Inner section, middle, marrow
<input type="checkbox"/>	Metacarp/o	Metacarpals
<input type="checkbox"/>	Metatars/o	Metatarsals
<input type="checkbox"/>	My/o, Myos/o, Muscul/o	Muscle
<input type="checkbox"/>	Myel/o	Bone marrow
<input type="checkbox"/>	Oss/e, Oss/i, Oste/o, Ost/o	Bone(s)
<input type="checkbox"/>	Patell/a, Patell/o	Patella
<input type="checkbox"/>	Pelv/o, Pelv/i	Pelvis
<input type="checkbox"/>	Phalang/o	Phalanges
<input type="checkbox"/>	Pod/o	Feet
<input type="checkbox"/>	Pub/o	Pubis
<input type="checkbox"/>	Radi/o	Radius
<input type="checkbox"/>	Rheumat/o	Watery flow
<input type="checkbox"/>	Sacr/o	Sacrum
<input type="checkbox"/>	Scapul/o	Scapula
<input type="checkbox"/>	Stern/o	Sternum
<input type="checkbox"/>	Tars/o	Tarsals
<input type="checkbox"/>	Ten/o, Tend/o, Tendin/o	Tendon
<input type="checkbox"/>	Thorac/o	Chest
<input type="checkbox"/>	Tibi/o	Tibia
<input type="checkbox"/>	Uln/o	Ulna
<input type="checkbox"/>	Vertebr/o	Vertebra
<input type="checkbox"/>	Viscer/o	Internal organs

Continues

## Medical Clipboard 5-1

Continued

**Suffixes** *The ending of a word that modifies its meaning and can be used to form a noun, adjective, or verb*

✓	Suffix	Meaning
<input type="checkbox"/>	-blast	Immature cell
<input type="checkbox"/>	-clasts	To break
<input type="checkbox"/>	-iatrist	Specialist in an area of medicine
<input type="checkbox"/>	-poiesis	Formation

**Abbreviations** *A shortened version of a word*

✓	Abbreviation	Meaning
<input type="checkbox"/>	ADL	Activities of daily living
<input type="checkbox"/>	C1-C7	Used to indicate specific bones of the neck (cervical spine)
<input type="checkbox"/>	Ca	Chemical symbol for calcium

✓	Abbreviation	Meaning
<input type="checkbox"/>	COTA	Certified occupational therapy assistant
<input type="checkbox"/>	DPM	Doctor of podiatric medicine
<input type="checkbox"/>	L1-L5	Used to indicate specific bones of the lumbar spine
<input type="checkbox"/>	MVA	Motor vehicle accident
<input type="checkbox"/>	OT	Occupational therapist
<input type="checkbox"/>	PT	Physical therapist
<input type="checkbox"/>	PTA	Physical therapy assistant
<input type="checkbox"/>	S1-S5	The last 5 sacral vertebrae, located in the lower spine
<input type="checkbox"/>	T1-T12	Used to indicate specific bones of the thoracic spine

### 5.1a Various Orthopedic Specialists

The musculoskeletal system obviously deals with your muscles and bones. There are a lot of professionals dedicated to treating this system. If someone sustains a significant bodily injury in an event such as a *motor vehicle accident (MVA)*, they will find themselves dealing with a whole host of medical professionals working to get them back to as normal as possible. The key players you will likely encounter in this area of medicine can be found in Table 5-1.





**Table 5-1 Professionals Found Working with the Musculoskeletal System**

Profession	Description
<b>Certified occupational therapy assistant (COTA)</b>	An individual who works under the supervision and direction of an occupational therapist
<b>Chiropractor</b> (chir/o = hand)	These individuals are not physicians but have been trained to treat ailments of spine and joints to relieve pressure and pain by way of realignment
<b>Massage therapist</b>	An individual who works to massage sore or injured muscles to relieve pain
<b>Occupational therapist (OT)</b>	A provider who works with patients to teach and train them how to adapt their abilities and regain the skills needed to perform the activities of daily living ( <b>ADL</b> )
<b>Orthopedist</b> (ortho = straight)	A physician who treats injuries and abnormalities of the muscle, bones, and joints
<b>Physical therapist (PT)</b>	A provider who creates a treatment plan and uses exercises and equipment to help the patient regain mobility
<b>Physical therapy assistant (PTA)</b>	A provider who works under the supervision and direction of a physical therapist
<b>Podiatrist (DPM)</b> (pod/o = feet, -iatrist = specialist in an area of medicine)	A physician, more specifically, a doctor of podiatric medicine (DPM), who specializes in diagnosing and treating diseases and abnormalities of the feet
<b>Rheumatologist</b> (rheumat/o = watery flow, as in your joints)	A physician who treats musculoskeletal diseases and autoimmune conditions that cause swelling, pain, and deformity in the joints, muscles, and bones

**Muscles**

A type of tissue that allows for movement

**Bones**

Rigid tissue structure that varies in shape and size and serves multiple roles and functions

**Joints**

An area where two or more bones meet allowing for movement

**Calcium (Ca)**

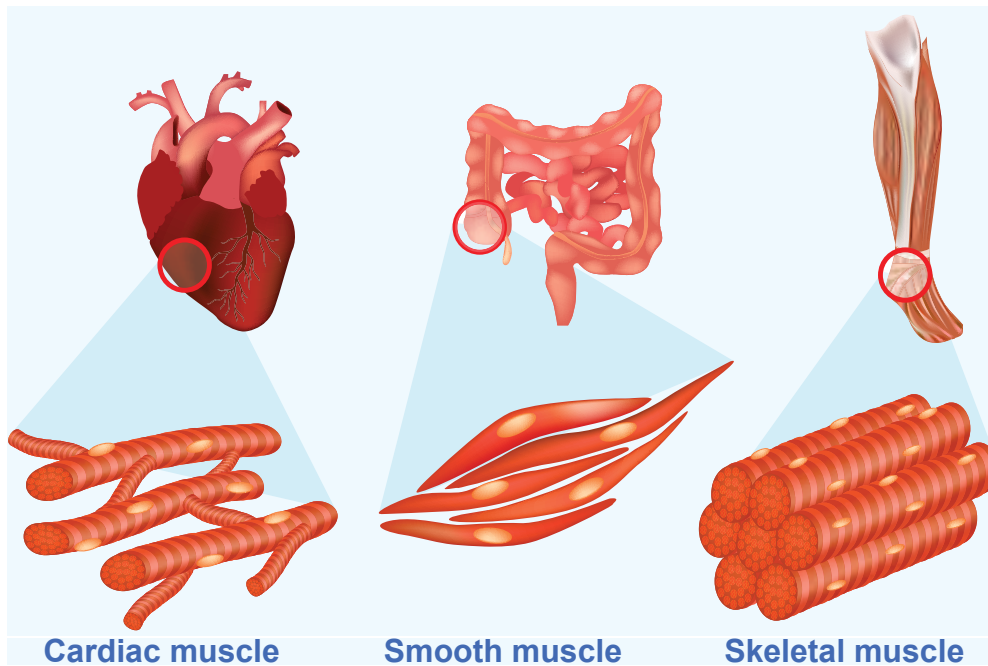
A mineral stored in the bones that is needed for the body to perform different functions

## 5.1b The Musculoskeletal System

The musculoskeletal system, as the term implies, is made up of the **muscles** (my/o) which are attached to the skeletal **bones** (oss/e, oss/i, oste/o, ost/o) and **joints** (arthr/o). This system allows for support, protection, body movement, and even storage of nutrients such as **calcium (Ca)**.

Let's begin with the muscular system and its function and associated terms. The general terms for *muscle* are my/o, myos/o, muscul/o. The muscular system has three types of muscle called skeletal, cardiac and smooth muscle as shown in Figure 5-1.

**Figure 5-1** Types of Muscle Tissue



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- **Skeletal muscles** are muscles attached to the skeleton to allow for body movement. You control this movement, meaning it is a voluntary movement. These muscles have a striped appearance at a microscopic level. The term for this is striated (striped) muscles.
- **Cardiac muscle** is only found in the heart and is the tissue that makes up the walls of the heart. This is also known as myocardial muscle (my/o = muscle, card/i = heart). This muscle is involuntary, meaning we do not consciously make our hearts beat.
- **Smooth muscle** is the type of muscle that is found in the walls of internal organs and vessels, such as the airway or blood vessels. It is called smooth muscle because it does not have stripes like skeletal muscles. Another word for organ is visceral and therefore, it is also referred to as visceral muscle (viscer/o = internal organs). These muscles, like the myocardial muscle, are involuntary and move on their own without our conscious control. Some examples include the smooth muscles in blood vessels that can vasoconstrict to make the vessels smaller or vasodilate to enlarge the vessel.

#### **Skeletal muscles**

Voluntary muscles attached to the skeleton, which allow for body movement

#### **Cardiac muscle**

Muscle that makes up the walls of the heart

#### **Smooth muscle**

The muscle found in the walls of internal organs and vessels, such as the airway or blood vessels

## **Muscle Attachment**

The skeletal muscles must have some attachment to allow them to connect to another bone or muscle. The three types of attachment are as follows:

- **Tendons** (ten/o, tend/o, tendin/o) – connect muscle to bone
- **Ligaments** (ligament/o) – connect bone to bone
- **Fascia** (fasci/o) – Latin for band. This is a sheet or band of connective tissue that encloses and separates muscles.

Figure 5-2 Knee Tendons

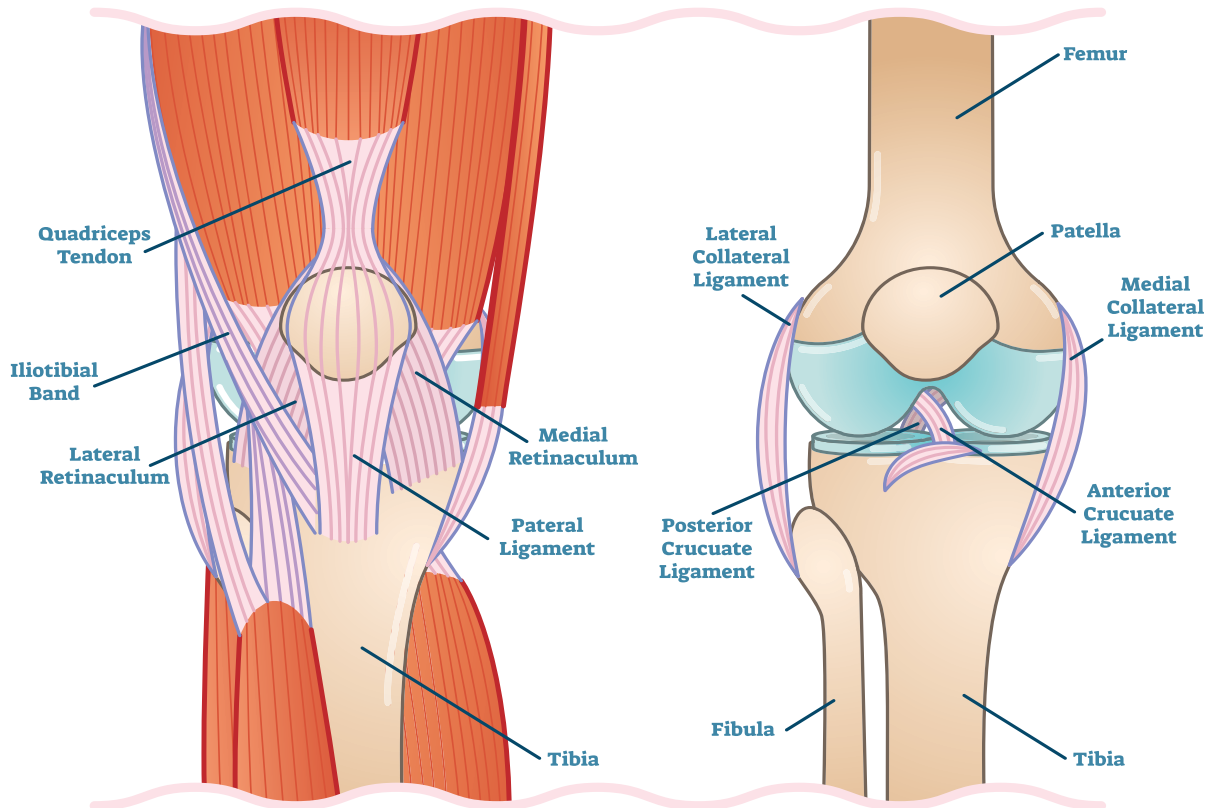


Figure 5-2 shows the quadriceps tendon connecting muscle to bone and various ligaments connecting bone to bone. The iliotibial band represents fascia.

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### Joints

Where two or more parts of the body meet to allow for movement

### Muscle Movement

**Joints** (arthr/o), or articulations, are found at the points where a bone connects to other bones. There are different types of joints depending on whether there is a need for movement or not. Joints that remain fixed or do not move are **fibrous joints**. These joints, also called **sutures**, can be found fusing the bones of the skull together. Now, you may be thinking, *I thought sutures were stitches*, and you would be correct to a degree. Though the words are used interchangeably, sutures are the threads or device used to close a wound, while stitching is the technique used. A physician or other qualified provider can use sutures to close a wound. In contrast, the sutures found on the skull are where the bones have fused together to ensure there are no gaps in between them.



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Sutures are the fibrous joints that fuse the bones of the skull together.

Most joints in our body, however, do require movement. **Synovial joints** are the type of joints that require movement. These joints have a **synovial capsule** that surrounds the joint. Membranes in the joint create **synovial fluid**. This fluid lubricates the joint and allows for ease of movement by decreasing friction. Another way these joints are cushioned is with the help of **bursa**, which is a closed, fluid-filled fibrous (fibr/o = fiber) sac found next to tendons. These are especially found in areas of large joints, such as knees and elbows, as illustrated in Figure 5-3.

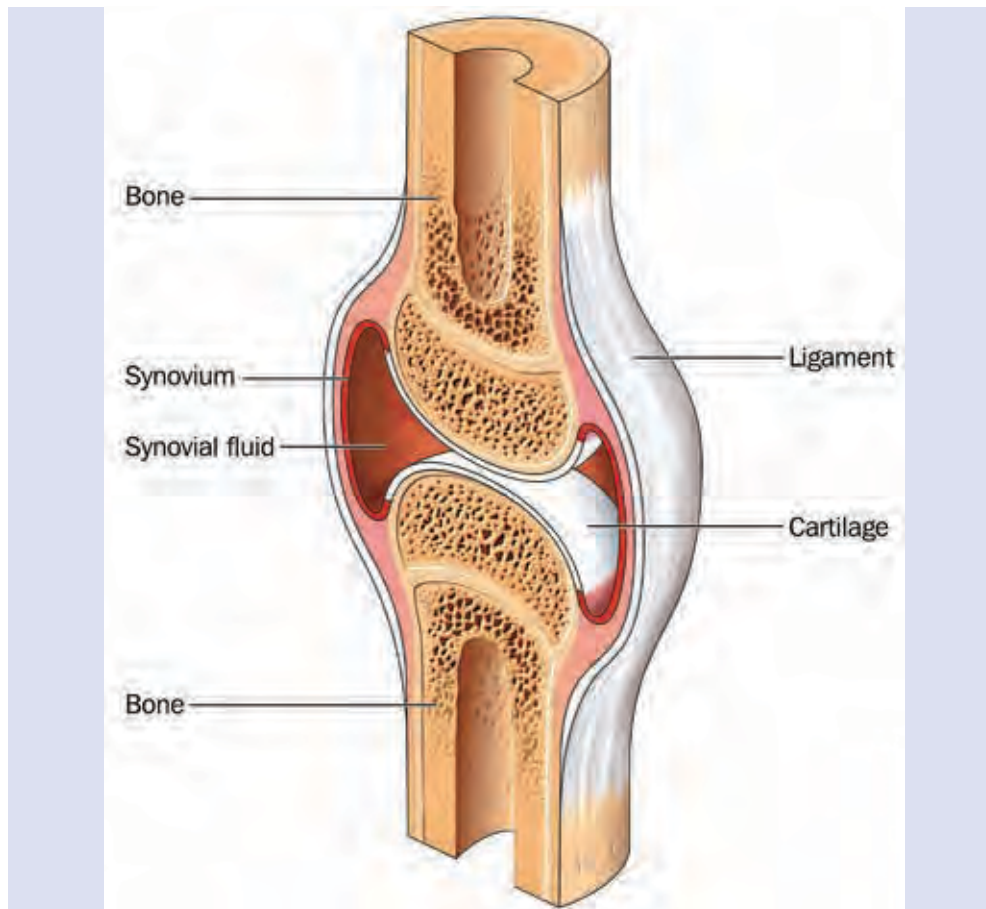
**Bursa**

A closed, fluid-filled fibrous sac next to tendons; found in areas of large joints such as knees and elbows

### Learning Hint 5-1

In Chapter 2, singular and plural forms were discussed. Bursa is the singular form while bursae is the plural form.

Figure 5-3 **A Synovial or Moveable Joint**



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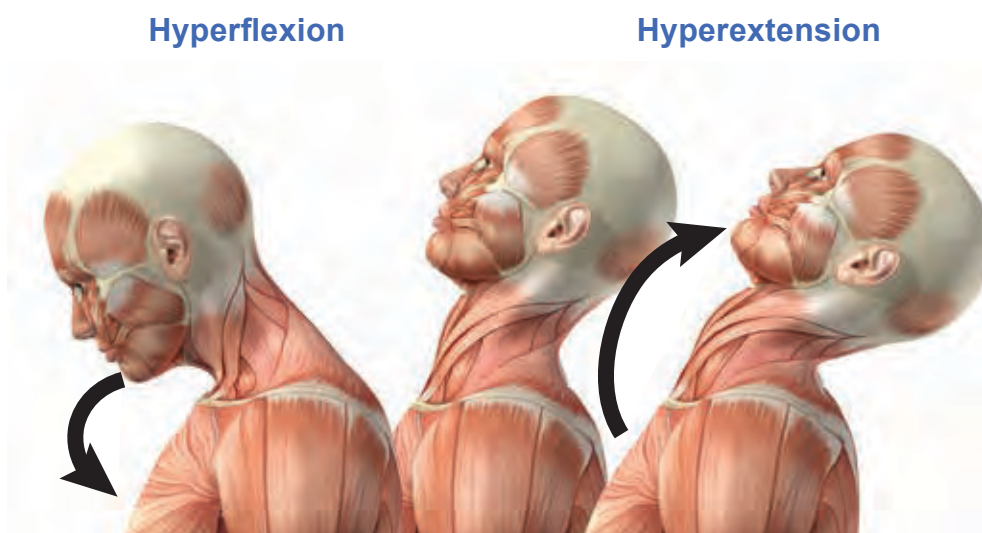
### Joint Movement

The body's synovial joints allow for a variety of types of movements, each with its own medical term as shown in Table 5-2.



**Table 5-2 Terms Associated with Common Muscle and Joint Movement**

Movement Term	Meaning
<b>Abduction</b>	Moves away from the midline. The midline is an imaginary line down the center of the body, which divides it into left and right. Putting your arms above your head would be abduction.
<b>Adduction</b>	Moves towards the midline or to the patient's side. Bringing your arms back down to your sides would be adduction.
<b>Flexion</b>	Bending movement that decreases the angle between two muscles or joints. For example, bending your knee is known as flexion, and straightening your knee is an extension.
<b>Extension</b>	A movement that increases the angle between two bones at a joint as the muscles contract to move the bent joint into a straightened position. For example, the extension of your arm straightens your arm
<b>Hyperflexion</b> (hyper- = above, excessive)	Excessive flexion (bending) of a joint beyond its normal range of motion (see Figure 5-4)
<b>Hyperextension</b>	Extending a joint beyond its normal range of motion (see Figure 5-4)
<b>Rotation</b>	The circular movement of a joint or muscle to move a limb
<b>Inversion</b>	Inward turning of a joint
<b>Eversion</b>	Outward turning of a joint
<b>Plantar (foot) flexion</b>	Downward movement of the foot
<b>Dorsiflexion</b>	Upward movement of the foot

**Figure 5-4 The Motion of a Whiplash**

As illustrated by the two arrows, hyperflexion decreases the angle between two body parts or joints and hyperextension increases the angle between the two joints and body parts.

## Learning Hint 5–2

*Abduction* and *adduction* can be hard to keep straight. For the term abduction, think of a kidnapper or alien abduction. In both instances, something or someone is being taken away. Hence the term, abduction meaning moving away from the midline.

### Medical Terms Associated with Bones

Now let's take a look at the various terms associated with the bones. Bones are a specialized connective tissue that has several functions beyond just protection. Bones store the body's calcium; the body maintains calcium-level equilibrium by moving it in and out of the bones to the bloodstream as needed. Another function of the bones is the ability to produce blood. This is known as **hemopoiesis** (hem/o = blood, -poiesis = formation). Blood production occurs in the red bone marrow. The medical term for bone marrow is (myel/o) and the terms used for bone are oss/e, oss/i, oste/o, and ost/o.

The general term for bone cells is **osteocytes**. When these bone cells are immature, they are known as **osteoblasts** (-blast = immature cell), where blast means embryonic or immature cell. Cells that break down bone cells are known as **osteoclasts** (-clasts = to break) and they are instrumental in bone repair and normal function.

Bone anatomy is illustrated in Figure 5-5. Some additional medical terms that can help you understand bone anatomy include:

- **Cartilage** is the cushion-like tissue that is more flexible than bone.
- **Epiphyseal line** is all that remains of the epiphyseal plate (growth plate) once the bone is mature and growth has stopped.
- **Periosteum** (peri- = around, surrounding) is the fibrous covering surrounding the outside of the bone.
- **Spongy bone** is the lighter portion of the bone tissue found in the inner regions of the bone. Located in this region is the **red bone marrow**, which is spongy bone tissue.
- **Nutrient foramen** is a small tunnel located on the cortex of a bone acting as a passageway for blood vessels to enter the medullary cavity
- **Compact bone** is the outside layer of bone tissue, which is very hard and provides strength and protection. This bone tissue has very small holes called **osteons**, which resemble the rings of a cut tree trunk.
- **Endosteum** (endo- = within) is the tissue that lines the medullary cavity of the bone.
- **Medullary** (medull/o = inner section, middle, marrow) **cavity** is a cavity in the inner region of the bone.

#### Hemopoiesis (hee-moh-poy-EE-sis)

The production of red blood cells; occurs in the bone marrow

#### Osteocytes

Bone cells

#### Osteoblasts

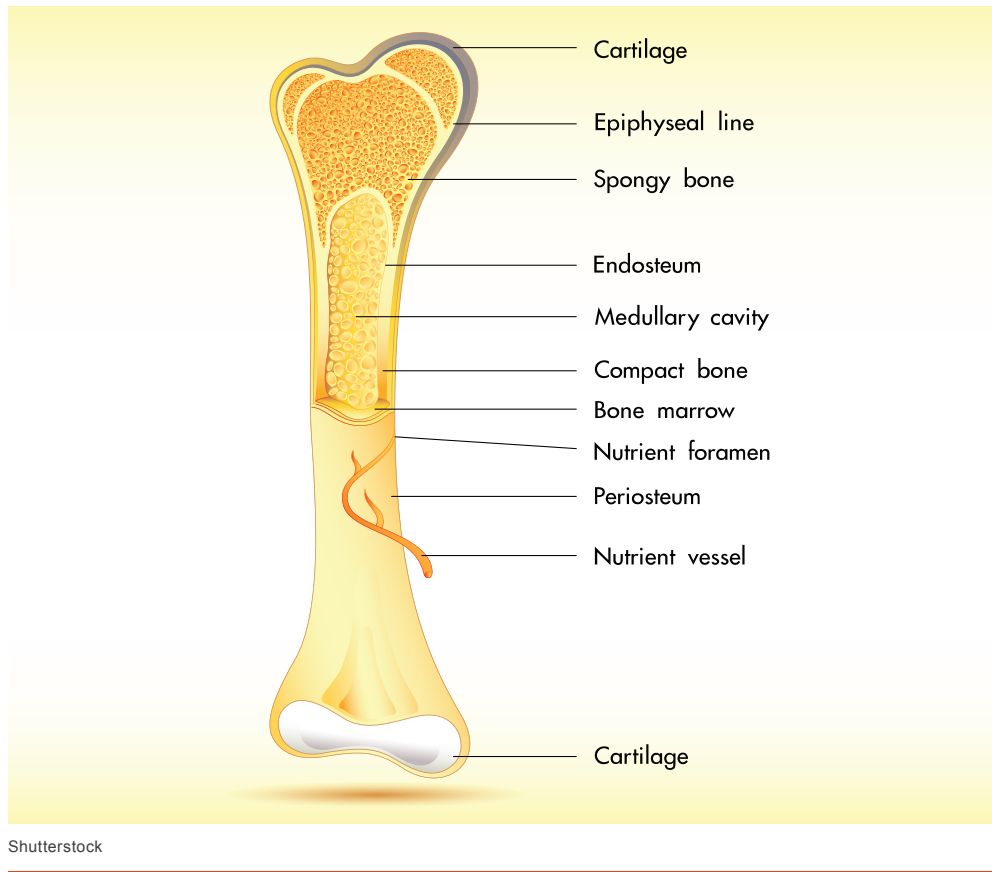
Embryonic or immature bone cells

#### Osteoclasts

Cells that break down bone cells as part of normal bone function

#### Bone marrow

A spongy, gelatinous tissue needed to produce certain blood cells (red bone marrow) or store fats (yellow bone marrow)

**Figure 5-5 Anatomy of the Bone**

### Names of Common Skeletal Bones

While the body consists of over 200 bones, let's focus on the most common bones of the body. You may be familiar with some of these bones already and have likely heard them most often in lay terms. Here is a description of these bones. These bones are illustrated in Figure 5-6, which is an anterior (front) view of the human skeletal system.

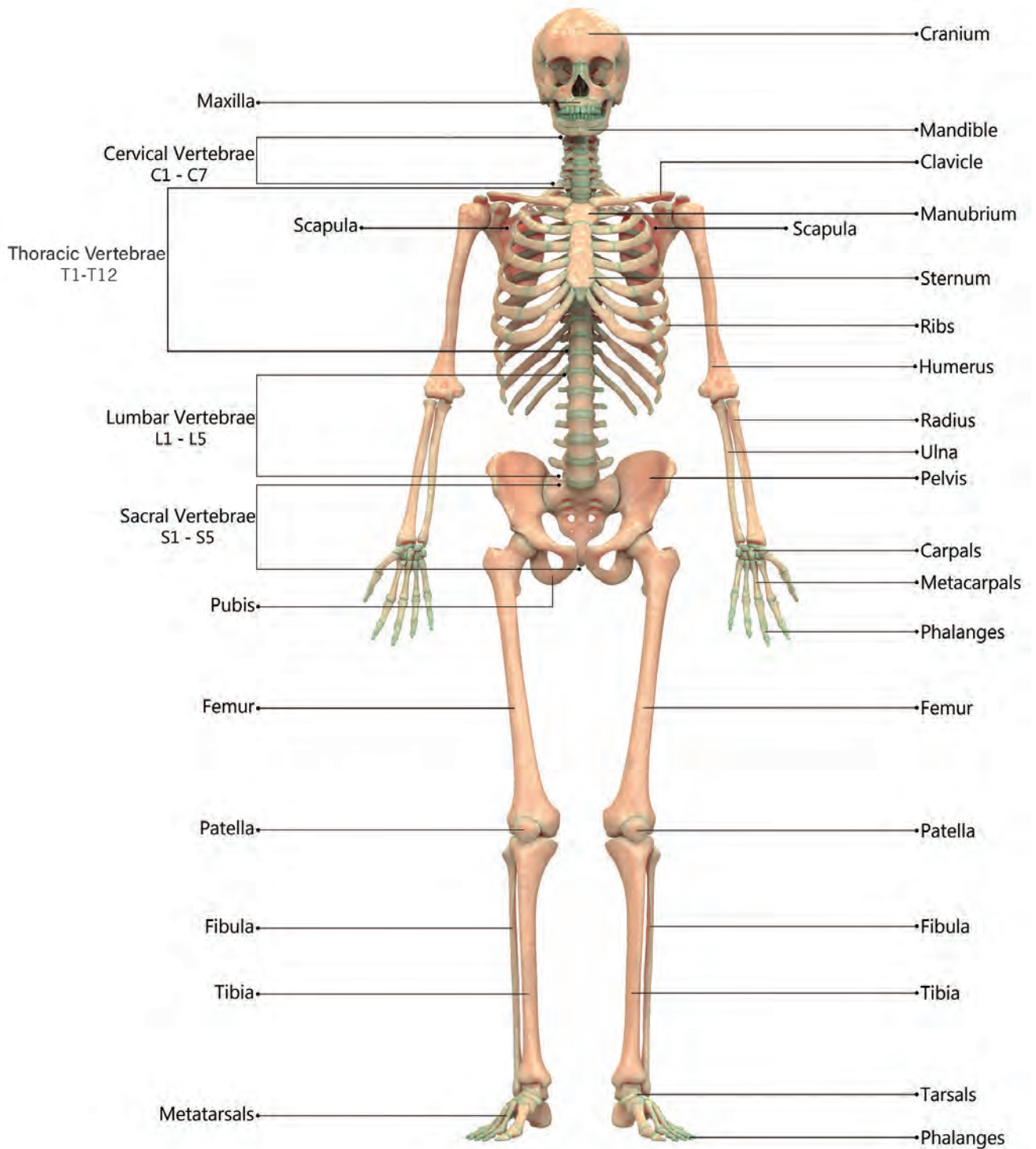
- **Cranium** (crani/o = skull) is the skull, which is constructed of plate-like bones held together by fibrous connective joints called sutures.
- **Maxilla** (maxill/o) is the bone that forms the upper jaw.
- **Mandible** (mandibul/o, submaxill/o) is the bone that forms the lower jaw.
- **Cervical vertebrae (C1-C7)** is the neck region of the vertebral column and consists of 7 vertebrae numbered 1 through 7.
- **Long bone** is a bone that is longer than it is wide and has a shaft and two ends; a femur is a long bone.
- **Clavicle** (clavicul/o), also known as the collarbone, is a horizontal long bone that acts to support the shoulder.

- **Thoracic vertebrae (T1-T12)** (thorac/o = chest) is the section of the vertebrae located at the upper back or chest region.
- **Scapula** (scapul/o), also known as the shoulder blade, is the bone that connects the humerus to the clavicle.
- **Sternum** (stern/o), also known as the breastbone, consists of three different parts: the **manubrium**, *body*, and **xiphoid process**. The manubrium is the superior portion of the sternum, the body is the large middle portion, and the xiphoid process is the lower portion of the sternum.
- **Ribs** (cost/o) are curved, archlike bones. There are 12 pairs of ribs. Ribs 1 through 7 are vertebrosternal (vertebr/o = vertebra, stern/o = sternum,) due to being fixed posteriorly to the vertebrae and anteriorly to the sternum via cartilage. These ribs are known as **true ribs**. The vertebrocostal ribs are ribs 8 through 10 and are known as **false ribs**. This is because these ribs are attached posteriorly to the vertebrae and anteriorly by the costal cartilage of the ribs above and not directly to the sternum. Ribs 11 and 12 are called the **floating ribs** since they only connect posteriorly to the vertebrae and have no anterior connection.
- **Humerus** is the long bone found in the upper arm or brachium (brachi/o= arm).
- **Lumbar vertebrae (L1-L5)** (lumb/o = lower back) is the section of the vertebrae located at the lower back region.
- The **radius** (radi/o) is also known as the radial bone. It is one of the two bones of the lower arm or forearm. This bone is located on the thumb side of the arm.
- The **ulna** (uln/o) is one of two bones in the lower arm and is found between the elbow and wrist.
- The term **pelvis** (pelv/o, pelv/i) is derived from Latin, meaning basin. This is the region known as the hipbone or bony pelvis. It houses reproductive and urinary organs and provides structure and protection to the area.
- The **sacral vertebrae (S1-S5)** (sacr/o = sacrum) is the section of vertebrae that consists of 3-5 bones located at the end of the vertebral column.
- The **pubis** (pub/o) are bones that form the anterior connection of the pelvis.
- **Carpals** (carp/o = wrist) are bones of the wrist.



- **Metacarpals** (metacarp/o) are the 5 bones in the hand.
- **Phalanges** (phalang/o) consist of the bones that form the digits of the fingers and toes.
- **Femur** (femor/o), also known as the thigh bone, is the longest long bone in the body. It is found in the upper leg (thigh).
- The **patella** (patell/a, patell/o) or kneecap is a flat, circular bone that provides protection to the anterior part of the knee.
- The **fibula** (fibul/o) is the smaller, thinner of the two bones located in the lower legs and helps stabilize the ankle.
- The **tibia** (tibi/o) is the larger of the two bones in the lower leg. This is commonly referred to as the shinbone.
- **Tarsals** (tars/o) are the bones of the ankle.
- **Metatarsals** (metatars/o) are the 5 bones in the foot.

Figure 5-6 Common Bones of the Skeleton



Anterior View

**Cartilage**

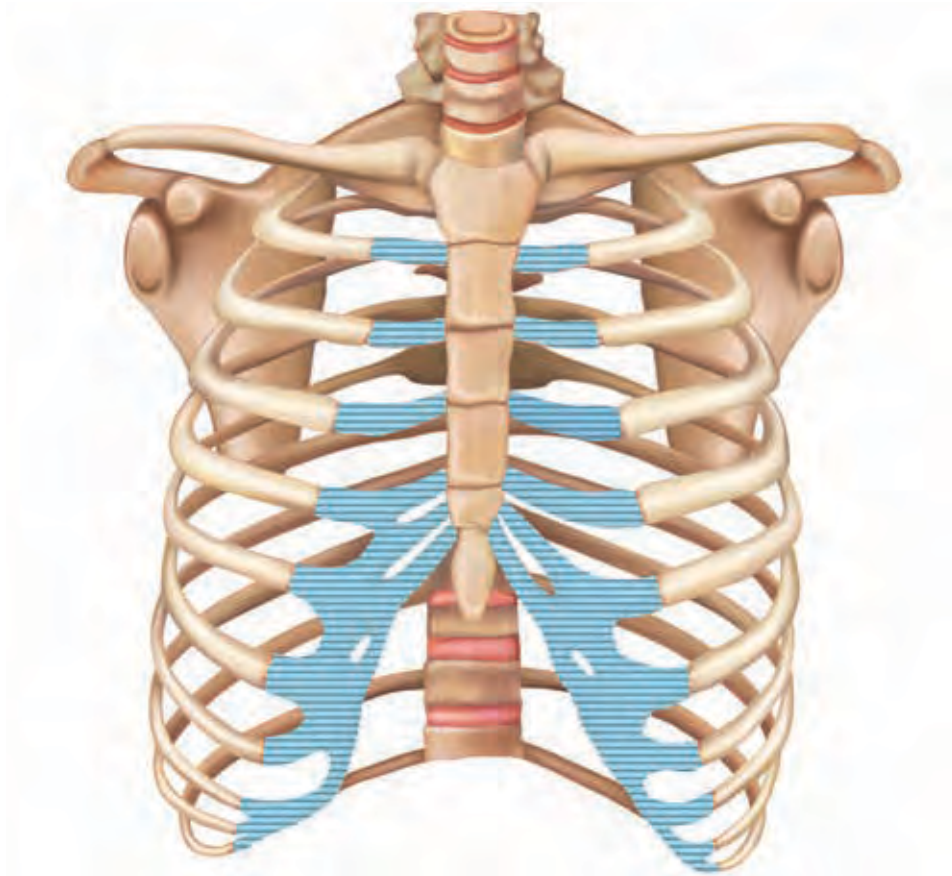
Firm connective tissue that holds structures together; can act as cushion-like tissue since it is more flexible than bone

**Ribs**

Curved, archlike bones

**Cartilage**

**Cartilage** (chondr/o) is the cushion-like tissue that is more flexible than bone. While cartilage is flexible, it still is a firm tissue made of connective tissue and holds structures together. For example, you have cartilage helping to hold your **ribs** (cost/o) in place. The flexible nature of cartilage still allows your ribs to move slightly as you breathe in and out. The image shows the bony thorax (thorac/o = chest) with the costal (rib) bones and the chondral (cartilage) costal bones.



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The bony thorax showing the costal (rib) bones and flexible chondral (cartilage) bones

## Medical Checkup 5-1

1. Which of the following health care professionals work directly under the supervision of an occupational therapist \_\_\_\_\_?
  - a. Chiropractor
  - b. DPM
  - c. PTA
  - d. COTA
2. Which of the following muscle types is involuntary and can be found in the walls of internal organs?
  - a. Skeletal muscle
  - b. Smooth muscle
  - c. Cardiac muscle
3. Which of the following connect bone to bone?
  - a. Ligament
  - b. Fascia
  - c. Tendon
  - d. Bursa
4. Which of the following is the term for ribs?
  - a. Maxill/o
  - b. Brachi/o
  - c. Pub/o
  - d. Cost/o
5. Match the following joint movement terms to the correct description.
 

___ Dorsiflexion	a. Excessive straightening of a joint beyond its normal range of motion
___ Hyperextension	b. Outward turning of a joint
___ Extension	c. Decreasing the angle between two muscles or joints in a bending movement
___ Flexion	d. Inward turning of a joint
___ Adduction	e. The circular movement of a joint or muscle to move a limb
___ Inversion	f. Increasing the angle between two bones at a joint to a straightened position
___ Abduction	g. Upward movement of the foot
___ Rotation	h. Downward movement of the foot
___ Plantar flexion	i. Movement towards midline
___ Hyperflexion	j. The excessive bending of a joint that is beyond its normal range
___ Eversion	k. Movement away from the midline

## 5.2 Common Diseases of the Musculoskeletal System

In the first section, we discussed the basic anatomy of the musculoskeletal system and associated medical terms. In section two, we will cover common diseases of the muscles, bones, and joints to expand on your medical terminology. You may have experienced some of these conditions or maybe you have known someone who has been affected, making you more familiar with some of the terms.

Also, while many of the terms in the section are new, you may have seen some of the terms that have been used in previous chapters used again here. Check out the *Medical Clipboard* below to see the terms used in this section.



## Medical Clipboard 5-2

Use the provided checkboxes to check off any prefixes, combining forms, suffixes, or abbreviations you already know. Continue to check them off as you study the chapter until you have learned them all.

**Prefixes** Placed in the beginning of a term to change its meaning

<input checked="" type="checkbox"/>	Prefix	Meaning
<input type="checkbox"/>	A-	Without
<input type="checkbox"/>	Dys-	Abnormal, bad, difficulty
<input type="checkbox"/>	Epi-	Above
<input type="checkbox"/>	Hemi-	Half
<input type="checkbox"/>	Par-, para-	Abnormal
<input type="checkbox"/>	Quadri-	Four

**Combining Forms** Consist of a word root with a combining vowel (usually o) so you can add other word parts

<input checked="" type="checkbox"/>	Combining form	Meaning
<input type="checkbox"/>	Ankyl/o	Stiff
<input type="checkbox"/>	Anter/o	Front
<input type="checkbox"/>	Arthr/o	Joint
<input type="checkbox"/>	Articul/o	Joint
<input type="checkbox"/>	Ather/o	Fatty deposits in the blood
<input type="checkbox"/>	Carp/o	Wrist
<input type="checkbox"/>	Chondr/o	Cartilage
<input type="checkbox"/>	Condyl/o	Rounded protrusion at the end of the bone
<input type="checkbox"/>	Cost/o	Rib
<input type="checkbox"/>	Cyst/o	Sac
<input type="checkbox"/>	Dipl/o	Double
<input type="checkbox"/>	Fasci/o	A band of tissue supporting muscles
<input type="checkbox"/>	Fibr/o	Fiber

<input checked="" type="checkbox"/>	Combining form	Meaning
<input type="checkbox"/>	Ganglion/o	Ganglion
<input type="checkbox"/>	Hem/o	Blood
<input type="checkbox"/>	Kinesi/o	Movement
<input type="checkbox"/>	Kyph/o	Humpback
<input type="checkbox"/>	Leiomy/o	Smooth muscle
<input type="checkbox"/>	Lord/o	Curve, swayback
<input type="checkbox"/>	Mandibul/o	Lower jaw
<input type="checkbox"/>	Menisc/o	Meniscus
<input type="checkbox"/>	My/o	Muscle
<input type="checkbox"/>	Myel/o	Bone marrow, spinal cord
<input type="checkbox"/>	Necr/o	Death
<input type="checkbox"/>	Oste/o	Bone
<input type="checkbox"/>	Patell/a, patell/o	Kneecap
<input type="checkbox"/>	Plant/o	Sole of foot
<input type="checkbox"/>	Poster/o	Back, behind
<input type="checkbox"/>	Rhabdomy/o	Striated muscle
<input type="checkbox"/>	Rheumat/o	Watery flow
<input type="checkbox"/>	Sarc/o	Flesh (connective tissue)
<input type="checkbox"/>	Scoli/o	Crooked, bent
<input type="checkbox"/>	Spondyl/o	Vertebra
<input type="checkbox"/>	Sten/o	Narrowing
<input type="checkbox"/>	Synov/o	Synovial membrane
<input type="checkbox"/>	Tempor/o	Temporal bone
<input type="checkbox"/>	Tox/o	Poison

Continues

## Medical Clipboard 5-2

Continued

**Suffixes** *The ending of a word that modifies its meaning and can be used to form a noun, adjective, or verb*

✓	Suffix	Meaning
<input type="checkbox"/>	-algia	Pain
<input type="checkbox"/>	-asthenia	Lack of strength
<input type="checkbox"/>	-esthesia	Feeling
<input type="checkbox"/>	-itis	Inflammation of
<input type="checkbox"/>	-listhesis	Slipping
<input type="checkbox"/>	-lysis	Breakdown
<input type="checkbox"/>	-malacia	Softening
<input type="checkbox"/>	-oma	Tumor
<input type="checkbox"/>	-opia	Vision condition
<input type="checkbox"/>	-paresis	Weakness
<input type="checkbox"/>	-pathy	Disease
<input type="checkbox"/>	-penia	Deficiency
<input type="checkbox"/>	-phagia	Swallowing
<input type="checkbox"/>	-phonia	Voice sound
<input type="checkbox"/>	-plegia	Paralysis
<input type="checkbox"/>	-porosis	Condition of pores
<input type="checkbox"/>	-rrhexis	Rupture
<input type="checkbox"/>	-sclerosis	Hardening
<input type="checkbox"/>	-trophy	Nourishment, development

**Abbreviations** *A shortened version of a word*

✓	Abbreviation	Meaning
<input type="checkbox"/>	ACh	Acetylcholine
<input type="checkbox"/>	ACL	Anterior cruciate ligament
<input type="checkbox"/>	ADL	Activities of daily living
<input type="checkbox"/>	Fx	Fracture
<input type="checkbox"/>	GBS	Guillain-Barre syndrome
<input type="checkbox"/>	HNP	Herniated nucleus pulposus
<input type="checkbox"/>	MG	Myasthenia gravis
<input type="checkbox"/>	MTSS	Medial tibial stress syndrome
<input type="checkbox"/>	OA	Osteoarthritis
<input type="checkbox"/>	PCL	Posterior cruciate ligament
<input type="checkbox"/>	RA	Rheumatoid arthritis
<input type="checkbox"/>	TMJ or TMD	Temporomandibular joint dysfunction

### 5.2a General Muscular Conditions

With the number of muscles in the body and their continual use, they are at risk for injury. Additionally, just like our other bodily systems, your muscles are also susceptible to diseases. To begin this section, let's discuss common ailments or muscle diseases medically known as **myopathy** (my/o = muscle, -pathy = disease). **Atrophy** (a- = without, -trophy = development) is a condition

**Myopathy**  
(my-OP-ah-thee)  
Muscle disease

**Atrophy**

A condition caused by the lack of use or presence of disease resulting in the withering away of muscles

**Sarcopenia**

Loss of muscle occurring as part of the natural aging process

**Myalgia (my-AL-jee-ah)**

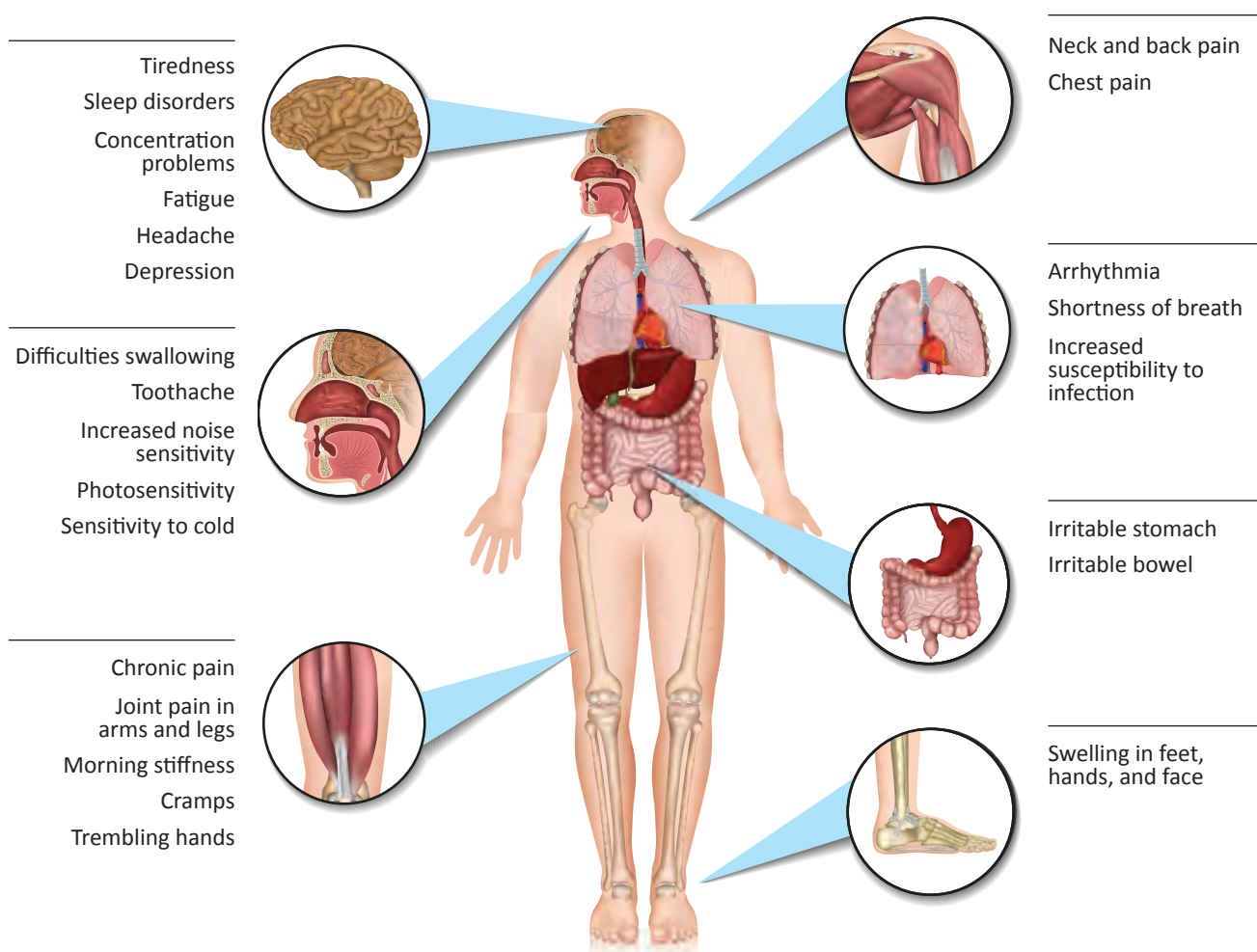
Muscle pain

where the patient's muscles are withering away as a result of either a lack of use or presence of disease. This can be caused by **myolysis** (-lysis = breakdown) where muscle tissue is broken down again by lack of use or disease. A related term is **myomalacia** (-malacia = softening) which is a softening of muscle tissue from a diseased state. **Sarcopenia** (sarc/o = flesh, -penia = deficiency) is a loss of muscle that occurs as part of the natural aging process.

Sometimes a muscle can be overused and experience severe damage; for instance, a bicep rupture may occur when lifting too heavy of a weight. **Myorrhesis** (-rrhexis = rupture) is a tearing or rupture of a muscle. Often there is pain in the affected muscles, which is termed **myalgia** (-algia = pain).

**Fibromyalgia** (fibr/o = fiber) is a common chronic musculoskeletal disorder that involves pain, fatigue, and tenderness in affected localized muscular regions.

**Figure 5-7 Potential Fibromyalgia Symptoms**



## Clinical Application

5-1

### 3 Main Types of Muscle Tumors

People often hear the word tumor and immediately think *cancer*. But tumors can be benign or noncancerous. The three types of muscle tumors are named according to the type of muscle affected.

- **Leiomyoma** (leiomy/o = smooth muscle, -oma = tumor) is a tumor in smooth muscle.
- **Rhabdomyomas** (rhabdomy/o = striated muscle) is a tumor found in cardiac muscle.
- **Rhabdomyosarcomas** (rhabdomy/o = striated muscle, sarc/o = flesh) is a tumor that is typically seen in skeletal muscle tissue.

## 5.2b Common Musculoskeletal Injuries

Whether you are injured playing a sport, working out, or conducting your normal **activities of daily living (ADL)** musculoskeletal injuries can commonly occur. One injury we often hear about or experience is a **sprain**.

A sprain is often seen in wrists and ankles, and it is a partially or completely stretched or torn ligament. Let's use the ankle as an example and say that it had turned inward during your basketball drive to the hoop. The term used to label this type of sprain would be an **inversion**. If you turn your ankle outwards, commonly referred to as "rolling" the ankle, it is known as an **eversion**.

#### Activities of daily living (ADL)

The tasks required for everyday living

#### Sprain

An injury to the bands of tissue, called ligaments, that connect two bones

Figure 5-8 Ankle Sprains





## Learning Hint 5–3

To help you remember the difference between inversion and eversion, take a look at the word inversion. It means the ankle turned inwards. Both words start with “in”: *inversion* and *inward*.

### Strains

#### Strain

An injury to the bands of tissue connecting muscle to bone or tendons

#### Spasm

A sudden, involuntary muscle contraction where the muscle quickly contracts and releases without any pain

#### Cramp

A sudden, involuntary muscle contraction occurring over a prolonged period and causing pain

#### Shin splints

Inflammation of bone tissue, muscles, and tendons around the tibia; occurs from being overworked

#### Medial tibial stress syndrome (MTSS)

More commonly referred to as shin splints, these occur when the muscle is torn away from the tibia

#### Dislocation

A complete separation of a bone from the joint

#### Subluxation

A partial dislocation

While a sprain involves ligament damage, a **strain** is a stretched or torn tendon or muscle. You may have heard people refer to this as a “pulled muscle.” Typically, a strain is the result of someone overdoing their level of physical exertion.



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A strain is a stretched or torn tendon or muscle that is often referred to as “pulled muscle.” Strains are typically the result of someone overdoing their level of physical exertion.

the tibia (shinbone). This occurrence is painful and is caused by prolonged exercise on a solid surface. The medical term is **medial tibial stress syndrome (MTSS)**.

With muscle overuse, a muscle **spasm** can develop. A spasm is a sudden, involuntary muscle contraction where the muscle quickly contracts and releases without any pain. A muscle **cramp**, on the other hand, is a sudden involuntary muscle contraction that is painful and occurs over a prolonged period of time. Muscle cramps occur due to dehydration or overuse of muscles.

**Shin splints** occur when the muscle is torn away from

### Dislocations

A **dislocation** is the complete separation of a bone from the joint. This can be caused by some sort of traumatic event or excessive tendon and muscle weakness.

#### Shoulder Dislocation



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Normal  
anatomy

Anterior  
dislocation

Posterior  
dislocation

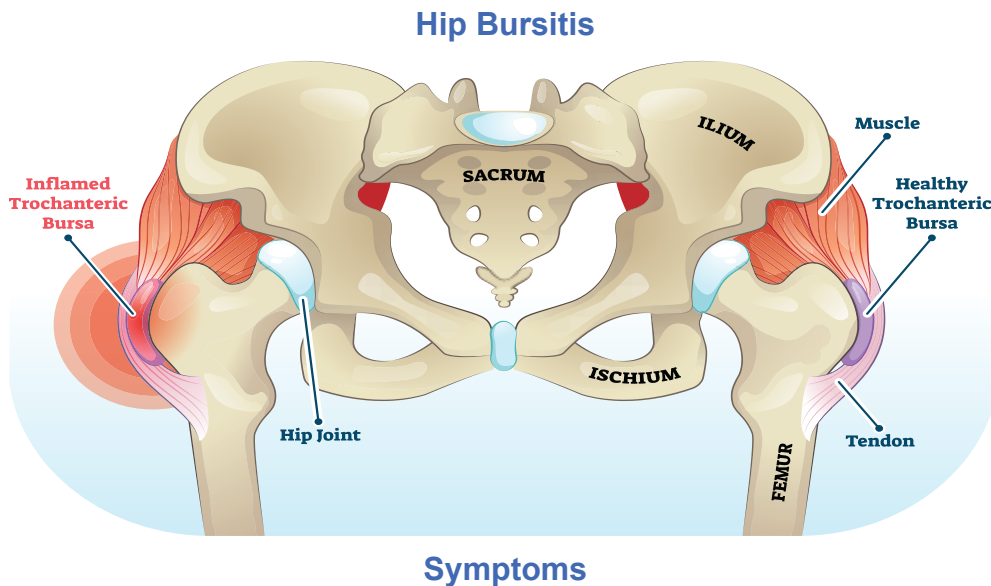
A **subluxation** is a partial bone from joint separation. As with a dislocation, a subluxation is caused by an injury that results in weakness of muscle and tendons.

## 5.2c Joint Conditions

Bursae are fluid-filled sacs found in joints to minimize friction during movement. These sacs can become inflamed, resulting in pain and a condition known as **bursitis** (-itis = inflammation of). See Figure 5-9.

### Figure 5-9 Bursitis

Bursae are small sacs of synovial fluid in the body. Bursae cushion the bones, tendons, and muscles near joints. Bursitis is the inflammation of one or more bursae. Common locations for bursitis include the shoulder, elbow, and hip.



Joint might feel achy or stiff

Joint might hurt more when you move it or press on it

Joint might look swollen or red

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Tendons are the connective tissue that holds muscle to bone and if injured it can become inflamed, resulting in the condition known as **tendonitis**.

#### Tendonitis

Inflammation of a tendon

## Clinical Application

5-2

### Not Only Hurting Your Pride Losing Golf Balls but Hurting Your Elbow too?

**Epicondylitis** (epi- = above, condyl/o = rounded protrusion at the end of the bone) is a condition that is often caused by a repetitive movement. Over time, inflammation develops in the area where the muscle of the forearm connects to the elbow. You may have heard people complain of tennis elbow or even golfer's elbow. Those are different variations of epicondylitis, which are named based on the exact area affected. For example, golfer's elbow is also known as *medial* epicondylitis because it affects the inside of the elbow. As for tennis elbow, it is also referred to as *lateral* epicondylitis because it affects the outside of the elbow.

#### Epicondylitis

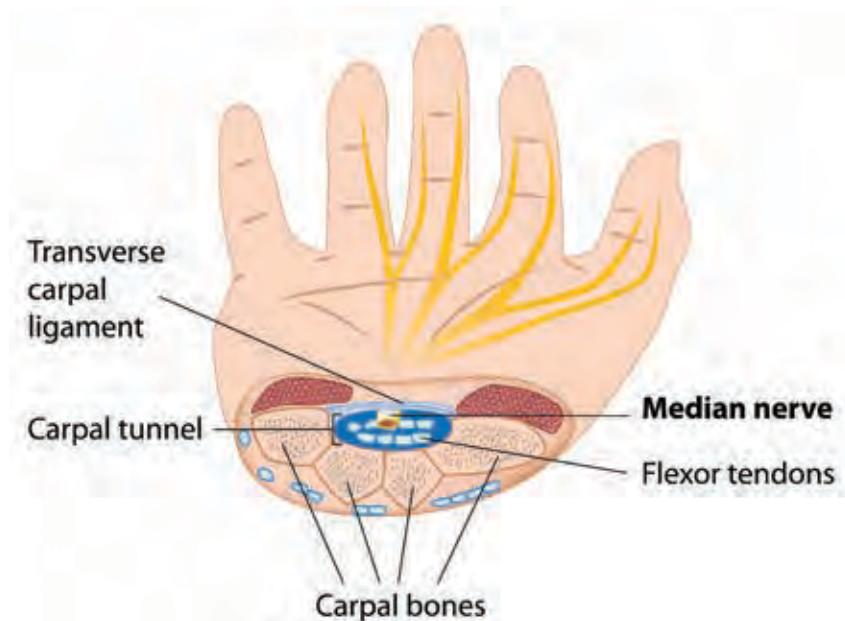
(ep-ih-kon-dih-LYE-tis)  
Inflammation in the area where the muscle of the forearm connects to the elbow

**Carpal tunnel syndrome**

A condition that develops due to redundant or repetitive movement; causes inflammation in the wrist

**Carpal Tunnel Syndrome**

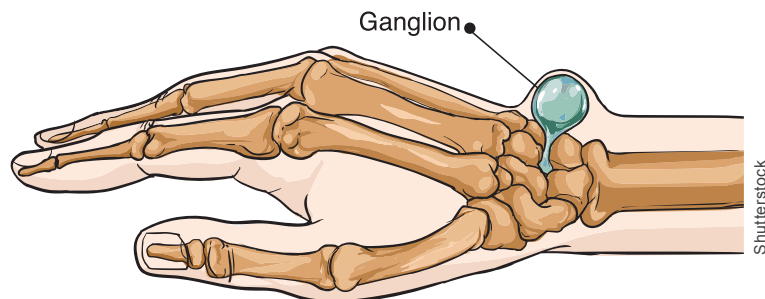
**Carpal tunnel syndrome** occurs when there is redundant or repetitive movement causing inflammation in the wrist (carp/o = wrist). One common cause is excessive typing on a keyboard. The inflammation infringes on a small passageway known as the carpal tunnel located at the wrist and forearm (see Figure 5-10). This swelling pushes on the median nerve resulting in pain and numbness, among other symptoms.

**Figure 5-10 The Carpal Tunnel**

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**Ganglion Cyst**

A **ganglion cyst** (ganglion/o = ganglion, cyst/o = sac) is a small sac that develops over a joint or tendon. Inside the cyst itself is a thick, jelly-like substance that is sticky and clear. Although it is suspected that ganglion cysts are caused by some sort of trauma, the exact cause of these cysts is unknown.



A ganglion cyst is a small sac that develops over a joint or tendon.

## Learning Hint 5–4

Be careful of the term ganglion because it has two meanings. In this case, it means an abnormal swelling of a tendon sheath, however, it does have another distinct meaning in the nervous system. A ganglion is also a network of neural cells or well-defined mass in the nervous system. More on this when we visit the neurologist in Chapter 10.

### Plantar Fasciitis

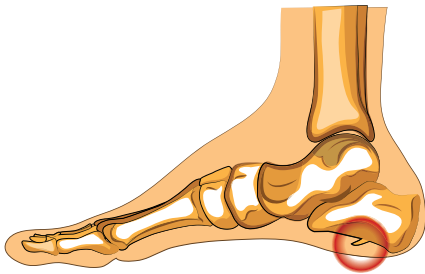
**Plantar fasciitis** (plant/o = sole of foot, fasci/o = a band of tissue supporting muscles) is a condition affecting the sole of the foot. This occurs when something has caused inflammation of the fascia. The fascia is the band of tissue connecting and supporting muscles between the toes and heel. This painful condition differs from a heel spur.

A **heel spur** is a condition caused by the accumulation of calcium that has deposited in the form of a bony protrusion. This growth is known to be uncomfortable and cause pain to the individual.

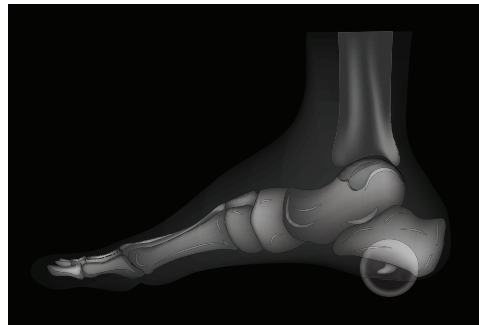


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Inflammation of the plantar fascia



X-ray evidence of a heel spur causing the patient's plantar fasciitis

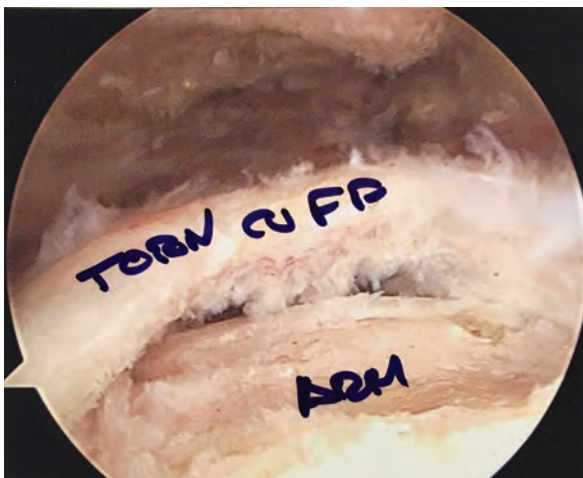


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### Torn Rotator Cuff

Your shoulder contains a group of muscles and tendons that allow for a large range of motion. A tear can occur in this area as a result of repetitive action, or when suddenly bearing a heavy weight. The severity of a **torn rotator cuff** affects the ability of the individual to rotate and lift their arm.

**Torn rotator cuff**  
A tear in the tendons around the shoulder joint



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Internal images of a torn rotator cuff shown via arthroscopic surgery

## Clinical Application

5-3

### The Study of Movement

#### Kinesiology (kin-ee-see-OHL-oh-jee)

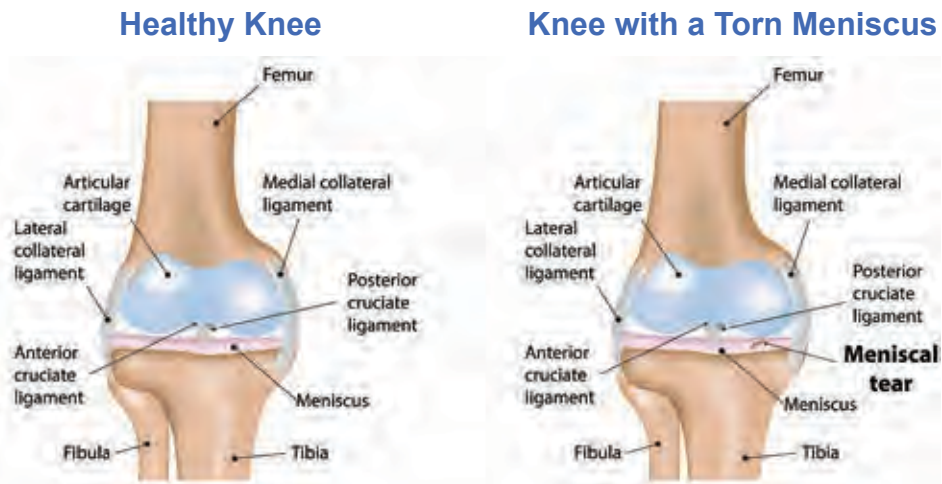
The study of body movement

As mentioned before, our muscles provide us the means to move. The study of this movement is known as **kinesiology** (kinesi/o = movement). Kinesiology focuses on the mechanics of our body's movement.

### Meniscal Tear

In your knee joint, there are cartilaginous pads that provide a cushion between the tibia and femur. These pads are known as the meniscus (menisc/o) of the knee. The menisci in the knee are located on the outside or lateral area and in the inner region or medial portion of the knee. When a **meniscal tear** occurs, the individual may experience pain, stiffness, inflammation, and loose sensation in the joint, to list just a few of the potential symptoms (see Figure 5-11).

Figure 5-11 **Meniscal Tear**



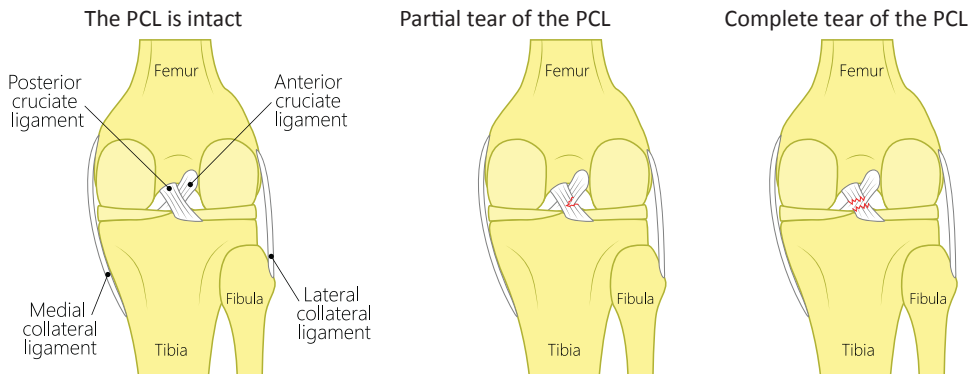
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### Cruciate Ligament Tears

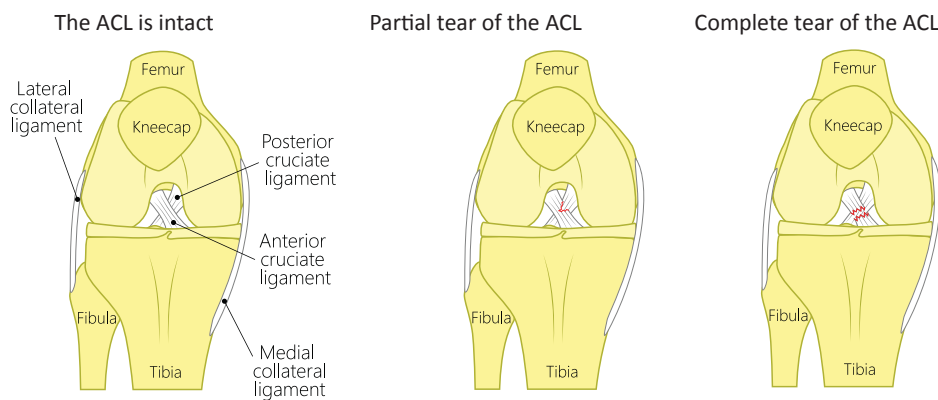
In the knee, there are two cross-shaped ligaments called cruciate ligaments. These two ligaments are the **anterior cruciate ligament (ACL)** (anter/o = front) and **posterior cruciate ligament (PCL)** (poster/o = back, behind). Both of these ligaments attach the femur or thighbone to the tibia, also known as your shinbone, except they do it from different angles. A **cruciate ligament tear** is a tear occurring to one or both of these ligaments (see Figure 5-12). These are major supporting structures of the knee and, when damaged, the individual can be expected to experience swelling, pain, and knee instability.



**Figure 5-12 Cruciate Ligament Tears**  
**Tear of the Posterior Cruciate Ligament (PCL)**  
 Back view of a straight knee



**Tear of the Anterior Cruciate Ligament (ACL)**  
 Front view of a flexed knee

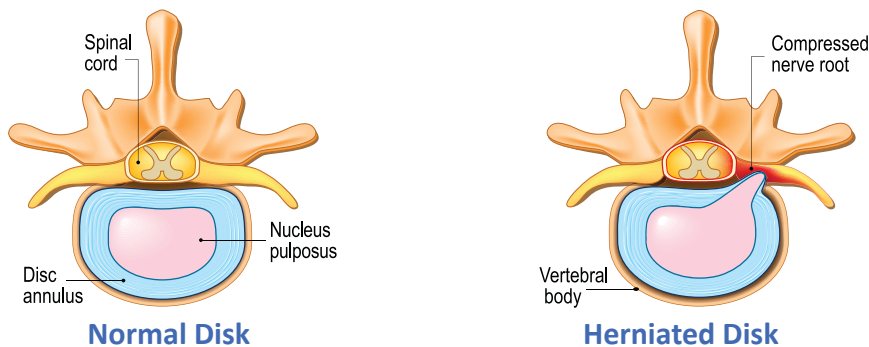


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## Herniated Nucleus Pulposus

**Herniated nucleus pulposus (HNP)**, also known as a herniated disc, is a degenerative condition of a vertebral disc that causes a weakening to part of the disc, which allows for the jelly-like inside cushioning to protrude into the spinal canal (see Figure 5-13). This herniation extends onto the nerve root and causes pain and discomfort.

**Figure 5-13 A Cross-Section View of Spinal Disc Herniation**



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## 5.2d Neuromuscular Diseases

While we will cover the neurological system in more depth in a later chapter, the muscles are affected by neurological diseases because of the neuromuscular connection. These diseases can be acute or short-lived or chronic in nature.

### Muscular dystrophy

A group of diseases known to cause a loss of muscle mass due to a mutated gene

### Normal Biceps

### Muscular Dystrophy

### Muscular Dystrophy



**Muscular dystrophy** (dys- = abnormal, bad; -trophy = nourishment, development) is a group of diseases known to cause a loss of muscle mass due to a mutated gene. The gene affected is what protects the fibers of the muscles from damage.

### Myasthenia Gravis

**Myasthenia gravis (MG)** (-asthenia = lack of strength) is an autoimmune disorder that causes descending paralysis (par-, para- =

abnormal, -lysis = breakdown), meaning the individual typically experiences muscle weakness in their face that works its way down to the extremities. This condition interferes with the muscles' ability to receive signals from **acetylcholine (ACh)**, which is a neurotransmitter. Figure 5-14 shows a visual comparison between a normal neuromuscular junction and the effects of myasthenia gravis. This condition is known to cause the following:

- **ptosis** – drooping, falling eyelid
- **diplopia** (dipl/o = double, -opia = vision condition) – double vision
- **dysphagia** (dys- = difficulty, -phagia = swallowing) – difficulty swallowing
- **dysphonia** (dys- = difficulty, -phonia = voice sound) – difficulty speaking

### Myasthenia gravis (MG) (my-as-THEE-nee-ah GRAH-vis)

An autoimmune disorder that causes descending paralysis

### Acetylcholine (ACh) (as-eh-til-KOH-leen)

A neurotransmitter that is used by nerve cells to send signals

### Diplopia

A condition where the patient sees two of the same objects; also known as double vision

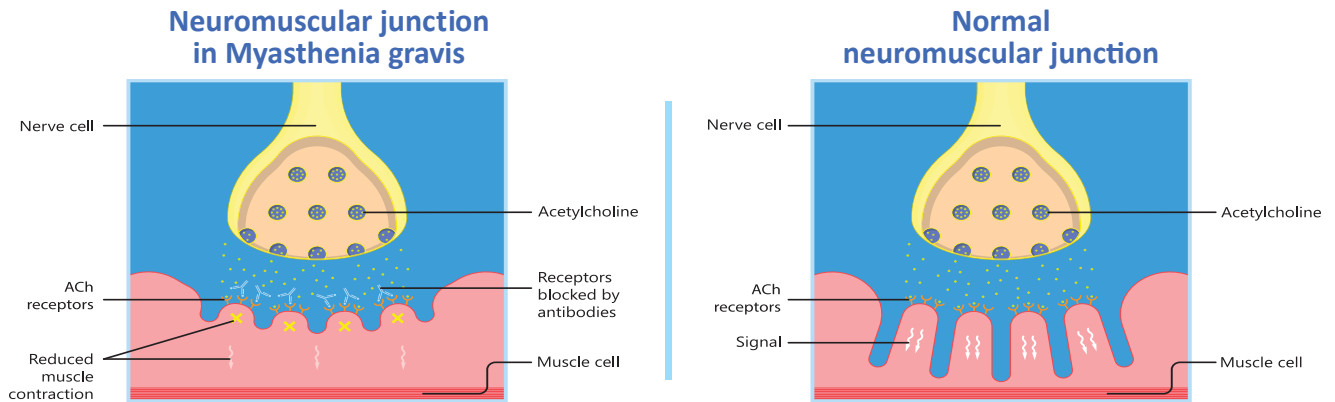
### Dysphagia

Difficulty swallowing

### Dysphonia

Difficulty speaking

**Figure 5-14 Visual Comparison Between a Normal Neuromuscular Junction and the Effects of Myasthenia Gravis**



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### Guillain-Barre Syndrome (GBS)

**Guillain-Barre syndrome (GBS)** is an autoimmune neuromuscular disorder that attacks the immune system by removing the sheath that acts as an insulation around nerve cells, causing an interruption in the muscle movement. This condition causes *ascending* paralysis, meaning it starts from the ground and works its way upwards. While this condition causes many other symptoms, fever and **paresthesia** (par-, para- = abnormal, -esthesia = feeling), such as tingling sensations, are often early signs (see Figure 5-15).

**Guillain-Barre syndrome (gee-YAHN bah-RAY SIN-droh)**

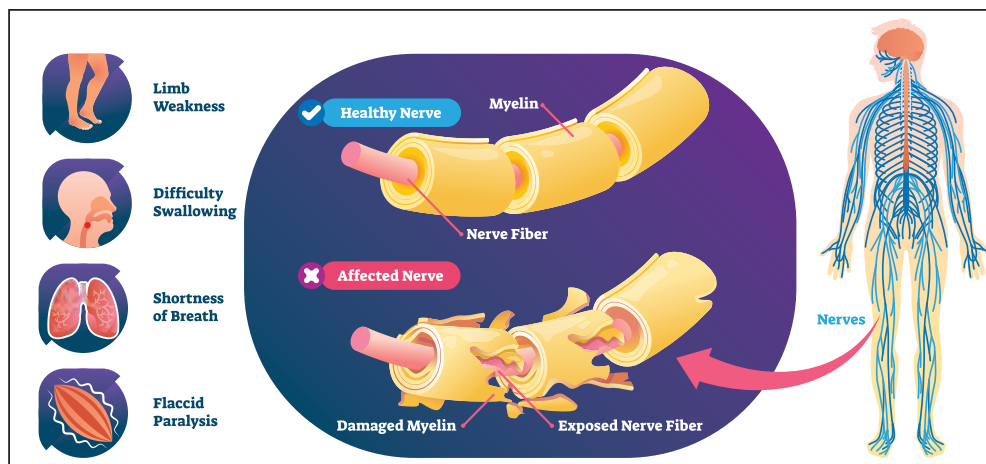
An autoimmune neuromuscular disorder known to cause ascending paralysis, from ground to brain

**Paresthesia**

The term referring to the pins and needles sensation felt by a patient

**Figure 5-15 Guillain-Barre Syndrome (GBS)**

Guillain-Barre syndrome attacks the immune system by removing the sheath that insulates nerve cells. Early symptoms include weakness and tingling sensations in the extremities.



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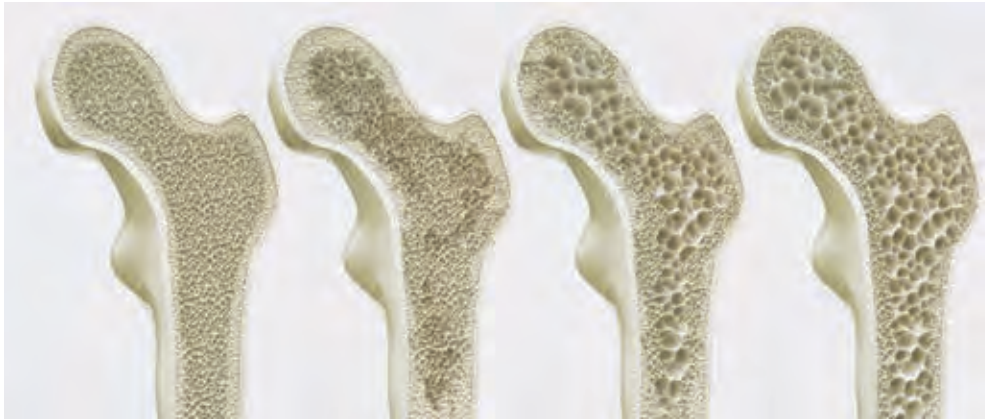


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Wrist inflammation and pain

## Common Bone Diseases

**Osteoporosis** (-porosis = condition of pores) is one of the most common bone diseases. This is a slow but progressive disease causing a decrease in bone density. As a result, the bones become porous and have a spongy appearance.



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The progression of osteoporosis

### Osteoporosis

A slow and progressive disease causing a decrease in bone density, resulting in a spongy appearance

### Osteomyelitis (oss-tee-oh-my-eh-LYE-tis)

An inflammation of the bone marrow

### Osteonecrosis (oss-tee-oh-neh-KROH-sis)

Death of bone tissue

### Osteomalacia (oss-tee-oh-mah-LAY-shee-ah)

Softening of the bones

## Stages of Osteoporosis

**Osteomyelitis** (myel/o = bone marrow, spinal cord) is an inflammation of the bone marrow and is caused by a bacterial infection. This causes inflammation and swelling, which can result in a decrease in blood supply to the bone. Bone tissue requires a blood supply to remain viable, and if there is a decrease in the blood flow, the bone tissue will die. This is known as **osteonecrosis** (necr/o = death). **Osteomalacia** (-malacia = softening) means softening of the bones. This can occur if there is a deficiency in vitamin D or calcium, which is needed to form strong bones.



**Spondylosis**  
(spon-dih-LOH-sis)

Degenerative arthritic change of the spine due to wear and tear over a period of time

**Spondylolisthesis**  
(spon-dih-loh-liss-THEE-sis)

The forward slipping of a vertebral disc onto the disc below

**Spinal stenosis**

A condition where the spine becomes narrowed as a result of wear and tear

## Spinal Deformities

**Spondylosis** (spondyl/o = vertebra) is the degenerative arthritic change of the spine due to wear and tear over a period of time. This is a very common condition that is incurable and progressively worsens. **Spondylolisthesis** (-listhesis = slipping) is the forward slipping of a vertebral disc onto the disc below. When the bone slips too far it can put pressure on the nerves causing back pain, leg pain, and numbness.

**Spinal stenosis** (sten/o = narrowing) is a condition where the spine becomes narrowed as a result of wear and tear. This can cause pressure to develop in the spine, which pushes on or compresses nerves, causing pain and numbness.

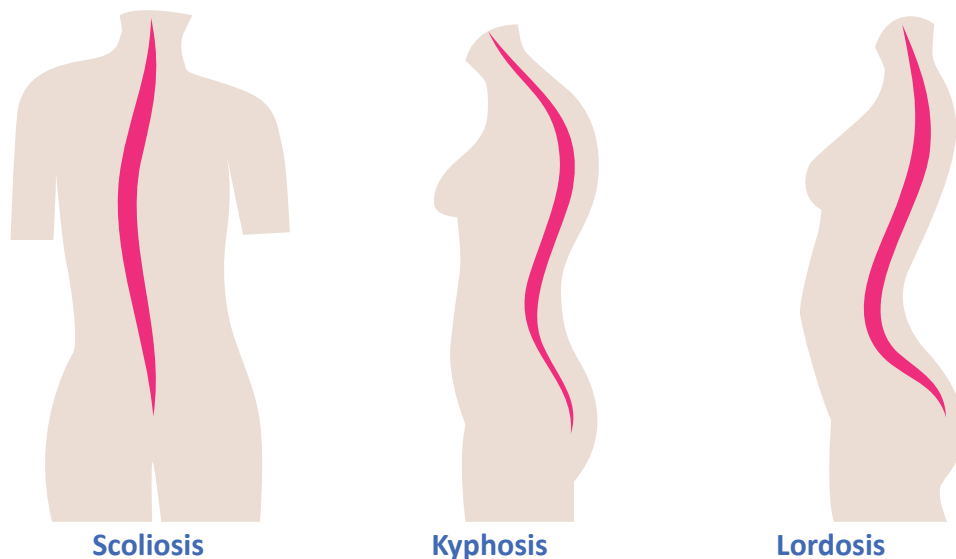


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**Kyphosis** (kyph/o = humpback) is an outward curvature to the spine causing a hunchback appearance. **Scoliosis** (scoli/o = crooked, bent) is the lateral or sideways curvature of the spine.

**Lordosis** (lord/o = curve, swayback) is the curvature of the lower back or lumbar of the spine.

### Spinal deformity types



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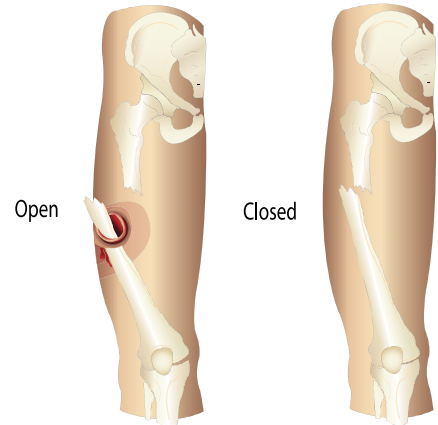
## Fractures

While the bones are strong and durable, they can be weakened by disease or damaged in an accident, causing bones to break or **fracture (Fx)**. To most people, a bone break is just that, a broken bone. However, there are many different types of fractures. Fractures are classified based on various characteristics such as the location, bone fragments, and positions of the break. The type of fracture impacts how the fracture is treated.

Two general types of fractures:

- A **simple** or **closed fracture** is a broken bone that has not penetrated the skin.
- A **compound fracture** or **open fracture**, is when the bone projects through the skin. This kind of fracture is very serious, as it can become infected easily.

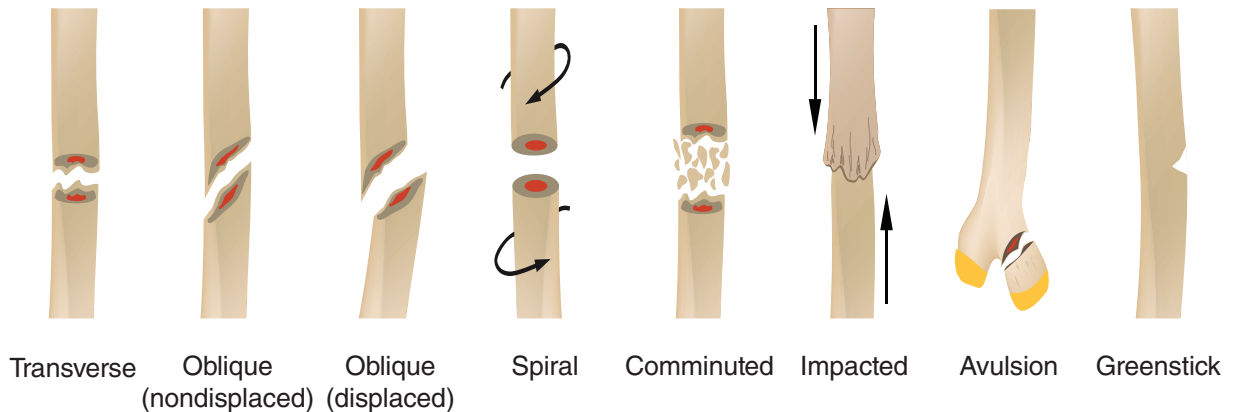
While there are many types of fractures, the following list of fractures in Figure 5-16 can help you associate the name with the actual type of break.



Comparison between open and closed fractures

**Fracture (Fx)**  
A broken or cracked bone

**Figure 5-16 Types of Fractures**



- A **transverse fracture** is when the bone breaks straight across or perpendicularly across the shaft of the bone.
- An **oblique fracture** is when the bone breaks through the bone at an angle. These breaks may be either displaced or nondisplaced. An *oblique nondisplaced fracture* means the bone broke at an angle but is still in place. An *oblique displaced fracture* means the bone has broken at an angle but has also shifted.
- A **spiral fracture** is a known as a torsion fracture. It occurs when the body is in motion and the extremity is planted causing a forceful, twisting break.
- A **comminuted fracture** is when there are bone fragments in the area between the break of a bone; these fragments can splinter off into the surrounding tissue.
- An **impacted fracture** is when the end of a bone is forced into another causing a break.

- A **complete fracture** is when the fracture goes completely through the bone.
- An **avulsion fracture** is when a break occurs where the ligament or tendon attaches.
- A **greenstick fracture** is when one side of the bone is broken and the other side is only bent.

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**Osteosarcoma**  
(oss-tee-oh-sar-KOH-mah)

A type of bone cancer affecting the cells that develop bone

**Osteochondroma**  
(oss-tee-oh-kon-DROH-mah)

A noncancerous overgrowth of bone and cartilage on the bone at the growth plate

**Multiple myeloma**

A cancerous condition affecting the plasma cells in the bone marrow

**Osteoarthritis (OA)**  
(oss-tee-oh-ar-THRIGH-tis)

Arthritis caused by the wear and tear on bones and joints

## Tumors of the Bones and Cartilage

While bone tumors are rare, there are both cancerous and noncancerous tumors known to affect the bones and cartilage in your body. **Osteosarcoma** (sarc/o = flesh [connective tissue], -oma = tumor) is a common form of cancer that typically develops in the long bones of the arms and legs. This type of cancer usually develops in children and young adults.

**Ewing sarcoma** is a rare type of bone tumor that has been known to affect children and young adults. This cancer is named after Dr. James Ewing who first described it back in the 1920s.

**Osteochondroma** (chondr/o = cartilage) is a noncancerous overgrowth of bone and cartilage on the bone at the growth plate. This is known to occur mostly in adolescents and young adults.

**Multiple myeloma** (myel/o = bone marrow, spinal cord) is a cancerous condition affecting the plasma cells in the bone marrow. This form of cancer overcrowds the healthy bone cells in the bone marrow as the cancerous cells multiply.

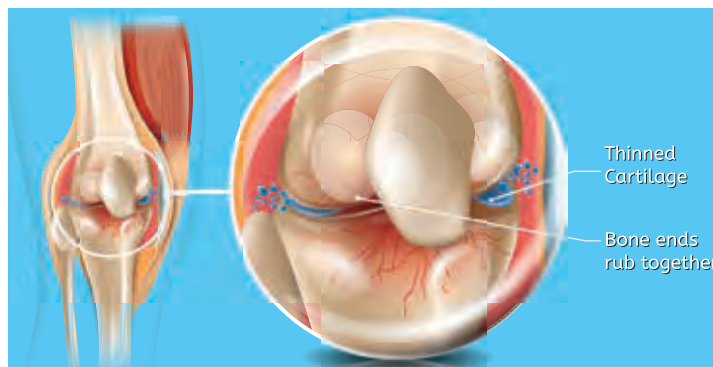
## 5.2f General Joint Conditions

Unfortunately, as we age, the wear and tear on our joints begins to show. Besides the normal wear, joints are also susceptible to diseases, which can greatly impact their ability to move.

Arthritis (arthr/o = joint) is a very common condition and is a general term meaning inflammation of the joints. Arthritis can occur from various causes and it has different names to denote these variations. **Osteoarthritis (OA)** is a degenerative condition caused by wear and tear on bones and joints over

time. However, this condition is not limited to senior citizens; it can also affect young individuals and be due to other existing factors.

### Osteoarthritis



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Image of a woman's hands deformed by RA

**Rheumatoid arthritis (RA)** (rheumat/o = watery flow) is an autoimmune condition where the lining of the joints are attacked by your body's own antibodies. In severe cases, a person's internal organs may also be attacked. The lining of the joints becomes inflamed, causing pain and restriction in their movement.

#### Rheumatoid arthritis (RA)

Chronic inflammation of the joints due to an autoimmune disorder

#### Gout

A condition caused by the accumulation of uric acid in the blood allowing for the development of uric crystals in the joints

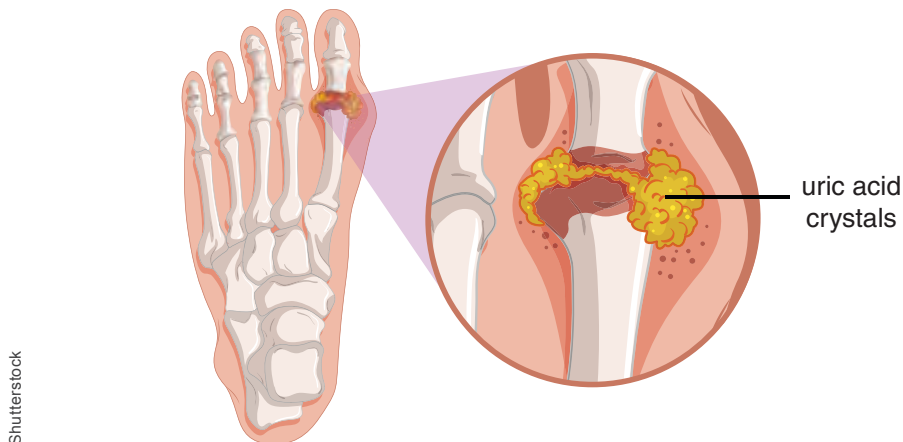
#### Gouty arthritis

Another term for gout

## Gout

**Gout**, also known as **gouty arthritis** is caused by an accumulation of uric acid in the blood, allowing for uric crystals to develop in the joints. This causes inflammation in the joints and is very painful. There are many factors that make you at greater risk, such as diet, gender, age, and lifestyle choices.

### Gout (Inflammatory Arthritis)



Uric acid crystals accumulating in a joint cause pain and inflammation. This occurs most commonly in the large toe.

## Temporomandibular Joint Dysfunction (TMJ or TMD)

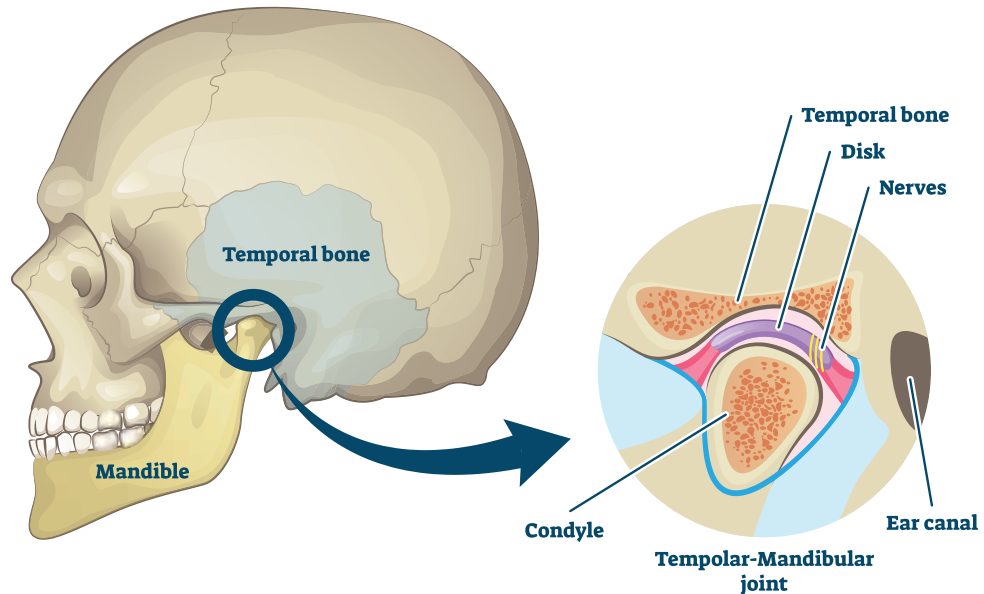
**Temporomandibular joint dysfunction (TMJ or TMD)** (tempor/o = temporal bone, mandibul/o = lower jaw) is a condition that affects the two joints that connect the mandible (jawbone) to the skull. These joints act as a sliding hinge to allow movement of your jaw. If you become stressed and clench your teeth, you are placing additional stress on this joint. Over time, this may result in TMJ (see Figure 5-17). If this condition is present, you can expect to experience tooth pain as well as pain around the ear, neck, and even in the shoulder region. Additional symptoms are **tinnitus** (ringing in the ears), and abnormal joint noise, such as popping and locking of the jaw during movement.

#### Tinnitus (tih-NITE-us)

Abnormal ringing sound in the ears

### Figure 5-17 **Temporomandibular Joint Disorder (TMJ)**

Caused by injury or inflammation, this very common disorder affects the sliding hinge joint connecting the jawbone to the skull, resulting in pain and the inability to properly move the jaws.



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## Miscellaneous Joint Conditions

### Arthrosclerosis

A general term for stiffness in the joints, which may result from disease or aging

### Ankylosis (ang-kih-LOH-sis)

When extreme stiffness occurs as a result of the joints fusing together

**Arthrosclerosis** (-sclerosis = hardening) is a general term for stiffness in the joints, which can occur from disease or aging. **Ankylosis** (ankyl/o = stiff) is an extreme version of arthrosclerosis where the joints become fused together with other bones, causing extreme stiffness. This can be caused by a disease or injury.

## Learning Hint 5–5

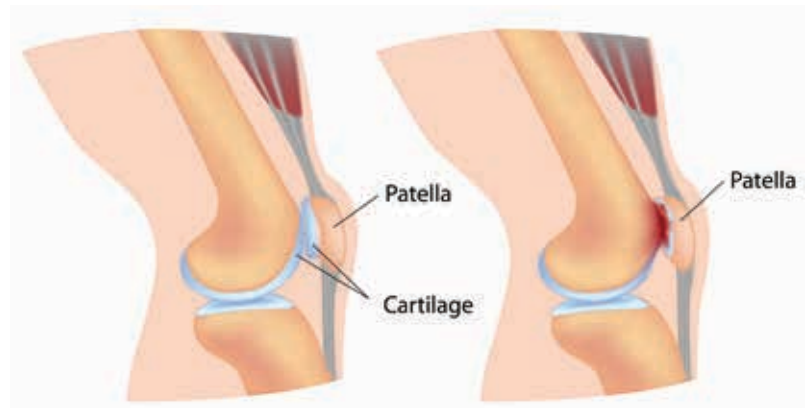
Be careful of the terms arthrosclerosis and atherosclerosis. These look very similar but have completely different meanings. While both mean hardening or stiffening, arthr/o refers to the joints and ather/o refers to the fatty deposits that build up in blood vessels and cause them to harden.



**Chondromalacia patella** (patell/a, patell/o = kneecap) is a common condition where the cartilage in the back of the knee has softened due to overuse or injury to this site. This condition is known to affect athletes and may be referred to as runner's knee.

**Costochondritis** (cost/o = rib) is inflammation of the cartilage between the ribs that typically occurs at the site of the cartilage connecting to the breastbone or sternum in the ribcage.

This can occur because of an injury or overdoing physical exertion and often causes discomfort when breathing as the ribs move. **Synovitis** (synov/o = synovial membrane) is an inflammation of the synovial membrane that lines synovial joints (see Figure 5-18). Synovial membranes are located in the **articular** (articul/o = joint) or joint cavity, also known as the synovial capsule or cavity.



Normal

Chondromalacia

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**Chondromalacia**  
(kon-droh-mah-LAY-shee-ah)

A condition caused by overuse or injury to the cartilage causing it to soften

**Costochondritis**  
(kos-toh-kon-DRIGH-tis)

Inflammation of the cartilage between the ribs

**Synovitis**

Inflammation of the synovial membrane that lines synovial joints

**Articular**  
(ar-TICK-you-lar)

Pertaining to a joint

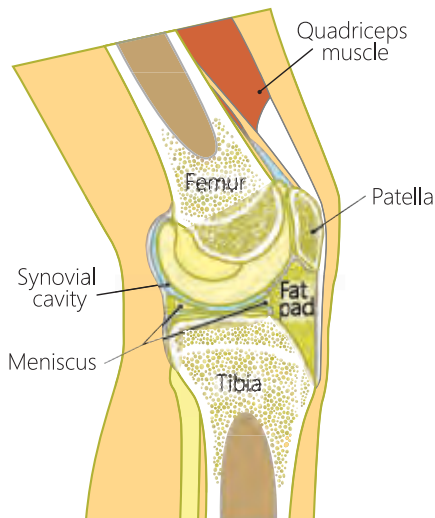
**Hemarthrosis**  
(hem-ar-THROH-sis)

Blood in the joint cavity

**Figure 5-18 Synovitis of the Knee**

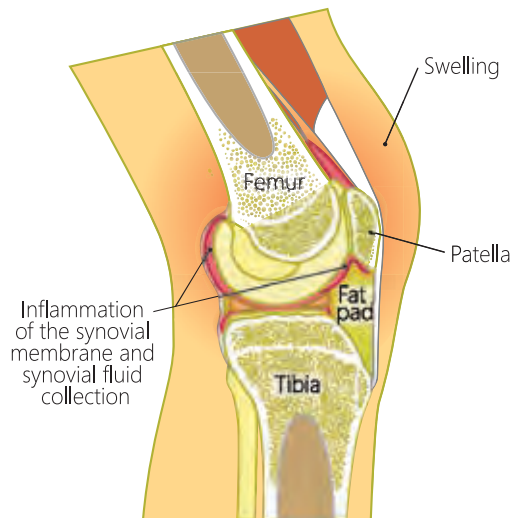
**Healthy knee joint**

Sagittal section of the knee



**Knee synovitis**

Sagittal section of the knee



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**Hemarthrosis** (hem/o = blood) means blood in the joint cavity. Potential causes for developing this condition are injury and bleeding disorders.

## Medical Checkup 5-2

- A patient has been complaining about a joint after an injury. After further evaluation, it is determined that the patient has blood in the joint. What is the medical term used for this condition?

  - Hemarthrosis
  - Synovitis
  - Ankylosis
  - Gout
- Which of the following is a degenerative condition caused by the wear and tear on bones and joints over time?

  - Costochondritis
  - Gouty Arthritis
  - Rheumatoid Arthritis
  - Osteoarthritis
- Which of the following terms means double vision?

  - Dysphagia
  - Ptosis
  - Diplopia
  - Dysphonia
- Match the following terms with the correct meaning.

___ kyph/o	a. Lower jaw
___ leiomy/o	b. Bone marrow, spinal cord
___ mandibul/o	c. Death
___ myel/o	d. Humpback
___ necr/o	e. Smooth muscle
- Match the following suffixes with the correct meaning.

___ -listhesis	a. Hardening
___ -lysis	b. Slipping
___ -malacia	c. Deficiency
___ -oma	d. Condition of pores
___ -opia	e. Softening
___ -paresis	f. Nourishment, development
___ -penia	g. Paralysis
___ -plegia	h. Vision condition (meaning double vision)
___ -porosis	i. Weakness
___ -rrhexis	j. Tumor
___ -sclerosis	k. Breakdown
___ -trophy	l. Rupture

### 5.3 **Diagnostics and Procedures of the Musculoskeletal System**

Since we have now discussed the basics of the musculoskeletal system, diseases, and associated terminology in the previous sections, let's take a look at some of the common diagnostics (Dx) and procedures used to treat the musculoskeletal system.

## Medical Clipboard 5-3

Use the provided checkboxes to check off any prefixes, combining forms, suffixes, or abbreviations you already know. Continue to check them off as you study the chapter until you have learned them all.

**Prefixes** Placed in the beginning of a term to change its meaning

<input checked="" type="checkbox"/>	Prefix	Meaning
<input type="checkbox"/>	Bio-	Life
<input type="checkbox"/>	Ultra-	Beyond, excess

**Combining Forms** Consist of a word root with a combining vowel (usually o) so you can add other word parts

<input checked="" type="checkbox"/>	Combining form	Meaning
<input type="checkbox"/>	All/o	Other
<input type="checkbox"/>	Arthr/o	Joint
<input type="checkbox"/>	Aut/o	Self, own
<input type="checkbox"/>	Burs/o	Bursa
<input type="checkbox"/>	Chondr/o	Cartilage
<input type="checkbox"/>	Cost/o	Rib
<input type="checkbox"/>	Crani/o	Skull
<input type="checkbox"/>	Densit/o	Density
<input type="checkbox"/>	Electr/o	Electricity
<input type="checkbox"/>	Fasci/o	Fascia
<input type="checkbox"/>	Goni/o	Angle
<input type="checkbox"/>	Lamin/o	Lamina or layer
<input type="checkbox"/>	Orth/o	Straight
<input type="checkbox"/>	Oss/e, Oss/i, Oste/o, Ost/o	Bone
<input type="checkbox"/>	Radi/o	X-ray
<input type="checkbox"/>	Spondyl/o	Vertebra
<input type="checkbox"/>	Synov/o	Synovial membrane, synovia
<input type="checkbox"/>	Ten/o, tend/o, tendin/o	Tendon
<input type="checkbox"/>	Vertebr/o	Vertebra

**Suffixes** The ending of a word that modifies its meaning and can be used to form a noun, adjective, or verb

<input checked="" type="checkbox"/>	Suffix	Meaning
<input type="checkbox"/>	-centesis	Surgical puncture
<input type="checkbox"/>	-clasis	To break
<input type="checkbox"/>	-desis	Bind, tie together
<input type="checkbox"/>	-ectomy	Excision, removal, resection
<input type="checkbox"/>	-graph	Instrument for recording
<input type="checkbox"/>	-graphy	Process of recording
<input type="checkbox"/>	-lysis	Breakdown
<input type="checkbox"/>	-meter	Measure
<input type="checkbox"/>	-metry	Process of measuring
<input type="checkbox"/>	-opsy	View of
<input type="checkbox"/>	-pathy	Disease
<input type="checkbox"/>	-plasty	Repair
<input type="checkbox"/>	-rrhaphy	Suture
<input type="checkbox"/>	-scope	Instrument for visual recording
<input type="checkbox"/>	-scopic	Pertaining to visual examination
<input type="checkbox"/>	-tic	Pertaining to
<input type="checkbox"/>	-tomy	Process of cutting

**Abbreviations** A shortened version of a word

<input checked="" type="checkbox"/>	Abbreviation	Meaning
<input type="checkbox"/>	BMD	Bone mineral density
<input type="checkbox"/>	BMT	Bone marrow transplant
<input type="checkbox"/>	CT	Computed tomography
<input type="checkbox"/>	DTR	Deep tendon reflexes
<input type="checkbox"/>	Dx	Diagnostics
<input type="checkbox"/>	DXA	Dual-energy X-ray absorptiometry
<input type="checkbox"/>	EMG	Electromyography
<input type="checkbox"/>	MRI	Magnetic resonance imaging
<input type="checkbox"/>	NCV	Nerve conduction velocity (test)
<input type="checkbox"/>	PKR	Partial knee replacement
<input type="checkbox"/>	ROM	Range of motion
<input type="checkbox"/>	THR	Total hip replacement
<input type="checkbox"/>	TKR	Total knee replacement
<input type="checkbox"/>	Tx	Treatments

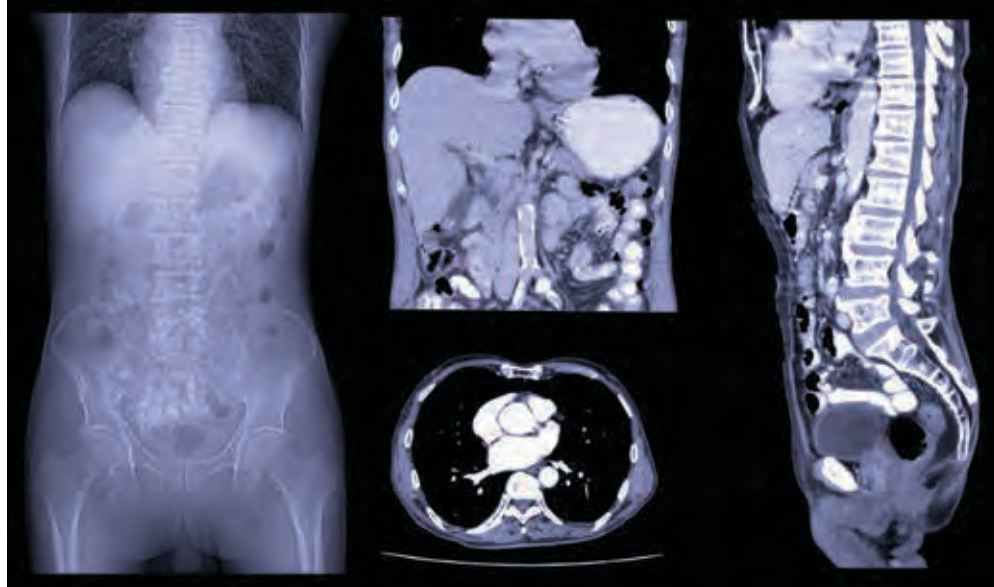
### 5.3a Common Imaging Diagnostics

Aside from visually examining the area the patient is complaining about, more in-depth structural analysis is often needed. Since a medical professional obviously cannot see inside the body, the physician may order certain types of imaging to help determine what exactly is going on so it can be treated effectively. You may remember the following imaging procedures from a prior chapter, but a quick review should be helpful in reinforcing your knowledge.

A **radiograph** (radi/o = x-ray, -graph = instrument for recording), also known as an *X-ray*, is typically the first form of imaging a physician will order, making it the most commonly utilized imaging procedure. This form of imaging is great for quickly viewing bones for fractures or other anomalies.

**Computed tomography (CT)** uses X-rays as well as computers to develop more detailed images of bone and soft tissues. This type of imaging allows for the creation of cross-sectional views. A CT can be performed with a dye, known as a contrast, that is injected into the patient to provide a sharper image of structures like the spinal column.

#### CT whole abdomen



CT scans use X-ray and computers to create cross-section images of the body.

#### Radiograph

The most common type of imaging ordered, great for quickly viewing bones for fractures or other anomalies; also known as an X-ray

#### Computed tomography

Utilizes X-rays and a computer to create images of the body

#### Magnetic resonance imaging (MRI)

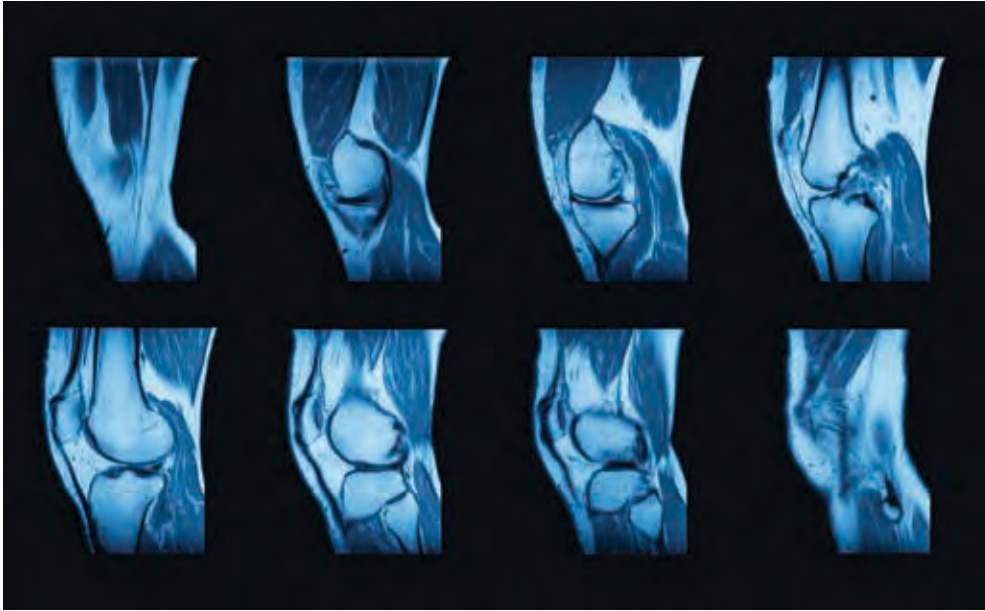
An imaging procedure that utilizes strong magnetic fields to obtain detailed images of the body; great for ligaments, tendons, and cartilage

Unlike an X-ray or CT scan, **magnetic resonance imaging (MRI)** does not use X-rays and instead uses a magnetic field to produce greater detailed cross-sectional images than even the CT. This imaging is great for examining soft tissues such as ligaments, tendons, and even cartilage. For example, if you are suspected to have a torn meniscus, an MRI can be ordered to determine its location and the extent of the damage.



X-ray image of fractured ulna and radius





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An MRI of the right knee

A **musculoskeletal ultrasound** (ultra- = beyond, excess) utilizes soundwaves to create an image. This type of imaging is used for fluid-filled structures and soft tissues. For example, it can be used to check the status of a bursa as well as muscles and tendons.

#### Musculoskeletal ultrasound

Utilizes soundwaves to create an image

#### P.R.I.C.E.

An acronym that stands for protection, rest, ice, compression, elevation; used as a reminder of how to treat an injury in the first 48 to 72 hours after it occurs

### 5.3b Common Injury Treatments

It is not uncommon for an injury to occur, especially to your muscles and joints. For example, if you are doing a strenuous activity that you are not used to, it can cause a muscle tear. Should you encounter such an injury, there



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is a way to treat it right away. For the first 48-72 hours, treatment involves protection, rest, ice, compression, and elevation. To make it easier to remember, the acronym **P.R.I.C.E.** is used. The description for each component can be seen in Table 5-3.



**Table 5-3 P.R.I.C.E.**

Acronym	Meaning	Description
P	Protection	Protecting the injured area by wrapping or bracing it with bandages in an effort to reduce more damage
R	Rest	Resting the injured site by keeping weight off it to prevent the injury from worsening
I	Ice	Icing the injured site will help to decrease swelling
C	Compression	Wrapping the injury in a flexible bandage to decrease swelling and movement
E	Elevation	Supporting the injured site to keep it above the heart to decrease inflammation

**Deep tendon reflex (DTR)**

A reflex exam used to determine the presence of abnormalities in the muscles

**Range of motion (ROM)**

The measurement of movement around a joint

**Goniometer**

An instrument used to measure the precise angle of a joint

**Muscle biopsy**

Used to take a sample of tissue from a muscle to test it for the presence of disease or infection

**5.3c Diagnostics for Muscles**

There are specific diagnostics (**Dx**) for muscles that test not only the muscles' ability but the neuromuscular connection. A **deep tendon reflex (DTR)** exam is used to determine if there is a neurological disease present affecting the peripheral nervous system and spinal cord's ability to elicit a muscle response. To elicit a response, a Babinski hammer can be used to tap the area of interest and determine the type of reflex response.

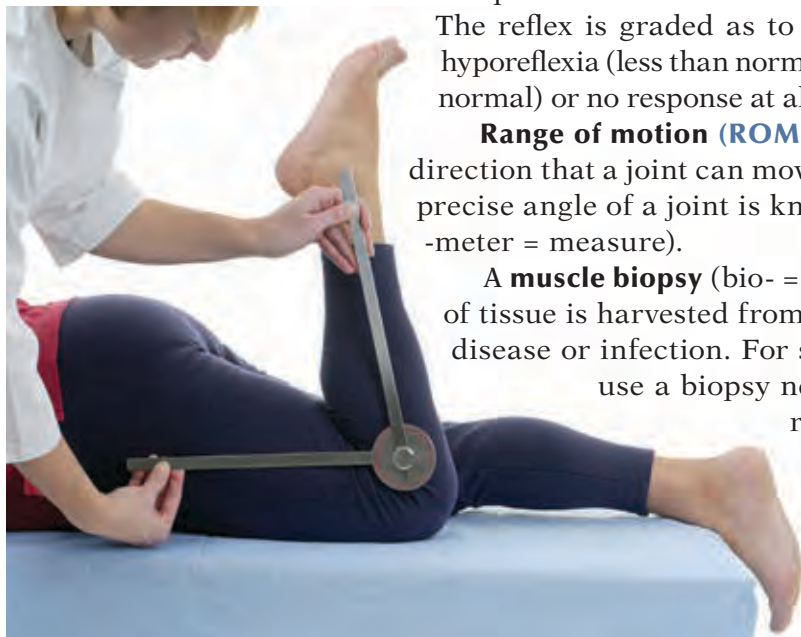


Deep tendon reflex (DTR) test of the tricep muscle

The reflex is graded as to whether there is a normal response, hyporeflexia (less than normal response), hyperreflexia (greater than normal) or no response at all.

**Range of motion (ROM)** is the measurement of distance and direction that a joint can move. An instrument used to measure the precise angle of a joint is known as a **goniometer** (goni/o = angle, -meter = measure).

A **muscle biopsy** (bio- = life, -opsy = view of) is when a sample of tissue is harvested from a muscle to test it for the presence of disease or infection. For small sample sizes, the physician can use a biopsy needle, but if a larger tissue sample is required, then an incision is made into the area of interest, a procedure known as an open biopsy.



◀ Measuring a patient's ROM with a goniometer

**Electromyography (EMG)** (electr/o = electricity, -graphy = process of recording) is done to measure the electrical activity of a patient's muscle. This electrical recording is taken by inserting a needle, known as an electrode, into the muscle (see Figure 5-19). This procedure is used to help determine if the patient's myopathy (-pathy = disease) is muscular or neurological in nature.

A **nerve conduction velocity (NCV) test** is usually done at the same time as an EMG. This test measures how fast the conduction of an electrical impulse moves through a nerve. This is done by measuring the time the impulse takes to move from one electrode to the other.

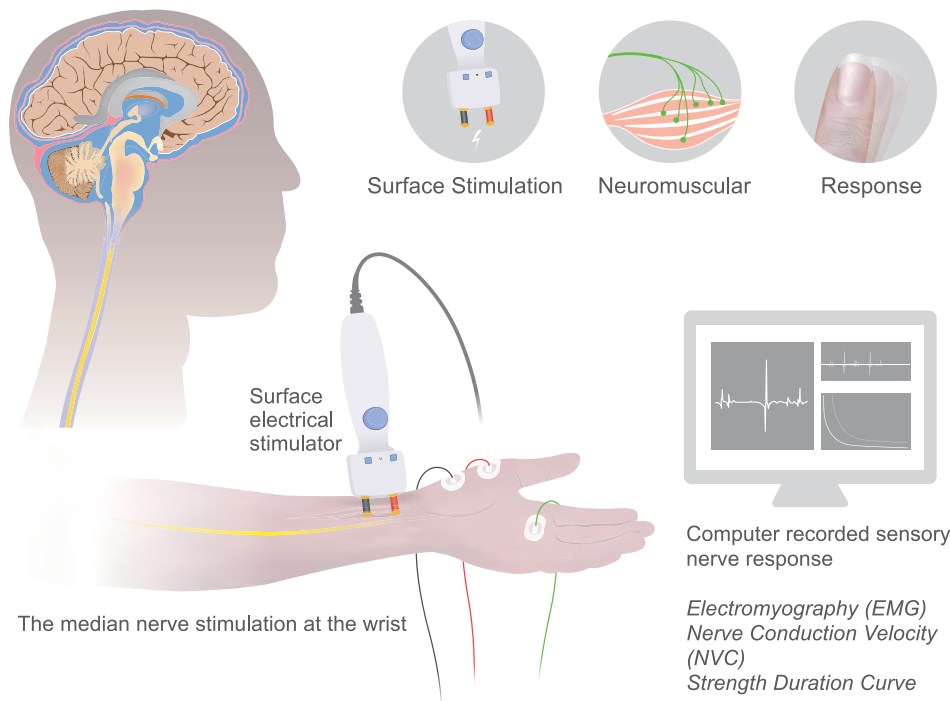
#### Electromyography (EMG)

Measures the electrical activity of a patient's muscles

#### Nerve conduction velocity (NCV) test

Measures how fast the conduction of an electrical impulse moves through a nerve

**Figure 5-19 Electromyography (EMG) Test Procedure**



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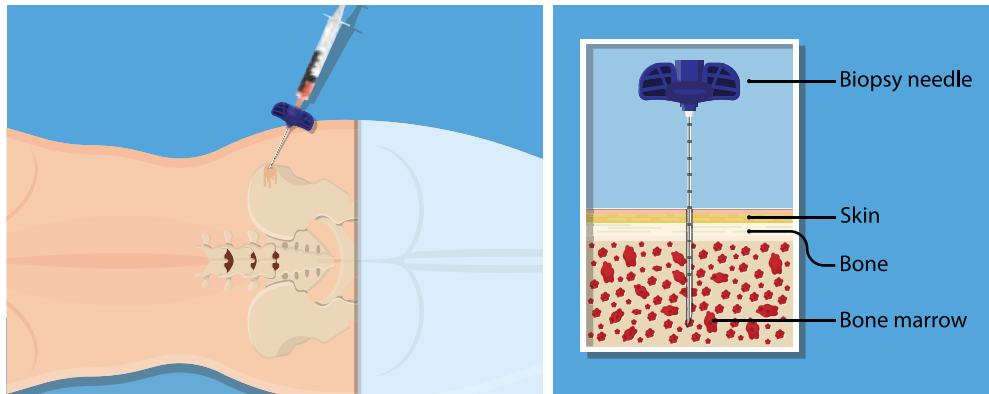
### 5.3d Bone Diagnostics

The most commonly used diagnostic tool for the bones is an X-ray. A CT scan is also used with a contrast medium that is injected into the patient to obtain clearer images of some areas of the body, such as the spine.

A **bone marrow biopsy** is a procedure that uses a needle to puncture a bone and retrieve bone marrow. The bone marrow sample is usually taken from the back of the pelvis (see Figure 5-20). Bone marrow is a type of bone tissue located in the center of the large bones of the body and is responsible for producing blood cells.

### Figure 5-20 **Bone Marrow Aspiration (Removal) and Biopsy**

The bone marrow biopsy procedure is used to collect a sample of bone marrow. It involves puncturing the bone with a needle, usually at the back of the pelvis.



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Bone density (densit/o) scans are used to determine the hardness of bones. This is a way to see if a disease such as osteoporosis is present before the patient finds out the hard way by breaking a bone. There are various names for this test such as **bone densitometry** (-metry = process of measuring), **dual-energy X-ray absorptiometry (DXA)**, and **bone mineral density (BMD)**. It is a specialized form of X-ray that determines the amount of minerals like calcium in the bones. There are two types of dual-energy X-ray absorptiometry (DXA) scans. There is a peripheral DXA scan used to examine the bones of the extremities and a central DXA used to check the bones in the trunk of the body, like the spine.

#### **Bone densitometry**

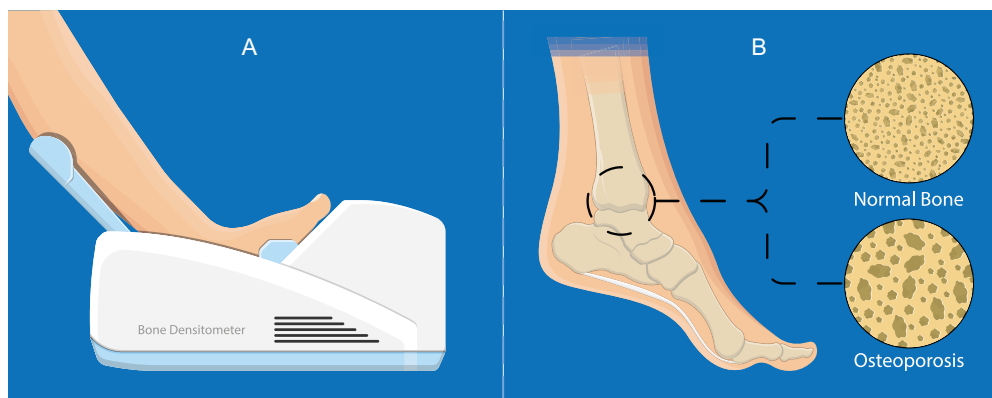
A scan used to determine the hardness of bones

#### **Bone mineral density (BMD)**

A scan used to determine the hardness of bones

### Figure 5-21 **Bone Mineral Density Test to Screen for Osteoporosis**

(a) Bone density scans to determine the hardness of bones are often conducted using a densitometer. (b) These scans help determine whether a disease such as osteoporosis is present.



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### 5.3e Joint Diagnostics

There are many different methods used to diagnose a joint (arthr/o) injury or disease. A physical examination is useful in determining the level of the swelling present, if any redness is apparent, and the patient's range of motion.

Blood tests can diagnose a joint disease such as gout, which is caused by an accumulation of uric acid crystals. High levels of uric acid can lead to the development of crystals in a joint, causing a lot of pain and inflammation in the affected area. For example, if your big toe is very painful and tender, a blood test can check for levels of uric acid in your blood or a sample of joint fluid obtained by a synovial fluid test can be examined under a microscope to look for the presence of uric crystals.

A common procedure involves actually looking at the joint with a flexible viewing scope known as an **arthroscope** (-scope = instrument for visual recording). A surgeon can use the arthroscope to not only see inside the joint but also to make repairs during **arthroscopic** (-scopic = pertaining to visual examination) surgery.



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A surgeon examines a knee during an arthroscopic procedure.

#### Arthroscope (AR-throh-scope)

A flexible viewing scope used to look into a joint

#### Arthroscopic (ar-throh-SKOP-ick)

A surgical procedure used to make repairs to a joint

#### Arthrography (ar-THROG-rah-fee)

A procedure utilizing contrast medium or dye that is injected into a joint to obtain an image that helps determine whether a problem is present

#### Arthrocentesis (ar-throh-sen-TEE-sis)

A procedure that involves placing a needle into a joint to extract a sample of synovial fluid; also known as a joint aspiration

### Arthrography

**Arthrography** is a procedure where a contrast medium or dye is injected into a joint to obtain an image that helps determine whether any problems are present. **Arthrocentesis** (-centesis = surgical puncture), or joint aspiration, is when a needle is placed into a joint to extract a sample of synovial fluid. This procedure is also helpful for diagnosing gout, as previously mentioned. Once the fluid has been obtained, a synovial fluid analysis can be completed to examine the fluid for any abnormal characteristics.

### 5.3f Treatments for Muscles

Once muscle disease or dysfunction has been diagnosed, the next step is to choose the appropriate *treatment* (**Tx**) to either correct the problem or slow the disease progression. Therapy is a necessary component in recovering from an



injury or ailment. So, it is likely to have staff members from the occupational therapy (OT) and physical therapy (PT) department working with patients to restore their mobility and functionality before and after intervention.

**Myoplasty** (-plasty = repair) is the general term for surgical repair of the muscle. Often this requires cutting into the muscle. **Myotomy** (-tomy = process of cutting) is the term for cutting into a muscle. **Myorrhaphy** (-rrhaphy = suture) is the surgical suturing of a muscle after an injury or operation.

A **myectomy** (-ectomy = excision, removal, resection) is the removal of muscle to reduce its size. An example of this in practice is in the form of a cardiac septal myectomy. This procedure is done to decrease the size of the heart muscle in patients with **hypertrophic cardiomyopathy** (overdeveloped heart muscle disease).

**Myoplasty**  
(MY-oh-plas-tee)

Surgical repair of the muscle

**Myotomy**  
(my-OT-oh-mee)

Cutting into a muscle

**Myorrhaphy**  
(my-OR-ah-fee)

Surgical suturing of a muscle

**Myectomy**  
(my-EK-toh-mee)

The removal of muscle to reduce its size

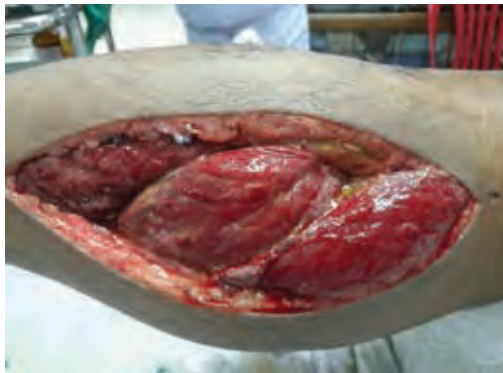
**Hypertrophic cardiomyopathy**

Overdeveloped heart muscle disease

## Clinical Application

5-5

### Compartment Syndrome—Rare but Serious



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Fascioplasty

Compartment syndrome is when pressures within muscles rise to severe levels and cut off blood flow and therefore oxygen and nutrients to that muscle. By making cuts into the fascia (fasci/o) around the muscle, the pressure can be relieved. **Fascioplasty** is the surgical repair of the fascia and a **fasciotomy** (-tomy = process of cutting) is used to treat compartment syndrome, thereby decreasing pressure and increasing circulation in the affected area.

**Tenoplasty**

Surgical repair of a tendon

**Tenolysis**

Surgical procedure to break down a tendon affected by an adhesion

**Tenectomy**

Removal of a tendon

**Tenorrhaphy**  
(ten-OR-ah-fee)

Suturing of a tendon to repair a rupture

**Chondrectomy**  
(kon-DREK-toe-mee)

Removal of a cartilage

**Chondroplasty**  
(KON-droh-plas-tee)

Surgical repair of cartilage

## 5.3g Tendon Treatments

**Tenoplasty** is the general term for surgical repair of a tendon (ten/o). **Tenolysis** (-lysis = breakdown) is used to surgically break down a tendon affected by an adhesion. An adhesion can occur as a result of scarring from an injury that causes the tendon to adhere to the tissue surrounding it. A **tenectomy** is performed to remove the tendon in the event that it has been adversely affected by the disease. **Tenorrhaphy** (-rrhaphy = suture) is the suturing of a tendon to repair a rupture.

## 5.3h Cartilage Treatment

**Chondrectomy** (chondr/o = cartilage, -ectomy = removal) is the removal of a cartilage. An example of this procedure being used is for the removal of damaged cartilage in the knee. **Chondroplasty** (-plasty = repair) is the surgical repair of cartilage. The cartilage found in the joints is a smooth tissue that has minimal friction. Should damage occur, there is a need for repair in order for the cartilage to regain its proper function as much as possible.



### 5.3i Bone Treatment

**Osteoplasty** is the general term for the surgical repair of bone (oss/e, oss/i, oste/o, ost/o = bone; -plasty = repair). **Osteotomy** is surgically cutting into the bone. This may be done to cut, repair and realign a malformed bone. Sometimes a bone might need to be removed, which is termed an **ostectomy**. For example, a **costectomy** (cost/o = rib, -ectomy = removal) is the partial or complete removal of a rib.

There are many different types of bone breaks or fractures. If the bone is splintered into pieces, an **osteorrhaphy** (-rrhaphy = suture) or suturing together of bone fragments with wire might be required for healing. Sometimes a bone needs to be surgically broken and then reset to repair a deformity; this is termed **osteoclasis** (-clasis = to break).

A **bone marrow transplantation (BMT)** is used to provide functioning bone marrow to an individual whose own bone marrow's blood-forming stem cell production has been compromised. Conditions such as cancer can have an impact on the bone marrow's ability to maintain this function. There are two types of bone marrow transplants. If the patient is having their own bone marrow transplanted in another region of their body, it is known as *autologous transplant* (aut/o = self, own). When bone marrow is taken from a donor and transplanted, it is called an *allogeneic transplant* (all/o = other).

Similarly, the whole bone can be transplanted. A **bone graft** is another term for a bone transplant. This can be done by transplanting the patient's own bone tissue to another part of their body (*autologous transplant*) or from a donor (*allogeneic transplant*).

#### Osteoplasty (OSS-tee-oh-plas-tee)

The surgical repair of bone

#### Osteotomy (oss-tee-OT-oh-mee)

Surgically cutting into the bone

#### Ostectomy

The surgical removal of part or all of a bone

#### Costectomy

Partial or complete removal of a rib

## Clinical Application

5–6

### Other Clinicians Found at the Orthopedist's Office



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Orthotics are used to support the limbs.

straight) is an individual who works to fit patients with supportive medical equipment. An example is a brace. A brace or other piece of supportive equipment is known as an **orthotic** (-tic = pertaining to) because it helps enhance a limb, such as in an arm or knee brace. If a limb is removed and needs to be replaced, the medical specialist needed is a **prosthetist**. These individuals fit patients with artificial limbs or other body parts, known as **prosthetics**.

Now that we covered terms let's take a moment to talk about other medical personnel you may meet in an orthopedist's office besides the surgeon. When you need medical intervention due to an injury, you will likely speak to a person who will fit you for medical equipment, such as crutches or other devices, prior to a scheduled surgery. This way you will have them on hand for when you are discharged postop.

An **orthotist** (orth/o =



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A prosthetist fits patients with artificial limbs, which are known as prosthetics.

### 5.3j Treatments for Bone Fractures

#### Closed reduction

When no surgical procedure is required, and a cast is used to immobilize the injury in order for it to heal

#### Open reduction

When an incision is made to reposition a fractured bone

#### Traction

The use of weights, ropes, and pulleys to slowly pull a broken bone back into place

Treatment for bone fractures varies depending on the type and location of the break. A few common terms associated with this process are open and **closed reduction**. A closed reduction is when no surgical procedure is required



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to correct the fracture and a cast is used to immobilize the site, allowing the bones time to heal. However, if the break requires surgical repair, such as the use of screws, pins, rods, or plates, this is referred to as an **open reduction**.

A cast can immobilize a broken bone to help it heal.



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#### Traction

A term you may hear on a med-surg floor is **traction**. This is when weights, ropes, and pulleys are used to slowly pull broken bones back into place and help them stabilize.

A form of traction being used to ensure correct healing

## Clinical Application

5-7

### Internal and External Fixation



External fixation using rods and screws to stabilize and align a broken leg bone.

Bones need to be “fixed” or kept in place to heal. This can be done with the closed reduction previously discussed by placing a cast over the broken bones. However, with more serious breaks, more invasive measures are needed. **External fixation** uses rods and screws placed on the outside of the body to stabilize and align a fractured bone. **Internal fixation** uses a combination of hardware such as plates, screws, pins, rods, to join the fractured ends of the bone together inside the body.



Internal fixation using rods and pins to join fractured ends of bones together

### 5.3k Treatment for the Skull

The skull houses and protects the brain, which controls the body. The word for skull is cranium (crani/o = skull). A **craniectomy** (-ectomy = removal of) may be performed to remove part of the skull to alleviate a buildup of pressure as a result of a traumatic head injury. If the pressure caused by swelling or bleeding is not relieved, then brain damage will ensue.

**Craniotomy** (-tomy = process of cutting) is surgically cutting into the skull. If brain surgery is required, a section of the skull is removed temporarily. Once the procedure is completed, the bone flap is placed back into its original place. **Cranioplasty** is the surgical repair of a deformity or abnormality of the skull.



Craniectomy taking place to remove a tumor from the brain

#### Craniectomy (kRAY-nee-EK-toh-mee)

Removal of part of the skull

#### Craniotomy (kRAY-nee-OT-oh-mee)

Surgically cutting into the skull

#### Cranioplasty (KRAY-nee-oh-plas-tee)

The surgical repair of the skull



### 5.31 Spinal Treatments

#### Laminectomy (lam-ih-NECK-toh-mee)

A surgical procedure to remove the part of the vertebra called the lamina; also known as decompression surgery

#### Discectomy (dis-KECK-toh-mee)

Removal of a disc

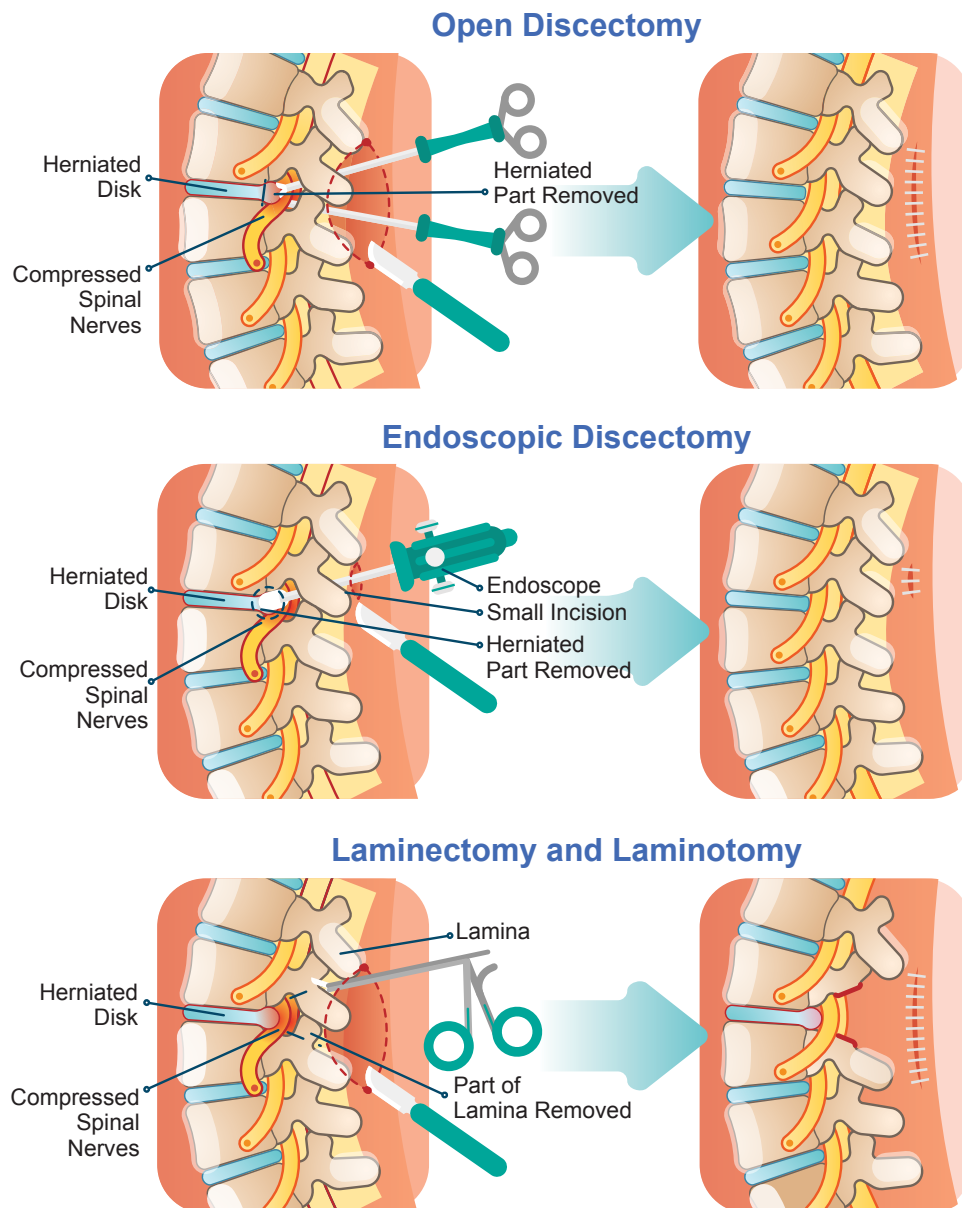
#### Percutaneous discectomy (per-kyou-TAY-nee-us Dis-KECK-toh-mee)

Removing part of a damaged disc using a needle instead of through an incision

A **laminectomy** (lamin/o = lamina or layer), also known as decompression surgery, is a surgical procedure where part of the vertebra, called the lamina, is removed. Once extracted, there is more space available because the spinal canal has been made larger, allowing for a decrease in pressure and pain found in that region of the spine. If only part of the lamina is removed, the procedure is referred to as a *laminotomy*.

A **discectomy**, also known as a microdiscectomy, is when a small incision is made to remove a herniated disc that is causing back pain (see Figure 5-22). A **percutaneous discectomy** also removes part of the damaged disc using a needle instead of making an incision.

Figure 5-22 Spinal Disk Surgery



**Percutaneous vertebroplasty** is an outpatient procedure that involves injecting medical bone cement into a fractured vertebra (vertebr/o) as a result of compression fractures or osteoporosis. The cement hardens and provides stabilization to the vertebral bone.

**Spinal fusion** or **spondylodesis** (spondyl/o = vertebra, -desis = bind, tie together) is the process of fusing two or more vertebrae into one piece of bone. The fused bones prevent movement, which helps to eliminate pain. A spinal fusion can be done on any part of the spine.

### 5.3m Treatments for the Joints

**Arthrodesis** is the term used when a joint is fused to connecting bones. You may hear this referred to as a joint fusion. **Arthrolysis** is performed when a joint has been stiffened as a result of adhesion. This procedure loosens the joint and allows for mobility. **Arthroplasty** is when a joint has been repaired or replaced.

The synovial membrane (synov/o) lines the joint cavity. When damaged, such as commonly seen in the knees, chronic inflammation can occur. When medication is not working, the membrane can be removed to provide relief to the patient. This is called a **synovectomy**.

As you may recall from an earlier section of this chapter, the bursae (burs/o = bursa) are small, fluid-filled sacs that act as cushions in some joints. These sacs can become chronically inflamed or infected. If they cannot be managed appropriately, they can be removed to remedy the issue. This is known as a **bursectomy**.

**Percutaneous vertebroplasty (per-kyou-TAY-nee-us VER-tee-broh-plas-tee)**

Injecting medical bone cement into a fractured vertebra to provide stabilization of the vertebral bone

**Spinal fusion**

The fusion of two or more vertebrae into one piece of bone; also known as spondylodesis

**Arthrodesis (ar-throh-DEE-sis)**

A fused joint

**Arthrolysis (ar-THROL-ih-sis)**

A procedure to loosen a joint that has stiffened due to adhesions

**Arthroplasty (AR-throh-plas-tee)**

Joint repair or replacement

**Synovectomy (sin-oh-VECK-toh-mee)**

Surgical removal of the synovial membrane

**Bursectomy (bur-SECK-toe-mee)**

Surgical removal of a bursa

## Clinical Application

5–8

### Arthroplasty

When damage to a joint is irreparable, then the best solution is often to replace it. Joint replacements can be in the form of a total replacement or partial replacement. The following are common types of joint replacements.



Total knee replacement

A total knee replacement (**TKR**) involves replacing the knee with metal or plastic parts. This includes placing artificial parts on the ends of the bones at the joint. This procedure may be done for cases of severe chronic knee pain as a result of osteoarthritis.

A **partial knee replacement (PKR)** is when an operation is performed to replace either the medial, lateral, or patella (kneecap) part of the knee.



**Partial hip replacement**

Only the ball of the joint on the femur is replaced

**Hip resurfacing**

A procedure done to preserve bone tissue that would otherwise be removed

**Acetabulum**

The socket section of the pelvis where the head of the femur connects

**Revision surgery**

Performed to repair a previous joint replacement when a complication occurs, such as infection or implant failure

A **total hip replacement (THR)** is when the hip bone and cartilage are replaced.

A **partial hip replacement** is when only the ball of the joint on the femur is replaced. Instead of having surgery to replace your hip, a patient with worn away cartilage and bone may opt for **hip resurfacing**. This is a procedure to preserve bone tissue that would otherwise be removed. Hip resurfacing involves placing a metal ball at the end of the femur. Additionally, a metal, cup-shaped liner is placed in the **acetabulum**.

**Revision surgery** is performed to repair a previous joint replacement when a complication occurs, such as infection or implant failure.



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Total hip replacement

## Medical Checkup 5-3

- Which of the following terms means “process of cutting”?
  - ectomy
  - scopy
  - tomy
  - plasty
- Which of the following is used to measure the angle of a joint?
  - Range of motion (ROM)
  - Arthroscope
  - Deep tendon reflexes (DTR)
  - Goniometer
- Which of the following procedures is used to repair a previous joint replacement?
  - Arthrography
  - Revision surgery
  - Total knee replacement (TKR)
  - Total hip replacement (THR)
- Match the following suffixes with the correct meaning.
 

___ -rrhaphy	a. Surgical puncture	___ -centesis	c. Breakdown
___ -clasis	b. Process of measuring	___ -ectomy	d. To break
		___ -graph	e. Disease
		___ -metry	f. Measure
		___ -pathy	g. Bind, tie together
		___ -meter	h. Process of recording
		___ -graphy	i. Instrument for recording
		___ -opsy	j. Suture
		___ -desis	k. Excision, removal, resection
		___ -lysis	l. View of
- Match the following combining form to the correct term.
 

___ arthr/o	a. Cartilage
___ oste/o	b. Vertebra
___ radi/o	c. Angle
___ burs/o	d. Straight
___ chondr/o	e. Rib
___ orth/o	f. Other
___ cost/o	g. X-ray
___ goni/o	h. Bone
___ all/o	i. Joint
___ spondyl/o	j. Bursa

## Chapter 5 Review

Review the following tables summarizing the key terms and abbreviations from this chapter. For each term or abbreviation you feel you know, check the corresponding checkbox. You can study the rest until all of them have been checked off.

### Key Terms and Abbreviations

✓	Medical term	Meaning
<input type="checkbox"/>	Abduction	The movement away from the midline, which is the imaginary line down the center of the body that divides it into left and right
<input type="checkbox"/>	Acetabulum	The socket section of the pelvis where the head of the femur connects
<input type="checkbox"/>	Acetylcholine (ACh) (as-eh-til-KOH-leen)	A neurotransmitter that is used by nerve cells to send signals
<input type="checkbox"/>	Activities of daily living (ADL)	The tasks required for everyday living
<input type="checkbox"/>	Adduction	A movement towards the midline or to the patient's side
<input type="checkbox"/>	Ankylosis (ang-kih-LOH-sis)	When extreme stiffness occurs as a result of the joints fusing together
<input type="checkbox"/>	Anterior cruciate ligament (ACL) (ann-teer-e-her KROO-shee-ayt LIG-ah-ment)	A ligament in the knee that crosses in front of the PCL and attaches to the femur and tibia
<input type="checkbox"/>	Arthrocentesis (ar-throh-sen-TEE-sis)	A procedure that involves placing a needle into a joint to extract a sample of synovial fluid; also known as a joint aspiration
<input type="checkbox"/>	Arthrodesis (ar-throh-DEE-sis)	A fused joint
<input type="checkbox"/>	Arthrography (ar-THROG-rah-fee)	A procedure utilizing contrast medium or dye that is injected into a joint to obtain an image that helps determine whether a problem is present
<input type="checkbox"/>	Arthrolysis (ar-THROL-ih-sis)	A procedure to loosen a joint that has stiffened due to adhesions
<input type="checkbox"/>	Arthroplasty (AR-throh-plas-tee)	Joint repair or replacement
<input type="checkbox"/>	Arthrosclerosis	A general term for stiffness in the joints, which may result from disease or aging
<input type="checkbox"/>	Arthroscope (AR-throh-scope)	A flexible viewing scope used to look into a joint
<input type="checkbox"/>	Arthroscopic (ar-throh-SKOP-ick)	A surgical procedure used to make repairs to a joint
<input type="checkbox"/>	Articular (ar-TICK-you-lar)	Pertaining to a joint
<input type="checkbox"/>	Atrophy	A condition caused by the lack of use or presence of disease resulting in the withering away of muscles
<input type="checkbox"/>	Avulsion (ah-VUL-shun) fracture	A break in the bone that occurs where the ligament or tendon attaches
<input type="checkbox"/>	Bone densitometry	A scan used to determine the hardness of bones

✓	Medical term	Meaning
<input type="checkbox"/>	Bone graft	Bone transplant
<input type="checkbox"/>	Bone marrow	A spongy, gelatinous tissue needed to produce certain blood cells (red bone marrow) or store fats (yellow bone marrow)
<input type="checkbox"/>	Bone marrow biopsy	A procedure that uses a needle to puncture a bone and retrieve bone marrow
<input type="checkbox"/>	Bone marrow transplantation (BMT)	Used to provide functioning bone marrow to an individual whose own bone marrow has been compromised
<input type="checkbox"/>	Bone mineral density (BMD)	A scan used to determine the hardness of bones
<input type="checkbox"/>	Bones	Rigid tissue structure that varies in shape and size and serves multiple roles and functions
<input type="checkbox"/>	Bursa	A closed, fluid-filled fibrous sac next to tendons; found in areas of large joints such as knees and elbows
<input type="checkbox"/>	Bursectomy (bur-SECK-toe-mee)	Surgical removal of a bursae
<input type="checkbox"/>	Bursitis	Inflammation of the bursae
<input type="checkbox"/>	Calcium (Ca)	A mineral stored in the bones that is needed for the body to perform different functions
<input type="checkbox"/>	Cardiac muscle	Muscle that makes up the walls of the heart
<input type="checkbox"/>	Carpal tunnel syndrome	A condition that develops due to redundant or repetitive movement; causes inflammation in the wrist
<input type="checkbox"/>	Carpals	A group of eight irregular-shaped bones that make up the wrist
<input type="checkbox"/>	Cartilage	Firm connective tissue that holds structures together; can act as cushion-like tissue since it is more flexible than bone
<input type="checkbox"/>	Cervical vertebrae (C1-C7)	Used to indicate specific bones of the neck (cervical spine)
<input type="checkbox"/>	Certified occupational therapy assistant (COTA)	An individual who works under the supervision and direction of an occupational therapist
<input type="checkbox"/>	Chiropractor	These individuals are not physicians but have been trained to treat ailments of spine and joints to relieve pressure and pain by way of realignment
<input type="checkbox"/>	Chondrectomy (kon-DREK-toe-mee)	Removal of a cartilage
<input type="checkbox"/>	Chondromalacia (kon-droh-mah-LAY-shee-ah)	A condition caused by overuse or injury to the cartilage causing it to soften
<input type="checkbox"/>	Chondroplasty (KON-droh-plas-tee)	Surgical repair of cartilage
<input type="checkbox"/>	Clavicle	Horizontal long bone that provides support to the shoulder; also known as the collarbone
<input type="checkbox"/>	Closed reduction	When no surgical procedure is required, and a cast is used to immobilize the injury in order for it to heal
<input type="checkbox"/>	Comminuted fracture (KOM-ih-newt-ed FRAK-shu)	A bone break where bone (fragments) are in the area between the break of a bone; these fragments can splinter off into the surrounding tissue
<input type="checkbox"/>	Compact bone	Very hard outside layer of bone tissue, which gives the bone strength and protection

✓	Medical term	Meaning
<input type="checkbox"/>	Complete fracture	A fracture that goes completely through the bone
<input type="checkbox"/>	Compound fracture or open fracture	When the bone projects through the skin
<input type="checkbox"/>	Computed tomography	Utilizes X-rays and a computer to create images of the body
<input type="checkbox"/>	Costectomy	Partial or complete removal of a rib
<input type="checkbox"/>	Costochondritis (kos-toh-kon-DRIGH-tis)	Inflammation of the cartilage between the ribs
<input type="checkbox"/>	Cramp	A sudden, involuntary muscle contraction occurring over a prolonged period and causing pain
<input type="checkbox"/>	Craniectomy (kray-nee-EK-toh-mee)	Removal of part of the skull
<input type="checkbox"/>	Cranioplasty (KRAY-nee-oh-plas-tee)	The surgical repair of the skull
<input type="checkbox"/>	Craniotomy (kray-nee-OT-oh-mee)	Surgically cutting into the skull
<input type="checkbox"/>	Cranium	The skull
<input type="checkbox"/>	Cruciate ligament tear	A tear in one of the two major supporting ligaments in the in knee
<input type="checkbox"/>	Deep tendon reflexes (DTR)	A reflex exam used to determine the presence of abnormalities in the muscles
<input type="checkbox"/>	Diplopia	A condition where the patient sees two of the same objects; also known as double vision
<input type="checkbox"/>	Discectomy (dis-KECK-toh-mee)	Removal of a disc
<input type="checkbox"/>	Dislocation	A complete separation of a bone from the joint
<input type="checkbox"/>	Dorsiflexion	Upward movement of the foot
<input type="checkbox"/>	Dual-energy X-ray absorptiometry (DXA)	There are two types of DXA scans, a peripheral and central. Central DXA scans are used to determine the hardness of bones in the trunk of the body; peripheral DXA scans are used for the extremities
<input type="checkbox"/>	Dysphagia	Difficulty swallowing
<input type="checkbox"/>	Dysphonia	Difficulty speaking
<input type="checkbox"/>	Electromyography (EMG)	Measures the electrical activity of a patient's muscles
<input type="checkbox"/>	Endosteum (en-DOS-tee-um)	Tissue that lines the medullary cavity of the bone
<input type="checkbox"/>	Epicondylitis (ep-ih-kon-dih-LYE-tis)	Inflammation in the area where the muscle of the forearm connects to the elbow
<input type="checkbox"/>	Epiphyseal line	All that remains of the epiphyseal plate (growth plate) once the bone is mature and growth has stopped
<input type="checkbox"/>	Eversion	The outward turning of a joint
<input type="checkbox"/>	Ewing sarcoma	A rare type of bone tumor that has been known to affect children and young adults
<input type="checkbox"/>	Extension	A movement that increases the angle between two bones at a joint as the muscles contract to move the bent joint into a straightened position

✓	Medical term	Meaning
<input type="checkbox"/>	External fixation	Utilization of rods and screws placed on the outside of the body to stabilize and align a broken bone
<input type="checkbox"/>	False ribs	Pairs of ribs connected posteriorly to the vertebrae and anteriorly by the costal cartilage of the ribs above; not connected directly to the sternum
<input type="checkbox"/>	Fascia	A sheet of connective tissue that wraps and surrounds bodily structures to support, connect, and separate structures of the body
<input type="checkbox"/>	Fascioplasty (FASH-ee-oh-plas-tee)	Surgical repair of the fascia
<input type="checkbox"/>	Fasciotomy (fash-ee-OT-oh-mee)	The process of cutting into a fascia
<input type="checkbox"/>	Femur	Known as the thigh bone; the longest long bone in the body
<input type="checkbox"/>	Fibromyalgia	A common chronic musculoskeletal disorder causing pain, fatigue, and tenderness in affected localized muscular regions
<input type="checkbox"/>	Fibrous joints	Joints that remain fixed or do not move, such as those found in the skull
<input type="checkbox"/>	Fibula (FIB-you-lah)	Located in the lower part of the legs, the smaller, thinner of the two bones; helps stabilize the ankle
<input type="checkbox"/>	Flexion	The decreasing of the angle between two muscles or joints in a bending movement
<input type="checkbox"/>	Floating ribs	Ribs 11 and 12 are called the floating ribs because they only connect posteriorly to the vertebrae and have no anterior attachment.
<input type="checkbox"/>	Fracture (Fx)	A broken or cracked bone
<input type="checkbox"/>	Ganglion cyst	A small sac that develops over a joint or tendon
<input type="checkbox"/>	Goniometer	An instrument used to measure the precise angle of a joint
<input type="checkbox"/>	Gout	A condition caused by the accumulation of uric acid in the blood allowing for the development of uric crystals in the joints
<input type="checkbox"/>	Gouty arthritis	Another term for gout
<input type="checkbox"/>	Greenstick fracture	Occurs when a bone does not break clean through and instead cracks and bends much like a break of a green tree branch
<input type="checkbox"/>	Guillain-Barre syndrome (gee-YAHN bah-RAY SIN-droh-m)	An autoimmune neuromuscular disorder known to cause ascending paralysis, from ground to brain
<input type="checkbox"/>	Heel spur	A condition caused by the accumulation of calcium that has deposited in the form of a bony protrusion in the heel
<input type="checkbox"/>	Hemarthrosis (hem-ar-THROH-sis)	Blood in the joint cavity
<input type="checkbox"/>	Hemiparesis (hem-ee-pah-REE-sis)	Slight paralysis on one side of the body
<input type="checkbox"/>	Hemiplegia (hem-ee-PLÉE-jee-ah)	Total paralysis occurring on one side of the body
<input type="checkbox"/>	Hemopoiesis (hee-moh-poy-EE-sis)	The production of red blood cells; occurs in the bone marrow
<input type="checkbox"/>	Herniated nucleus pulposus (HER-nee-ayt-ed NEW-klee-us pull-POH-sis)	A degenerative condition of the vertebral disc



✓	Medical term	Meaning
<input type="checkbox"/>	Hip resurfacing	A procedure done to preserve bone tissue that would otherwise be removed
<input type="checkbox"/>	Humerus	Long bone found in the upper arm or brachium
<input type="checkbox"/>	Hyperextension	Excessive straightening of a joint beyond its normal range of motion
<input type="checkbox"/>	Hyperflexion	Excessive bending of a joint beyond its normal range of motion
<input type="checkbox"/>	Hypertrophic cardiomyopathy	Overdeveloped heart muscle disease
<input type="checkbox"/>	Impacted fracture	Occurs when the end of a bone is forced into another bone causing a break
<input type="checkbox"/>	Internal fixation	Utilization of hardware such as plates, screws, pins, rods, to join the fractured ends of the bone together from inside the body
<input type="checkbox"/>	Inversion	The inward turning of a joint
<input type="checkbox"/>	Joints	An area where two or more bones meet allowing for movement
<input type="checkbox"/>	Kinesiology (n-ee-see-OHL-oh-jee)	The study of body movement
<input type="checkbox"/>	Kyphosis (kye-FOH-sis)	The outward curvature to the spine causing a hunchback appearance
<input type="checkbox"/>	Laminectomy (lam-ih-NECK-toh-mee)	A surgical procedure to remove the part of the vertebra called the lamina; also known as decompression surgery
<input type="checkbox"/>	Leiomyoma (lee-oh-mye-OH-mah)	A tumor in a smooth muscle
<input type="checkbox"/>	Ligaments	Fibrous, connective tissues connecting bone to bone
<input type="checkbox"/>	Long bone	A bone that is longer than it is wide and has a shaft and two ends; a femur is a long bone
<input type="checkbox"/>	Lordosis	A curvature of the lower back or lumbar of the spine
<input type="checkbox"/>	Lumbar vertebrae (L1-L5)	Section of the vertebrae located at the lower back region
<input type="checkbox"/>	Magnetic resonance imaging (MRI)	An imaging procedure that utilizes strong magnetic fields to obtain detailed images of the body; great for ligaments, tendons, and cartilage
<input type="checkbox"/>	Mandible (MAN-dih-bul)	The bone that forms the lower jaw
<input type="checkbox"/>	Manubrium (mah-NEW-bree-um)	The upper part of the sternum
<input type="checkbox"/>	Massage therapist	An individual who works to massage sore or injured muscles to relieve pain
<input type="checkbox"/>	Maxilla (mack-SIH-lah)	The bone that forms the upper jaw
<input type="checkbox"/>	Medial tibial stress syndrome (MTSS)	More commonly referred to as shin splints, these occur when the muscle is torn away from the tibia
<input type="checkbox"/>	Medullary cavity	The cavity in the inner region of the bone
<input type="checkbox"/>	Meniscal tear (meh-NIS-kal TEHR)	A tear in the cartilaginous pads of the knee
<input type="checkbox"/>	Metacarpals	The five bones in the hand

✓	Medical term	Meaning
<input type="checkbox"/>	Metatarsals	The five bones in the foot
<input type="checkbox"/>	Multiple myeloma	A cancerous condition affecting the plasma cells in the bone marrow
<input type="checkbox"/>	Muscle biopsy	Used to take a sample of tissue from a muscle to test it for the presence of disease or infection
<input type="checkbox"/>	Muscles	A type of tissue that allows for movement
<input type="checkbox"/>	Muscular dystrophy	A group of diseases known to cause a loss of muscle mass due to a mutated gene
<input type="checkbox"/>	Musculoskeletal ultrasound	Utilizes soundwaves to create an image of muscles and joints
<input type="checkbox"/>	Myalgia (my-AL-jee-ah)	Muscle pain
<input type="checkbox"/>	Myasthenia gravis (MG) (my-as-THEE-nee-ah GRAH-vis)	An autoimmune disorder that causes descending paralysis
<input type="checkbox"/>	Myectomy (my-EK-toh-mee)	The removal of muscle to reduce its size
<input type="checkbox"/>	Myolysis (my-OL-ih-sis)	Breakdown of muscle tissue
<input type="checkbox"/>	Myomalacia (my-oh-mah-LAY-see-ah)	Softening of muscle tissue
<input type="checkbox"/>	Myopathy (my-OP-ah-thee)	Muscle disease
<input type="checkbox"/>	Myoplasty (MY-oh-plas-tee)	Surgical repair of the muscle
<input type="checkbox"/>	Myorrhaphy (my-OR-ah-fee)	Surgical suturing of a muscle
<input type="checkbox"/>	Myorrhexis (my-oh-RECK-sis)	Tearing or rupture of a muscle
<input type="checkbox"/>	Myotomy (my-OT-oh-mee)	Cutting into a muscle
<input type="checkbox"/>	Nerve conduction velocity (NCV) test	Measures how fast the conduction of an electrical impulse moves through a nerve
<input type="checkbox"/>	Nutrient foramen	A small tunnel located on the cortex of a bone acting as a passageway for blood vessels to enter the medullary cavity
<input type="checkbox"/>	Oblique fracture	When the break through the bone is at an angle
<input type="checkbox"/>	Occupational therapist (OT)	A provider who works with patients to teach and train them how to adapt their abilities and regain the skills needed to perform the activities of daily living (ADL)
<input type="checkbox"/>	Osteotomy (oss-tee-OT-oh-mee)	Surgically cutting into the bone
<input type="checkbox"/>	Open reduction	When an incision is made to reposition a fractured bone
<input type="checkbox"/>	Orthopedist	A physician who treats injuries and abnormalities of the muscle, bones, and joints
<input type="checkbox"/>	Orthotic (or-THOT-ick)	Supportive equipment, such as a brace
<input type="checkbox"/>	Orthotist (OR-tho-tist)	An individual who works to fit patients with supportive medical equipment, such as a brace
<input type="checkbox"/>	Ostealgia (oss-tee-AL-jee-ah)	Pain in the bone
<input type="checkbox"/>	Ostectomy	The surgical remove of part or all of a bone
<input type="checkbox"/>	Osteitis (oss-tee-EYE-tis)	Inflammation of the bone

✓	Medical term	Meaning
<input type="checkbox"/>	Osteoarthritis (OA) (oss-tee-oh-ar-THRIGH-tis)	Arthritis caused by the wear and tear on bones and joints
<input type="checkbox"/>	Osteoblasts	Embryonic or immature bone cells
<input type="checkbox"/>	Osteochondroma (oss-tee-oh-kon-DROH-mah)	A noncancerous overgrowth of bone and cartilage on the bone at the growth plate
<input type="checkbox"/>	Osteoclasia	Surgically breaking a bone to reset and repair it
<input type="checkbox"/>	Osteoclasts	Cells that break down bone cells as part of normal bone function
<input type="checkbox"/>	Osteocytes	Bone cells
<input type="checkbox"/>	Osteomalacia (oss-tee-oh-mah-LAY-shee-ah)	Softening of the bones
<input type="checkbox"/>	Osteomyelitis (oss-tee-oh-my-eh-LYE-tis)	An inflammation of the bone marrow
<input type="checkbox"/>	Osteonecrosis (oss-tee-oh-neh-KROH-sis)	Death of bone tissue
<input type="checkbox"/>	Osteons	Tiny holes in bone that are similar in appearance to the rings of a cut tree trunk
<input type="checkbox"/>	Osteopathy (oss-tee-OP-ah-thee)	Disease of the bone
<input type="checkbox"/>	Osteoplasty (OSS-tee-oh-plas-tee)	The surgical repair of bone
<input type="checkbox"/>	Osteoporosis	A slow and progressive disease causing a decrease in bone density, resulting in a spongy appearance
<input type="checkbox"/>	Osteorrhaphy (oss-tee-OR-ah-fee)	Suturing bone fragments together to heal
<input type="checkbox"/>	Osteosarcoma (oss-tee-oh-sar-KOH-mah)	A type of bone cancer affecting the cells that develop bone
<input type="checkbox"/>	Osteotomy (oss-tee-OT-oh-mee)	Surgically cutting into the bone
<input type="checkbox"/>	Paralysis	Partial or complete loss of the function of muscles
<input type="checkbox"/>	Paraplegia	Paralysis of the legs
<input type="checkbox"/>	Paresthesia	The term referring to the pins and needles sensation felt by a patient
<input type="checkbox"/>	Partial hip replacement	Only the ball of the joint on the femur is replaced
<input type="checkbox"/>	Partial knee replacement (PKR)	Replacement of either the medial, lateral, or patella (kneecap) part of the knee
<input type="checkbox"/>	Patella	A flat, circular bone found in the anterior portion of the knee that provides protection to the knee; also referred to as the kneecap
<input type="checkbox"/>	Pelvis	Also known as the hipbone or bony pelvis; provides structure and protection for the reproductive and urinary organs
<input type="checkbox"/>	Percutaneous discectomy (per-kyou-TAY-nee-us dis-KECK-toh-mee)	Removing part of a damaged disc using a needle instead of through an incision
<input type="checkbox"/>	Percutaneous vertebroplasty (per-kyou-TAY-nee-us VER-tee-broh-plas-tee)	Injecting medical bone cement into a fractured vertebra to provide stabilization of the vertebral bone
<input type="checkbox"/>	Periosteum	A fibrous covering surrounding the outside of the bone
<input type="checkbox"/>	Phalanges (fah-LAN-jeez)	The bones that make up the fingers and toes

✓	Medical term	Meaning
<input type="checkbox"/>	Physical therapist (PT)	A provider who creates a treatment plan and uses exercises and equipment to help the patient regain mobility
<input type="checkbox"/>	Physical therapy assistant (PTA)	A provider who works under the supervision and direction of a physical therapist
<input type="checkbox"/>	Plantar (foot) flexion	Downward movement of the foot
<input type="checkbox"/>	Plantar fasciitis (PLAN-tar fas-ee-EYE-tis)	Inflammation of a band of tissue in the foot that connects from the heel to the toes
<input type="checkbox"/>	Podiatrist (DPM)	A physician, more specifically, a doctor of podiatric medicine (DPM), who specializes in diagnosing and treating diseases and abnormalities of the feet
<input type="checkbox"/>	Posterior cruciate ligament (PCL)	The ligament crossing behind the ACL; attaches to the femur and tibia
<input type="checkbox"/>	P.R.I.C.E.	An acronym that stands for protection, rest, ice, compression, elevation; used as a reminder of how to treat an injury in the first 48 to 72 hours after it occurs
<input type="checkbox"/>	Prosthetic (pros-THET-ick)	Artificial limbs or other body parts
<input type="checkbox"/>	Prosthetist (PROS-the-tist)	The medical specialist who fits a patient for an artificial limb
<input type="checkbox"/>	Ptosis (TOH-sis)	Drooping eyelid
<input type="checkbox"/>	Pubis	The bones that form the anterior connection of the pelvis
<input type="checkbox"/>	Quadriplegia	Paralysis of the arms, legs, and torso
<input type="checkbox"/>	Radiograph	The most common type of imaging ordered, great for quickly viewing bones for fractures or other anomalies; also known as an X-ray
<input type="checkbox"/>	Radius	One of the two bones of the lower arm or forearm, located on the thumb side of the arm; also known as radial bone
<input type="checkbox"/>	Range of motion (ROM)	The measurement of movement around a joint
<input type="checkbox"/>	Revision surgery	Performed to repair a previous joint replacement when a complication occurs, such as infection or implant failure
<input type="checkbox"/>	Rhabdomyoma (rab-doh-my-OH-mah)	A tumor found in cardiac muscle
<input type="checkbox"/>	Rhabdomyosarcomas (rab-doh-my-oh-sar-KOH-mahs)	A type of cancerous tumor developed in skeletal muscle tissue
<input type="checkbox"/>	Rheumatoid arthritis (RA)	Chronic inflammation of the joints due to an autoimmune disorder
<input type="checkbox"/>	Rheumatologist	A physician who treats musculoskeletal disease and autoimmune conditions that cause swelling, pain, and deformity in the joints, muscles, and bones
<input type="checkbox"/>	Ribs	Curved, archlike bones
<input type="checkbox"/>	Rotation	The circular movement of a joint or muscle to move a limb
<input type="checkbox"/>	Sacral vertebrae (S1-S5)	The section of vertebral column consisting of 3-5 bones located at the end of the vertebral column

✓	Medical term	Meaning
<input type="checkbox"/>	Sarcopenia	Loss of muscle occurring as part of the natural aging process
<input type="checkbox"/>	Scapula	The bone that connects the humerus to the clavicle; also known as the shoulder blade
<input type="checkbox"/>	Scoliosis (skoh-lee-OH-sis)	The lateral curvature of the spine
<input type="checkbox"/>	Shin splints	Inflammation of bone tissue, muscles, and tendons around the tibia; occurs from being overworked
<input type="checkbox"/>	Simple or closed fracture	A broken bone that has not penetrated the skin; also known as a closed fracture
<input type="checkbox"/>	Skeletal muscles	Voluntary muscles attached to the skeleton, which allow for body movement
<input type="checkbox"/>	Smooth muscle	The muscle found in the walls of internal organs and vessels, such as the airway or blood vessels
<input type="checkbox"/>	Spasm	A sudden, involuntary muscle contraction where the muscle quickly contracts and releases without any pain
<input type="checkbox"/>	Spinal fusion	The fusion of two or more vertebrae into one piece of bone; also known as spondylodesis
<input type="checkbox"/>	Spinal stenosis	A condition where the spine becomes narrowed as a result of wear and tear
<input type="checkbox"/>	Spiral fracture	A rotational or twisting bone break that occurs when the body is in motion and the extremity is planted; also known as a torsion fracture
<input type="checkbox"/>	Spondylodesis (spon-dih-loh-DEE-sis)	The fusion of two or more vertebrae into one piece of bone; also known as a spinal fusion
<input type="checkbox"/>	Spondylolisthesis (spon-dih-loh-liss-THEE-sis)	The forward slipping of a vertebral disc onto the disc below
<input type="checkbox"/>	Spondylosis (spon-dih-LOH-sis)	Degenerative arthritic change of the spine due to wear and tear over a period of time
<input type="checkbox"/>	Spongy bone	The lighter portion of the bone tissue found in the inner regions of the bone; consists of spongy bone tissue
<input type="checkbox"/>	Sprain	An injury to the bands of tissue, called ligaments, that connect two bones
<input type="checkbox"/>	Sternum	Flat bone that sits anterior of the chest
<input type="checkbox"/>	Strain	An injury to the bands of tissue connecting muscle to bone or tendons
<input type="checkbox"/>	Subluxation	A partial dislocation
<input type="checkbox"/>	Sutures	A type of immovable joint of the skull made of fibrous tissue
<input type="checkbox"/>	Synovectomy (sin-oh-VECK-toh-mee)	Surgical removal of the synovial membrane
<input type="checkbox"/>	Synovial capsule	Surrounds the joint and produces synovial fluid
<input type="checkbox"/>	Synovial fluid	The fluid that lubricates the joint and allows for ease of movement by decreasing friction



✓	Medical term	Meaning
<input type="checkbox"/>	Synovial joints	Contain a synovial capsule and membrane that allow for ease of movement
<input type="checkbox"/>	Synovitis	Inflammation of the synovial membrane that lines synovial joints
<input type="checkbox"/>	Tarsals	The bones of the ankle
<input type="checkbox"/>	Temporomandibular joint dysfunction (TMJ or TMD)	A condition affecting the two joints that connect the mandible (jawbone) to the skull
<input type="checkbox"/>	Tendonitis	Inflammation of a tendon
<input type="checkbox"/>	Tendons	A tough strand of fibrous connective tissue attaching muscle to bone
<input type="checkbox"/>	Tenectomy	Removal of a tendon
<input type="checkbox"/>	Tenolysis	Surgical procedure to break down a tendon affected by an adhesion
<input type="checkbox"/>	Tenoplasty	Surgical repair of a tendon
<input type="checkbox"/>	Tenorrhaphy (ten-OR-ah-fee)	Suturing of a tendon to repair a rupture
<input type="checkbox"/>	Tetanus	A neuromuscular condition characterized by severe muscle contractions and caused by a microorganism living in soil
<input type="checkbox"/>	Thoracic vertebrae (T1-T12)	The section of the vertebral column located in the upper back or chest region
<input type="checkbox"/>	Tibia	The larger of the two bones in the lower leg; also known as the shinbone
<input type="checkbox"/>	Tinnitus (tih-NITE-us)	Abnormal ringing sound in the ears
<input type="checkbox"/>	Torn rotator cuff	A tear in the tendons around the shoulder joint
<input type="checkbox"/>	Total hip replacement (THR)	Surgical replacement of the entire hip
<input type="checkbox"/>	Traction	The use of weights, ropes, and pulleys to slowly pull a broken bone back into place
<input type="checkbox"/>	Transverse fracture	A break in the bone that is straight across the shaft of the bone
<input type="checkbox"/>	True ribs	Pairs of ribs that are fixed posteriorly to the vertebrae and anteriorly to the sternum via cartilage
<input type="checkbox"/>	Ulna	One of two bones in the lower arm located between the elbow and wrist
<input type="checkbox"/>	Xiphoid process (ZI-foid PRO-sess)	The lower portion of the sternum

The following table contains the key medical abbreviations that appeared in this chapter. Please note that there may be regional differences in what abbreviations are used and some of these abbreviations may not be used at all health care facilities. Additionally, some abbreviations may conflict with other abbreviations that carry other meanings (eg, pt for patient and PT for physical therapy). When in doubt, write out what you mean rather than using an abbreviation that may introduce confusion.

✓	Medical abbreviation	Meaning
<input type="checkbox"/>	ACh	Acetylcholine
<input type="checkbox"/>	ACL	Anterior cruciate ligament
<input type="checkbox"/>	ADL	Activities of daily living
<input type="checkbox"/>	BMD	Bone mineral density
<input type="checkbox"/>	BMT	Bone marrow transplantation
<input type="checkbox"/>	C1-C7	Used to indicate specific bones of the neck (cervical spine)
<input type="checkbox"/>	Ca	Chemical symbol for calcium
<input type="checkbox"/>	COTA	Certified occupational therapy assistant
<input type="checkbox"/>	CT	Computed tomography
<input type="checkbox"/>	DPM	Doctor of podiatric medicine
<input type="checkbox"/>	DTR	Deep tendon reflexes
<input type="checkbox"/>	Dx	Diagnostics
<input type="checkbox"/>	DXA	Dual-energy X-ray absorptiometry
<input type="checkbox"/>	EMG	Electromyography
<input type="checkbox"/>	Fx	Fracture
<input type="checkbox"/>	GBS	Guillain-Barre syndrome
<input type="checkbox"/>	HNP	Herniated nucleus pulposus
<input type="checkbox"/>	L1-L5	Used to indicate specific bones of the lumbar spine
<input type="checkbox"/>	MG	Myasthenia gravis
<input type="checkbox"/>	MRI	Magnetic resonance imaging
<input type="checkbox"/>	MTSS	Medial tibial stress syndrome
<input type="checkbox"/>	MVA	Motor vehicle accident
<input type="checkbox"/>	NCV	Nerve conduction velocity (test)
<input type="checkbox"/>	OA	Osteoarthritis
<input type="checkbox"/>	OT	Occupational therapist
<input type="checkbox"/>	PCL	Posterior cruciate ligament
<input type="checkbox"/>	PKR	Partial knee replacement
<input type="checkbox"/>	PT	Physical therapist
<input type="checkbox"/>	PTA	Physical therapy assistant
<input type="checkbox"/>	RA	Rheumatoid arthritis
<input type="checkbox"/>	ROM	Range of motion
<input type="checkbox"/>	S1-S5	The last 5 vertebrae located in the lower spine
<input type="checkbox"/>	T1-T12	Used to indicate specific bones of the thoracic spine
<input type="checkbox"/>	THR	Total hip replacement

✓	Medical abbreviation	Meaning
<input type="checkbox"/>	TKR	Total knee replacement
<input type="checkbox"/>	TMJ or TMD	Temporomandibular joint dysfunction
<input type="checkbox"/>	Tx	Treatment

## Medical Exam 5

---

1. Match the following terms.

- |                  |                           |
|------------------|---------------------------|
| ___ Osteomalacia | a. Joint inflammation     |
| ___ Myopathy     | b. Study of movement      |
| ___ Arthritis    | c. Rupture of a muscle    |
| ___ Bursa        | d. Muscle disease         |
| ___ Osteoblasts  | e. Muscle pain            |
| ___ Kinesiology  | f. Herniation of a muscle |
| ___ Myalgia      | g. Fluid-filled sac       |
| ___ Myocele      | h. Soft bones             |
| ___ Myorrhexis   | i. Embryonic bone cells   |

2. Match the following conditions.

- |                       |                                     |
|-----------------------|-------------------------------------|
| ___ Sprain            | a. Degenerative wear of the spine   |
| ___ Strain            | b. Bone cancer                      |
| ___ Subluxation       | c. Tumor of the smooth muscle       |
| ___ Carpal tunnel     | d. Inflammation of the bone marrow  |
| ___ Plantar fasciitis | e. Condition affecting sole of foot |
| ___ Rhabdomyosarcoma  | f. Torn ligament                    |
| ___ Leiomyoma         | g. Tumor of skeletal muscle         |
| ___ Osteomyelitis     | h. Torn tendon                      |
| ___ Spondylolisthesis | i. Partial bone separation          |
| ___ Osteosarcoma      | j. Condition affecting the wrist    |
-



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## Case No. 5.1

Robert was an MVA victim who suffered extensive injury. Due to several bone fractures, an orthopedist was consulted. MRI imaging showed a broken femur and tibia along with lumbar and sacral damage. In addition, he had a displaced patella. His lungs also showed contusions and bleeding because several ribs were also fractured. His complaints included shortness of breath, costal pain, and “hurting all over.” The spinal image showed severe lumbar HNP from L1-L5.

1. What was the etiology?
  - a. Stroke
  - b. Car accident
  - c. Skateboard accidental
  - d. Severe fall
2. The type of high-resolution imaging was accomplished by use of \_\_\_\_\_.
  - a. radiation
  - b. gamma rays
  - c. infrared rays
  - d. magnetism
3. The broken bones were in the \_\_\_\_\_.
  - a. arms
  - b. head
  - c. legs
  - d. wrist
4. The displaced structure was his \_\_\_\_\_.
  - a. kneecap
  - b. shoulder
  - c. wrist
  - d. leg
5. The spinal damage occurred in his \_\_\_\_\_.
  - a. upper back
  - b. neck
  - c. mid-spine
  - d. lower back
6. The spinal damage is best classified as a \_\_\_\_\_ disc.
  - a. fractured
  - b. enlarged
  - c. herniated
  - d. missing

7. Costal pain most likely occurs when he was \_\_\_\_\_.
- a. sitting up
  - b. eating
  - c. breathing
  - d. reading

After spending two weeks in ICU and another three weeks on a med-surg floor, he was sent to a rehabilitation center. He had several operations during his stay that included arthroscopic knee surgery, spondylodeisis, and arthroplasty surgery of the ankle.

8. What health care professional will help him with exercise and therapy to regain his mobility?
- a. Occupational therapist
  - b. Physical therapist
  - c. Podiatrist
  - d. Rheumatologist
9. What health care professional will help Robert with his ADL?
- a. Occupational therapist
  - b. Physical therapist
  - c. Podiatrist
  - d. Rheumatologist

10. When the cast is removed from his leg, his muscles from disuse will most likely develop \_\_\_\_\_.
- a. hypertrophy
  - b. muscular dystrophy
  - c. atrophy
  - d. bursitis

11. What surgical procedure was performed on his spine?
- a. Spinal fusion
  - b. Spinal removal
  - c. Spinal realignment
  - d. Spinal stimulation



12. The arthroscopic and arthroplastic procedures repaired his \_\_\_\_\_.
- a. muscles
  - b. bones
  - c. spinal vertebrae
  - d. joints
-





## Case No. 5.2

Verra has severe osteoarthritis and degenerative spinal disease. She is seen by her physician with the chief concern of severe joint and back pain. Imaging reveals osteomalacia and spinal stenosis and spondylosis. The doctor diagnosis for her includes severe osteoarthritis (OA), spondylosis, and bursitis in the elbow.

1. She was scheduled for a bursectomy and was informed that the bursa is a small lubricating sac in our elbow that needs to be \_\_\_\_\_.
  - a. repaired
  - b. replaced
  - c. realigned
  - d. removed
2. While performing the bursectomy, the surgeon saw the need to repair a portion of a tendon by suturing it. This is referred to as \_\_\_\_\_.
  - a. tendonitis
  - b. tenorrhaphy
  - c. tenaglia
  - d. tenolysis
3. She is told the pain in the back is from her spinal stenosis, which means the spine has become \_\_\_\_\_.
  - a. enlarged
  - b. softened
  - c. narrowed
  - d. porous
4. The osteomalacia meant the bones had \_\_\_\_\_.
  - a. enlarged
  - b. narrowed
  - c. atrophied
  - d. softened
5. Verra is ordered a bone density test that confirms her hip bones have become very brittle due to degeneration and small holes throughout. This condition is known as \_\_\_\_\_.
  - a. gouty arthritis
  - b. rheumatoid arthritis
  - c. osteomyelitis
  - d. osteoporosis
6. Verra is told that a laminectomy would help her lumbar pain. This procedure would remove a portion of the \_\_\_\_\_.
  - a. knee
  - b. vertebra
  - c. lumbago
  - d. cranium



## Case No. 5.3

Denesha is a successful executive at a finance firm and works long hours. Lately, she has been feeling very lethargic and weak. She was always upbeat and smiling, but lately has been struggling to smile because she feels facial weakness and is experiencing double vision and tinnitus. She has also noticed that she is having difficulty swallowing and even speaking. She has sought help from her physician.

1. What is the medical term for difficulty swallowing?
  - a. Dysphonia
  - b. Dyslexia
  - c. Dysphagia
  - d. Polyphagia
2. Tinnitus is \_\_\_\_\_.
  - a. tasting metal when you swallow
  - b. inflammation of the tin molecules in your body
  - c. weakness of facial muscles
  - d. ringing sound in ears
3. The medical term for double vision is \_\_\_\_\_.
  - a. triopia
  - b. diplopia
  - c. biopia
  - d. dysopia
4. Dysphonia would mean she had difficulty \_\_\_\_\_.
  - a. hearing
  - b. seeing
  - c. speaking
  - d. walking
5. She also noticed her eyelids were drooping. The medical term for “drooping” is \_\_\_\_\_.
  - a. ptosis
  - b. visopia
  - c. droopia
  - d. saggina
6. The doctor is most likely to diagnose her with what neuromuscular disease?
  - a. Myasthenia gravis
  - b. Muscular dystrophy
  - c. Guillain-Barre syndrome

- d. Hemiplegia
7. While Denesha was successfully treated for her neuromuscular disease, she still had some mild facial paralysis. Match the following associated paralysis terms.
- |                  |                               |
|------------------|-------------------------------|
| ___ Hemiparesis  | a. Leg paralysis              |
| ___ Paraplegia   | b. Legs and arm paralysis     |
| ___ Quadriplegia | c. Slight one-sided paralysis |
- 

## *Medical Checkup Answers*

5-1 (1) d, (2) b, (3) a, (4) d (5) g, a, f, c, i, d, k, e, h, j, b

5-2 (1) a, (2) d, (3) c, (4) d, e, a, b, c, (5) b, k, e, j, h, i, c, g, d, l, a, f

5-3 (1) c, (2) d, (3) b, (4) j, d, a, k, i, b, e, f, h, l, g, c, (5) i, h, g, j, a, d, e, c, f, b

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