

# Illustrated Guide to Medical Terminology

SECOND EDITION



Juanita J. Davies

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Juanita J. Davies



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**Illustrated Guide to Medical Terminology,  
Second Edition  
Juanita J. Davies**

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## Dedication To Jim



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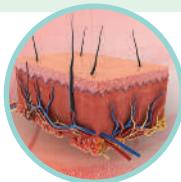
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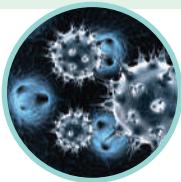


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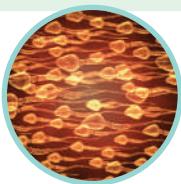
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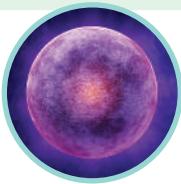
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# PREFACE

## Development of the Text

Most learners find the structure of the body and its diseases very interesting to learn. However, over the years, I observed many of my students struggle with the written material to be learned. My colleagues said the same thing—they sensed frustration in many learners. More and more frequently, I found myself thinking that a comprehensive book with extensive illustrations and very simple writing would be very useful. That's what led me to write *Illustrated Guide to Medical Terminology*. I wanted to make it easy and enjoyable for every student to learn anatomy, physiology, medical terminology, and pathology.

The theme of this book is “Read, Look, and Listen so you can Speak and Write.” This means that you first read the text and then look at diagrams corresponding to what you have read. Often you are asked to write the names of parts on the diagrams. Then, you complete the review exercises and listen to terms from the chapter pronounced (the audio pronunciations can be found on the Student Companion Website). You are asked to say the terms and then write them down. This process of reading the text, looking at the diagrams, writing in the structure names, completing the review exercises, listening to and repeating the correct pronunciation of terms, and finally writing the terms down on paper is the best way to learn. *Illustrated Guide to Medical Terminology, 2e* is ideal for visual and auditory learners, as well as learners whose first language is not English. I hope it serves you well.

## Text Organization

*Illustrated Guide to Medical Terminology, 2e* is organized based on the body-system approach. After more than 30 years of teaching, I feel confident that this is the most effective and learner-friendly way to teach terminology.

Chapter 1 outlines the proper way to analyze terms. Chapter 2 presents basic body organization and introduces the common anatomical roots. Chapter 3 introduces suffixes, and Chapter 4 presents prefixes. Chapter 5 explains how the body is organized. The remaining 14 chapters are each devoted to a single body system.

## Chapter Organization

Each chapter begins with a very brief chapter outline in point form. This is followed by the learning objectives for the chapter, also in point form, and a brief introduction. In the body system chapters, an illustration of the body system to be studied immediately follows the introduction. The purpose is to provide a broad overview of the body system before details are presented. Each chapter has diagrams illustrating body structure, function, and disease. The text associated with the diagrams is as simple as possible. Regular review is accomplished by the use of sidebars that contain brief summaries. Memory devices designed to enhance learning are also included.

Vocabulary building is presented throughout each chapter. Near the end of each chapter is a list of common system-specific terms and their pronunciation. This list, used together with the accompanying audio files, accomplishes the objective of having the learner listen to the correct pronunciation in order to speak and write the medical terms correctly. Quizzes with answers included throughout each chapter allow learners to test themselves on the content presented before moving on to new content in the chapter.

## Features Designed to Enhance Learning

This is the most comprehensive of the short-course medical terminology books on the market. The writing is simple and straightforward, even though the content is quite challenging. Despite the brevity of the textual material, each chapter tells a story so that the learner can chunk the information, which allows for ease of learning.

Be sure to read the **How to Use This Book** section on page XXV for detailed descriptions and images of the many features specifically developed to enhance your learning of medical terminology.

## New to This Edition

### Chapter 1

- Significantly rewritten

### Chapter 2

- Minor changes

### Chapter 3

- New terms added to Learning the Terms

### Chapter 4

- New terms added to Learning the Terms

### Chapter 5

- Content on body planes rewritten

## Chapter 6

- Additional topics added: subcutaneous tissue, accessory structures
- New terms added to Learning the Terms
- Pathology added: bruises, lesions, skin infections
- New images: cutaneous lesions

## Chapter 7

- New terms added to Learning the Terms
- Pathology added: abnormal curvatures, fractures
- Added table of bones, common names, and adjectives
- New images skull, abnormal spinal curvatures, and fractures

## Chapter 8

- New terms added to Learning the Terms
- Pathology added: carpal tunnel syndrome

## Chapter 9

- Additional topics added: synapse, protective coverings
- New terms added to Learning the Terms
- Pathology added: amyotrophic lateral sclerosis, levels of consciousness, poliomyelitis, sciatica, types of seizures
- New images: protective coverings

## Chapter 10

- Additional topics added: accessory structures
- New terms added to Learning the Terms
- Pathology added: otitis media, otosclerosis
- New images: flow of aqueous humor, accessory structures, extraocular muscles, normal versus abnormal vision

## Chapter 11

- Additional topics added: teeth, salivary glands
- New terms added to Learning the Terms
- Pathology added: cleft palate, cleft lip, cirrhosis of liver, diverticulosis hemorrhoids, hiatal hernia intestinal obstruction
- New images: structures of the tooth, salivary glands, stomach, hiatal hernia, intestinal obstruction, diverticulosis

## Chapter 12

- Additional topics added: Major arteries and veins
- New terms added to Learning the Terms

- Pathology added: arrhythmia, types of strokes, congestive heart failure, murmur, valvular disorders
- New images: electrocardiography, common arteries, common veins, cardiac catheterization, angioplasty, coronary artery bypass surgery

#### Chapter 13

- New terms added to Learning the Terms

#### Chapter 14

- No changes

#### Chapter 15

- New terms added to Learning the Terms
- Pathology added: allergic rhinitis, cystic fibrosis, deviated nasal septum, epistaxis, pneumoconiosis, tuberculosis

#### Chapter 16

- New terms added to Learning the Terms
- Pathology added: nephrotic syndrome
- New images: vesicovaginal fistula, extracorporeal shockwave lithotripsy

#### Chapter 17

- New terms added to Learning the Terms

#### Chapter 18

- Additional topics added: obstetrics
- New terms added to Learning the Terms
- Pathology added: breast cancer revised, cervical cancer, abortion, abruptio placenta, infertility, placenta previa, pre-eclampsia, premature infant, stillbirth, uterine inertia

#### Chapter 19

- Additional topics added: thymus
- New terms added to Learning the Terms
- Pathology revised

## Resources to Accompany This Book

### Student Companion Website

The Student Companion Website contains the following resources to aid you with study and learning the medical terminology in your course:

- Audio files for pronunciation of terms
- PowerPoint presentations
- Animations and videos to help further comprehension of content areas

To set up your Student Companion account:

- Log into <https://login.cengage.com>
- Click on **New Student User** and follow the instructions for completing your account setup.
- If you already have a student account, simply login and add the book to your bookshelf.

### Instructor Companion Website

The Instructor Companion Website contains the following resources to aid you in planning your course and implementing class activities:

- Syllabus
- Instructor Manual
- Handouts
- PowerPoint presentations
- Animations and videos
- Answer key to review questions in the text
- Testbank powered by Cognnero

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- If you are unable to find your Institution, complete an **Account Request Form**.

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- Select the book and click **Continue**.
- You will receive a list of available resources for the title you selected.
- Choose the resources you would like and click **Add to My Bookshelf**.



## ABOUT THE AUTHOR

Juanita Davies has taught anatomy and medical terminology for over 30 years. She has also written extensively on the subject of medical terminology. Her early work includes *A Programmed Learning Approach to Medical Terminology* and a computerized testbank containing 15,000 questions. Her first book with Delmar, *Modern Medical Language*, is a combination of anatomy, medical terminology, pathology, signs and symptoms, diagnostic procedures, and treatment. Her second book, *Essentials of Medical Terminology*, combines anatomy with medical terminology. Her third book, *A Quick Reference to Medical Terminology*, is a basic handbook on medical terminology.



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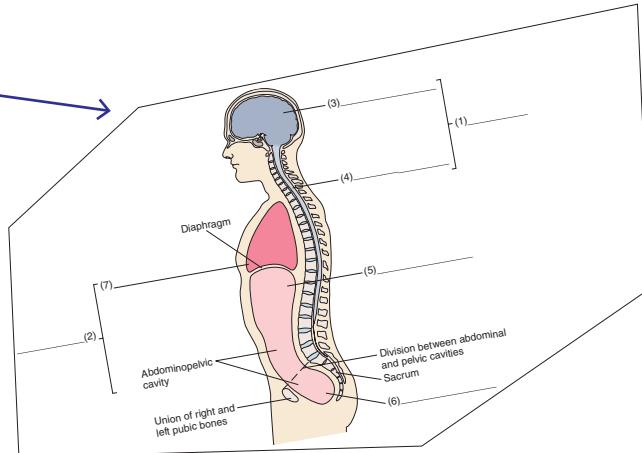
# HOW TO USE THIS BOOK

## Learner-Friendly Approach

The approach is simple—“Read, Look, and Listen in order to Speak and Write.” This means that you first read the text and then look at diagrams corresponding to the text. You are often asked to write the names of parts on the diagrams. At the end of each chapter, complete the review exercises. Go to the Student Companion Website and listen to terms from the chapter pronounced. Say the terms aloud and then write them down. This process of reading the text, looking at the diagrams, writing in the structure names, completing the review exercises, listening to and repeating the correct pronunciation of terms, and finally writing the terms down on paper maximizes your learning experience.

## Full-Color Illustrations

An illustration of the body system to be studied immediately follows the chapter introduction to provide a broad overview of the system before learning the details. Writing labels on the diagrams helps reinforce learning. Numerous diagrams illustrate body structure, function, and disease with the associated content presented as simply as possible.



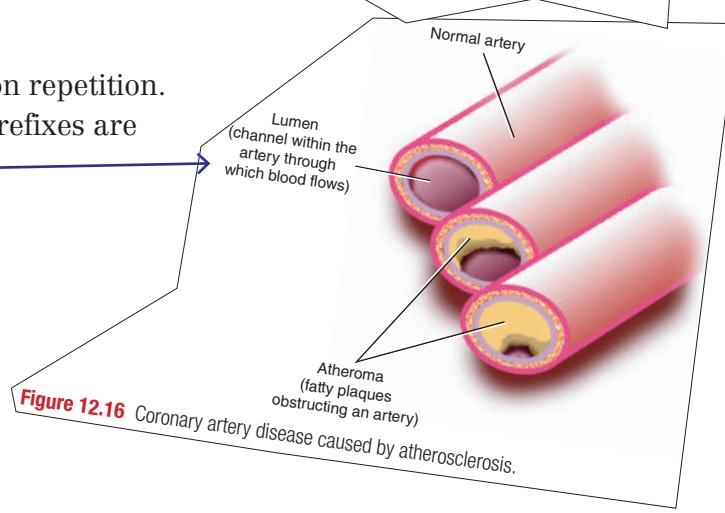
## Pronunciations

Pronunciations are presented phonetically beside every new term and are repeated throughout the chapter.

Term	ROOT ather/o	Term Analysis	MEANING fatty debris
atheroma (ath-er-OH-mah)		-oma = mass; tumor	name given to the fatty mass (plaque) that accumulates on the wall of an artery. The fatty mass contains cholesterol.
atherosclerosis (ath-er-oh-skleh-ROH-sis)		-sclerosis = hardening	hardening and narrowing of an artery due to an atheroma (Figure 12-16)

## Learning the Terms

Learning medical language is based on repetition. In each chapter, roots, suffixes, and prefixes are often repeated to reinforce learning. After each word element is introduced, it is followed by several examples of terms using that word element. This helps you remember the terms because you learn them in clusters using the same word element.



### Dorsal Cavity

The dorsal cavity is subdivided into two parts: the cranial cavity and vertebral cavity. The cranial cavity is inside the skull. The brain is contained in the cranial cavity. The vertebral cavity is inside the vertebral column, or spine. The spinal cord (a group of nerves) is contained in the vertebral cavity.

### Ventral Cavity

The ventral cavity contains many internal organs including the heart, lungs, kidneys, digestive organs, and others. These internal organs are also called **viscera** (VIS-er-ah). A large muscle called the **diaphragm** (DYE-ah-fram) divides the ventral cavity into upper and lower cavities. The upper cavity is called the thoracic cavity. The lower cavity is the **abdominopelvic** (ab-dom-ih-noh-PEL-vick) cavity.

The thoracic cavity contains the heart and lungs. The abdominopelvic cavity is divided into two smaller cavities: the abdominal cavity and the pelvic cavity. The abdominal cavity is above the pelvic cavity. It contains organs such as the liver, intestines, stomach, and kidneys. The pelvic cavity contains some reproductive organs, the urinary bladder, and parts of the intestine.

#### In Brief

The **dorsal cavity** is subdivided into the cranial and vertebral cavities. The **ventral cavity** is subdivided into the thoracic and abdominopelvic cavities.

### In Brief

Regular review of what you have learned is accomplished through the use of sidebars that contain brief definitions of terms found on the same page.

**PRACTICE FOR LEARNING: Directional Terms**

1. Write the opposite meaning of the following directional terms. The first one is done for you.
- a. anterior posterior
  - b. lateral \_\_\_\_\_
  - c. proximal \_\_\_\_\_
  - d. deep \_\_\_\_\_
  - e. prone \_\_\_\_\_
  - f. dorsum \_\_\_\_\_
2. Choose the correct answer from the choices in parentheses.
- g. The neck is (inferior/superior) to the chin.
  - h. Your mouth is (medial/lateral) to your ear.
  - i. You have stepped on a sharp object. The bottom of your foot starts to bleed. You have cut the (plantar/dorsum) area of your foot.

**Practice for Learning**

Brief reviews ensure that you have mastered the content presented and are ready to move on to the next section of material.

**Helping You Remember**

Suggestions are provided to help you remember a difficult term or concept presented in the chapter.

**Directional Terms**

As stated above, we need directional terms to describe the position of body parts, particularly in relation to each other. Directional terms are also useful in communicating the location of diseases when they appear in the body. All of the directional terms are listed in Table 5-1. To help you remember them, they are grouped in opposite pairs. For example, the terms "superior" and "inferior" are grouped because they are opposites: superior means "above," and inferior means "below." Figures 5-2 A-F illustrate the use of the terms.

**Helping You Remember**

To remember the meaning of supine, notice that supine has "up" as part of the word.

**6.6 Look-Alike and Sound-Alike Words**

Below is a list of look-alike and sound-alike words. Study the definitions of each set of words. Questions will follow in the Review Exercises.

**TABLE 6-1 Look-Alike and Sound-Alike Words**

ablation	treatment that involves the excision of body tissue or the destruction of its function through surgery, hormones, drugs, heat, chemicals, or electricity
abrasion	an injury caused by scraping
glands	organs that secrete chemicals
glans	the tip of the penis (glans penis)
patience	showing self-control
patients	persons under medical care
vesical	pertaining to the bladder
vesicle	blister
plantar	the sole of the foot
planter	container for a plant
cirrhosis	any chronic disease of the liver
psoriasis	skin condition characterized by silvery scales
Mohs	surgery for melanoma
mow	to mow (cut) the lawn with a lawnmower
wheel	a raised, circular area of skin, usually pale in the center, and surrounded by redness
wheel	round object that turns, such as the wheel on a bicycle

## Review Exercises

Numerous review exercises at the end of each chapter reinforce learning. **Look-Alike and Sound-Alike Words** lists medical terms and other words that are similar in spelling and sound. Reinforce your understanding of the correct spelling by completing the exercises that follow. **Medical Terms in Context** provides practice learning terms through mock sample medical reports.

**EXERCISE 8-6 Definitions in Context**

Define the bolded terms in context in the space below. Use your dictionary if necessary.

**Discharge Summary**

**HISTORY OF PRESENT ILLNESS:** The patient is a seven-year-old boy who showed signs of muscular weakness at age three to four years. The diagnosis of **muscular dystrophy** was made when a muscle **biopsy** confirmed **degeneration** of muscle fibers. He is still walking and was started on drug **therapy** four months ago.

**PHYSICAL EXAMINATION:** On examination, the patient is a pleasant young fellow. He has **proximal** muscle weakness. He has **hypertrophy** and some shortening of the **Achilles tendon**. General physical examination is within normal limits.

**COURSE IN HOSPITAL:** While in the hospital, an **intravenous** line was started, and blood samples were taken for tests during a 24-hour period. The course in hospital was eventful.

```

graph TD
    A[possible Diagnoses] --> B[Dystrophy]
    C[ ] --> B
    D[ ] --> B
    E[ ] --> B
    F[ ] --> B
    G[ ] --> B
    H[ ] --> B
    I[ ] --> B
    J[ ] --> B
    K[ ] --> B
    L[ ] --> B
    M[ ] --> B
    N[ ] --> B
    O[ ] --> B
    P[ ] --> B
    Q[ ] --> B
    R[ ] --> B
    S[ ] --> B
    T[ ] --> B
    U[ ] --> B
    V[ ] --> B
    W[ ] --> B
    X[ ] --> B
    Y[ ] --> B
    Z[ ] --> B
  
```

**Pronunciation and Spelling Exercises** in each chapter helps you learn the common system-specific terms and their pronunciation.

**5.9 Pronunciation and Spelling**

- Listen to each word on the audio file provided on the Student Companion Website.
- Pronounce each word carefully.
- Spell each word in the space provided.

Word	Pronunciation	Spelling
epigastric	ep-ih-GAS-trick	
hypogastric	high-poh-GAS-trick	
iliac	ILL-ee-ack	
abdominal	ab-DOM-ih-nal	
cranial	KRAY-nee-al	
dorsal	DOR-sal	
caudal	KAUD-al	

## CHAPTER 1

# Basic Word Structure



### Chapter Outline

*This chapter will help you learn the basics of medical word structure. It is divided into the following sections:*

- 1.1** Analysis of Medical Word Parts
- 1.2** Basic Word Structure
- 1.3** New Roots, Suffixes, and Prefixes
- 1.4** Review Exercises

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

- 1.** Define a root, suffix, and prefix.
- 2.** Distinguish between roots, suffixes, and prefixes in a medical word.
- 3.** Learn the basic rules of medical word structure.
- 4.** Write the meaning of the roots, suffixes, and prefixes found in this chapter.
- 5.** Build medical words.
- 6.** Define medical words.

### Introduction

Medical words are made of parts. You need to learn what the parts are and what they mean in order to easily learn medical words. This chapter will teach you how to do that.

## 1.1 Analysis of Medical Word Parts

Medical words are made up of the following word parts: roots, suffixes, and prefixes. Not all medical words have all three parts, but we will start by looking at an example that does. The word is **perineuritis** (**p**er-ih-nyoo-**R**YE-tis). It means inflammation around a nerve. When you break the word into its word parts you will have the following:

- peri-
- neur
- -itis

The first part, **peri-**, is the prefix. Whenever a prefix stands alone in this text, it is followed by a hyphen, as can be seen in the above example. Common prefixes are studied in Chapter 4.

The root in this example is **neur**. A root is usually (but not always) a body part. An introduction to roots is in Chapter 2.

The last part of the example is the suffix, **-itis**. Whenever a suffix stands alone in this text it is preceded by a hyphen. You will learn the suffixes in Chapter 3.

Once you learn roots, suffixes, and prefixes you will be able to define words you have not seen before by simply analyzing the word using the method described in the next section.

## How to Define Medical Words

This is the way to define medical words:

**1. Identify** the suffix first, then the prefix (if there is one), and then the root.

Remember that most words have only two parts, so do not think you will find all three all the time. A few words only have one part.

**2. Define** the medical word by starting at the suffix. Find out what it means. Then go to the beginning of the word. It will be either a prefix or a root. Find out what it means. If there is another part, it will be a root. Once you have all the meanings, put them together.

### In Brief

#### Word Parts

- root
- suffix
- prefix

#### Defining Words

Define the suffix first.

Then define the first part of the word, then the second part (if there is one).

## PRACTICE FOR LEARNING: Analysis of Medical Word Parts

Identify and write the part of **perineuritis** indicated below. The answers are provided, but try to do the exercise first without looking at them.

1. Suffix \_\_\_\_\_ (means **inflammation**)
2. Prefix \_\_\_\_\_ (means **around**)
3. Root \_\_\_\_\_ (means **nerve**)
4. Now write the meaning of **perineuritis** \_\_\_\_\_

Answers: 1. -itis. 2. peri-. 3. neur. 4. inflammation around the nerve.

## 1.2 Basic Word Structure

### Roots

A root is the main part of a medical word. It often refers to a body part. Examples used in this chapter are:

- **aden** means **gland**
- **arthr** means **joint**
- **col** means **colon**
- **hemat** means **blood**
- **neur** means **nerve**
- **oste** means **bone**

### Combining Vowel

Previously, you learned the word **perineuritis**. In that example, the suffix **-itis** joined the root **neur** quite easily. Sometimes roots and suffixes do not go together as well. For example, if the root **hemat** was combined with the suffix **-logy**, the word would be spelled **hematology**. Try pronouncing this word. You will find it difficult. To make this word easier to pronounce, the letter “o” is added to the end of the root to make the word **hematology** (hee-mah-TOL-eh-jee). The “o” is called a **combining vowel**. As you can see, with the combining vowel added, the word is much easier to pronounce.

The combining vowel is usually “o.” It can be used to connect a root to a suffix (as in the above example) or to join two roots. When connecting a root to a suffix, the combining vowel is used only when the suffix starts with a consonant, such as in the word “hematology” above. If the suffix starts with a vowel (a, e, i, o, u) the combining vowel is **not** needed. For example, in the word **arthritis** (ar-THRIGH-tis), we do not add the combining vowel to *arthr* because the suffix *-itis* starts with a vowel.

As stated above, the combining vowel can also be used to joint two roots. For example, in the word “oste~~o~~arthritis,” the combining vowel joins the roots *oste* and *arthr*.

### Example

**osteoa**rthritis (inflammation of bone and joint)

(os-tee-oh-ar-THRIGH-tis)

<b>oste</b>	+	<b>/o</b>	+	<b>arthr</b>	+	<b>-itis</b>
↑		↑		↑		↑
root = bone		combining vowel		root = joint		suffix = inflammation

### In Brief

#### Vowels

a, e, i, o, u

#### Consonants

letters that are not vowels

#### Combining vowel

usually “o”

#### Used when

- Combining two roots
- Combining a root with a suffix beginning with a consonant

### PRACTICE FOR LEARNING: Roots and Combining Vowels

1. Define a root
2. Define a combining vowel.
3. In the word **hematology**,
  - a. \_\_\_\_\_ is the root.
  - b. \_\_\_\_\_ is the combining vowel.
  - c. \_\_\_\_\_ is the suffix.
4. A combining vowel is used when the suffix starts with a \_\_\_\_\_
5. A combining vowel is **not** used when the suffix starts with a \_\_\_\_\_

Answers: 1. The root is the main part of a medical word. It is often a body part.  
 2. A combining vowel is a single letter, usually “o,” added onto the end of the root.  
 3. (a) hemat = root, (b) “o” = combining vowel, (c) -logy = suffix. 4. consonant. 5. vowel.

## Combining Forms

You have already learned what a combining vowel is. The **combining form** is the name given to a root that is followed by a combining vowel. For example, the root *arthr*, written in its combining form, is:

arthr/o

The root is separated from the combining vowel by a slash (/). This is the standard way to write a combining form. It means that the combining vowel might be used in building medical words. Where the combining vowel is not needed for pronunciation, it is not used. In medical language, the root standing alone is almost always written in the combining form. So you should expect to see a root like **aden** written as **aden/o** almost all of the time.

### In Brief

#### Combining form

root + combining vowel

#### Example

hemat/o

### PRACTICE FOR LEARNING: Combining Forms

1. Define a combining form. Give an example.

---

---

2. What is the difference between the combining vowel and the combining form?

---

---

---

---

Answers: 1. A combining form is the name given to a root that is followed by a combining vowel. Example: arthr/o is one example of many. 2. A combining vowel is a single letter, usually “o,” added onto the end of a root. A combining form is the name given to a root plus combining vowel.

## Suffixes

A suffix is the last part of a word. It can be attached to a root or a prefix. Whenever a suffix stands alone in this book, a hyphen comes before it.

## When the Suffix Starts with a Vowel, the Combining Vowel Is Dropped

### Example

**arthralgia** (joint pain)

(ar-**THRAL**-jee-ah)

<b>arthr</b>	+	<b>-algia</b>
↑		↑
root = joint		suffix = pain

## When the Suffix Starts with a Consonant, the Combining Vowel Is Not Dropped

### Example

**colostomy** (new opening in the colon)

(koh-**LOSS**-toh-mee)

<b>col</b>	+	<b>/o</b>	+	<b>-stomy</b>
↑		↑		↑
root = colon	+	combining vowel	+	suffix = new opening

## Prefixes

A prefix is the first part of a medical word. It can be attached to the beginning of the root or sometimes a suffix. Whenever a prefix stands alone in this book, it is followed by a hyphen.

### Prefix Joining with a Root

#### Example

**polyadenoma** (tumor of many glands)

(pahl-ee-ah-deh-**NOH**-mah)

<b>poly-</b>	+	<b>aden</b>	+	<b>-oma</b>
↑		↑		↑
prefix = many		root = gland		suffix = tumor; mass

### Prefix Joining with a Suffix

#### Example

**dysphasia** (difficulty speaking)

(dis-**FAY**-zhee-ah)

<b>dys-</b>	+	<b>-phasia</b>
↑		↑
prefix = difficulty		suffix = speech

**PRACTICE FOR LEARNING: Suffixes and Prefixes**

**1.** Underline the suffix in the following words:

- a. adenoma
- b. hematology
- c. osteoarthritis
- d. dysphasia

**2.** Underline the prefix in the following words:

- a. dysphasia
- b. polyadenoma

Answers: 1. (a) -oma, (b) -logy, (c) -itis, (d) -phasia. 2. (a) dys-, (b) poly-.

### 1.3 New Roots, Suffixes, and Prefixes

Use the following suggestions for learning word parts (roots, suffixes, and prefixes):

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.

**Helping You Remember**

Many students find that using memory tricks helps them remember. That works with medical terminology too. It can really help if you learn to mentally connect a word or word part with a feeling or a mental picture, especially if it is something that has personal meaning to you. For example, the first suffix below, *-algia*, means “pain.” The best way to remember that suffix is to think of a particular pain you have experienced every time you see the suffix. So if someone who has broken a leg thinks of that every time she sees *-algia*, she will never forget it. Use memory tricks whenever you can.

ROOTS	MEANING
aden/o	gland
arthr/o	joint
hemat/o	blood
col/o	colon
neur/o	nerve
oste/o	bone

SUFFIX	MEANING
-algia; -dynia	pain
-itis	inflammation
-logy	study of
-oma	tumor; mass
-phasia	speech

PREFIX	MEANING
dys-	difficult; pain; bad
peri-	around
poly-	many

## 1.4 Review Exercises

### EXERCISE 1-1 Vocabulary

Build the medical word by filling in the blank with the correct word part or parts.

Example: adenitis

inflammation of a gland

1. \_\_\_\_\_ itis

inflammation of a joint

2. \_\_\_\_\_ logy

study of blood

3. aden \_\_\_\_\_

tumor of a gland

4. \_\_\_\_\_ oma

tumor of bone

5. \_\_\_\_\_ oma

tumor of many glands

- |                     |                                  |
|---------------------|----------------------------------|
| 6. _____ itis       | inflammation of bones and joints |
| 7. col _____        | new opening in the colon         |
| 8. _____ neur _____ | inflammation around a nerve      |
| 9. _____ phasia     | difficult speech                 |
| 10. arthr _____     | joint pain                       |

### EXERCISE 1-2 Definitions

Define the following words:

**1. arthritis**

---

**2. adenoma**

---

**3. polyadenoma**

---

**4. osteoarthritis**

---

**5. hematology**

---

### EXERCISE 1-3 Word Parts

Fill in the blanks with the correct word.

1. The three main parts of a medical word are the \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
2. The word part usually found at the end of a medical word is the \_\_\_\_\_.
3. When you define a medical word, you usually start at the \_\_\_\_\_, and then define the \_\_\_\_\_.
4. The combining form in “hematology” is \_\_\_\_\_.
5. The difference between the combining form and combining vowel is \_\_\_\_\_.

**EXERCISE 1-4 Word Parts**

*Circle True if the statement is true. Circle False if the statement is false.*

- |   |               |
|---|---------------|
| 1. The word “adenoma” has no suffix.  | True    False |
| 2. In the word “hematology,” the combining form is used because the suffix starts with a consonant. | True    False |
| 3. Usually, a combining vowel is not used between two roots.  | True    False |
| 4. The prefix <i>poly-</i> means “many.”  | True    False |

**EXERCISE 1-5 Definitions (Medical to English)**

*Give the meaning of the following word parts:*

**1. hemat/o**

---

**2. arthr/o**

---

**3. aden/o**

---

**4. oste/o**

---

**5. -logy**

---

**6. -itis**

---

**7. -oma**

---

**8. -phasia**

---

**9. dys-**

---

**10. poly-**

**EXERCISE 1-6 Definitions (English to Medical)**

I. Write the root for the following:

**1. bone**

---

**2. joint**

---

**3. blood**

---

**4. gland**

---

II. Write the suffix for the following:

**1. inflammation**

---

**2. speech**

---

**3. study of**

---

**4. tumor**

---

III. Write the prefix for the following:

**1. difficult**

---

**2. many**

---



## CHAPTER 2

# Basic Body Structure



### Chapter Outline

*This chapter will help you understand how the body is organized. Basic anatomical roots are also learned. It is divided into the following sections:*

- 2.1** Anatomy and Physiology
- 2.2** Levels of Organization
- 2.3** Body Systems
- 2.4** Common Anatomical Roots
- 2.5** Review Exercises

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

- 1.** Define anatomy and physiology.
- 2.** Describe how the body is organized.
- 3.** Define cells, tissues, organs, and systems.
- 4.** Name 12 body systems and the common organs found in each system.
- 5.** Define roots pertaining to the body systems.

### Introduction

This chapter starts by introducing you to some basic concepts related to the study of the human body. It will prepare you to learn the roots you need to know for this and the following chapters on suffixes and prefixes.

The roots in this chapter are grouped according to body systems. You will find it much easier to remember each root if you associate it with a mental picture of the organ it refers to. The roots you encounter in this chapter will give you a foundation for building medical terms. Note that the roots in the tables of this chapter are expressed in their combining forms, as described in Chapter 1.

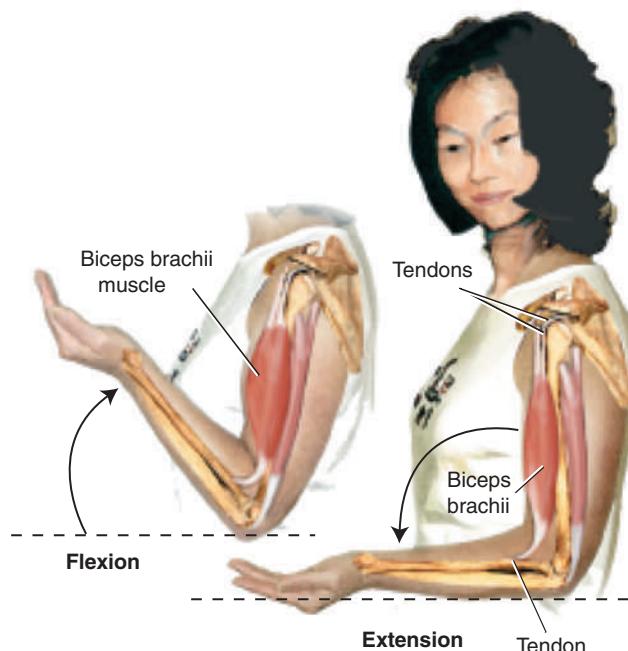
## 2.1 Anatomy and Physiology

Two terms often used in this text are **anatomy** (ah-NAT-oh-mee) and **physiology** (fiz-ee-OL-oh-jee). Anatomy is the study of the structure or parts of the body. Physiology is the study of how a body part functions. For example, the biceps brachii (**BYE**-seps **BRAY**-kee-eye) muscle is located on top of the upper arm (Figure 2-1). It is made up of cells that are long and slender. These cells are called muscle fibers. The function of the biceps brachii is to flex the lower arm by pulling on the bones of the forearm.

## 2.2 Levels of Organization

All life consists of microscopic living structures called cells. They perform various functions throughout the body. All cells are similar in structure, but not identical. Each cell has a **cell membrane**, which acts as a barrier separating the inside of the cell from its surroundings. The inside of the cell is called the **cytoplasm** (SIGH-toh-plaz-um). The cytoplasm contains small organs called organelles. These organelles carry on life's functions as mentioned below.

The central portion of the cell is the **nucleus** (NOO-klee-us). The nucleus contains DNA. Human DNA contains thousands of genes, which are responsible for transmitting hereditary characteristics such as the shape of the body and color of the hair. **Chromosomes** (KROH-moh-zohms) are structures in the nucleus that carry the DNA



**Figure 2-1** The biceps brachii muscle flexes the lower arm by pulling on the bones of the forearm. Tendons attach muscle to bone.

and likewise the genetic information of each cell. DNA analysis is used to identify individuals and to prove genetic relationships.

The body's cells carry on all of the functions of life such as:

- Taking in food and oxygen
- Producing heat and energy
- Eliminating wastes
- Responding to changes in the environment
- Reproducing

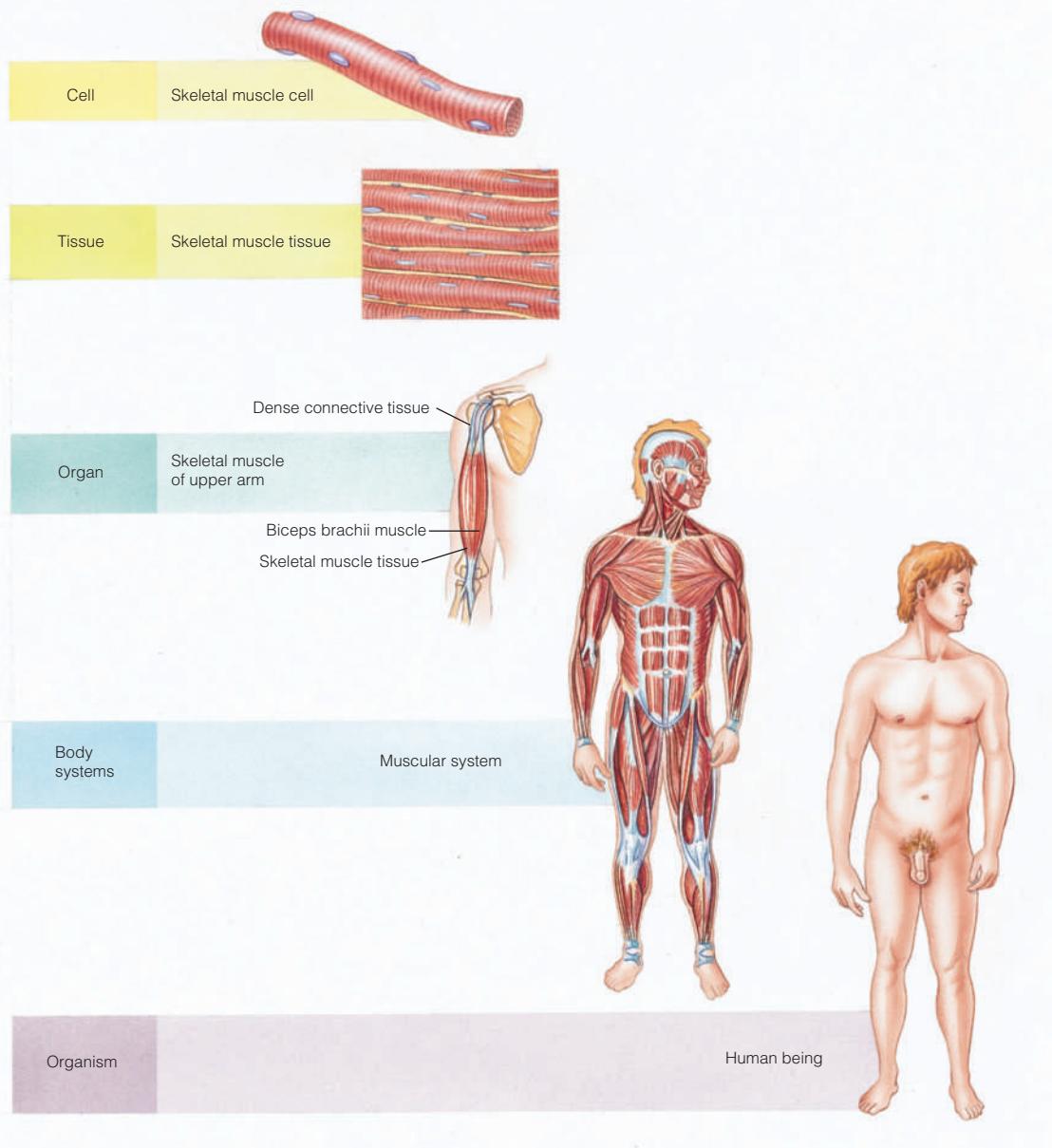
Trillions of cells make up the cellular level, which is the first level of organization of the body.

The next level is called **tissues**. Similar cells working together to perform a specific function combine to make up tissues. For example, muscle cells form muscle tissue. Nerve cells form nervous tissue. A **histologist** (hiss-TOL-oh-jist) is someone who specializes in the study of tissues. The major tissue types are:

- **Epithelial (ep-ih-THEE-lee-al) tissue:** Epithelial tissue covers external surfaces of the body, lines body structures, and forms glands. The skin is an example of an organ that is made up of epithelial tissue. Mucous membrane is also made up of epithelial tissue. It is found lining the digestive, respiratory, reproductive, and urinary tracts.
- **Connective tissue:** Connective tissue functions to support and shape the body structures and keeps them in place. Tendons and ligaments, blood, bone, cartilage, and fat are examples of connective tissue.
- **Muscle tissue:** Muscle tissue takes its name from its location in the body; for example, in the heart it is called **cardiac** muscle tissue. Within organs, such as the stomach and intestines, it is called **visceral** (VIS-er-al) muscle tissue. Muscle associated with bones is called **skeletal** muscle tissue. All muscles, no matter where their location, create movement of some kind. Muscle cells are not round, but long and slender. For this reason, muscle cells are often referred to as fibers. See Figure 2-1.
- **Nervous tissue:** This tissue makes up nerves that conduct electrical impulses throughout the body. The brain, spinal cord, and nerves are made up of nervous tissue.

The next level of organization is the **organs**. Tissues of all types combine to make up organs such as the **muscles, nerves, liver**, and **heart**.

Related organs make up body systems, such as the muscular and nervous systems. All of the body systems combine to form the human being. These levels of organization are in Figure 2-2.



**Figure 2-2** Levels of organization.

### In Brief

Cells → Tissues → Organs → Body Systems → Human Being

**PRACTICE FOR LEARNING: Anatomy and Physiology**

Choose the correct answer from the choices in parentheses.

1. The study of body structure is (anatomy/physiology).
2. The third structural level of body organization is (tissues/organs/cells/body systems).
3. Tissue that holds body structures together is (epithelial/connective).
4. Tissue covering the external surfaces of the body is (epithelial/connective).
5. A specialist in the study of tissue is a (histologist/physiologist/geneticist).
6. Muscles in the esophagus are made up of (cardiac/skeletal/visceral) muscle tissue.
7. Mucous membrane is made up of (connective/epithelial/muscle) tissue.
8. The cell nucleus contains genetic structures known as (chromosomes/cytoplasm).
9. DNA and the body's genes are found on structures called (chromosomes/cytoplasm).
10. Muscular tissue in the stomach and intestine are known as (cardiac/skeletal/visceral) tissue.

Answers: 1. anatomy. 2. organs. 3. connective. 4. epithelial. 5. histologist. 6. visceral. 7. epithelial. 8. chromosomes. 9. chromosomes. 10. visceral.

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## 2.3 Body Systems

The following body systems make up the human body: integumentary, skeletal, muscular, nervous, eyes and ears, endocrine, cardiovascular and blood, lymphatic and immune, respiratory, digestive, urinary, male reproductive, and female reproductive. These systems work together to perform all of the necessary functions of life. Figures 2-3 to 2-14 illustrate the most common features of all of these systems. A list of the common anatomical roots of each system is given for each figure.

## 2.4 Common Anatomical Roots

### Body as a Whole

ROOT	MEANING
<b>axill/o</b>	armpit
<b>bi/o</b>	life
<b>cephal/o</b>	head
<b>cervic/o</b>	neck
<b>cyt/o</b>	cell
<b>hist/o; histi/o</b>	tissue
<b>lip/o; adip/o</b>	fat
<b>path/o</b>	disease
<b>viscer/o</b>	internal organs



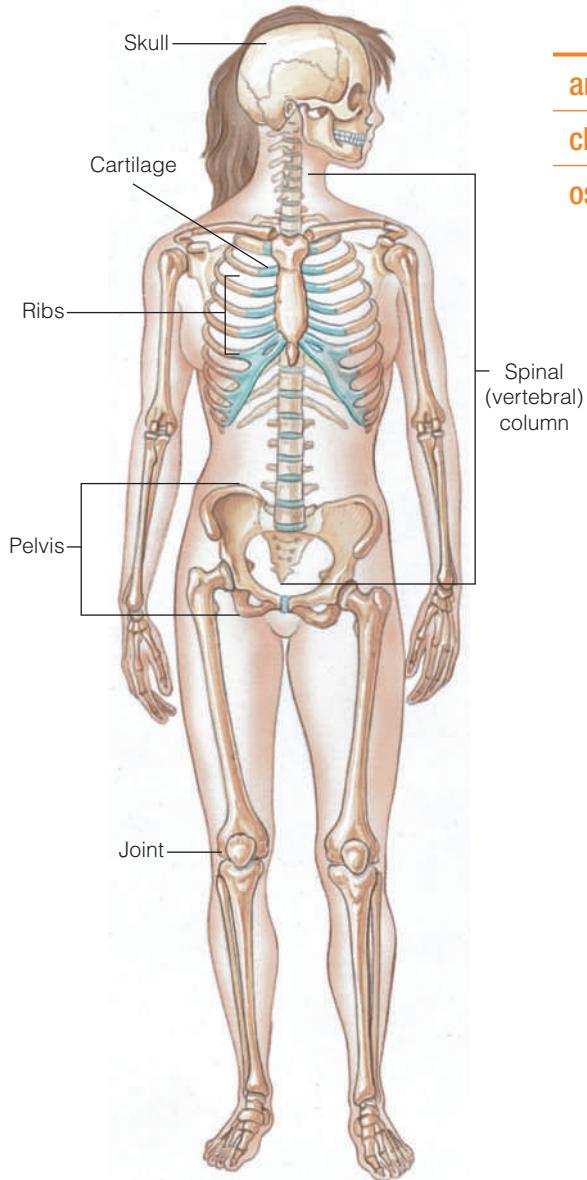
### Integumentary System

ROOT	MEANING
<b>cili/o; pil/o</b>	hair
<b>derm/o; dermat/o; cutane/o</b>	skin
<b>onych/o; ungu/o</b>	nail

**Integumentary system  
(The Skin)**

**Figure 2-3** The skin and related structures.  
Common structures: skin, hair, and nails.

## Skeletal System



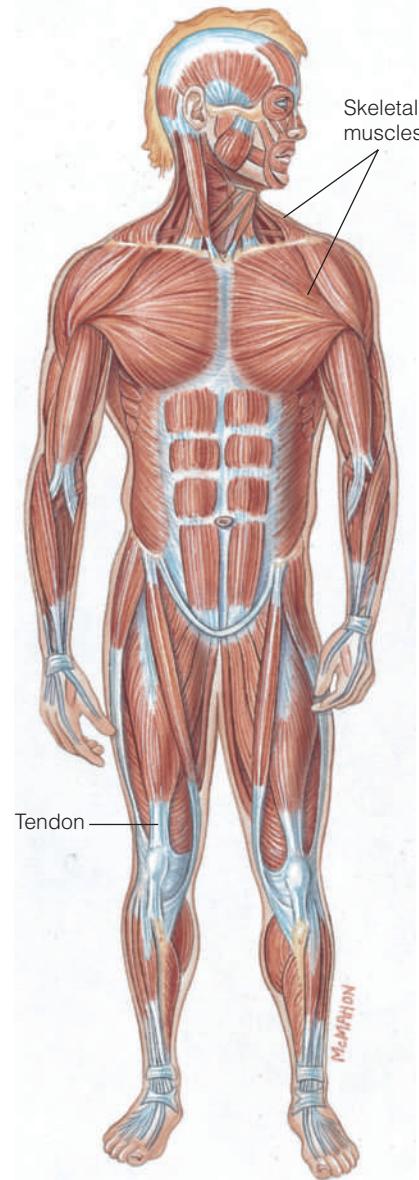
ROOT	MEANING
<b>arthr/o</b>	joint
<b>chondr/o</b>	cartilage
<b>oste/o</b>	bone

**Skeletal system**

**Figure 2-4** Skeletal system. Common structures: joints, cartilage, and bones.

## Muscular System

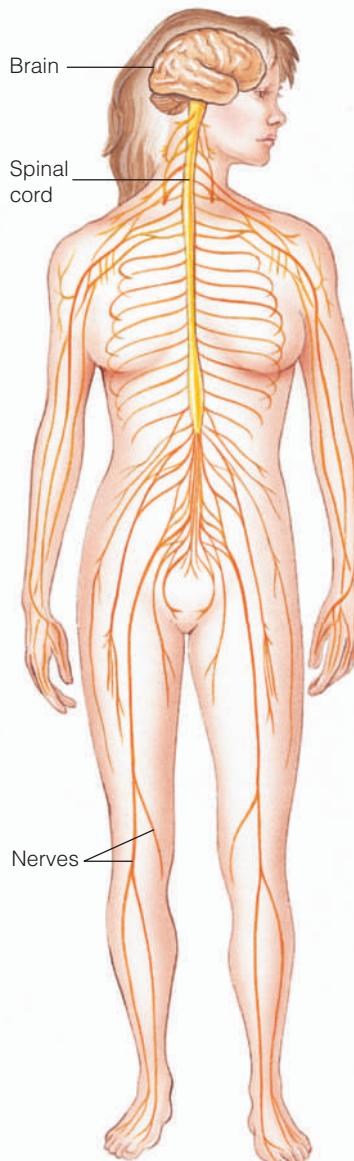
ROOT	MEANING
my/o; muscul/o	muscle
tend/o; tendin/o	tendon



**Muscular system**

**Figure 2-5** Muscular system. Common structures: muscles and tendons.

## Nervous System, Eyes, Ears



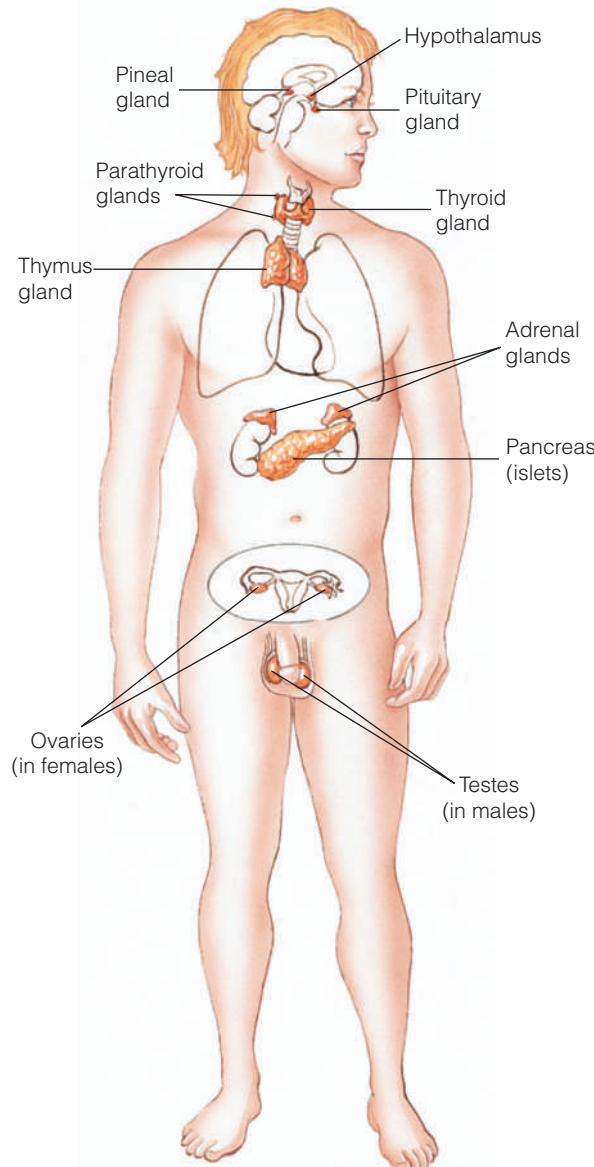
**Nervous system**

**Figure 2-6** Nervous system, eyes, and ears. Common structures: brain, spinal cord, nerves, eyes, and ears.

ROOT	MEANING
<b>blephar/o</b>	eyelid
<b>cerebr/o; encephal/o</b>	brain
<b>myel/o</b>	spinal cord (also bone marrow)
<b>neur/o</b>	nerve
<b>ophthalm/o;</b> <b>ocul/o</b>	eye
<b>ot/o</b>	ear

## Endocrine System

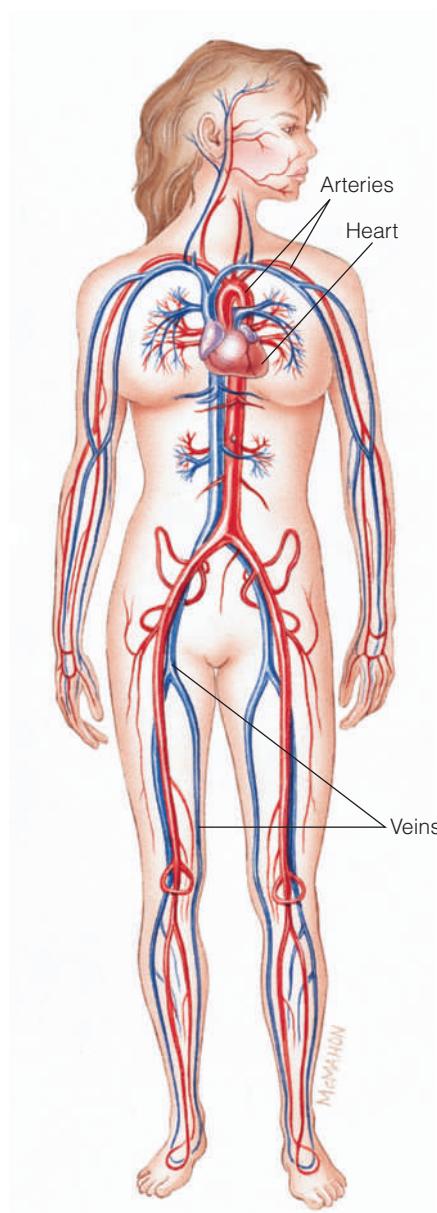
ROOT	MEANING
aden/o	gland
adren/o	adrenal gland
pituitar/o	pituitary gland
thyroid/o	thyroid gland



**Endocrine system**

**Figure 2-7** Endocrine system. Common structures: pineal gland, hypothalamus, pituitary gland, thyroid gland, thymus gland, pancreas, ovaries, testes, adrenal glands, and parathyroid glands.

## Cardiovascular System and Blood



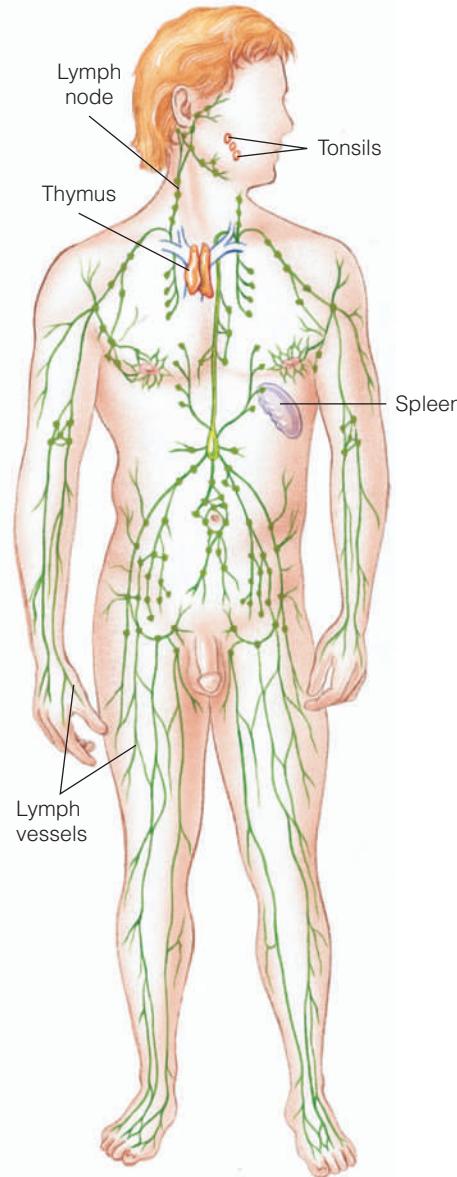
**Cardiovascular system**

**Figure 2-8** Cardiovascular system and blood.  
Common structures: heart, arteries, veins, and blood.

ROOT	MEANING
adenoid/o	adenoids
angi/o; vascul/o; vas/o	vessel
arteri/o	artery
cardi/o	heart
hem/o; hemat/o	blood
ven/o; phleb/o	vein

## Lymphatic and Immune Systems

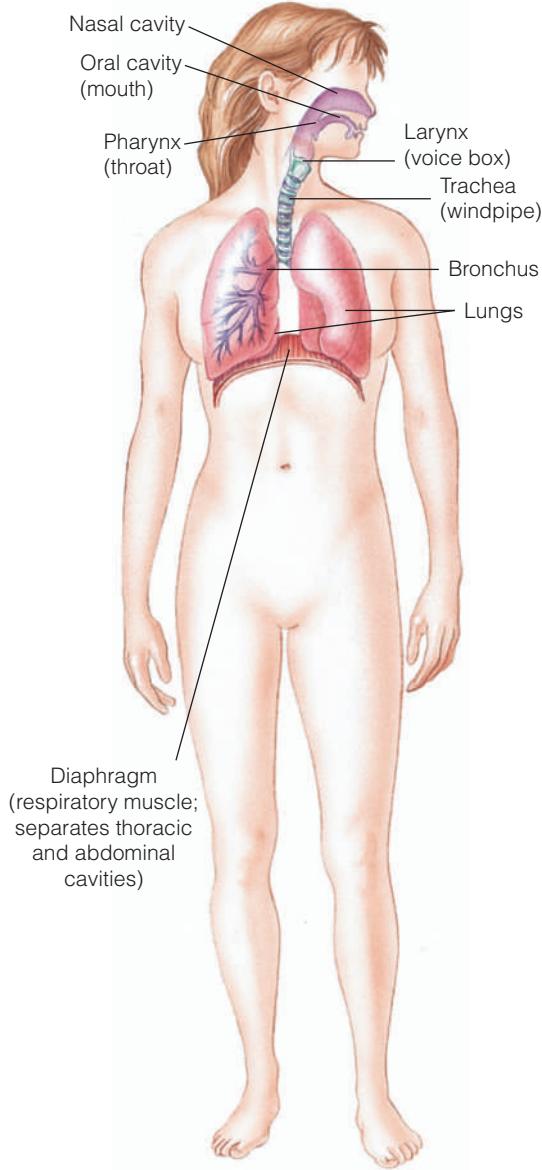
ROOT	MEANING
adenoid/o	adenoids
lymph/o	clear fluid in lymphatic vessels
lymphaden/o	lymph gland; lymph node
lymphangi/o	lymph vessel
splen/o	spleen
tonsill/o	tonsil



**Lymphatic and immune systems**

**Figure 2-9** Lymphatic and immune systems. Common structures: tonsils, lymph nodes, spleen, lymph vessels, and thymus.

## Respiratory System



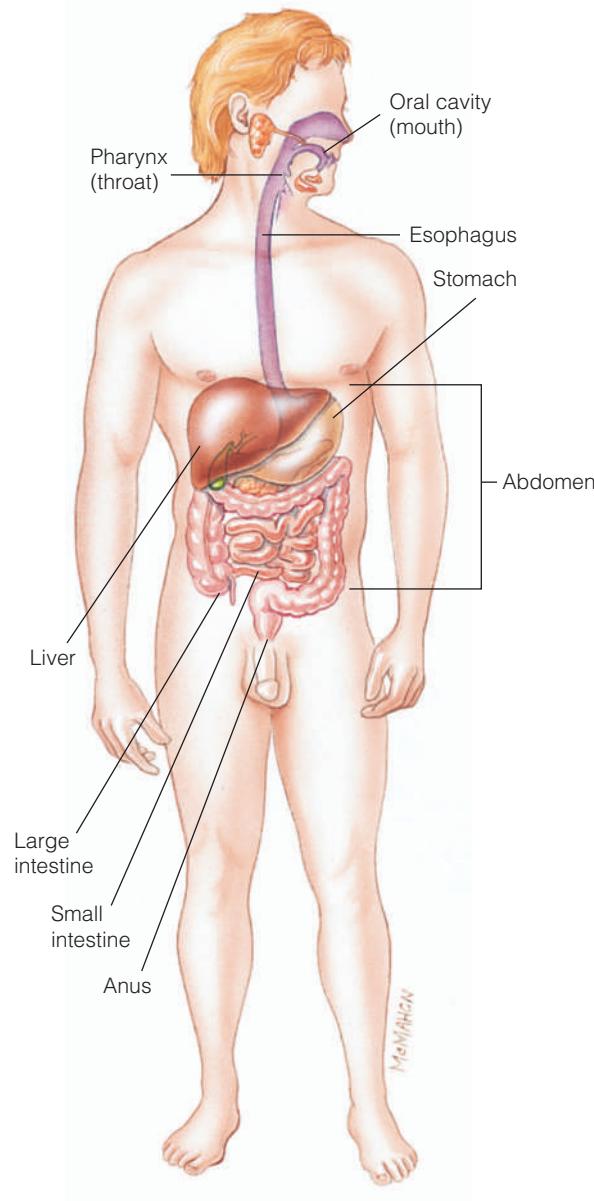
**Respiratory system**

**Figure 2-10** Respiratory system. Common structures: oral cavity, nasal cavity, pharynx, larynx, trachea, bronchus, lungs, and diaphragm.

ROOT	MEANING
<b>bronch/o</b>	bronchus
<b>laryng/o</b>	larynx; voice box
<b>naso; rhin/o</b>	nose
<b>pharyng/o</b>	pharynx; throat
<b>phren/o</b>	diaphragm
<b>pneum/o; pneumon/o; pulmon/o</b>	lung
<b>thorac/o</b>	chest
<b>trache/o</b>	trachea; windpipe

## Digestive System

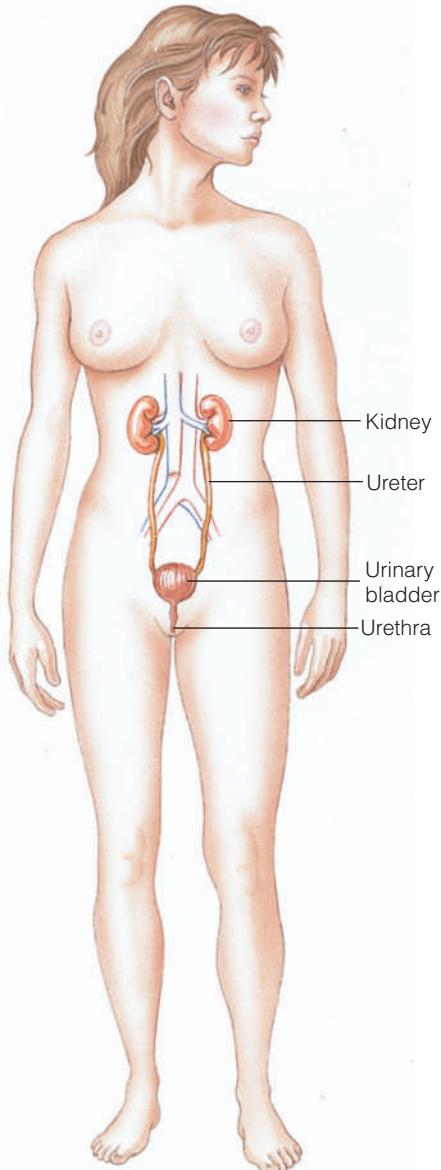
ROOT	MEANING
<b>abdomin/o</b>	abdomen
<b>an/o</b>	anus
<b>cheil/o</b>	lips
<b>col/o</b>	colon; large intestine
<b>enter/o</b>	small intestine
<b>esophag/o</b>	esophagus
<b>gastr/o</b>	stomach
<b>gloss/o; lingu/o</b>	tongue
<b>hepat/o</b>	liver
<b>or/o; stomat/o</b>	mouth
<b>pharyng/o</b>	pharynx; throat (also part of the respiratory tract)
<b>rect/o</b>	rectum



**Digestive system**

**Figure 2-11** Digestive system. Common structures: oral cavity, pharynx, esophagus, stomach, small intestine, large intestine, anus, abdomen, and liver.

## Urinary System



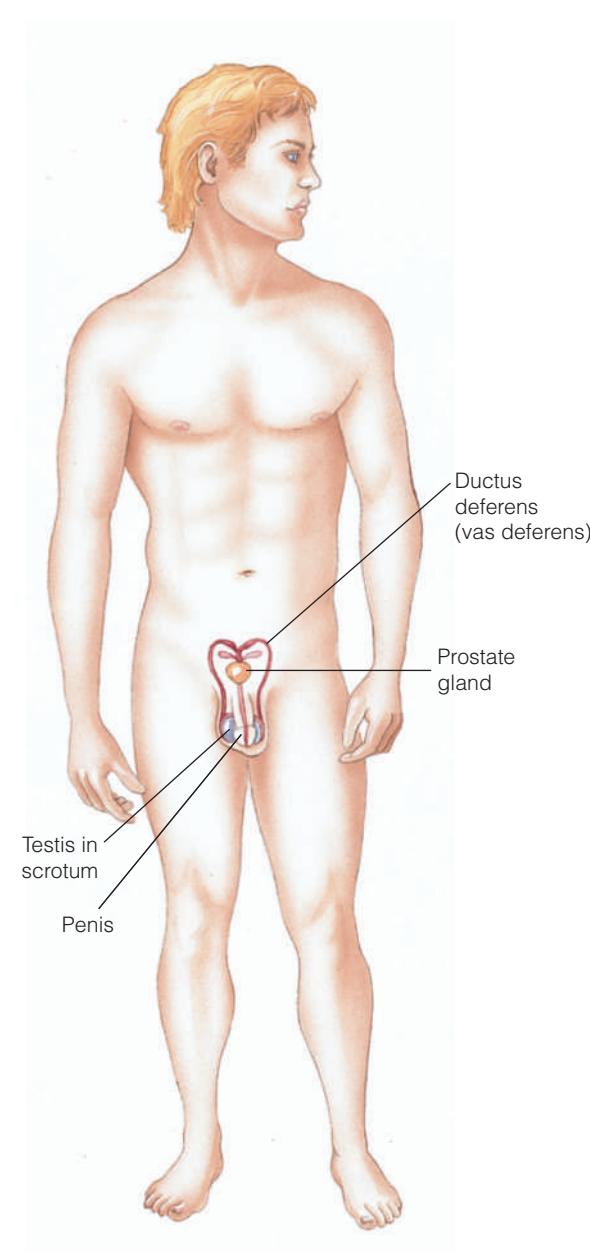
**Urinary system**

**Figure 2-12** Urinary system. Common structures: kidneys, ureters, urinary bladder, and urethra.

ROOT	MEANING
cyst/o	bladder
ren/o; nephro/o	kidney
ureter/o	ureters
urethr/o	urethra

## Male Reproductive System

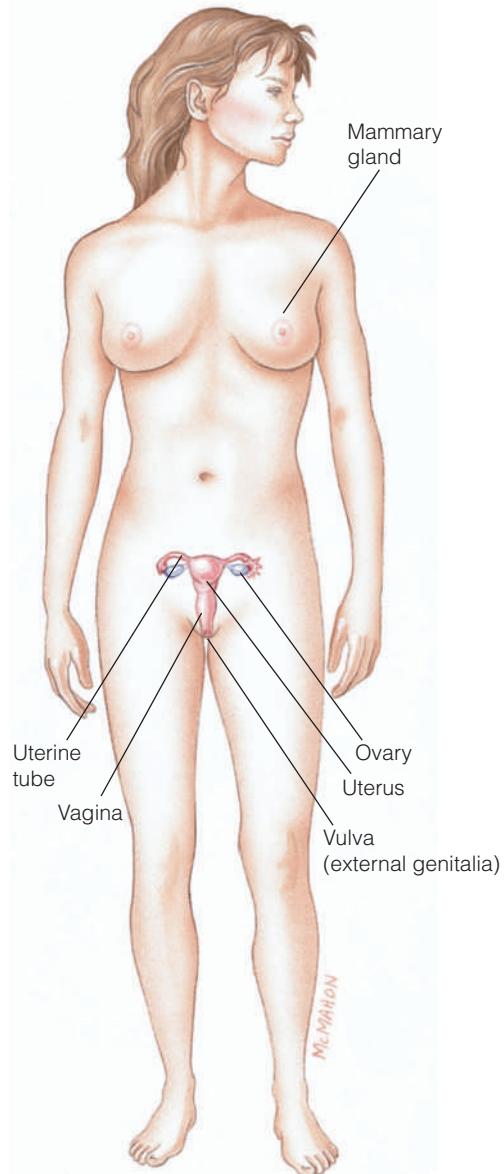
ROOT	MEANING
orchid/o; test/o	testicle; testis
prostat/o	prostate
vas/o	ductus deferens; vas deferens



**Male Reproductive system**

**Figure 2-13** Male reproductive system. Common structures: prostate gland, testes, penis, and ductus deferens.

## Female Reproductive System



**Female Reproductive system**

**Figure 2-14** Female reproductive system. Common structures: mammary gland, uterine tubes, ovaries, uterus, vagina, and vulva (external genitalia).

ROOT	MEANING
colp/o; vagin/o	vagina
gynec/o	female
mast/o; mamm/o	breast
oophor/o; ovari/o	ovary
salping/o	fallopian tube; uterine tube
uter/o; hyster/o; metr/o	uterus
vulv/o	vulva; external genitalia

## 2.5 Review Exercises

### EXERCISE 2-1 Definitions

Give the meaning of the following roots.

1. **abdomin/o** \_\_\_\_\_
2. **aden/o** \_\_\_\_\_
3. **adren/o** \_\_\_\_\_
4. **angi/o** \_\_\_\_\_
5. **arteri/o** \_\_\_\_\_
6. **arthr/o** \_\_\_\_\_
7. **bi/o** \_\_\_\_\_
8. **bronch/o** \_\_\_\_\_
9. **cardi/o** \_\_\_\_\_
10. **cephal/o** \_\_\_\_\_
11. **cerebr/o** \_\_\_\_\_
12. **cervic/o** \_\_\_\_\_
13. **chondr/o** \_\_\_\_\_
14. **cili/o** \_\_\_\_\_
15. **col/o** \_\_\_\_\_
16. **colp/o** \_\_\_\_\_
17. **cutane/o** \_\_\_\_\_
18. **cyst/o** \_\_\_\_\_
19. **cyt/o** \_\_\_\_\_
20. **dermat/o** \_\_\_\_\_
21. **encephal/o** \_\_\_\_\_
22. **enter/o** \_\_\_\_\_
23. **esophag/o** \_\_\_\_\_
24. **gastr/o** \_\_\_\_\_

25. **gloss/o** \_\_\_\_\_
26. **gynec/o** \_\_\_\_\_
27. **hem/o** \_\_\_\_\_
28. **hepat/o** \_\_\_\_\_
29. **hist/o** \_\_\_\_\_
30. **hyster/o** \_\_\_\_\_
31. **laryng/o** \_\_\_\_\_
32. **lingu/o** \_\_\_\_\_
33. **lip/o** \_\_\_\_\_
34. **lymphaden/o** \_\_\_\_\_
35. **lymphangi/o** \_\_\_\_\_
36. **mamm/o** \_\_\_\_\_
37. **mast/o** \_\_\_\_\_
38. **my/o** \_\_\_\_\_
39. **myel/o** \_\_\_\_\_
40. **nas/o** \_\_\_\_\_
41. **nephro** \_\_\_\_\_
42. **neur/o** \_\_\_\_\_
43. **ocul/o** \_\_\_\_\_
44. **onych/o** \_\_\_\_\_
45. **oophor/o** \_\_\_\_\_
46. **ophthalm/o** \_\_\_\_\_
47. **or/o** \_\_\_\_\_
48. **orchid/o** \_\_\_\_\_
49. **oste/o** \_\_\_\_\_
50. **ot/o** \_\_\_\_\_
51. **ovari/o** \_\_\_\_\_
52. **path/o** \_\_\_\_\_
53. **pharyng/o** \_\_\_\_\_

54. **phleb/o** \_\_\_\_\_
55. **pil/o** \_\_\_\_\_
56. **pneum/o** \_\_\_\_\_
57. **prostat/o** \_\_\_\_\_
58. **ren/o** \_\_\_\_\_
59. **rhin/o** \_\_\_\_\_
60. **salping/o** \_\_\_\_\_
61. **splen/o** \_\_\_\_\_
62. **stomat/o** \_\_\_\_\_
63. **tend/o** \_\_\_\_\_
64. **test/o** \_\_\_\_\_
65. **thorac/o** \_\_\_\_\_
66. **tonsill/o** \_\_\_\_\_
67. **trache/o** \_\_\_\_\_
68. **ungu/o** \_\_\_\_\_
69. **ureter/o** \_\_\_\_\_
70. **urethr/o** \_\_\_\_\_
71. **vagin/o** \_\_\_\_\_
72. **vas/o** \_\_\_\_\_
73. **vascul/o** \_\_\_\_\_
74. **ven/o** \_\_\_\_\_
75. **viscer/o** \_\_\_\_\_
76. **vulv/o** \_\_\_\_\_

### EXERCISE 2-2 Roots

Give the root for each of the following.

1. **fat** \_\_\_\_\_
2. **life** \_\_\_\_\_
3. **head** \_\_\_\_\_

4. **neck** \_\_\_\_\_
5. **cell** \_\_\_\_\_
6. **tissue** \_\_\_\_\_
7. **disease** \_\_\_\_\_
8. **internal organs** \_\_\_\_\_
9. **hair** \_\_\_\_\_
10. **skin** \_\_\_\_\_
11. **nail** \_\_\_\_\_
12. **joint** \_\_\_\_\_
13. **cartilage** \_\_\_\_\_
14. **bone** \_\_\_\_\_
15. **muscle** \_\_\_\_\_
16. **tendon** \_\_\_\_\_
17. **brain** \_\_\_\_\_
18. **spinal cord** \_\_\_\_\_
19. **nerve** \_\_\_\_\_
20. **eye** \_\_\_\_\_
21. **ear** \_\_\_\_\_
22. **gland** \_\_\_\_\_
23. **adrenal gland** \_\_\_\_\_
24. **pituitary gland** \_\_\_\_\_
25. **thyroid gland** \_\_\_\_\_
26. **vessel** \_\_\_\_\_
27. **artery** \_\_\_\_\_
28. **heart** \_\_\_\_\_
29. **blood** \_\_\_\_\_
30. **vein** \_\_\_\_\_
31. **lymph node** \_\_\_\_\_
32. **lymph vessel** \_\_\_\_\_

**33. spleen** \_\_\_\_\_

**34. tonsil** \_\_\_\_\_

## EXERCISE 2-3 Short Answers

*Answer the following in the space provided.*

- ## **1. Define anatomy and physiology.**

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- 2.** Name at least 12 body systems and at least two organs in each.

## CHAPTER 3

# Common Suffixes



### Chapter Outline

- 3.1** New Roots, Suffixes, and Prefixes
- 3.2** Learning the Terms
- 3.3** Review Exercises
- 3.4** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the exercises, you should be able to do the following:*

1. Spell and define common suffixes.
2. Identify suffixes used to convert medical nouns to adjectives.
3. Pronounce, spell, define, and write medical terms found in this chapter.

### Introduction

In Chapter 1 you learned two important points to remember about suffixes:

- The suffix is always at the end of a medical word.
- The suffix is the first word part to look at when you try to understand a medical word.

This chapter starts by listing new roots and prefixes. The next section introduces you to the most common suffixes. Each suffix and its meaning are listed first, followed by words using the suffix. These examples will help you remember the meaning of the suffixes. When you have learned them, you will be able to understand a great number of medical words.

### 3.1 New Roots, Suffixes, and Prefixes

Use these additional roots, prefixes, and suffixes when studying the terms in this chapter.

ROOT	MEANING
acr/o	top; extremities
all/o	referring to another
electr/o	electric
home/o	same; constant
iatr/o	physician
idi/o	individual; distinct
radi/o	x-rays
tom/o	to cut

PREFIX	MEANING
dia-	through; complete
pro-	before

### 3.2 Learning the Terms

Use the following suggestions for learning medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

SUFFIX -algia (see also -dynia)	TERM ANALYSIS	MEANING
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
cephalgia (sef-AL-jee-ah)	cephal/o = head	headache; pain in the head
otalgia (oh-TAL-jee-ah)	ot/o = ear	earache; pain in the ear

SUFFIX -cyte		MEANING
Term		Term Analysis
<b>adipocyte</b> (AD-ih-poh-sight)		adip/o = fat
Definition		fat cell
SUFFIX -dynia		MEANING
Term		Term Analysis
<b>gastrodynia</b> (gas-troh-DIN-ee-ah)		gastr/o = stomach
Definition		Pain in the stomach. Also known as gastralgia (gas-TRAL-jee-ah).
<b>mastodyn ia</b> (mas-toh-DIN-ee-ah)		mast/o = breast
Definition		breast pain
SUFFIX -ectomy		MEANING
Term		Term Analysis
<b>hysterectomy</b> (hiss-ter-ECK-toh-mee)		hyster/o = uterus
Definition		surgical removal or excision of the uterus
<b>mastectomy</b> (mas-TECK-toh-mee)		mast/o = breast
Definition		surgical removal or excision of the breast
SUFFIX -emesis		MEANING
Term		Term Analysis
<b>hematemesis</b> (hee-mah-TEM-eh-sis)		hemat/o = blood
Definition		vomiting of blood
<b>emetic</b> (eh-MET-ick)		-ic = pertaining
Definition		an agent such as a drug that causes vomiting
SUFFIX -genic		MEANING
Term		Term Analysis
<b>allogenic</b> (al-oh-JEN-ick)		all/o = referring to another
Definition		originating within another. In an allogenic heart transplant, the heart would be harvested from an individual of the same species but different genetic background.
<b>iatrogenic</b> (eye-at-roh-JEN-ick)		iatr/o = physician
Definition		adverse (harmful) side effects from treatment by physicians

SUFFIX -gnosis		MEANING knowledge
Term	Term Analysis	Definition
<b>diagnosis</b> (dye-ag-NOH-sis)	dia- = through; complete	determining what disease or condition is present through a study of the signs and symptoms, and laboratory, x-ray, and other diagnostic procedures <i>Example: After complete investigation, a diagnosis of osteoarthritis was made.</i>
<b>prognosis</b> (prahg-NOH-sis)	pro- = before	forecast of the outcome of the disease <i>Example: The patient is admitted for a hip replacement because of osteoarthritis. His prognosis is good.</i>

**Note:** The prognosis is either good or bad. If the patient is likely to recover from the disease, the prognosis is good. If the patient is not likely to recover from the disease, the prognosis is bad.

SUFFIX -gram		MEANING record (written record or image)
Term	Term Analysis	Definition
<b>angiogram</b> (AN-jee-oh-gram)	angi/o = vessel	record (image) of a blood vessel is produced using x-rays and contrast medium (Figure 3-1).

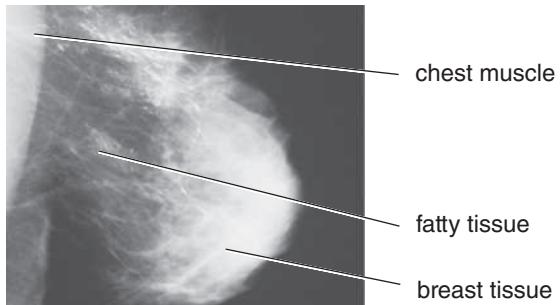
**Note 1:** An image is produced of the body structure, thereby creating a record of that structure.

**Note 2:** Contrast medium is a dye that is placed into the patient's body to improve the visibility of the x-ray.



**Figure 3-1** Angiogram. The blood vessels, in black, are highlighted because a contrast medium was used to improve visibility.

Term	Term Analysis	Definition
<b>mammogram</b> (MAM-oh-gram)	mamm/o = breast	record (image) of the breast is produced using x-rays (Figure 3-2).


**Figure 3-2** Mammogram: record of the breast.

<b>myelogram</b> (MY-eh-loh-gram)	myel/o = spinal cord	record (image) of the spinal cord taken by x-rays
<b>venogram</b> (VEE-noh-gram)	ven/o = vein	record (image) of a vein is produced using x-rays and contrast medium

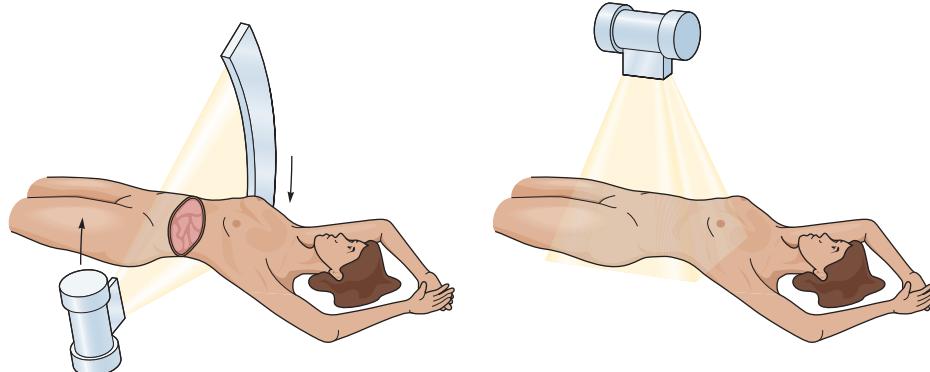
SUFFIX -graph		MEANING instrument used to record
Term	Term Analysis	Definition
<b>cardiograph</b> (KAR-dee-oh-graf)	cardi/o = heart	instrument used to record the heart's activity
<b>electrocardiograph</b> (ee-leck-troh-KAR-dee-oh-graf)	electr/o = electric cardi/o = heart	instrument used to record the electrical activity of the heart (Figure 3-3A and 3-3B)



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**Figure 3-3A** Electrocardiograph: instrument that records the electrical activity of the heart.**Figure 3-3B** Electrocardiogram: record of the electrical activity of the heart.

SUFFIX -graphy	MEANING process of recording; process of producing images	
Term	Term Analysis	Definition
<b>cardiography</b> (Kar-dee-OG-rah-fee)	cardi/o = heart	process of recording the heart's activity
<b>computed tomography</b> (kom-PYOO-ted) (toh-MOG-rah-fee)	tom/o = to cut	an x-ray beam rotates around the patient taking multiple images of an organ at different depths (Figure 3-4A, and C). The information is computer analyzed and converted to a picture of the body part.



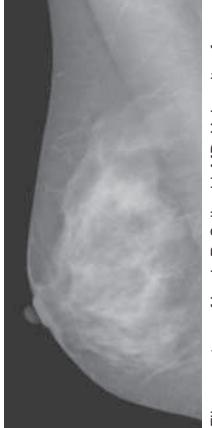
**Figure 3-4** A. CT scan has an x-ray beam rotating around the patient. Images are taken of the organ at various depths. B. Conventional x-ray. The x-ray beam travels through the body from anterior to posterior (AP view). C. Abdominal CT scan showing the liver.

Term	Term Analysis	Definition
<b>mammography</b> (mam- <b>OG</b> -rah-fee)	mamm/o = breast	process of producing images of the breast (See Figure 3-5)



(A)

© Jean-Paul Chassénet/Science Source.



(B)

Films courtesy of Lorrie R. Salkoski, MD, University of Wisconsin School of Medicine and Public Health, Madison, WI.



(C)

Films courtesy of Lorrie R. Salkoski, MD, University of Wisconsin School of Medicine and Public Health, Madison, WI.

**Figure 3-5** A. Mammography. B. Normal mammogram. C. Mammogram showing visible breast cancer.

<b>myelography</b> (my-eh- <b>LOG</b> -rah-fee)	myel/o = spinal cord	producing images of the spinal cord (using x-rays)
<b>radiography</b> (ray-dee- <b>OG</b> -rah-fee)	radi/o = x-rays	process of producing images using x-rays

**Note:** Radiography is a general term. It refers to images that are taken of any internal body structure using x-rays.

### In Brief

- gram** = record
- graph** = instrument used to record
- graphy** = process of recording

SUFFIX -itis	MEANING	
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>enteritis</b> (en-ter-EYE-tis)	enter/o = small intestine	inflammation of the small intestine
<b>stomatitis</b> (sto-mah-TYE-tis)	stomat/o = mouth	inflammation of the mouth
<b>tonsillitis</b> (ton-sih-LYE-tis)	tonsill/o = tonsil	inflammation of the tonsils

SUFFIX -logy		MEANING study of
Term	Term Analysis	Definition
<b>cardiology</b> (kar-dee-OL-oh-jee)	cardi/o = heart	study of the heart
<b>dermatology</b> (der-mah-TOL-oh-jee)	dermat/o = skin	study of the skin

SUFFIX -logist		MEANING specialist; one who studies
Term	Term Analysis	Definition
<b>gynecologist</b> (guy-neh-KOL-oh-jist)	gynec/o = woman	specialist in the study of the diseases and treatment of female disorders
<b>ophthalmologist</b> (ahf-thal-MOL-eh-jist)	ophthalm/o = eye	specialist in the study of the diseases and treatment of eye disorders

SUFFIX -malacia		MEANING softening
Term	Term Analysis	Definition
<b>adenomalacia</b> (ad-eh-noh-mah-LAY-shee-ah)	aden/o = gland	abnormal softening of a gland
<b>osteomalacia</b> (os-tee-oh-mah-LAY-shee-ah)	oste/o = bone	softening of bone

SUFFIX -megaly		MEANING enlargement
Term	Term Analysis	Definition
<b>visceromegaly</b> (VIS-er-oh-meg-ah-lee)	viscer/o = internal organs	enlarged internal organs

SUFFIX -oma		MEANING tumor; mass
Term	Term Analysis	Definition
<b>adenocarcinoma</b> (ad-eh-o-kar-sih-NOH-mah)	aden/o = gland carin/o = cancer	cancer of glandular tissue
adenoma ( <b>ad-eh-NOH-mah</b> )	aden/o = gland	tumor of a gland
<b>osteoma</b> (os-tee-OH-mah)	oste/o = bone	tumor of bone
<b>hematoma</b> (hem-ah-TOH-mah)	hemat/o = blood	mass or collection of blood outside a blood vessel; a bruise

SUFFIX -osis		MEANING abnormal condition
Term	Term Analysis	Definition
nephrosis (neh-FROH-sis)	nephro/o = kidney	abnormal condition of the kidney

SUFFIX -pathy		MEANING disease
Term	Term Analysis	Definition
<b>nephropathy</b> (neh-FROP-pah-thee)	nephro/o = kidney	disease of the kidney
<b>neuropathy</b> (new-ROP-pah-thee)	neur/o = nerve	disease of the nerve

SUFFIX -phobia		MEANING fear
Term	Term Analysis	Definition
<b>acrophobia</b> (ack-roh-FOH-bee-ah)	acr/o = top; extremities	fear of heights

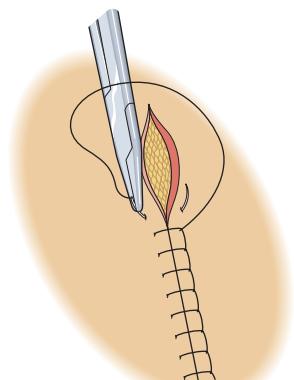
SUFFIX -plasty		MEANING surgical reconstruction
Term	Term Analysis	Definition
<b>rhinoplasty</b> (RYE-noh-plas-tee)	rhin/o = nose	surgical reconstruction of the nose; nose job
<b>arthroplasty</b> (AR-throh-plas-tee)	arthr/o = joint	surgical reconstruction of a joint

SUFFIX <b>-ptosis</b>		MEANING drooping; sagging
Term	Term Analysis	Definition
<b>nephroptosis</b> (nef-rop-TOH-sis)	nephro = kidney	drooping kidney

SUFFIX <b>-ptysis</b>		MEANING spitting
Term	Term Analysis	Definition
<b>hemoptysis</b> (hee-MOP-tih-sis)	hem/o = blood	spitting up of blood

SUFFIX <b>-rrhage; -rrhagia</b>		MEANING bursting forth
Term	Term Analysis	Definition
<b>hemorrhage</b> (HEM-or-idj)	hem/o = blood	bursting forth of blood; bleeding
<b>gastrorrhagia</b> (gas-troh-RAY-jee-ah)	gastr/o = stomach	bleeding from the stomach

SUFFIX <b>-rrhaphy</b>		MEANING to suture (to sew)
Term	Term Analysis	Definition
<b>colporrhaphy</b> (kol-POR-ah-fee)	colp/o = vagina	suturing the wall of the vagina (Figure 3-6)



Continuous sutures

**Figure 3-6** To suture (sew). The edges of the wound are brought together by suturing.

SUFFIX <b>-rrhea</b>		MEANING flow; discharge
Term	Term Analysis	Definition
<b>otorrhea</b> (oh-toh-REE-ah)	ot/o = ear	discharge from the ear

SUFFIX <b>-rrhexis</b>		MEANING rupture
Term	Term Analysis	Definition
<b>splenorrhesis</b> (splee-nor-ECKS-sis)	splen/o = spleen	ruptured spleen

**In Brief**

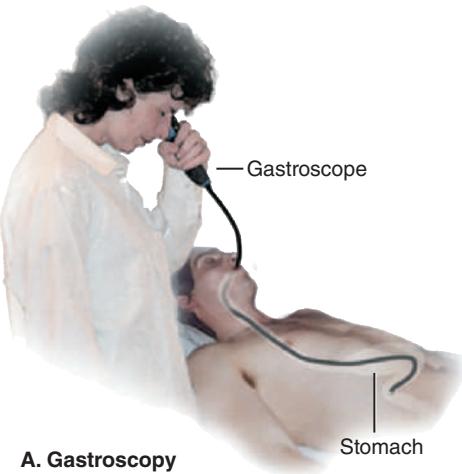
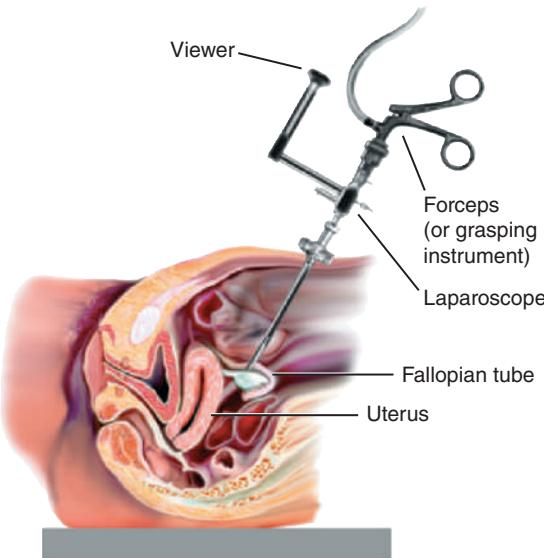
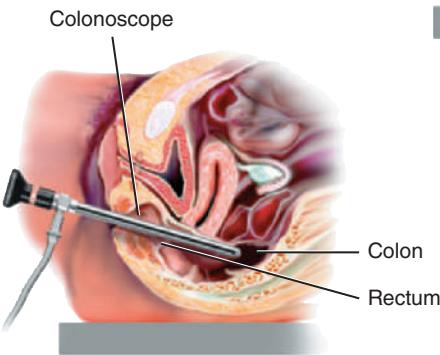
- rrhage** = burst forth
- rrhaphy** = suture
- rrhea** = flow; discharge
- rrhexis** = rupture

SUFFIX <b>-sclerosis</b>		MEANING hardening
Term	Term Analysis	Definition
<b>arteriosclerosis</b> (ar-teer-ee-oh-skleh-ROH-sis)	arteri/o = artery	hardening of the arteries

SUFFIX <b>-scope</b>		MEANING instrument used to view inside a body cavity or organ
Term	Term Analysis	Definition
<b>arthroscope</b> (AR-throh-skope)	arthr/o = joint	instrument used to view the inside of a joint cavity
<b>gastroscope</b> (GAS-troh-skope)	gastr/o = stomach	instrument used to view the inside of the stomach

**In Brief**

- scope** = instrument used to view inside a body cavity or organ
- scopy** = process of viewing inside a body cavity or organ

SUFFIX -scopy		MEANING the process of viewing inside a body cavity or organ
Term	Term Analysis	Definition
<b>endoscopy</b> (en-DOS-koh-peel)	endo- = within	process of visually examining the inside of a body cavity or organ using an endoscope (Figure 3-7)
<b>A. Gastroscopy</b>		
<b>B. Laparoscopy</b>		
<b>C. Colonoscopy</b>		

**Figure 3-7** Endoscopies. A. Gastroscopy. B. Laparoscopy. C. Colonoscopy.

**Note:** Endoscopy is a general term. Specific endoscopies are named after the organ being studied. See the following terms as examples.

<b>bronchoscopy</b> (brong-KOS-koh-peel)	bronch/o = bronchus	process of viewing inside the bronchus
<b>laparoscopy</b> (lap-ah-ROS-koh-peel)	lapar/o = abdomen	process of viewing the abdomen (refer to Figure 3-7B)

SUFFIX <b>-spasm</b>		MEANING <b>sudden involuntary muscle contraction</b>
Term	Term Analysis	Definition
<b>laryngospasm</b> (lah-RING-go-spaz-um)	laryng/o = larynx	sudden muscular spasm of the larynx

SUFFIX <b>-stasis</b>		MEANING <b>stable; stopping; controlling</b>
Term	Term Analysis	Definition
<b>hemostasis</b> (hee-moh-STAY-sis)	hem/o = blood	stopping of bleeding
<b>homeostasis</b> (hoh-mee-oh-STAY-sis)	home/o = same	balanced yet varied state

SUFFIX <b>-stenosis</b>		MEANING <b>narrowing</b>
Term	Term Analysis	Definition
<b>arteriostenosis</b> (ar-teer-ee-oh-steh-NOH-sis)	arteri/o = artery	narrowing of an artery

SUFFIX <b>-stomy</b>		MEANING <b>surgical creation of a new opening</b>
Term	Term Analysis	Definition
<b>colostomy</b> (koh-LOSS-toh-mee)	col/o = colon	surgical creation of a new opening in the colon
<b>tracheostomy</b> (tray-kee-OS-toh-mee)	trache/o = trachea; windpipe	surgical creation of a new opening into the trachea

SUFFIX <b>-tomy</b>		MEANING <b>to cut; incision</b>
Term	Term Analysis	Definition
<b>tenotomy</b> (teh-NOT-oh-mee)	ten/o = tendon	to cut the tendon; incision of the tendon
<b>tracheotomy</b> (tray-kee-OT-toh-mee)	trache/o = trachea; windpipe	to cut the trachea; incision of the trachea

**Note:** Incision means to cut into.

**In Brief**

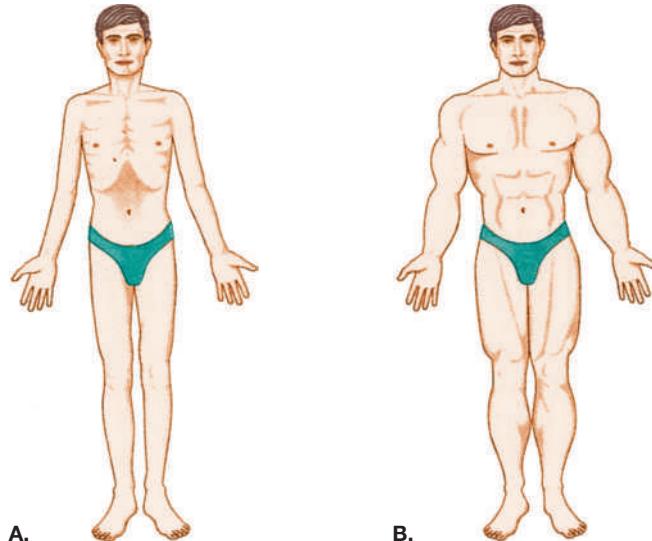
**-stomy** = surgical creation of a new opening

**-tomy** = to cut

**incision** means to cut into

**excision** means to cut out

SUFFIX <b>-trophy</b>		MEANING growth; nourishment
Term	Term Analysis	Definition
<b>atrophy</b> (AH-troh-fee)	a- = no; not	wasting away of the muscle (Figure 3-8A)
<b>hypertrophy</b> (high-PER-troh-fee)	hyper- = excessive	excessive growth or enlargement of an organ or part (Figure 3-8B)



**Figure 3-8** Differences in muscle size. A. Atrophy. B. Hypertrophy.

**Suffixes Used as Adjectives**

SUFFIX <b>-ac; -ous; -ic; -al -ary; -ar; -eal</b>		MEANING pertaining to
Term	Term Analysis	Definition
<b>cardiac</b> (KAR-dee-ack)	cardi/o = heart	pertaining to the heart
<b>chondral</b> (KON-dral)	chondr/o = cartilage	pertaining to cartilage

Term	Term Analysis	Definition
<b>cutaneous</b> (kyoo-TAY-nee-us)	cutane/o = skin	pertaining to the skin
<b>gastric</b> (GAS-trik)	gastr/o = stomach	pertaining to the stomach
<b>idiopathic</b> (id-ee-oh-PATH-ick)	idi/o = one's own; distinct path/o = disease	unknown cause. <i>Example: idiopathic disease.</i>
<b>mammary</b> (MAM-ah-ree)	mamm/o = breast	pertaining to the breast
<b>muscular</b> (MUS-kyou-lar)	muscul/o = muscle	pertaining to muscle
<b>natal</b> (NAY-tal)	nat/o = birth	pertaining to birth
<b>pharyngeal</b> (far-IN-jee-al)	pharyng/o = throat; pharynx	pertaining to the throat
<b>septic</b> (SEHP-tick)	sept/o = infection	pertaining to infection
<b>venous</b> (VEE-nus)	ven/o = vein	pertaining to a vein

**Note:** Although there are some exceptions, the suffixes meaning “pertaining to” are not interchangeable with a given root. For example, you can say **muscular**, but not **musculal**, **musculic**, or **musculosus**. You can say **cardiac** but not **cardious** or **cardiary**.

### 3.3 Review Exercises

#### EXERCISE 3-1 Matching Word Elements with Meaning

Match the word part in Column A with its meaning in Column B

Column A	Column B
_____ 1. -algia	A. specialist
_____ 2. -ectomy	B. tumor; mass
_____ 3. -logy	C. nourishment
_____ 4. -logist	D. excision; surgical removal
_____ 5. -ous	E. surgical reconstruction
_____ 6. -scopy	F. pertaining to

- |       |                    |  |
|-------|--------------------|--|
| _____ | <b>7.</b> -scope   | G. pain                                    |
| _____ | <b>8.</b> -plasty  | H. instrument used to view inside an organ |
| _____ | <b>9.</b> -oma     | I. study of                                |
| _____ | <b>10.</b> -trophy | J. process of viewing inside an organ      |

### EXERCISE 3-2 Definitions

*Give the meaning of the following suffixes.*

- a. **-trophy** \_\_\_\_\_
- b. **-algia** \_\_\_\_\_
- c. **-tomy** \_\_\_\_\_
- d. **-ectomy** \_\_\_\_\_
- e. **-gram** \_\_\_\_\_
- f. **-logist** \_\_\_\_\_
- g. **-scope** \_\_\_\_\_
- h. **-itis** \_\_\_\_\_
- i. **-plasty** \_\_\_\_\_
- j. **-logy** \_\_\_\_\_
- k. **-ous** \_\_\_\_\_
- l. **-oma** \_\_\_\_\_
- m. **-ic** \_\_\_\_\_
- n. **-al** \_\_\_\_\_
- o. **-scopy** \_\_\_\_\_
- p. **-osis** \_\_\_\_\_

### EXERCISE 3-3 Identifying and Defining Word Parts

*In the words listed below, separate the medical term into its word parts with a slash (/). Then, define the term in the space provided. The first question is answered for you.*

- a. **aden/oma** tumor of a gland
- b. **otalgia** \_\_\_\_\_
- c. **dermatologist** \_\_\_\_\_

- d. **hysterectomy** \_\_\_\_\_
- e. **cardiology** \_\_\_\_\_
- f. **myelogram** \_\_\_\_\_
- g. **tonsillitis** \_\_\_\_\_
- h. **cutaneous** \_\_\_\_\_
- i. **hypertrophy** \_\_\_\_\_
- j. **rhinoplasty** \_\_\_\_\_
- k. **arthroscopy** \_\_\_\_\_
- l. **arthroscope** \_\_\_\_\_
- m. **tracheotomy** \_\_\_\_\_
- n. **natal** \_\_\_\_\_
- o. **septic** \_\_\_\_\_

### EXERCISE 3-4 Adjectival Suffix

*Match the root with the correct adjectival ending, then complete the sentences below.*

ROOT	ADJECTIVAL SUFFIX
muscul-	-al
nat-	-ic
sept-	-ous
cutane-	-ar

- I pulled a muscle. I now have \_\_\_\_\_ pain.
- I have red marks on my skin. The doctor said it was a \_\_\_\_\_ rash.
- I am going to have a baby. I am going to pre- \_\_\_\_\_ classes.
- Throw the infectious material away. Put it in the garbage for \_\_\_\_\_ material.

**EXERCISE 3-5 Spelling**

*Circle the word that is correctly spelled in each group below.*

- |                    |                 |                |
|--------------------|-----------------|----------------|
| 1. cephalalga      | cefalalgia      | cephalgia      |
| 2. hysterectomy    | histerectomy    |                |
| 3. tonsillitis     | tonsilitis      |                |
| 4. cardology       | cardiology      |                |
| 5. ophthalmologist | ophthalmologist | ophtalmologist |
| 6. nephrosis       | nephrosus       |                |
| 7. tracheotomy     | traechotomy     |                |
| 8. hypertrophe     | hypertrophy     |                |
| 9. enteritis       | enteritus       |                |
| 10. mylogram       | myelogram       |                |

**EXERCISE 3-6 Definitions**

*Define the following terms.*

1. **adenoma** \_\_\_\_\_
2. **arthroplasty** \_\_\_\_\_
3. **arthroscope** \_\_\_\_\_
4. **bronchoscopy** \_\_\_\_\_
5. **cardiology** \_\_\_\_\_
6. **cephalgia** \_\_\_\_\_
7. **dermatology** \_\_\_\_\_
8. **enteritis** \_\_\_\_\_
9. **gastroscope** \_\_\_\_\_
10. **laparoscopy** \_\_\_\_\_
11. **gynecologist** \_\_\_\_\_
12. **hematoma** \_\_\_\_\_
13. **hypertrophy** \_\_\_\_\_
14. **hysterectomy** \_\_\_\_\_
15. **mastectomy** \_\_\_\_\_

16. **myelogram** \_\_\_\_\_
17. **nephropathy** \_\_\_\_\_
18. **nephrosis** \_\_\_\_\_
19. **neuropathy** \_\_\_\_\_
20. **ophthalmologist** \_\_\_\_\_
21. **osteoma** \_\_\_\_\_
22. **otalgia** \_\_\_\_\_
23. **rhinoplasty** \_\_\_\_\_
24. **stomatitis** \_\_\_\_\_
25. **tenotomy** \_\_\_\_\_
26. **tonsillitis** \_\_\_\_\_
27. **tracheotomy** \_\_\_\_\_
28. **tracheostomy** \_\_\_\_\_
29. **excision** \_\_\_\_\_
30. **incision** \_\_\_\_\_

### 3.4 Pronunciation and Spelling

To practice your pronunciation:

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

Word	Pronunciation	Spelling
<b>acrophobia</b>	ack-roh-FOH-bee-ah	_____
<b>adenocarcinoma</b>	ad-eh-no-kar-sih-NOH-mah	_____
<b>adenomalacia</b>	ad-eh-noh-mah-LAY-shee-ah	_____
<b>adenoma</b>	ad-eh-NOH-mah	_____
<b>allogenic</b>	al-oh-JEN-ick	_____
<b>arteriosclerosis</b>	ar-teer-ee-oh-skleh-ROH-sis	_____

Word	Pronunciation	Spelling
<b>arthroscope</b>	<b>AR-throh-skohp</b>	
<b>arthroscopy</b>	<b>ar-THROS-koh-pee</b>	
<b>cardiac</b>	<b>KAR-dee-ack</b>	
<b>cardiology</b>	<b>kar-dee-OL-oh-jee</b>	
<b>chondral</b>	<b>KON-dral</b>	
<b>colostomy</b>	<b>koh-LOSS-toh-mee</b>	
<b>cutaneous</b>	<b>kyoo-TAY-nee-us</b>	
<b>dermatology</b>	<b>der-mah-TOL-oh-jee</b>	
<b>electrocardiograph</b>	<b>ee-leck-troh-KAR-dee-oh-graf</b>	
<b>emetic</b>	<b>eh-MET-ick</b>	
<b>enteritis</b>	<b>en-ter-EYE-tis</b>	
<b>gastric</b>	<b>GAS-trik</b>	
<b>gastrodynia</b>	<b>gas-troh-DIN-ee-ah</b>	
<b>gastroscopy</b>	<b>gas-TROS-koh-pee</b>	
<b>gynecologist</b>	<b>guy-neh-KOL-oh-jist</b>	
<b>hematemesis</b>	<b>hee-mah-TEM-eh-sis</b>	
<b>hematoma</b>	<b>hem-ah-TOH-mah</b>	
<b>hemoptysis</b>	<b>hee-MOP-tih-sis</b>	
<b>hemostasis</b>	<b>hee-moh-STAY-sis</b>	
<b>homeostasis</b>	<b>hoh-mee-oh-STAY-sis</b>	
<b>hypertrophy</b>	<b>high-PER-troh-fee</b>	
<b>hysterectomy</b>	<b>hiss-ter-ECK-toh-mee</b>	
<b>iatrogenic</b>	<b>eye-at-roh-JEN-ick</b>	
<b>idiopathic</b>	<b>id-ee-oh-PATH-ick</b>	
<b>laryngospasm</b>	<b>lah-RING-go-spaz-um</b>	
<b>mastectomy</b>	<b>mas-TECK-toh-mee</b>	
<b>mastodynia</b>	<b>mas-toh-DIN-ee-ah</b>	
<b>muscular</b>	<b>MUS-kyoo-lar</b>	
<b>myelogram</b>	<b>MY-eh-loh-gram</b>	

Word	Pronunciation	Spelling
<b>myelography</b>	<b>my-eh-LOG-rah-fee</b>	
<b>natal</b>	<b>NAY-tal</b>	
<b>nephropathy</b>	<b>nef-ROP-pah-thee</b>	
<b>nephroptosis</b>	<b>nef-rop-TOH-sis</b>	
<b>nephrosis</b>	<b>neh-FROH-sis</b>	
<b>neuropathy</b>	<b>new-ROP-pah-thee</b>	
<b>ophthalmologist</b>	<b>ahf-thal-MOL-eh-jist</b>	
<b>osteomalacia</b>	<b>os-tee-oh-mah-LAY-shee-ah</b>	
<b>osteoma</b>	<b>os-tee-OH-mah</b>	
<b>otalgia</b>	<b>oh-TAL-gee-ah</b>	
<b>pharyngeal</b>	<b>far-IN-jee-al</b>	
<b>prognosis</b>	<b>prahg-NOH-sis</b>	
<b>radiography</b>	<b>ray-dee-OG-rah-fee</b>	
<b>stomatitis</b>	<b>sto-mah-TYE-tis</b>	
<b>tenotomy</b>	<b>teh-NOT-oh-mee</b>	
<b>tomography</b>	<b>toh-MOG-rah-fee</b>	
<b>tonsillitis</b>	<b>ton-sih-LYE-tis</b>	
<b>tracheotomy</b>	<b>tray-kee-OT-toh-mee</b>	
<b>venous</b>	<b>VEE-nus</b>	
<b>visceromegaly</b>	<b>VIS-er-oh-meg-ah-lee</b>	



## CHAPTER 4

# Common Prefixes

### Chapter Outline

- 4.1** New Roots and Suffixes
- 4.2** Learning the Terms
- 4.3** Summary of Prefixes That Have the Same Meaning
- 4.4** Summary of Prefixes That Have the Opposite Meaning
- 4.5** Review Exercises
- 4.6** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the exercises, you should be able to do the following:*

- 1.** State the meaning of prefixes found in this chapter.
- 2.** Pronounce, spell, define, and write medical terms that use prefixes in this chapter.
- 3.** Identify prefixes that have the same meaning.
- 4.** Identify prefixes that have the opposite meaning.

### Introduction

This chapter introduces you to the most common prefixes. It starts by listing new roots and suffixes used in this chapter. The next section displays the prefix and its meaning first, followed by words using the prefix.



## 4.1 New Roots and Suffixes

Use these additional roots and suffixes when studying the medical terms in this chapter.

ROOT	MEANING
<b>cellul/o</b>	cell
<b>cis/o</b>	to cut
<b>cost/o</b>	rib
<b>duct/o</b>	to draw
<b>later/o</b>	side
<b>sect/o</b>	to cut
<b>son/o</b>	sound
<b>versi/o</b>	turning; tilting; tipping

SUFFIX	MEANING
<b>-drome</b>	run
<b>-genous</b>	produced by
<b>-iasis</b>	abnormal condition
<b>-ion</b>	process
<b>-mortem</b>	death
<b>-opsy</b>	to view
<b>-partum</b>	delivery
<b>-plasia; -plasm</b>	development; formation
<b>-pnea</b>	breathing
<b>-tic</b>	pertaining to
<b>-um</b>	structure
<b>-uria</b>	urination; urine
<b>-y</b>	condition; process

## 4.2 Learning the Terms

Use the following suggestions for learning medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

PREFIX a(n)-		MEANING no; not
Term	Term Analysis	Definition
<b>apnea</b> (AP-hee-ah)	-pnea = breathing	not breathing
<b>anuria</b> (ah-NOO-ree-ah)	-uria = urine; urination	no urine (being formed in the kidney)

### Helping You Remember

The prefix “a-” changes to “an-” in the word “anuria” because the suffix begins with a vowel.

PREFIX ab-		MEANING away from
Term	Term Analysis	Definition
<b>abduction</b> (ab-DUCK-shun)	-ion = process duct/o = to draw	process of drawing away from the midline

PREFIX ad-		MEANING toward
Term	Term Analysis	Definition
<b>adduction</b> (ah-DUCK-shun)	-ion = process duct/o = to draw	process of drawing toward the midline

PREFIX ana-		MEANING up; apart
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>anatomy</b> (ah-NAT-oh-mee)	-tomy = process of cutting	the study of the structure or parts of the body

PREFIX ante-		MEANING before
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>antenatal</b> (an-tee-NAY-tal)	-al = pertaining to nat/o = birth	pertaining to before birth, referring to the fetus; prenatal
<b>Note:</b> Fetus is the name given to the unborn infant.		
<b>antepartum</b> (an-tee-PAR-tum)	-partum = delivery, labor, childbirth	before childbirth, referring to the mother

PREFIX anti-		MEANING against
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>antibiotic</b> (an-tih-bye-OT-ick)	-tic = pertaining to bi/o = life	drugs used against bacteria that have infected the body

### Helping You Remember

The prefix *anti-* means “against.” Note that both the prefix and its meaning contain the letter “i.”

The prefix *ante-* means “before.” Both the prefix and its meaning contain the letter “e.”

PREFIX auto-		MEANING self
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>autopsy</b> (AW-top-see)	-opsy = to view	internal and external examination of the body after death to determine the cause of death. Also called a <b>necropsy</b> (NECK-rop-see) or postmortem examination

PREFIX bi- (see di-)		MEANING two
Term	Term Analysis	Definition
<b>bilateral</b> (bye-LAT-er-al)	-al = pertaining to later/o = side	pertaining to two sides

**Helping You Remember**

A bicycle has two wheels.

PREFIX circum-		MEANING around
Term	Term Analysis	Definition
<b>circumduction</b> (ser-kum-DUCK-shun)	-ion = process duct/o = to draw	process of moving a limb in a circular motion

PREFIX contra-		MEANING against
Term	Term Analysis	Definition
<b>contraindication</b> (kon-trah-in-dih-KAY-shun)	indication = a sign or symptom that serves to reveal a disease or condition exists	a medical reason that indicates a specific treatment, i.e., medications, procedure, or surgery, should not be performed because it may harm the patient. <i>Example: Drugs used to treat acne are contraindicated in pregnancy because of possible harmful effects to the fetus.</i>
<b>contralateral</b> (kon-trah-LAT-er-ahl)	-al = pertaining to later/o = side	pertaining to the opposite side

PREFIX di-		MEANING two
Term	Term Analysis	Definition
<b>dissection</b> (dye-SECK-shun)	-ion = process sect/o = to cut	the process of cutting and separating parts of the body

PREFIX dys-		MEANING bad; difficult; painful; abnormal
Term	Term Analysis	Definition
<b>dysplasia</b> (dis-PLAY-zha)	-plasia = development; formation	abnormal development
<b>dyspnea</b> (DISP-nee-ah)	-pnea = breathing	difficult breathing
<b>dysuria</b> (dis-YOO-ree-ah)	-uria = urine; urination	painful urination
<b>dystrophy</b> (DIS-troh-fee)	-trophy = nourishment; growth; development	abnormal development. <i>Example: muscular dystrophy</i>

PREFIX endo-		MEANING within
Term	Term Analysis	Definition
<b>endogenous</b> (en-DOJ-eh-nus)	-genous = produced by	produced from within the body; disease that originates from within the body. <i>Example: adult chicken pox (shingles) is the reactivation of the virus that caused childhood chicken pox. The virus has stayed inactive within the body for years.</i>

PREFIX epi-		MEANING upon; above
Term	Term Analysis	Definition
<b>epicardium</b> (ep-ih-KAR-dee-um)	-um = structure cardi/o = heart	outer wall of the heart

PREFIX ex- (see also exo-)		MEANING out
Term	Term Analysis	Definition
<b>excision</b> (eck-SIH-zhun)	-ion = process cis/o = to cut	process of cutting out; the surgical removal of tissue from the body

PREFIX exo-; ecto-		MEANING out
Term	Term Analysis	Definition
<b>exogenous</b> (eck-SOJ-eh-nus)	-genous = produced by	produced outside the body; also known as <b>ectogenous</b> (eck-TOJ-eh-nus)

PREFIX hyper-		MEANING above; excessive
Term	Term Analysis	Definition
<b>hyperplasia</b> (high-per-PLAY-zha)	-plasia = development; formation	excessive formation of cells; abnormal increase in the <b>number</b> of normal cells in normal tissue. May indicate a precancerous condition. Do not confuse with hypertrophy, which is enlargement of an organ due to an increase in the <b>size</b> of cells.

PREFIX hypo-		MEANING below; deficient
Term	Term Analysis	Definition
<b>hypogastric</b> (high-poh-GAS-trick)	-ic = pertaining to gastr/o = stomach	pertaining to below the stomach
<b>hypochondriasis</b> (high-poh-kon-DRY-ah-sis)	-iasis = abnormal condition chondr/o = cartilage	mental illness characterized by persistent thoughts that one has a serious illness despite complete medical evaluation and reassurance that there is no such illness

PREFIX in-		MEANING in; into
Term	Term Analysis	Definition
<b>incision</b> (in-SIH-zhun)	-ion = process cis/o = to cut	process of cutting
<b>inversion</b> (in-VER-zhun)	-ion = process versi/o = turning; tilting; tipping	turning inward, as in the turning of the sole of the foot inward. The opposite is <b>eversion</b> (ee-VER-zhun), turning outward.

PREFIX <b>infra-</b>		MEANING below
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>infracostal</b> (in-frah-KOS-tal)	-al = pertaining to cost/o = rib	pertaining to below the rib

PREFIX <b>inter-</b>		MEANING between
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>intercellular</b> (in-ter-SEL-yoo-lar)	-ar = pertaining to cellul/o = cell	pertaining to between the cells
<b>intercostal</b> (in-ter-KOS-tal)	-al = pertaining to cost/o = rib	pertaining to between the ribs

PREFIX <b>intra-</b>		MEANING within
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>intracranial</b> (in-trah-KRAY-nee-al)	-al = pertaining to crani/o = head	pertaining to within the head
<b>intramuscular</b> (in-trah-MUS-kyoo-lar)	-ar = pertaining to muscul/o = muscle	pertaining to within a muscle
<b>intravenous</b> (in-trah-VEE-nus)	-ous = pertaining to ven/o = vein	pertaining to within a vein

**In Brief**

**infra-** = below  
**inter-** = between  
**intra-** = within

PREFIX <b>macro-</b>		MEANING large
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>macrocephaly</b> (mack-roh-SEF-eh-lee)	-y = condition; process cephal/o = head	abnormally large head

PREFIX <b>meta-</b>		MEANING beyond
Term	Term Analysis	Definition
<b>metaplasia</b> (met-ah-PLAY-zha)	-plasia = formation; development	change in formation
<b>metastasis</b> (meh-TAS-tah-sis)	-stasis = stopping; controlling	the uncontrolled spread of cancerous cells from one organ to another

PREFIX <b>micro-</b>		MEANING small
Term	Term Analysis	Definition
<b>microscope</b> (MY-kroh-skohp)	-scope = instrument used to visually examine	an instrument used to view objects too small to be seen with the naked eye

PREFIX <b>neo-</b>		MEANING new
Term	Term Analysis	Definition
<b>neoplasm</b> (NEE-oh-plazm)	-plasm = development; formation	new growth of tissue; a tumor. The tumor can be <b>benign</b> (bee-NIGHN), meaning harmless, or <b>malignant</b> (mah-LIG-nant), meaning harmful.

PREFIX <b>pan-</b>		MEANING all
Term	Term Analysis	Definition
<b>panhysterectomy</b> (pan-hiss-ter-ECK-toh-mee)	-ectomy = excision; surgical removal hyster/o = uterus	surgical removal of the entire uterus

PREFIX <b>para-</b>		MEANING beside; near
Term	Term Analysis	Definition
<b>parenteral drugs</b> (pah-REN-ter-al)	-al = pertaining to enter/o = small intestine	therapeutic drugs placed in the body in ways other than through the digestive tract. Parenteral drugs are given by injection into several sites, including the skin, muscle, vein, or spine.

PREFIX per-	MEANING through
<i>Term</i>	<i>Term Analysis</i>
<b>percutaneous</b> (per-kyou-TAY-nee-us)	-ous = pertaining to cutane/o = skin
	pertaining to through the skin

**In Brief**

**pan-** = all  
**pre-** = before  
**pro-** = before  
**per-** = through

PREFIX peri-	MEANING around
<i>Term</i>	<i>Term Analysis</i>
<b>perineuritis</b> (per-ih-nyoo-RYE-tis)	-itis = inflammation neur/o = nerve
	inflammation around the nerve

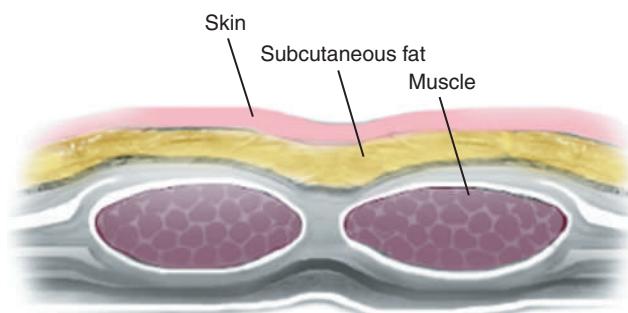
PREFIX post-	MEANING after
<i>Term</i>	<i>Term Analysis</i>
<b>postmortem</b> (pohst-MOR-tehm) <b>examination</b>	-mortem = death examination = to look at; to inspect
<b>postpartum</b> (pohst-PAR-tum)	-partum = delivery; labor; childbirth
	inspection of the body after death; autopsy
	after childbirth, with reference to the mother

PREFIX pre-	MEANING before
<i>Term</i>	<i>Term Analysis</i>
<b>prenatal</b> (pree-NAY-tal)	-al = pertaining to nat/o = birth
	pertaining to before birth, referring to the fetus

PREFIX pro-		MEANING before
Term	Term Analysis	Definition
<b>prodrome</b> (PROH-drohm)	-drome = run	symptom or symptoms occurring before the onset of disease. <i>Example: chest pain, tiredness, and shortness of breath are prodromal symptoms of a heart attack.</i>

PREFIX retro-		MEANING back
Term	Term Analysis	Definition
<b>retroversion</b> (ret-roh-VER-zhun)	-ion = process versi/o = turning; tipping; tilting	backward turning or tipping of an organ

PREFIX sub-		MEANING under; below
Term	Term Analysis	Definition
<b>subcutaneous</b> (sub-kyoo-TAY-nee-us)	-ous = pertaining to cutane/o = skin	pertaining to under the skin (Figure 4-1)

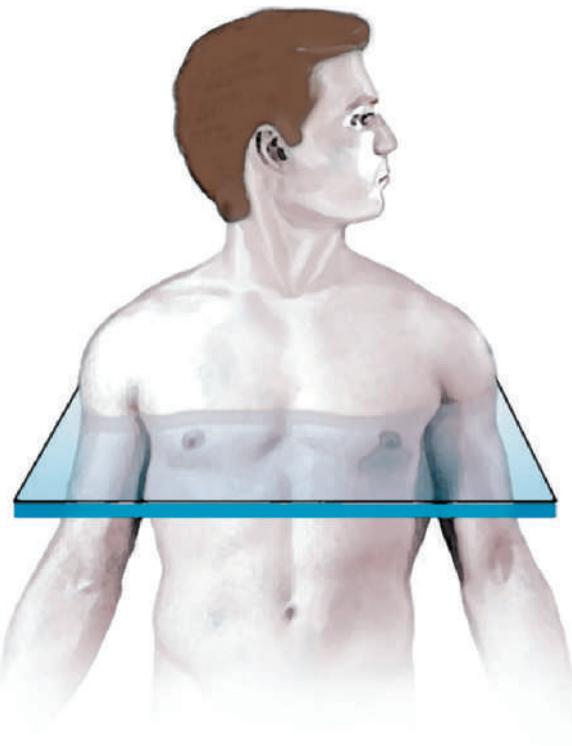


**Figure 4-1** Skin and subcutaneous fat.

<b>sublingual</b> (sub-LING-gwal)	-al = pertaining to lingu/o = tongue	pertaining to under the tongue
--------------------------------------	---	--------------------------------

PREFIX <b>supra-</b>	MEANING above	
Term	Term Analysis	Definition
<b>suprarenal</b> (soo-prah-REE-nal)	-al = pertaining ren/o = kidney	pertaining to above the kidney

PREFIX <b>trans-</b>	MEANING through; across	
Term	Term Analysis	Definition
<b>transection</b> (tran-SECK-shun)	-ion = process sect/o = cut	process of cutting across (Figure 4-2)



**Figure 4-2** Transection (the process of cutting across the body or an organ).

	PREFIX ultra-	MEANING beyond
Term	Term Analysis	Definition
<b>ultrasonography</b> (ul-trah-son-OG-rah-fee)	-graphy = process of recording son/o = sound	process of recording an image of internal structures by using high frequency sound waves (Figure 4-3). Also known as ultrasound or <b>sonogram</b> (SOHN-oh-gram)



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**Figure 4-3** A. Image of fetal ultrasound at about 15 weeks. B. Ultrasonography is a noninvasive procedure that monitors fetal development during pregnancy.

**4.3****Summary of Prefixes That Have the Same Meaning**

PREFIX	MEANING
epi-; hyper-; supra-	above
ante-; pre-; pro-	before
hypo-; infra-; sub-	below
meta-; ultra-	beyond
endo-; intra-	within
ex-; exo-; ecto-	out

**4.4****Summary of Prefixes That Have the Opposite Meaning**

PREFIX	MEANING
hyper-	excessive
hypo-	deficient
post-	after
ante-; pre-; pro-	before
epi-; hyper-; supra-	above
hypo-; infra-; sub-	below
in-	in; into
ex-; exo-; ecto-	out

**4.5****Review Exercises****EXERCISE 4-1 Matching Word Elements with Meaning**

Match the word element in Column A with its meaning in Column B.

<b>Column A</b>	<b>Column B</b>
_____ 1. trans-	A. before
_____ 2. anti-	B. difficult
_____ 3. endo-	C. below
_____ 4. para-	D. across

Column A	Column B
_____	<b>5.</b> ante-
_____	<b>6.</b> infra-
_____	<b>7.</b> hyper-
_____	<b>8.</b> post-
_____	<b>9.</b> dys-
_____	<b>10.</b> peri-
	E. excessive
	F. after
	G. against
	H. beside
	I. around
	J. within

### EXERCISE 4-2 Definitions

Write the meaning of the prefix in the space provided.

- a. **sub-** \_\_\_\_\_
- b. **dys-** \_\_\_\_\_
- c. **ex-** \_\_\_\_\_
- d. **bi-** \_\_\_\_\_
- e. **post-** \_\_\_\_\_
- f. **anti-** \_\_\_\_\_
- g. **intra-** \_\_\_\_\_
- h. **ante-** \_\_\_\_\_
- i. **hypo-** \_\_\_\_\_
- j. **a(n)-** \_\_\_\_\_
- k. **hyper-** \_\_\_\_\_
- l. **endo-** \_\_\_\_\_
- m. **pre-** \_\_\_\_\_
- n. **peri-** \_\_\_\_\_
- o. **ab-** \_\_\_\_\_
- p. **ad-** \_\_\_\_\_
- q. **contra-** \_\_\_\_\_
- r. **di-** \_\_\_\_\_
- s. **pan-** \_\_\_\_\_
- t. **para-** \_\_\_\_\_

- u. **meta-** \_\_\_\_\_
- v. **per-** \_\_\_\_\_
- w. **retro-** \_\_\_\_\_
- x. **supra-** \_\_\_\_\_
- y. **auto-** \_\_\_\_\_
- z. **micro-** \_\_\_\_\_

### EXERCISE 4-3 Identifying and Defining Word Parts

*In the words listed below, separate the medical term into its word parts with a slash. Then, define the term in the space provided. The first question is answered for you.*

- a. **pre/nat/al** pertaining to before birth \_\_\_\_\_
- b. **postmortem** \_\_\_\_\_
- c. **perineuritis** \_\_\_\_\_
- d. **apnea** \_\_\_\_\_
- e. **dysuria** \_\_\_\_\_
- f. **antenatal** \_\_\_\_\_
- g. **subcutaneous** \_\_\_\_\_
- h. **hypogastric** \_\_\_\_\_
- i. **bilateral** \_\_\_\_\_
- j. **intramuscular** \_\_\_\_\_
- k. **dyspnea** \_\_\_\_\_
- l. **infracostal** \_\_\_\_\_
- m. **hyperplasia** \_\_\_\_\_
- n. **endogenous** \_\_\_\_\_
- o. **adduct** \_\_\_\_\_
- p. **contralateral** \_\_\_\_\_
- q. **dissection** \_\_\_\_\_
- r. **parenteral** \_\_\_\_\_
- s. **macrocephaly** \_\_\_\_\_
- t. **inversion** \_\_\_\_\_

### EXERCISE 4-4 Word Building and Sentence Completion

*Build a known medical word by matching one of the prefixes from the left-hand column with the correct root or suffix in the right-hand column. Then, complete the following sentences using the correct medical word.*

PREFIX	ROOT OR SUFFIX
anti-	-cutaneous
a-	-gnosis
infra-	-pnea
sub-	-biotics
pro-	-costal

- I have an infection. The physician gave me a prescription for \_\_\_\_\_.
- Salina broke her arm. The physician said her bone would repair itself quickly. He said that the \_\_\_\_\_ was good.
- Miguel received an injection under his skin. It is called a(n) \_\_\_\_\_ injection.
- Sometimes when I am sleeping I stop breathing. The physician says I have sleep \_\_\_\_\_.
- The pain is located below the ribs. The physician said this was \_\_\_\_\_ pain.

### EXERCISE 4-5 Spelling

*Circle the word that is correctly spelled in each group below.*

- |                 |              |              |
|-----------------|--------------|--------------|
| 1. antenatal    | antinatal    | antenatul    |
| 2. antebiotic   | antibyotic   | antibiotic   |
| 3. bylateral    | bilateral    | billateral   |
| 4. dispnea      | dyspnea      | dysneea      |
| 5. dysuria      | dysurea      | disuria      |
| 6. exsision     | eccision     | excision     |
| 7. intracranal  | intracranial | intracraneal |
| 8. perineuritis | perenuritis  | perineuritus |
| 9. postmortum   | postmortem   | postmoretem  |
| 10. subqutaneus | subcutaneus  | subcutaneous |

## 4.6 Pronunciation and Spelling

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

Word	Pronunciation	Spelling
<b>antenatal</b>	<b>an-tee-NAY-tal</b>	
<b>antepartum</b>	<b>an-tee-PAR-tum</b>	
<b>antibiotic</b>	<b>an-tih-bye-OT-ick</b>	
<b>anuria</b>	<b>ah-NOO-ree-ah</b>	
<b>apnea</b>	<b>AP-nee-ah</b>	
<b>autopsy</b>	<b>AW-top-see</b>	
<b>bilateral</b>	<b>bye-LAT-er-al</b>	
<b>circumduction</b>	<b>ser-kum-DUCK-shun</b>	
<b>contraindication</b>	<b>kon-trah-in-dih-KAY-shun</b>	
<b>contralateral</b>	<b>kon-trah-LAT-er-ahl</b>	
<b>dissection</b>	<b>dye-SECK-shun</b>	
<b>dysplasia</b>	<b>dis-PLAY-see-ah</b>	
<b>dyspnea</b>	<b>DISP-nee-ah</b>	
<b>dysuria</b>	<b>dis-YOO-ree-ah</b>	
<b>endogenous</b>	<b>en-DOJ-eh-nus</b>	
<b>epicardium</b>	<b>ep-ih-KAR-dee-um</b>	
<b>excision</b>	<b>eck-SIH-zhun</b>	
<b>exogenous</b>	<b>eck-SOJ-eh-nus</b>	
<b>hyperplasia</b>	<b>high-per-PLAY-see-ah</b>	
<b>hypochondriasis</b>	<b>high-poh-kon-DRY-ah-sis</b>	
<b>hypogastric</b>	<b>high-poh-GAS-trick</b>	
<b>incision</b>	<b>in-SIH-zhun</b>	
<b>inversion</b>	<b>in-VER-zhun</b>	
<b>infracostal</b>	<b>in-frah-KOS-tal</b>	

Word	Pronunciation	Spelling
<b>intracranial</b>	in-trah-KRAY-nee-al	
<b>intramuscular</b>	in-trah-MUS-kyoo-lar	
<b>macrocephaly</b>	mack-roh-SEF-eh-lee	
<b>metaplasia</b>	met-ah-PLAY-zha	
<b>metastasis</b>	meh-TAS-tah-sis	
<b>microscope</b>	MY-kroh-skohp	
<b>panhysterectomy</b>	pan-hiss-ter-ECK-toh-mee	
<b>parenteral</b>	pah-REN-ter-al	
<b>percutaneous</b>	per-kyou-TAY-nee-us	
<b>perineuritis</b>	per-ih-nyoo-RYE-tis	
<b>postmortem</b>	pohst-MOR-tehm	
<b>postpartum</b>	pohst-PAR-tum	
<b>prenatal</b>	pre-NAY-tal	
<b>retroversion</b>	ret-roh-VER-zhun	
<b>subcutaneous</b>	sub-kyoo-TAY-nee-us	
<b>sublingual</b>	sub-LING-gwal	
<b>suprarenal</b>	soo-prah-REE-nal	
<b>transection</b>	tran-SECK-shun	
<b>ultrasonography</b>	ul-trah-son-OG-rah-fee	



## CHAPTER 5

# Body Organization



### Chapter Outline

- 5.1** Body Cavities
- 5.2** Directional Terminology
- 5.3** Body Planes
- 5.4** Abdominopelvic Regions
- 5.5** Abdominopelvic Quadrants
- 5.6** New Roots, Suffixes, and Prefixes
- 5.7** Learning the Terms
- 5.8** Review Exercises
- 5.9** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the exercises, you should be able to do the following:*

- 1.** Name the cavities of the body and their related organs.
- 2.** Define the anatomical position.
- 3.** Define common terms used for directions.
- 4.** Name and locate the abdominopelvic regions.
- 5.** Name and locate the abdominopelvic quadrants.
- 6.** Pronounce, spell, define, and write medical terms common to the body as a whole.
- 7.** Listen, read, and study, so you can speak and write.

### Introduction

This chapter will teach you common terminology relating to the organization of the body. You will also learn the terms used to describe the position of the body and the placement of various body parts.

## 5.1 Body Cavities

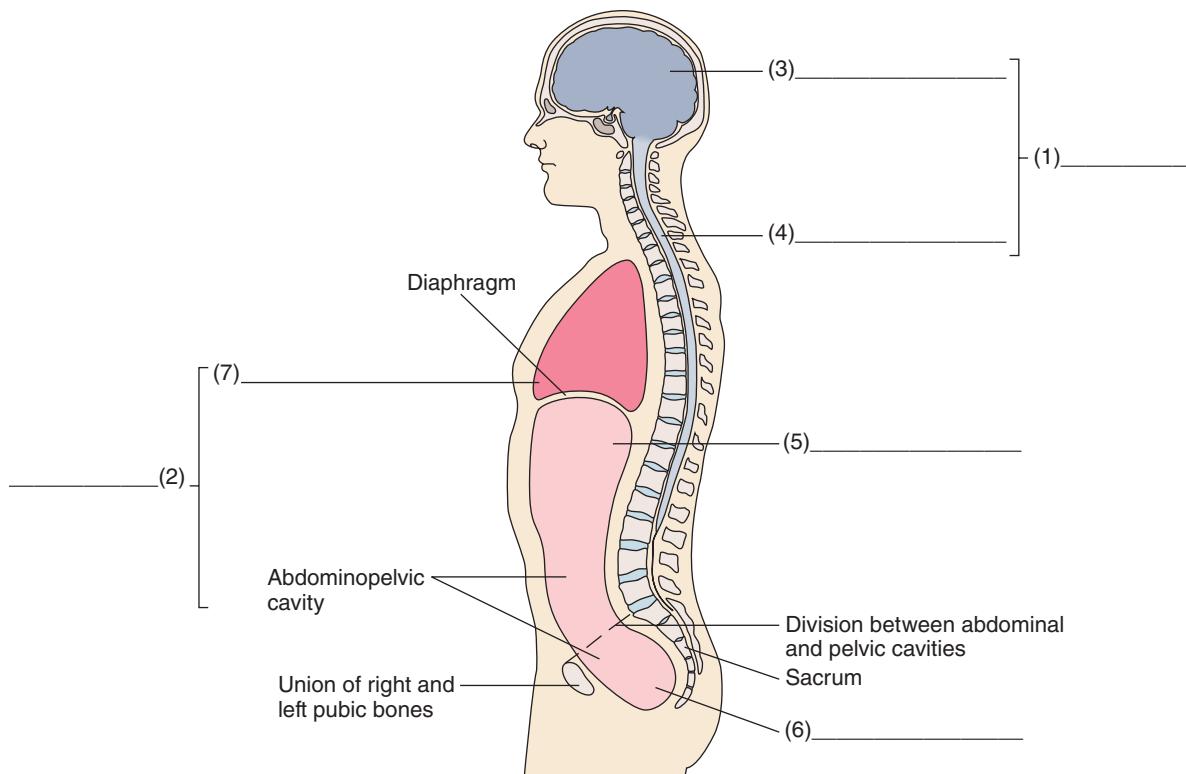
### PRACTICE FOR LEARNING: Body Cavities

Write the words below in the correct spaces on Figure 5-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. dorsal cavity (**DOR**-sal **KAH**-vih-tee)
2. ventral cavity (**VEN**-tral)
3. cranial cavity (**KRAY**-nee-al)
4. vertebral cavity (**VER**-teh-bral)
5. abdominal cavity (ab-**DOM**-ih-nal)
6. pelvic cavity (**PEL**-vick)
7. thoracic cavity (thoh-**RAS**-ick)

When you study the body cavities, think of a backpack. The backpack has empty spaces called pouches. Some are big, some are small. The body has empty spaces inside it as well. But they are not called pouches. They are called cavities.

The body has two main cavities: the dorsal and the ventral. The dorsal cavity is also called the posterior cavity, because it is at the back of the body. Posterior refers to the



**Figure 5-1** Major body cavities and subdivisions

back. The ventral cavity is also called the anterior cavity, because it is at the front of the body. Anterior refers to the front. Each of these cavities has further subdivisions, which are shown in Figure 5-1.

## Dorsal Cavity

The dorsal cavity is subdivided into two parts: the cranial cavity and vertebral cavity. The cranial cavity is inside the skull. The brain is contained in the cranial cavity. The vertebral cavity is inside the vertebral column, or spine. The spinal cord (a group of nerves) is contained in the vertebral cavity.

## Ventral Cavity

The ventral cavity contains many internal organs including the heart, lungs, kidneys, digestive organs, and others. These internal organs are also called **viscera** (VIS-er-ah). A large muscle called the **diaphragm** (DYE-ah-fram) divides the ventral cavity into upper and lower cavities. The upper cavity is called the thoracic cavity. The lower cavity is the **abdominopelvic** (ab-dom-ih-noh-PEL-vick) cavity.

The thoracic cavity contains the heart and lungs. The abdominopelvic cavity is divided into two smaller cavities: the abdominal cavity and the pelvic cavity. The abdominal cavity is above the pelvic cavity. It contains organs such as the liver, intestines, stomach, and kidneys. The pelvic cavity contains some reproductive organs, the urinary bladder, and parts of the intestine.

### In Brief

The **dorsal cavity** is subdivided into the cranial and vertebral cavities. The **ventral cavity** is subdivided into the thoracic and abdominopelvic cavities.

### PRACTICE FOR LEARNING: Body Cavities

Fill in the blanks with the most appropriate answer.

1. Write the two major body cavities. \_\_\_\_\_ and \_\_\_\_\_
2. What body organ would you find in the cranial cavity? \_\_\_\_\_  
Vertebral cavity? \_\_\_\_\_
3. Name the two cavities contained in the ventral cavity. \_\_\_\_\_ and \_\_\_\_\_
4. The stomach and kidneys are found in which body cavity? \_\_\_\_\_
5. The urinary bladder is found in which body cavity? \_\_\_\_\_

**Answers:** 1. dorsal (posterior) and ventral (anterior). 2. brain; spinal cord.  
3. thoracic; abdominopelvic. 4. abdominal. 5. pelvic.

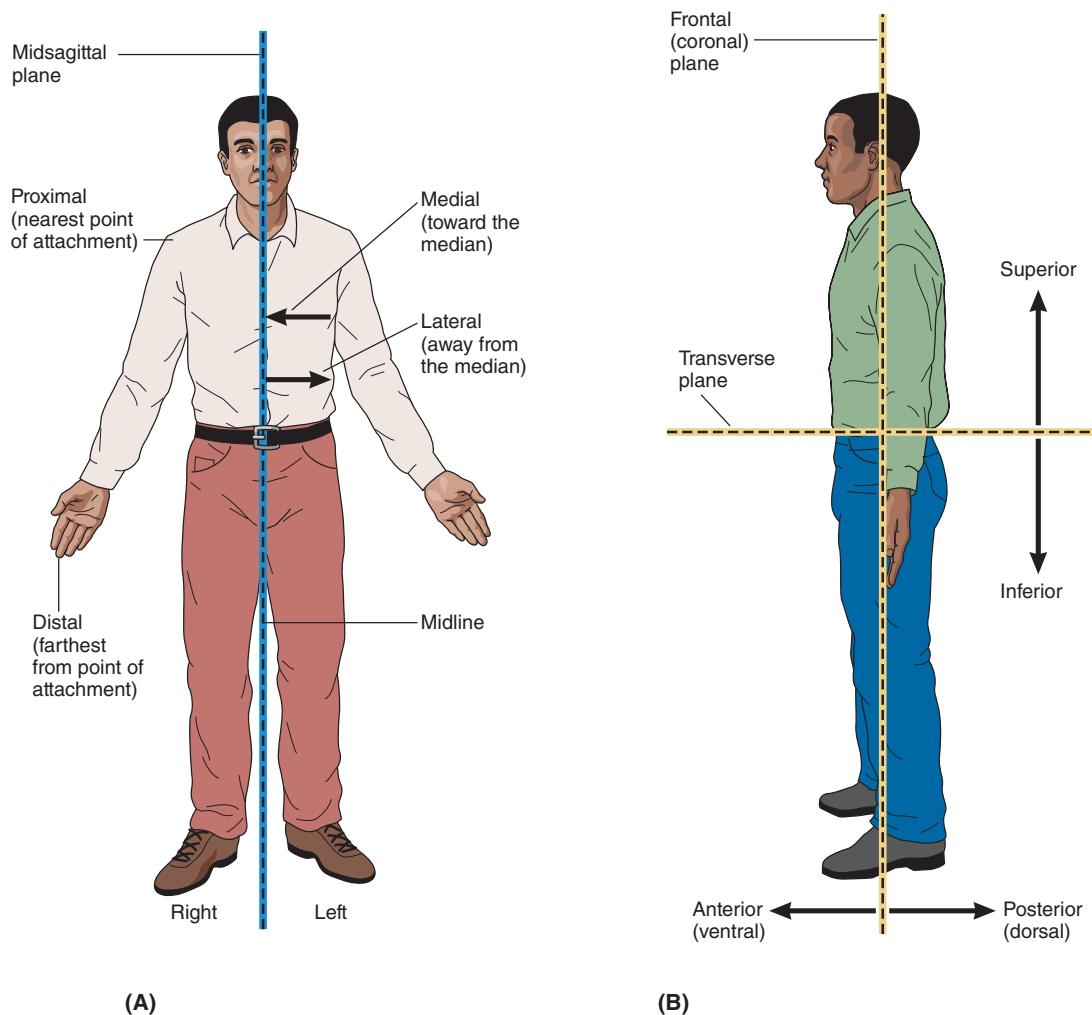
## 5.2 Directional Terminology

### Anatomical Position

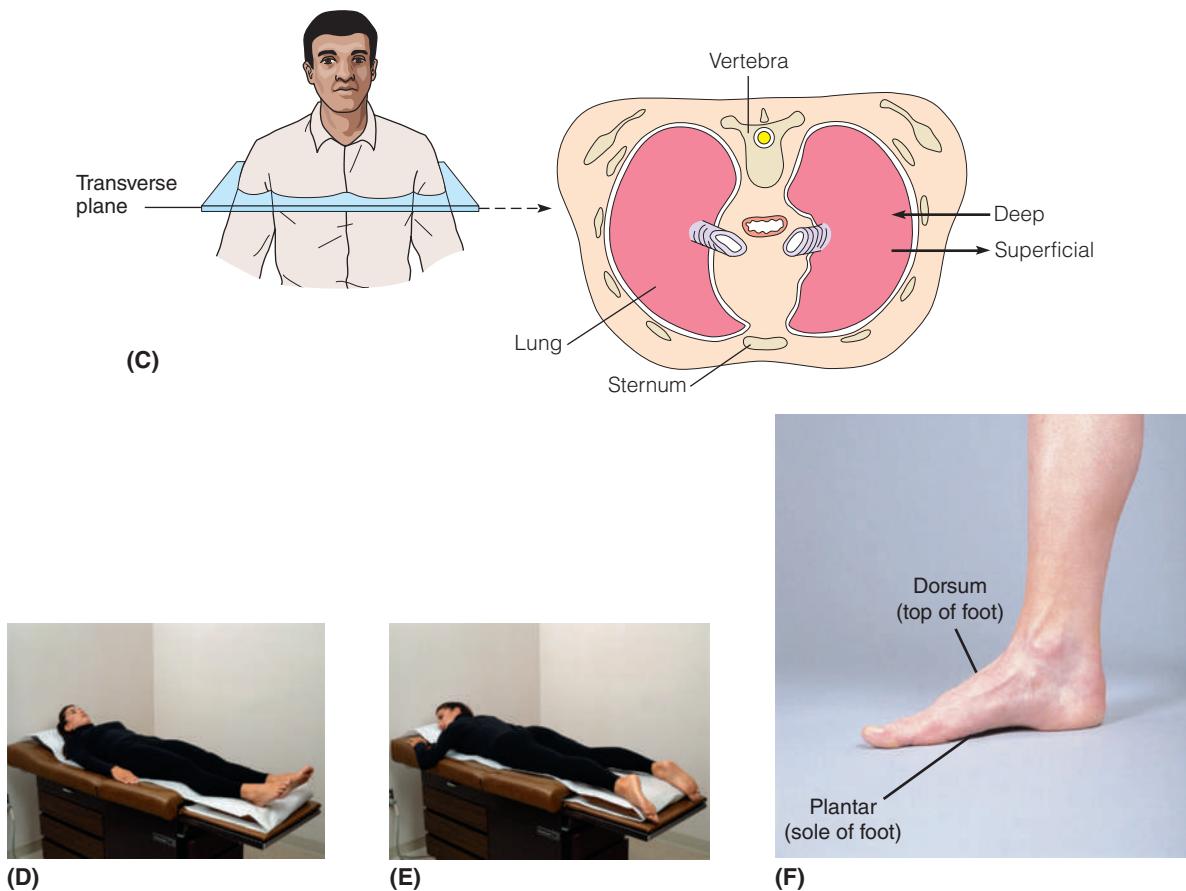
If you are going to tell someone how to get somewhere, you both need to understand what east, west, north, and south mean. These words are called directional terms because they tell direction.

In health care, we need directional terms that will accurately describe where particular body structures are located. The problem is that bodies can move. You can lie on your back, your front, or either side. You can stand or sit. A change in position would change the meaning of the directional terms.

There is a simple solution to this problem. Everyone using directional terminology in health care must think of the body in a standard position. This is known as the **anatomical position**. It is illustrated in Figure 5-2A. The body is standing erect, arms by the side, with head, palms, and feet facing forward. All directional terms assume that the body is in this position.



**Figure 5-2** Anatomical position and directional terms A. Anatomical position. Directional Terms: lateral and medial; proximal and distal B. Superior and inferior; anterior and posterior.



**Figure 5-2** C. Deep and superficial. D. Supine. E. Prone. F. Dorsum and plantar (continued).

### In Brief

**Anatomical position** is standing erect, arms by the side, head, palms, and feet facing forward.

## Directional Terms

As stated above, we need directional terms to describe the position of body parts, particularly in relation to each other. Directional terms are also useful in communicating the location of diseases when they appear in the body.

All of the directional terms are listed in Table 5-1. To help you remember them, they are grouped in opposite pairs. For example, the terms “superior” and “inferior” are grouped because they are opposites: superior means “above,” and inferior means “below.” Figures 5-2 A–F illustrate the use of the terms.

### Helping You Remember

To remember the meaning of supine, notice that supine has “up” as part of the word.

**TABLE 5-1 Directional Terms**

Directional Term	Meaning	Example
superior	above	The head is superior to the neck.
inferior	below	The neck is inferior to the head.
ventral (anterior)	front	The thoracic cavity is anterior to the vertebral cavity.
dorsal (posterior)	back	The vertebral cavity is posterior to the thoracic cavity.
medial	toward the midline of the body	The big toe is medial to the small toe.
lateral	away from the midline of the body	The small toe is lateral to the big toe.
proximal	1. nearest to the point of attachment to the trunk 2. nearest the point of origin (In the digestive tract, the mouth is the point of origin.)	The elbow is proximal to the wrist. The stomach is proximal to the intestine.
distal	1. farthest from the point of attachment to the trunk 2. farthest from the point of origin	The knee is distal to the hip. The intestine is distal to the stomach.
superficial	near the surface of the body	The skin is superficial to muscle.
deep	away from the surface of the body	The muscle is deep to skin.
supine	lying on the back, face up	During an operation on the abdomen, the patient is placed in the supine position.
prone	lying on the abdomen	For a back operation, the patient is placed in the prone position.
plantar	bottom of the foot; sole of the foot	Plantar warts are on the sole of the foot.
dorsum	top of the foot	The dorsum of the foot is the top of the foot.

**PRACTICE FOR LEARNING: Directional Terms**

- 1.** Write the opposite meaning of the following directional terms. The first one is done for you.

- a. anterior posterior \_\_\_\_\_  
b. lateral \_\_\_\_\_  
c. proximal \_\_\_\_\_  
d. deep \_\_\_\_\_  
e. prone \_\_\_\_\_  
f. dorsum \_\_\_\_\_

- 2.** Choose the correct answer from the choices in parentheses.

- g. The neck is (inferior/superior) to the chin.  
h. Your mouth is (medial/lateral) to your ear.  
i. You have stepped on a sharp object. The bottom of your foot starts to bleed. You have cut the (plantar/dorsum) area of your foot.  
j. Jacque has a sunburn on the surface of his skin. The sunburn is said to be (superficial/deep).  
k. A patient is having an operation on her breast. The patient will be placed on the operating table in the (supine/prone) position.  
l. Ed has a rash on his chest and a bruise under his armpit. The bruise is (lateral/medial) to the rash.

**Answers:** a. posterior. b. medial. c. distal. d. superficial. e. supine. f. plantar. g. inferior. h. medial. i. plantar. j. superficial. k. supine. l. lateral.

### 5.3 Body Planes

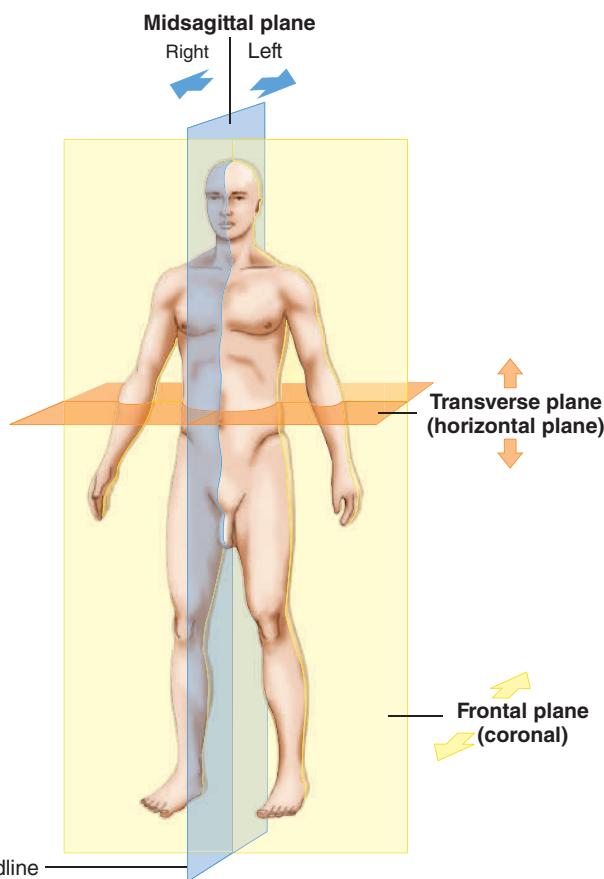
Sections of the body are often referred to as anatomical planes (flat surfaces). Imagine cutting an organ, vertically or horizontally. Once this is done, a flat surface is exposed. This surface is called a **plane** (**PLAYN**). Because an organ can be cut in different ways, there are different kinds of planes. They are listed in Table 5-2 and illustrated in Figure 5-3.

**Helping You Remember**

To help you remember that sagittal separates a structure into right and left, think of the astrological sign of Sagittarius. With its bow and arrow, Sagittarius can hit a body structure, slicing it into right and left portions.

**TABLE 5-2 Planes of the Body**

Plane	Definition
<b>frontal; coronal (KOR-eh-nal)</b>	separates a structure into anterior and posterior portions
<b>sagittal (SAJ-ih-tal)</b>	separates a structure into right and left portions. If the sagittal section divides the body into equal portions, it is called a <b>midsagittal</b> section.
<b>transverse; horizontal</b>	separates a structure into superior and inferior portions

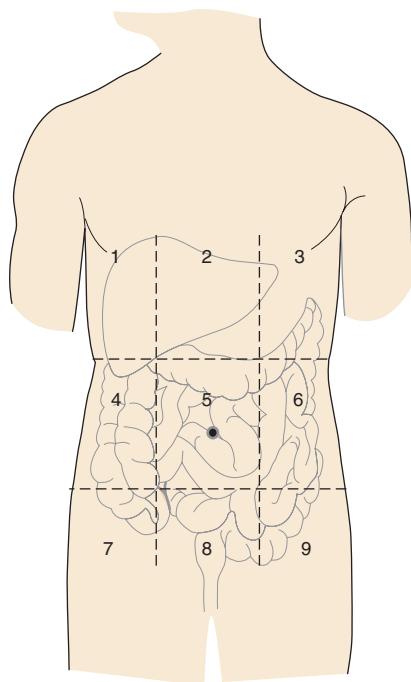
**Figure 5-3** Planes of the body.

## 5.4 Abdominopelvic Regions

### PRACTICE FOR LEARNING: **Abdominopelvic Regions**

Write the words below in the correct spaces beside Figure 5-4. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. right hypochondriac region (**high-poh-KON-dree-ack**)
2. epigastric region (**ep-ih-GAS-trick**)
3. left hypochondriac region (**high-poh-KON-dree-ack**)
4. right lumbar region (**LUM-bar**)
5. umbilical region (**um-BILL-ih-cahl**)
6. left lumbar region (**LUM-bar**)
7. right inguinal or iliac region (**ING-gwih-nal** or **ILL-ee-ack**)
8. hypogastric region (**high-poh-GAS-trick**)
9. left inguinal or iliac region (**ING-gwih-nal** or **ILL-ee-ack**)



1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_

**Figure 5-4** Abdominopelvic regions.

Looking at the outside of the body, the abdominopelvic area can be divided into nine regions. As you can see in Figure 5-4, it looks like a tic-tac-toe board. Each region is given a name and each region contains specific organs.

When a patient has pain in the abdominopelvic area, the name of the region is used to communicate the exact location of the pain. For example, a physician may say, “The pain is in the right iliac region.” This means the pain is located in the patient’s right hip area.

When you are looking at illustrations, be careful to remember that the right and left abdominal regions refer to the patient’s right or left, not yours.

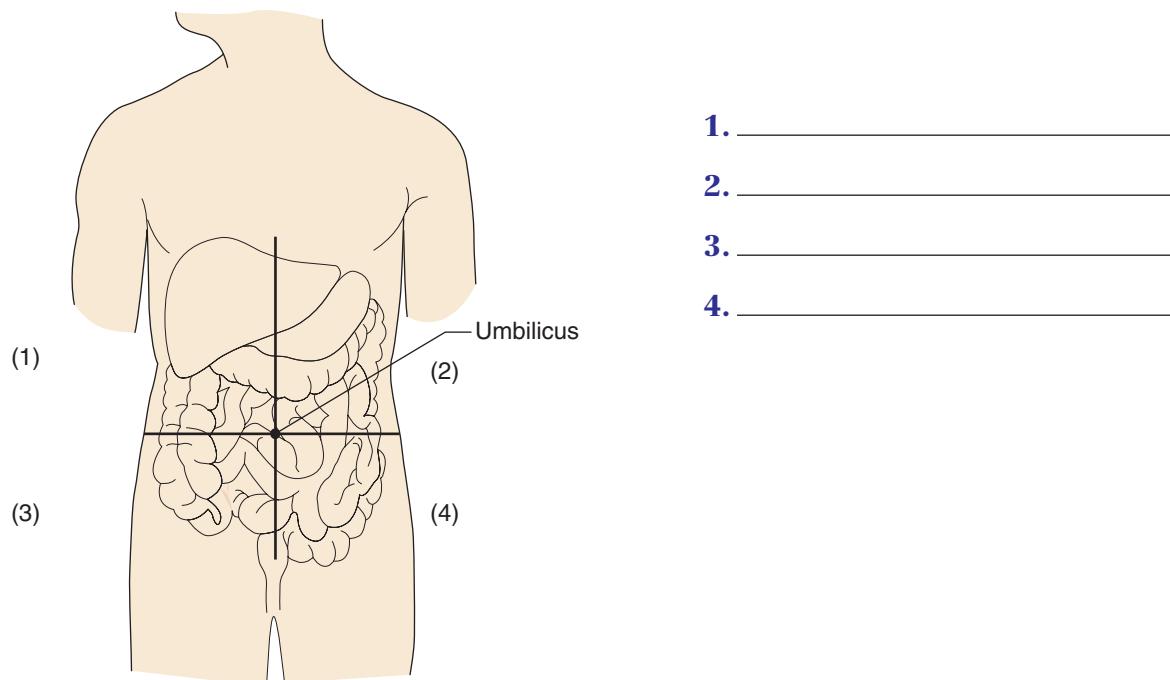
## 5.5 Abdominopelvic Quadrants

### PRACTICE FOR LEARNING: Abdominopelvic Quadrants

Write the words below in the correct spaces beside Figure 5-5. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. right upper quadrant (RUQ)
2. left upper quadrant (LUQ)
3. right lower quadrant (RLQ)
4. left lower quadrant (LLQ)

The abdominopelvic area can also be divided into four areas called quadrants (Figure 5-5).



**Figure 5-5** Abdominopelvic quadrants.

## 5.6 New Roots, Suffixes, and Prefixes

Use these additional roots when studying the medical terms of this chapter.

ROOT	MEANING
<b>anter/o</b>	front
<b>dors/o</b>	back
<b>ili/o</b>	hip
<b>infer/o</b>	below; downward
<b>inguin/o</b>	groin
<b>medi/o</b>	middle
<b>poster/o</b>	back
<b>proxim/o</b>	near
<b>super/o</b>	above; toward the head
<b>ventr/o</b>	front
<b>vertebr/o</b>	vertebra (any of 33 bones making up the spine)

## 5.7 Learning the Terms

Use the following suggestions for learning medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

### Suffixes

SUFFIX -ac		MEANING pertaining to
Term	Term Analysis	Definition
<b>iliac</b> (ILL-ee-ack)	ili/o = hip	pertaining to the hip

Term	Term Analysis	Meaning pertaining to
SUFFIX -al		Definition
<b>abdominal</b> (ab- <b>DOM</b> -ih-nal)	abdomin/o = abdomen (The abdomen is the portion of the body between the chest and pelvis)	pertaining to the abdomen
<b>cranial</b> (KRAY-nee-al)	crani/o = skull	pertaining to the skull
<b>dorsal</b> (DOR-sal)	dors/o = back	pertaining to the back of the body or organ; posterior (Figure 5-2B)
<b>inguinal</b> (ING-gwih-nal)	inguin/o = groin (the groin is the fold between the thigh and lower abdomen)	pertaining to the groin
<b>lateral</b> (LAT-er-al)	later/o = side	pertaining to the side (Figure 5-2A)
<b>medial</b> (MEE-dee-al)	medi/o = middle	pertaining to the middle (Figure 5-2A)
<b>proximal</b> (PROCK-sih-mal)	proxim/o = near; close to	pertaining to something being near a specific point (Figure 5-2A)
<b>spinal</b> (SPYE-nal)	spin/o = spine; vertebral column	pertaining to the spine
<b>ventral</b> (VEN-tral)	ventr/o = front	pertaining to the front; anterior (Figure 5-2B)
<b>vertebral</b> (VER-teh-bral)	vertebr/o = vertebra	pertaining to any one of the 33 bones making up the spine
<b>visceral</b> (VIS-er-al)	viscer/o = internal organs	pertaining to the internal organs

### Helping You Remember

The combining form is spelled abdomin/o. The word is spelled abdomen.

SUFFIX -ic		MEANING pertaining to
Term	Term Analysis	Definition
<b>epigastric</b> (ep-ih-GAS-trick)	epi- = above; upon gastr/o = stomach	pertaining to upon the stomach (Figure 5-4)
<b>pelvic</b> (PEL-vick)	pelv/o = pelvis	pertaining to the pelvis
thoracic (thoh-RAS-ick)	thorac/o = chest	pertaining to the chest

SUFFIX -ior		MEANING pertaining to
Term	Term Analysis	Definition
<b>anterior</b> (an-TEER-ee-or)	anter/o = front	pertaining to the front (Figure 5-2B)
<b>inferior</b> (in-FEER-ee-or)	infer/o = below; downward	pertaining to below or in a downward position; a structure below another structure (Figure 5-2B)
<b>posterior</b> (pos-TEER-ee-or)	poster/o = back	pertaining to the back of the body or an organ (Figure 5-2B)
<b>superior</b> (soo-PEER-ee-or)	super/o = above; toward the head	pertaining to above or toward the head (Figure 5-2B)

## 5.8 Review Exercises

### EXERCISE 5-1 Matching Word Parts with Meaning

Match the meaning in Column A with the word part in Column B.

Column A	Column B
_____ 1. hip	A. gastr/o
_____ 2. back	B. thorac/o
_____ 3. near	C. anter/o
_____ 4. above; upon	D. -ic
_____ 5. stomach	E. ili/o

<b>Column A</b>	<b>Column B</b>
_____	6. below
_____	7. front
_____	8. pertaining to
_____	9. chest
_____	10. skull
	F. epi-
	G. crani/o
	H. dors/o
	I. infer/o
	J. proxim/o

### EXERCISE 5-2 Directional Terms

Match each directional term in Column A with its meaning in Column B.

<b>Column A</b>	<b>Column B</b>
_____	1. superior
_____	2. anterior
_____	3. thoracic
_____	4. visceral
_____	5. epigastric
_____	6. iliac
_____	7. cranial
_____	8. hypogastric
	A. pertaining to the skull
	B. pertaining to the hip
	C. above; toward the head
	D. pertaining to the front
	E. pertaining to below the stomach
	F. pertaining to upon the stomach
	G. pertaining to the chest
	H. pertaining to internal organs

### EXERCISE 5-3 Defining Directional Terms

Underline the root and then define the medical word. The first question is answered for you.

1. **hypogastric** pertaining to below the stomach \_\_\_\_\_
2. **iliac** \_\_\_\_\_
3. **dorsal** \_\_\_\_\_
4. **inguinal** \_\_\_\_\_
5. **visceral** \_\_\_\_\_
6. **cranial** \_\_\_\_\_
7. **anterior** \_\_\_\_\_
8. **superior** \_\_\_\_\_

**EXERCISE 5-4 True/False**

*Circle True if the statement is correct. Circle False if the statement is not correct.*

- |   |      |       |
|---|------|-------|
| 1. The liver is located in the pelvic cavity.                   | True | False |
| 2. The abdominal cavity is superior to the thoracic cavity.     | True | False |
| 3. The small toe is medial to the big toe.                      | True | False |
| 4. The wrist is proximal to the elbow.                          | True | False |
| 5. Prone is lying on the abdomen.                               | True | False |
| 6. The right iliac region is in the right upper quadrant.       | True | False |
| 7. Dorsum refers to the back of a structure                     | True | False |
| 8. The right hypochondriac region of the abdomen is in the RUQ. | True | False |

**EXERCISE 5-5 Spelling**

*Circle the words that are spelled incorrectly in the list below. Then correct the spelling in the space provided.*

1. epigastric \_\_\_\_\_
2. abdominal \_\_\_\_\_
3. inquinal \_\_\_\_\_
4. thorasic \_\_\_\_\_
5. vicseral \_\_\_\_\_
6. anterior \_\_\_\_\_
7. medial \_\_\_\_\_

**Animation**

Watch a video on Body Planes.

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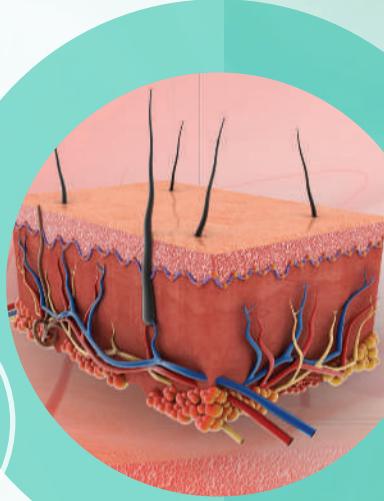
**5.9 Pronunciation and Spelling**

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

Word	Pronunciation	Spelling
<b>epigastric</b>	<b>ep-ih-GAS-trick</b>	
<b>hypogastric</b>	<b>high-poh-GAS-trick</b>	
<b>iliac</b>	<b>ILL-ee-ack</b>	
<b>abdominal</b>	<b>ab-DOM-ih-nal</b>	
<b>cranial</b>	<b>KRAY-nee-al</b>	
<b>dorsal</b>	<b>DOR-sal</b>	
<b>inguinal</b>	<b>ING-gwih-nal</b>	
<b>medial</b>	<b>MEE-dee-al</b>	
<b>proximal</b>	<b>PROCK-sih-mal</b>	
<b>spinal</b>	<b>SPYE-nal</b>	
<b>ventral</b>	<b>VEN-tral</b>	
<b>visceral</b>	<b>VIS-er-al</b>	
<b>pelvic</b>	<b>PEL-vick</b>	
<b>thoracic</b>	<b>thoh-RAS-ick</b>	
<b>inferior</b>	<b>in-FEER-ee-or</b>	
<b>posterior</b>	<b>pos-TEER-ee-or</b>	
<b>superior</b>	<b>soo-PEER-ee-or</b>	

## CHAPTER 6

# Skin: The Integumentary System



### Chapter Outline

- 6.1** Skin and Subcutaneous Tissue
- 6.2** Accessory Structures
- 6.3** New Roots, Suffixes, and Prefixes
- 6.4** Learning the Terms
- 6.5** Pathology
- 6.6** Look-Alike and Sound-Alike Words
- 6.7** Review Exercises
- 6.8** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the exercises, you should be able to do the following:*

- 1.** Identify the cells, tissues, and accessory structures of the system.
- 2.** Identify the layers of the skin and describe the structures found in these layers.
- 3.** List the functions of the skin.
- 4.** Pronounce, spell, define, and write medical terms common to this system.
- 5.** Describe common diseases of the system.
- 6.** Listen, read, and study, so you can speak and write.

## Introduction

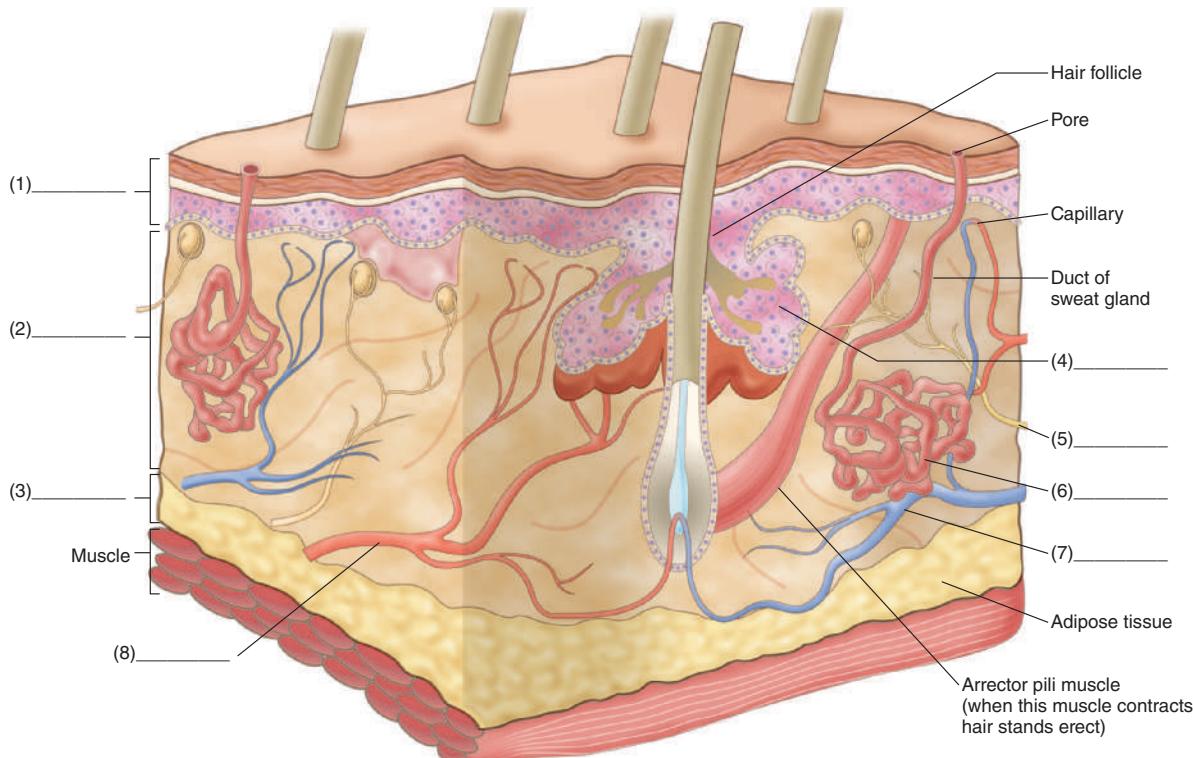
The body is covered with skin, nails, and hair. Together with glands found in the skin they make up the integumentary (*in-teg-yoo-MEN-tar-ee*) system. It gets its name from the Latin word *integumentum* meaning “covering.”

The skin is an organ, just like the heart and lungs. It is the largest organ in the body. The skin has two layers. The outer layer (epidermis) helps prevent harmful substances from entering the body. The inner layer (dermis) contains glands that secrete important substances, nerves that carry electrical impulses, and blood vessels that help keep the body at the right temperature.

### 6.1 Skin and Subcutaneous Tissue

#### PRACTICE FOR LEARNING: Layers of the Skin and Subcutaneous Tissue

Write the words below in the correct spaces on Figure 6-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say. Only numbers 1–3 will be labeled here.



**Figure 6-1** Layers of the skin and subcutaneous tissue. Structures associated with the dermis.

1. epidermis (**ep-ih-DER-mis**)
2. dermis (**DER-mis**)
3. subcutaneous tissue (**sub-kyoo-TAY-nee-us TISH-yoo**)

Figure 6-1 shows you the layers of tissue. The outer layer is part of the skin and is called the epidermis. Underneath it is another layer of skin called the dermis. Underneath the dermis is a fatty layer called subcutaneous tissue. It is not part of the skin. The subcutaneous tissue attaches the skin to muscles close to the surface.

### In Brief

The **epidermis** is the outer layer of skin.

The **dermis** is under the epidermis.

**Subcutaneous** tissue is under the dermis.

## Epidermis

In Chapter 2, you learned that organs are made of tissues and tissues are made of cells. The epidermis is an organ made of tissue called **epithelium** (**ep-ih-THEE-lee-um**). The cells are called **epithelial** (**ep-ih-THEE-lee-al**) cells. The epidermis is a protective covering over the entire body and lines body cavities and covers organs.

The epidermis protects us from the sun's rays by producing **melanin** (**MEL-ah-nin**). Melanin is produced by cells in the epidermis called **melanocytes** (**meh-LAN-oh-sights**). Darker skin has more melanocytes than lighter skin. Skin with more melanin has better protection from the sun.

Skin also protects by keeping infectious materials from entering the body and it waterproofs the body and prevents fluid loss.

### In Brief

#### Epidermis

Protects from sun, infection, and fluid loss

## Dermis

### PRACTICE FOR LEARNING: Dermis

Write the words below in the correct spaces in Figure 6-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

4. sebaceous (seh-BAY-shus) gland
5. nerve (**NURV**)

**6. sweat gland (SWET GLAND)****7. vein (VAYN)****8. artery (AR-ter-ee)**

The dermis is made of connective tissue. A major component of connective tissue is **collagen** (**KOL-ah-jen**), which makes the skin flexible and strong.

If you look at Figure 6-1, you can see that the dermis contains blood vessels. If you are cut down to this layer, you will bleed. The blood vessels supply nutrients to the epidermis and dermis. They also help control body temperature.

The dermis also contains nerves. They give us sensations such as touch, pain, temperature, and pressure. Also in the dermis are glands and hair follicles. These parts are discussed below under the heading Accessory Structures.

**In Brief**

The organs located in the **dermis** are: blood vessels, nerves, glands, and hair follicles.

## Subcutaneous Tissue

Subcutaneous tissue is deep to the dermis and is composed of mostly adipose (**AD-**ih-pohs) tissue. Its cells are called adipocytes. Besides storing fat, this layer loosely connects the skin to the underlying muscles and protects us from injury. It is also known as **superficial fascia** (**FASH-ee-ah**). Fascia is connective tissue that holds parts together. In this case, it holds the skin to the muscles. It is called superficial fascia because the subcutaneous tissue is closer to the surface of the body than the fascia surrounding the muscle.

### PRACTICE FOR LEARNING: Epidermis and Dermis

Choose the correct answer from the choices in parentheses.

- 1.** The function of the epidermis is (protection/sensation).
- 2.** The tissue making up the epidermis is (epithelial/connective) tissue.
- 3.** The substance that gives the skin a darker color is (melanin/sebum).
- 4.** The dermis is made of (epithelial/connective) tissue.
- 5.** A function of the blood vessels in the dermis is (sensation/temperature regulation).
- 6.** Collagen is most likely to be found in the (epithelial/connective/muscle) tissue.

7. Superficial fascia is also known as (epidermis/ dermis/ subcutaneous tissue).
8. Adipocytes are (skin/fat) cells commonly found in the (epidermis/dermis/ superficial fascia).

Answers: 1. protection. 2. epithelial. 3. melanin. 4. connective. 5. temperature regulation. 6. connective. 7. subcutaneous tissue. 8. fat; superficial fascia

## 6.2 Accessory Structures

### Glands

There are glands in the dermis that secrete substances necessary for skin function. **Sebaceous** glands secrete oil called **sebum** (SEE-bum). It keeps the skin and the hair soft and pliable (flexible). **Sweat** glands help regulate temperature by secreting sweat onto the surface of the skin. When the sweat evaporates, the skin cools. Specialized glands in the ear named **ceruminous** (seh-ROO-min-us) glands secrete **cerumen** (seh-ROO-men), a waxy substance that helps prevent bacterial infection.

### Hair Follicles

There are also hair follicles in the dermis (Figure 6-1). They grow the hairs that cover our skin in certain places. When hair is lost on top of the head, the person is said to be bald. The medical word for bald is **alopecia** (al-oh-PEE-she-ah). The opposite, the presence of excessive body and facial hair, especially in women, is called **hirsutism** (HER-soot-iz-um).

### Nails

Nails are protective coverings on the ends of fingers and toes. Nails are epithelial cells that have been hardened. At the base of each nail is the white, half-moon shaped **lunula** (LOO-nuh-lah). The word “luna” means moon. It is from the lunula that the nail grows. Other anatomical structures are the **nail bed** and the cuticle or **eponychium** (ep-oh-NICK-ee-um).

### In Brief

#### Accessory Structures

glands, hair, nails

#### Glands

sebaceous, sweat, ceruminous

#### Nails

includes lunula, nail bed, eponychium

## 6.3 New Roots, Suffixes, and Prefixes

Use these additional roots, suffixes, and prefixes when studying the terms in this chapter.

ROOT	MEANING
<b>chem/o</b>	drug
<b>cry/o</b>	cold
<b>crypt/o</b>	hidden
<b>melan/o</b>	black
<b>myc/o</b>	fungus
<b>staphyl/o</b>	resembling a bunch of grapes
<b>strept/o</b>	twisted
<b>xer/o</b>	dry

SUFFIX	MEANING
<b>-cle</b>	small
<b>-edema</b>	swelling
<b>-ion</b>	process
<b>-ium</b>	structure
<b>-ose</b>	pertaining to
<b>-sis</b>	condition

PREFIX	MEANING
<b>tele-</b>	distant

## 6.4 Learning the Terms

Use the following suggestions for learning medical terms.

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

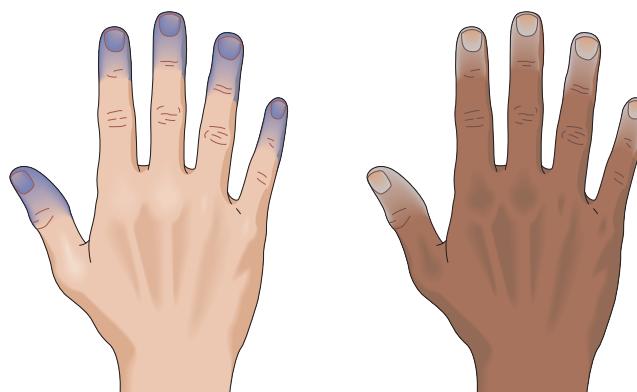
## Roots

ROOT <b>adip/o</b> (see also lip/o)		MEANING fat
Term	Term Analysis	Definition
<b>adipose</b> (AD-ih-pohs)	-ose = pertaining to	pertaining to fat

ROOT <b>bi/o</b>		MEANING life
Term	Term Analysis	Definition
<b>biopsy</b> (BYE-op-see)	-opsy = to view	a procedure involving the removal of a piece of living tissue, which is then examined for any abnormalities

ROOT <b>cutane/o</b> (see also derm/o and dermat/o)		MEANING skin
Term	Term Analysis	Definition
<b>subcutaneous</b> (sub-kyoo-TAY-nee-us)	sub- = under -ous = pertaining to	pertaining to under the skin

ROOT <b>cyan/o</b>		MEANING blue
Term	Term Analysis	Definition
<b>cyanosis</b> (sigh-ah-NOH-sis)	-sis = condition	bluish discoloration of skin (Figure 6-2)



**Figure 6-2** Cyanosis.

ROOT <b>derm/o; dermat/o</b>		MEANING skin
Term	Term Analysis	Definition
<b>dermatitis</b> (der-mah-TYE-tis)	-itis = inflammation	inflammation of the skin
<b>dermatologist</b> (der-mah-TOL-oh-jist)	-logist = one who specializes in the study of	one who specializes in the study of the skin and its diseases
<b>hypodermic</b> (high-poh-DER-mick)	-ic = pertaining to hypo- = under; below	pertaining to under the skin

**Note:** The prefixes hypo- and sub- cannot be interchanged with the roots meaning skin. Hypo- is used with the root **derm/o**, and sub- is used with the root **cutane/o**.

ROOT <b>erythem/o</b>		MEANING red
Term	Term Analysis	Definition
<b>erythema</b> (er-ih-THEE-mah)	“-a” is a noun ending	red discoloration of the skin
<b>erythematous</b> (er-ih-THEM-ah-tus)	-ous = pertaining to	pertaining to redness of the skin

ROOT <b>kerat/o</b>		MEANING hard; horn-like
Term	Term Analysis	Definition
<b>keratosis</b> (ker-ah-TOH-sis)	-osis = abnormal condition	any skin growth, such as a wart or callus, in which there is overgrowth or thickness of the skin

ROOT <b>lip/o</b>		MEANING fat
Term	Term Analysis	Definition
<b>lipedema</b> (lip-eh-DEE-mah)	-edema = swelling	chronic abnormal condition that is characterized by the accumulation of fat and fluid in the tissues just under the skin of the hips and legs.

Term	Term Analysis	Definition
<b>lipoma</b> (lih-POH-mah)	-oma = tumor; mass	tumor or mass containing fat
<b>liposuction</b> (lip-oh-SUCK-shun)	suction = process of aspirating or withdrawing	withdrawal of fat from the subcutaneous tissue

ROOT necr/o		MEANING death
Term	Term Analysis	Definition
<b>necrotic tissue</b> (neh-KROT-ick)	-tic = pertaining to	pertaining to the death of tissues. Example: decubitus ulcer (Figure 6-3)



SPL/Science Source

**Figure 6-3** Decubitus ulcer (pressure sore, bedsore).

**Note:** Decubitus means lying down. A **decubitus** (deh-KYOU-bih-tus) ulcer is also known as a pressure sore or bedsore. It is caused by lying on a body part for too long. This puts constant pressure on the skin, especially over bony areas such as elbows. The pressure cuts off the circulation to the part. The skin becomes necrotic (dies) because of the lack of oxygen. When necrotic tissue is sloughed (falls off), it leaves an open sore (Figure 6-3). Figure 6-6c illustrates necrotic tissue before it is sloughed. In this case the necrosis is from a burn.

ROOT onych/o (see ungu/o)		MEANING nail
Term	Term Analysis	Definition
<b>eponychium</b> (ep-oh-NICK-ee-um)	-ium = structure epi- = upon	structure upon the nail; cuticle
<b>onychocryptosis</b> (on-ih-koh-krip-TOH-sis)	-osis = abnormal condition crypt/o = hidden	in-grown toenail
<b>onychomycosis</b> (on-ih-koh-my-KOH-sis)	-osis = abnormal condition myc/o = fungus	<b>fungal</b> infection of the nail; also known as tinea unguium (TIN-ee-ah UNG-gwim)

ROOT <b>pedicul/o</b>		MEANING lice
Term	Term Analysis	Definition
<b>pediculosis</b> (peh-dick-yoo-LOH-sis)	-osis = abnormal condition	infestation with lice

ROOT <b>ras/o</b>		MEANING scrape
Term	Term Analysis	Definition
<b>abrasion</b> (ab-RAY-zhun)	-ion = process ab- = away from	scraping away of the superficial layers of injured skin; for example, scraping your skin on the cement results in an abrasion. Also known as an <b>excoriation</b> (ecks-kor-ee-AY-shun)

ROOT <b>ungu/o</b>		MEANING nail
Term	Term Analysis	Definition
<b>subungual</b> (sub-UNG-gwal)	-al = pertaining to sub- = under	pertaining to under the nail

ROOT <b>vesic/o</b>		MEANING small sac; bladder
Term	Term Analysis	Definition
<b>vesicle</b> (VES-ih-kul)	-cle = small	a blister; a small elevation on the skin filled with clear fluid

## Suffixes

SUFFIX <b>-coccus</b>		MEANING berry-shape
Term	Term Analysis	Definition
<b>staphylococcus</b> (staf-ih-loh-KOCK-us)	staphyl/o = resembling a bunch of grapes	berry-shaped bacteria growing in small clusters, like grapes
<b>streptococcus</b> (strep-toh-KOCK-us)	strept/o = resembling twisted chains	berry-shaped bacteria growing in twisted chains

SUFFIX -cyte		MEANING
Term	Term Analysis	Definition
<b>melanocyte</b> (meh-LAN-oh-sight)	melan/o = black	cells producing melanin

SUFFIX -derma		MEANING
Term	Term Analysis	Definition
<b>scleroderma</b> (skler-oh-DER-mah)	scler/o = hard	skin becomes hard and swollen because the connective tissues become thick and hard
<b>xeroderma</b> (zer-oh-DER-mah)	xer/o = dry	extreme dryness of the skin

SUFFIX -therapy		MEANING
Term	Term Analysis	Definition
<b>chemotherapy</b> (kee-moh-THER-ah-pee)	chem/o = drugs	treatment with drugs. Usually refers to the use of drugs on cancer patients.
<b>cryotherapy</b> (krye-oh-THER-ah-pee)	cry/o = cold	destruction of unwanted tissue, such as warts, by freezing with liquid nitrogen. The freezing destroys the tissue (Figure 6-4).



**Figure 6-4** Cryotherapy.

Term	Term Analysis	Definition
<b>laser therapy</b> (LAY-zer THER-ah-pee)	laser = intense beam of light	removal of skin lesions such as birthmarks or tattoos using an intense beam of light called a laser. Lasers are also used in cosmetic surgeries.

**Note:** In this example, therapy is used as a word rather than a suffix.

<b>radiotherapy</b> (ray-dee-oh-THER-ah-pee)	radi/o = x-rays	the use of radiation to treat disease, usually cancer. Radiotherapy is not used to diagnose disease.
<b>teletherapy</b> (tel-eh-THER-ah-pee)	tele- = distant	radiation treatment applied to a tumor at a distance from the body

## 6.5 Pathology

### Burns

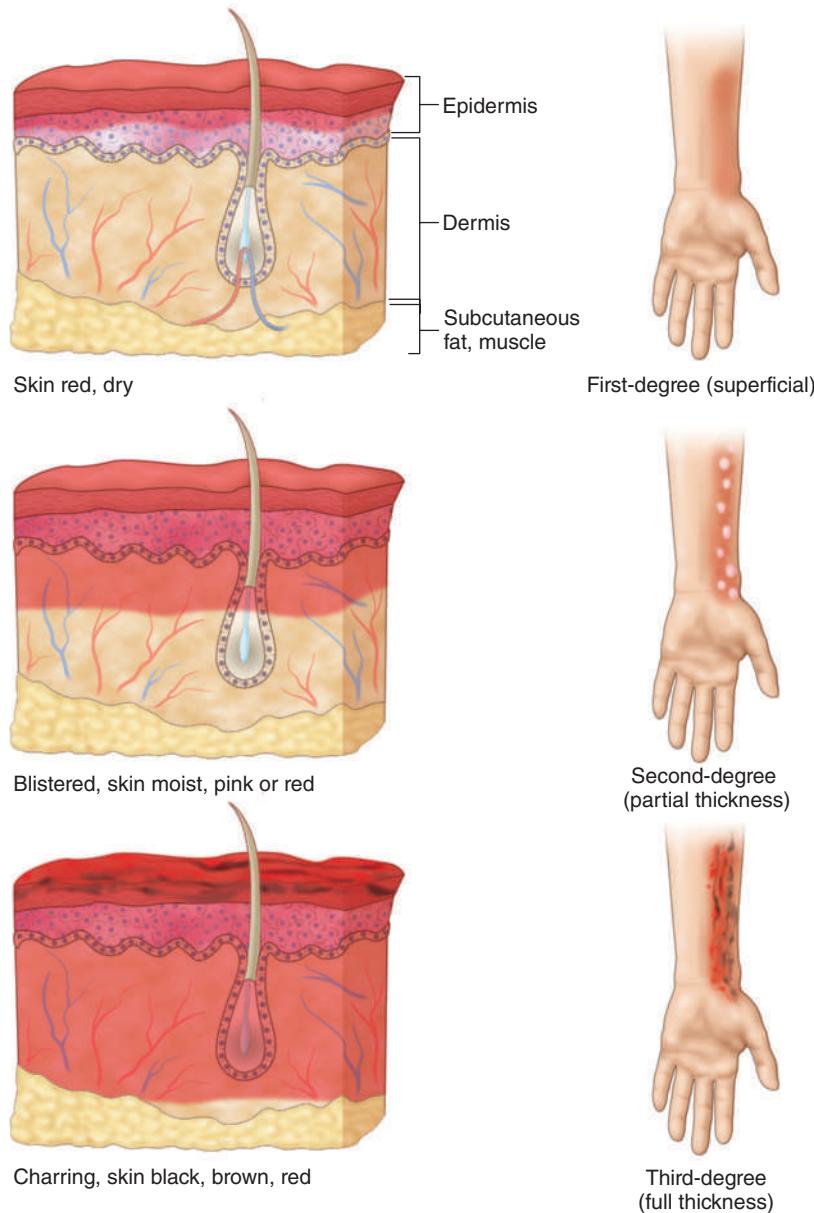
A burn is an injury to the skin caused by heat, chemicals, electricity, or radiation. Burns can be described by how deep the burn is and by the area of skin burned. Look at Figures 6-5 and 6-6 as you read the descriptions below:

- **First-degree burn (superficial burn)** is a burn to the epidermis only. There is redness but no vesicles (blisters). An example is a sunburn.
- **Second-degree burn (partial-thickness burn)** involves the epidermis and upper portion of the dermis. The skin is red. There are vesicles (blisters).
- **Third-degree burn (full-thickness burn)** involves the epidermis and all of the dermis. The subcutaneous tissue may be damaged.
- **Fourth-degree burn** involves the epidermis, dermis, subcutaneous tissue, and muscle.

### Bruises

A bruise is a discoloration to the skin from a ruptured blood vessel. The skin is not broken and blood accumulates in the tissue spaces. A bruise, is also known as a **contusion** (kon-TOO-zhun). Bruises can take on different looks each with a different name. These are listed below:

- **Ecchymosis** (ek-ih-MOH-sis) (plural ecchymoses) is a large, irregular area of purplish discoloration (Figure 6-7A).



**Figure 6-5** Superficial (first degree), partial thickness (second degree), and full thickness (third degree). The degree of the burn is determined by the layers of skin involved.

- **Hematoma** is a mass or collection of blood causing a swelling under the skin. Hematomas are often named after their location. For example, **subungual hematoma**.
- **Petechiae** (peh-TEE-kee-ee) are small pinpoint hemorrhages under the skin (Figure 6-7B).
- **Purpura** (PER-per-ah) is a broad term that includes a number of conditions characterized by bleeding into the skin such as ecchymoses and petechiae. Purpura means purple, the color of the bruise (Figure 6-7C).



**Figure 6-6** Burns. A. First-degree burn. B. Second-degree burn. C. Third-degree burn. D. Fourth-degree burn.  
(All photographs courtesy of the Phoenix Society for Burn Survivors, Inc.)

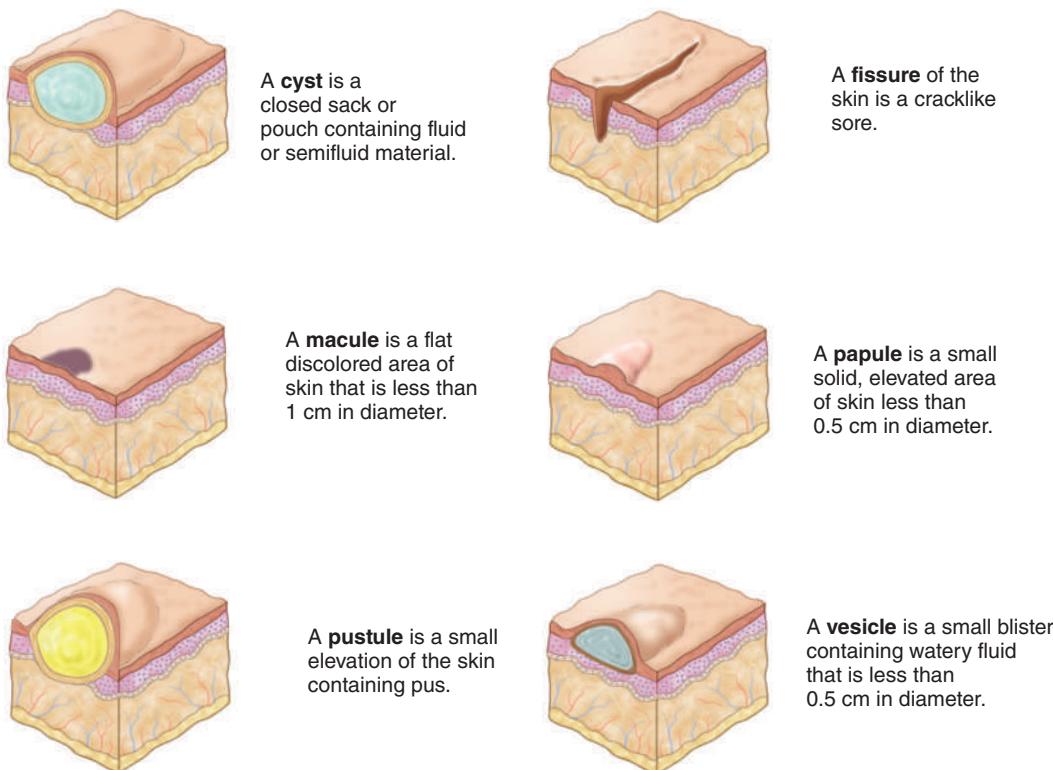


**Figure 6-7** A. Ecchymoses. B. Petechiae. C. Purpura: Purple discoloration of skin. Ecchymosis and petechiae are examples of purpura.

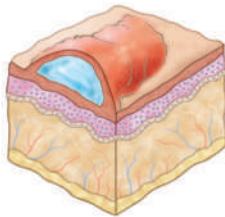
## Cutaneous Lesions (LEE-zhunz)

A skin lesion is any abnormality caused by disease or injury (trauma). Any deviation from the normal appearance of the skin can be called a lesion. Distinguishing the various kinds of skin lesions is important, since they characterize specific diseases. (Figure 6-8A-G)

- **Cicatrix** (**sick-ah-TRICKS**) is normal scar tissue resulting from the normal healing of a wound.
- **Cyst** (**SIST**) is a small closed sac or cavity filled with fluid or semifluid. Example: ovarian cyst (Figure 6-8A)
- **Fissure** is a crack-like sore. Often seen on the heels and between the toes when the skin is very dry (Figure 6-8B).
- **Macule** (**MACK-yool**) is a discolored, unelevated area of skin. Example: birthmarks (Figure 6-8C)
- **Papule** (**PAP-yool**) is a solid, elevated area of skin. Example: acne (Figure 6-8D)
- **Pustule** (**PUS-tyool**) is a small, elevated area of skin that contains pus. Example: acne, abscess (Figure 6-8E)
- **Vesicle** is an elevated area of skin containing clear fluid. Example: blister (Figure 6-8F). A blister larger than 0.5 cm is called a **bulla** (**BOO-lah**).



**Figure 6-8** Cutaneous Lesions. A. Cyst. B. Fissure. C. Macule. D. Papule. E. Pustule. F. Vesicle.



A **wheal** is a raised circular area of skin usually pale in center, surrounded by redness.

**Figure 6-8** G. Wheal (continued).

- **Wheal (WHEEL)** is a raised, circular area of skin usually pale in the center, surrounded by redness. Example: mosquito bite and hives (also known as **urticaria**) (yoo-tih-KEHR-ee-ah) (Figure 6-8G).

## Exanthem

**Exanthem** (egg-ZAN-thum) is a widespread rash.

## Infections

### Bacterial Infections

- **Furuncle (FYOO-run-kul)** are also known as boils. They are large, tender, swollen areas around hair follicles or sebaceous glands. A cluster of boils is called a **carbuncle (KAR-bun-kul)**. Boils are caused by a staphylococcus infection.
- **Cellulitis (sell-yoo-LYE-tis)** is an inflammation of the connective tissue underlying the epidermis caused by staphylococcus or streptococcus.
- **Impetigo (im-peh-TYE-goh)** is a superficial but highly contagious skin infection that usually affects infants and children. Characteristic red sores appear on the face.
- **Necrotizing fascitis (NEK-roh-tye-zing fah-SIGH-tis)** is a severe infection caused by streptococcus bacteria causing inflammation of the fascia and resulting in tissue death. If left untreated, the infected body tissue becomes necrotic. Can be fatal. Also known as flesh-eating disease.

### Fungal Infections

- **Candidiasis (kan-dih-DYE-ah-sis)** is a yeast infection occurring on the skin and mucous membrane. Also known as **moniliasis (mon-ih-LYE-eh-sis)**. If the fungus appears in the oral cavity, the condition is called **thrush**. The mucous membrane of the vagina can also be affected, resulting in an inflamed vagina.
- **Tinea (TIN-ee-ah)** is a fungal infection that can grow on skin, hair, and nails.



**Figure 6-9** Psoriasis. (Courtesy of Robert A. Silverman, MD, Pediatric Dermatology, Georgetown University.)

### Viral Infection

- **Verrucae** (veh-ROO-see) are small, hard skin lesions caused by the human papillomavirus. Verrucae is commonly known as warts.

### Psoriasis (sor-EYE-ah-sis)

Psoriasis is a chronic inflammation of the skin (Figure 6-9). The skin appears erythematous (red), with silvery scales. Symptoms include xeroderma and pruritus (proo-EYE-tus). Pruritus means itchy. Psoriasis is not infectious.

### Tumors, Neoplasms

An abnormal growth of tissue cells. Tumors can be **benign** or **malignant**. Benign tumors are noncancerous, usually harmless, and do not spread from one location to another. Malignant tumors are cancerous and harmful and usually spread or **metastasize** (meh-TAS-tah-size). Common benign and malignant tumors are listed below. Treatment involves removal of the tumor by surgery, laser, radiation, and/or chemotherapy.

#### Benign Tumors

- **Papilloma** (pap-ih-LOH-mah) a benign nipple-like growth projecting from epithelial tissue (papill/o = nipple). Example: a wart.
- **Lipoma** (lih-POH-mah) is a benign tumor of fatty tissue.

#### Malignant Tumors

- **Carcinoma** (kar-sih-NOH-mah) is a malignant tumor of epithelial cells. Two types are basal (**BAY**-sal) cell and squamous (**SKWAY**-mus) cell carcinomas.



**Figure 6-10** Carcinoma of the skin. A. Basal cell carcinoma. B. Squamous cell carcinoma.

(Courtesy of Robert A. Silverman, MD, Pediatric Dermatology, Georgetown University.)



**Figure 6-11** Melanoma. (Courtesy of Robert A. Silverman, MD, Pediatric Dermatology, Georgetown University.)

- **Basal cell carcinoma** is a malignant tumor of the epidermis. Unlike other malignant skin cancers, it rarely spreads to other locations (Figure 6-10A).
- **Squamous cell carcinoma** is also a malignant tumor of the epidermis. It has a tendency to spread to other organs (Figure 6-10B).
- **Melanoma (mel-ah-NOH-mah)** is a malignant tumor arising from the melanocytes in the epidermis (Figure 6-11).
- **Sarcoma (sar-KOH-mah)** is a malignant tumor arising from connective tissues of the skin. One example is Kaposi sarcoma, a type of skin cancer that is a typical complication of AIDS.

Basal cell carcinoma, squamous cell carcinoma, and some types of melanomas are most commonly treated by Mohs (**MOHZ**) surgery. This type of surgery removes cancerous tissues in layers. This limits the loss of normal tissue and provides the highest cure rate.

### Helping You Remember

Mohs surgery is an eponym. A disease named for the person who discovered or described it first. Eponyms can also apply to structures, operations, and procedures.

## 6.6 Look-Alike and Sound-Alike Words

*Below is a list of look-alike and sound-alike words. Study the definitions of each set of words. Questions will follow in the Review Exercises.*

**TABLE 6-1 Look-Alike and Sound-Alike Words**

<b>ablation</b>	treatment that involves the excision of body tissue or the destruction of its function through surgery, hormones, drugs, heat, chemicals, or electricity
<b>abrasion</b>	an injury caused by scraping
<b>glands</b>	organs that secrete chemicals
<b>glans</b>	the tip of the penis (glans penis)
<b>patience</b>	showing self-control
<b>patients</b>	persons under medical care
<b>vesical</b>	pertaining to the bladder
<b>vesicle</b>	blister
<b>plantar</b>	the sole of the foot
<b>planter</b>	container for a plant
<b>cirrhosis</b>	any chronic disease of the liver
<b>psoriasis</b>	skin condition characterized by silvery scales
<b>Mohs</b>	surgery for melanoma
<b>mow</b>	to mow (cut) the lawn with a lawnmower
<b>wheal</b>	a raised, circular area of skin, usually pale in the center, and surrounded by redness
<b>wheel</b>	round object that turns, such as the wheel on a bicycle

## 6.7 Review Exercises

### EXERCISE 6-1 Look-Alike and Sound-Alike Words

*Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 6-1 if it helps you.*

1. Genital warts are sexually transmitted. They often appear on the (**glands/glans**) penis.
2. After swallowing the medication, the patient broke out in (**vesicals/vesicles**).

3. Cryotherapy was used to treat the (**plantar/planter**) warts on the bottom of the foot.
  4. All of the (**patients/patience**) showed up at the medical clinic at the same time. It took a lot of (**patients/patience**) to look after them.
  5. The patient has been given a cream to treat his (**cirrhosis/psoriasis**).
  6. After he (**mohs/mows**) the lawn, Juan will travel to the hospital for treatment of his melanoma. (**Mohs/Mows**) surgery will be performed.
  7. During the bike race, rider number 82 fell off the bike and slid on the pavement. There was a large (**abrasion/ablation**) extending the length of the thigh.
  8. Following antibiotic treatment for a urinary tract infection, Georgia broke out in (**wheals/wheels**) on 80 percent of her body.

## EXERCISE 6-2 Matching Word Parts with Meanings

*Match the word part in Column A with its meaning in Column B.*

Column A	Column B
_____	<b>1.</b> adip/o
_____	<b>2.</b> cry/o
_____	<b>3.</b> bi/o
_____	<b>4.</b> cyan/o
_____	<b>5.</b> neocr/o
_____	<b>6.</b> erythema/o
_____	<b>7.</b> radi/o
_____	<b>8.</b> myc/o
_____	<b>9.</b> ras/o
_____	<b>10.</b> -opsy
_____	<b>11.</b> -tic
_____	<b>12.</b> ab-
_____	<b>13.</b> onych/o
_____	<b>14.</b> derm/o
_____	<b>15.</b> -oma
	A. blue
	B. scrape
	C. nail
	D. life
	E. tumor
	F. fungus
	G. fat
	H. pertaining to
	I. away from
	J. skin
	K. cold
	L. death
	M. x-rays
	N. red
	O. to view

## EXERCISE 6-3 Matching Medical Words with Definitions

*Match the term in Column A with its definition in Column B.*

<b>Column A</b>	<b>Column B</b>
_____ 1. epidermis	A. tissue making up the dermis
_____ 2. sebum	B. bald

<b>Column A</b>	<b>Column B</b>
_____	3. alopecia C. pertaining to fat
_____	4. epithelium D. treatment with drugs
_____	5. adipose E. top layer of skin
_____	6. erythema F. scraping away of skin
_____	7. connective G. keeps hair soft
_____	8. chemotherapy H. death of tissue
_____	9. abrasion I. red discoloration
_____	10. necrotic J. tissue making up the epidermis

### EXERCISE 6-4 Word Completion

Complete the medical word by adding the most appropriate word element. The first question is completed for you.

1. A specialist in the study of the skin is a dermatologist.
2. Pertaining to fat is \_\_\_\_\_ ose.
3. Under the skin is \_\_\_\_\_ cutaneous.
4. Under the skin is \_\_\_\_\_ dermic.
5. Pertaining to the death of tissues is \_\_\_\_\_ tic.
6. A tumor or mass containing fat is \_\_\_\_\_ oma.
7. Cell producing melanin is called melano \_\_\_\_\_.
8. Treatment with drugs \_\_\_\_\_ therapy.

### EXERCISE 6-5 Spelling

Circle any misspelled words in the list below and correctly spell them in the space provided.

1. **subqutaneous** \_\_\_\_\_
2. **sebaceous** \_\_\_\_\_
3. **malanin** \_\_\_\_\_
4. **sweet glands** \_\_\_\_\_
5. **epithelial** \_\_\_\_\_
6. **airythemia** \_\_\_\_\_

7. **soriasis** \_\_\_\_\_
8. **metastasize** \_\_\_\_\_
9. **subungual** \_\_\_\_\_
10. **ecchymosis** \_\_\_\_\_

### EXERCISE 6-6 Pathology

Choose the correct answer and write it in the space provided.

1. A term describing a group of boils is \_\_\_\_\_  
carbuncle    ecchymoses    furuncle    petechiae
2. A contusion is another name for \_\_\_\_\_  
boil    bruise    crushed    furuncle
3. A partial-thickness burn is a \_\_\_\_\_ burn  
first-degree    second-degree    third-degree
4. A chronic skin condition characterized by redness and silvery scales is \_\_\_\_\_  
cellulitis    impetigo    psoriasis    xeroderma
5. The term used to describe the spreading of a tumor from one location to another is \_\_\_\_\_  
abrasion    cyanosis    metastasis    necrosis
6. A malignant tumor of connective tissue is called a \_\_\_\_\_  
carcinoma    hematoma    papilloma    sarcoma
7. Staphylococci are \_\_\_\_\_  
bacteria    fungus    parasite    virus
8. Tumors that are noncancerous are said to be \_\_\_\_\_  
benign    malignant    metastatic
9. A wart is an example of a(n) \_\_\_\_\_  
adipoma    carcinoma    lipoma    papilloma
10. A melanoma is generally considered a \_\_\_\_\_ tumor  
benign    malignant

**11.** The term *excoriation* is also known as \_\_\_\_\_

abrasion    erythema    keratosis    pruritus

**12.** A patient complains of red and itchy skin. The medical term for itchy is \_\_\_\_\_

abrasive    erythematous    necrotic    pruritus

**13.** A discolored, unelevated area of skin is a \_\_\_\_\_

vesicle    macule    papule    wheal

**14.** A blister is also known as a \_\_\_\_\_

vesicle    macule    papule    wheal

**15.** A raised, circular area of skin usually pale in the center, surrounded by redness is a \_\_\_\_\_

vesicle    macule    papule    wheal

## Animations

Visit the companion website to watch a video on **burns**.

## 6.8 Pronunciation and Spelling

*Listen, read, and study, so you can speak and write.*

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

Word	Pronunciation	Spelling
abrasion	ab-RAY-zhun	
adipose	AD-ih-pohs	
biopsy	BYE-op-see	
carcinoma	kar-sih-NOH-mah	
cryotherapy	krye-oh-THER-ah-pee	
cyanosis	sigh-ah-NOH-sis	
dermatitis	der-mah-TYE-tis	

Word	Pronunciation	Spelling
<b>dermatologist</b>	<b>der-mah-TOL-oh-jist</b>	
<b>dermis</b>	<b>DER-mis</b>	
<b>epidermis</b>	<b>ep-ih-DER-mis</b>	
<b>epithelial</b>	<b>ep-ih-THEE-lee-al</b>	
<b>epithelium</b>	<b>ep-ih-THEE-lee-um</b>	
<b>eponychium</b>	<b>ep-oh-NICK-ee-um</b>	
<b>erythematous</b>	<b>er-ih-THEM-ah-tus</b>	
<b>hypodermic</b>	<b>high-poh-DER-mick</b>	
<b>keratosis</b>	<b>ker-ah-TOH-sis</b>	
<b>laser therapy</b>	<b>LAY-zer THER-ah-pee</b>	
<b>lipedema</b>	<b>lip-eh-DEE-mah</b>	
<b>lipoma</b>	<b>lih-POH-mah</b>	
<b>liposuction</b>	<b>lip-oh-SUCK-shun</b>	
<b>melanin</b>	<b>MEL-ah-nin</b>	
<b>melanocytes</b>	<b>meh-LAN-oh-sights</b>	
<b>melanoma</b>	<b>mel-ah-NOH-mah</b>	
<b>necrotic</b>	<b>neh-KROT-ick</b>	
<b>onychocryptosis</b>	<b>on-ih-koh-krip-TOH-sis</b>	
<b>onychomycosis</b>	<b>on-ih-koh-my-KOH-sis</b>	
<b>papilloma</b>	<b>pap-ih-LOH-mah</b>	
<b>pruritus</b>	<b>proo-EYE-tus</b>	
<b>psoriasis</b>	<b>sor-EYE-ah-sis</b>	
<b>sebaceous</b>	<b>seh-BAY-shus</b>	
<b>staphylococcus</b>	<b>staf-ih-loh-KOCK-us</b>	
<b>streptococcus</b>	<b>strep-toh-KOCK-us</b>	
<b>subcutaneous</b>	<b>sub-kyoo-TAY-nee-us</b>	
<b>subungual</b>	<b>sub-UNG-gwal</b>	
<b>vesicle</b>	<b>VES-ih-kul</b>	
<b>xeroderma</b>	<b>zer-oh-DER-mah</b>	

## CHAPTER 7

# Skeletal System

### Chapter Outline

- 7.1** Major Bones of the Body
- 7.2** Bone Structure and Function
- 7.3** Vertebral Column
- 7.4** Joints
- 7.5** New Roots, Suffixes, and Prefixes
- 7.6** Learning the Terms
- 7.7** Pathology
- 7.8** Look-Alike and Sound-Alike Words
- 7.9** Review Exercises
- 7.10** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to do the following:*

1. Name and locate the major bones of the body.
2. Describe the structure and functions of bones and joints.
3. Pronounce, spell, and define the medical terms related to the skeletal system.
4. Describe the common diseases related to the skeletal system.
5. Listen, read, and study so you can speak and write.

### Introduction

The skeletal system is made up of 206 bones. They are attached to each other at joints. In this chapter you will learn about the location of the major bones, the structure of bones, and how bones contribute to body function. You will also learn about the structure of joints and how they function to produce movement.

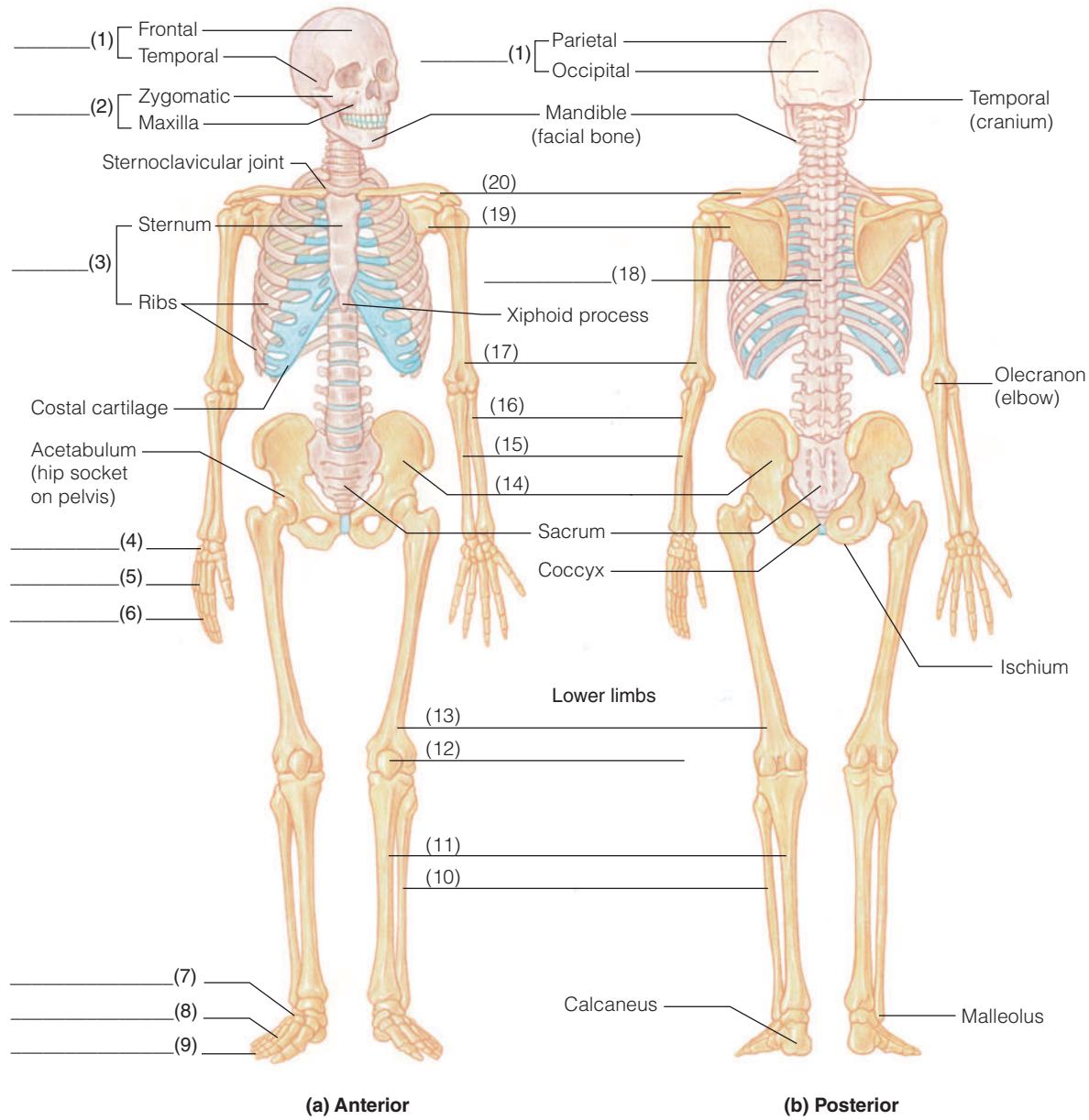


## 7.1 Major Bones of the Body

### PRACTICE FOR LEARNING: Major Bones of the Body

Write the words below in the correct spaces on Figure 7-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say. The common names and adjectival forms are listed in Table 7-1.

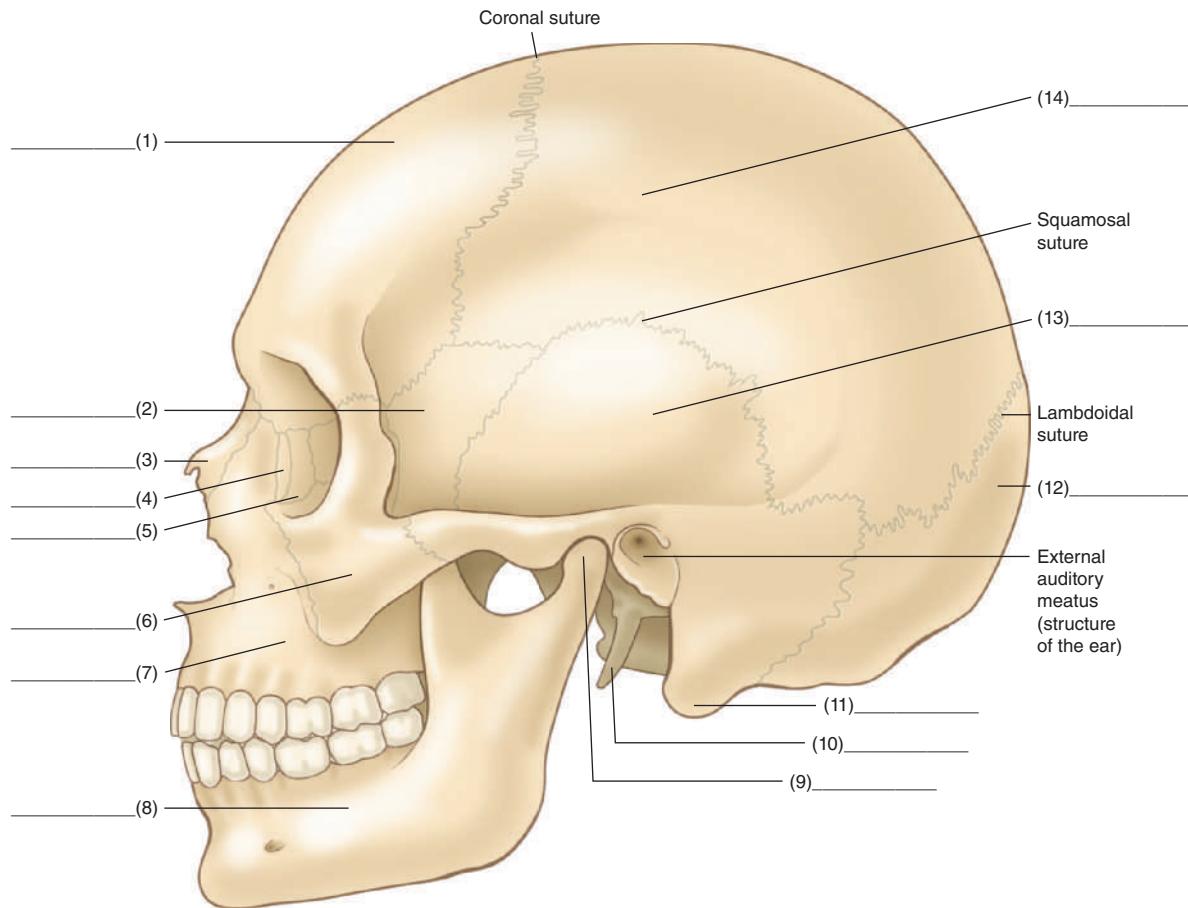
1. cranium (**KRAY**-nee-um)
2. facial bones (**FAY**-shal)
3. thorax (**THOR**-acks)
4. carpals (**KAR**-palz)
5. metacarpals (**met**-ah-**KAR**-palz)
6. phalanges (fah-**LAN**-jeez)
7. tarsals (**TAR**-salz)
8. metatarsals (**met**-ah-**TAR**-salz)
9. phalanges (fah-**LAN**-jeez)
10. fibula (**FIB**-yoo-lah)
11. tibia (**TIB**-ee-ah)
12. patella (pah-**TEL**-ah)
13. femur (**FEE**-mur)
14. pelvis (**PEL**-vis)
15. ulna (**ULL**-nah)
16. radius (**RAY**-dee-us)
17. humerus (**HEW**-mer-us)
18. vertebra (**VER**-teh-brah)
19. scapula (**SKAP**-yoo-lah)
20. clavicle (**KLAV**-ih-kul)



**Figure 7-1** Major bones of the body. A. Anterior view. B. Posterior view.

### PRACTICE FOR LEARNING: Bones and Other Structures of the Skull

Write the words below in the correct spaces on Figure 7-2. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.



**Figure 7-2** Lateral view of the skull. Sutures are immovable joints. Mastoid process and styloid process are for muscle attachment.

1. frontal (**FRUN-tal**) bone
2. sphenoid (**SFEE-noyd**) bone
3. nasal (**NAY-zal**) bone
4. lacrimal (**LACK-rih-mal**) bone
5. ethmoid (**ETH-moyd**) bone
6. zygoma (zye-**GOH-mah**)
7. maxilla (**MACK-sil-ah**)
8. mandible (**MAN-dih-bull**)
9. temporomandibular (**tem-por-oh-man-DIB-you-lar**) joint
10. styloid (**STIGH-loyd**) process
11. mastoid (**MASS-toyd**) process
12. occipital (ock-**SIP-ih-tal**) bone
13. temporal (**TEM-por-al**) bone
14. parietal (pah-**RYE-eh-tal**) bone

**TABLE 7-1 Major Bones, their Common Names, and Adjectival Forms**

Bone	Common Name	Adjectival Form
calcaneus	heel	calcaneal
carpus	wrist	carpal
clavicle	collarbone	clavicular
coccyx	tailbone	coccygeal
cranium	skull	cranial
femur	thigh bone	femoral
humerus	upper arm	humeral
ilium	hip or pelvis	iliac
mandible	lower jaw	mandibular
maxilla	upper jaw	maxillary
metacarpus	bones of hand	metacarpals
metatarsus	bones of foot	metatarsals
olecranon	elbow	olecranal
patella	kneecap	patellar
phalanges	fingers or toes	phalangeal
scapula	shoulder blade	scapular
sternum	breastbone	sternal
tarsus	ankle bones	tarsals
thorax	chest	thoracic
tibia	shin	tibial
vertebra	backbone	vertebral
zygoma	cheek	zygomatic

**PRACTICE FOR LEARNING: Major Bones of the Body**

- I.** Using Figure 7-1 answer the following questions;
- The parietal and temporal bones are bones of the \_\_\_\_\_.
  - The tibia is also known as the \_\_\_\_\_.
  - Where is the occipital bone located on the cranium? \_\_\_\_\_
  - Where is the parietal bone located on the cranium? \_\_\_\_\_
  - Name two bones of the thorax. \_\_\_\_\_

f. On which bone is the acetabulum located? \_\_\_\_\_

g. Name two bones making up the forearm. \_\_\_\_\_

h. Name two bones making up the lower leg. \_\_\_\_\_

**II.** Study Table 7-1 and then write the medical name for the following:

Common Name	Medical Name
a. kneecap	
b. fingers or toes	
c. cheek bone	
d. elbow	
e. hip or pelvis	
f. breastbone	
g. collarbone	
h. shoulder blade	
i. wrist	
j. tailbone	

Answers: 1. a. cranium or skull. b. shin. c. back of cranium. d. crown or top of cranium. e. sternum and ribs. f. ilium or pelvic bone. g. radius; ulna. h. tibia; fibula. 2. a. patella. b. phalanges. c. zygomatic bone or zygoma. d. olecranon. e. ilium. f. sternum. g. clavicle. h. scapula. i. carpal. j. coccyx.

## 7.2 Bone Structure and Function

### Bone Structure

#### Cells and Minerals

Just like other organs, bones are made up of cells and tissues. Bones grow and renew themselves. Immature bone cells are called **osteoblasts** (OS-tee-oh-blasts). They grow into mature cells called **osteocytes** (OS-tee-oh-sights). Osteocytes form bone tissue called **osseous** (OS-ee-us) tissue.

#### In Brief

**Osteoblasts** are immature bone cells.

**Osteocytes** are mature bone cells.

Osteocytes form **osseous** tissue.

**Calcium** and **phosphorus** are minerals that make bone hard.

For bones to properly form and become hard and strong, we need to eat food that contains two minerals: **calcium** (**KAL-see-um**) and **phosphorus** (**FOS-for-us**). We also need plenty of vitamin D to help us absorb the calcium.

Cartilage is similar to bone but it is soft because it lacks the calcium deposits that make bone hard. Cartilage is found in all joints, the spinal column, and the rib cage.

## Bone Function

Bones have many functions. They provide protection and support, and allow movement to happen because they provide a rigid structure for the muscles to pull on. They also act as a storehouse for calcium and phosphorus, and release these minerals into the bloodstream when required. The inner part of the bone is called bone marrow. It produces blood cells that are necessary for life. This blood-forming process is called **hematopoiesis** (**he-mah-toh-poy-EE-sis**).

### PRACTICE FOR LEARNING: Bone Structure and Function

Circle True if the statement is correct. Circle False if the statement is not correct.

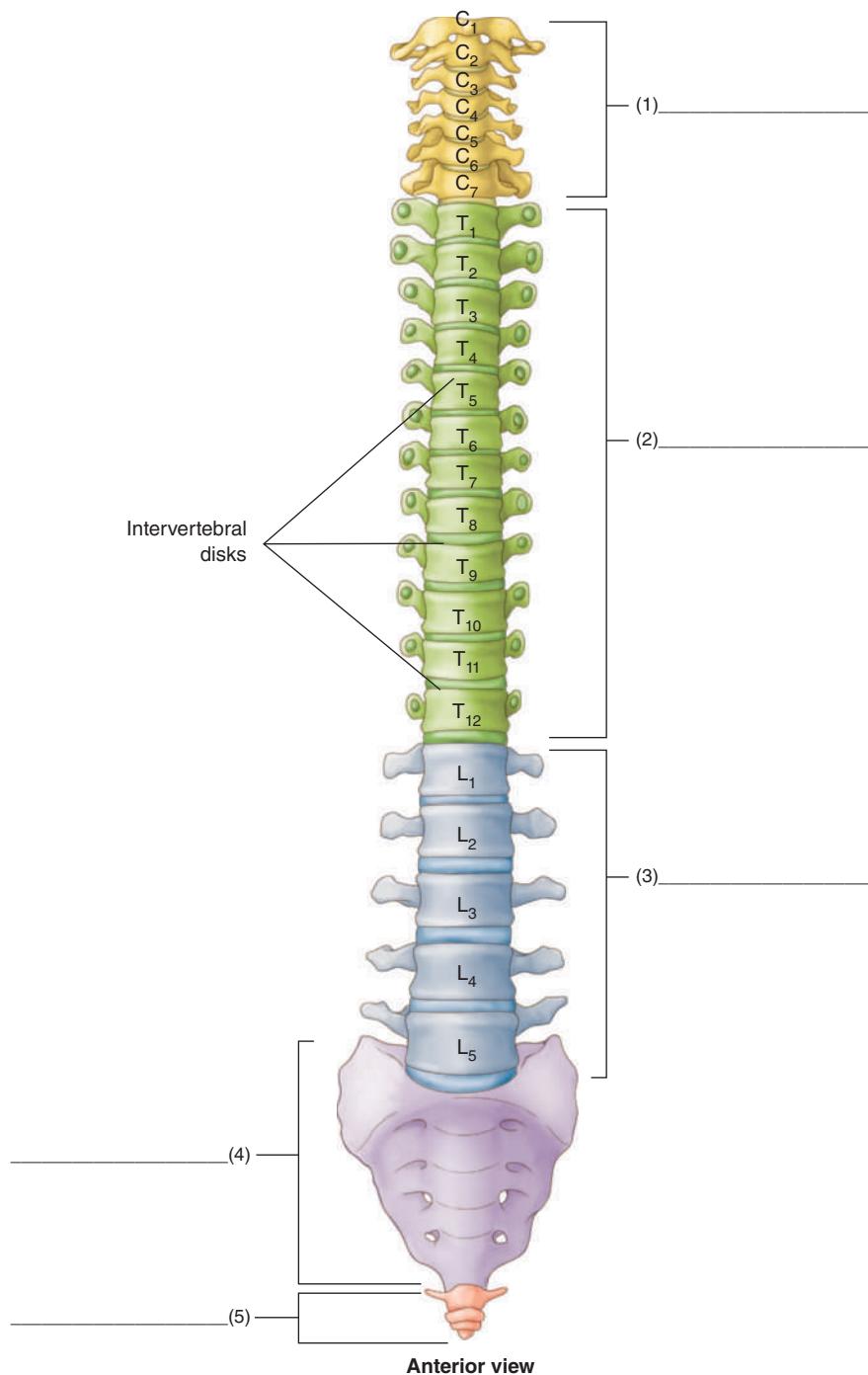
- |   |               |
|---|---------------|
| 1. Calcium is a mineral found in bone.  | True or False |
| 2. Bone marrow produces blood cells.    | True or False |
| 3. Osseous is a type of bone cell.      | True or False |
| 4. Osteoblasts are a type of bone cell. | True or False |

Answers: 1. True. 2. True. 3. False. 4. True.

## 7.3 Vertebral Column

### PRACTICE FOR LEARNING: Vertebral Column

Write the bones of the vertebral column in the correct space on Figure 7-3. To help you, the number beside the bone tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.



**Figure 7-3** Vertebral column, anterior view.

1. cervical vertebrae (**SER-vih-kal VER-teh-bree**)
2. thoracic (thoh-**RAS**-ick)
3. lumbar (**LUM**-bar)
4. sacrum (**SAY**-krum)
5. coccyx (**KOCK**-sicks)

The bones of the **vertebral** (VER-teh-brahl) **column** are organized into five groups. They are illustrated in Figure 7-3. The vertebral column is also called the spinal column, spine, or backbone.

The vertebral column consists of 33 bones arranged in a column that extends from the base of the skull to the lower back. Each bone is called a **vertebra** (VER-teh-brah) (plural vertebrae [VER-teh-bree]). There are 7 **cervical** vertebrae (C1 to C7), 12 **thoracic** vertebrae (T1 to T12), 5 **lumbar** vertebrae (L1 to L5), 5 fused bones called the **sacrum** (S1 to S5), and 4 fused bones called the coccyx or tailbone. Each vertebra has a round hole in the middle. The holes line up to form a canal. The spinal cord lies within this canal. The vertebrae protect the spinal cord, which is made up of nerves.

### In Brief

The **vertebral column** is also known as the spinal column, spine, or backbone.

The **vertebral column** is made up of bone.

The **spinal cord** is made up of nerves.

In Figure 7-3 there is a diagram of a cushion of cartilage called the **intervertebral** (in-ter-VER-teh-bral) disc, which lies between each vertebrae. These discs allow the vertebrae to glide over each other, making movement smooth and painless.

### Helping You Remember

Think of the vertebral column as a stack of doughnuts with the spinal cord passing through the holes. The intervertebral discs would be like thick wax paper placed between the doughnuts to prevent sticking.

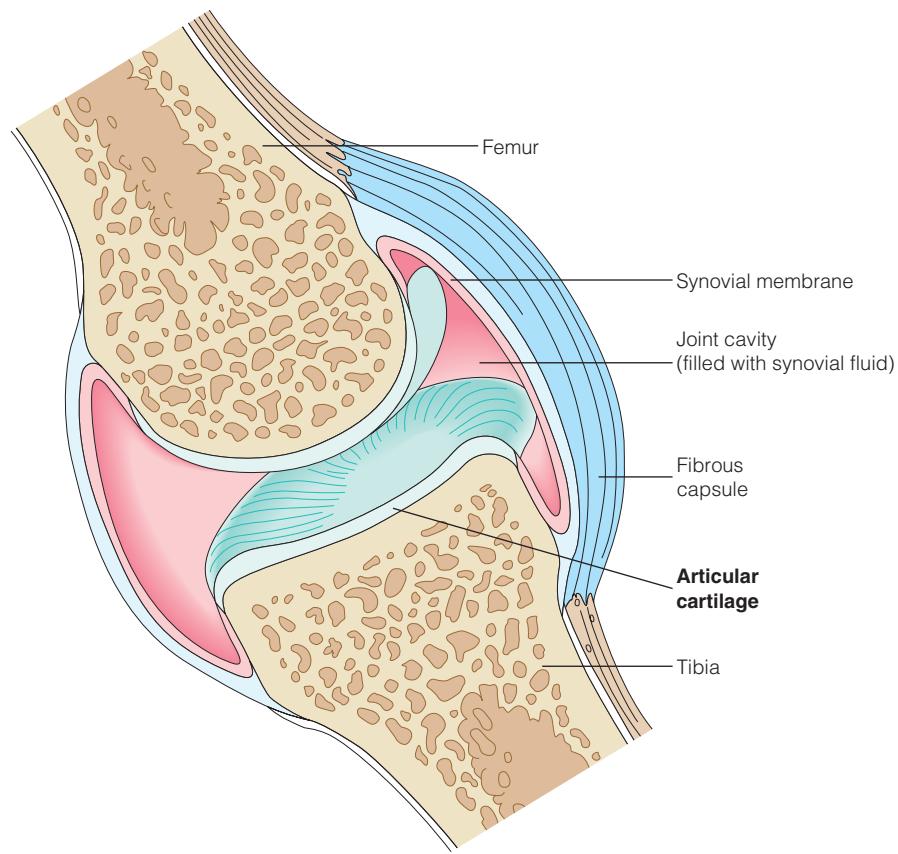
## 7.4 Joints

A joint is where two bones come together. Movement occurs at joints. A joint is usually named after the bones that it joins. For example, the sternoclavicular (ster-noh-klah-VICK-yoo-lar) joint is the union between the sternum (stern/o) and clavicle (clavicul/o) (Figure 7-1).

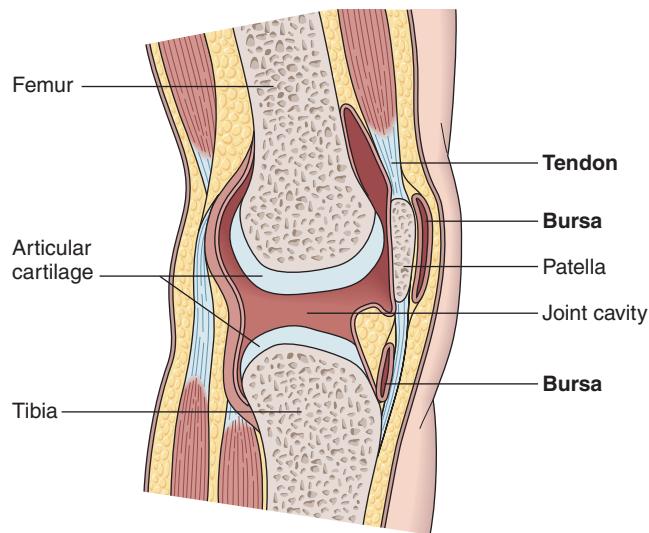
For joints to work properly and without pain, it is important that the two bones glide smoothly over each other (Figure 7-4). This is accomplished by **articular** (ar-TIK-yoo-lar) **cartilage** and **synovial** (sih-NOH-vee-al) fluid inside the joint. The synovial fluid is produced by **synovial membrane** lining the joint.

Although most of the joints in the body are movable, there are a few immovable joints in the skull. These immovable joints are called **sutures**.

Also at joints (but not inside) are **tendons** (TEN-donz), **ligaments** (LIG-ah-ments), and **bursae** (BUR-see) (Figure 7-5). Tendons attach muscle to bone. Ligaments attach bone to bone. Bursae are tiny, purse-like sacs lined with synovial membrane and filled with



**Figure 7-4** A joint cavity.



**Figure 7-5** Bursae around a joint.

synovial fluid. Each **bursa** (**BUR-sah**) prevents friction between two structures that need to glide past each other when they move. The bursa can become inflamed through overuse, resulting in a condition called **bursitis** (bur-SIGH-tis). Baseball pitchers will sometimes develop bursitis at the shoulder, while tennis players often develop it in the elbow.

### PRACTICE FOR LEARNING: Vertebral Column and Joints

Write the correct answers on the space provided:

1. Name the bones of the vertebral column. Write the number of bones in each segment.

---



---

2. Define a joint. \_\_\_\_\_

3. Where is articular cartilage located? \_\_\_\_\_

Answers: 1. 7 cervical; 12 thoracic; 5 lumbar; 5 fused sacral bones; 4 fused coccygeal bones. 2. A joint is where two bones come together. 3. Covering ends of bone in joints.

### 7.5

### New Roots, Suffixes, and Prefixes

Use these additional roots and suffixes when studying the terms in this chapter.

ROOT	MEANING
<b>ankyl/o</b>	fusion of parts; stiffening
<b>faci/o</b>	face
<b>kyph/o</b>	humpback
<b>lord/o</b>	swayback
<b>ped/o</b>	child
<b>sacr/o</b>	sacrum
<b>sarc/o</b>	flesh
<b>scoli/o</b>	crooked

SUFFIX	MEANING
<b>-desis</b>	surgical fusion
<b>-immune</b>	immunity; safe (The immune system protects the body against disease.)
<b>-listhesis</b>	slipping
<b>-luxation</b>	dislocation
<b>-malacia</b>	softening

## 7.6 Learning the Terms

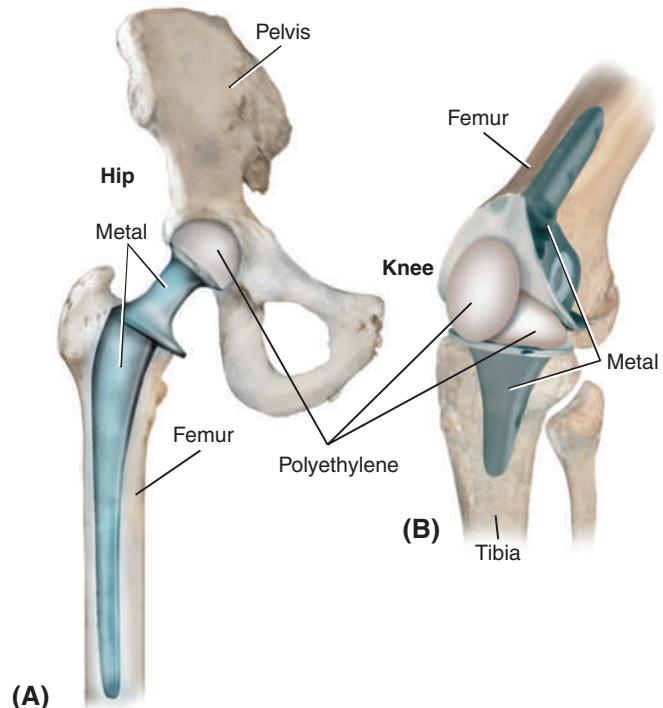
Following these steps will make it easier for you to learn medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

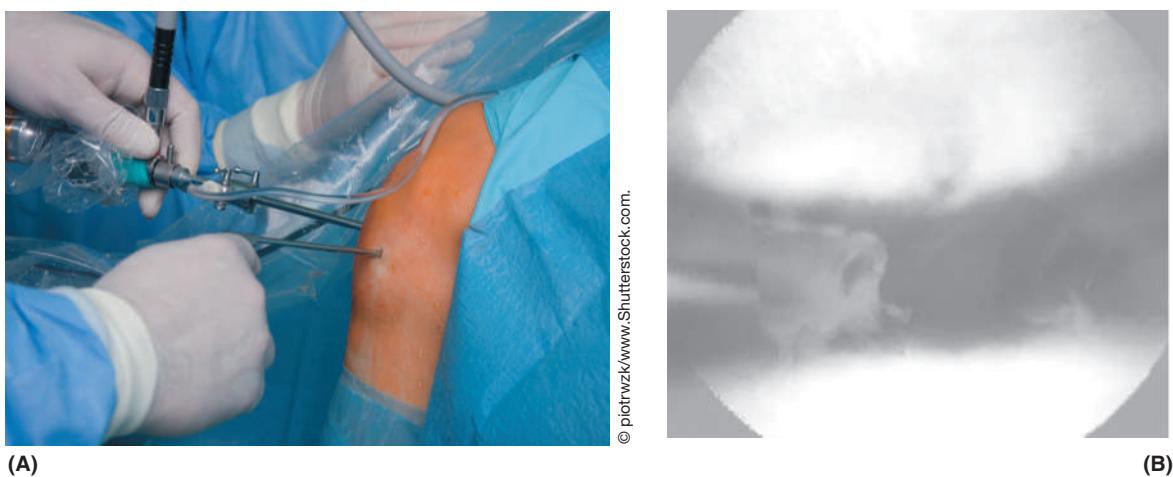
### Roots

ROOT acetabul/o		MEANING acetabulum; hip socket
Term	Term Analysis	Definition
<b>acetabular</b> (ass-eh-TAB-yoo-lar)	-ar = pertaining to	pertaining to the hip socket; the hip socket is a dent (depression) on the pelvic bone (ilium)

ROOT arthr/o		MEANING joint
Term	Term Analysis	Definition
<b>arthralgia</b> (ar-THRAL-jah)	-algie = pain	joint pain
<b>arthritis</b> (ar-THRIGH-tis)	-itis = inflammation	inflammation of a joint. See Section 7.7 for more details.
<b>arthrocentesis</b> (ar-throh-sen-TEE-sis)	-centesis = surgical puncture	surgical puncture to remove fluid from the joint cavity
<b>arthrodesis</b> (ar-throh-DEE-sis)	-desis = surgical fusion	surgical fusion of a joint
<b>arthropathy</b> (ar-THROP-ah-thee)	-pathy = disease	diseased joint
<b>arthroplasty</b> (AR-throh-plas-tee)	-plasty = surgical repair or reconstruction	surgical repair of a joint. (Figures 7-6A and B)



**Figure 7-6** Arthroplasty. A. Total hip replacement. B. Total knee replacement.



**Figure 7-7** A. Arthroscopic surgery. B. Picture of the knee joint as seen through an arthroscope.

**arthroscopy**  
(ar-**THROS**-koh-pee)

-scop<sup>y</sup> = process of visual  
examination

process of visually examining  
the joint cavity by using an  
arthroscope (Figures 7-7A and B).

ROOT <b>brachi/o</b>	MEANING arm
<i>Term</i>	<i>Term Analysis</i>
<b>brachiocephalic</b> (bray-kee-oh-seh-FAL-ik)	-ic = pertaining to cephal/o = head

ROOT <b>calcane/o</b>	MEANING heel
<i>Term</i>	<i>Term Analysis</i>
<b>calcaneal</b> (kal-KAY-nee-al)	-eal = pertaining to

ROOT <b>cervic/o</b>	MEANING neck
<i>Term</i>	<i>Term Analysis</i>
<b>cervical</b> (SER-vih-kal)	-al = pertaining to

ROOT <b>chondr/o</b>	MEANING cartilage
<i>Term</i>	<i>Term Analysis</i>
<b>chondromalacia</b> (kon-dro-mah-LAY-she-ah)	-malacia = soft

ROOT <b>clavicul/o</b>	MEANING clavicle; collarbone
<i>Term</i>	<i>Term Analysis</i>
<b>infraclavicular</b> (in-frah-klah-VICK-yoo-lar)	-ar = pertaining to infra- = below; under

ROOT <b>coccyg/o</b>		MEANING <b>coccyx; tailbone</b>
Term	Term Analysis	Definition
<b>coccygeal</b> (kock-SIJ-ee-al)	-eal = pertaining to	pertaining to the tailbone

ROOT <b>cost/o</b>		MEANING <b>rib</b>
Term	Term Analysis	Definition
<b>costal</b> (KOS-tal)	-al = pertaining to	pertaining to the ribs
<b>subcostal</b> (sub-KOS-tal)	-al = pertaining to sub- = under	pertaining to under the ribs
<b>costochondritis</b> (kos-toh-kon-DRY-tis)	-itis = inflammation chondr/o = cartilage	inflammation of ribs and cartilage
<b>costovertebral</b> (kos-toh-VER-teh-bral)	-al = pertaining to vertebr/o = vertebra	pertaining to ribs and vertebra

ROOT <b>crani/o</b>		MEANING <b>skull</b>
Term	Term Analysis	Definition
<b>craniofacial</b> (kray-nee-oh-FAY-shal)	-al = pertaining to faci/o = face	pertaining to the skull and face
<b>craniotomy</b> (kray-nee-OT-ah-mee)	-tomy = to cut; incision	incision into the skull

ROOT <b>femor/o</b>		MEANING <b>femur; thigh bone</b>
Term	Term Analysis	Definition
<b>femoral</b> (FEM-or-al)	-al = pertaining to	pertaining to the femur

ROOT ili/o		MEANING hip
Term	Term Analysis	Definition
<b>iliac</b> (ILL-ee-ack)	-ac = pertaining to	pertaining to the hip
<b>iliosacral joint</b> (ill-ee-oh-SAY-kral)	-al = pertaining to sacr/o = sacrum	pertaining to the joint between the hip and sacrum; also known as the sacroiliac (say-kroh-ILL-ee-ack) joint

ROOT lumb/o		MEANING lower back; loins
Term	Term Analysis	Definition
<b>lumbodynia</b> (lum-boh-DIN-yah)	-dynia = pain	pain in the lower back; lumbago

ROOT mandibul/o		MEANING mandible; lower jaw
Term	Term Analysis	Definition
<b>mandibular</b> (man-DIB-yoo-lar)	-ar = pertaining to	pertaining to the mandible

ROOT maxill/o		MEANING upper jaw
Term	Term Analysis	Definition
<b>maxillary</b> (MACK-sih-lar-ee)	-ary = pertaining to	pertaining to the upper jaw

ROOT myel/o		MEANING bone marrow
Term	Term Analysis	Definition
<b>myelogenous</b> (my-eh-LOJ-en-us)	-genous = produced by	produced by the bone marrow

ROOT <b>olecran/o</b>		MEANING <b>elbow</b>
Term	Term Analysis	Definition
<b>olecranal</b> (oh-LECK-ran-al)	-al = pertaining to	pertaining to the elbow

ROOT <b>patell/o</b>		MEANING <b>patella; kneecap</b>
Term	Term Analysis	Definition
<b>suprapatellar</b> (soo-prah-pah-TEL-ar)	-ar = pertaining to supra- = above	pertaining to above the kneecap

ROOT <b>oste/o</b>		MEANING <b>bone</b>
Term	Term Analysis	Definition
<b>osteitis</b> (os-tee-EYE-tis)	-itis = inflammation	inflammation of the bone
<b>osteomalacia</b> (os-tee-oh-mah-LAY-shee-ah)	-malacia = softening	softening of bone
<b>osteomyelitis</b> (os-tee-oh-my-eh-LYE-tis)	-itis = inflammation myel/o = bone marrow	inflammation of bone and bone marrow
<b>osteonecrosis</b> (os-tee-oh-neh-KRO-sis)	-sis = condition necr/o = death	death of bone tissue due to the lack of blood supply

ROOT <b>phalang/o</b>		MEANING <b>phalanx; one of the bones making up the fingers or toes</b>
Term	Term Analysis	Definition
<b>interphalangeal joint</b> (in-ter-fah-LAN-jee-al)	-al = pertaining to inter- = between	pertaining to joints between the phalanges

ROOT radi/o		MEANING radius (one of the bones of the lower arm)
Term	Term Analysis	Definition
<b>radiocarpal joint</b> (ray-dee-oh-KAR-pal)	-al = pertaining to carp/o = wrist	pertaining to the joint between the radius and wrist

ROOT scapul/o		MEANING scapula; shoulder blade
Term	Term Analysis	Definition
<b>subscapular</b> (sub-SKAP-yoo-lar)	-ar = pertaining to sub- = under; below	pertaining to under the shoulder blade; infrascapular

ROOT spondyl/o		MEANING vertebra
Term	Term Analysis	Definition
<b>spondylolisthesis</b> (spon-dih-loh-lis-THEE-sis)	-listhesis = slipping	forward slipping of one vertebra over another. Usually the fifth lumbar vertebra over the sacrum.

ROOT synovi/o		MEANING synovial membrane
Term	Term Analysis	Definition
<b>synovectomy</b> (sin-oh-VECK-toh-me)	-ectomy = excision	surgical removal of the synovial membrane

ROOT thorac/o		MEANING chest
Term	Term Analysis	Definition
<b>thoracolumbar</b> (thoh-rack-oh-LUM-bar)	-ar = pertaining to lumb/o = lower back; loins	pertaining to the chest and lower back

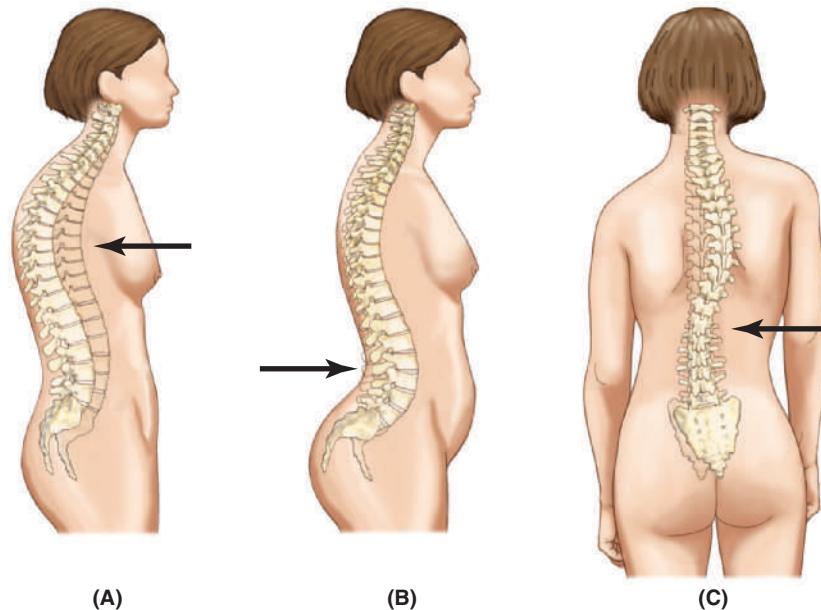
ROOT uln/o		MEANING ulna (one of the bones of the lower arm)
Term	Term Analysis	Definition
<b>ulnar</b> (ULL-nar)	-ar = pertaining to	pertaining to the ulna

## Suffixes

SUFFIX -luxation		MEANING displacement; dislocation
Term	Term Analysis	Definition
<b>subluxation</b> (sub-leck-SAY-shun)	sub- = under; below	partial displacement or dislocation of a bone from its joint

SUFFIX -oma		MEANING tumor; mass
Term	Term Analysis	Definition
<b>carcinoma</b> (kar-sih-NOH-mah)	carcin/o = cancer	malignant tumor of epithelial cells
<b>chondroma</b> (kon-DROH-mah)	chondr/o = cartilage	benign tumor of cartilage
<b>chondrosarcoma</b> (kon-droh-sar-KOH-mah)	-sarcoma = malignant tumor of connective tissue.	malignant tumor of cartilage. Cartilage is a type of connective tissue.
<b>osteoma</b> (os-tee-OH-mah)	oste/o = bone	benign tumor of bone
<b>osteosarcoma</b> (os-tee-oh-sar-KOH-mah)	-sarcoma = malignant tumor of connective tissue	malignant tumor of bone. Bone is a type of connective tissue.
<b>sarcoma</b> (sar-KOH-mah)	sarc/o = flesh	sarcoma can also be used as a word on its own to mean a malignant tumor of connective tissue

SUFFIX -osis	Term Analysis	MEANING abnormal condition
Term	Term Analysis	Definition
<b>kyphosis</b> (kye-FOH-sis)	kyph/o = humpback	abnormal increase in the outward curvature of the thoracic spine (Figure 7-8A)
<b>lordosis</b> (lor-DOH-sis)	lord/o = swayback	abnormal increase in the forward curvature of the lumbar spine (Figure 7-8B)
<b>scoliosis</b> (skoh-lee-OH-sis)	scoli/o = crooked	abnormal lateral curvature of the spine (Figure 7-8C)



**Figure 7-8** Abnormal Curvatures of the spine. (A) Kyphosis. (B) Lordosis. (C) Scoliosis

## Prefixes

PREFIX auto-	Term Analysis	MEANING self
Term	Term Analysis	Definition
<b>autoimmune disease</b> (aw-toh-ih-MYOON)	-immune = immunity; safe	immune response to one's own body tissue; destruction of one's own cells by one's own immune system. An example of an autoimmune disease is rheumatoid arthritis. (See under pathology for more detail on rheumatoid arthritis.)

**Note:** The immune system helps protect the body against harmful substances.

PREFIX ortho-	MEANING straight	
Term	Term Analysis	Definition
<b>orthopedics</b> (or-thoh-PEE-dicks)	-ic = pertaining to ped/o = child	surgical specialty dealing with the correction of deformities and dysfunctions of the skeletal system.

## 7.7 Pathology

### Fractures

A fracture is a break or crack in a bone.

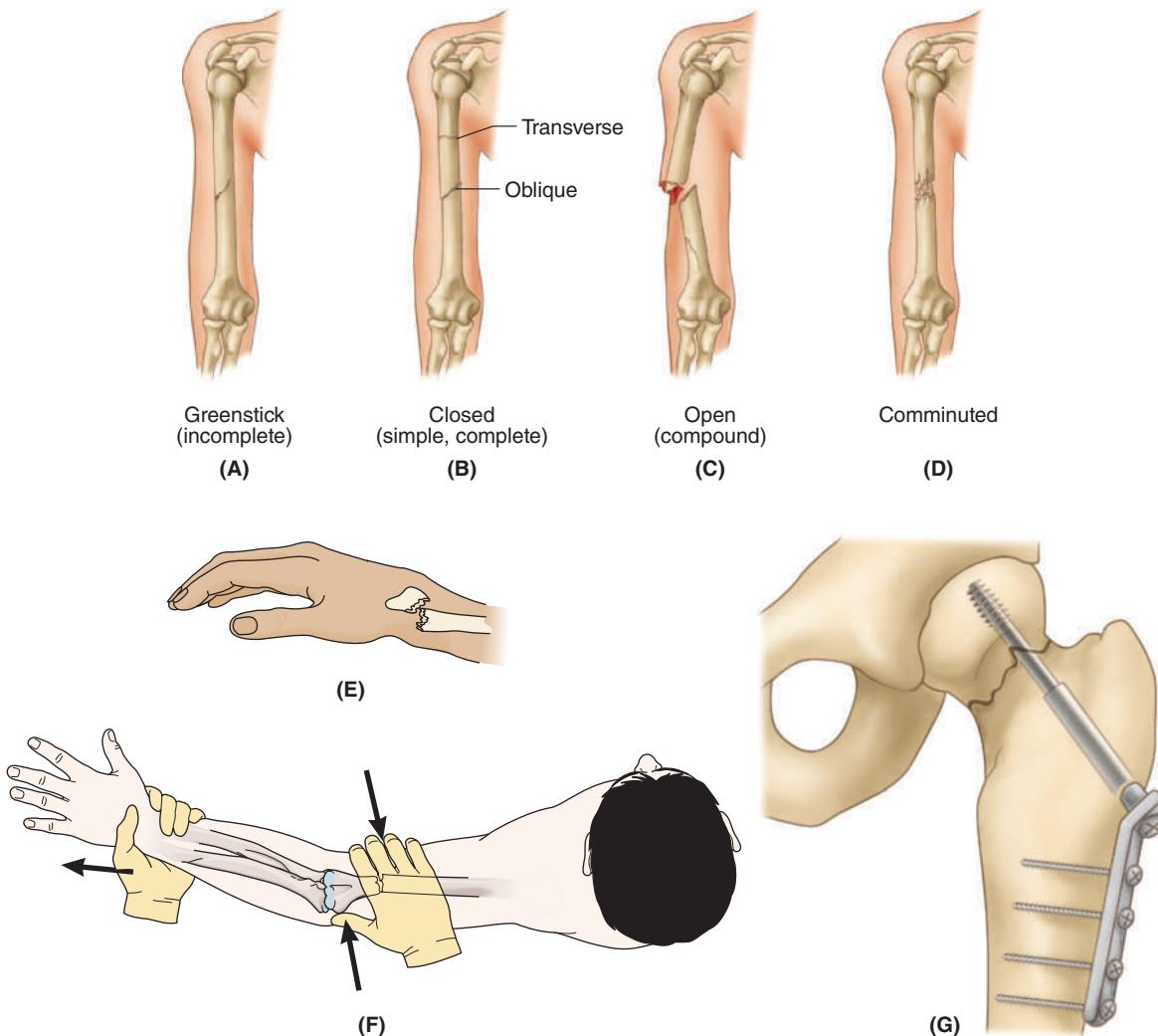
#### Types of Fractures

- **Greenstick** fracture means a bone is partially broken on one side and bent on the other (Figure 7-9A).
- **Closed fracture**, also known as a simple fracture, means a bone is broken but there is no open cut in the skin (Figure 7-9B).
- **Open fracture**, also known as a compound fracture, means a bone is broken and there is an open cut in the skin (Figure 7-9C).
- **Comminuted** (kom-ih-NOOT-id) fracture means the bone has been splintered (Figure 7-9D).
- **Colles** (KOHL-eez) fracture is of the distal radius near the wrist (Figure 7-9E).
- **Pathological** fracture means the bone breaks because it is weak from disease.

#### Treatment

The treatment of fractures involves reduction and immobilization. Reduction means placing the bones back together. Immobilization results from placing a cast over the broken bone to prevent movement.

If an incision in the skin is not necessary to place the bones back together, the procedure is called **closed reduction** (Figure 7-9F). If it is necessary to incise (cut) the skin in order to see how to place the bones back together, the procedure is called **open reduction**. When the fracture is severe, screws, nails, or pins may be needed to hold the bones in place. This procedure is called **open reduction internal fixation (ORIF)** (Figure 7-9G).



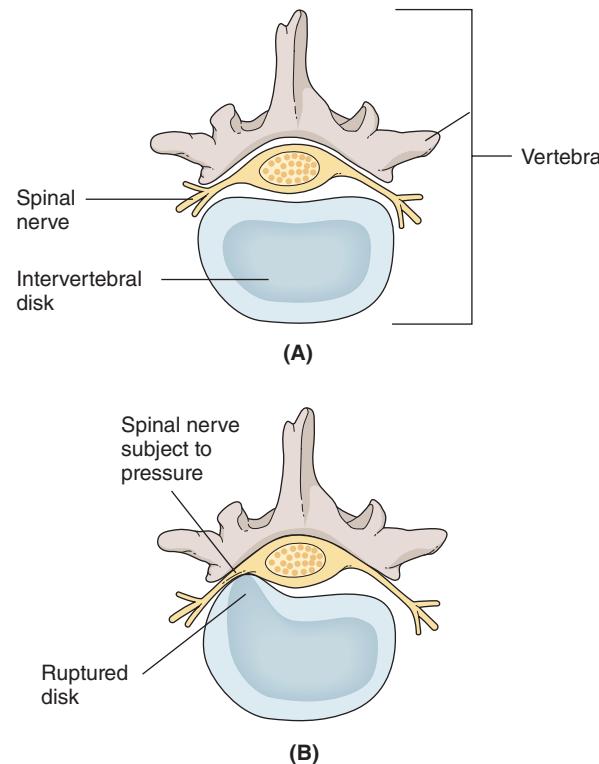
**Figure 7-9** Fractures: A. Greenstick (incomplete). B. Closed (simple, complete). C. Open (compound). D. Comminuted. E. Colles. F. Closed reduction. G. Open reduction internal fixation.

## Herniated Intervertebral Disc; Slipped Disc

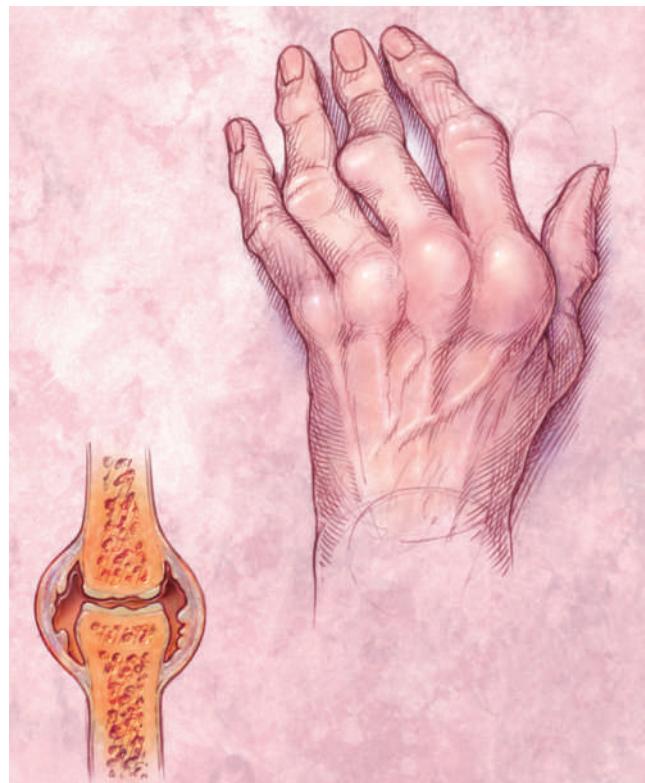
A portion of the intervertebral disc moves out of place (herniates). The result is that a nerve may be pinched, causing pain (Figure 7-10). Although herniation can occur at any point along the vertebral column, the lumbar vertebrae are most often affected because of the weight they bear.

## Osteoarthritis (os-tee-oh-ar-THRIGH-tis) (OA)

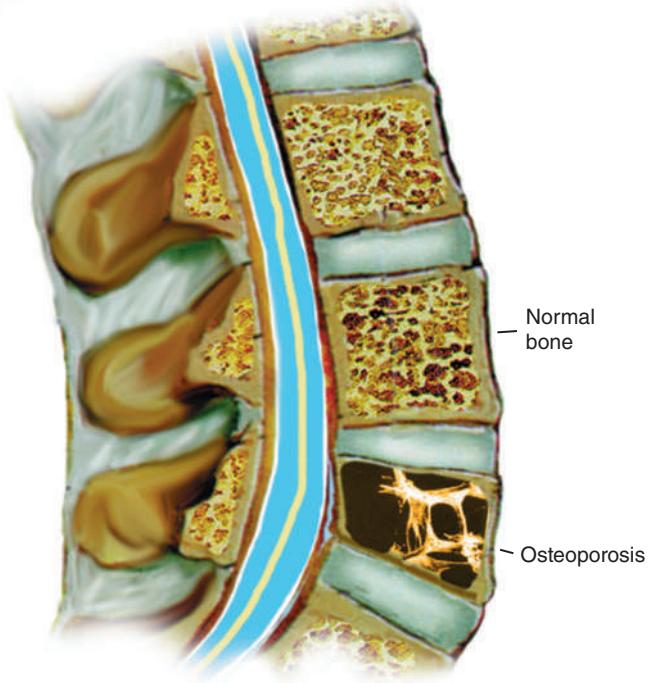
Chronic progressive degeneration of the articular cartilage. It is the most common form of arthritis (Figure 7-11). The exact cause is unknown, but joint injury and cartilage degeneration may leave the ends of bone without cartilage and without protection from opposing bony surfaces. Movement is painful because bone rubs on bone without protection from the articular cartilage.



**Figure 7-10** A. Normal intervertebral disc. B. Herniated intervertebral disc places pressure on spinal cord.



**Figure 7-11** Osteoarthritis.



**Figure 7-12** Osteoporosis.

### Osteoporosis (os-tee-oh-pah-ROH-sis)

Loss of bone mass (density of bone), especially in the thoracic vertebrae (Figure 7-12). The bone becomes thin, porous, and weak. Pathological fractures are common because of the weak bone.

### Rheumatoid Arthritis (ROO-mah-toyd) (RA)

A chronic autoimmune disease that first attacks joints. It can progress to other body organs including skin, blood vessels, and lungs. An autoimmune disease occurs when the body's immune system fails to recognize its own cells as normal and attacks the body's tissues as if they were foreign invaders. In rheumatoid arthritis, the synovial membranes at the joint are attacked, making movement difficult.

## 7.8 Look-Alike and Sound Alike Words

Below is a list of look-alike and sound-alike words. Study the spelling and definitions of each set of words. Questions will follow in the Review Exercises.

**TABLE 7-2 Look-Alike and Sound-Alike Words**

<b>hypercalcemia</b>	increased amounts of calcium in the blood
<b>hyperkalemia</b>	increased amounts of potassium in the blood
<b>humeral</b>	pertaining to the humerus
<b>humoral</b>	pertaining to body fluids
<b>humerus</b>	the arm bone
<b>humorous</b>	funny
<b>ilium</b>	hip bone
<b>ileum</b>	third portion of the small intestine
<b>malleolus</b>	bony bump on the distal end of the tibia and fibula
<b>malleus</b>	bone of the middle ear
<b>sprain</b>	stretching or tearing of a ligament
<b>strain</b>	stretching or tearing of a tendon or muscle

## 7.9 Review Exercises

### EXERCISE 7-1 Look-Alike and Sound-Alike Words

Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 7-2 if it helps you.

1. In (**humoral/humeral**) immunity, antibodies are released into the blood.
2. While bouncing on the bed, Julio fell off and broke his (**humorous/humerus**). This was not (**humorous/humerus**).
3. José slipped on the rocks and broke the distal tibia at the (**malleus/malleolus**).
4. Jack had a difficult time hearing. The MRI showed degeneration of the (**malleolus/malleus**).
5. While skiing, Anastasia tore her shoulder ligaments. The diagnosis was a (**sprain/strain**) of the shoulder.
6. (**Hypercalcemia/Hyperkalemia**) is due to kidney dysfunction resulting in abnormal potassium levels.

### EXERCISE 7-2 Matching Word Parts with Meanings

Match the word part in Column A with its meaning in Column B.

Column A	Column B
_____	<b>1.</b> arthr/o
_____	<b>2.</b> -pathy
_____	<b>3.</b> -plasty
_____	<b>4.</b> -scopy
_____	<b>5.</b> chondr/o
_____	<b>6.</b> cost/o
_____	<b>7.</b> oste/o
_____	<b>8.</b> myel/o
_____	<b>9.</b> -itis
_____	<b>10.</b> orth/o
_____	<b>11.</b> -malacia
_____	<b>12.</b> -cyte
_____	<b>13.</b> -oma
_____	<b>14.</b> -al
_____	<b>15.</b> sub-
_____	<b>16.</b> -sarcoma
_____	<b>17.</b> -centesis
_____	<b>18.</b> auto-
_____	<b>19.</b> -immune
_____	<b>20.</b> ped/o
	A. cartilage
	B. inflammation
	C. softening
	D. tumor
	E. under
	F. joint
	G. rib
	H. straight
	I. malignant tumor of connective tissue
	J. self
	K. child
	L. safe
	M. disease
	N. bone
	O. cell
	P. process of viewing
	Q. bone marrow
	R. surgical puncture
	S. pertaining to
	T. surgical reconstruction

### EXERCISE 7-3 Short Answer—Anatomy

Answer the following in the space provided.

1. Name two cells found in osseous tissue. \_\_\_\_\_
  
2. Bones come together to form \_\_\_\_\_. \_\_\_\_\_
  
3. How are joints named? \_\_\_\_\_
  
4. Name two mineral substances found in bone. \_\_\_\_\_
  
5. The tailbone is also known as the \_\_\_\_\_. \_\_\_\_\_

6. The bones of the skull are called the \_\_\_\_\_. The bones of the chest are called the \_\_\_\_\_.
7. Tendons attach \_\_\_\_\_. Ligaments attach \_\_\_\_\_.
8. What type of tissue is the spinal column made up of? What type of tissue is the spinal cord made up of? \_\_\_\_\_
9. Name the five divisions of the vertebral column. State the number of bones in each division.

---

---

---

10. Name five functions of bone. \_\_\_\_\_

#### EXERCISE 7-4 Location of Bones

Match each bone with its location. The location may be used more than once.

#### Locations

- arm
- 
- cranium
- 
- face
- 
- foot
- 
- hand
- 
- leg
- 
- pelvis
- 
- thorax
- 
- vertebral column
- 
- wrist
- 

#### Bones

1. calcaneus \_\_\_\_\_
2. fibula \_\_\_\_\_

3. carpal \_\_\_\_\_
4. sternum \_\_\_\_\_
5. metatarsals \_\_\_\_\_
6. olecranon \_\_\_\_\_
7. radius \_\_\_\_\_
8. occipital \_\_\_\_\_
9. zygomatic \_\_\_\_\_
10. maxilla \_\_\_\_\_
11. parietal \_\_\_\_\_
12. metacarpals \_\_\_\_\_
13. coccyx \_\_\_\_\_
14. ilium \_\_\_\_\_
15. sacrum \_\_\_\_\_
16. femur \_\_\_\_\_
17. humerus \_\_\_\_\_
18. ulna \_\_\_\_\_
19. patella \_\_\_\_\_
20. mandible \_\_\_\_\_

### EXERCISE 7-5 Naming Bones

*Write the common name of the following bones.*

1. cranium \_\_\_\_\_
2. zygomatic \_\_\_\_\_
3. mandible \_\_\_\_\_
4. maxilla \_\_\_\_\_
5. sternum \_\_\_\_\_
6. coccyx \_\_\_\_\_
7. humerus \_\_\_\_\_
8. olecranon \_\_\_\_\_
9. carpal \_\_\_\_\_

- 10.** metacarpals \_\_\_\_\_
- 11.** phalanges \_\_\_\_\_
- 12.** ilium \_\_\_\_\_
- 13.** femur \_\_\_\_\_
- 14.** tibia \_\_\_\_\_
- 15.** patella \_\_\_\_\_

### EXERCISE 7-6 Matching—Pathology

I. Match the term in Column A with its description in Column B.

<b>Column A</b>	<b>Column B</b>
_____	<b>1.</b> rheumatoid arthritis
_____	<b>2.</b> reduction and immobilization
_____	<b>3.</b> osteoarthritis
_____	<b>4.</b> osteoporosis
_____	<b>5.</b> arthroplasty
	A. loss of bone mass
	B. treatment for osteoarthritis
	C. autoimmune disease
	D. treatment for fractures
	E. degeneration of articular cartilage

II. Match the term in Column A with its description in Column B.

<b>Column A</b>	<b>Column B</b>
_____	<b>6.</b> kyphosis
_____	F. inflammation causing fusion of joints between vertebrae
_____	<b>7.</b> lordosis
_____	G. partial dislocation
_____	<b>8.</b> ankylosing spondylitis
_____	H. increased forward curvature of lumbar spine
_____	<b>9.</b> subluxation
_____	I. forward slipping of one vertebrae over another
_____	<b>10.</b> spondylolisthesis
	J. increased outward curvature of thoracic spine

III. Match the term in Column A with its description in Column B.

<b>Column A</b>	<b>Column B</b>
_____	<b>11.</b> open fracture
_____	K. fracture of distal radius
_____	<b>12.</b> closed fracture
_____	L. bone is splintered
_____	<b>13.</b> Colles
_____	M. fractured bone with broken skin
_____	<b>14.</b> comminuted fracture
_____	N. bone is partially broken on one side and bent on the other
_____	<b>15.</b> greenstick
	O. fractured bone with no broken skin

### EXERCISE 7-7 Definitions—Learning the Terms

Give the meanings of the following terms.

1. arthralgia \_\_\_\_\_
2. chondromalacia \_\_\_\_\_
3. subcostal \_\_\_\_\_
4. osteitis \_\_\_\_\_
5. osteosarcoma \_\_\_\_\_
6. osteomyelitis \_\_\_\_\_
7. orthopedics \_\_\_\_\_
8. myelogenous \_\_\_\_\_
9. arthropathy \_\_\_\_\_
10. osteomalacia \_\_\_\_\_
11. spondylolisthesis \_\_\_\_\_
12. subluxation \_\_\_\_\_
13. open/compound fracture \_\_\_\_\_
14. scoliosis \_\_\_\_\_
15. herniated intervertebral disc \_\_\_\_\_

### EXERCISE 7-8 Definitions in Context

Define the bolded terms in context. Use your dictionary if necessary.

1. Severe **arthropathy** in the back involves the **sacroiliac joint**.
  - a. arthropathy \_\_\_\_\_
  - b. sacroiliac joint \_\_\_\_\_
2. **Reduction** and **immobilization** have been performed on a previously noted **Colles fracture**.
  - c. reduction and immobilization \_\_\_\_\_
  - d. Colles fracture \_\_\_\_\_
3. It was felt he would benefit from **arthroscopy** and repair of the **articular cartilage**.
  - e. arthroscopy \_\_\_\_\_
  - f. articular cartilage \_\_\_\_\_

4. The patient's x-ray showed a **comminuted** fracture of the right **femur** and **greenstick** fracture of the left **humerus**. He was admitted for **open reduction and internal fixation** of right femur.

- g. comminuted \_\_\_\_\_
- h. femur \_\_\_\_\_
- i. greenstick \_\_\_\_\_
- j. humerus \_\_\_\_\_
- k. open reduction and internal fixation \_\_\_\_\_

### EXERCISE 7-9 Word Building

I. Use the root *arthr/o* to build medical words for the following definitions:

- a. joint pain \_\_\_\_\_
- b. inflammation of a joint \_\_\_\_\_
- c. surgical puncture to remove fluid from the joint cavity \_\_\_\_\_
- d. diseased joint \_\_\_\_\_
- e. surgical reconstruction of a joint \_\_\_\_\_
- f. process of visually examining a joint cavity \_\_\_\_\_

II. Use the root *chondr/o* to build medical words for the following definitions:

- a. softening of cartilage \_\_\_\_\_
- b. benign tumor of cartilage \_\_\_\_\_
- c. cartilaginous cell \_\_\_\_\_

III. Use the root *oste/o* to build medical words for the following definitions:

- a. inflammation of bone \_\_\_\_\_
- b. benign tumor of bone \_\_\_\_\_
- c. softening of bone \_\_\_\_\_
- d. inflammation of bone and bone marrow \_\_\_\_\_
- e. malignant tumor of bone \_\_\_\_\_

IV. Use the suffix *-osis* to build medical words for the following definitions

- a. Increase in the outward curvature of the thoracic spine \_\_\_\_\_
- b. Increase in the forward curvature of the lumbar spine \_\_\_\_\_
- c. Abnormal lateral curvature of the spine \_\_\_\_\_

V. Use the suffix *-al* to build medical words for the following definitions:

- a. pertaining to the head and face \_\_\_\_\_
- b. pertaining to the lower jaw \_\_\_\_\_
- c. pertaining to the neck \_\_\_\_\_
- d. pertaining to under the collarbone \_\_\_\_\_
- e. pertaining to the elbow \_\_\_\_\_

### EXERCISE 7-10 Spelling

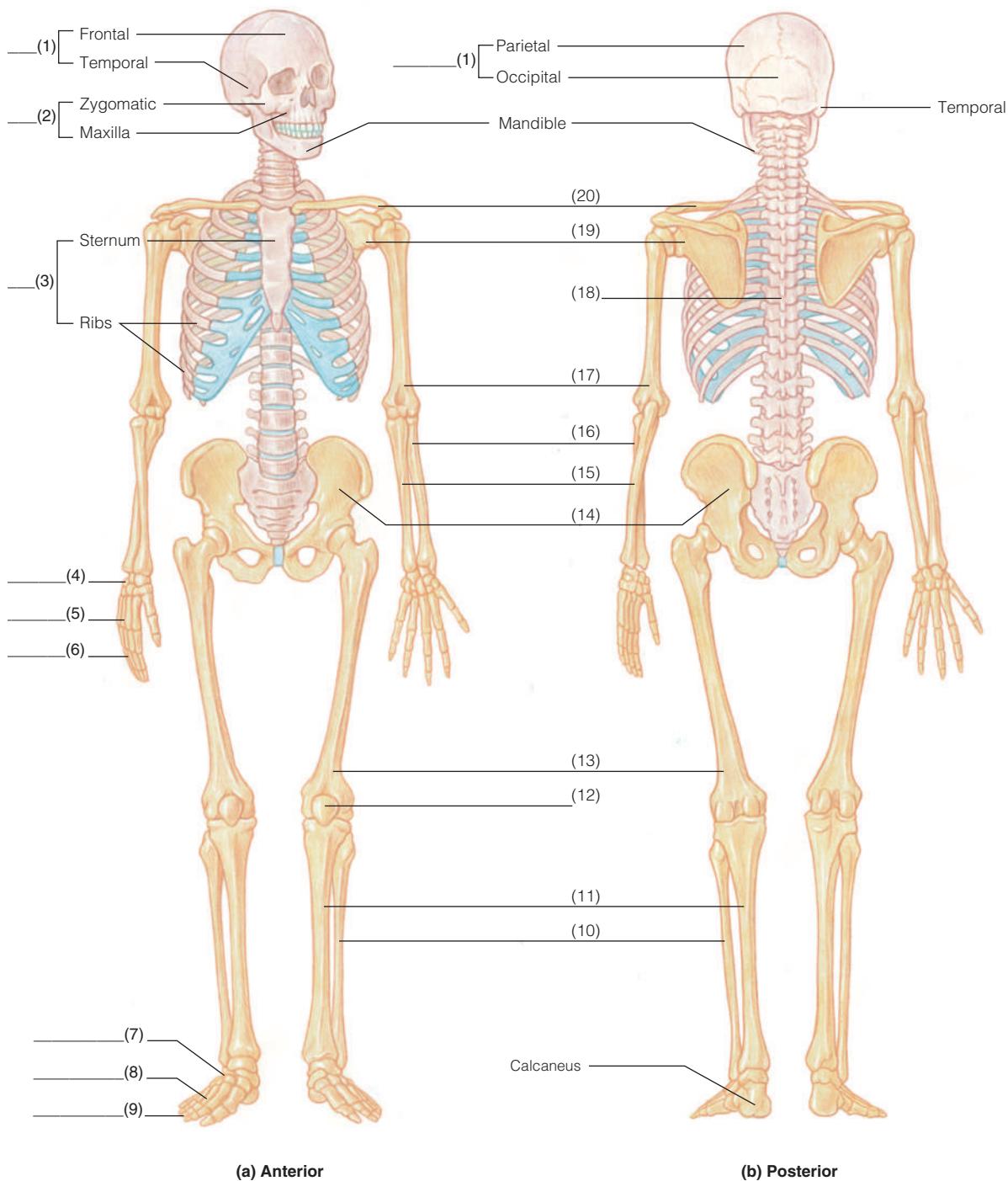
Circle any words that are spelled incorrectly in the list below. Then correct the spelling in the space provided.

1. calcaneus \_\_\_\_\_
2. osseous \_\_\_\_\_
3. mylogenus \_\_\_\_\_
4. cocyx \_\_\_\_\_
5. humeral \_\_\_\_\_
6. vertabral \_\_\_\_\_
7. phalanges \_\_\_\_\_
8. reumatoid \_\_\_\_\_
9. imobilization \_\_\_\_\_
10. cartalage \_\_\_\_\_

### EXERCISE 7-11 Labeling—Bones

Using the body structures listed below, label Figure 7-13. Write your answer on the numbered space provided below, or if you prefer, on the diagram.

carpals	humerus	scapula
clavicle	metacarpals	tarsals
cranium	metatarsals	thorax
facial bones	patella	tibia
femur	phalanges	ulna
fibula	radius	vertebra
hip bones		

**Figure 7-13** Major bones of the body.

Example:

- 1.** cranium
- 2.** \_\_\_\_\_
- 3.** \_\_\_\_\_

4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_
10. \_\_\_\_\_
11. \_\_\_\_\_
12. \_\_\_\_\_
13. \_\_\_\_\_
14. \_\_\_\_\_
15. \_\_\_\_\_
16. \_\_\_\_\_
17. \_\_\_\_\_
18. \_\_\_\_\_
19. \_\_\_\_\_
20. \_\_\_\_\_

## Animations

Visit the companion website to view the video on **kyphosis**, **lordosis**, and **scoliosis**.

Also watch the following videos: **Osteorheumatoid Arthritis**; **Arthroscopy**; **Internal Fixation of a Fracture**.

### 7.10 Pronunciation and Spelling

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

Word	Pronunciation	Spelling
acetabular	ass-eh-TAB-yoo-lar	_____
arthralgia	ar-THRAL-jee-ah	_____
arthritis	ar-THRIGH-tis	_____

Word	Pronunciation	Spelling
<b>arthrocentesis</b>	<b>ar-throh-sen-TEE-sis</b>	
<b>arthrodesis</b>	<b>ar-throh-DEE-sis</b>	
<b>arthroplasty</b>	<b>AR-throh-plas-tee</b>	
<b>arthroscopy</b>	<b>ar-THROS-koh-pee</b>	
<b>carpals</b>	<b>KAR-palz</b>	
<b>chondrocyte</b>	<b>KON-droh-sight</b>	
<b>chondroma</b>	<b>kon-DROH-mah</b>	
<b>chondromalacia</b>	<b>kon-droh-mah-LAY-she-ah</b>	
<b>chondrosarcoma</b>	<b>kon-droh-sar-KOH-mah</b>	
<b>clavicle</b>	<b>KLAV-ih-kul</b>	
<b>coccyx</b>	<b>KOCK-sicks</b>	
<b>cranium</b>	<b>KRAY-nee-um</b>	
<b>ethmoid</b>	<b>ETH-moyd</b>	
<b>facial</b>	<b>FAY-shal</b>	
<b>femur</b>	<b>FEE-mur</b>	
<b>fibula</b>	<b>FIB-yoo-lah</b>	
<b>frontal</b>	<b>FRUN-tal</b>	
<b>humerus</b>	<b>HEW-mer-us</b>	
<b>kyphosis</b>	<b>kye-FOH-sis</b>	
<b>lacrimal</b>	<b>LACK-rih-mal</b>	
<b>lordosis</b>	<b>lor-DOH-sis</b>	
<b>mandible</b>	<b>MAN-dih-bull</b>	
<b>maxilla</b>	<b>MACK-sil-ah</b>	
<b>metacarpals</b>	<b>met-ah-KAR-palz</b>	
<b>metatarsals</b>	<b>met-ah-TAHR-salz</b>	
<b>myelogenous</b>	<b>my-eh-LOJ-en-us</b>	
<b>occipital</b>	<b>ock-SIP-ih-tal</b>	
<b>orthopedics</b>	<b>or-thoh-PEE-dicks</b>	
<b>osseous</b>	<b>OS-ee-us</b>	

Word	Pronunciation	Spelling
<b>osteitis</b>	<b>os-tee-EYE-tis</b>	
<b>osteoma</b>	<b>os-tee-OH-ma</b>	
<b>osteomalacia</b>	<b>os-tee-oh-mah-LAY-shee-ah</b>	
<b>osteomyelitis</b>	<b>os-tee-oh-my-eh-LYE-tis</b>	
<b>osteoporosis</b>	<b>os-tee-oh-por-OH-sis</b>	
<b>osteosarcoma</b>	<b>os-tee-oh-sar-KOH-mah</b>	
<b>patella</b>	<b>pah-TEL-ah</b>	
<b>phalanges</b>	<b>fah-LAN-jeez</b>	
<b>radius</b>	<b>RAY-dee-us</b>	
<b>sacrum</b>	<b>SAY-krum</b>	
<b>scapula</b>	<b>SKAP-yoo-lah</b>	
<b>scoliosis</b>	<b>skoh-lee-OH-sis</b>	
<b>sphenoid</b>	<b>SFEE-noyd</b>	
<b>sternum</b>	<b>STER-num</b>	
<b>subcostal</b>	<b>sub-KOS-tal</b>	
<b>tarsals</b>	<b>TAHR-salz</b>	
<b>temporal</b>	<b>TEM-por-al</b>	
<b>temporomandibular</b>	<b>tem-por-oh-man-DIB-you-lar</b>	
<b>thorax</b>	<b>THOR-acks</b>	
<b>tibia</b>	<b>TIB-ee-ah</b>	
<b>ulna</b>	<b>ULL-nah</b>	
<b>vertebral column</b>	<b>VER-teh-bral KOL-um</b>	
<b>zygomatic</b>	<b>zye-goh-MAT-ick</b>	

## CHAPTER 8

# Muscular System

### Chapter Outline

- 8.1** Major Muscles of the Body
- 8.2** Types of Muscle Tissue
- 8.3** Movements of Skeletal Muscles
- 8.4** New Roots, Suffixes, and Prefixes
- 8.5** Learning the Terms
- 8.6** Pathology
- 8.7** Look-Alike and Sound-Alike Words
- 8.8** Review Exercises
- 8.9** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

1. Name three types of muscle tissue and state the location of each.
2. Name and define types of muscular movement.
3. Name, locate, and state the function of common skeletal muscles.
4. Pronounce, spell, define, and write the medical terms related to the muscular system.
5. Describe common diseases related to the muscular system.
6. Listen, read, and study so you can speak and write.

### Introduction

All bodily movement is performed by muscle. Bend your arm and move your hand toward your shoulder. The muscles in your forearm and upper arm have made this happen. They are called **voluntary** muscles because you can make them move when you want them to. At the same time you were doing this, your heart kept beating even though you were not thinking about it. The heart is an example of **involuntary** muscle. It does its job without being told.

## 8.1 Major Muscles of the Body

### PRACTICE FOR LEARNING: Major Muscles of the Body

Write the muscles listed below in the correct spaces in Figure 8-1A and B. To help you, the number beside the muscle tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

#### Anterior View

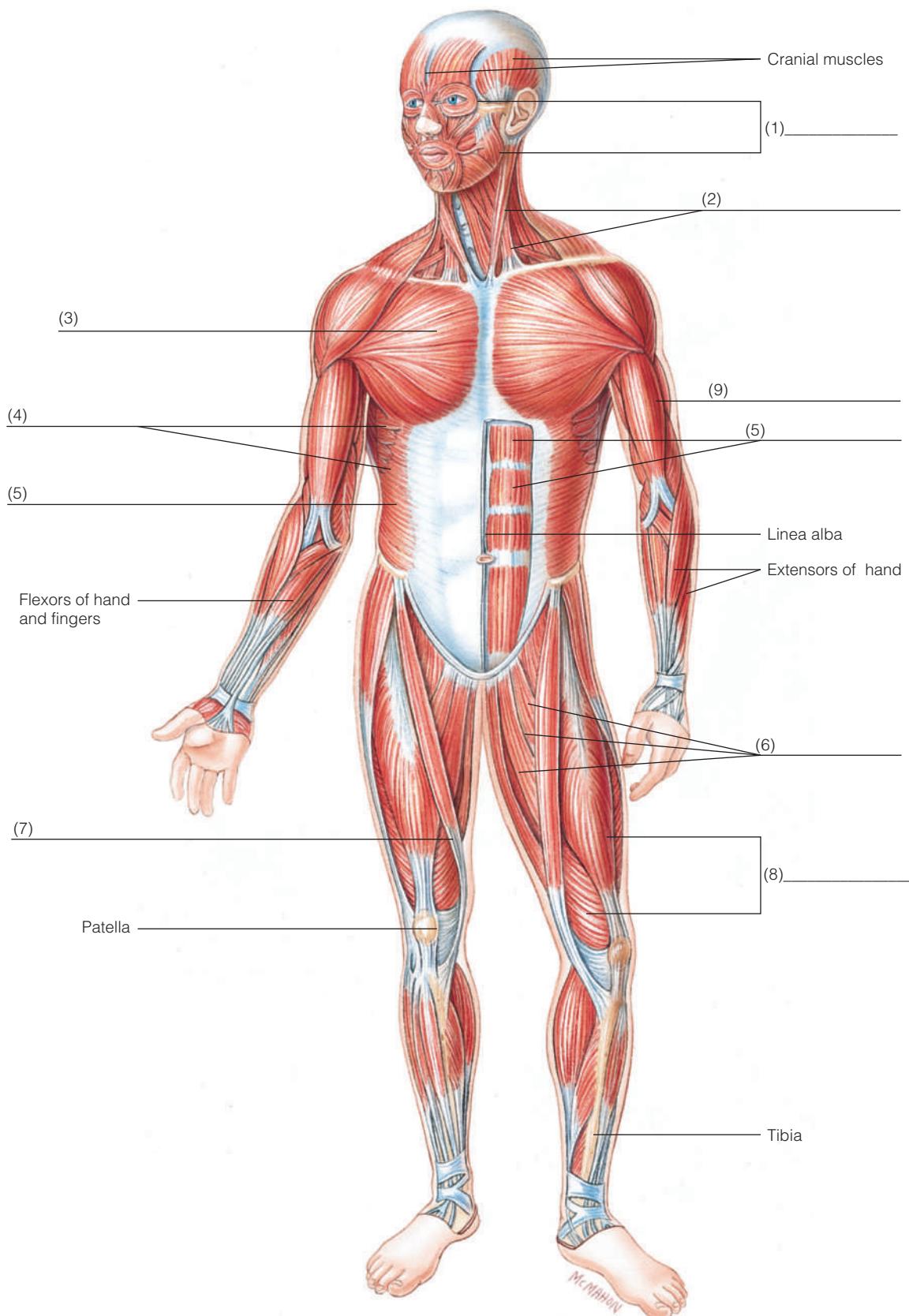
1. facial muscles (**FAY-shul MUSS-elz**)
2. sternocleidomastoid (**stern-oh-kleye-doh-MASS-toyd**)
3. pectoralis major (**peck-tor-AL-iss MAY-jor**)
4. serratus anterior (**seh-RAY-tuss an-TEER-ee-or**)
5. abdominal muscles (**ab-DOM-ih-nul**)
6. adductors of thigh (**ah-DUCK-terz**)
7. sartorius (**sar-TOR-ee-us**)
8. quadriceps femoris (**KWAH-drih-seps FEM-or-iss**)
9. biceps brachii (**BYE-seps BRAY-kee**)

#### Posterior View

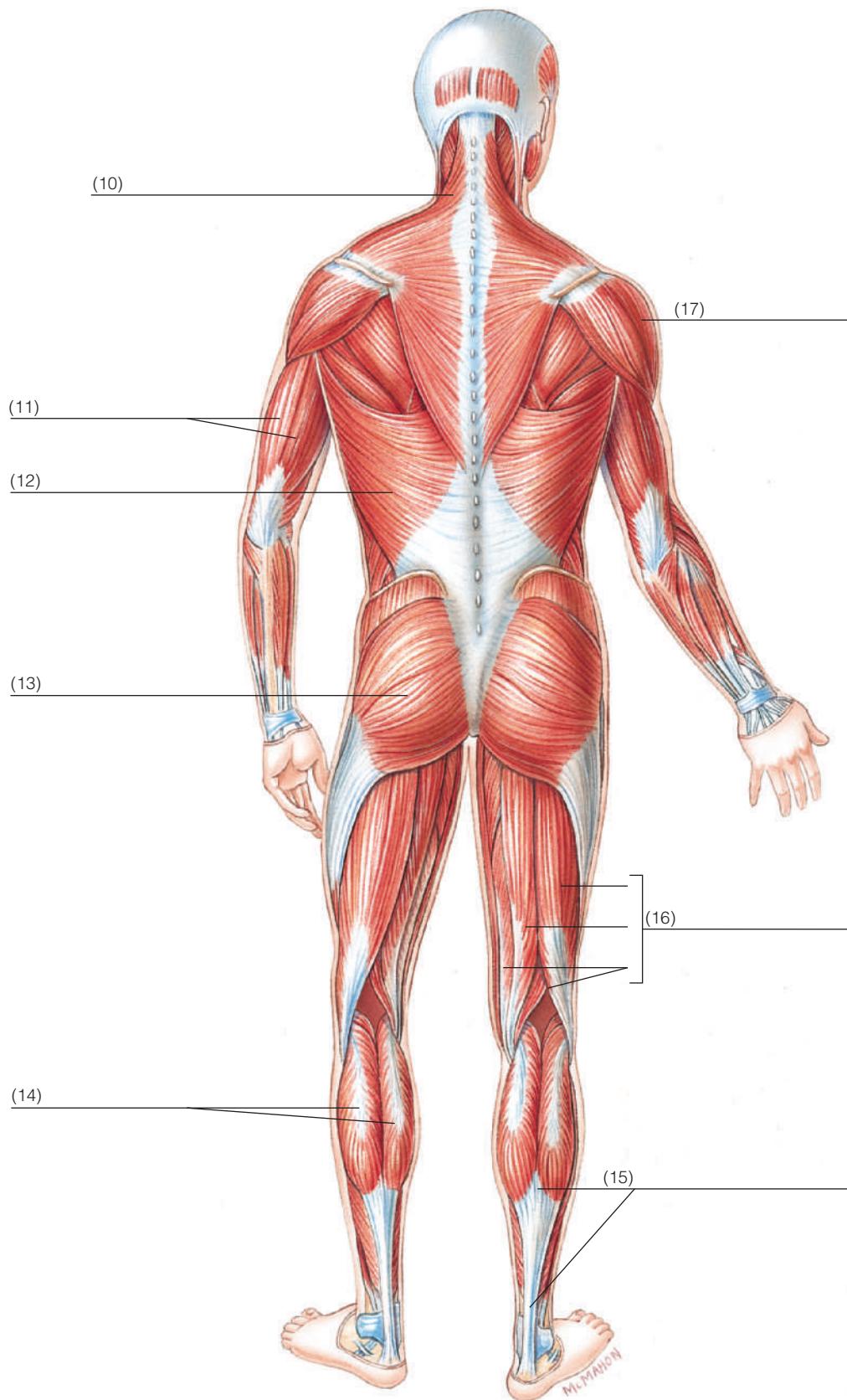
10. trapezius (**trah-PEE-zee-us**)
11. triceps brachii (**TRIGH-seps BRAY-kee**)
12. latissimus dorsi (**lah-TIS-ih-mus**)
13. gluteus maximus (**GLOO-tee-us MAX-ih-muss**)
14. gastrocnemius (**gas-troh-NEE-mee-us**)
15. Achilles tendon (**ah-KILL-eez TEN-don**)
16. hamstrings (**HAM-stringz**)
17. deltoid (**DEL-toyd**)

#### Helping You Remember

The words “biceps” and “triceps” always end in “s,” whether they are referring to one muscle or more than one.



**Figure 8-1** A. Skeletal muscles, anterior view.



**Figure 8-1** B. Skeletal muscles, posterior view.

## 8.2 Types of Muscle Tissue

The cells found in muscle are called muscle fibers. They are long, slender, and thread-like. They can **contract** (kon-TRAKT), which means they can shorten their length. This makes movement possible. Muscle fibers form three types of muscle tissue: **cardiac** (KAR-dee-ack), **visceral** (VISS-er-al), and **skeletal** (SKEL-eh-tal). Cardiac muscle is located in the heart and functions to pump blood. Visceral muscles move internal organs such as the respiratory tract, digestive tract, and blood vessels. Skeletal muscles are located on top of bone. They move bone by pulling on it.

### In Brief

There are three types of muscle tissue:

**cardiac**

**visceral**

**skeletal**

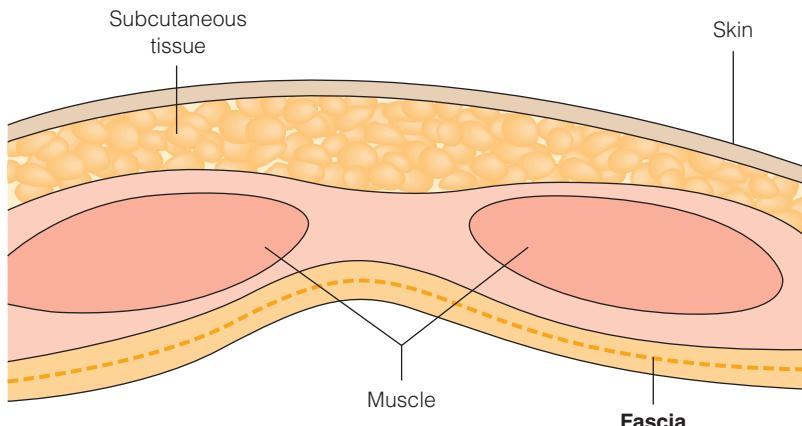
All muscle is wrapped in a band of connective tissue called **fascia** (FASH-ee-ah), as illustrated in Figure 8-2. This is called deep fascia.

In this chapter you will learn only about the skeletal muscles.

### PRACTICE FOR LEARNING: Muscle Types

Fill in the blanks with the correct answer.

1. Muscle cells are also called \_\_\_\_\_.
2. Name three types of muscle tissue: \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
3. What is the main function of muscle tissue? \_\_\_\_\_



**Figure 8-2** Fascia wraps around muscle.

4. Where are visceral muscles located? \_\_\_\_\_

5. Where are skeletal muscles located? \_\_\_\_\_

6. Define deep fascia. \_\_\_\_\_

**Answers:** 1. muscle fibers. 2. cardiac, skeletal, and visceral. 3. movement; contraction. 4. internal organs. 5. on top of bones. 6. band of connective tissue around the muscle

### 8.3 Movements of Skeletal Muscles

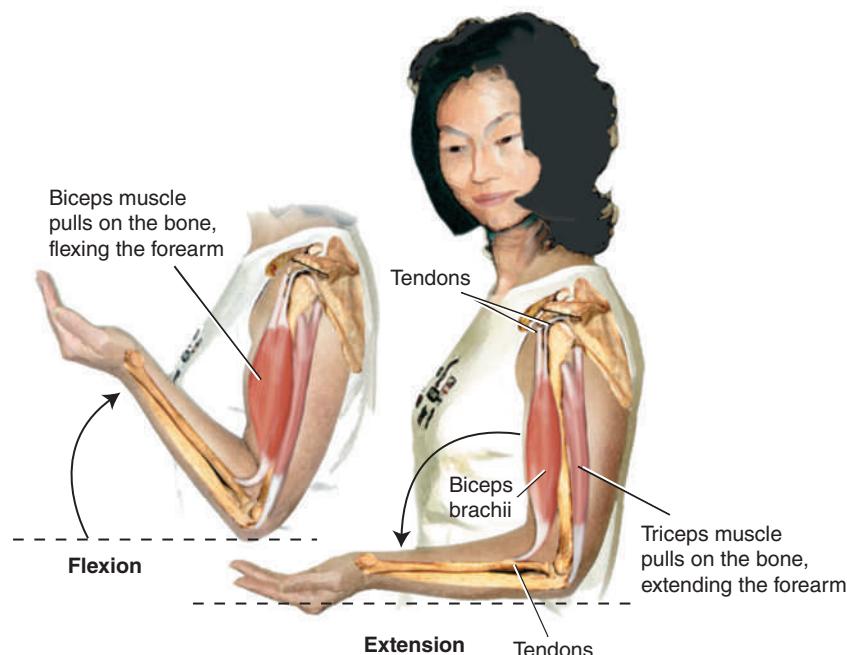
All skeletal muscles are connected to two bones. This makes movement possible. When the muscle contracts, one of the two bones it is connected to moves because the muscle pulls on the bone. This is illustrated in Figure 8-3.

The muscles are connected to bones by bands of connective tissue. Some of these tissues are thin and cordlike. They are called tendons (Figure 8-3). Broader bands of connective tissues are called **aponeuroses** (ah-poh-new-ROH-seez).

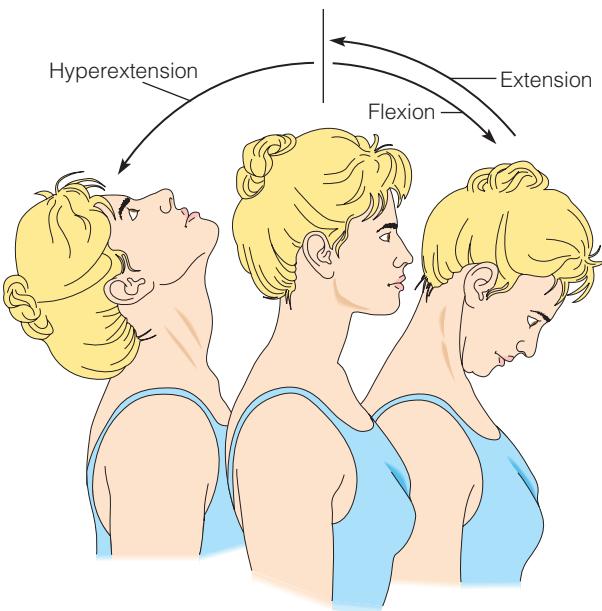
#### Types of Muscle Movements

Muscles move bone in different ways. The common movements are listed below and are illustrated in Figures 8-4 to 8-8.

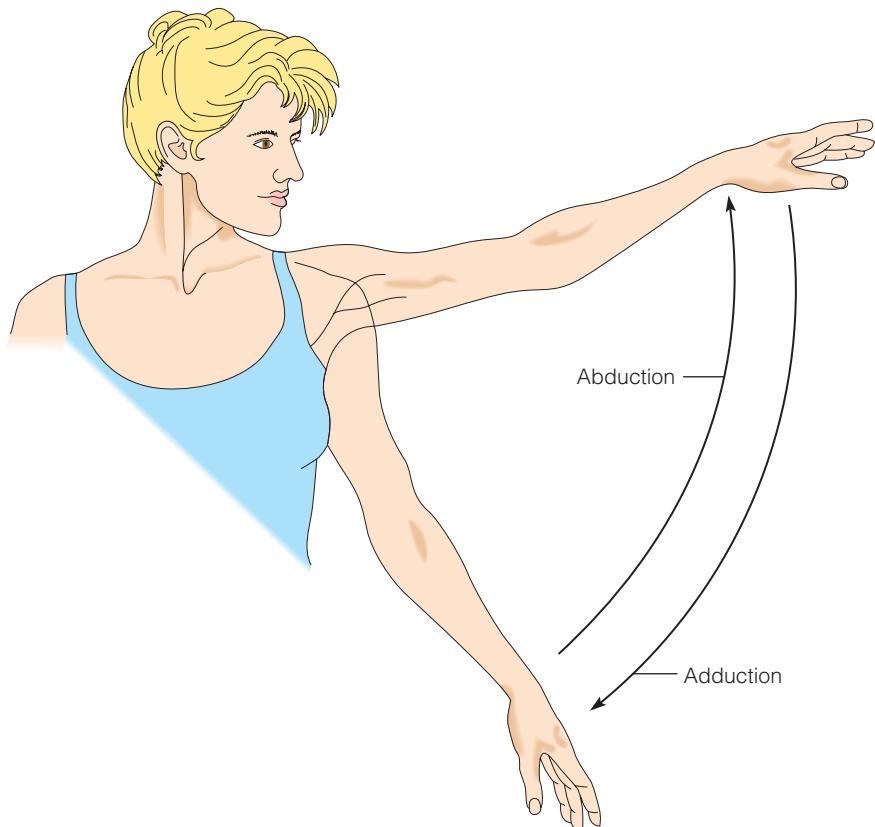
- **Flexion** means decreasing the angle between two bones, such as bending the neck forward or bending a limb.



**Figure 8-3** Movement of the forearm by biceps and triceps muscles. All skeletal muscles are connected to bones by tendons. Bone movement occurs when the muscle pulls on the bone.



**Figure 8-4** Muscle movements: flexion, extension, and hyperextension.



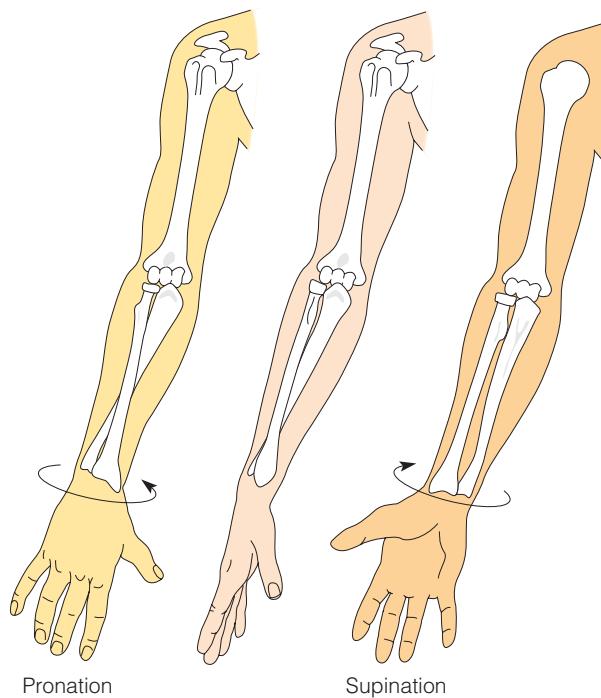
**Figure 8-5** Muscle movements: abduction and adduction.

- **Extension** means increasing the angle between two bones; it is a return from flexion.
- **Hyperextension** means overextending the joint beyond straight (beyond the anatomical position).
- **Abduction** means movement **away** from the midline of the body, usually involving the upper or lower limbs.
- **Adduction** means movement **toward** the midline of the body, usually involving the upper or lower limbs.

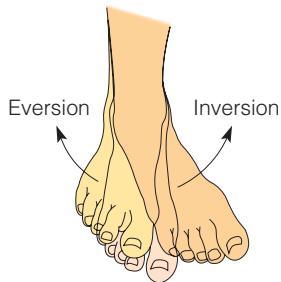
### Helping You Remember

Notice that adduction has the word “add” in it, meaning “to bring things together.”

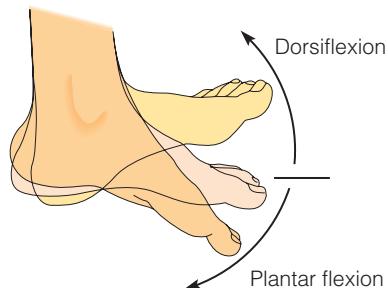
- **Pronation** means turning the palm down or backward.
- **Supination** means turning the palm up or toward the front.
- **Eversion** means movement of the sole of the foot outward, away from the midline.
- **Inversion** means movement of the sole of the foot inward, toward the midline.



**Figure 8-6** Muscle movements: pronation and supination.



**Figure 8-7** Muscle movements: eversion and inversion.



**Figure 8-8** Muscle movements: dorsiflexion and plantar flexion.

- **Dorsiflexion** means flexion at the ankle moving the foot upward.
- **Plantar flexion** means flexion at the ankle pointing the toes toward the ground.

### PRACTICE FOR LEARNING: Muscle Movements

Fill in the blanks with the correct muscle movement:

1. Overextending the joint beyond the anatomical position.  
\_\_\_\_\_

2. Movement of the sole inward toward the midline.  
\_\_\_\_\_

3. Turning the palm down or backward.  
\_\_\_\_\_

4. Movement toward the midline of the body.  
\_\_\_\_\_

5. Decreasing the angle between two bones.  
\_\_\_\_\_

6. Turning the palm up or toward the front.  
\_\_\_\_\_

**7.** Flexion at the ankle pointing the toes toward the ground.

**8.** Movement away from the midline of the body.

Answers: 1. hyperextension. 2. inversion. 3. pronation. 4. adduction. 5. flexion. 6. supination. 7. plantar flexion. 8. abduction.

## 8.4 New Roots, Suffixes, and Prefixes

Use these additional roots, suffixes, and prefixes when studying the terms in this chapter.

ROOT	MEANING
<b>fibr/o</b>	fiber
<b>skelet/o</b>	skeleton

SUFFIX	MEANING
<b>-asthenia</b>	no strength
<b>-cele</b>	hernia; protrusion or displacement of an organ through a structure that normally contains it
<b>-clonus</b>	violent action; turmoil
<b>-ia</b>	condition

PREFIX	MEANING
<b>brady-</b>	slow
<b>hemi-</b>	half
<b>para-</b>	abnormal; beside; near
<b>quadri-; tetra-</b>	four

## 8.5 Learning the Terms

Following these steps will make it easier for you to learn medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.

3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

## Roots

ROOT <b>condyl/o</b>		MEANING a small rounded bony process or projection like the elbow; condyle (KON-dil)
Term	Term Analysis	Definition
<b>epicondylitis</b> (ep-ih-kon-dih-LYE-tis)	epi- above; on; upon -itis = inflammation	inflammation of tissue surrounding the elbow

ROOT <b>fasci/o</b>		MEANING fascia (band of connective tissue surrounding the muscle)
Term	Term Analysis	Definition
<b>fascial</b> (FASH-ee-al)	-al = pertaining to	pertaining to fascia
<b>fascitis</b> (fah-SIGH-tis). Also, <b>fasciitis</b> (fas-ee-EYE-tis)	-itis = inflammation	inflammation of the fascia

ROOT <b>kinesi/o</b>		MEANING movement
Term	Term Analysis	Definition
<b>kinesiology</b> (kih-nee-see-OL-oh-jee)	-logy = study of	study of movement

ROOT <b>muscul/o (see also my/o)</b>		MEANING muscle
Term	Term Analysis	Definition
<b>muscular</b> (MUS-kyoo-lar)	-ar = pertaining to	pertaining to muscle
<b>musculoskeletal</b> (mus-kyoo-loh-SKEL-eh-tal)	-al = pertaining to skelet/o = skeleton	pertaining to the muscles and skeleton

ROOT my/o	MEANING muscle	
Term	Term Analysis	Definition
<b>electromyography</b> (ee-leck-troh-my-OH-rah-fee)	-graphy = process of recording electr/o = electricity	process of recording the electrical activity of a muscle
<b>fibromyalgia</b> (figh-broh-my-AL-jee-ah)	-algia = pain fibr/o = fiber	chronic muscle pain
<b>myasthenia gravis (MG)</b> (mye-as-THEE-nee-ah GRAH-vis)	-asthenia = no strength; muscle weakness gravis = grave or severe	weakening and fatigue of the skeletal muscles. The disease is caused by abnormalities at the neuromuscular junction.
<b>myocele</b> (MY-oh-seel)	-cele = hernia; protrusion or displacement of an organ through a structure that normally contains it	hernia of muscle; protrusion of muscle through its fascia
<b>myoclonus</b> (my-oh-KLOH-nus)	-clonus = violent action; turmoil	sudden involuntary jerking of a muscle or group of muscles

ROOT tendin/o; ten/o	MEANING tendon	
Term	Term Analysis	Definition
<b>tendinitis</b> (ten-dih-NIGH-tis)	-itis = inflammation	inflammation of a tendon
<b>tendinous</b> (TEN-dih-nus)	-ous = pertaining to	pertaining to a tendon
<b>tenotomy</b> (teh-NOT-eh-me)	-tomy = to cut	cutting of a tendon

ROOT ton/o	MEANING tone; tension	
Term	Term Analysis	Definition
<b>atonic</b> (ah-TON-ick)	-ic = pertaining to a- = no; not; lack of	pertaining to no tone or tension
<b>dystonia</b> (dis-TOH-nee-ah)	-ia = condition dys- = abnormal; bad; difficult; painful	abnormal muscle tone

Term	Term Analysis	Definition
<b>myotonia</b> (my-oh-TOH-nee-ah)	-ia = condition my/o = muscle	muscle is unable to relax; a type of dystonia
<b>tonic</b> (TON-ick)	-ic = pertaining to	pertaining to tone

## Suffixes

SUFFIX -kinesia; -kinesis		MEANING movement
Term	Term Analysis	Definition
<b>bradykinesia</b> (brad-ee-kih-NEE-zee-ah)	brady- = slow	slow movement
<b>dyskinesia</b> (dis-kih-NEE-zee-ah)	dys- = poor; bad; difficult; painful; abnormal	poor muscle movement
<b>hyperkinesis</b> (high-per-kih-NEE-sis)	hyper- = excessive; above normal	excessive movement; hyperactivity

SUFFIX -paresis		MEANING weakness or incomplete paralysis
Term	Term Analysis	Definition
<b>hemiparesis</b> (hem-ee-pah-REE-sis)	hemi- = half	weakness or partial paralysis affecting either the right or left side of the body
<b>myoparesis</b> (my-oh-pah-REE-sis)	my/o = muscle	weak or slight muscular paralysis

SUFFIX -plegia		MEANING paralysis
Term	Term Analysis	Definition
<b>paraplegia</b> (par-ah-PLEE-jee-ah)	para- = abnormal	paralysis of the lower trunk and legs. The trunk refers to the body, not including the head and extremities.
<b>quadriplegia</b> (kwad-rih-PLEE-jee-ah)	quadri- = four	paralysis of all four extremities. Also known as tetraplegia.

SUFFIX -penia		MEANING decrease; deficiency
Term	Term Analysis	Definition
<b>sarcopenia</b> (sar-koh-PEE-nee-ah)	sarc/o = flesh	loss of muscle mass, strength, and function that comes with aging

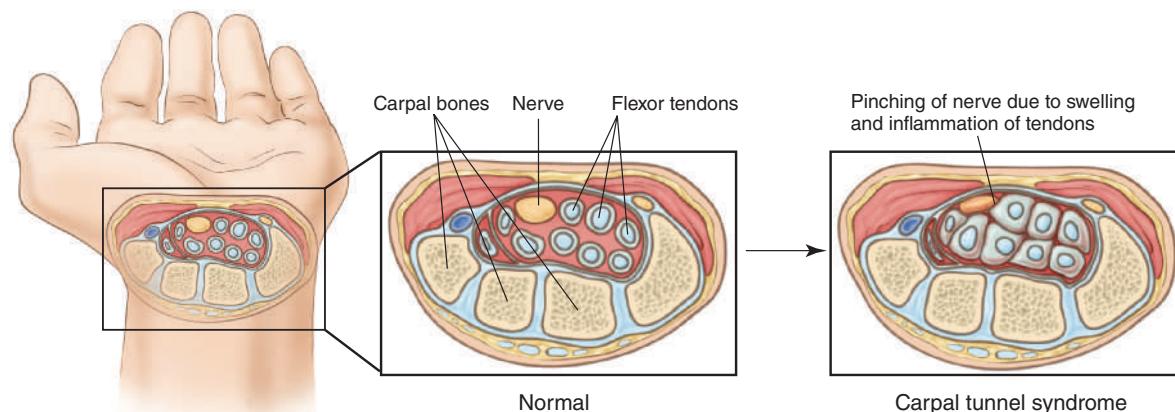
SUFFIX -taxia		MEANING order
Term	Term Analysis	Definition
<b>ataxia</b> (ah-TACKS-ee-ah)	a- = no; not; lack of	no muscular coordination

## 8.6 Pathology

### Carpal Tunnel Syndrome (CTS)

A syndrome is a group of signs and symptoms that indicates a specific disease. A sign is something that the physician can observe, such as swelling. A symptom is something that the patient experiences, such as pain.

The carpal tunnel (Figure 8-9) is a small passageway in the wrist on the palmar side (the palm side) of the forearm. This passageway is made of ligaments. It protects the median nerve and tendons on the palmar side of the wrist. When the tendons and ligaments in this area are overused, they become inflamed, putting pressure on the median nerve. This causes numbness, pain, and weakness.



**Figure 8-9** Carpal Tunnel Syndrome The carpal tunnel is located at the wrist. Tendons pass through this tunnel. When the tendons become inflamed, pressure is placed on the median nerve causing pain, numbness, and weakness.

## Muscular Dystrophy (MD)

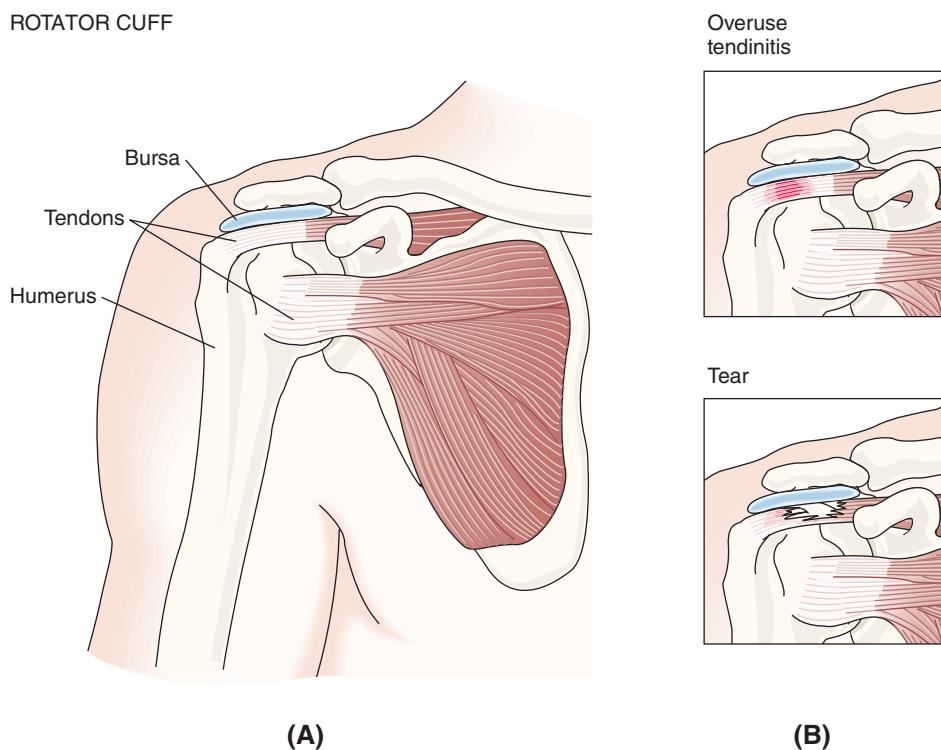
"Muscular dystrophy" is a broad term that includes a number of inherited disorders of the skeletal muscles. The main features are muscular weakness and degeneration of muscle tissue. The most common type is **Duchenne** (doo-SHEN) muscular dystrophy. There is no cure for the disease.

## Rotator Cuff Tendinitis

The rotator cuff is a group of tendons. The tendons hold the shoulder joint in place (Figure 8-10A). Rotator cuff tendinitis is the inflammation of these tendons (Figure 8-10B). The major cause is overuse. Swimmers, tennis players, and baseball pitchers are particularly prone to rotator cuff tendinitis.

## Strain

A strain results from overstretching or tearing a muscle. It is commonly called a pulled muscle. Do not confuse a strain with a **sprain**. A sprain is a tearing of a ligament.



**Figure 8-10** Rotator cuff. A. Healthy rotator cuff. B. Injured rotator cuff (overuse tendinitis and tear).

## 8.7 Look-Alike and Sound-Alike Words

Below is a list of look-alike and sound-alike words. Study the spelling and definitions of each set of words. Questions will follow in the Review Exercises.

**TABLE 8-1 Look-Alike and Sound-Alike Words**

<b>abduction</b>	to draw away from the midline of the body
<b>adduction</b>	to draw toward the midline of the body
<b>myelography</b>	process of recording the spinal cord
<b>myography</b>	process of recording a muscle
<b>fascial</b>	pertaining to the fascia
<b>facial</b>	pertaining to the face
<b>flexor</b>	a muscle that flexes a joint
<b>flexure</b>	a portion of a structure that is bent
<b>peroneal</b>	pertaining to the muscles over the fibula. Term of the muscular system
<b>peritoneal</b>	pertaining to the peritoneum. The peritoneum is a membrane lining the abdominopelvic cavity. Term of the digestive system
<b>perineal</b>	pertaining to the perineum. The perineum is the area between the vagina and anus in the female. In the male, it is the area between the scrotum and anus. Term of the reproductive system.

## 8.8 Review Exercises

### EXERCISE 8-1 Look-Alike and Sound-Alike Words

*Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 8-1 if it helps you.*

1. Move your leg away from the midline of your body. This motion is (**abduction/adduction**).
2. Muscle disease may be assessed by (**myelography/myography**).
3. Plantar (**fascial/facial**) pain can be caused by flat feet.
4. The (**fascial/facial**) muscles can wrinkle the forehead and pucker the lips.

5. Bob cannot bend his wrist because the (**flexor/flexure**) muscles were damaged in a motorcycle accident.
6. Debra tore the (**peroneal/peritoneal/perineal**) area when she delivered her baby.
7. The (**peroneal/peritoneal/perineal**) cavity in the abdomen was filled with fluid.
8. The (**peroneal/peritoneal/perineal**) muscle is responsible for abduction of the foot.

### EXERCISE 8-2 Match Word Parts with Meanings

Match the word part in Column A with its meaning in Column B:

Column A	Column B
_____	1. fasci/o A. order
_____	2. -ia B. pertaining to
_____	3. kinesi/o C. pain
_____	4. my/o D. to cut
_____	5. -taxia E. tendon
_____	6. -ous F. muscle
_____	7. -tomy G. band of tissue
_____	8. -algia surrounding muscle
_____	9. ton/o H. tension
_____	10. ten/o I. movement
	J. condition

### EXERCISE 8-3 Short Answer—Anatomy and Physiology

Answer the following in the space provided.

1. Name three types of muscle tissue.

---

---

2. What is the primary function of muscle?

---

3. State the difference between:

a. pronation and supination \_\_\_\_\_

b. dorsiflexion and plantar flexion \_\_\_\_\_

c. hyperextension and extension \_\_\_\_\_

**EXERCISE 8-4 Location of Muscles**

Match the muscle with its location using the locations listed below:

arm \_\_\_\_\_

back \_\_\_\_\_

chest \_\_\_\_\_

leg \_\_\_\_\_

neck \_\_\_\_\_

shoulder \_\_\_\_\_

trunk \_\_\_\_\_

**1.** quadriceps \_\_\_\_\_

**2.** serratus anterior \_\_\_\_\_

**3.** pectoralis major \_\_\_\_\_

**4.** adductors \_\_\_\_\_

**5.** gastrocnemius \_\_\_\_\_

**6.** triceps brachii \_\_\_\_\_

**7.** hamstrings \_\_\_\_\_

**8.** Achilles tendon \_\_\_\_\_

**9.** biceps brachii \_\_\_\_\_

**10.** trapezius \_\_\_\_\_

**11.** latissimus dorsi \_\_\_\_\_

**12.** deltoid \_\_\_\_\_

**13.** sartorius \_\_\_\_\_

**14.** sternocleidomastoid \_\_\_\_\_

**EXERCISE 8-5 Definitions—Anatomy, Physiology, Pathology**

*Give the meaning of the following:*

1. **muscle fibers** \_\_\_\_\_
2. **tendons** \_\_\_\_\_
3. **fascia** \_\_\_\_\_
4. **adduction** \_\_\_\_\_
5. **eversion** \_\_\_\_\_
6. **ataxia** \_\_\_\_\_
7. **rotator cuff tendinitis** \_\_\_\_\_
8. **fibromyalgia** \_\_\_\_\_
9. **dystonia** \_\_\_\_\_
10. **tenotomy** \_\_\_\_\_

**EXERCISE 8-6 Definitions in Context**

*Define the bolded terms in context in the space below. Use your dictionary if necessary.*

**Discharge Summary**

**HISTORY OF PRESENT ILLNESS:** The patient is a seven-year-old boy who showed signs of muscular weakness at age three to four years. The diagnosis of **muscular dystrophy** was made when a muscle **biopsy** confirmed **degeneration** of muscle fibers. He is still walking and was started on drug **therapy** four months ago.

**PHYSICAL EXAMINATION:** On examination, the patient is a pleasant young fellow. He has **proximal** muscle weakness. He has **hypertrophy** and some shortening of the **Achilles tendon**. General physical examination is within normal limits.

**COURSE IN HOSPITAL:** While in the hospital, an **intravenous** line was started, and blood samples were taken for tests during a 24-hour period. The course in hospital was uneventful.

**Most Responsible Diagnosis: Muscular Dystrophy**

- a. **muscular dystrophy** \_\_\_\_\_
- b. **biopsy** \_\_\_\_\_
- c. **degeneration** \_\_\_\_\_

- d.** therapy \_\_\_\_\_
- e.** proximal \_\_\_\_\_
- f.** hypertrophy \_\_\_\_\_
- g.** Achilles tendons \_\_\_\_\_
- h.** intravenous \_\_\_\_\_

### EXERCISE 8-7 Word Building

*I. Use the root ton/o to build terms for the following definitions.*

- a.** pertaining to no tone or tension \_\_\_\_\_
- b.** abnormal muscle tone \_\_\_\_\_
- c.** muscle is unable to relax \_\_\_\_\_
- d.** pertaining to tone \_\_\_\_\_

*II. Use the suffix -kinesia to build terms for the following definitions.*

- a.** slow movement \_\_\_\_\_
- b.** impaired movement \_\_\_\_\_
- c.** excessive movement \_\_\_\_\_

*III. Use the correct suffix, -plegia or -paresis, to build terms for the following definitions.*

- a.** slight muscular paralysis \_\_\_\_\_  
\_\_\_\_\_
- b.** paralysis of both legs and the lower part of the body  
\_\_\_\_\_
- c.** paralysis of all four extremities \_\_\_\_\_
- d.** slight paralysis or weakness affecting half of the body \_\_\_\_\_

### EXERCISE 8-8 Spelling

*Circle any misspelled words in the list below and correctly spell them in the space provided.*

- 1.** quadraceps \_\_\_\_\_
- 2.** sternocliedomastoid \_\_\_\_\_
- 3.** serratus \_\_\_\_\_

4. adductor muscles \_\_\_\_\_
5. plantar \_\_\_\_\_
6. trapezious \_\_\_\_\_
7. latissimus dorsi \_\_\_\_\_
8. gastrocnemius \_\_\_\_\_
9. Achilles \_\_\_\_\_
10. biceps brachii \_\_\_\_\_

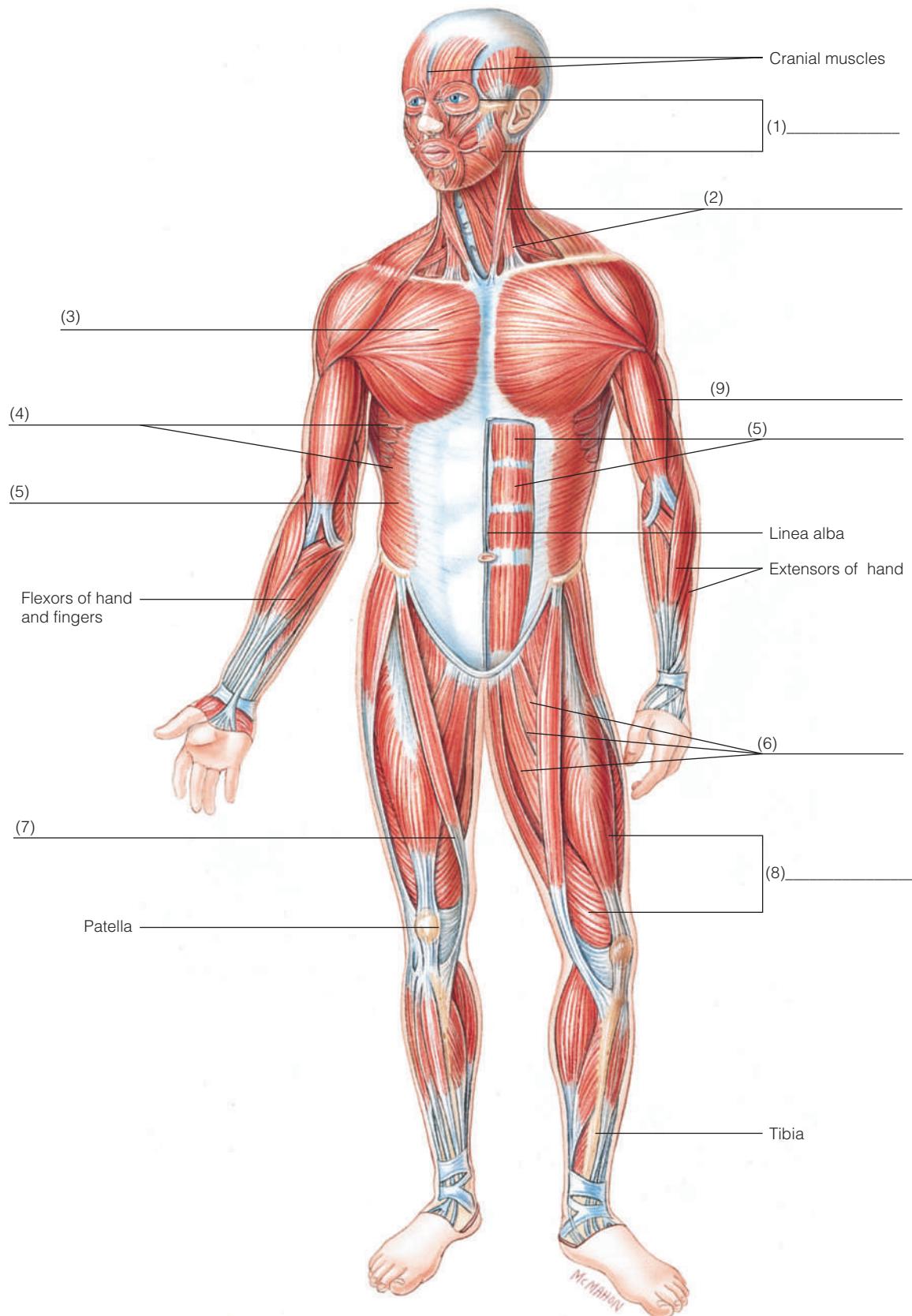
### EXERCISE 8-9 Labeling

#### *I. Skeletal Muscles, Anterior View*

*Using the body structures listed below, label Figures 8-11. Write your answers in the numbered space provided below, or if you prefer, on the diagram.*

abdominal muscles  
adductors  
biceps brachii  
facial muscles  
pectoralis major  
quadriceps femoris  
sartorius  
serratus major  
sternocleidomastoid

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_



**Figure 8-11** Skeletal muscles, anterior view.

*II. Skeletal Muscles, Posterior View*

Using the body structures listed below, label Figure 8-12. Write your answers in the numbered space provided.

Achilles tendon

deltoid

gastrocnemius

gluteus maximus

hamstrings

latissimus dorsi

trapezius

triceps brachii

**10.** \_\_\_\_\_

**11.** \_\_\_\_\_

**12.** \_\_\_\_\_

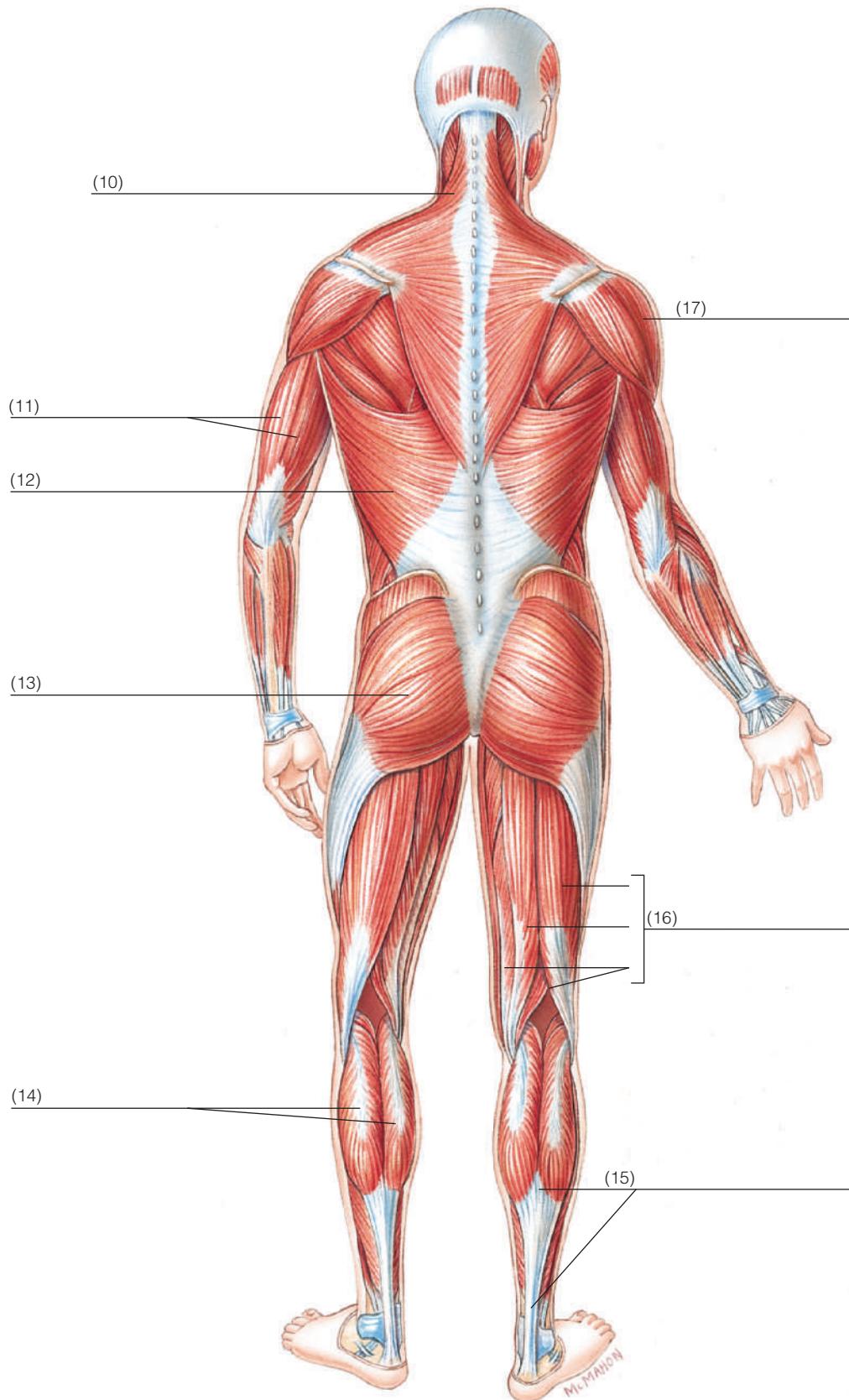
**13.** \_\_\_\_\_

**14.** \_\_\_\_\_

**15.** \_\_\_\_\_

**16.** \_\_\_\_\_

**17.** \_\_\_\_\_



**Figure 8-12** Skeletal muscles, posterior view.

## 8.9 Pronunciation and Spelling

*Listen, read, and study, so you can speak and write effectively.*

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

Word	Pronunciation	Spelling
<b>atonic</b>	ah-TON-ick	
<b>biceps brachii</b>	BYE-seps BRAY-kee	
<b>deltoid</b>	DEL-toyd	
<b>dorsiflexion</b>	dor-sih-FLECK-shun	
<b>dyskinesia</b>	dis-kih-NEE-zee-ah	
<b>dystonia</b>	dis-TOH-nee-ah	
<b>electromyography</b>	ee-leck-troh-my-OG-rah-fee	
<b>fascia</b>	FASH-ee-ah	
<b>fascitis</b>	fah-SIGH-tis	
<b>fibromyalgia</b>	figh-broh-my-AL-jee-ah	
<b>gastrocnemius</b>	gas-troh-NEE-mee-us	
<b>hemiparesis</b>	hem-ee-pah-REE-sis	
<b>inversion</b>	in-VER-zhun	
<b>kinesiology</b>	kih-nee-see-OL-oh-jee	
<b>latissimus dorsi</b>	lah-TISSLih-mus DOR-see	
<b>muscular</b>	MUS-kyoo-lar	
<b>muscular dystrophy</b>	MUS-kyoo-lar DISS-troh-fee	
<b>musculoskeletal</b>	mus-kyoo-loh-SKEL-eh-tal	
<b>myasthenia gravis</b>	(mye-as-THEE-nee-ah GRAH-vis)	
<b>myocele</b>	MY-oh-seel	
<b>myoclonus</b>	my-oh-KLOH-nus	
<b>myoparesis</b>	my-oh-pah-REE-sis	

Word	Pronunciation	Spelling
<b>myopathy</b>	my-OP-ah-thee	
<b>paraplegia</b>	par-ah-PLLEE-jee-ah	
<b>pectoralis major</b>	peck-tor-AL-iss MAY-jor	
<b>plantar flexion</b>	PLAN-tar FLECK-shun	
<b>pronation</b>	proh-NAY-shun	
<b>quadriplegia</b>	kwad-rih-PLLEE-jee-ah	
<b>sarcopenia</b>	sar-koh-PEE-nee-ah	
<b>serratus anterior</b>	seh-RAY-tuss an-TEER-ee-or	
<b>sternocleidomastoid</b>	stern-oh-kleye-doh-MASS-toyd	
<b>supination</b>	soo-pih-NAY-shun	
<b>tendinous</b>	TEN-dih-nus	
<b>tenotomy</b>	teh-NOT-oh-me	
<b>trapezius</b>	trah-PEE-zee-us	
<b>triceps brachii</b>	TRIGH-seps BRAY-kee	

## CHAPTER 9

# Nervous System



### Chapter Outline

- 9.1** Major Organs of the Nervous System
- 9.2** Divisions of the Nervous System
- 9.3** Nerve Cells and Nerves
- 9.4** Central Nervous System
- 9.5** Peripheral Nervous System
- 9.6** New Roots, Suffixes, and Prefixes
- 9.7** Learning the Terms
- 9.8** Pathology
- 9.9** Look-Alike and Sound-Alike Words
- 9.10** Review Exercises
- 9.11** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

- 1.** Name and describe the divisions of the nervous system.
- 2.** State the function of nerve cells.
- 3.** Name, locate, and describe the structures and functions of the brain and spinal cord.
- 4.** Describe the peripheral nervous system.
- 5.** Pronounce, spell, define, and write the medical terms related to the nervous system.
- 6.** Describe common diseases related to the nervous system.
- 7.** Listen, read, and study so you can speak and write.

## Introduction

The nervous system helps your body adjust to what is happening to it. If you touch something hot, the nervous system sends signals to the brain that make you quickly pull away. If the light around you grows stronger, the nervous system tells your eyes to adjust. If your body needs water, the nervous system makes you thirsty. The organs that carry the messages are called **nerves (NERVZ)**. This chapter will teach you the terms you need to know about this very complicated system.

### 9.1 Major Organs of the Nervous System

#### PRACTICE FOR LEARNING: Major Organs and Divisions

Write the words below in the correct space in Figure 9-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. brain (**BRAYN**)
2. spinal cord (**SPYE-nal KORD**)
3. central nervous system (CNS) (**SEN-tral NERV-us SIS-tem**)
4. peripheral nerves (**per-IF-er-al NERVZ**)
5. peripheral nervous system (PNS)

### 9.2 Divisions of the Nervous System

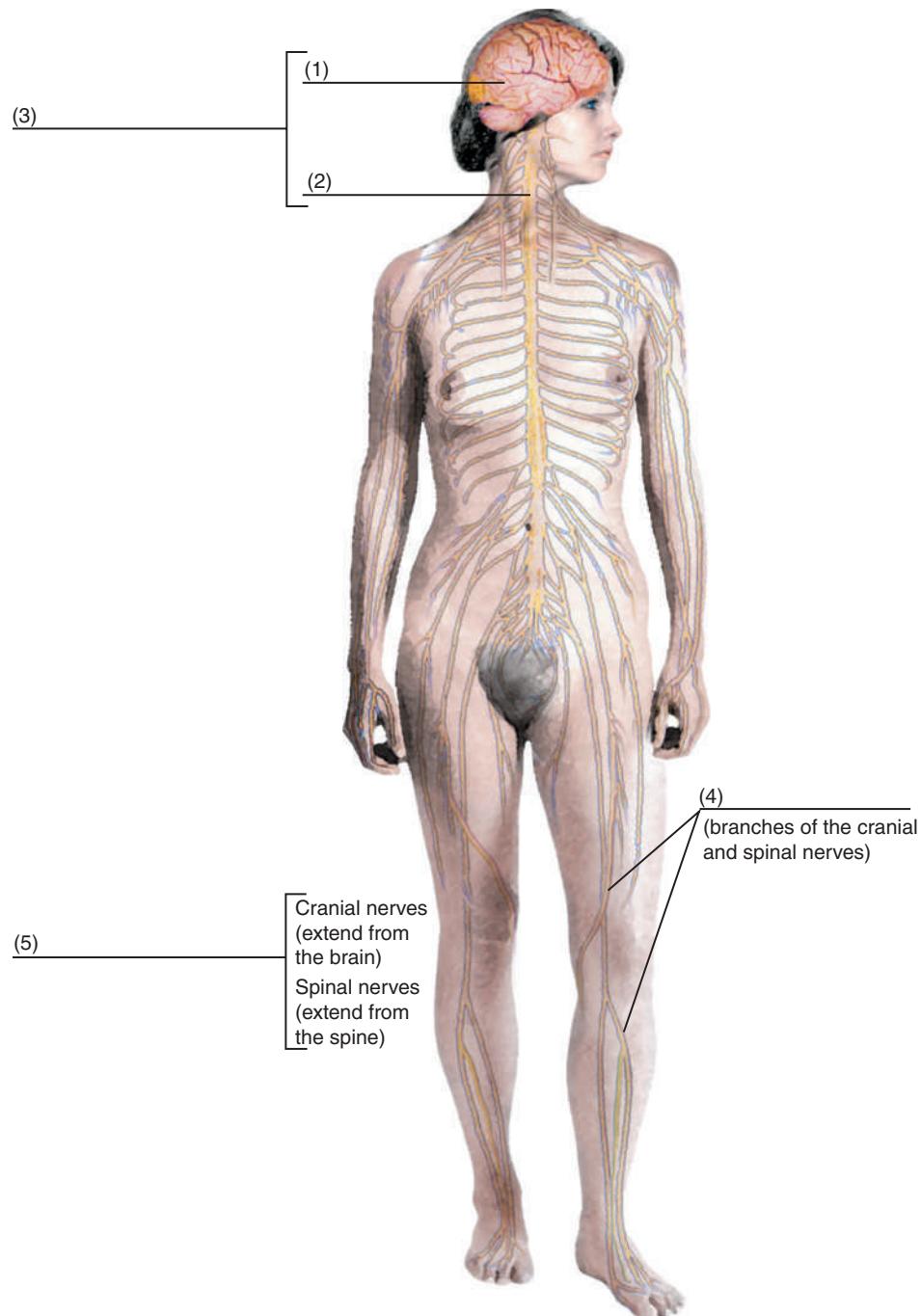
Figure 9-1 shows you the two main divisions of the nervous system. They are the central nervous system (CNS) and the peripheral nervous system (PNS).

The CNS consists of the brain and the spinal cord.

The PNS consists mostly of nerves. There are 12 pairs of **cranial** nerves. They extend from the brain. There are also 31 pairs of spinal nerves. They extend from the spinal cord. These nerves transmit electrical impulses to different parts of the body from the CNS. The nerves also transmit electrical impulses from all parts of the body back to the CNS.

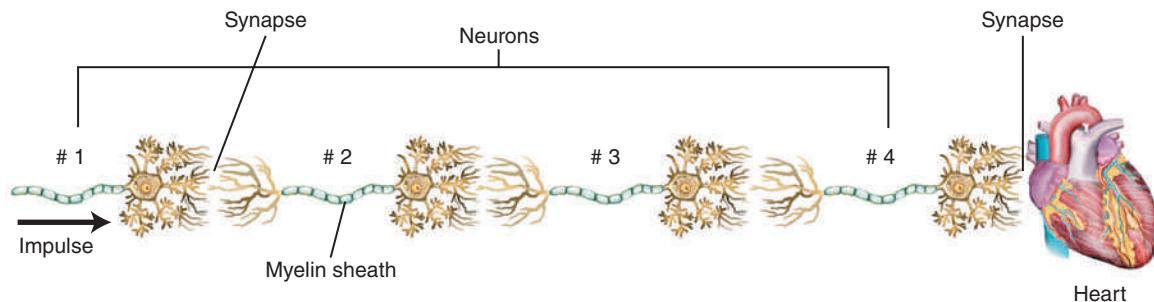
### 9.3 Nerve Cells and Nerves

**Neurons (NOO-ronz)** are nerve cells. They are very tiny, long, and slender (Figure 9-2). They make up organs called nerves. Neurons carry electrical impulses (messages) to and from the brain and spinal cord. They vary in size (some are as long as 3 feet or 91 centimeters).



**Figure 9-1** Nervous system generalized.

Some neurons are covered with a white fatty substance called a **myelin sheath** (**MY-eh-lin SHEETH**). The myelin sheath acts as an insulator, keeping the impulse traveling from neuron to neuron until its destination is reached (Figure 9-2). Neurons wrapped with myelin sheath are called **myelinated** (**MY-eh-lih-nayt-ed**). They are also called white matter. Neurons that are not covered with myelin are called **unmyelinated** (**UN-my-eh-lih-nayt-ed**). They are also called gray matter.



**Figure 9-2** Neurons placed end-to-end. An electrical impulse travels from one neuron to the next until it reaches its destination, which in this case is the heart.

**Neuroglia** (noo-ROG-glee-ah) are found between the neurons, connecting them and providing support and protection. Neuroglia do not carry electrical impulses. Astrocytes and microglia are two examples of neuroglia.

### In Brief

**Neurons** and **neuroglia** are **nerve cells**.

Some neurons are myelinated; some neurons are unmyelinated.

Neurons transport electrical impulses.

Neuroglia support and protect neurons.

### Helping You Remember

Neurons are like electrical wires. The myelin sheath is like the wrapping on an electric wire. Electric impulses move through an electrical wire, and nerve impulses travel from neuron to neuron. If the electric wire is broken, the impulses won't travel. Similarly, if the neuron is torn, the nerve impulses will not be transmitted.

## Nerves

Nerves are made up of neurons bunched together. They can be seen with the naked eye. There are two kinds of nerves. One kind carries impulses **to** the brain and spinal cord. For example, when the skin of your back is itchy, a message travels from the skin through a nerve to the spinal cord and then to the brain. When the message about the itch reaches the brain, the information is analyzed. An appropriate message is sent back from the brain through a second kind of nerve, which carries messages **from** the brain and spinal cord. These messages travel down the spinal cord and stimulate the muscles of the arms and hands. The muscles then respond to the message by scratching the skin. When a group of nerves is bundled together within the brain or spinal cord, the bundle is called a **tract**.

## Synapse

A **synapse** (SIN-apps) is the space between two neurons or between a neuron and an organ (Figure 9-2). When an electrical impulse reaches the end of a neuron, a neurotransmitter is released. The neurotransmitter carries the impulse across the space (the synapse) and onto the next neuron, or onto the organ the impulse is meant to stimulate. Some examples of neurotransmitters are **acetylcholine** (ah-SEE-tul-KOL-een), **dopamine** (DOH-pah-meen), **endorphins** (EN-dor-fins), **serotonin** (ser-oh-TOH-nin), and **norepinephrine** (nor-ep-ih-NEF-rin). These neurotransmitters have a variety of functions, including muscle movement, mood, and stress release.

### PRACTICE FOR LEARNING: Nerve Cells and Nerves

Circle true if the statement is correct. Circle false if the statement is not correct.

- |  |      |       |
|--|------|-------|
| 1. The myelin sheath acts as an insulator, keeping the nerve impulse on track. | True | False |
| 2. Neurons carry electrical impulses.  | True | False |
| 3. Neurons wrapped with myelin sheath are said to be myelinated.               | True | False |
| 4. Myelinated neurons are also called white matter.                            | True | False |
| 5. Electrical impulses travel to and away from the brain and spinal cord.      | True | False |
| 6. Neurons are organs made up of nerves.                                       | True | False |
| 7. Dopamine is a neurotransmitter.   | True | False |
| 8. The synapse carries serotonin to another neuron.                            | True | False |
| 9. A synapse is the gap between two neurons.                                   | True | False |

Answers: 1. True. 2. True. 3. True. 4. True. 5. True. 6. False. 7. True. 8. False. 9. True.

## 9.4 Central Nervous System

### The Brain

#### PRACTICE FOR LEARNING: Parts of the Brain

Write the different parts of the brain in the correct space in Figure 9-3. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

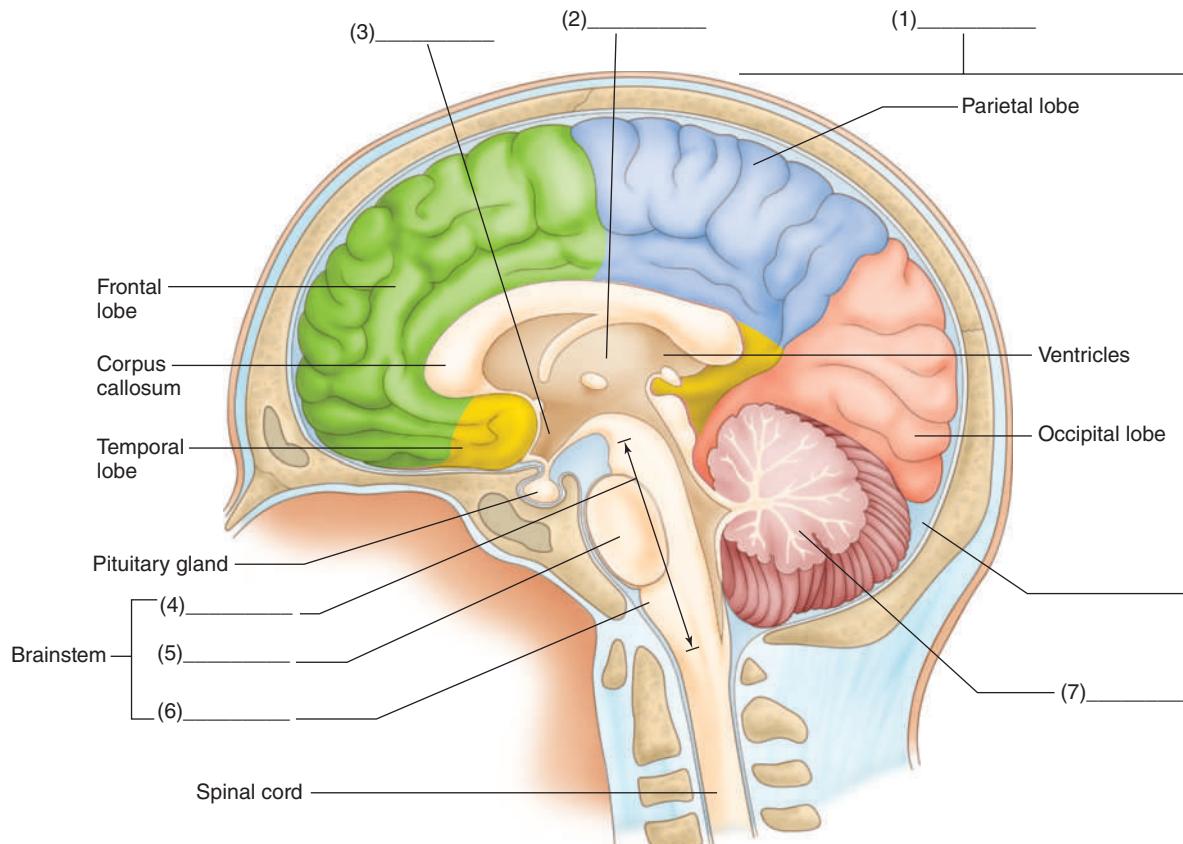
1. cerebrum (seh-REE-brum)
2. thalamus (THAL-ah-mus)
3. hypothalamus (high-poh-THAL-ah-mus)
4. midbrain (MID-brayn)
5. pons (PONZ)
6. medulla oblongata (meh-DULL-ah ob-long-GAH-tah)
7. cerebellum (ser-eh-BELL-um)

The brain is protected by the skull, which is also called the cranium. The brain is made up of billions of neurons and is divided into several parts. Each part has its own function.

### Parts of the Brain

The cerebrum is the largest part of the brain. It is divided into right and left hemispheres. The hemispheres are connected in the middle of the cerebrum by the **corpus callosum** (KOR-pus kah-LOH-sum). The left hemisphere controls the right side of the body and the right hemisphere controls the left side of the body. Each hemisphere is divided into lobes. The lobes are named after the cranial bones covering them: **frontal** lobe, **parietal** lobe, **temporal** lobe, **occipital** lobe.

The cerebrum is covered by gray matter called the **cerebral cortex** (seh-REE-bral KOR-tecks). The cerebrum is involved in movement, sensation, as well as thought, reasoning, and judgment.



**Figure 9-3** Structures of the brain.

The thalamus and hypothalamus are two other important structures of the brain.

The thalamus, deep inside the brain, receives stimuli such as pain, touch, and temperature. It sends this information to the cerebral cortex for analysis and interpretation. It is the thalamus that first makes the body aware of a stimulus such as hot temperature. However, the sensation must be sent to the cerebral cortex before a proper response to the abnormal temperature can be made.

The hypothalamus is located below the thalamus. It regulates appetite, thirst, and temperature. It is also associated with emotions and behavior.

The midbrain, pons, and medulla oblongata are together called the **brainstem**. The brainstem regulates basic life functions such as waking, respiration, heart rate, and blood pressure. It also serves as a pathway for impulses traveling to and from the brain and spinal cord.

The cerebellum lies under the cerebrum. It is important in maintaining balance and muscle coordination. Cerebellar dysfunction may cause abnormal gait (the manner or style of walking).

### In Brief

#### Parts of the Brain

cerebrum, cerebral cortex, thalamus, hypothalamus, cerebellum, brainstem (midbrain, pons, medulla oblongata)

#### PRACTICE FOR LEARNING: Brain

Name the part of the brain described below.

1. outer gray matter covering the cerebrum

---

2. sends information to the cerebral cortex for analysis and interpretation

---

3. maintains balance and muscle coordination

---

4. includes pons, midbrain, and medulla

---

5. regulates appetite and thirst

---

Answers: 1. cerebral cortex. 2. thalamus. 3. cerebellum. 4. brainstem.  
5. hypothalamus.

#### Protective Coverings

#### PRACTICE FOR LEARNING: Protective Coverings

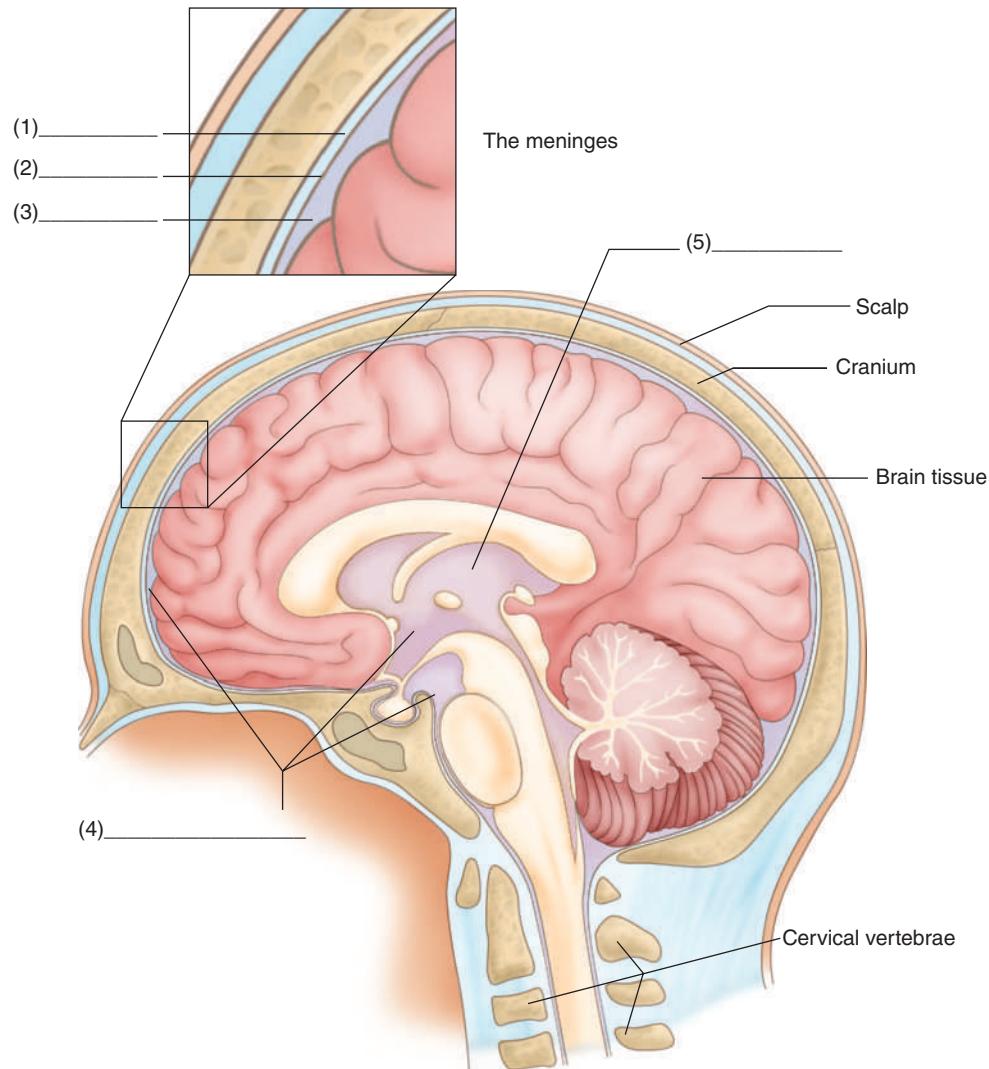
Write the structures listed below in the correct spaces in Figure 9-4. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce

each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. dura mater (**D**OO-rah **M**AY-ter)
2. arachnoid membrane (ah-**R**ACK-noid **M**EM-brayn)
3. pia mater (**P**EE-yah **M**AY-ter)
4. cerebrospinal (**s**er-eh-broh-**S**PYE-nal) fluid
5. ventricles (**V**EN-trih-kulz)

The most obvious protection for the brain and spinal cord are the skull bones and vertebrae. However, three membranes called **meninges** (meh-**N**IN-jeez) also serve as protective coverings (Figure 9-4).

The outermost covering is the **dura mater** (**D**OO-rah **M**AY-ter). It is tough and thick. The middle layer is the **arachnoid membrane** (ah-**R**ACK-noid **M**EM-brayn). The inner



**Figure 9-4** Coverings of the brain and spinal cord.

covering is the **pia matter** (PEE-yah- MAY-ter). Below the dura is the subdural space, and below the arachnoid membrane is the subarachnoid space.

Another form of protection is the **cerebrospinal fluid** (CSF), a colorless liquid that continuously circulates within the subarachnoid space around the brain and spinal cord, inside the spinal cord, and in hollow cavities inside the brain called **ventricles**. CSF protects by acting as a shock absorber.

## Spinal Cord

The **spinal cord** is shown in Figure 9-1. It is a half-inch-thick cable made up of nerves bunched together. The nerves are soft tissue. They are protected by the bones of the vertebral column. Spinal nerves branch out from both sides of the spinal cord, extending to most parts of the body.

### In Brief

**Spinal cord** is made up of nerves.

**Nerves** branch from the spinal cord to the rest of the body.

**Vertebral column** is bone protecting the spinal cord.

### Helping You Remember

The spinal cord and spinal column are not the same structure. The spinal cord is made up of nerves; the spinal column is made up of bone. The spinal column is also known as the vertebral column, spine, or backbone.

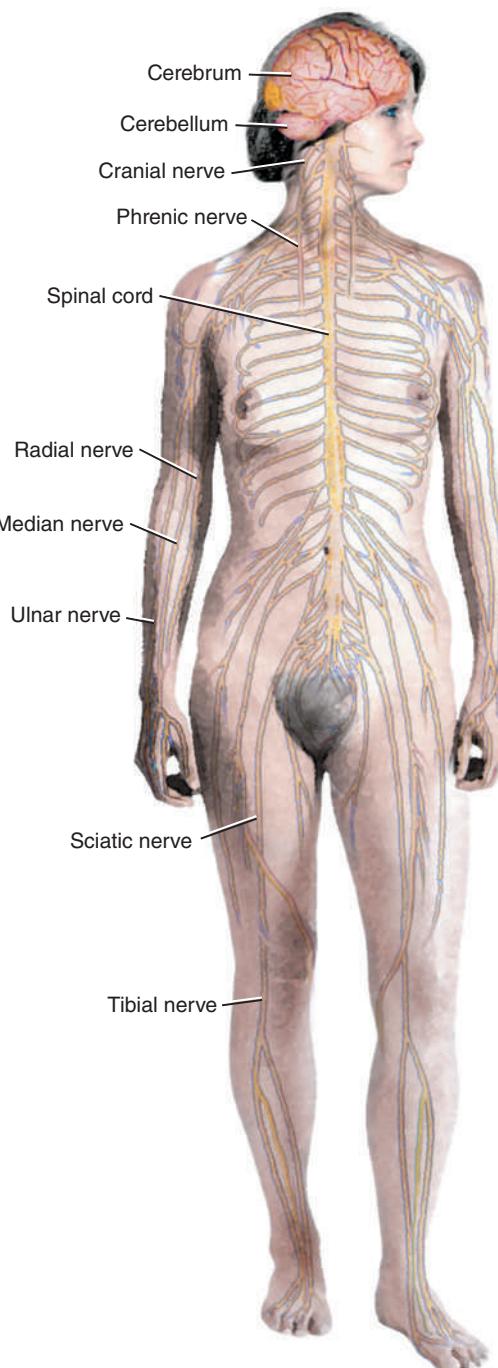
## 9.5

## Peripheral Nervous System (PNS)

Nerves leave the brain and spinal cord and extend to almost all body structures. This includes structures that are away from the center, which are called peripheral structures. In this case, peripheral means away from the brain and spinal cord. Figure 9-5 illustrates some spinal nerves as they extend from the spinal cord to peripheral sites. The names given to these nerves relate to the organ or structure the nerve serves. For example, the ulnar nerve stimulates the muscles attaching to the ulnar bone of the arm. The tibial nerve stimulates the muscles over the tibia or shin bone. The sciatic nerve stimulates the lower back, buttocks, thigh, and lower leg.

### In Brief

**PNS** includes nerves extending from the brain and spinal cord to body organs.



**Figure 9-5** Peripheral nerves branch from the brain and spinal cord.

## 9.6 New Roots, Suffixes, and Prefixes

Use these additional roots, suffixes, and prefixes when studying the terms in this chapter.

ROOT	MEANING
ech/o	sound
ment/o	mind
myelin/o	myelin sheath
narc/o	stupor
poli/o	gray matter
spin/o	spinal cord (when referring to the skeletal system, <b>spin/o</b> means spine; backbone; spinal column; vertebral column)

SUFFIX	MEANING
-us	thing

## 9.7 Learning the Terms

Following these steps will make it easier for you to learn medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

### Roots

TERM	TERM ANALYSIS	DEFINITION
causalgia (kaw-ZAL-jah)	-algie = pain	burning pain

ROOT <b>cerebr/o</b> (see also <b>encephal/o</b> )		MEANING brain
Term	Term Analysis	Definition
<b>cerebral angiography</b> (seh-REE-bral an-jee-OG-rah-fee)	-al = pertaining to -graphy = process of recording; process of producing images angi/o = vessel	process of producing an image of the blood vessels of the brain
<b>cerebrovascular</b> (ser-eh-broh-VAS-kyoo-lar)	-ar = pertaining to vascul/o = vessel	pertaining to the brain and blood vessels
<b>cerebrospinal fluid (CSF)</b> (ser-eh-broh- SPYE-nal)	-al = pertaining to spin/o = spinal cord	fluid in and around the brain and spinal cord

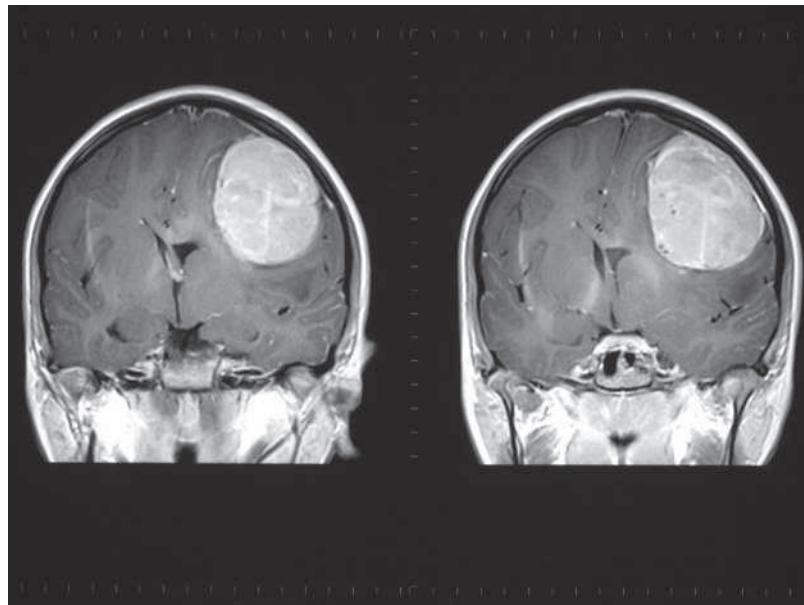
ROOT <b>encephal/o</b>		MEANING brain
Term	Term Analysis	Definition
<b>echoencephalography (EEG)</b> (eck-oh-en-sef-ah-LOG-rah-fee)	-graphy = process of recording; process of producing images echo- = sound	use of ultrasound to create an image of the brain for diagnostic purposes
<b>encephalitis</b> (en-sef-ah-LYE-tis)	-itis = inflammation	inflammation of the brain
<b>electroencephalography</b> (ee-leck-troh-en-sef-ah-LOG-rah-fee)	-graphy = process of recording; process of producing images electr/o = electric	process of recording the electrical activity of the brain
<b>encephalopathy</b> (en-sef-ah-LOP-ah-thee)	-pathy = disease	any disease of the brain

ROOT <b>hydr/o</b>		MEANING water
Term	Term Analysis	Definition
<b>hydrocephalus</b> (high-droh-SEF-ah-lus)	-us = condition; thing cephal/o = head	accumulation of cerebrospinal fluid in the brain (Figure 9-6)



**Figure 9-6** Hydrocephalus. (Courtesy of Dr. Russell Cox)

TERM	TERM ANALYSIS	DEFINITION
<b>magnetic resonance imaging (MRI)</b> (mag- <b>NET</b> -ik RES-oh-nance <b>IM</b> -ah-jing)	-ic = pertaining to resonance = magnification imaging = picture	a picture of the brain produced by using magnetic waves (Figure 9-7)



**Figure 9-7** MRI of the brain with a visible tumor in the upper right side.

ROOT <b>mening/o</b>		MEANING <b>membrane; meninges (membranes around the brain and spinal cord)</b>
Term	Term Analysis	Definition
<b>meningitis</b> (men-in-JIGH-tis)	-itis = inflammation	inflammation of the membranes surrounding the brain and spinal cord

ROOT <b>myel/o</b>		MEANING <b>spinal cord</b>
Term	Term Analysis	Definition
<b>poliomyelitis</b> (poh-lee-oh-my-eh-LYE-tis)	-itis = inflammation poli/o = gray matter	inflammation of the gray matter of the spinal cord. Also known as polio.

### Helping You Remember

In the skeletal system, myel/o means bone marrow. In the nervous system, myel/o means spinal cord.

ROOT <b>neur/o</b>		MEANING <b>nerve</b>
Term	Term Analysis	Definition
<b>neuromuscular</b> (noo-row-MUS-kyoo-lar)	-ar = pertaining to muscul/o = muscle	pertaining to the nerve and muscle; myoneural
<b>neurology</b> (noo-ROL-oh-jee)	-logy = study of	the study of the nervous system including diseases and treatment
<b>neurologist</b> (noo-ROL-oh-jist)	-logist = specialist; one who studies	a specialist in the study of the diagnosis and treatment of nervous system disorders

SUFFIX -cele		MEANING <b>hernia (protrusion or displacement of an organ through a structure that normally contains it)</b>
Term	Term Analysis	Definition
<b>meningocele</b> (meh-NIN-goh-seel)	mening/o = meninges; membrane	displacement of the meninges from its normal position through an abnormal opening in the skull or vertebra. (See spina bifida in Section 9.8.)

ROOT radicul/o		MEANING <b>nerve roots (attaches spinal nerve to spinal cord)</b>
Term	Term Analysis	Definition
<b>cervical radiculopathy</b> (SER-vih-kal reh-dick-you-LOP-eh-thee)	-al = pertaining to cervic/o = neck -pathy = disease	disease of the nerve roots of the neck

## Suffixes

SUFFIX -esthesia		MEANING <b>sensation</b>
Term	Term Analysis	Definition
<b>anesthesia</b> (an-es-THEE-zee-ah)	an- = no; not	loss of sensation
<b>anesthesiologist</b> (an-es-thee-zee-OL-oh-jist)	-logist = specialist; one who studies	a medical doctor who specializes in the administration of anesthetic
<b>anesthetist</b> (an-EES-the-tist)	-ist = specialist	a specialist in the administration of anesthetic agents
<b>dysesthesia</b> (dis-es-THEE-zee-ah)	dys- = bad; painful; difficult; poor; abnormal	painful sensation in response to normal stimulation
<b>paresthesia</b> (par-es-THEE-zee-ah)	para- = abnormal	abnormal sensation such as numbness and tingling

SUFFIX -lepsy		MEANING seizure
Term	Term Analysis	Definition
<b>narcolepsy</b> (NAR-koh-lep-see)	narc/o = stupor	sleep disorder involving sudden and uncontrollable brief episodes of falling asleep during the day

SUFFIX -phasia		MEANING speech
Term	Term Analysis	Definition
<b>aphasia</b> (ah-FAY-zee-ah)	a- = no; not; lack of	no speech
<b>dysphasia</b> (dis-FAY-zee-ah)	dys- = bad; poor; difficult; painful; abnormal	poor speech

SUFFIX -plegia		MEANING paralysis
Term	Term Analysis	Definition
<b>hemiplegia</b> (hem-ee-PLEE-jee-ah)	hemi- = half	paralysis affecting either the right or left side of the body
<b>paraplegia</b> (par-ah-PLEE-jee-ah)	para- = beside; near; abnormal	paralysis of the lower part of the body and legs
<b>tetraplegia</b> (TET-rah-PLEE-jee-ah)	tetra- = four	paralysis of all four limbs; quadriplegia

## Prefixes

PREFIX de-		MEANING lack of; removal
Term	Term Analysis	Definition
<b>dementia</b> (deh-MEN-she-ah)	-ia = condition ment/o = mind	mental deterioration; lack of brain function including memory, judgment, reasoning, and personality changes

## 9.8 Pathology

### Alzheimer (ALZ-high-mer) Disease

Alzheimer disease (AD) is a type of dementia. It is caused by the degeneration of brain cells. The disease results in the loss of memory, judgment, and reasoning. The disease gets worse over time, which means it is progressive. There are personality and behavior disorders.

### Amyotrophic (ah-mye-oh-TROH-fick) Lateral Sclerosis

Amyotrophic lateral sclerosis (**ALS**) is also known as Lou Gehrig disease. This is a progressive disease affecting the nerves in the brain and spinal cord responsible for movement. Muscular degeneration results. It often starts with weakness and twitching in the extremities. Eventually, the disease affects the ability to control the muscles needed to breathe, eat, and speak.

### Brain Tumors; Intracranial Tumors

There are two types of intracranial (within the skull) tumors: **gliomas** (glij-**OH**-mahz) and **meningiomas** (meh-**nin**-jee-**OH**-mahz).

- Gliomas are malignant tumors of brain tissue (Figure 9-8). They can be fast or slow growing.
- Meningiomas are benign tumors. They are located outside the brain tissue but still within the cranium. They are slow growing.



**Figure 9-8** Brain tumor. Magnetic resonance imaging shows a brain tumor in the frontal lobe.

## Levels of Consciousness (LOC)

Consciousness is the state of awareness of self and the environment. Disease, injury, or ingestion of drugs, alcohol, or medication can alter levels of consciousness (ALOC). The various levels of consciousness are listed below:

- **Conscious**: the person is attentive, awake, and aware of their surroundings.
- **Drowsy**: the person is tired, dozy, but can easily be aroused.
- **Lethargy** (**LETH**-ar-jee): state of being sluggish, drowsy, listless, and the person has to try hard to focus on his or her surroundings. The word “lethargic” is used to describe the conscious state of the patient.
- **Stupor** (**STOO**-por): a lower level of consciousness characterized by the person responding only to powerful stimuli.
- **Syncope** (**SING**-koh-peee): also known as fainting, is the brief loss of consciousness caused by the decreased flow of blood to the brain.
- **Coma** (**KOH**-mah): unconscious and unable to be aroused.

## Multiple Sclerosis (**MUL-tih-pul Skler-OH-sis**)

Multiple sclerosis (MS) is a condition in which the myelin sheath covering the neurons of the brain and spinal cord are destroyed. This is called demyelination (“lack of myelin sheath”). The lack of myelin sheath prevents impulses from being transmitted through the axon. This results in muscle weakness, paralysis, and other physical disabilities.

## Parkinson (**PAR-kin-son**) Disease (PD)

A disease that results in bradykinesia (slow movement), muscular rigidity, and resting tremors (shaking), also called pill-rolling tremors. Resting tremors involve the thumb and fingers and are present at rest, but disappear when the part moves. Parkinson is a chronic, progressive condition.

The cause is unknown. However, the abnormal movements are due to a decrease in levels of dopamine, in the brain. Treatment is with drugs to increase the levels of dopamine. This treatment is palliative, which means that it does not cure but eases symptoms of the disease.

## Poliomyelitis

Poliomyelitis (polio) is an infection caused by a virus. It is highly contagious. It attacks the nervous system and may cause paralysis. There is no cure. Polio can only be prevented by immunization with a weakened polio vaccine. Widespread use of the vaccine has eliminated the disease in most of the world.

**Postpoliomyelitis** has been identified in people who have had polio. The condition is characterized by muscle fatigue and weakness 15 years or more after they have recovered from polio.

## Sciatica (sigh-AT-ih-kah)

Inflammation of the sciatic nerve resulting in pain extending from the back into the buttocks and down the leg. It is often caused by a slipped disc in the lumbar area.

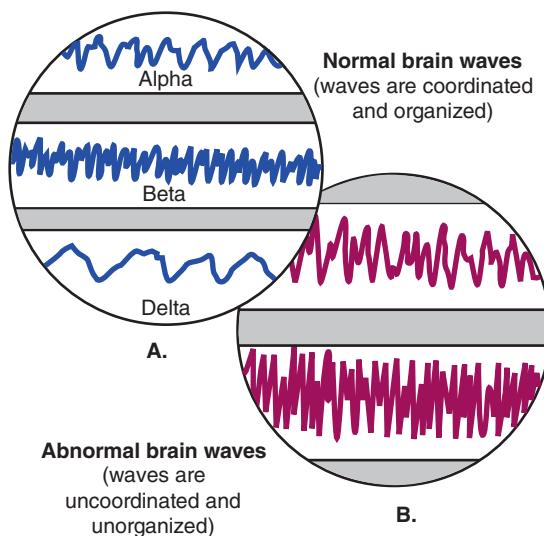
## Seizure Disorder; Epilepsy (EP-ih-lep-see)

A condition that causes the electrical impulses in the brain to become disorganized, uncoordinated, and excessive. The result is cerebral dysfunction, which causes abnormal movement, sensations, and changes in consciousness. The term “seizure” is used to describe these abnormalities.

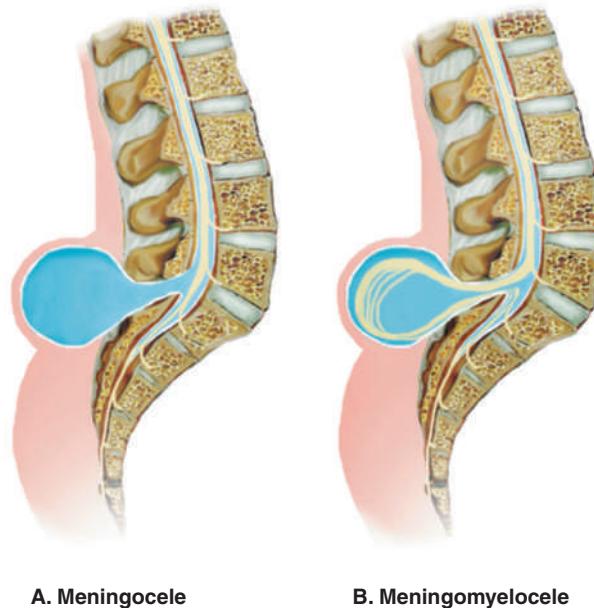
An **electroencephalography** can detect the electrical impulses in the brain and register them as brain waves. It is commonly known as an **EEG**. Figure 9-9 illustrates normal and abnormal brain waves. Normal brain waves are the same in height and width. Abnormal brain waves, as seen in seizure disorder, are not the same in height and width.

### Types of Seizures

**Absence** (**AB-senz**) seizures, also known as **petit mal** (**pe-TEE MAHL**) seizures, are brief attacks lasting 1 to 30 seconds. The seizure takes the form of blank stares, eye abnormalities, and changes in the level of consciousness.



**Figure 9-9** Brain waves. A. Normal brain waves are usually consistent in height and width. Alpha waves are typical of a normal person who is awake and in a resting state. Beta waves are typical of a brain experiencing intense activity. Delta waves are typical of a normal person in deep sleep. B. Abnormal brain waves. Note the inconsistent height and width of the brain waves as seen in patients with seizure disorders.



A. Meningocele

B. Meningomyelocele

**Figure 9-10** Meningocele and meningomyelocele due to spina bifida.

**Tonic-clonic** seizure, also known as **grand mal** seizure, alternates between the tonic phase, where the muscles become rigid, and the clonic phase, where the muscles uncontrollably jerk.

### Spina Bifida (SPYE-nah BIF-ih-da)

A defect in fetal development. The vertebrae do not form a complete circle around the spinal cord. It is a **congenital** (kon-JEN-ih-tal) condition, which means that it is present at birth.

In cases where the opening in the vertebrae is severe, the meninges and/or the spinal cord may protrude outside the vertebrae. They form a sac-like structure. If the sac contains only meninges, the condition is called **meningocele** (Figure 9-10A). If the sac contains meninges and spinal cord, the condition is called **meningomyelocele** (meh-ning-goh-MY-eh-loh-seel) (Figure 9-10B).

### 9.9

### Look-Alike and Sound-Alike Words

*Below is a list of look-alike and sound-alike words. Study the spelling and definitions of each set of words. Questions will follow in the Review Exercises.*

**TABLE 9-1 Look-Alike and Sound-Alike Words**

<b>aphasia</b>	no speech
<b>aphagia</b>	no eating
<b>aphakia</b>	no lens (anatomical structure of the eye)
<b>ataxia</b>	no coordination
<b>attacks</b>	to become sick
<b>clonus</b>	twitching of a muscle
<b>conus</b>	resembling a cone shape
<b>CNS</b>	central nervous system
<b>C&amp;S</b>	culture and sensitivity (a laboratory test)
<b>elicit</b>	to bring on; to elicit a response
<b>illicit</b>	illegal
<b>gait</b>	style of walking or running
<b>gate</b>	entrance or opening

## 9.10 Review Exercises

### EXERCISE 9-1 Look-Alike and Sound-Alike Words

Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 9-1 if it helps you.

1. Jacob was admitted to the hospital with loss of blood to the speech centers in the brain due to a motor vehicle accident. On physical examination, at the time of admission, there was noted (**aphakia/aphagia/aphasia**).
2. Expect (**attacks/ataxia**) of delirium tremens following alcohol withdrawal. If there is cerebellar dysfunction, expect (**attacks/ataxia**).
3. The (**clonus/conus**) medullaris is the end portion of the spinal cord.
4. Continual (**clonus/conus**) indicates disruption of nerve impulses to the muscle.
5. To confirm inflammation of the (**CNS/C&S**), Dr. Lorentz withdrew CSF for (**CNS/C&S**).
6. To (**elicit/illicit**) a Babinski reflex on a newborn, stimulate the sole of the foot. The big toe should fan out.
7. Maria was caught with (**elicit/illicit**) drugs in the hospital.

8. Observe the patient carefully. Abnormal (**gate/gait**) may be the result of cerebellar damage.
  9. A (**gait/gate**) was required to prevent the Alzheimer patient from wandering.

## EXERCISE 9-2 Matching Word Parts with Meaning

*Match the word part in Column A with its meaning in Column B.*

Column A	Column B
_____	<b>1.</b> poli/o
_____	<b>2.</b> para-
_____	<b>3.</b> tetra-
_____	<b>4.</b> cerebr/o
_____	<b>5.</b> ment/o
_____	<b>6.</b> -cele
_____	<b>7.</b> -ar
_____	<b>8.</b> dys-
_____	<b>9.</b> -esthesia
_____	<b>10.</b> mening/o
_____	<b>11.</b> hemi-
_____	<b>12.</b> -phasia
_____	<b>13.</b> vascul/o
_____	<b>14.</b> de-
_____	<b>15.</b> -ia
	A. brain
	B. hernia
	C. painful
	D. mind
	E. gray matter
	F. vessel
	G. four
	H. membrane
	I. abnormal
	J. pertaining to
	K. speech
	L. half
	M. sensation
	N. condition
	O. lack of

### **EXERCISE 9-3 Short Answer—Anatomy**

*Answer the following questions in the space provided.*

- 1.** (A) Name the organs that make up the central nervous system. (B) The peripheral nervous system.

---

---

- 2.** Write one function for the following structures:

- a. cerebrum \_\_\_\_\_
  - b. thalamus \_\_\_\_\_
  - c. hypothalamus \_\_\_\_\_
  - d. brainstem \_\_\_\_\_

3. What type of tissue makes up the spinal cord?

---

4. What type of tissue protects the spinal cord?

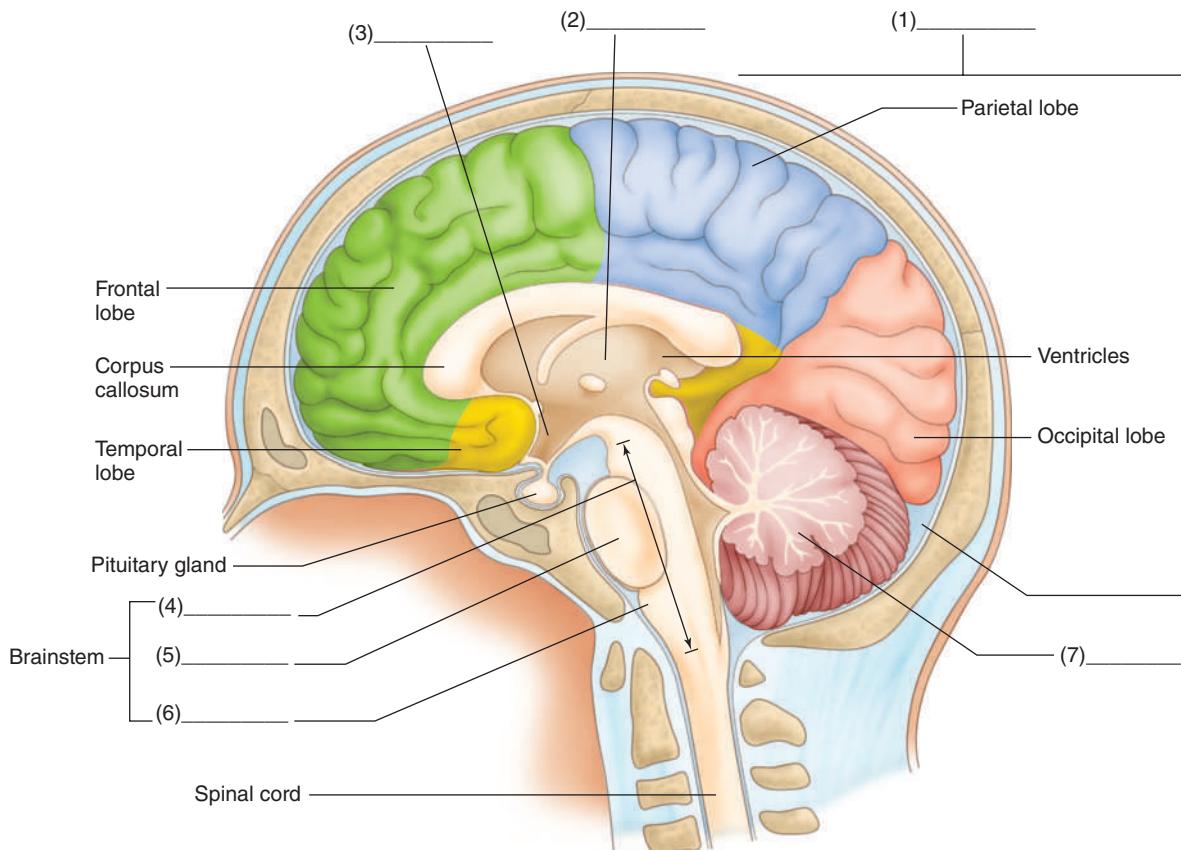
---

5. Name three portions of the brainstem.

---

#### EXERCISE 9-4 Labeling—Structures of the Brain

Using the body structures listed below, label Figure 9-11. Write your answer in the numbered space provided below, or if you prefer, on the diagram.



**Figure 9-11** Structures of the brain.

cerebellum

---

cerebrum

---

hypothalamus

---

medulla oblongata

---

midbrain

---

pons

---

thalamus

---

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

7. \_\_\_\_\_

### EXERCISE 9-5 Definitions—Anatomy

*Define the following terms. Use your dictionary if necessary.*

**1. neurons**

---

**2. nerves**

---

**3. myelin sheath**

---

**4. gray matter**

---

**5. pons**

---

**6. cerebral cortex**

---

**7. cerebellum**

---

**8. spinal cord**

---

**9. vertebral column**

---

**10. peripheral nerves**

---

### EXERCISE 9-6 Pathology

Match the disease in Column A with its meaning in Column B.

Column A	Column B
_____	1. Alzheimer disease
_____	2. multiple sclerosis
_____	3. Parkinson disease
_____	4. spina bifida
_____	5. seizure disorder
_____	6. meningomyelocele
_____	7. hydrocephalus
_____	8. lethargy
_____	9. sciatica
_____	10. tonic-clonic seizure
_____	11. absence seizure
_____	12. poliomyelitis
_____	13. syncope
	A. may result in displaced meninges and/or spinal cord
	B. characterized by resting tremors and muscle rigidity
	C. disorganized, uncoordinated, and excessive electrical impulses in the brain
	D. type of dementia
	E. a complication of spina bifida
	F. characterized by demyelination of brain and spinal cord
	G. accumulation of cerebrospinal fluid in the brain
	H. contagious disease caused by a virus
	I. uncoordinated movement alternating between muscular rigidity and jerky movement
	J. uncoordinated electrical impulses in the brain of a short duration, 1–30 seconds
	K. fainting
	L. sluggish, drowsy, listless
	M. usually caused by a slip disc in the lumbar vertebrae

### EXERCISE 9-7 Definitions—Learning the Terms

Define the following terms:

1. **cerebrovascular**

---

2. **poliomyelitis**

---

**3. neurology****4. anesthesia****5. dysesthesia****6. paresthesia****7. dysphasia****8. tetraplegia****9. paraplegia****10. cerebrospinal fluid****EXERCISE 9-8 Building Medical Words**

I. Use *encephal/o* to build medical words for the following definitions.

a. inflammation of the brain \_\_\_\_\_

b. any disease of the brain \_\_\_\_\_

II. Use *neur/o* to build medical words for the following definitions.

a. pertaining to the nerve and muscle \_\_\_\_\_

b. study of the nervous system \_\_\_\_\_

III. Use *-esthesia* to build medical words for the following definitions.

a. loss of sensation \_\_\_\_\_

b. painful sensations in response to normal stimulation  
\_\_\_\_\_

c. abnormal sensations such as numbness and tingling  
\_\_\_\_\_

IV. Use *-plegia* to build medical words for the following definitions.

a. paralysis affecting either the right or left side of the body  
\_\_\_\_\_

- b. paralysis of the lower part of the body and legs \_\_\_\_\_
- c. paralysis of all four limbs \_\_\_\_\_

### EXERCISE 9-9 Definitions in Context

Define the bold terms in context. Use your dictionary if necessary.

Alita Lopez is a 62-year-old woman who was diagnosed with a brain tumor two months prior to admission. She suffered from **dysphasia**, abnormal **gait**, and **migraines** prior to admission. **MRI** showed increased **cerebrospinal fluid** in the left ventricle. Ms. Lopez underwent **neurosurgery** to relieve the **intracranial** pressure caused by the tumor. She was then treated with **chemotherapy** and **radiotherapy**.

- a. dysphasia \_\_\_\_\_
- b. gait \_\_\_\_\_
- c. migraines \_\_\_\_\_
- d. MRI \_\_\_\_\_
- e. cerebrospinal fluid \_\_\_\_\_
- f. neurosurgery \_\_\_\_\_
- g. intracranial \_\_\_\_\_
- h. chemotherapy \_\_\_\_\_
- i. radiotherapy \_\_\_\_\_

### EXERCISE 9-10 Spelling

Circle any words that are spelled incorrectly in the list below. Then correct the spelling in the space provided.

1. disesthesia \_\_\_\_\_
2. myelin sheath \_\_\_\_\_
3. siezure \_\_\_\_\_
4. Parkinsin diese \_\_\_\_\_
5. resonence \_\_\_\_\_
6. thalmus \_\_\_\_\_
7. cerebellum \_\_\_\_\_

8. conjenital \_\_\_\_\_
9. medulla oblongata \_\_\_\_\_
10. Alzheimer disease \_\_\_\_\_

## Animations

Visit the companion website to view the video on **protective coverings** of the brain and spinal cord.

Also watch the following videos: **Spinal Cord Injuries; Parkinson Disease**.

### 9.11 Pronunciation and Spelling

*Listen, read, and study, so you can speak and write.*

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

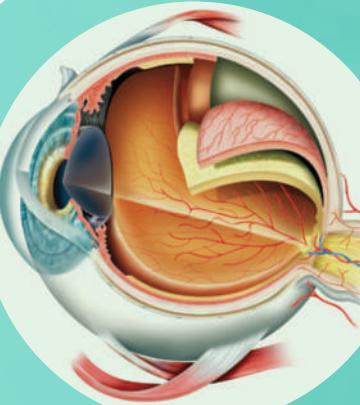
Word	Pronunciation	Spelling
<b>anesthesia</b>	<b>an-es-THEE-zee-ah</b>	
<b>aphasia</b>	<b>ah-FAY-zee-ah</b>	
<b>cerebellum</b>	<b>ser-eh-BELL-um</b>	
<b>cerebrospinal</b>	<b>ser-eh-broh-SPYE-nal</b>	
<b>cerebrovascular</b>	<b>ser-eh-broh-VAS-kyoo-lar</b>	
<b>cerebrum</b>	<b>seh-REE-brum</b>	
<b>dementia</b>	<b>deh-MEN-she-ah</b>	
<b>demyelination</b>	<b>dee-my-eh-lih-NAY-shun</b>	
<b>dysesthesia</b>	<b>dis-es-THEE-zee-ah</b>	
<b>dysphasia</b>	<b>dis-FAY-zee-ah</b>	
<b>electroencephalography</b>	<b>ee-leck-troh-en-sef-ah-LOG-rah-fee</b>	
<b>encephalitis</b>	<b>en-sef-ah-LYE-tis</b>	
<b>encephalopathy</b>	<b>en-sef-ah-LOP-ah-thee</b>	
<b>hemiplegia</b>	<b>hem-ee-PLEE-jee-ah</b>	

Word	Pronunciation	Spelling
<b>hypothalamus</b>	<b>high-poh-THAL-ah-mus</b>	
<b>medulla oblongata</b>	meh-DULL-ah <b>ob-long-</b> <b>GAH-tah</b>	
<b>meninges</b>	meh-NIN-jeez	
<b>meningocele</b>	meh-NIN-goh-seel	
<b>meningoencephalitis</b>	meh-NIN-goh-en- <b>sef-ah-</b> <b>LYE-tis</b>	
<b>myelin sheath</b>	<b>MY-eh-lin SHEETH</b>	
<b>neurology</b>	noo- <b>ROL-oh-jee</b>	
<b>neurons</b>	<b>NOO-ronz</b>	
<b>paraplegia</b>	<b>par-ah-PLLEE-jee-ah</b>	
<b>paresthesia</b>	<b>par-es-THEE-zee-ah</b>	
<b>poliomyelitis</b>	<b>poh-lee-oh-my-eh-LYE-tis</b>	
<b>pons</b>	<b>PONZ</b>	
<b>thalamus</b>	<b>THAL-ah-mus</b>	



## CHAPTER 10

# The Eyes and Ears



### Chapter Outline

- 10.1** Major Structures of the Eyeball
- 10.2** Layers of the Eyeball, Lens, and Cavities
- 10.3** Accessory Structures
- 10.4** Refraction
- 10.5** Visual Pathway
- 10.6** New Roots, Suffixes, and Prefixes of the Eye
- 10.7** Learning the Terms of the Eye
- 10.8** Pathology of the Eye
- 10.9** Major Structures of the Ear
- 10.10** Auditory Pathway
- 10.11** New Roots, Suffixes, and Prefixes of the Ear
- 10.12** Learning the Terms of the Ear
- 10.13** Pathology of the Ear
- 10.14** Look-Alike and Sound-Alike Words
- 10.15** Review Exercises
- 10.16** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

- 1.** Name and describe the structures and functions of the eye and its accessory structures.
- 2.** Describe the pathway of vision to the brain.
- 3.** Pronounce, spell, define, and write the medical terms related to the eyes.
- 4.** Describe common diseases related to the eyes.
- 5.** Name and describe the structures and functions of the ear.
- 6.** Describe the pathway of hearing to the brain.

7. Pronounce, spell, define, and write the medical terms related to the ears.
8. Describe common diseases related to the ear.
9. Listen, read, and study so you can speak and write.

## Introduction

Our eyes and ears connect us with the world. The eyes send signals to one part of the brain, and we see. The ears send signals to another part of the brain, and we hear. This chapter explains these amazing organs.

### 10.1 Major Structures of the Eyeball

#### PRACTICE FOR LEARNING: **Eyeball**

Write the words below in the correct spaces in Figure 10-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

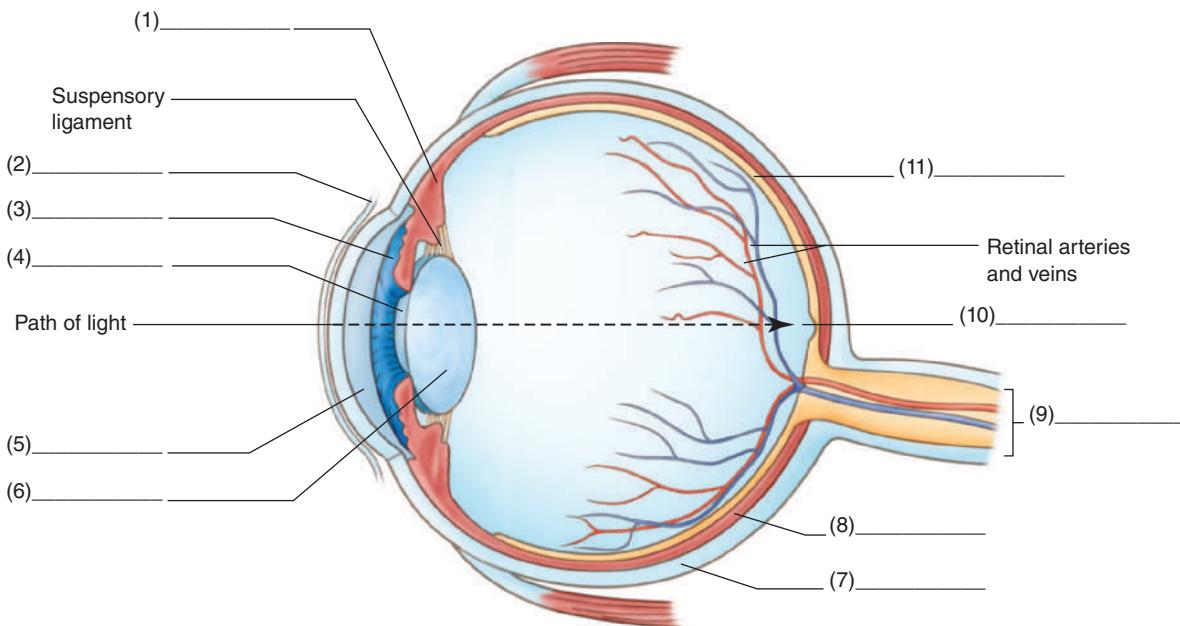
1. Ciliary (**SIL-ee-ahr-ee**) body and muscle
2. Conjunctiva (**kon-JUNK-tih-vah**)
3. Iris (**EYE-ris**)
4. Pupil (**PYOO-pil**)
5. Cornea (**KOR-nee-ah**)
6. Lens (**LENZ**)
7. Sclera (**SKLEHR-ah**)
8. Choroid (**KOH-roid**)
9. Optic nerve (**OP-tick NERV**)
10. Macula lutea (**MACK-yoo-lah LOO-tee-ah**)
11. Retina (**RET-ih-nah**)

### 10.2 Layers of the Eyeball, Lens, and Cavities

The eyeball has three layers: outer, middle, and inner. They are described below.

#### Outer Layer

The outer layer of the eye is made up of the cornea and the sclera. The cornea is transparent. This means that it is clear and lets light into the eye. The sclera is the white of the eye. It is fibrous and not transparent, and therefore light does not pass through it.



**Figure 10-1** Major structures of the eye.

Find the sclera on Figure 10-1. Using your finger, make a circle by following the sclera. Notice how the sclera joins the cornea at the front of the eye and then becomes the sclera again as the circle is completed.

## Middle Layer

Figure 10-1 also illustrates the middle layer of the eyeball. It is called the **uvea** (YOO-vee-ah). The uvea has three parts: the choroid, ciliary body, and the iris.

Find the choroid on Figure 10-1. Again, using your finger, follow the outline of the middle layer. The choroid is vascular and provides blood to the entire eye.

The ciliary body produces aqueous humor. The ciliary muscles move the lens to focus on near and far objects.

The iris is the colored portion of the eye. There is an opening in the middle of the iris called the pupil. It regulates the amount of light that enters the eye. In bright light, the pupil constricts (narrows) to protect the eye from bright light. In dimmer light, the pupil dilates (widens).

## Inner Layer

The inner layer of the eye is called the retina (Figure 10-1). Once again use your finger and trace the outline of the retina on the diagram. The retina contains cells called **rods** (RODZ) and **cones** (KOHNZ). These structures are named for their shape. They receive light rays and transform them into electrical impulses that travel to the brain along the optic nerve. This allows vision to occur.

The cones are located in the fovea centralis (**FOH-vee-ah sen-TRAL-iss**), which is a pit in the middle of the macula lutea. The rods are located peripheral to the macula lutea.

**In Brief****Outer layer**

Sclera, cornea

**Middle layer, or uvea**

Choroid, ciliary body, iris

**Inner layer**

Retina (rods and cones)

**PRACTICE FOR LEARNING: Outer Layer, Middle Layer, Inner Layer**

Write your answer in the space provided.

1. Write the structures that make up the following layers of the eye:

- a. outer layer \_\_\_\_\_
- b. middle layer \_\_\_\_\_
- c. inner layer \_\_\_\_\_

2. The middle layer is also known as the \_\_\_\_\_.

3. Name the location of the cones and rods. \_\_\_\_\_

4. State a function of rods and cones. \_\_\_\_\_

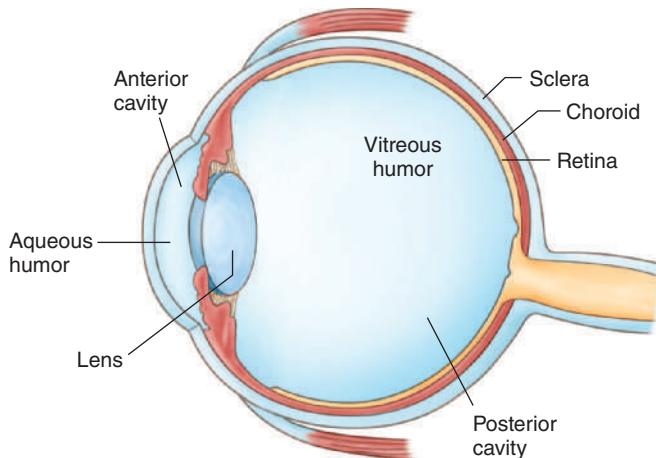
Answers: 1. a. cornea, sclera. b. choroid, ciliary body, iris. c. retina containing rods and cones. 2. uvea. 3. cones are located in the fovea centralis. Rods are located peripheral to the macula lutea. 4. changes light rays into electrical impulses.

**Lens, Anterior Cavity, Posterior Cavity**

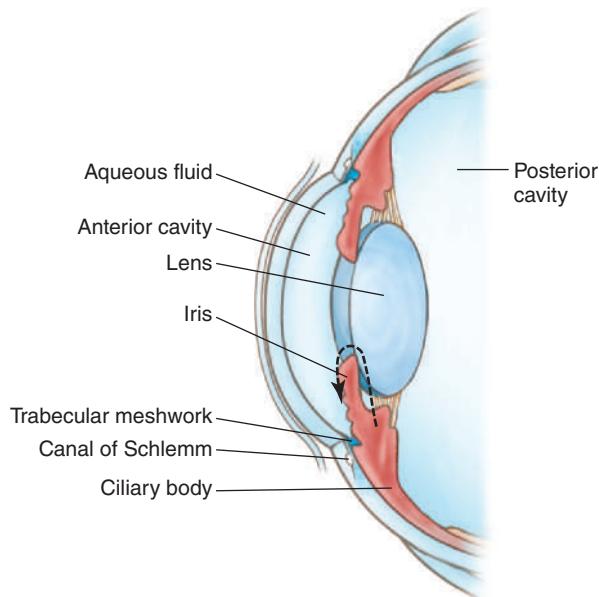
Some structures of the eyeball are not considered to be part of any one layer of the eye. They are the lens, anterior cavity, and posterior cavity. You can see these in Figure 10-2. The lens is located behind the iris. It bends light rays.

There is a cavity in front of the lens and one behind it. The one in front is the **anterior cavity** (**KAV-ih-tee**). It is filled with a watery fluid called **aqueous humor** (**AY-kwee-us HYOO-mer**). The aqueous humor maintains the proper pressure within the eye. This is called intraocular pressure (IOP). As new aqueous humor is produced by the ciliary body, the old is drained into the bloodstream through a meshwork called the **trabeculae** (trah-**BECK**-yoo lee) and a canal called the canal of **Schlemm** (**SHLEM**). (Figure 10-3)

The **posterior cavity** is behind the lens. It is filled with gel called **vitreous** (VIT-ree-us) humor. It maintains the round shape of the eyeball and holds the retina in place, firmly against the choroid.



**Figure 10-2** Lens, anterior cavity, and posterior cavity.



**Figure 10-3** Flow of aqueous humor in the anterior cavity. As aqueous humor is produced, the old is drained into the blood stream through the trabeculae and Canal of Schlemm.

### In Brief

The **lens** is behind the iris.

The **anterior cavity** is in front of the lens and contains aqueous humor.

The **posterior cavity** is behind the lens and contains vitreous humor.

### 10.3 Accessory Structures

The accessory structures are located outside the eyeball. These include the **orbital cavity**, **eyelids**, **conjunctiva**, **lacrimal apparatus**, and **extraocular muscles**.

The orbital cavity is the eye socket. It is a depression in the skull bone into which the eyeball fits.

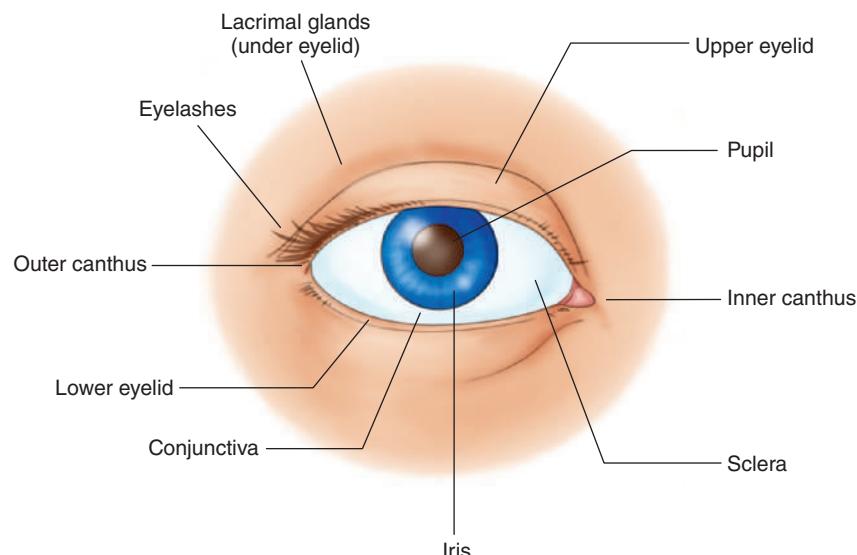
The upper and lower eyelids (Figure 10-4) protect the eye from foreign matter. The eyelids meet at the **canthus** (KAN-thus) at the medial and lateral corners of the eye.

The conjunctiva (kon-junk-TYE-vah) (Figure 10-1 and Figure 10-4) is a transparent layer of mucous membrane lining the eyelid and covering the front of the eye exposed to the air. It also provides protection.

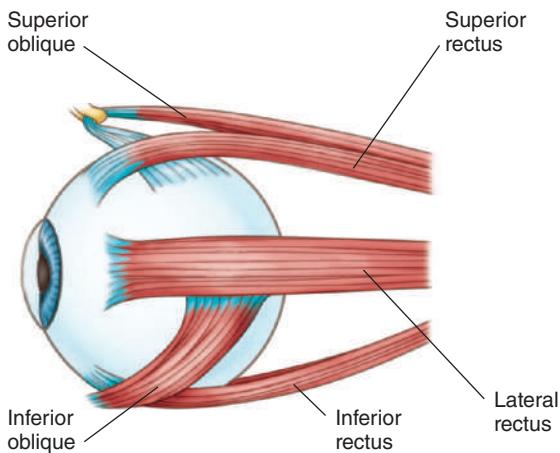
The lacrimal apparatus includes glands and a system of ducts. The glands continually produce tears (Figure 10-4) and the ducts transport tears across the eye to clean and lubricate the eye. Excess tears flow through ducts into the nose. This is why your nose runs when you cry.

The **extraocular** (ecks-trah-OCK-yoo-lar) muscles (Figure 10-5) are located outside the eyeball. These muscles move the eye upward, downward, medially, and laterally. They are named according to their location and orientation. An example is the **superior rectus** (RECK-tuss) muscle. Its location is superior to the eyeball. Its orientation is **rectus**, which means straight. The other locations are **inferior**, **lateral**, and **medial**. The other orientation is **oblique** (oh-BLEEK), which means slanted (Figure 10-5). The extraocular muscles include:

- Superior and inferior rectus muscle
- Superior and inferior oblique muscles
- Lateral and medial rectus muscles



**Figure 10-4** Accessory structures of the eye.



**Figure 10-5** Extraocular muscles.

### PRACTICE FOR LEARNING: Lens, Anterior and Posterior Cavities

Write one function for the following:

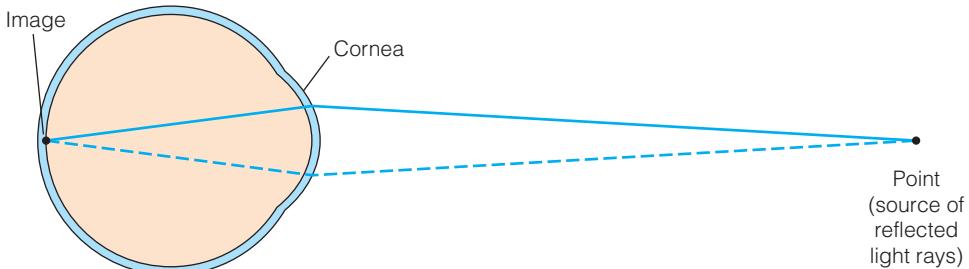
1. lens \_\_\_\_\_
2. vitreous humor \_\_\_\_\_
3. aqueous humor \_\_\_\_\_

Answers: 1. refraction. 2. maintains round shape of the eyeball; holds the retina against the choroid; refraction. (any one answer is correct). 3. maintains intraocular pressure; refraction (either answer is correct).

## 10.4 Refraction

The eye bends light rays so that they come together at the retina at the same time. This is illustrated in Figure 10-6. This bending of light is called **refraction** (ree-FRACK-shun). Without the proper amount of refraction, vision will be blurred.

**Visual acuity** (ah-KYOO-ih-tee) is the eye's ability to see. A visual acuity test measures the patient's ability to see the smallest letters on a chart (a Snellen chart) from 20 feet away. The results are stated as two numbers. The first is 20, as it is the distance



**Figure 10-6** Refraction: bending of light rays.

the patient is from the chart. The second is the number that shows the patient's ability to see the letters on the chart, as compared to most people. So, for example, a measure of 20/20 would mean that the patient sees the letters that someone with normal vision would see at 20 feet. A measure of 20/40 would mean that the patient sees at 20 feet what a normal patient would see at 40 feet.

### In Brief

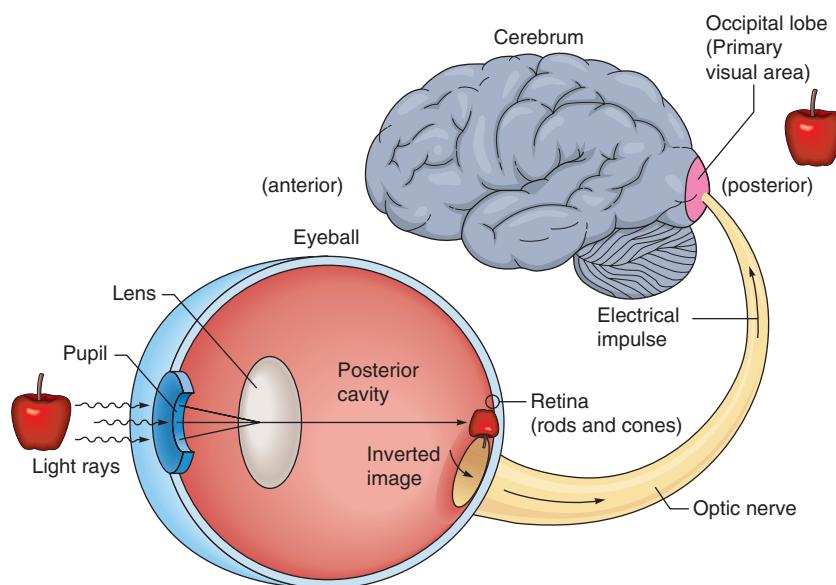
**Refraction** means bending

## 10.5 Visual Pathway

Sight is possible because various structures work together. Light rays must travel unobstructed through the cornea, aqueous humor, pupil, lens, and vitreous humor. The light rays are bent by each structure or fluid, and then focus on the retina. The light rays must focus precisely on the same point on the retina to produce a clear, sharp image. The rods and cones then change the image into electrical impulses. These impulses travel along the optic nerve to the brain. The brain then makes us aware of the object we are looking at. Figure 10-7 illustrates light traveling through this visual pathway.

### In Brief

**Path that light travels** → cornea → aqueous humor → pupil → lens → vitreous humor → retina (light rays change to electrical impulses) → optic nerve → brain



**Figure 10-7** Visual pathway. Notice the image of the apple is upside down on the retina. The brain turns the image right side up and clear vision is obtained.

## 10.6 New Roots, Suffixes, and Prefixes of the Eye

Use these additional roots, suffixes, and prefixes when studying the terms in this chapter.

ROOT	MEANING
ambly/o	dull; dim
ametr/o	out of proportion
anis/o	unequal
dipl/o	double
nyct/o	night

SUFFIX	MEANING
-ician	specialist; one who specializes; expert
-metrist	specialist in the measure of
-pexy	surgical fixation
-phobia	fear

PREFIX	MEANING
eso-	inward
exo-	outside
extra-	outside
presby-	old age

## 10.7 Learning the Terms of the Eye

Following these steps will make it easier for you to learn medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

## Roots

ROOT <b>blephar/o</b> (see also palpebr/o)		MEANING eyelid
Term	Term Analysis	Definition
<b>blepharoptosis</b> (blef-ah-rop-TOH-sis)	-ptosis = drooping; sagging	drooping eyelid. Also known simply as “ptosis.”
ROOT <b>conjunctiv/o</b>		MEANING conjunctiva (membrane lining the eyelids and anterior part of eye)
Term	Term Analysis	Definition
<b>conjunctivitis</b> (kon-junk-tih-VYE-tiss)	-itis = inflammation	inflammation of the conjunctiva
ROOT <b>core/o</b>		MEANING pupil
Term	Term Analysis	Definition
<b>anisocoria</b> (an-iss-oh-KOR-ee-ah)	-ia = condition anis/o = unequal	condition in which the pupils are of unequal size
ROOT <b>corne/o</b> (see also kerat/o)		MEANING cornea
Term	Term Analysis	Definition
<b>corneal abrasion</b> (KOR-nee-al ab-RAY-zhun)	-eal = pertaining to -ion = process ab- = away from ras/o = scrape	scraping of the superficial layers of the cornea
ROOT <b>irid/o; ir/o</b>		MEANING iris
Term	Term Analysis	Definition
<b>iridectomy</b> (ir-ih-DECK-toh-mee)	-ectomy = excision; surgical removal	excision of the iris
<b>iritis</b> (eye-RYE-tiss)	-itis = inflammation	inflammation of the iris

ROOT <b>kerat/o</b>		MEANING <b>cornea</b>
Term	Term Analysis	Definition
<b>keratoplasty</b> (ker-AT-oh-plas-tee)	-plasty = surgical reconstruction; surgical repair	surgical reconstruction of the cornea; corneal transplant

ROOT <b>ocul/o</b> (see also <b>ophthalm/o</b> )		MEANING <b>eye</b>
Term	Term Analysis	Definition
<b>extraocular muscles</b> (ecks-trah-OCK-yoo-lar)	-ar = pertaining to extra- = outside	muscles located outside the eyeball

ROOT <b>ophthalm/o</b>		MEANING <b>eye</b>
Term	Term Analysis	Definition
<b>exophthalmia</b> (eck-sof-THAL-mee-ah)	-ia = condition ex- = outward	outward protrusion of the eyeball
<b>ophthalmologist</b> (ahf-thal-MOL-eh-jist)	-logist = specialist	a medical doctor who specializes in the study of the diagnosis and medical and surgical treatment of eye disorders
<b>ophthalmoscopy</b> (ahf-thal-MOS-koh-pee)	-scopy = process of visually examining	process of visually examining the eye. Also known as funduscopic (fun-DUSS-keh-pee)

**Note:** The fundus is the back portion of the eye. It includes the retina and macula lutea.

<b>ophthalmology</b> (ahf-thal-MOL-eh-jee)	-logy = study of	medical speciality dealing with the study of the eye including disease and treatment
<b>xerophthalmia</b> (zer-off-THAL-me-ah)	-ia = condition ophthalm/o = eye	drying of the surfaces of the eye including the conjunctiva

ROOT opt/o		MEANING vision; sight
Term	Term Analysis	Definition
<b>optician</b> (op-TISH-an)	-ician = specialist; one who specializes; expert	expert who fills prescriptions for eyeglasses and contact lenses
<b>Note:</b> Opticians are not medical doctors and do not carry out medical and surgical treatments of eye conditions.		
<b>optometrist</b> (op-TOM-eh-trist)	-metrist = specialist in the measurement of	specialist in the testing of visual function and in the diagnosis and nonsurgical treatment of eye conditions

**Note:** Optometrists prescribe eyeglasses and contact lenses and are licensed in some areas to prescribe medication. They do not have a degree in medicine.

ROOT palpebr/o		MEANING eyelid
Term	Term Analysis	Definition
<b>palpebral</b> (PAL-peh-bral)	-al = pertaining to	pertaining to the eyelid

ROOT phac/o; phak/o		MEANING lens
Term	Term Analysis	Definition
<b>aphakia</b> (ah-FAY-kee-ah)	a- = absence; no; not; lack of;	absence of a lens

ROOT phot/o		MEANING light
Term	Term Analysis	Definition
<b>photophobia</b> (foh-toh-FOH-bee-ah)	-phobia = fear	intolerance or sensitivity to light

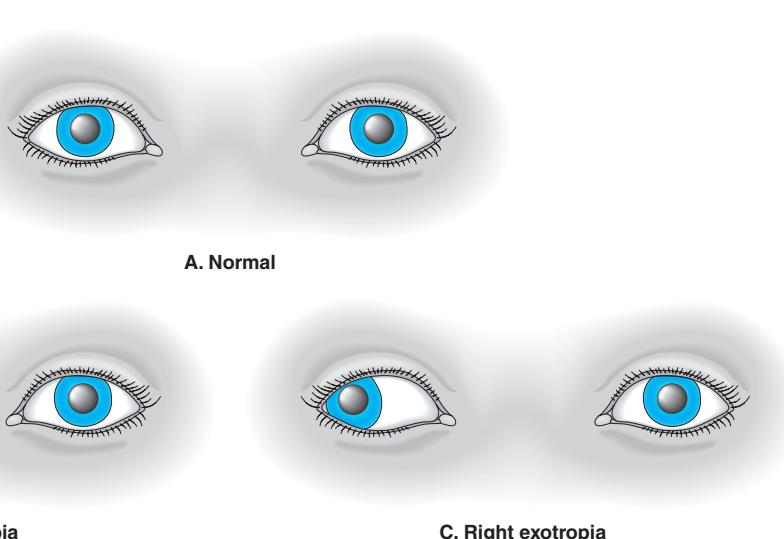
TERM	TERM ANALYSIS	DEFINITION
<b>retinopathy</b> (ret-ih-NOP-eh-thee)	-pathy = disease	any disease of the retina
<b>retinopexy</b> (RET-ih-noh-peck-see)	-pexy = surgical fixation	surgical fixation of the retina

## Suffixes

SUFFIX	MEANING
<b>-opia</b>	visual condition; vision
<b>amblyopia</b> (am-blee-OH-pee-ah)	ambly/o = dull; dim
<b>metropia</b> (am-eh-TROH-pee-ah)	metr/o = out of proportion
<b>hemianopia</b> (hem-ee-an-0H-pee-ah)	hemi- = half an- = no; not
<b>nyctalopia</b> (nick-tah-LOH-pee-ah)	nyct/o = night
<b>diplopia</b> (dih-PLOH-pee-ah)	dipl/o = double
<b>presbyopia</b> (pres-bee-0H-pee-ah)	presby- = old age

SUFFIX	MEANING
<b>-tropia; tropion</b>	turning
<b>Term</b>	<b>Term Analysis</b>
<b>entropion</b> (en-TROH-pee-on)	en- = in

Term	Term Analysis	Definition
<b>esotropia</b> (es-oh-TROH-pee-ah)	eso- = inward	inward turning of the <b>eyeball</b> (Figure 10-8B); cross-eyes
<b>exotropia</b> (eck-soh-TROH-pee-ah)	exo- = outward	outward turning of the <b>eyeball</b> (Figure 10-8C)



**Figure 10-8** Normal vision compared with types of strabismus. A. Normal vision. B. Right esotropia. C. Right exotropia.

**Note:** Esotropia and exotropia are also known as strabismus.

## 10.8 Pathology of the Eye

### Cataracts (KAT-ah-rakts)

Fogging of the lens (Figure 10-9). Normally, the lens is clear. When the lens is foggy, the light rays cannot focus on the retina. As a result, vision becomes blurred. Cataracts can be treated by destroying the diseased lens. This can be done by using ultrasound (high frequency sound waves). The removed lens is replaced with an artificial (prosthetic) intraocular lens (IOL).

### Errors of Refraction

Errors in the bending of light rays in the eye, resulting in blurred vision. Types are myopia, hyperopia, and astigmatism.

### Myopia (my-OH-pee-ah)

Nearsightedness. Only near objects can be seen clearly. Light rays focus in front of the retina because they are bent too quickly or because the eyeball is too long. Illustrated in Figure 10-10A.



**Figure 10-9** Cataract. Courtesy of the National Eye Institute, NIH

### Hyperopia (high-per-OH-peh-ah)

Farsightedness. Only far-away objects can be seen clearly. Light rays focus behind the retina because they are bent too slowly or because the eyeball is too short. Illustrated in Figure 10-10B.

### Astigmatism (ah-STIG-mah-tiz-um)

Blurred vision, both near and far. The curve of the cornea is uneven. Thus, light rays do not reach a point of focus. Illustrated in Figure 10-10C.

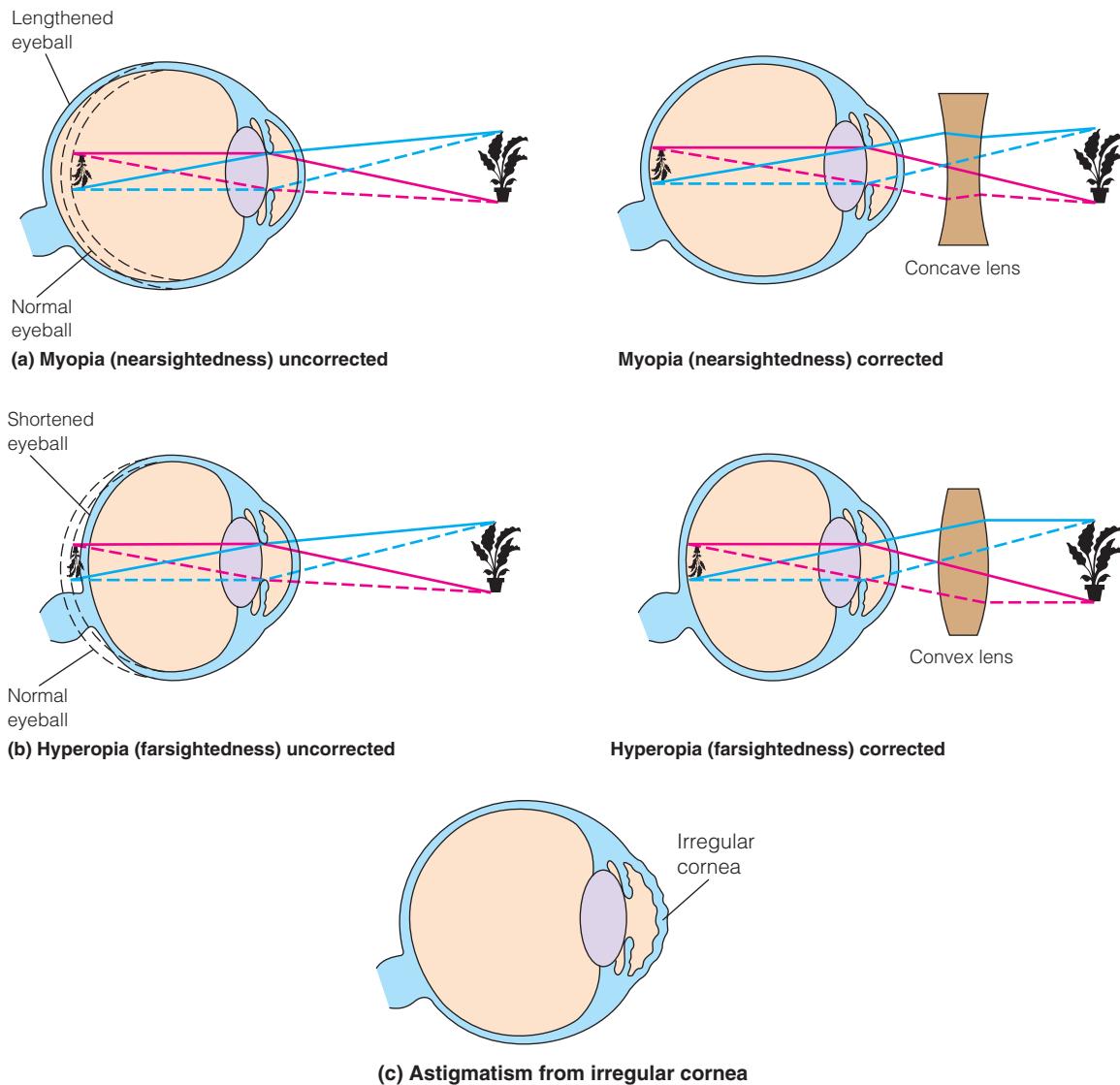
All errors of refraction can be treated in a nonsurgical or surgical manner. Nonsurgical treatment is the prescription of eyeglasses with the appropriate lens to correct the visual distortion (Figures 10-10A and B). Surgical treatment involves using a laser to reshape the curvature of the cornea so that the light rays will focus on the retina. Some types of laser surgery are LASIK and LASEK.

#### Helping You Remember

LASIK and LASEK are acronyms. These are words formed from the initial letter of the major parts of a compound term. LASIK means Laser-Assisted In-Situ Keratomileusis. LASEK means Laser-Assisted Subepithelial Keratectomy.

### Glaucoma (glaw-KOH-mah)

Damage to the retina and optic nerve due to increased intraocular pressure. The intraocular pressure increases because the aqueous humor produced is greater than the amount that flows out of the eye. Thus, aqueous humor builds up inside the anterior cavity. This distorts the shape of the eye and impairs vision (Figure 10-11c). The first level of treatment is eyedrops. If this is unsuccessful, surgery is done to increase the outflow of aqueous humor. Glaucoma can lead to blindness.



**Figure 10-10** Errors of refraction. A. Myopia (nearsightedness). B. Hyperopia (farsightedness). C. Astigmatism.

## Macular Degeneration (MAK-yoo-ler)

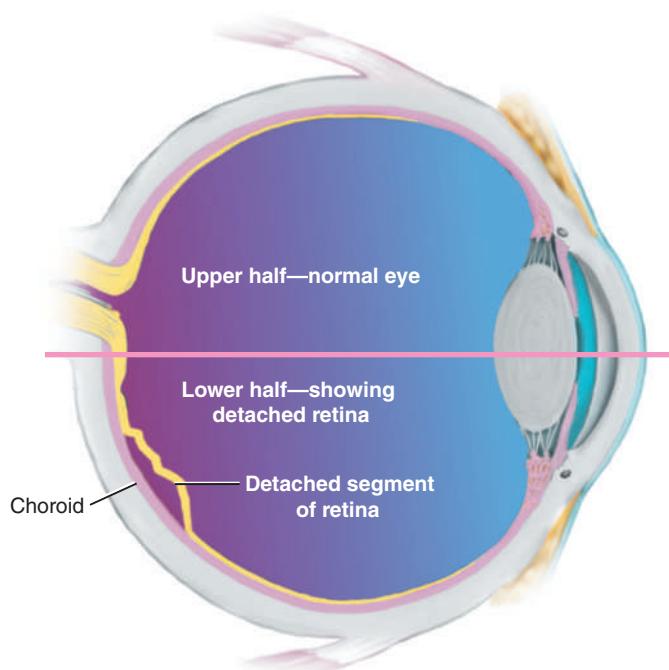
Deterioration of the macula lutea. Also known as age-related macular degeneration (AMD) because in some people, deterioration of the macula comes with the aging process. There is loss of central vision. It progresses to blindness (Figure 10-11D).

## Retinal Tears (TAYRZ) (do Not confuse with TEERZ)

Holes that develop on the retina. With age, the vitreous humor shrinks. As it shrinks, the humor pulls tightly on the retina and results in the creation of holes along the retinal wall. If not treated, they will result in the detachment (separation) of the retina from the layers underneath (Figure 10-12). If not treated, this will lead to blindness.



**Figure 10-11** Normal vision and pathologic vision changes. A. Normal vision. B. Vision reduced by cataracts. C. The loss of peripheral vision due to untreated glaucoma. D. The loss of central vision due to macular degeneration.



**Figure 10-12** Retinal detachment.

**Helping You Remember**

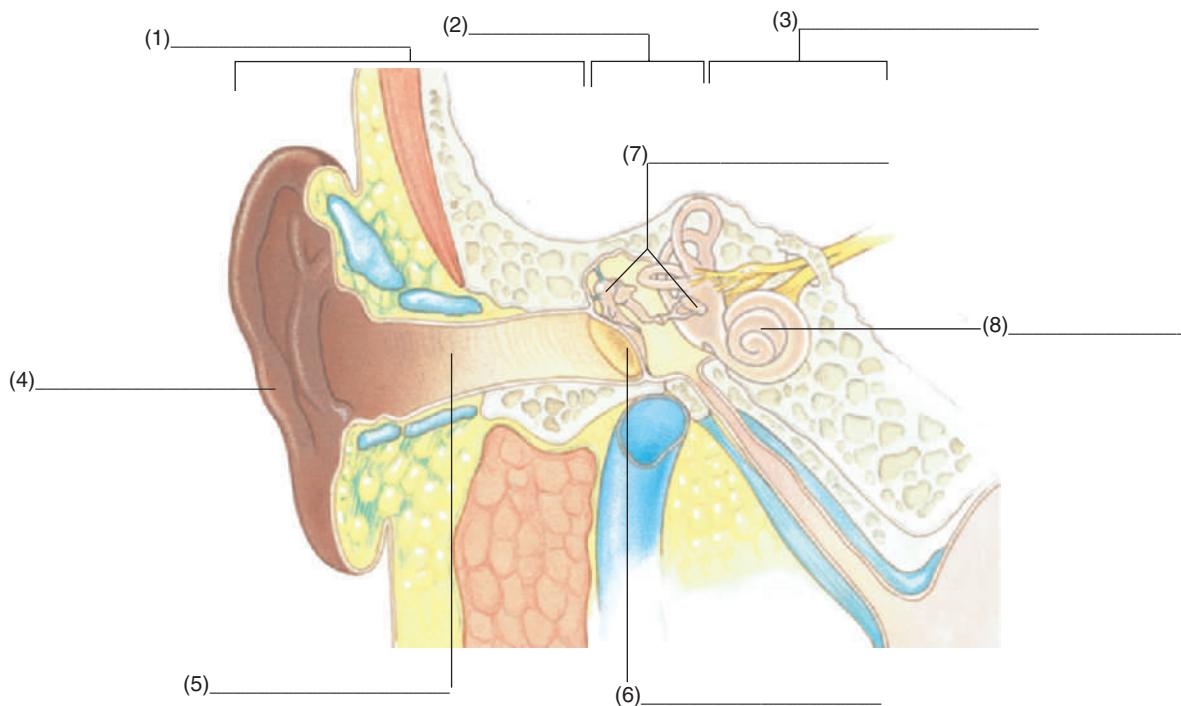
Tears (**TEERZ**) refer to the droplets of fluid that fall from the eye.  
 Tears (**TAYRZ**) are holes that develop due to a pulling force.

## 10.9 Major Structures of the Ear

### PRACTICE FOR LEARNING: Ear

Write the words below in the correct spaces in Figure 10-13. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. external ear
2. middle ear
3. inner ear
4. auricle (**AW-rih-kul**) or pinna (**PIN-ah**)
5. external auditory meatus (**AW-dih-tor-ee mee-AY-tus**)
6. tympanic (tim-**PAN-ick**) membrane or eardrum
7. ossicles (**OSS-ih-kulz**)
8. cochlea (**KOCK-lee-ah**)



**Figure 10-13** Major structures of the ear.

## External Ear

The external ear can be seen in Figure 10-13. It includes the auricle (also called the pinna or earflap), the external auditory meatus, and the tympanic membrane (TM) or eardrum.

The auricle gathers the sounds. Sound travels down the external auditory meatus to the eardrum. The sound makes the eardrum vibrate. The sound waves from this vibration travel to the middle ear.

Glands in the external auditory meatus secrete a wax called **cerumen** (seh-ROO-men). It protects the ear from infection by trapping microorganisms.

### In Brief

#### External Ear

Includes: auricle, external auditory meatus, tympanic membrane

Function: gathers and transmits sound to middle ear

## Middle and Inner Ears

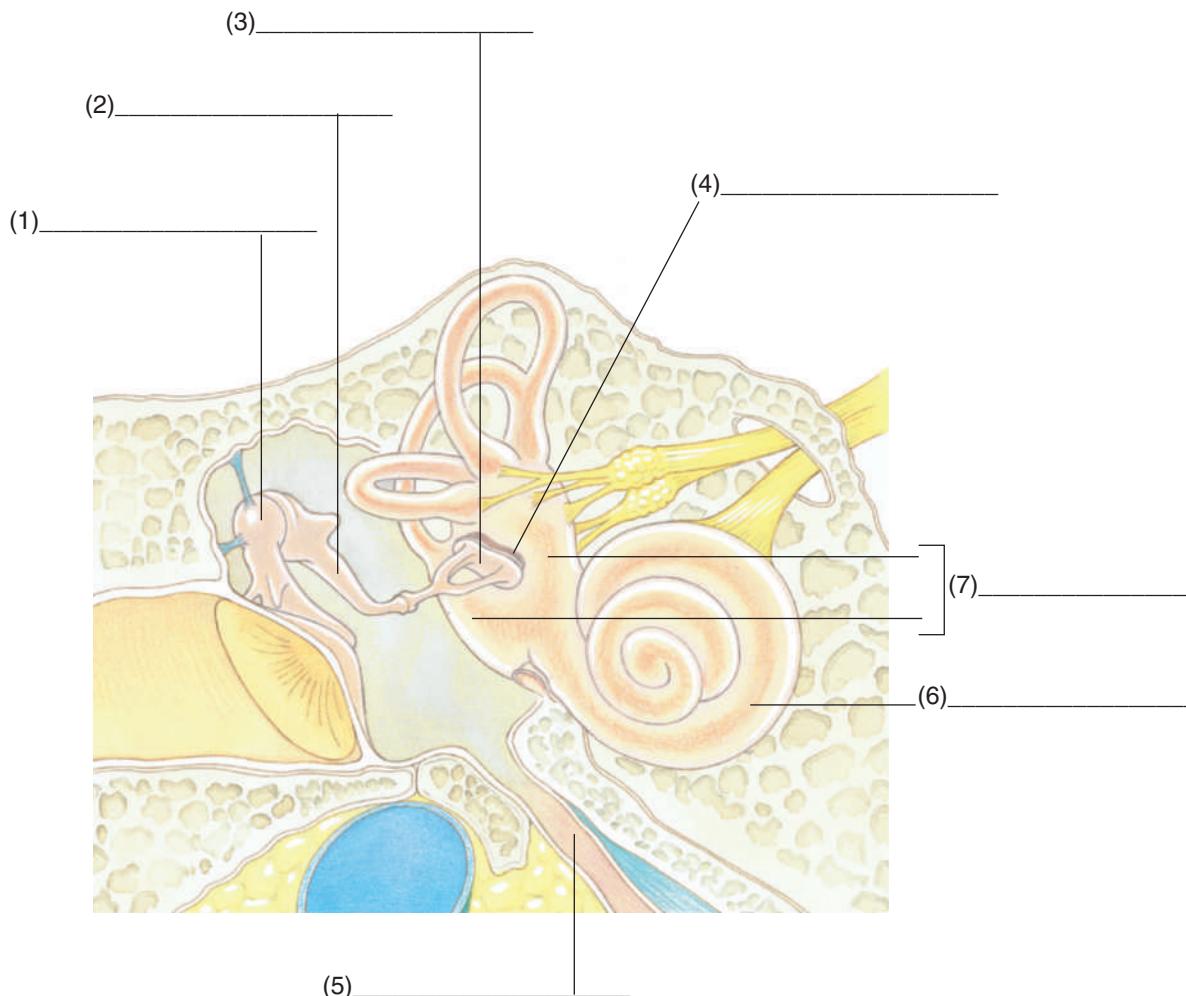
### PRACTICE FOR LEARNING: Middle Ear and Inner Ears

Write the words below in the correct spaces in Figure 10-14. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. **malleus** (MAL-ee-uss)
2. **incus** (ING-kuss)
3. **stapes** (STAY-peez)
4. **oval window**
5. **eustachian tube** (yoo-STAY-shun)
6. **cochlea** (KOCK-lee-ah)
7. **vestibule** (VES-tih-byool)

The middle ear consists of three tiny bones called **ossicles** (OSS-ih-kulz). They are the malleus, the incus, and the stapes. The stapes is connected to the oval window. The eustachian tube connects the middle ear to the throat.

The inner ear consists of the cochlea and vestibule. These structures look like winding passageways that resemble a maze, so the inner ear is also called the **labyrinth** (LAB-ih-rinth). The inner ear is responsible for balance and hearing. Balance is maintained through the action of fluid in the inner ear. When we are off balance, the fluid is disturbed, and messages are sent to the brain telling it that the body is not in the right position. The brain then corrects the body's position to get back into balance.



**Figure 10-14** Middle and inner ear.

### In Brief

#### Middle Ear

Structures: malleus, incus, and stapes

Function: transmission of sound to the inner ear

#### Inner Ear

Structures: cochlea and vestibule

Functions: balance and hearing

### PRACTICE FOR LEARNING: Structures of the Ear

**1.** Circle the structure that does not fit into a given category.

- a. external ear: pinna, malleus, tympanic membrane
- b. middle ear: ossicles, malleus, external auditory meatus, stapes
- c. inner ear: vestibule, cochlea, auricle

2. Name the three ossicles found in the middle ear.

---

3. Name the structure that connects the middle ear to the throat.

---

4. What is the other name for the inner ear?

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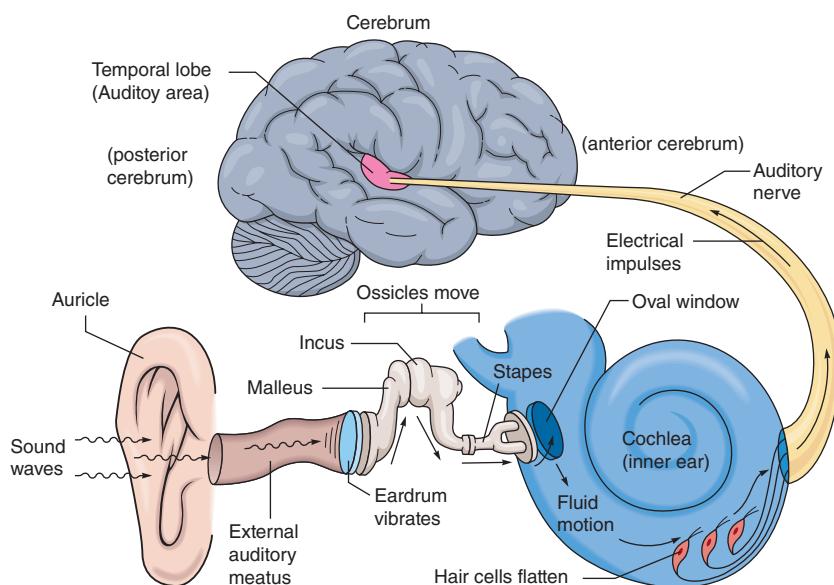
Answers: 1. a. malleus; b. external auditory meatus; c. auricle. 2. malleus, incus, stapes. 3. eustachian tube. 4. labyrinth.

## 10.10 Auditory Pathway

Hearing is possible because sound waves travel through the external auditory meatus and hits the tympanic membrane. The sound is transmitted through the middle ear to the inner ear, where it reaches the cochlea. Fluid inside the cochlea is set in motion, which disturbs tiny hair cells inside the cochlea. These hair cells react to the vibration by moving, like tall grass swaying in the wind. The movement of the hair cells stimulates the underlying nerve cells, which create nerve impulses that travel along the auditory nerve to the brain for interpretation (Figure 10-15).

### In Brief

**Path that sound travels** → pinna or auricle → external auditory meatus → tympanic membrane → ossicles (malleus, incus, stapes) → cochlea → auditory nerve → brain



**Figure 10-15** Auditory pathway.

## 10.11 New Roots, Suffixes, and Prefixes of the Ear

Use these additional suffixes when studying the terms in this chapter.

SUFFIX	MEANING
-metry	process of measuring
-ory	pertaining to

## 10.12 Learning the Terms of the Ear

### Roots

ROOT audi/o (see also audit/o)	MEANING hearing	
Term	Term Analysis	Definition
<b>audiometry</b> (aw-dee-OM-eh-tree)	-metry = process of measuring	process of measuring a patient's hearing ability

ROOT audit/o	MEANING hearing	
Term	Term Analysis	Definition
<b>auditory</b> (AW-dih-tor-ee)	-ory = pertaining to	pertaining to hearing

ROOT aur/o	MEANING ear	
Term	Term Analysis	Definition
<b>aural</b> (AW-ral)	-al = pertaining to	pertaining to the ear

### Helping You Remember

Do not confuse oral with aural. Oral means “pertaining to the mouth.” Aural means “pertaining to the ear.”

ROOT <b>labyrinth/o</b>		MEANING inner ear; labyrinth
Term	Term Analysis	Definition
<b>labyrinthitis</b> (lab-ih-rin-THIGH-tiss)	-itis = inflammation	inflammation of the inner ear

ROOT <b>myring/o</b> (see also <i>tympan/o</i> )		MEANING tympanic membrane; eardrum
Term	Term Analysis	Definition
<b>myringotomy</b> (mir-ing-GOT-oh-me)	-tomy = process of cutting; to cut	process of cutting into the eardrum to remove fluid from the middle ear
<b>myringoplasty</b> (mih-RING-goh-plas-tee)	-plasty = surgical reconstruction, surgical repair	surgical reconstruction of the tympanic membrane only. There is no repair of the ossicles. Compare with tympanoplasty below.

ROOT <b>ot/o</b>		MEANING ear
Term	Term Analysis	Definition
<b>otalgia</b> (oh-TAL-jee-ah)	-algia = pain	earache
<b>otitis media</b> (oh-TYE-tis ME- dee-ah)	-itis = inflammation media = middle	inflammation of the middle ear
<b>otorrhea</b> (oh-toh-REE-ah)	-rrhea = discharge; flow	discharge from the ear

ROOT <b>staped/o</b>		MEANING stapes
Term	Term Analysis	Definition
<b>stapedioplasty</b> (stah-PEE-dee-oh-plas-tee)	-plasty = surgical reconstruction; surgical repair	a surgical reconstruction of the stapes. It includes a stapedectomy (stah-peh-DECK-teh-mee) followed by replacement of the stapes with a prosthetic (pros-THEICK) (artificial) stapes.

ROOT tympan/o		MEANING tympanic membrane
Term	Term Analysis	Definition
tympanometry (tim-peh-NOM-eh-tree)	-metry = process of measuring	use of air pressure in the ear canal to test for disorders of the middle ear
tympanoplasty (TIM-peh-noh-plas-tee)	-plasty = surgical repair; surgical reconstruction	surgical reconstruction of a torn eardrum and/or the ossicles of the middle ear. If necessary, drainage tubes are inserted to manage middle ear disease.

## Suffixes

SUFFIX -cusis		MEANING hearing
Term	Term Analysis	Definition
presbycusis (pres-bih-KYOO-sis)	presby- = old age	diminished hearing due to old age

## 10.13 Pathology of the Ear

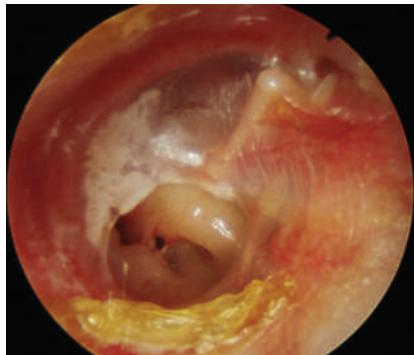
### Hearing Impairment

Hearing impairment is diminished or total loss of hearing with impaired ability to distinguish between speech sounds. There are two types of deafness. **Conductive deafness** is caused by the obstruction of the path traveled by sound waves from the external ear to the inner ear. Examples of obstruction are a buildup of earwax or a foreign body such as a raisin lodged in the ear canal. Treatment is by removing the obstruction.

The second type of deafness is **sensorineural** (sen-seh-ree-NOOR-al) **deafness**. This is caused by damage to the auditory nerve. This occurs with age. It can also be caused by loud noises from machinery or music, tumors, or infections. Hearing aids may be helpful for treating sensorineural deafness. If not, then a cochlear implant may be needed.

### Meniere Disease (meh-NYAR)

A condition of the inner ear. It includes hearing loss, a feeling of pressure in the ear, dizziness or **vertigo** (VER-tih-goh), and ringing in the ears or **tinnitus** (TIN-ih-tuss). **Nystagmus** (niss-TAG-muss), an involuntary, rapid, rhythmic movement of the eyeball may also be present.



**Figure 10-16** Perforated tympanic membrane. Courtesy of Dr. Andrew B. Silva, Pediatric Otolaryngology.

## Otitis Media

Inflammation is the most common disorder of the middle ear. When the infection is of sudden onset and short duration, the diagnosis is **acute**. When the infection is of gradual onset and long duration, the diagnosis is **chronic**. If there is a buildup of a watery fluid in the middle ear, it is known as **serous** (SEER-uhs) otitis media. If there is a buildup of pus in the middle ear, it is known as **purulent** (PYOO-roo-lent) otitis media. Tympanometry is a diagnostic procedure used to determine whether the middle ear is filled with fluid. Antibiotics are the usual treatment. Should they not clear the infection, then a myringotomy is performed to drain the fluid and a tiny tube called a tympanostomy (**tim-peh-NOSS-teh-mee**) tube is placed in the eardrum to prevent the fluid from building up.

## Otosclerosis (oh-toh-skleh-ROH-sis)

A bony formation around the oval window resulting in the inability of the stapes to transmit sound through the oval window and into the inner ear. This results in deafness. Treatment is stapedioplasty.

## Perforated Tympanic Membrane

Rupture of the tympanic membrane (Figure 10-16). It often results in hearing loss. If surgery is necessary to restore hearing loss, the procedure is called tympanoplasty.

### 10.14 Look-Alike and Sound-Alike Words

Below is a list of look-alike and sound-alike words. Study the spelling and definitions of each set of words. Questions will follow in the Review Exercises.

**TABLE 10-1 Look-Alike and Sound-Alike Words**

<b>aura</b>	warning signs to the patient that a seizure is starting
<b>aural</b>	pertaining to the ear
<b>oral</b>	pertaining to the mouth
<b>here</b>	the place you are in
<b>hear</b>	to hear sound
<b>malleus</b>	bone of middle ear
<b>malleolus</b>	bony bumps on the lower leg, commonly called the ankle
<b>palpable</b>	to feel
<b>palpebral</b>	pertaining to the eyelid
<b>serious</b>	not joking; causing great harm
<b>serous</b>	watery fluid
<b>tears</b>	(TEERZ) droplets of fluid that fall from the eye
<b>tears</b>	(TAYRZ) holes that develop due to a pulling force
<b>tendinitis</b>	inflammation of the tendon
<b>tinnitus</b>	ringing in the ears

## 10.15 Review Exercises

### EXERCISE 10-1 Look-Alike and Sound-Alike Words

Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 10-1 if it helps you.

1. On (**aural/oral**) examination, the tympanic membrane was red and inflamed.
2. When the tuning fork is placed (**hear/here**), the patient cannot (**hear/here**) the sound.
3. The swelling over the (**malleus/malleolus**) was caused by a sprained ankle.
4. The (**malleus/malleolus**), incus, and stapes are bones in the middle ear.
5. No (**palpable/palpebral**) neck masses; no (**serious/serous**) abnormalities. However, he did have a discharge from his right ear and was admitted with a diagnosis of (**serious/serous**) otitis media.
6. The patient thinks his (**tendonitis/tinnitus**) is caused by loud noises.

**EXERCISE 10-2 Matching Word Parts with Meaning**

Match the word part in Column A with its meaning in Column B.

<b>Column A</b>	<b>Column B</b>
_____	1. aur/o
_____	2. nyct/o
_____	3. anis/o
_____	4. -ptosis
_____	5. eso-
_____	6. opt/o
_____	7. myring/o
_____	8. dipl/o
_____	9. -phobia
_____	10. presby-
_____	11. phot/o
_____	12. audi/o
_____	13. kerat/o
_____	14. phac/o
_____	15. ophthalm/o
	A. cornea
	B. lens
	C. light
	D. tympanic membrane
	E. double
	F. hearing
	G. fear
	H. night
	I. vision
	J. ear
	K. eye
	L. unequal
	M. drooping
	N. inward
	O. old age

**EXERCISE 10-3 Matching—Structure and Function**

Match the structures listed below with its function. Write your answer in the space provided.

aqueous humor	pupil
cochlea	tympanic membrane
cornea	vestibule
macula lutea	vitreous humor

1. maintains intraocular pressure \_\_\_\_\_
2. location of cones in the retina \_\_\_\_\_
3. regulates amount of light entering the eye \_\_\_\_\_
4. maintains shape of eyeball \_\_\_\_\_
5. entry point of light into the eye \_\_\_\_\_
6. transmits sound to the middle ear \_\_\_\_\_
7. function is balance \_\_\_\_\_
8. function is hearing \_\_\_\_\_

**EXERCISE 10-4 Short Answer—Anatomy and Physiology**

I. Arrange the following structures of the ear so that they indicate the correct sequence in the transmission of sound waves to the brain from the external ear.

auditory nerve  
brain  
cochlea

external auditory meatus  
ossicles

pinna or auricle  
tympanic membrane

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_

II. Arrange the following structures of the eye so that they indicate the correct sequence in the transmission of light rays to the brain from the external eye.

aqueous humor  
brain  
cornea

lens  
optic nerve  
pupil

retina  
vitreous humor

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_

**EXERCISE 10-5 Labeling—Eye**

Using the body structures listed below, label Figure 10-17. Write your answer in the numbered spaces provided below, or if you prefer, on the diagram.

choroid

ciliary body

conjunctiva

cornea \_\_\_\_\_

iris \_\_\_\_\_

lens \_\_\_\_\_

macula lutea \_\_\_\_\_

optic nerve \_\_\_\_\_

pupil \_\_\_\_\_

retina \_\_\_\_\_

sclera \_\_\_\_\_

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

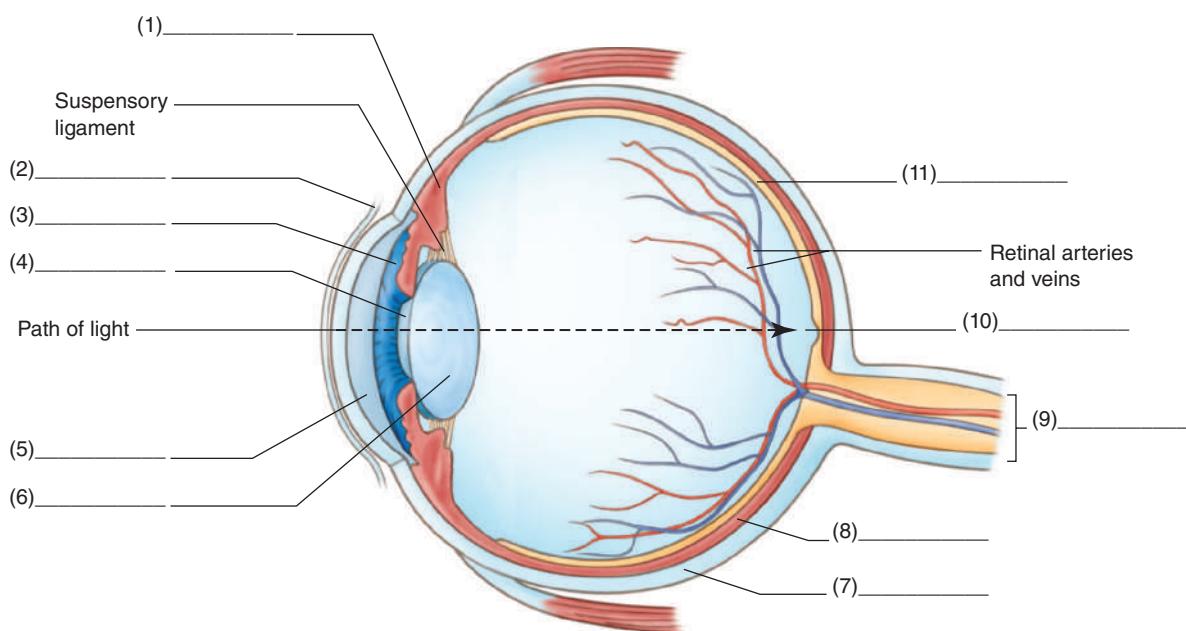
7. \_\_\_\_\_

8. \_\_\_\_\_

9. \_\_\_\_\_

10. \_\_\_\_\_

11. \_\_\_\_\_



**Figure 10-17** Labeling the major structures of the eye.

**EXERCISE 10-6 Labeling—Ear**

Using the body structures listed below, label (Figure 10-18). Write your answers in the numbered spaces provided below.

auricle

cochlea

eustachian tube

external auditory meatus

ossicles

tympanic membrane

1. \_\_\_\_\_

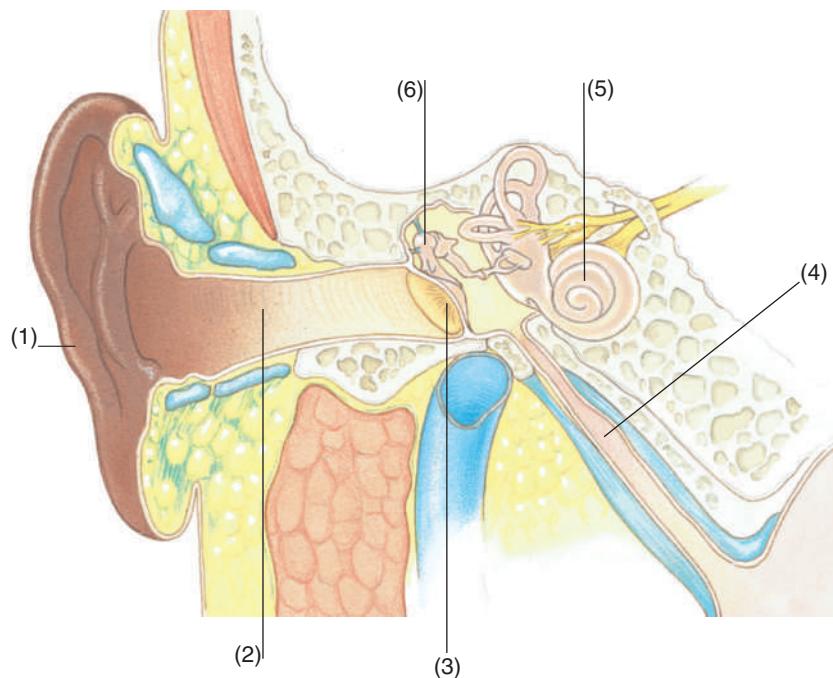
2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_



**Figure 10-18** Labeling the major structures of the ear.

**EXERCISE 10-7 Definitions—Pathology**

*Define the following.*

**1. retinal detachment**

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**2. serous otitis media**

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**3. perforated tympanic membrane**

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**4. Meniere disease**

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**5. myopia**

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**6. astigmatism**

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**7. cataracts**

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**8. glaucoma**

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**EXERCISE 10-8 Definitions—learning the Terms**

*Define the following terms.*

- 1. blepharoptosis** \_\_\_\_\_
- 2. ophthalmoscopy** \_\_\_\_\_
- 3. ophthalmologist** \_\_\_\_\_
- 4. optician** \_\_\_\_\_
- 5. optometrist** \_\_\_\_\_
- 6. aphakia** \_\_\_\_\_
- 7. photophobia** \_\_\_\_\_
- 8. retinopathy** \_\_\_\_\_
- 9. diplopia** \_\_\_\_\_
- 10. presbyopia** \_\_\_\_\_
- 11. esotropia** \_\_\_\_\_
- 12. auditory** \_\_\_\_\_
- 13. aural** \_\_\_\_\_
- 14. audiometry** \_\_\_\_\_
- 15. myringotomy** \_\_\_\_\_
- 16. otorrhea** \_\_\_\_\_
- 17. presbycusis** \_\_\_\_\_
- 18. otalgia** \_\_\_\_\_

**EXERCISE 10-9 Building Medical Words**

I. Using the suffix **-opia**, build the medical word meaning:

- a. double vision \_\_\_\_\_
- b. nearsightedness \_\_\_\_\_
- c. dimness of vision \_\_\_\_\_
- d. impaired vision due to old age \_\_\_\_\_

II. Using the suffix **-tropia**, build the medical word meaning:

- a. turning inward of the eyeball \_\_\_\_\_
- b. outward turning of the eyeball \_\_\_\_\_

III. Using the root **ot/o**, build the medical word meaning:

- a. pain in the ear \_\_\_\_\_
- b. discharge from the ear \_\_\_\_\_

**EXERCISE 10-10 Definitions in Context**

Define the bolded terms in context. Use your medical dictionary if necessary.

**Report #1 Discharge Summary**

ADMISSION DIAGNOSIS: LEFT **CATARACT** FOR EXTRACTION.

HISTORY: Mrs. Serowan had noted progressive **deteriorating** vision in the right eye over a number of years. Remainder of medical history is unremarkable.

PHYSICAL EXAMINATION: Best corrected **visual acuity** was 20/70 in the right eye.

COURSE IN HOSPITAL: On June 21, **ultrasound** was used to destroy the cataract. A **prosthetic intraocular lens** was inserted. On the first postoperative day, she was discharged home.

- a. **cataract** \_\_\_\_\_
- b. **deteriorating** \_\_\_\_\_
- c. **visual acuity** \_\_\_\_\_
- d. **ultrasound** \_\_\_\_\_
- e. **prosthetic intraocular lens** \_\_\_\_\_

## Report #2 Operative Report

PREOPERATIVE DIAGNOSIS: **OTITIS MEDIA**.

OPERATION PROPOSED: BILATERAL **MYRINGOTOMY** AND TUBE INSERTION.

POSTOPERATIVE DIAGNOSIS: **RECURRENT** OTITIS MEDIA.

OPERATION PERFORMED: **BILATERAL** MYRINGOTOMY WITH TUBE INSERTION.

OPERATIVE NOTE: The patient was brought to the operating room, placed in the **supine** position, and given a general anesthetic. Using the operative **microscope**, the right **external auditory meatus** was cleaned of a small amount of **cerumen** revealing an abnormal **tympanic membrane** with a buildup of pus-filled material. A myringotomy was performed and the infectious material was suctioned out. A tube was inserted to drain any further fluid buildup. The procedure was then performed on the left side with a similar technique. A buildup of watery fluid was noted. The patient was then taken to the recovery room in good condition.

- a. **otitis media** \_\_\_\_\_
- b. **myringotomy** \_\_\_\_\_
- c. **recurrent** \_\_\_\_\_
- d. **bilateral** \_\_\_\_\_
- e. **supine** \_\_\_\_\_
- f. **microscope** \_\_\_\_\_
- g. **external auditory meatus** \_\_\_\_\_
- h. **cerumen** \_\_\_\_\_
- i. **tympanic membrane** \_\_\_\_\_

## EXERCISE 10-11 Spelling

*Circle any words that are spelled incorrectly in the list below. Then correct the spelling in the space provided*

- 1. tinnitus \_\_\_\_\_
- 2. maleus \_\_\_\_\_
- 3. aqueus \_\_\_\_\_
- 4. glaucoma \_\_\_\_\_
- 5. vitreus \_\_\_\_\_
- 6. otorhea \_\_\_\_\_

7. conjunctiva \_\_\_\_\_
8. palpebra \_\_\_\_\_
9. kornea \_\_\_\_\_
10. serumen \_\_\_\_\_

## Animations

Visit the companion website to view the video on **How We Hear**.  
Also watch the following videos: **Cataracts; Serous Otitis Media**.

### 10.16 Pronunciation and Spelling

*Listen, read, and study, so you can speak and write.*

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

Word	Pronunciation	Spelling
amblyopia	am-blee-OH-pee-ah	
aphakia	ah-FAY-kee-ah	
aqueous humor	AY-kwee-us HYOO-mer	
audiometry	aw-dee-OM-eh-tree	
ametropia	am-eh-TROH-pee-ah	
anisocoria	an-iss-oh-KOR-ee-ah	
auditory	AW-dih-tor-ee	
aural	AW-ral	
auricle	AW-rih-kul	
blepharoptosis	blef-ah-rop-TOH-sis	
cataracts	KAT-ah-rackts	
cochlea	KOCK-lee-ah	
conjunctivitis	kon-junk-tih-VYE-tiss	
corneal abrasion	COR-nee-al ab-RAY-zhun	
diplopia	dih-PLOH-pee-ah	

Word	Pronunciation	Spelling
<b>esotropia</b>	es-oh-TROH-pee-ah	
<b>eustachian tube</b>	yoo-STAY-shun	
<b>exotropia</b>	eck-soh-TROH-pee-ah	
<b>glaucoma</b>	glaw-KOH-mah	
<b>incus</b>	INK-uss	
<b>iridectomy</b>	ir-ih-DECK-toh-mee	
<b>iritis</b>	eye-RYE-tiss	
<b>labyrinthitis</b>	lab-ih-rin-THIGH-tiss	
<b>malleus</b>	MAL-ee-uss	
<b>Meniere disease</b>	meh-NYAR	
<b>myopia</b>	my-OH-pee-ah	
<b>ophthalmologist</b>	ahf-thal-MOL-eh-jist	
<b>ophthalmoscopy</b>	ahf-thal-MOS-koh-pee	
<b>optician</b>	op-TISH-an	
<b>optometrist</b>	op-TOM-eh-trist	
<b>otalgia</b>	oh-TAL-jee-ah	
<b>otitis media</b>	oh-TYE-tis ME-dee-ah	
<b>otorrhea</b>	oh-toh-REE-ah	
<b>palpebral</b>	PAL-peh-bral	
<b>photophobia</b>	foh-toh-FOH-bee-ah	
<b>presbycusis</b>	pres-bih-KYOO-sis	
<b>presbyopia</b>	pres-bee-OH-pee-ah	
<b>purulent</b>	PYOO-roo-lent	
<b>retinopathy</b>	ret-ih-NOP-ah-thee	
<b>retinopexy</b>	RET-ih-noh-peck-see	
<b>stapes</b>	STAY-peez	
<b>tinnitus</b>	TIN-ih-tuss	
<b>tympanic</b>	tim-PAN-ick	
<b>tympanoplasty</b>	tim-pah-no-PLAS-tee	
<b>vertigo</b>	VER-tih-goh	
<b>vestibule</b>	VESS-tih-byool	

## CHAPTER 11

# Digestive System



### Chapter Outline

- 11.1** Major Organs of the Digestive System
- 11.2** Oral Cavity
- 11.3** Pharynx, Esophagus, and Stomach
- 11.4** Small Intestine
- 11.5** Large Intestine
- 11.6** Liver, Gallbladder, Biliary Ducts, and Pancreas
- 11.7** Peritoneum
- 11.8** New Roots, Suffixes, and Prefixes
- 11.9** Learning the Terms
- 11.10** Pathology
- 11.11** Look-Alike and Sound-Alike Words
- 11.12** Review Exercises
- 11.13** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

- 1.** Name and locate the organs of the digestive system.
- 2.** Describe the structures and functions of the organs of the digestive system.
- 3.** Describe the peritoneum.
- 4.** Pronounce, spell, define, and write the medical terms related to the digestive system.
- 5.** Describe common diseases related to the digestive system.
- 6.** Listen, read, and study so you can speak and write.

## Introduction

Figure 11-1 shows you the digestive system. The main part is a long tube called the **digestive tract**. It is also known as the **gastrointestinal tract**. It is about 16 feet (5 m) long. It starts at the mouth and ends at the anus. The inside wall is lined with **mucous membrane**, also known as **mucosa** (myoo-KOSA).

The digestive tract takes in food. It then breaks it down so that the body can use it. This is called **digestion**. The food molecules then go into the blood and lymph systems. This is called the process of **absorption**. The waste materials that are left continue to the end of the digestive tract and are eliminated.

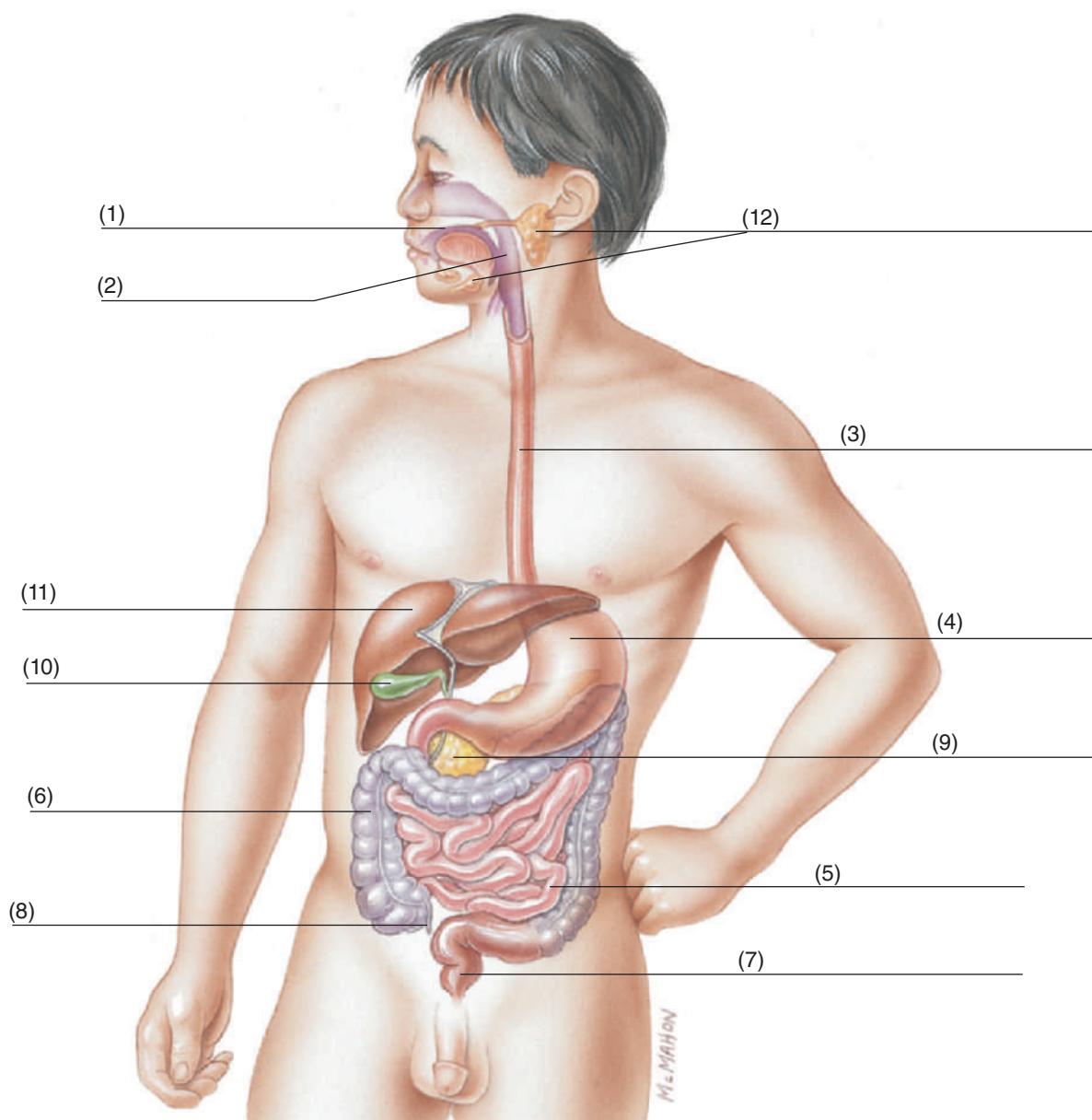
### 11.1 Major Organs of the Digestive System

#### PRACTICE FOR LEARNING: Major Organs of the Digestive System

Write the words below in the correct spaces in Figure 11-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. oral cavity (**OR-al**)
2. pharynx (**FAR-inks**)
3. esophagus (eh-**SOF-ah-gus**)
4. stomach (**STUM-ick**)
5. small intestine (in-**TESS-tine**)
6. large intestine (in-**TESS-tine**)
7. rectum (**RECK-tum**)
8. appendix (ah-**PEN-dicks**)
9. pancreas (**PAN-kree-ass**)
10. gallbladder (**GALL-blad-er**)
11. liver (**LIV-er**)
12. salivary gland (**SAL-ih-vehr-ee**)

Figure 11-1 shows you the six regions of the digestive tract. They are the oral cavity (mouth), the pharynx, the esophagus, the stomach, the small intestine, and the large intestine.



**Figure 11-1** Major organs of the digestive system.

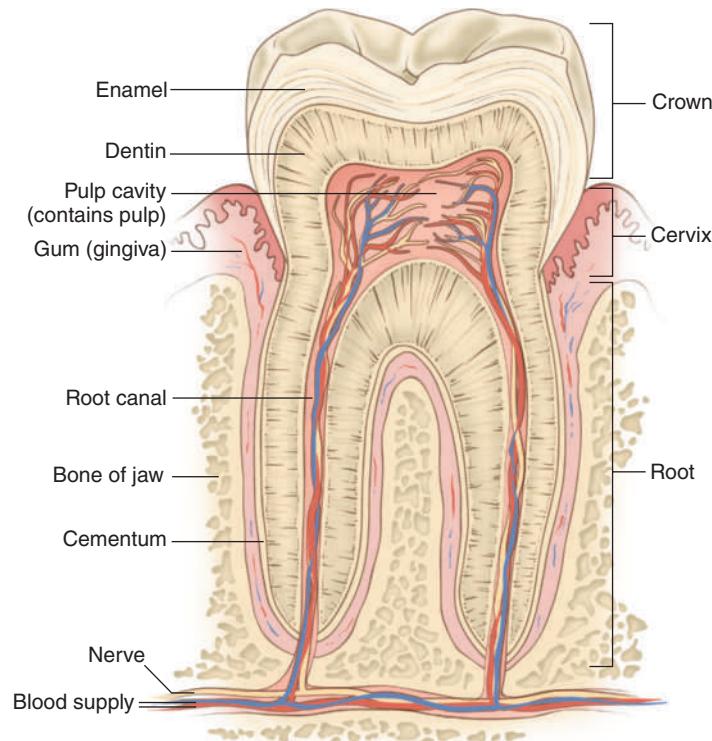
Four organs connected to the digestive system help out in the process of digestion. They are the salivary glands, the pancreas, the liver, and the gallbladder. Identify them in Figure 11-1.

## 11.2 Oral Cavity

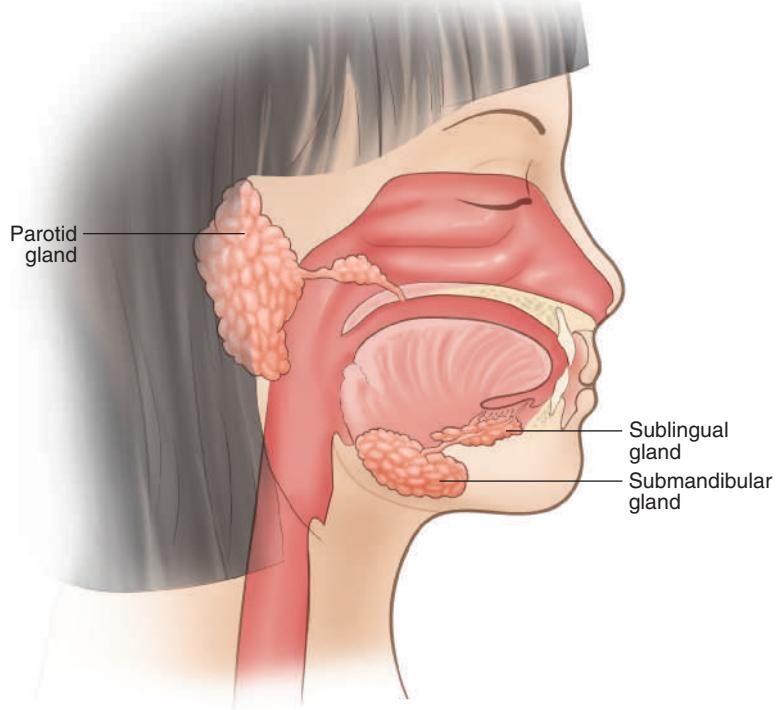
The **oral (OR-al) cavity** is the mouth. The roof of the mouth is the **palate (PAL-at)**. It separates the mouth from the nasal cavity. If you place your tongue on the anterior portion of the palate, you will feel the hard palate made of bone. Drag your tongue over the posterior palate, and you will feel the soft palate made up of muscle. At the back of the palate is the **uvula (YOO-vyoo-lah)**. It looks like a sack hanging from the soft palate. It closes off the nasal passage during swallowing.

The **tongue** is the most versatile muscle in the body. Its primary functions are to provide a sense of taste and to assist in swallowing. It is also very important in the production of speech. The tongue is attached to the bottom of the mouth by a mucous membrane cord called the **frenulum (FREN-yoo-lum)**.

There are four types of **teeth**: incisors, bicuspids, canines, and molars. Between the ages of 6 months and 2 years, children grow 20 temporary teeth. They are also called deciduous teeth. They are eventually replaced by 32 permanent teeth. At the core of the tooth is **pulp**. It is made up of blood vessels and nerves, which extend into the root of the tooth through the root canal. Covering the pulp is the **dentin (DEN-tin)**. Around the dentin and above the gums is hard, white **enamel**. The root of the tooth is anchored to bone and held in place by **cementum (seh-MEN-tum)**. The front teeth tear the food, and the back teeth **masticate (MAS-tih-kayt)** or chew food (Figure 11-2).



**Figure 11-2** Structures of the tooth.



**Figure 11-3** Salivary glands.

Salivary glands produce saliva. Saliva drains into the oral cavity via salivary ducts. Saliva contains an antibacterial substance that protects the mouth against germs. Saliva also starts the digestion (breakdown) of carbohydrates. There are three pairs of salivary glands: the **parotid** (pah-ROT-id), the **submandibular** (sub-man-DIB-yoo-lar), and **sublingual** (sub-LING-gwal) (Figure 11-3).

### In Brief

**Oral cavity is the mouth.**

**Palate** separates the nasal cavity from the oral cavity.

**Uvula** closes off the nasal passage during swallowing.

**Tongue** is for speech, taste, and swallowing.

**Teeth** are made up of pulp, dentin, and enamel.

Function: mastication.

**Salivary glands:** parotid, submandibular, sublingual.

Function: produce saliva

**Saliva** starts digestion

### PRACTICE FOR LEARNING: Oral Cavity

Choose the correct answer or answers from the choices in parentheses.

1. The sac-like structure at the back of the mouth is the (uvea/uvula).
2. The roof of the mouth is the (gingiva/labia/palate).
3. Which of the following is **not** a salivary gland? (submandibular/carotid/parotid).
4. The blood vessels and nerves of the tooth are located in the (dentin/pulp/gums).
5. Deciduous teeth are also known as (permanent/temporary) teeth.
6. The root canal contains (blood vessels/enamel/nerves/dentin).

**Answers:** 1. uvula. 2. palate. 3. carotid. 4. pulp. 5. temporary. 6. blood vessels; nerves.

### 11.3 Pharynx, Esophagus, and Stomach

During chewing, the food is mixed with saliva, producing a softened ball of food called a **bolus** (**BO-lus**). The bolus is pushed by the tongue into the throat, or pharynx, which is a 5-inch (12.5-cm) tube. This pushing commences the process of swallowing, which moves the bolus into the esophagus.

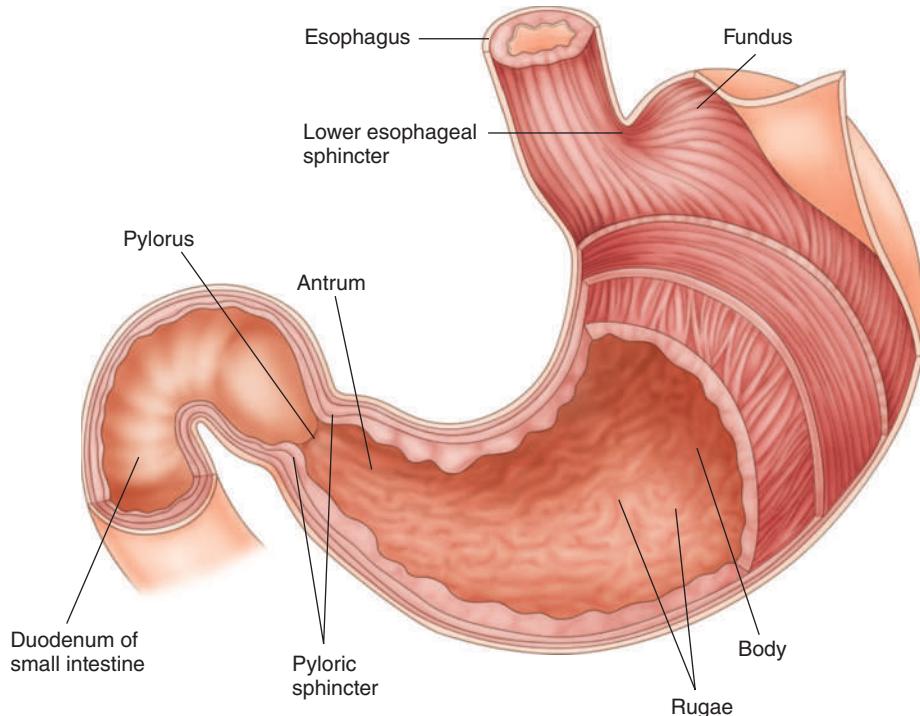
The esophagus is a 10-inch (25-cm) tube. It begins at the pharynx, extends to the diaphragm, and passes through an opening in the diaphragm called the **esophageal hiatus** (eh-sof-ah-JEE-ul high-AYE-tus). The esophagus continues through the diaphragm to the stomach. The muscles of the esophagus cause wave-like contractions called **peristaltic** (per-ih-STAL-tick) **waves**. These waves push the bolus down the esophagus and into the stomach.

As the bolus nears the stomach, it encounters a closed area caused by a tight circular muscle called a **sphincter** (SFINK-ter). The sphincter opens to allow the bolus into the stomach and then closes again to prevent stomach contents from reentering the esophagus. The sphincter is called the **lower esophageal sphincter** (LES). It is also known as the **cardiac** sphincter or the **gastroesophageal** sphincter. Once the bolus passes through the sphincter into the stomach, the food is broken down by enzymes. It becomes a semiliquid called **chyme** (KYM).

The stomach is J-shaped, with four regions: the **cardia** (KAR-dee-ah), **fundus** (FUN-dus), **body**, and **antrum** (AN-trum). The inner lining of mucous membrane consists of a series of folds called **rugae** (ROO-jee), which stretch to accommodate food (Figure 11-4).

Food (called chyme at this point) leaves the stomach for the small intestine through another sphincter called the **pyloric** (pie-LOR-ick) **sphincter**.

The function of the stomach is to break down food.



**Figure 11-4** Structures of the stomach.

### In Brief

**Pharynx** is also known as the throat.

**Peristalsis** pushes the bolus through the esophagus.

**Esophagus** is located between the pharynx and stomach.

**Esophageal hiatus** is a normal opening in the diaphragm.

**Sphincters** are circular muscles that keep food moving in one direction.

**Stomach** regions are the cardia, antrum, body, and fundus.

**Bolus** is a wet ball of food.

**Chyme** is partially digested food.

**Rugae** are folds in stomach.

Function of stomach: breaks down food

### PRACTICE FOR LEARNING: Pharynx, Esophagus, Stomach

Choose the correct answer from the choices in parentheses.

1. Hiatus refers to a(n) (peristaltic wave/muscle/opening).
2. Which of the following is **not** a part of the stomach? (body/ frenulum/rugae/cardia)
3. The esophageal hiatus is located in the (stomach/esophagus/diaphragm).

4. The cardiac sphincter is located between the (esophagus and stomach/stomach and small intestine).
5. Food enters the small intestine as a semiliquid substance called (bolus/chyme).
6. The (fundus/hiatus/sphincter/antrum) is defined as a tight circular muscle.

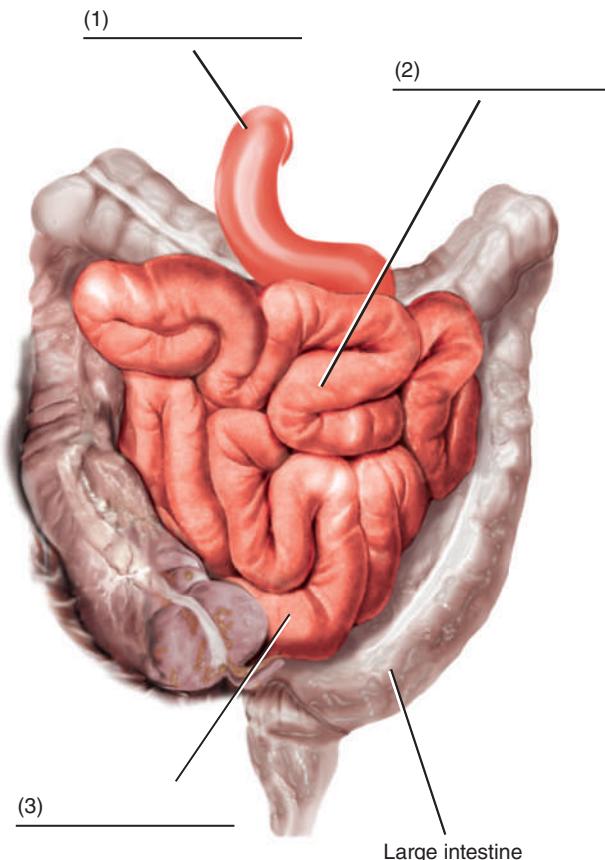
Answers: 1. opening. 2. frenulum. 3. diaphragm. 4.esophagus and stomach.  
5. chyme. 6. sphincter.

## 11.4 Small Intestine

### PRACTICE FOR LEARNING: Small Intestine

Write the words below in the correct spaces in Figure 11-5. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. duodenum (**doo-oh-DEE-num**)
2. jejunum (**jeh-JOO-num**)
3. ileum (**ILL-ee-um**)



**Figure 11-5** Small intestine.

Figure 11-5 illustrates the small intestine coiled within the abdominopelvic cavity. It is also called the small **bowel**. It is 11 feet (3.35 m) long and has three regions: The duodenum is the proximal (first) section, the jejunum is the middle section, and the ileum is the distal (last) section. The small intestine leads to the large intestine. Although the diameter of the small intestine is only about 1 inch (2.54 cm), it expands to accommodate food as it passes through.

The function of the small intestine is to absorb nutrients from digested food and pass them into the bloodstream. The remaining waste products enter the large intestine.

### In Brief

#### Small intestine

Includes: duodenum, jejunum, ileum

Function: break down, absorb, and transport foodstuffs

## 11.5 Large Intestine

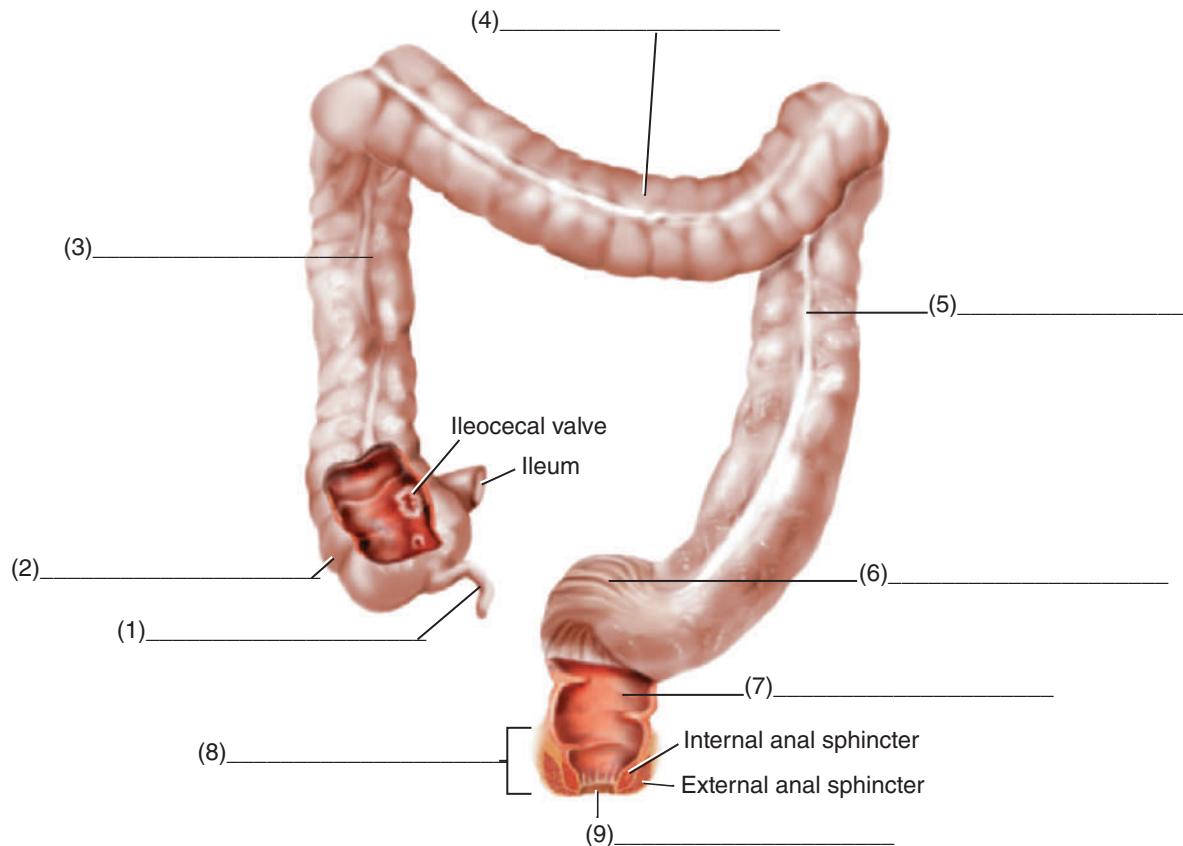
### PRACTICE FOR LEARNING: Large Intestine

Write the words below in the correct spaces in Figure 11-6. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. appendix (ah-PEN-dicks)
2. cecum (SEE-kum)
3. ascending colon (ah-SEN-ding KOH-lon)
4. transverse colon (tranz-VERS KOH-lon)
5. descending colon (dee-SEN-ding KOH-lon)
6. sigmoid colon (SIG-moid KOH-lon)
7. rectum (RECK-tum)
8. anal canal (AY-nul)
9. anus (AY-nus)

The large intestine is about 5 feet (1.8 m) long. It is also called the large bowel. As illustrated in Figure 11-6, the large intestine has three regions. First is a pouch called the cecum. The appendix, which has no known function, hangs down from the cecum. The next region is the colon. It forms a long, square arch consisting of four areas: The ascending colon, transverse colon, descending colon, and sigmoid colon. The last region of the large intestine is the rectum. It is about 8 inches long and is lined with mucous folds.

The final segment of the rectum is the anal canal.



**Figure 11-6** Large intestine.

The functions of the large intestine are to absorb water, vitamin K, some B vitamins and **defecation (def-eh-KAY-shun)**, the elimination of wastes.

### In Brief

#### Large intestine

Includes: cecum, colon, rectum

#### Colon

Includes: ascending colon, transverse colon, descending colon, sigmoid colon

**Bowel** refers to the large and small intestines.

Functions: Defecation

Absorption of water, Vitamin K and B

### PRACTICE FOR LEARNING: Small and Large Intestines

Choose the correct answer from the choices in parentheses:

1. Food leaves the stomach and enters the (jejunum/duodenum/ileum).
2. The small **and** large intestines are also known as (bowel/colon/peritoneum).
3. A function of the large intestine is (mastication/defecation).
4. The transverse colon is part of the (small/large) intestine.
5. The duodenum is part of the (small/large) intestine.
6. A function of the small intestine is (mastication/defecation/absorption) of nutrients.
7. The appendix is located on the \_\_\_\_\_ side of the abdomen.

Answers: 1. duodenum. 2. bowel. 3. defecation. 4. large intestine. 5. small intestine. 6. absorption. 7. right.

## 11.6 Liver, Gallbladder, Biliary Ducts, and Pancreas

The liver weighs about 4 pounds (1.75 kg). It is located below the diaphragm in the right upper quadrant (RUQ) of the abdomen (Figure 11-7). The liver has many functions, including the production of bile; elimination of toxic substances; and breakdown of proteins, fats, and carbohydrates (CHO).

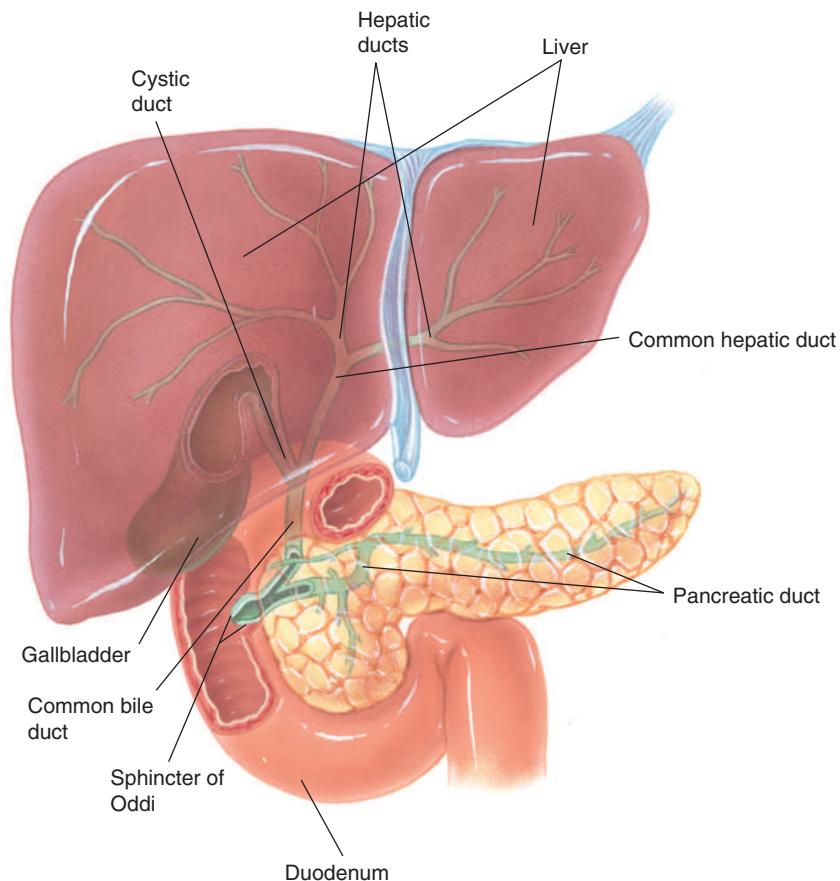
The biliary tract includes the liver, the gallbladder (GB), and the biliary ducts. The biliary ducts include the hepatic ducts, the common hepatic duct, the cystic duct, and the common bile duct (CBD) (Figure 11-7).

Bile is a greenish-yellow fluid produced in the liver. Look at the bile ducts in Figure 11-7. Bile goes from the liver through the right and left hepatic ducts, through the common hepatic duct, and into the cystic duct, which leads to the gallbladder. Bile is stored in the gallbladder. The function of bile is to break down fats in the duodenum. When bile is required, it travels through the cystic duct and into the common bile duct (CBD) where the common hepatic and cystic ducts meet. The CBD drains into the duodenum.

The liver is essential to life. However, the gallbladder may be surgically removed without too much disruption to body function. After removal of the gallbladder, the bile may be stored in the biliary ducts, and biliary processes proceed normally.

The pancreas is illustrated in Figure 11-7. It is a long, fish-shaped organ lying behind the stomach. It secretes pancreatic juice, which contains enzymes to break down food in the duodenum.

The pancreas also secretes the hormones **insulin** (IN-suh-lin) and **glucagon** (GLOO-kah-gon). These hormones work together to regulate the amount of sugar in the bloodstream. See Chapter 19, under Pancreas, for details of sugar regulation.



**Figure 11-7** Liver, gallbladder, pancreas, and biliary tract.

## In Brief

### Liver

Location: RUQ

Functions: produces bile; breaks down proteins, carbohydrates, and fats; eliminates toxic waste

### Gallbladder

Location: Under the liver

Function: Stores bile

### Pancreas

Location: Lies behind the stomach

Function: Secretes enzymes and hormones

## 11.7 Peritoneum

Figure 11-8 illustrates the **peritoneum** (per-ih-toh-NEE-um). It is a membrane lining the abdominopelvic cavity and covering the abdominopelvic organs. It has two layers. The space between the two layers is called the **peritoneal** (per-ih-toh-NEE-al) **cavity**. It is filled with peritoneal fluid, a watery substance that prevents friction between the two layers.

### In Brief

#### Peritoneum

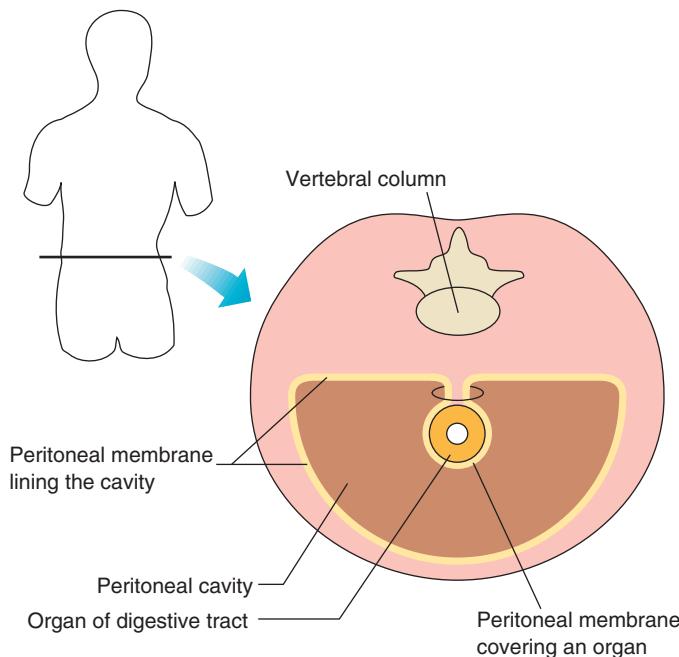
Membrane lining the abdominal and pelvic cavities and covering its organs

Peritoneal fluid fills the peritoneal cavity.

### PRACTICE FOR LEARNING: Biliary Tract and the Peritoneum

Choose the correct answer from the choices in parentheses:

1. The hepatic ducts carry bile from the (gallbladder/liver).
2. A greenish-yellow fluid stored in the gallbladder is (glucagon/bile).
3. The (pancreas/liver) regulates blood sugar.



**Figure 11-8** Peritoneal membrane.

4. The peritoneum lines the (thoracic/abdominal) cavity.
5. Fats are broken down by (bile/insulin) in the (duodenum/liver).

Answers: 1. liver. 2. bile. 3. pancreas. 4. abdominal. 5. bile; duodenum.

## 11.8 New Roots, Suffixes, and Prefixes

Use these additional roots, suffixes, and prefixes when studying the medical terms in this chapter.

ROOT	MEANING
aer/o	air
ceco/o	cecum (first portion of the large intestine)
intestin/o	intestine

SUFFIX	MEANING
-aise	ease
-flux	flow
-hexia	habit
-tripsy	crushing
-y	process; condition

PREFIX	MEANING
meso-	middle
re-	back

## 11.9 Learning the Terms

Following these steps will make it easier for you to learn medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

## Roots

ROOT append/o; appendic/o		MEANING appendix
Term	Term Analysis	Definition
<b>appendicitis</b> (ah-pen-dih-SIGH-tis)	-itis = inflammation	inflammation of the appendix

ROOT bucc/o		MEANING cheek
Term	Term Analysis	Definition
<b>buccal mucosa</b> (BUCK-ahl myoo-KOH-sa)	-al = pertaining to mucosa = mucous membrane	pertaining to the mucous membrane of the cheek

ROOT cac/o (see mal-)		MEANING bad
Term	Term Analysis	Definition
<b>cachexia</b> (kah-KECK-see-ah)	-hexia = habit	state of ill health and malnutrition; wasting away of muscle; emaciation (ee-may-she-AY-shun)  Cachexia is associated with severe cancers.

ROOT cholangi/o		MEANING bile duct; bile vessel
Term	Term Analysis	Definition
<b>cholangiogram</b> (koh-LAN-jee-oh-gram)	-gram = record	record (image) of the bile ducts produced by x-rays

ROOT cholecyst/o		MEANING gallbladder
Term	Term Analysis	Definition
<b>cholecystectomy</b> (koh-lee-sis-TECK-toh-mee)	-ectomy = excision; surgical removal	excision of the gallbladder
<b>cholecystitis</b> (koh-lee-sis-TYE-tis)	-itis = inflammation	inflammation of the gallbladder

ROOT <b>choledoch/o</b>		MEANING common bile duct
Term	Term Analysis	Definition
<b>choledochotomy</b> (koh-led-oh-KOT-oh-mee)	-tomy = to cut into; incision; process of cutting	incision into the common bile duct

ROOT <b>col/o</b>		MEANING colon
Term	Term Analysis	Definition
<b>colitis</b> (koh-LYE-tis)	-itis = inflammation	inflammation of the colon
<b>colic</b> (KOLL-ick)	-ic = pertaining to	severe abdominal pain; pertaining to the colon

### Helping You Remember

The roots *chol/e* and *col/o* are often confused. They are pronounced the same but have entirely different meanings: *chol/e* means gall and *col/o* means colon. Therefore, the term for inflammation of the gallbladder is spelled cholecystitis, not colecystitis.

ROOT <b>enter/o</b>		MEANING small intestine; intestine
Term	Term Analysis	Definition
<b>gastroenteritis</b> (gas-tro-en-ter-EYE-tis)	-itis = inflammation gastr/o = stomach	inflammation of the stomach and intestines often accompanied by nausea (a sick feeling) and vomiting
<b>mesentery</b> (MEZ-en-ter-ee)	meso- = middle	membrane attaching the intestines to the posterior abdominal wall. The mesentery is situated in the middle of the intestines. It holds the intestines in place.

ROOT <b>gastr/o</b>	MEANING <b>stomach</b>	
Term	Term Analysis	Definition
<b>gastroenterologist</b> (gas-tro-en-ter-OL-oh-jist)	-ist = specialist enter/o = intestine	specialist in the study and treatment of diseases of the digestive tract
<b>gastroesophageal reflux disease (GERD)</b> (gas-tro-eh-sof-ah-JEE-ul REE-flucks)	-eal = pertaining to esophag/o = esophagus -flux = flow re- = back	backward flow of stomach contents into the esophagus When this happens, the esophageal mucosa (mucous membrane) is damaged by the acid from the stomach.
<b>nasogastric intubation</b> (nay-zo-GAS-trick in-too-BAY-shun)	-ic = pertaining to nas/o = nose intubation = insertion of a tube into a body cavity or canal	placement of a tube through the nose and into the stomach for feeding purposes

ROOT <b>gingiv/o</b>	MEANING <b>gums; gingival</b>	
Term	Term Analysis	Definition
<b>gingivitis</b> (jin-jih-VYE-tis)	-itis = inflammation	inflamed gums

### Helping You Remember

Inflammation is spelled with two “m’s.” Inflamed is spelled with one “m.”

ROOT <b>gloss/o (see also lingu/o)</b>	MEANING <b>tongue</b>	
Term	Term Analysis	Definition
<b>glossitis</b> (glos-EYE-tis)	-itis = inflammation	inflammation of the tongue

ROOT <b>hepat/o</b>	MEANING <b>liver</b>	
Term	Term Analysis	Definition
<b>hepatitis</b> (hep-ah-TYE-tis)	-itis = inflammation	inflammation of the liver

### Helping You Remember

Do not confuse *ile/o*, which means “intestine,” with *ili/o*, which means “hip.” To remember, think of the “e” in *ile/o* corresponding to the “e” in intestine and the “i” in *ili/o* corresponding to the “i” in hip.

ROOT <b>ile/o</b>	MEANING <b>ileum(distal portion of the small intestine)</b>	
Term	Term Analysis	Definition
<b>ileectomy</b> (ill-ee-ECK-toh-mee)	-ectomy = excision; surgical removal	excision of the ileum
<b>ileocecal junction</b> (il-ee-oh-SEE-kal)	-al = pertaining to cec/o = cecum	pertaining to the area where the ileum joins the cecum

ROOT <b>labi/o</b>	MEANING <b>lips</b>	
Term	Term Analysis	Definition
<b>labial</b> (LAY-bee-al)	-al = pertaining to	pertaining to the lips

ROOT <b>lapar/o</b>	MEANING <b>abdomen</b>	
Term	Term Analysis	Definition
<b>laparoscope</b> (LAP-ah-roh-skohp)	-scope = instrument used to visually examine	instrument used to visually examine the inside of the abdomen

ROOT <b>lingu/o</b>	MEANING tongue	
Term	Term Analysis	Definition
<b>sublingual</b> (sub- <b>LING</b> -gwal)	-al = pertaining to sub- = under	pertaining to under the tongue

ROOT <b>lith/o</b>	MEANING stone; calculus	
Term	Term Analysis	Definition
<b>lithotripsy</b> (LITH-oh-trip-see)	-tripsy = crushing	crushing of gallstones into pebbles tiny enough to be eliminated without surgical removal

ROOT <b>orex/o</b>	MEANING appetite	
Term	Term Analysis	Definition
<b>anorexia</b> (an-oh-RECK-see-ah)	-ia = condition an- = no; not; lack of	loss of appetite

### Helping You Remember

Do not confuse anorexia with anorexia nervosa.

Anorexia is a loss of appetite due to an underlying condition.

Anorexia nervosa is a psychological eating disorder of self-starvation.

ROOT <b>or/o (see also stomat/o)</b>	MEANING mouth	
Term	Term Analysis	Definition
<b>oral</b> (OR-al)	-al = pertaining to	pertaining to the mouth

ROOT <b>stomat/o; stom/o</b>		MEANING <b>mouth</b>
Term	Term Analysis	Definition
<b>stomatitis</b> (sto-mah-TYE-tis)	-itis = inflammation	inflammation of the mouth
<b>xerostomia</b> (zeer-oh-STOH-me-ah)	-ia = condition xer/o = dry	dryness of the mouth due to a dysfunction of the salivary glands, as they fail to produce sufficient saliva. Often seen as a side effect to medication.

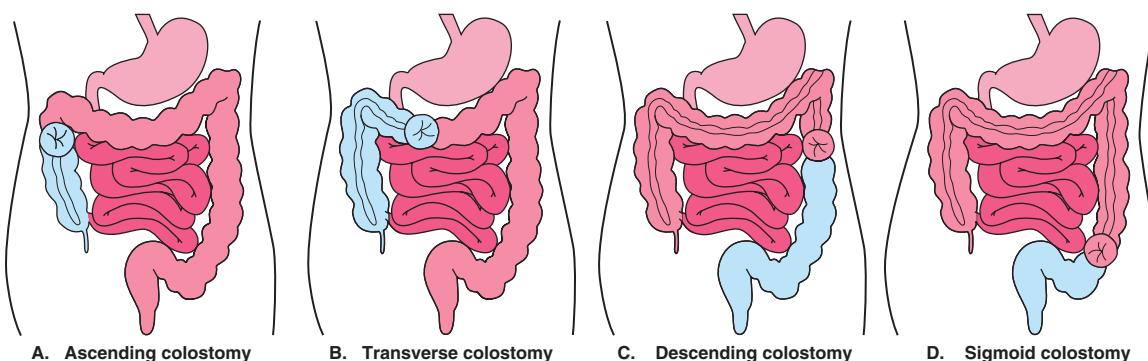
## Suffixes

SUFFIX <b>-emesis</b>		MEANING <b>vomiting</b>
Term	Term Analysis	Definition
<b>hyperemesis</b> (high-per-EM-eh-sis)	hyper- = excessive; above normal	excessive vomiting
<b>hematemesis</b> (hee-mah-TEM-eh-sis)	hemat/o = blood	vomiting of blood
<b>melanemesis</b> (mel-ah-NEM-eh-sis)	melan/o = black	black vomit. The vomit looks like coffee grounds because food mixes with the blood.

SUFFIX <b>-pepsia</b>		MEANING <b>digestion</b>
Term	Term Analysis	Definition
<b>dyspepsia</b> (dis-PEP-see-ah)	dys- = difficult; painful; bad	indigestion

SUFFIX -phagia		MEANING eating; swallowing
Term	Term Analysis	Definition
<b>aerophagia</b> (ayr-oh-FAY-jee-ah)	aer/o = air	excessive swallowing of air while drinking or eating. This causes abdominal distention and eructation (eh-ruck-TAY-shun). Commonly known as burping.  In some cases, flatulence (FLAT-yoo-lence) may be present. This is the passage of gas through the digestive tract.
<b>aphagia</b> (ah-FAY-jee-ah)	a- = no; not; lack of	inability to swallow
<b>dysphagia</b> (dis-FAY-jee-ah)	dys- = difficult; painful; bad	difficulty in swallowing
<b>polyphagia</b> (pol-ee-FAY-jee-ah)	poly- = many	excessive eating

SUFFIX -stomy		MEANING surgical creation of a new opening
Term	Term Analysis	Definition
<b>colostomy</b> (koh-LOSS-toh-mee)	col/o = colon	surgical creation of a new opening between the colon and the abdominal wall. Wastes are then eliminated through this opening. Can be temporary or permanent (Figure 11-9).



**Figure 11-9** Colostomies: A colostomy is named for the part of the colon that is removed. In this diagram, the areas of intestine that are removed are shown in blue.

Term	Term Analysis	Definition
<b>ileostomy</b> (ill-ee-OS-toh-mee)	ile/o = ileum; distal portion of small intestine	surgical creation of a new opening between the ileum and abdominal wall. Wastes are eliminated through this new opening.
<b>duodenojejunostomy</b> (doo-oh-dee-no-jay-joon-OSS-teh-mee)	duoden/o = duodenum; proximal portion of small intestine jejun/o = jejunum; middle portion of small intestine	surgical creation of a new opening between the duodenum and jejunum

**Note:** The joining of two structures inside the body that are normally separate is called **anastomosis** (ah-nas-teh-MOH-sis). Duodenojejunostomy is an anastomosis between the duodenum and jejunum. When a new opening is made between two or more organs, both word roots are used in the medical term. Compare this with ileostomy. In this procedure, the ileum is attached to the abdominal wall, not another organ, so only one combining form is used.

## Prefixes

PREFIX dia-		MEANING through; complete
Term	Term Analysis	Definition
<b>diarrhea</b> (dye-ah-REE-ah)	-rrhea = flow; discharge	frequent and watery excretion of stool. Stool is the waste products eliminated from the body. Stool is also known as feces ( <b>FEE-seez</b> ).

**Note:** When a person has no control over when feces are discharged, they are said to be **incontinent** (in-KON-tih-nent).

PREFIX mal-		MEANING bad
Term	Term Analysis	Definition
<b>malaise</b> (mah-LAYZ)	-aise = ease	a feeling of uneasiness or discomfort. A sign of illness.

## 11.10 Pathology

### Cholecystolithiasis (koh-leh-sis-toh-lih-THIGH-eh-sis) or cholelithiasis (koh-leh-lih-THIGH-eh-sis)

Calculi (stones) in the gallbladder are commonly called gallstones. If the calculi are located in the common bile duct, the condition is called **choledocholithiasis** (koh-led-eh-koh-lih-THIGH-eh-sis) (Figure 11-10). Treatment includes **laparoscopic** (lap-ah-roh-skop-ick) **cholecystectomy**, which removes the gallbladder through a small, minimally invasive incision or an **open cholecystectomy**, which removes the gallbladder through a larger, more invasive abdominal incision.

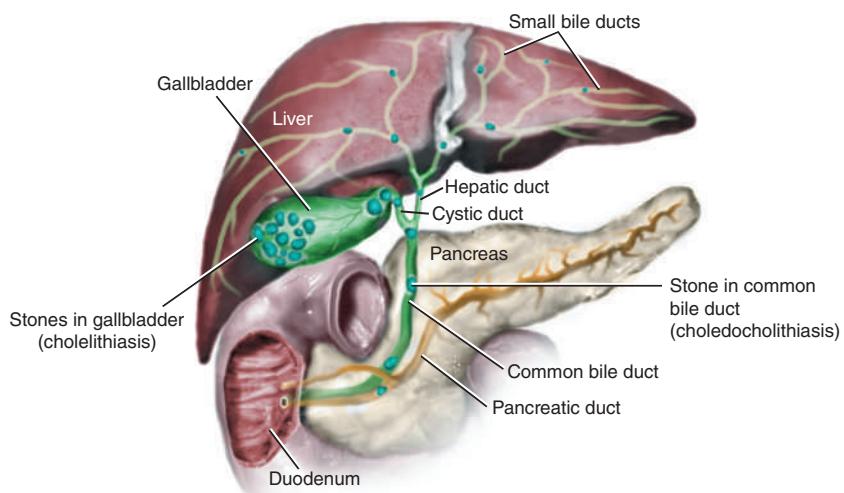
### Cirrhosis of the Liver

Cirrhosis (sih-ROH-sis) is a chronic degeneration of liver cells caused by alcoholism or hepatitis B or C. As the liver degenerates, normal hepatic cells become scarred and replaced with fat giving the liver a yellowish color (*cirrh/o* means “yellow”).

Chronic liver damage results in abnormalities throughout the body such as high blood pressure, **jaundice** (yellow appearance of the skin), **ascites** (eh-SIGH-teez) (accumulation of fluid [edema] in the abdomen), and **edema** in the legs.

### Cleft Palate and Cleft Lip

**Cleft palate** is a birth defect in which the hard and/or soft palate fails to close during development. Because the nasal cavity is no longer separated from the oral cavity, eating



**Figure 11-10** Stones in the gallbladder and bile ducts.

and speaking are difficult. Treatment is surgical reconstruction of the palate. This is called **palatoplasty** (pal-ah-toh-PLAS-tee).

**Cleft lip** is a birth defect where both sides of the lip fail to join completely. It is also known as **harelip**. This results in an opening in the upper lip. This opening can be a small slit or can be a large opening extending toward the nose. The opening can be on one or both sides of the lip. Cleft lip and cleft palate can occur together or singly. They both can be corrected surgically.

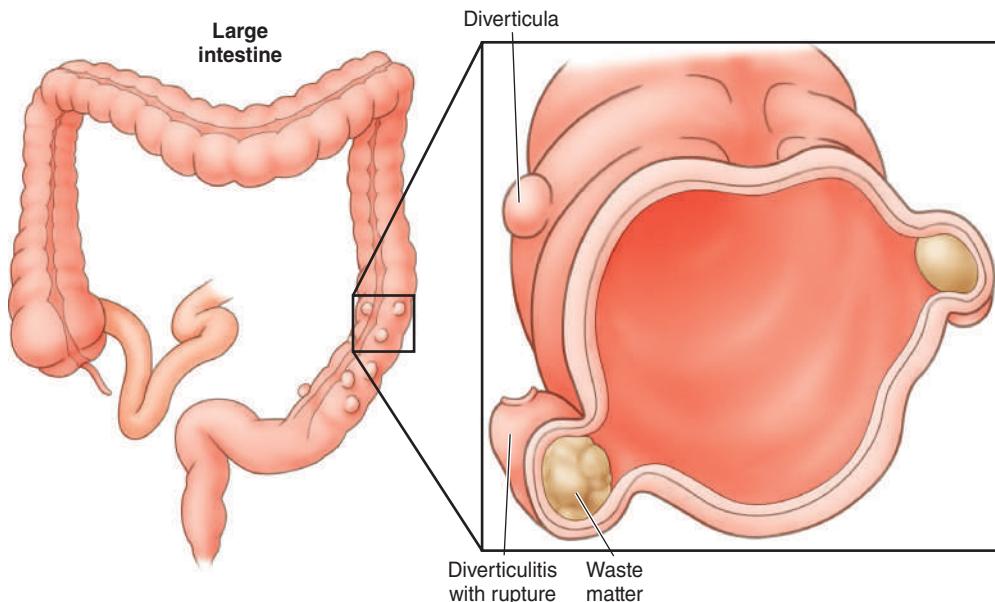
## Crohn (KROHN) Disease

Crohn disease (CD) is a form of inflammatory bowel disease that can involve any part of the digestive tract. It is most often found in the ileum. The inflammation causes obstruction of intestinal contents.

In severe cases, the diseased bowel is removed and an artificial opening is created between the intestine and abdominal wall. (See colostomy in Section 11.9, Learning the Terms). If the artificial opening is between the colon and abdominal wall, the operation is called a **colostomy** (koh-LOSS-toh-mee). If the artificial opening is between the ileum and abdominal wall, the operation is called an **ileostomy** (ill-ee-OSS-toh-mee).

## Diverticulosis

Pocket(s) in the mucous membrane may occur at any point along the stomach and small and large intestines (Figure 11-11). One pocket is called a **diverticulum** (dye-ver-TICK-yoo-lum). The plural is **diverticula** (dye-ver-TICK-you-lah). **Diverticulosis** (dye-ver-tick-yoo-LOH-sis) describes a condition of many diverticula.



**Figure 11-11** Diverticula, diverticulitis.

Bacteria and bits of food are easily trapped in the diverticulum. This can cause inflammation, a condition called **diverticulitis** (dye-ver-TICK-yoo-lye-tiss).

Diverticulosis is often asymptomatic (no symptoms). However, sometimes it leads to diverticular bleeding, which can result in serious loss of blood. Also, if chronic diverticulitis does not respond to treatment, surgery may be necessary to remove the affected bowel.

## Hemorrhoids

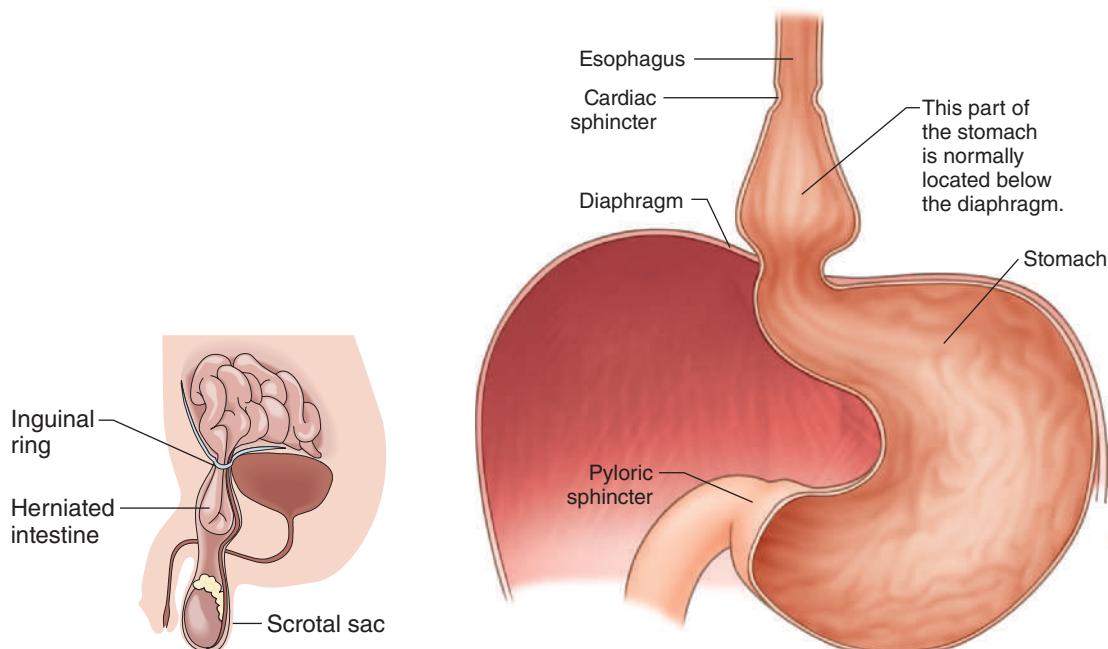
Varicose veins in the anal canal. Varicose veins means the veins are dilated (widened) and filled with blood. Depending upon the location within the anus, they are called internal or external. Surgical treatment is **hemorrhoidectomy** (hem-ah-royd-ECK-teh-mee).

## Hernia

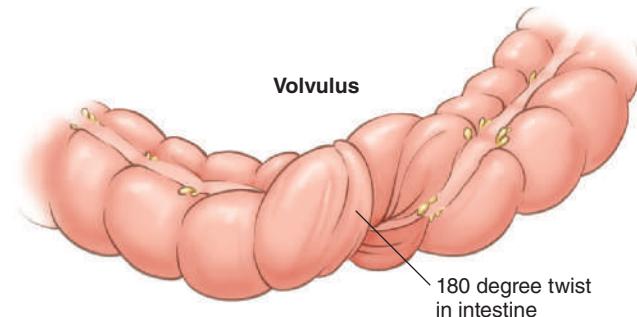
A protrusion or displacement of an organ through a structure that normally holds it in place. Herniae of the digestive tract occur when the abdominal muscles are unable to hold the intestines in place because of a weakness. The weakness can be congenital (present at birth) or acquired from lifting heavy objects or straining on defecation.

An **inguinal hernia** occurs when a small portion of bowel is displaced into the groin area (Figure 11-12A).

An **hiatal hernia** involves the displacement of the stomach through the hiatal opening in the diaphragm. (Figure 11-12B).



**Figure 11-12** A. Inguinal hernia. B. Hiatal hernia.



**Figure 11-13** Intestinal obstruction: Volvulus is a twisting of the bowel on itself.

## Intestinal Obstruction

Failure of the contents of the digestive tract to move toward the rectum because of a blockage. Several reasons for obstruction include:

- **Adhesions**, scar tissue that forms between organs and abdominal tissues causing them to stick together
- **Ileus** (ILL-ee-us), the temporary loss of peristalsis along the small intestine
- **Intussusception** (in-tuh-suh-SEP-shun), a telescoping of one segment of bowel into another
- **Volvulus** (VOL-vyoo-lus), a twisting of the intestine (Figure 11-13)

## Ulcers

Wearing away of the mucous membrane lining the digestive tract. This creates an open sore. The ulcer can literally eat a hole through the mucous membrane, causing bleeding to the digestive tract. This can result in complications such as hematemesis or **melanemesis**. It can also result in the passage of black or tarry stool, which is called **melena** (meh-LEE-nah). Ulcers are named after their location.

**Aphthous** (AFF-thuss) **stomatitis** are ulcers in the mouth, also called **canker** sores.

**Peptic** (PEP-tick) **ulcers** are of the stomach or duodenum. Also known as gastric or duodenal ulcers respectively.

Antibiotics are used to treat ulcers caused by the bacteria *Helicobacter pylori*. Other drug treatment includes antacids and agents that protect the mucous membrane lining.

### 11.11 Look-Alike and Sound-Alike Words

*Below is a list of look-alike and sound-alike words. Study the spelling and definitions of each set of words. Questions will follow in the Review Exercises.*

**TABLE 11-1 Look-Alike and Sound-Alike Words**

<b>acidic</b>	pertaining to an acid
<b>acetic</b>	sour
<b>ascitic</b>	pertaining to ascites (accumulation of fluid in the abdomen)
<b>aphagia</b>	inability to swallow
<b>aphasia</b>	inability to speak or write
<b>aplasia</b>	lack of development
<b>cirrhosis</b>	a liver disease
<b>scirrhou</b> s	pertaining to a hard cancerous tumor
<b>dysphagia</b>	difficulty swallowing
<b>dysphasia</b>	difficulty speaking
<b>hepatoma</b>	tumor of the liver
<b>hematoma</b>	bruise
<b>ingestion</b>	taking food or liquid into the body
<b>injection</b>	the placement of a substance into the body via a needle
<b>ileum</b>	the distal portion of the small intestine
<b>iliu</b> m	the hip bone
<b>labial</b>	pertaining to the lip
<b>labile</b>	unstable
<b>liver</b>	large organ of the digestive system
<b>livor</b>	discoloration on different parts of the body after death
<b>palate</b>	roof of the mouth
<b>pallet</b>	a moveable platform for transporting objectives
<b>palette</b>	a thin board with a thumb holes, used by artists to mix their paint
<b>pellet</b>	a small round ball of food
<b>reflux</b>	to flow backward
<b>reflex</b>	involuntary response to a stimulus

## 11.12 Review Exercises

### EXERCISE 11-1 Look-Alike and Sound-Alike Words

*Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 11-1 if it helps you.*

1. On examination of the gastrointestinal tract, there were no signs of (**dysphasia/dysphagia**), nausea, vomiting, or hematemesis. However, on neurological exam some (**aphasia/aphagia**) was noted due to the stroke.
2. She complained of tiredness and malaise as well as symptoms of (**reflux/reflex**) and heartburn.
3. Chronic hepatitis and (**cirrhosis/scirrhous**) are possible (**liver/livor**) diseases. Suggest (**liver/livor**) biopsy.
4. The physician's impression was that a (**cirrhosis/scirrhous**) mass was in the distal (**ileum/ilium**).
5. This patient has been admitted with dyspeptic symptoms due to multiple drug (**ingestions/injections**).
6. She has no abdominal distention, vomiting, (**acidic/ascitic**) regurgitation, or dyspepsia.
7. The disease is characterized by enlarged lips and enlarged (**labial/labile**) glands.
8. The patient was admitted with a large (**hepatoma/hematoma**) due to multiple wounds to the neck and back.

### EXERCISE 11-2 Matching Word Parts With Meaning

*I. Match the word part in Column A with its meaning in Column B.*

Column A	Column B
_____ 1. -tripsy	A. gallbladder
_____ 2. cholecyst/o	B. common bile duct
_____ 3. stomat/o	C. gums
_____ 4. -flux	D. crushing
_____ 5. cholangi/o	E. lips
_____ 6. lapar/o	F. mouth
_____ 7. choledoch/o	G. liver
_____ 8. hepat/o	H. bile duct
_____ 9. gingiv/o	I. flow
_____ 10. labi/o	J. abdomen

*II. Match the word part in Column A with its meaning in Column B.*

<b>Column A</b>	<b>Column B</b>
_____	1. bucc/o
_____	2. cac/o
_____	3. -emesis
_____	4. xer/o
_____	5. aer/o
_____	6. -stomy
_____	7. -hexia
_____	8. -rrhea
_____	9. melan/o
_____	10. stom/o
	A. new opening
	B. black
	C. dry
	D. cheek
	E. flow; discharge
	F. bad
	G. mouth
	H. vomiting
	I. air
	J. habit

### EXERCISE 11-3 Matching—Pathology

*I. Match the disease in Column A with its description in Column B.*

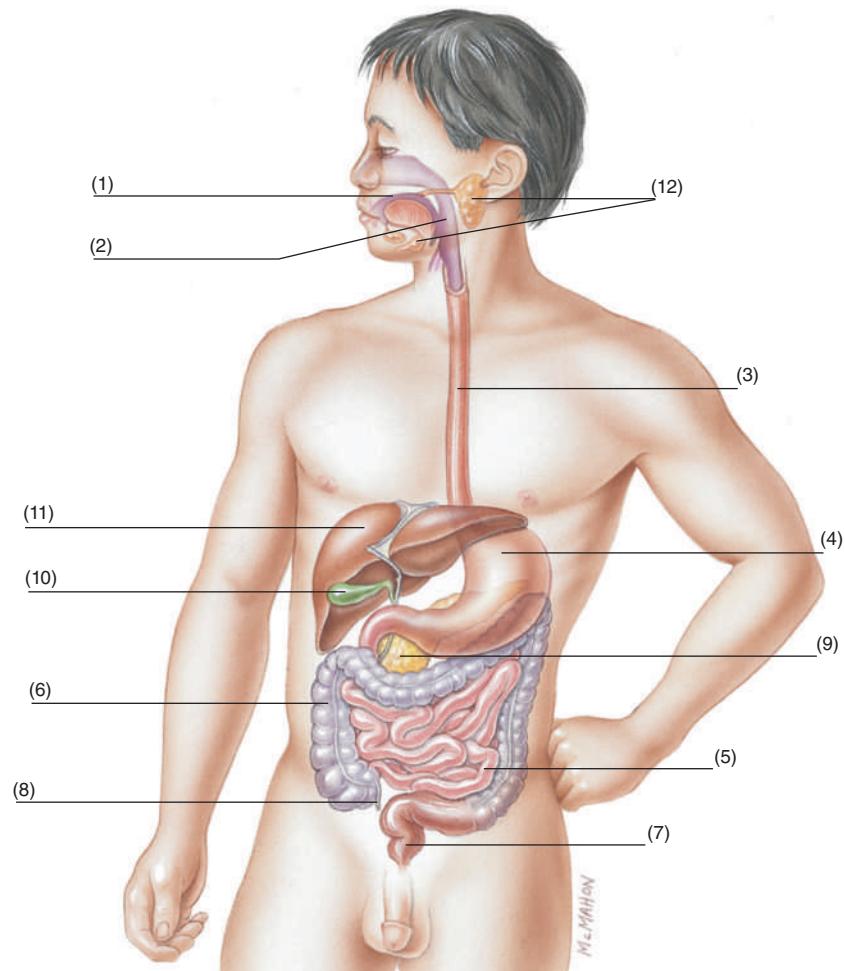
<b>Column A</b>	<b>Column B</b>
_____	1. cholelithiasis
_____	2. hernia
_____	3. melanemesis
_____	4. gingivitis
_____	5. Crohn disease
_____	6. ulcer
	A. inflammatory bowel disease
	B. wearing away of the mucous membrane lining the digestive tract
	C. inflammation of the gums
	D. stones in the gallbladder
	E. black vomit
	F. displacement of an organ through a structure that normally contains it

*II. Match the disease in Column A with its description in Column B.*

<b>Column A</b>	<b>Column B</b>
_____	1. diverticula
_____	2. hemorrhoids
_____	3. hiatal hernia
_____	4. ascites
_____	5. inguinal hernia
_____	6. ileus
_____	7. xerostomia
_____	8. melena
	A. abdominal edema
	B. displacement of intestine into the groin
	C. involves the salivary glands
	D. passage of bloody stools
	E. temporary loss of peristalsis
	F. displacement of stomach through an opening in the diaphragm
	G. varicose veins in anal canal
	H. abnormal pockets in the mucous membrane of the stomach or bowel

**EXERCISE 11-4 Labeling—Digestive Tract**

Using the body structures listed below, label Figure 11-14. Write your answer in the numbered spaces provided below, or if you prefer, on the diagram.



**Figure 11-14** Major organs of the digestive system.

appendix

esophagus

gallbladder

large intestine

liver

oral cavity

pancreas

pharynx \_\_\_\_\_

rectum \_\_\_\_\_

salivary gland \_\_\_\_\_

small intestine \_\_\_\_\_

stomach \_\_\_\_\_

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

7. \_\_\_\_\_

8. \_\_\_\_\_

9. \_\_\_\_\_

10. \_\_\_\_\_

11. \_\_\_\_\_

12. \_\_\_\_\_

### EXERCISE 11-5 Definitions—Anatomy and Physiology

I. Define the following anatomical terms. Use your medical dictionary if necessary.

1. **oral cavity** \_\_\_\_\_

2. **pharynx** \_\_\_\_\_

3. **duodenum** \_\_\_\_\_

4. **cecum** \_\_\_\_\_

5. **gallbladder** \_\_\_\_\_

6. **bowel** \_\_\_\_\_
7. **jejunum** \_\_\_\_\_
8. **biliary tract** \_\_\_\_\_
9. **cardiac sphincter** \_\_\_\_\_
10. **gingiva** \_\_\_\_\_

II. Write the function of the following anatomical structures:

1. **small intestine** \_\_\_\_\_
2. **bile** \_\_\_\_\_
3. **large intestine** \_\_\_\_\_
4. **esophagus** \_\_\_\_\_
5. **saliva** \_\_\_\_\_
6. **insulin** \_\_\_\_\_
7. **cementum** \_\_\_\_\_
8. **pharynx** \_\_\_\_\_
9. **teeth** \_\_\_\_\_
10. **cardiac sphincter** \_\_\_\_\_

### EXERCISE 11-6 Definitions—Learning the Terms

Define the following terms.

1. **glossitis** \_\_\_\_\_
2. **anorexia** \_\_\_\_\_
3. **colic** \_\_\_\_\_
4. **colostomy** \_\_\_\_\_
5. **malaise** \_\_\_\_\_
6. **dyspepsia** \_\_\_\_\_
7. **gastroesophageal reflux** \_\_\_\_\_
8. **hyperemesis** \_\_\_\_\_
9. **sublingual** \_\_\_\_\_
10. **lithotripsy** \_\_\_\_\_

**EXERCISE 11-7 Building Medical Words**

I. Use *lith/o* to build medical words for the following definitions.

- a. condition of stones in the gallbladder \_\_\_\_\_
- b. condition of stones in the common bile ducts \_\_\_\_\_
- c. crushing of gallstones \_\_\_\_\_

II. Use *-emesis* to build medical words for the following definitions.

- a. excessive vomiting \_\_\_\_\_
- b. vomiting of blood \_\_\_\_\_
- c. black vomit \_\_\_\_\_

III. Use *-phagia* to build medical words for the following definitions.

- a. no eating \_\_\_\_\_
- b. difficulty in eating \_\_\_\_\_
- c. excessive eating \_\_\_\_\_

IV. Use *-itis* to build medical words for the following definitions

- a. inflammation of the appendix \_\_\_\_\_
- b. inflammation of the gallbladder \_\_\_\_\_
- c. inflammation of the colon \_\_\_\_\_
- d. inflammation of the stomach and intestines \_\_\_\_\_
- e. inflammation of the gums \_\_\_\_\_
- f. inflammation of the tongue \_\_\_\_\_
- g. inflammation of the liver \_\_\_\_\_
- h. inflammation of the mouth \_\_\_\_\_

V. Use *-stomy* to build medical words for the following definitions

- a. surgical creation of a new opening into the colon \_\_\_\_\_
- b. surgical creation of a new opening into the ileum \_\_\_\_\_
- c. surgical creation of a new opening between the first and second portion of the small intestine \_\_\_\_\_

**EXERCISE 11-8 Definitions in Context**

Define the bolded terms in context. Use your medical dictionary if necessary.

- 1.** The patient had an **x-ray** while in the emergency department that showed a normal **pharynx**, esophagus, stomach, and **duodenum**.

a. x-ray \_\_\_\_\_

b. pharynx \_\_\_\_\_

c. duodenum \_\_\_\_\_

- 2.** On his last admission, a **colonoscopy** showed worsening of his **Crohn disease**.

He also had a **gastroscopy** showing mild **gastritis** but no **ulcer disease**.

d. colonoscopy \_\_\_\_\_

e. Crohn disease \_\_\_\_\_

f. gastroscopy \_\_\_\_\_

g. gastritis \_\_\_\_\_

h. ulcer disease \_\_\_\_\_

- 3.** The patient was admitted with **epigastric pain**, at which time she was diagnosed with **cholecystolithiasis**. We therefore decided to proceed with a **cholecystectomy**.

i. epigastric pain \_\_\_\_\_

j. cholecystolithiasis \_\_\_\_\_

k. cholecystectomy \_\_\_\_\_

- 4.** He has no visible **emesis** or **gastroesophageal reflux**.

l. emesis \_\_\_\_\_

m. gastroesophageal reflux \_\_\_\_\_

- 5.** There was no **dysphagia**, **nausea**, **malaise**, or **hematemesis**.

n. dysphagia \_\_\_\_\_

o. nausea \_\_\_\_\_

p. malaise \_\_\_\_\_

q. hematemesis \_\_\_\_\_

**EXERCISE 11-9 Spelling**

Circle any words that are spelled incorrectly in the list below. Then correct the spelling in the space provided.

1. **duodenum** \_\_\_\_\_
2. **malaise** \_\_\_\_\_
3. **Chron disease** \_\_\_\_\_
4. **melanemesis** \_\_\_\_\_
5. **cholitis** \_\_\_\_\_
6. **appendix** \_\_\_\_\_
7. **jegunum** \_\_\_\_\_
8. **peritoneum** \_\_\_\_\_
9. **coledocholithiasis** \_\_\_\_\_
10. **disphagia** \_\_\_\_\_

**Animations**

Visit the companion website to view the videos on **Digestion** and **Laparoscopic Examination**.

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**11.13 Pronunciation and Spelling**

*Listen, read, and study, so you can speak and write.*

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

Word	Pronunciation	Spelling
aerophagia	ayr-oh-FAY-jee-ah	_____
aphthous stomatitis	AFF-thuss sto-mah-TYE-tis	_____
anorexia	an-oh-RECK-see-ah	_____
appendicitis	ah-pen-dih-SIGH-tis	_____
biliary	BILL-ee-air-ee	_____

Word	Pronunciation	Spelling
<b>buccal mucosa</b>	BUCK-ahl myoo-KOH-sa	
<b>cachexia</b>	kah-KECK-see-ah	
<b>cholecystectomy</b>	koh-lee-sis-TECK-toh-mee	
<b>choledochotomy</b>	koh-led-oh-KOT-oh-mee	
<b>cirrhosis</b>	sih-ROH-sis	
<b>colitis</b>	koh-LYE-tis	
<b>colostomy</b>	koh-LOSS-toh-mee	
<b>Crohn disease</b>	KROHN	
<b>diverticulosis</b>	dye-ver-tick-yoo-LOH-sis	
<b>diarrhea</b>	dye-ah-REE-ah	
<b>duodenajejunostomy</b>	doo-oh-dee-no-jay-joon-OSS-teh-mee	
<b>dyspepsia</b>	dis-PEP-see-ah	
<b>dysphagia</b>	dis-FAY-jee-ah	
<b>esophagus</b>	eh-SOF-ah-gus	
<b>gastroenteritis</b>	gas-troh-en-ter-EYE-tis	
<b>gingivitis</b>	jin-jih-VYE-tis	
<b>hematemesis</b>	hee-mah-TEM-eh-sis	
<b>hyperemesis</b>	high-per-EM-eh-sis	
<b>ileectomy</b>	ill-ee-ECK-toh-mee	
<b>ileum</b>	ILL-ee-um	
<b>insulin</b>	IN-suh-lin	
<b>jejunum</b>	jeh-JOO-num	
<b>labial</b>	LAY-bee-al	
<b>malaise</b>	mah-LAYZ	
<b>melanemesis</b>	mel-ah-NEM-eh-sis	
<b>mesentery</b>	MEZ-en-ter-ee	
<b>oral</b>	OR-al	
<b>peritoneum</b>	per-ih-toh-NEE-um	
<b>stomatitis</b>	sto-mah-TYE-tis	
<b>sublingual</b>	sub-LING-gwal	

## CHAPTER 12

# Cardiovascular System



### Chapter Outline

- 12.1** Major Organs of the Cardiovascular System
- 12.2** Structures of the Heart
- 12.3** How the Heart Beats
- 12.4** Blood Pressure and Pulse
- 12.5** Blood Vessels and Circulation
- 12.6** New Roots, Suffixes, and Prefixes
- 12.7** Learning the Terms
- 12.8** Pathology
- 12.9** Look-Alike and Sound-Alike Words
- 12.10** Review Exercises
- 12.11** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

1. Name and locate the major organs of the cardiovascular system.
2. Name, locate, and describe the structures of the heart and associated blood vessels.
3. Describe the function of the heart and blood vessels.
4. Name common blood vessels.
5. Trace blood flow through the heart and body.
6. Pronounce, spell, define, and write the medical terms related to the cardiovascular system.
7. Describe common diseases related to the cardiovascular system.
8. Listen, read, and study so you can speak and write.

## Introduction

The human body is made up of 70 to 80 trillion cells. All of these cells need to be fed oxygen and nutrients. These are provided by the cardiovascular system (CVS), which is illustrated in Figure 12-1.

The body's cells must also get rid of waste materials. The CVS does this job too, at the same time it delivers oxygen and nutrients.

### 12.1 Major Organs of the Cardiovascular System

#### PRACTICE FOR LEARNING: Major Organs of the CVS

Write the words below in the correct spaces in Figure 12-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. heart (**HART**)
2. arteries (**AR-ter-eez**)
3. arterioles (**ar-TEER-ee-ohlz**)
4. capillaries (**ka-PILL-ah-reez**)
5. venules (**VEN-yoolz**)
6. veins (**VAYNZ**)

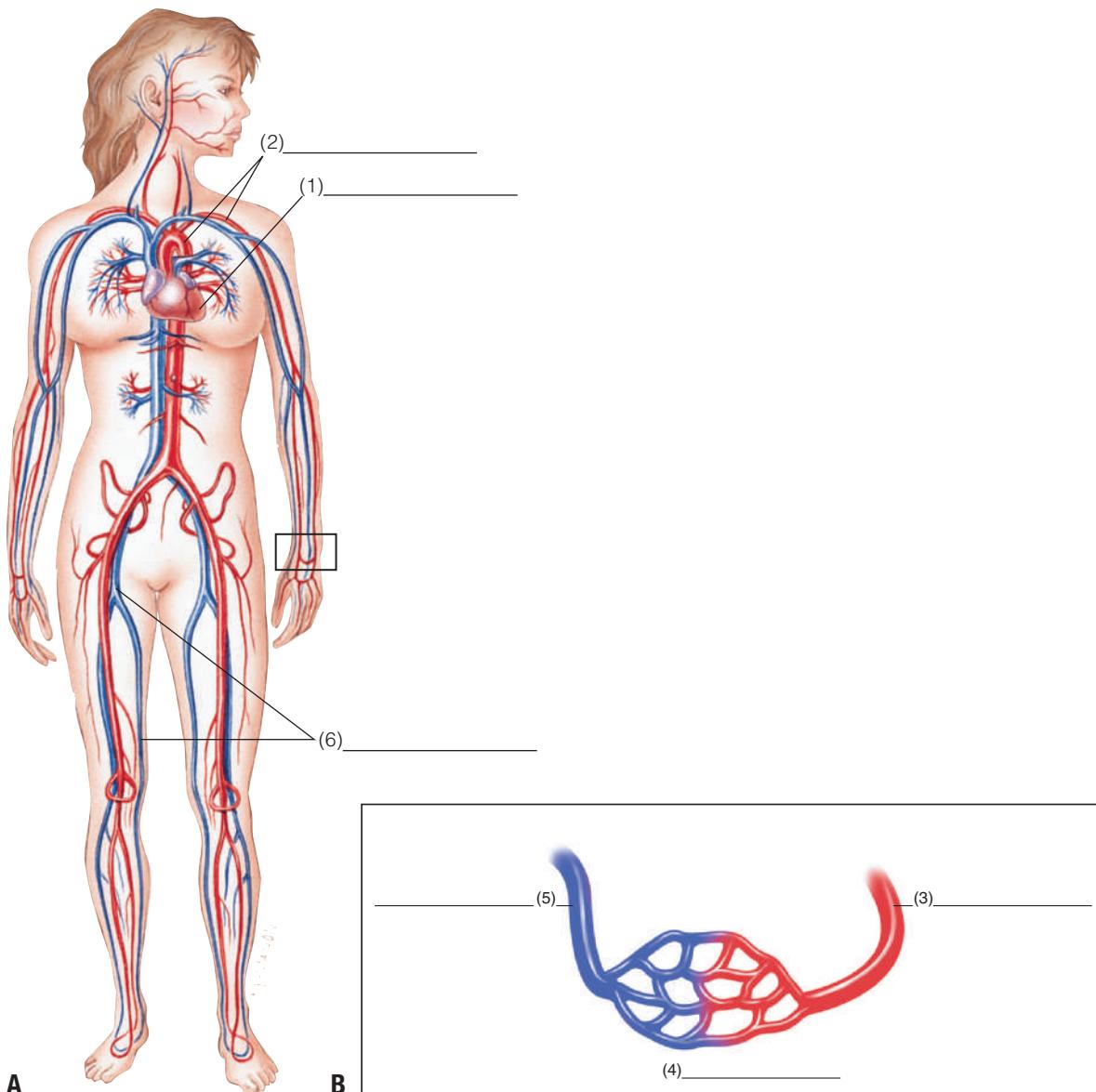
The heart pumps blood. It beats 60 to 90 times every minute for your whole life. Each beat pumps blood throughout the body. The blood flows through blood vessels. Numbers 2 through 6 on Figure 12-1 are the different types of blood vessels.

### 12.2 Structures of the Heart

#### PRACTICE FOR LEARNING: The Heart

Write the structures listed below in the correct spaces in Figure 12-2. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the word several times if you find the word hard to say.

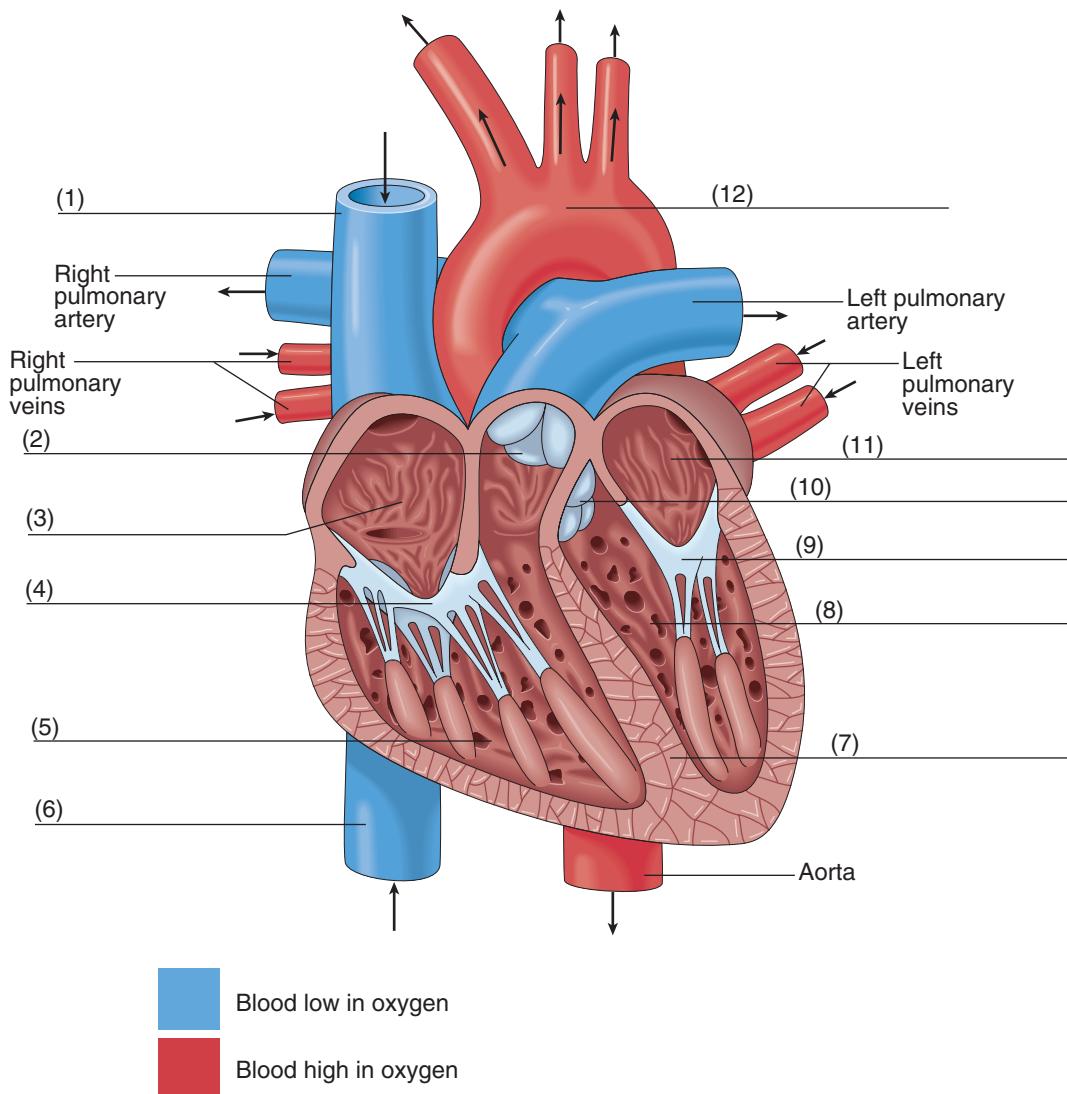
1. superior vena cava (**VE-nah KAY-vah**)
2. pulmonary semilunar valve (**POOL-mon-ayr-ee seh-me-LOO-nar VALV**)
3. right atrium (**AY-tree-um**)
4. tricuspid valve (trigh-**KUS-pid**)
5. right ventricle (**VEN-trih-kul**)



**Figure 12-1** A. Structures of the cardiovascular system. B. Arteries, arterioles, capillaries, venules, and veins.

6. inferior vena cava (**VE-nah KAY-vah**)
7. septum (**SEP-tum**)
8. left ventricle (**VEN-trih-kul**)
9. bicuspid (bye-**KUS-pid**) or mitral (**MY-tral**) valve
10. aortic semilunar valve (ay-**OR-tick seh-mee-LOO-nar VALV**)
11. left atrium
12. aorta (ay-**OR-tah**)

Figure 12-2 shows you a big picture of the heart and the large blood vessels attached to it. The large blood vessels include the aorta, superior vena cava (SVC), inferior vena



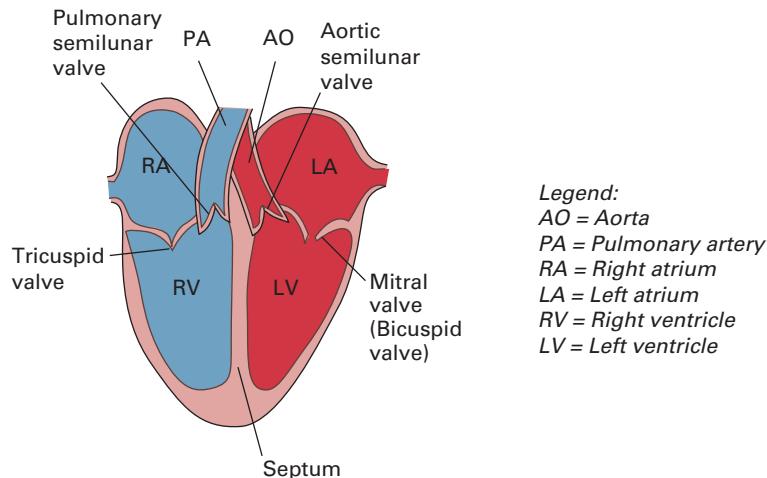
**Figure 12-2** Heart and major blood vessels.

cava (IVC), and pulmonary artery. Review Figure 12-2 carefully before you move on to the rest of the chapter.

## Heart Chambers

Look at Figure 12-3. It shows that the heart contains four cavities. They are called chambers. The upper chambers are called **atria** (AY-tree-ah) (singular is atrium). The lower chambers are called ventricles (singular is ventricle).

Figure 12-3 also illustrates that the heart is separated into the right and left sections. The wall dividing them is called the septum.



**Figure 12-3** Heart chambers.

### In Brief

**Atria** are the upper chambers.

**Ventricles** are the lower chambers.

**Septum** separates the right and left sides of the heart.

### PRACTICE FOR LEARNING: Heart Chambers

Write the correct answer in the space provided.

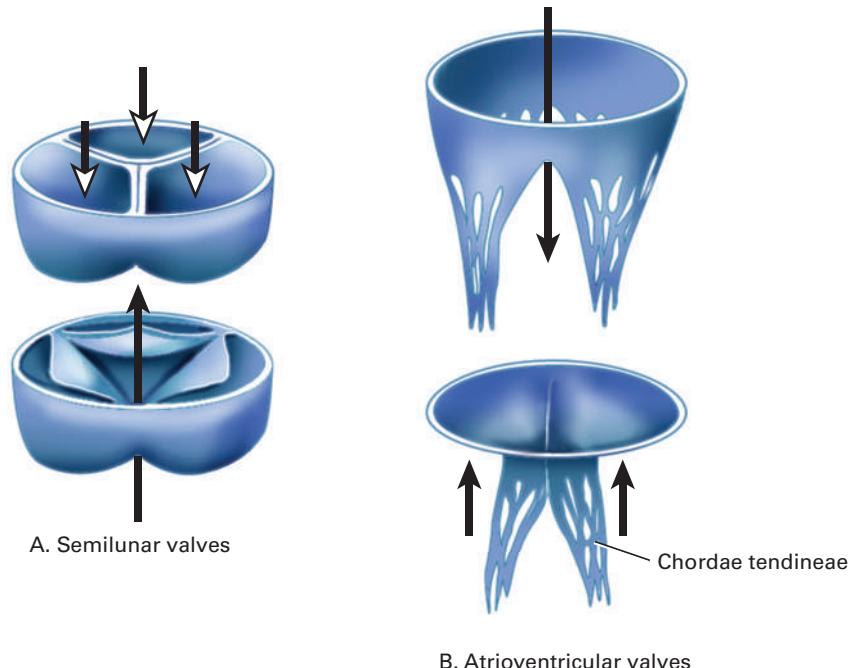
1. Write the name for the upper chambers. \_\_\_\_\_
2. Write the name for the lower chambers. \_\_\_\_\_
3. Write the name for the partition that separates the right side of the heart from the left side. \_\_\_\_\_

Answers: 1. atria. 2. ventricles. 3. septum.

### Heart Valves

There are four valves in the heart. They open to let blood in, and then they close tightly to ensure there is no backward flow of blood (Figure 12-4).

Two of the valves are called semilunar valves (Figure 12-4A). The semilunar valve at the entrance of the pulmonary artery is called the pulmonary semilunar valve. The one at the entrance of the aorta is called the aortic semilunar valve.



**Figure 12-4** Heart valves. A. Semilunar valves. B. Atrioventricular valves.

The other two valves are called **atrioventricular** (ay-tree-oh-ven-TRICK-yoo-lar) valves, or AV valves (Figure 12-4B). The AV valve between the right atrium and ventricle is called the tricuspid valve because it has three cusps, or flaps. The AV valve between the left atrium and ventricle has two cusps and is referred to as the bicuspid, or mitral valve.

Tough fibers called **chordae tendineae** (KOR-dee TEN-din-ee) attach the flaps of the AV valves to the heart wall. They ensure that the flaps close tightly.

### In Brief

#### Semilunar valves

pulmonary valve  
aortic valve

#### Atrioventricular (AV) valves

tricuspid valve  
bicuspid valve

### PRACTICE FOR LEARNING: Valves and Chordae Tendineae

Write the correct answer in the space provided.

1. Name the valve that separates the right atrium from the right ventricle.

---

2. How many flaps does the tricuspid valve have?

---

3. Write another name for the bicuspid valve.

4. Write the name of the fibrous cords that attach the atrioventricular flaps to the heart wall. The term is difficult to spell. Make sure your spelling is correct.

5. Write the name of the valve located at the entrance to the pulmonary artery.

6. Write the name of the valve located at the entrance to the aortic artery.

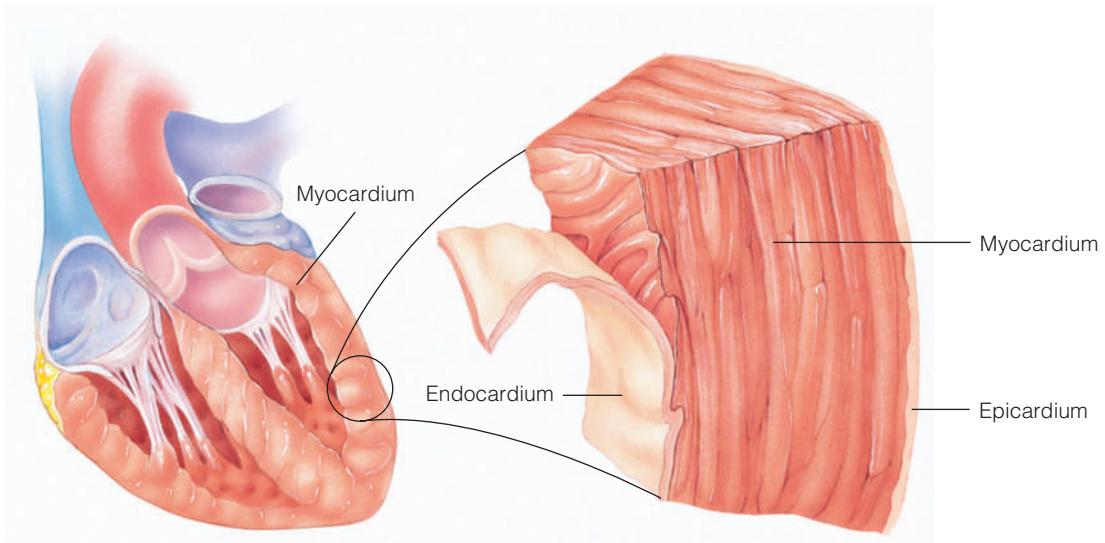
Answers: 1. tricuspid or atrioventricular (AV) valve. 2. three. 3. mitral valve. 4. chordae tendineae. 5. pulmonary semilunar valve. 6. aortic semilunar valve.

## Walls of the Heart

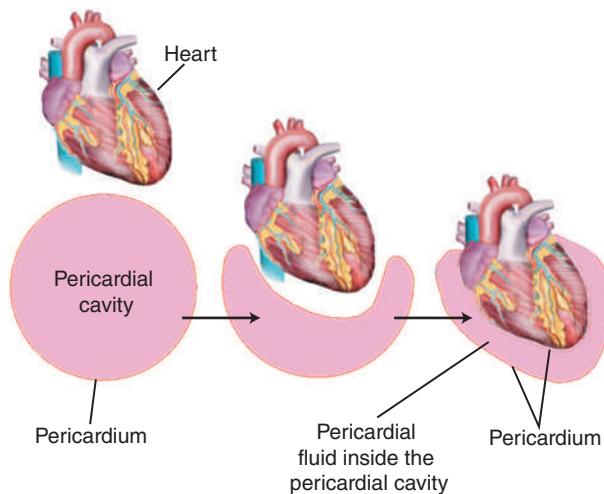
The heart has three walls (Figure 12-5). The outer wall is the **epicardium** (**e**p-ih-KAR-dee-um). The middle wall is the **myocardium** (**m**yoh-KAR-dee-um). It is composed of the muscle that contracts the ventricles, pumping the blood out of the heart. The inner wall is the **endocardium** (**e**n-do-KAR-dee-um).

### Pericardium

The heart is surrounded by a sac called the pericardium (**p**er-ih-KAR-dee-um) (Figure 12-6). It has two layers. Pericardial fluid lies between the layers. This fluid prevents friction between the two layers when the heart beats.



**Figure 12-5** Walls of the heart.



**Figure 12-6** Pericardium.

### In Brief

**Epicardium** outermost wall of the heart

**Myocardium** muscle wall of the heart

**Endocardium** innermost wall of the heart

**Pericardium** sac surrounding the heart

### PRACTICE FOR LEARNING: Heart Walls

Write the correct answer in the space provided.

- 1.** Name the three walls making up the heart.

\_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_ .

- 2.** Using the terminology you have learned, write the meaning of the following word parts.

**a.** my/o \_\_\_\_\_

**b.** cardi/o \_\_\_\_\_

**c.** -um \_\_\_\_\_

**d.** epi- \_\_\_\_\_

**e.** endo- \_\_\_\_\_

- 3.** Mark the following statements as True or False.

**a.** The pericardium surrounds the heart. \_\_\_\_\_

**b.** The endocardium is a sac filled with fluid. \_\_\_\_\_

- c. The pericardium is responsible for muscular contraction. \_\_\_\_\_
- d. The pericardium has two layers. \_\_\_\_\_

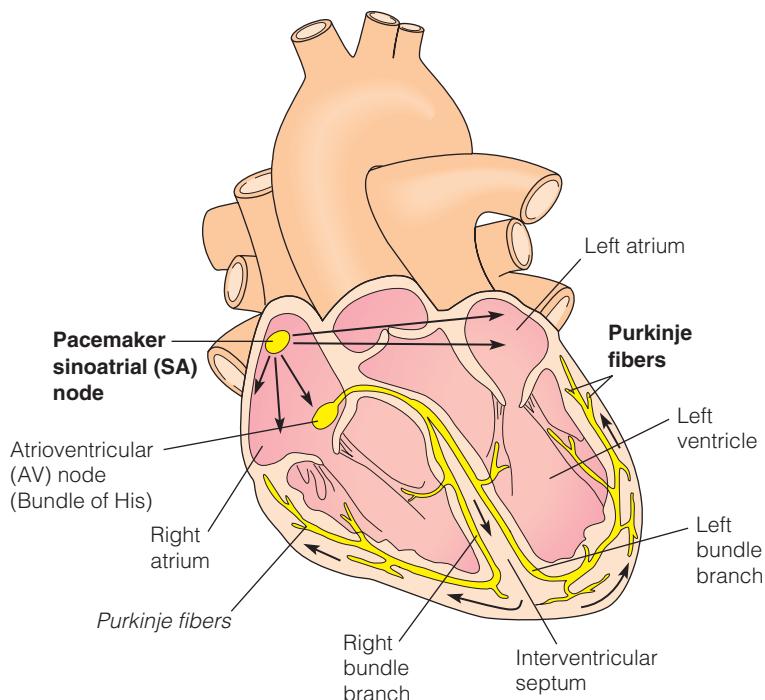
Answers: 1. epicardium, myocardium, endocardium. 2. a. muscle, b. heart, c. structure, d. on; upon, e. within. 3. a. True, b. False, c. False, d. True.

## 12.3 How the Heart Beats

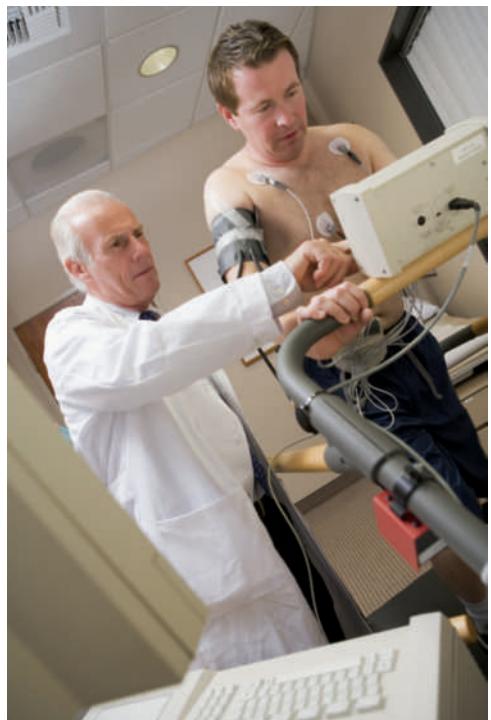
Electrical impulses stimulate the heart to beat. Unlike other nerve impulses, they do not come from the brain. They are created in special tissue in the atrium called the pacemaker. They then follow a trail through the heart to the **Purkinje** (per-KIN-jee) fibers, which extend throughout the ventricles. When the impulses reach the Purkinje fibers, the ventricles contract and push blood out of the heart into arteries.

The trail the impulses follow from the pacemaker to the ventricles is called the conduction pathway. It is illustrated in Figure 12-7. When the electrical impulses follow the conduction pathway properly, the heart will beat in a regular way, 60 to 90 beats per minute. This is called **normal sinus rhythm**.

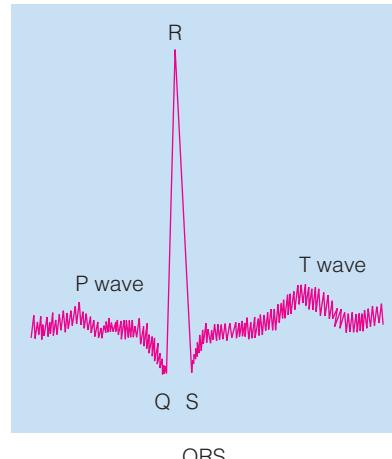
The electrical activity of the heart can be recorded in a procedure called electrocardiography (Figure 12-8A). The record of such a test is called an **electrocardiogram**.



**Figure 12-7** Conduction Pathway. Arrows indicate electrical impulses as they travel from the pacemaker to the Purkinje fibers.



© iStockphoto/Monkey Business Images.

**A****B**

**Figure 12-8** A. Electrocardiography. The electrical activities of the heart are recorded by electrodes placed on the skin. B. Normal electrocardiogram. P wave indicates strength of atrial contraction. QRS wave indicates strength of ventricular contraction. T wave indicates ventricular relaxation.

(ee-leck-troh-KAR-dee-oh-gram). It is usually referred to as an ECG or EKG. Figure 12-8B shows a record of a normal ECG. The spikes or waves on the record represent the strength of contraction of the atria and ventricles.

### In Brief

**Electrical impulses** travel through the heart from the pacemaker to the Purkinje fibers, causing the ventricles to contract and the heart to beat. An ECG monitors the electrical impulses as they travel through the heart.

### PRACTICE FOR LEARNING: How the Heart Beats

1. What is the purpose of an electrocardiogram?

---

2. When electrical impulses reach the Purkinje fibers, which heart structure contracts? \_\_\_\_\_

**Answers:** 1. to record the electrical activity through the heart. 2. ventricles.

## 12.4 Blood Pressure and Pulse

On each ventricular contraction, blood is pumped through an artery. It pushes on the artery wall. The pressure this creates is called blood pressure (BP).

Blood pressure is measured with an instrument called a **sphygmomanometer** (**sfig-moh-man-OM-eh-ter**). Figure 12-9 shows you what that instrument looks like. When the blood pressure (BP) is taken manually, as shown in Figure 12-9, a stethoscope (**STETH-oh-skope**) is used to listen to blood sounds. When using a digital sphygmomanometer, which is automated, no stethoscope is used.

A normal blood pressure reading is written like this: 115/75 mm Hg. The first number is the **systolic** (**SIS-tohl-ick**) pressure, the pressure against the arterial wall when the ventricles contract and pumps blood out of the heart. The second number is the **diastolic** (**dye-as-TOHL-ick**) pressure, the pressure against the arterial wall when the ventricles relax. High blood pressure is called **hypertension** (**high-per-TEN-shun**). Low blood pressure is called **hypotension** (**high-poh-TEN-shun**). If high blood pressure affects the heart, the condition is called **hypertensive heart disease**.

A BP reading between 120/80 to 139/89 is considered **prehypertension** (**pree-high-per-TEN-shun**). A reading over 140/90 is hypertension. BP of 90/60 is hypotension. Many experts now suggest that 115/75 is the optimum.

The arteries dilate and constrict in unison with the heartbeat. These movements, known as a pulse, can be readily detected at several sites. Figure 12-10 illustrates the following pulse sites: temporal, carotid, brachial, radial, femoral, popliteal, and dorsalis pedis.

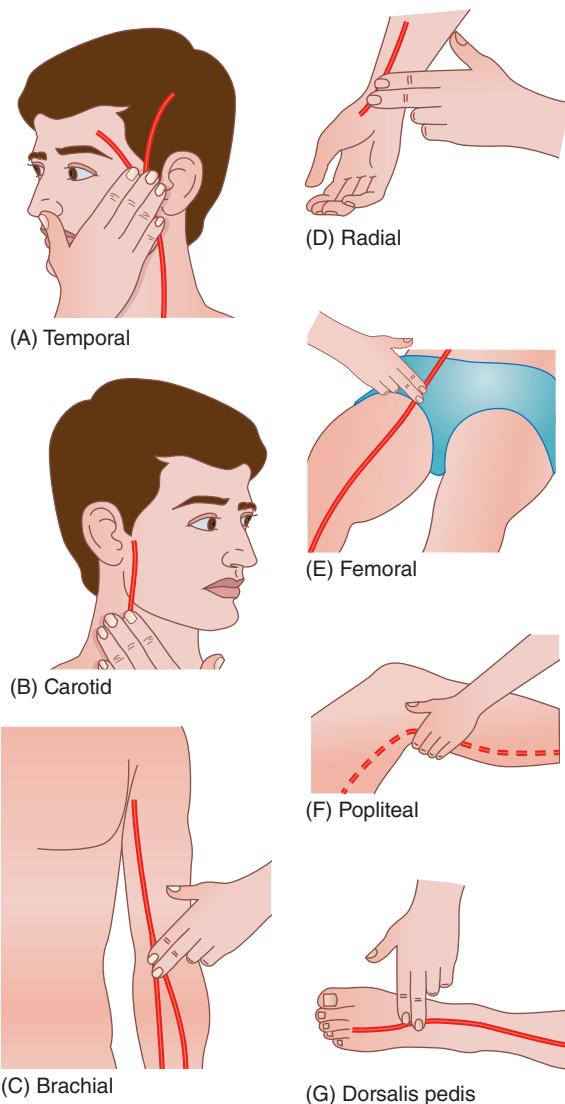
### In Brief

#### Sphygmomanometer

A device used to measure blood pressure. Optimum blood pressure reading is 115/75 mm Hg.



**Figure 12-9** Blood pressure reading using a sphygmomanometer.



**Figure 12-10** Pulse sites.

### PRACTICE FOR LEARNING: Blood Pressure and Pulse

1. Write the name of the device used to measure blood pressure.

---

2. Name the location of the following pulse sites:

(a) radial pulse \_\_\_\_\_.

(b) carotid pulse \_\_\_\_\_.

(c) dorsalis pedis pulse \_\_\_\_\_.

(d) popliteal pulse \_\_\_\_\_.

**Answers:** 1. sphygmomanometer. 2. (a) wrist/over the radius, (b) neck, (c) top of foot, (d) behind the knee.

## 12.5 Blood Vessels and Circulation

### Blood Vessels

Blood vessels carry blood throughout the body. **Arteries** (AR-ter-eez), **arterioles** (ar-TEER-ee-ohlz), **capillaries** (kah-PILL-ah-reez), **venules** (VEN-youlz), and **veins** (VAYNZ) are types of blood vessels (see Figure 12-1 at the beginning of the chapter).

#### Arteries

Arteries are thick, muscular, and elastic. They are capable of expanding to accommodate the surge of blood when the heart contracts. All arteries except the pulmonary artery carry oxygenated (**OCK-see-jeh-nay-ted**) blood.

Generally, arteries are named according to the organs they supply. For example, the artery carrying blood to the kidneys is called the renal artery (Figure 12-11).

#### Capillaries

Capillaries are located in the organs. They are extremely tiny and have thin walls. Capillaries are not named. The thin walls of the capillaries enable the transfer of oxygen to the organs and carbon dioxide from the organs.

#### Veins

Veins are similar to arteries, except the walls are less muscular and elastic. Therefore, they need help to push blood up toward the heart from the lower extremities. This assistance is provided by the contraction of the skeletal muscles and a system of tiny valves that prevent backflow of blood.

All veins except the pulmonary vein carry deoxygenated blood. Deoxygenated blood carries carbon dioxide and waste rather than oxygen.

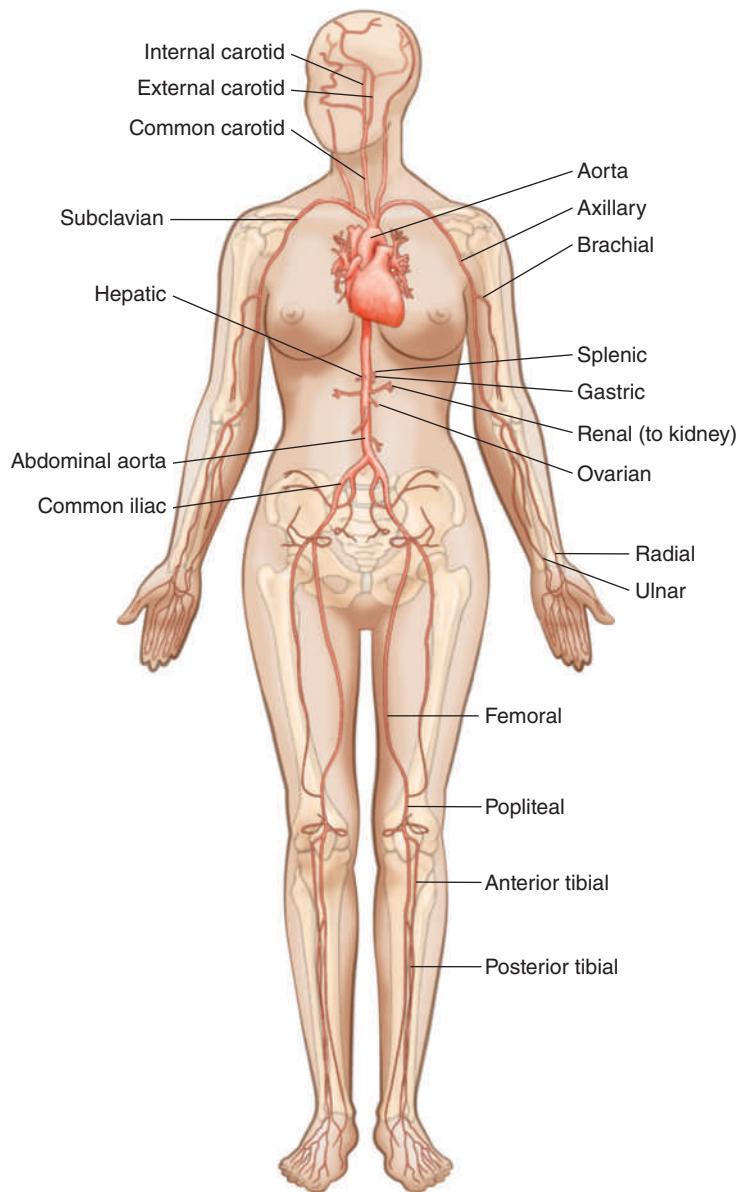
Like arteries, many veins are named after the organs they are associated with. For example, the vein associated with the liver is the hepatic vein (Figure 12-12).

### Circulation

Figure 12-13 outlines the circulatory system. Using your finger, start on the right side of the heart and trace the flow of blood through the heart, lungs, and body.

Deoxygenated blood containing carbon dioxide and waste materials is pumped out of the right side of the heart through the pulmonary arteries to the lungs. There, the carbon dioxide and waste are absorbed by the lungs and breathed out. Oxygen is breathed in and absorbed by the blood. This **oxygenated** blood then flows back through the pulmonary veins to the left side of the heart, where it is pumped through the aorta and out into arteries. It flows from the arteries into smaller arteries called arterioles until it reaches an organ.

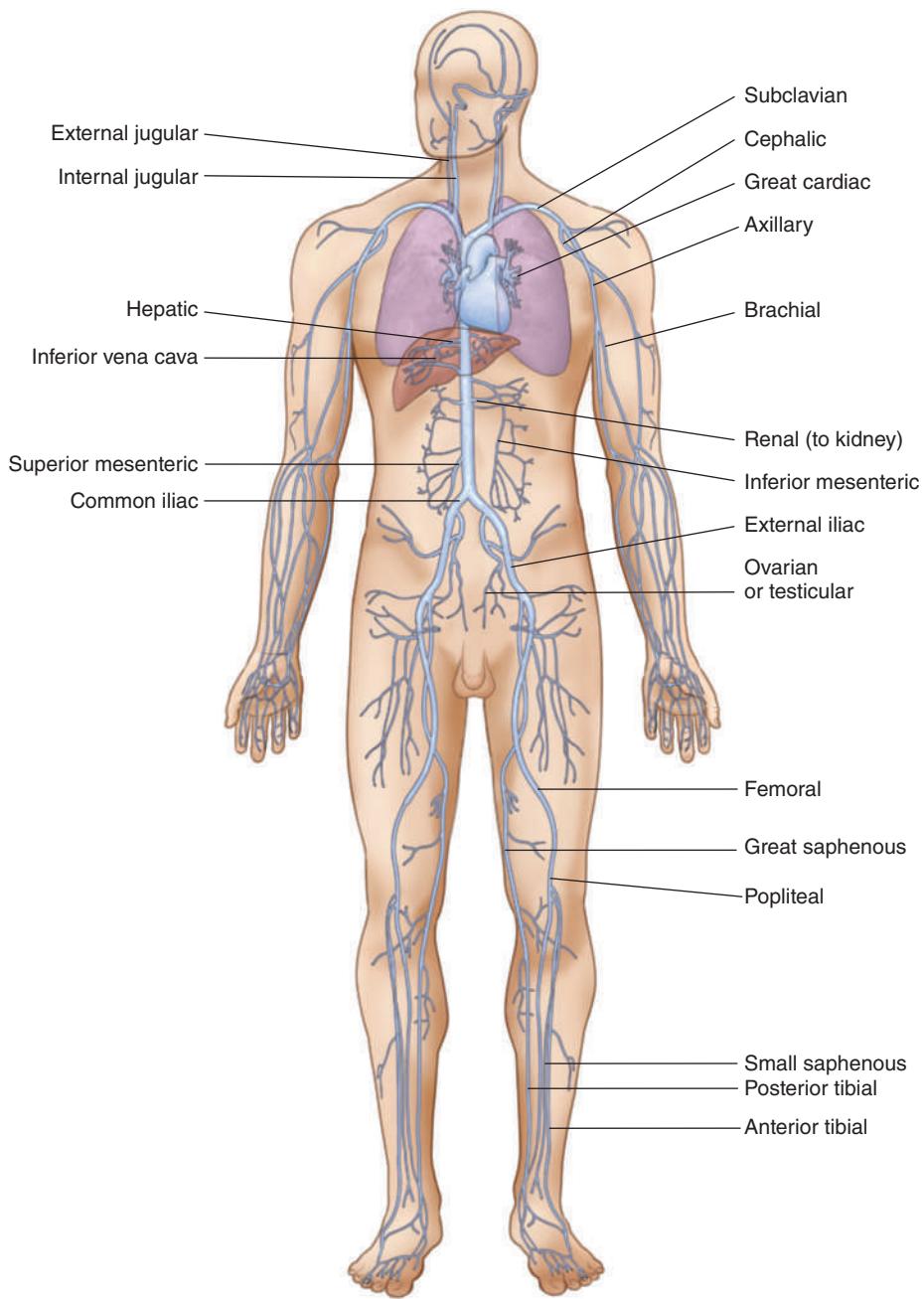
In each organ are the smallest blood vessels, called capillaries. The blood flows into the capillaries. Tissue cells in the organ absorb the oxygen from the blood in the capillaries, as well as nutrients that the blood has picked up from the digestive system



**Figure 12-11** Major arteries, anterior view.

before it reaches the organ. At the same time, the organ's cells release carbon dioxide and waste into the capillaries. This deoxygenated blood then leaves the capillaries and flows through tiny vessels called venules (small veins) into bigger vessels called veins. The veins lead into the **inferior** and **superior vena cavae** (VEE-nee KAY-vee), which are much larger veins. They carry the blood back to the heart. The blood is then pumped to the lungs where the cycle is repeated.

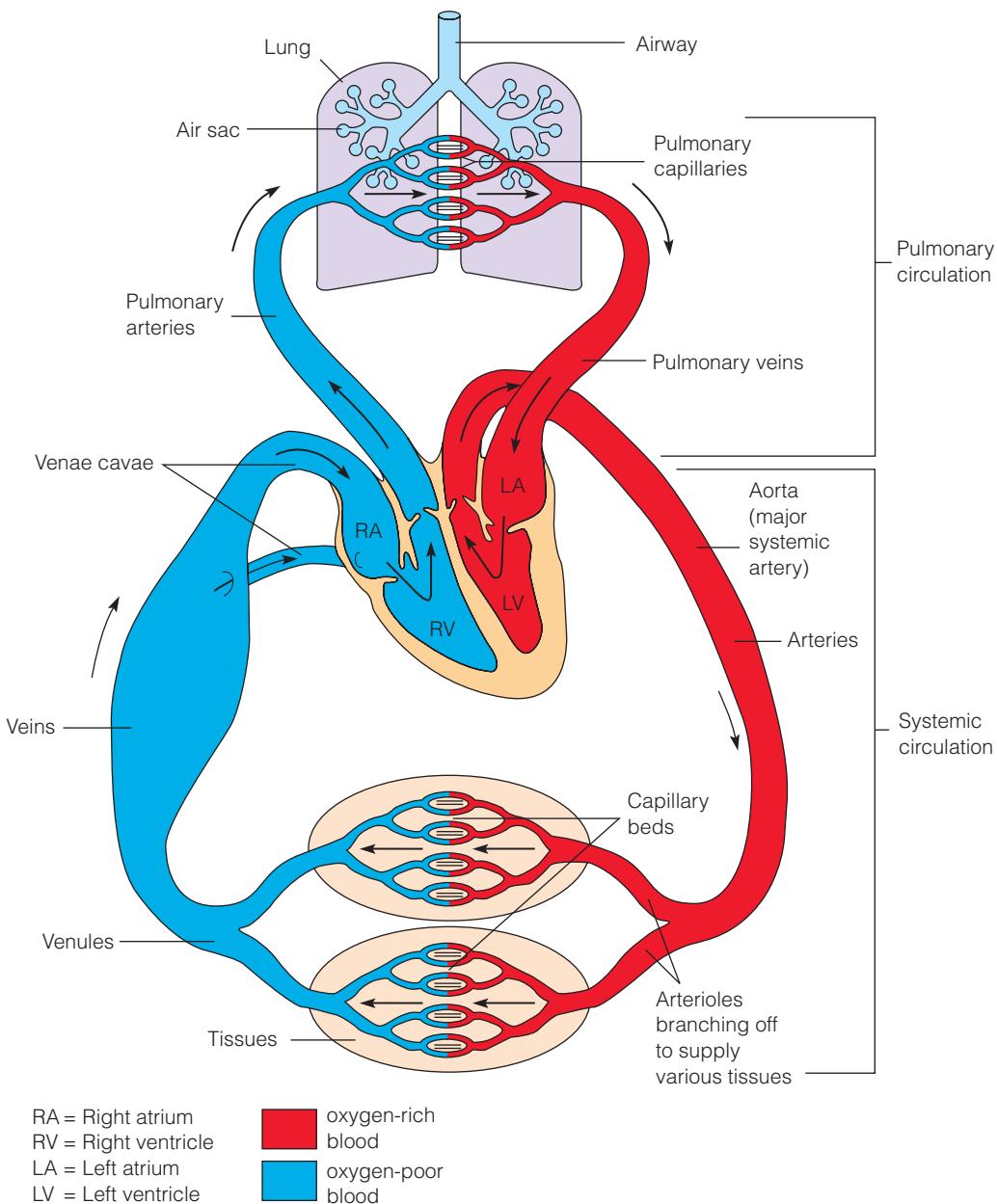
The heart cannot feed itself from the blood that flows through it. Its walls are too thick and muscular. It has its own system of arteries and veins. These are the **coronary** arteries and veins. They supply the heart muscle with the oxygen and nutrients it needs to function properly. A heart attack or myocardial infarction (**my-oh-KAR-dee-al in-FARK-shun**) is a blockage in the coronary arteries. Because oxygen and nutrients can no longer reach the heart muscle, the muscle is damaged.



**Figure 12-12** Common Veins, anterior view.

### In Brief

Blood flow through the body: right side of heart → pulmonary arteries → lungs → pulmonary veins → left side of heart → aorta → arteries → arterioles → capillaries → venules → veins → inferior and superior vena cavae → right side of heart



**Figure 12-13** Circulation of blood through the body.

### PRACTICE FOR LEARNING: Blood Vessels and Circulation

1. Name the three types of blood vessels. \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
2. What are small arteries called? \_\_\_\_\_
3. What are small veins called? \_\_\_\_\_

4. Generally, all arteries carry (oxygenated/deoxygenated blood). Which artery is the exception?
5. Generally, all veins carry (oxygenated/deoxygenated blood). Which vein is the exception?

**Answers:** 1. arteries, veins, capillaries. 2. arterioles. 3. venules. 4. oxygenated; pulmonary artery. 5. deoxygenated; pulmonary vein.

## 12.6 New Roots, Suffixes and Prefixes

Use these additional roots and suffix when studying the terms in this chapter.

ROOT	MEANING
<b>constrict/o</b>	to draw together; constrict
<b>dilat/o</b>	to expand; widen
SUFFIX	MEANING
<b>-emia</b>	blood condition

## 12.7 Learning the Terms

Following these steps will make it easier for you to learn medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

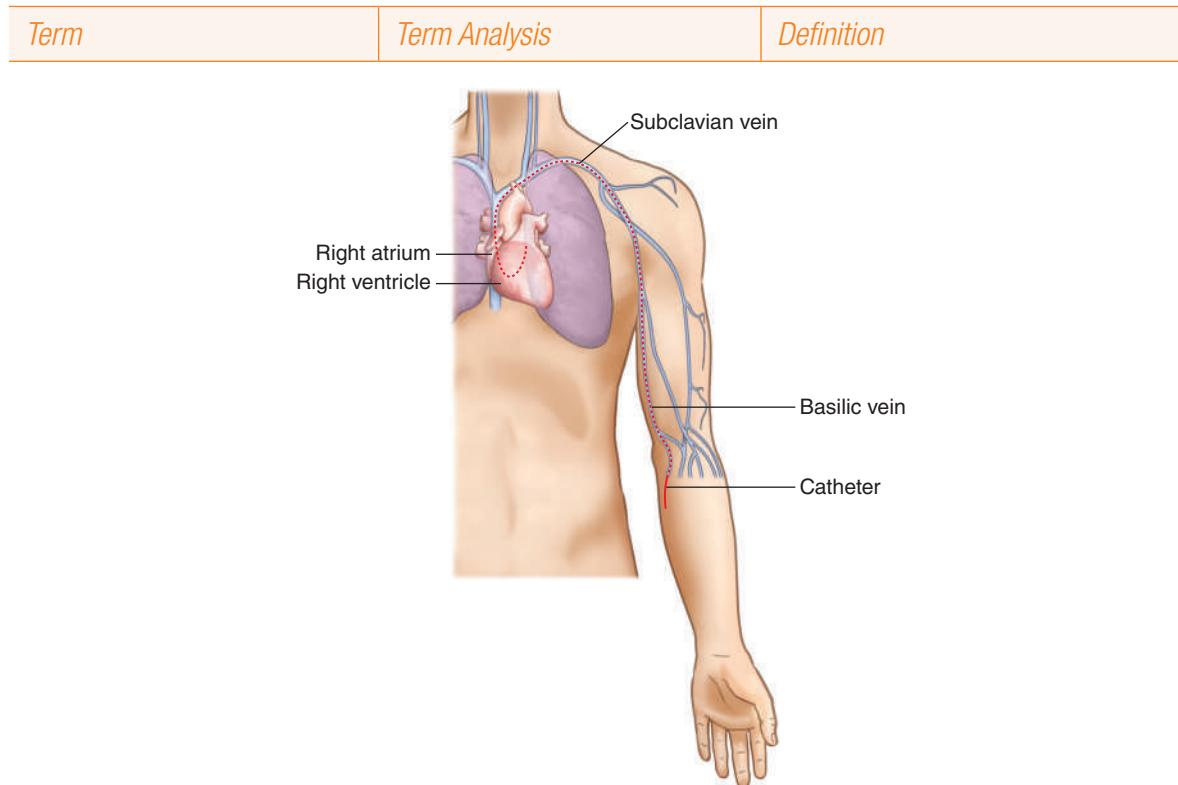
### Roots

ROOT angi/o	MEANING blood vessel	
Term	Term Analysis	Definition
<b>angioplasty</b> (AN-jee-oh-plas-tee)	-plasty = surgical repair; surgical reconstruction	surgical repair of a blood vessel

ROOT arteri/o	TERM ANALYSIS	MEANING
TERM	TERM ANALYSIS	DEFINITION
<b>arteriosclerosis</b> (ar-teer-ee-oh-skleh-ROH-sis)	-sclerosis = hardening	hardening of the arteries due to the loss of elasticity in the arterial wall
<b>arterostenosis</b> (ar-teer-ee-oh-steh-NOH-sis)	-stenosis = narrowing	narrowing of an artery
<b>carotid endarterectomy</b> (kah-ROT-id end-ar-ter-ECK-toh-mee)	carotid = artery in the neck -ectomy = excision; surgical removal endo- = within	excision of the inner lining of the carotid artery

ROOT ather/o	TERM ANALYSIS	MEANING
TERM	TERM ANALYSIS	DEFINITION
<b>atheroma</b> (ath-er-OH-mah)	-oma = mass; tumor	name given to the fatty mass (plaque) that accumulates on the wall of an artery. The fatty mass contains cholesterol.
<b>atherosclerosis</b> (ath-er-oh-skleh-ROH-sis)	-sclerosis = hardening	hardening and narrowing of an artery due to an atheroma (Figure 12-16)

ROOT cardi/o	TERM ANALYSIS	MEANING
TERM	TERM ANALYSIS	DEFINITION
<b>cardiac catheterization</b> (KAR-dee-ack kath-eh-ter-eye-ZAY-shun)	-ac = pertaining to catheterization = a procedure to remove fluid from the body using a flexible tube called a catheter	diagnostic procedure in which a flexible tube called a catheter is inserted into a vein, sliding it upward into the heart to obtain diagnostic information about how well the heart is working. Figure 12-14

**Figure 12-14** Cardiac Catheterization.

<b>cardiologist</b> (kar-dee-OL-oh-jist)	-logist = specialist in the study of	specialist in the study of the heart including its diseases and treatment
<b>cardiomegaly</b> (KAR-dee-oh MEG-ah-lee)	-megaly = enlargement	enlarged heart
<b>cardiomyopathy</b> (kar-dee-oh-my-OP-ah-thee)	-pathy = disease my/o = muscle	disease of the heart muscle
<b>echocardiograph</b> (eck-oh-KAR-dee-oh-graf)	-graph = instrument used to record ech/o = sound	an instrument using ultrasound to record an image of the heart
<b>pancarditis</b> (pan-kar-DYE-tis)	-itis = inflammation pan- = all	inflammation of all the walls of the heart (this includes the epicardium, myocardium, and endocardium)

ROOT coron/o	MEANING crown	
Term	Term Analysis	Definition
<b>coronary arteries</b> (KOR-uh-nehr-ee)	-ary = pertaining to	the arteries that supply the heart with blood

**Helping You Remember**

The coronary arteries sit on top of the heart like a crown.

ROOT cyan/o	MEANING blue
<i>Term</i>	<i>Term Analysis</i>
<b>cyanosis</b> (sigh-ah-NOH-sis)	-sis = state of; condition

ROOT diaphor/e	MEANING profuse sweating
<i>Term</i>	<i>Term Analysis</i>
<b>diaphoresis</b> (dye-ah-foh-REE-sis)	-sis = state of; condition

**Helping You Remember**

Embolus comes from the Greek “embolos” meaning “plug.” An embolos was used as a cork in a liquor bottle.

ROOT embol/o	MEANING plug
<i>Term</i>	<i>Term Analysis</i>
<b>embolus</b> (EM-boh-lus)	-us = condition; thing

ROOT isch/o	MEANING hold back
<i>Term</i>	<i>Term Analysis</i>
<b>myocardial ischemia</b> (my-oh-KAR-dee-al iss-KEE-me-ah)	-emia = blood condition -al = pertaining to my/o = muscle cardi/o = heart

ROOT <b>phleb/o</b> (see also <b>ven/o</b> )		MEANING vein
Term	Term Analysis	Definition
<b>thrombophlebitis</b> (throm-boh-fleh-BYE-tis)	-itis = inflammation thromb/o = clot	inflammation of a vein with clot formation

ROOT <b>rhythm/o</b>		MEANING rhythm
Term	Term Analysis	Definition
<b>arrhythmia</b> (ah-RITH-mee-ah)	-ia = state of; condition a- = no; not	deviation from normal sinus rhythm. For further detail, see arrhythmia in Section 12.8 below.

### Helping You Remember

The prefix *a-* changes to *ar-* in the word “arrhythmia” because the root begins with *r*.

ROOT <b>scler/o</b>		MEANING hardening
Term	Term Analysis	Definition
<b>sclerotherapy</b> (skleh-roh-THER-ah-pee)	-therapy = treatment	injection of a solution into the vein for the purpose of destroying the vein’s inner lining by hardening. Sclerotherapy is very effective in treating varicose veins and requires no hospitalization.

ROOT <b>thromb/o</b>		MEANING clot
Term	Term Analysis	Definition
<b>thrombus</b> (THROM-bus)	-us = condition; thing	a blood clot that obstructs a blood vessel

ROOT <b>vas/o</b>		MEANING vessel
Term	Term Analysis	Definition
<b>vasoconstriction</b> (vas-oh-kon-STRICK-shun)	-ion = process constrict/o = to draw together; constrict	constriction or narrowing of the vessel walls
<b>vasodilation</b> (vas-oh-dye-LAY-shun)	-ion = process dilat/o = expand; widen	widening of the vessel walls

ROOT <b>ven/o</b>		MEANING vein
Term	Term Analysis	Definition
<b>venous</b> (VEE-nus)	-ous = pertaining to	pertaining to a vein

## Suffixes

SUFFIX <b>-centesis</b>		MEANING surgical puncture to remove fluid
Term	Term Analysis	Definition
<b>cardiocentesis</b> (kar-dee-oh-sen-TEE-sis)	cardi/o = heart	surgical puncture of the heart to remove fluid
<b>pericardial centesis</b> (par-ee-KAR-dee-al sen-TEE-sis)	-al = pertaining to peri- = around cardi/o = heart	surgical puncture to remove fluid in the pericardium

**Note:** “Centesis” can be used as a suffix or as a word standing alone. Both forms have the same meaning.

## Prefixes

PREFIX <b>brady-</b>		MEANING slow
Term	Term Analysis	Definition
<b>bradycardia</b> (brad-ee-KAR-dee-uh)	-ia = condition; state of cardi/o = heart	slow heartbeat; slower than 60 beats per minute

PREFIX de-	MEANING lack of; removal	
Term	Term Analysis	Definition
<b>defibrillation</b> (dee-fib-rih-LAY-shun)	fibrillation = fast, uncoordinated heartbeat	stopping atrial or ventricular fibrillation using an electronic device called a defibrillator

**Note:** A defibrillator applies an electric shock to a heart muscle. The defibrillator is placed on top of the chest muscle and activated. The electrical current momentarily stops the heart action so that the pacemaker can reestablish normal heart rhythm.

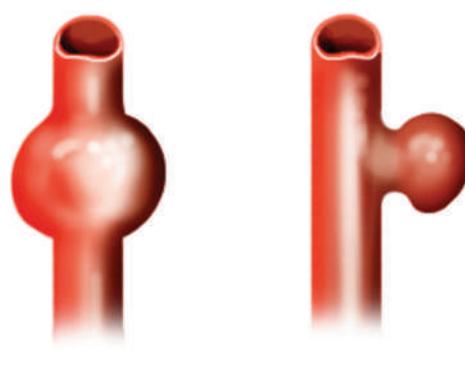
PREFIX tachy-	MEANING fast	
Term	Term Analysis	Definition
<b>tachycardia</b> (tack-ee-KAR-dee-ah)	-ia = condition; state of cardi/o = heart	fast heartbeat; faster than 100 beats per minute

## 12.8 Pathology

### Aneurysm (AN-yoo-riz-um)

An abnormal bulge in the wall of an artery (Figure 12-15). It occurs most often in the aorta or in the brain.

A ruptured aneurysm occurs when the wall of the artery bursts. This causes internal hemorrhaging, which may result in death.



A. Fusiform  
aneurysm

B. Saccular  
aneurysm

**Figure 12-15** Aneurysms. A. Fusiform—bulging on both sides of the artery. B. Saccular—bulging on one side of the artery.

## Arrhythmia

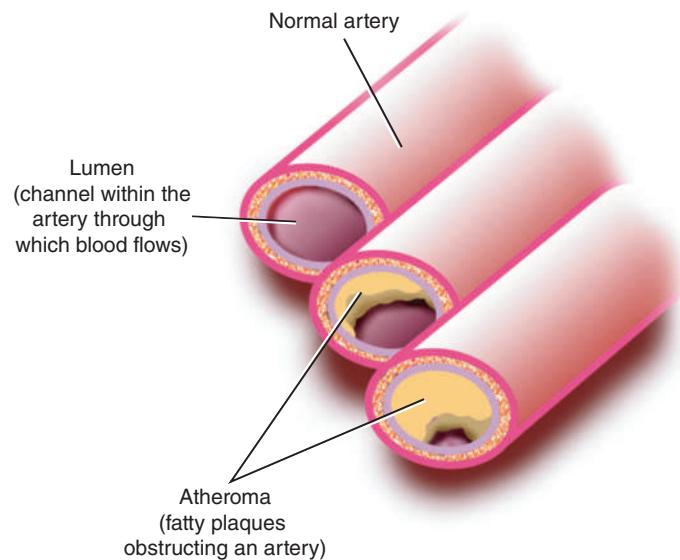
An irregular heart rhythm that deviates from the normal sinus rhythm. Examples include:

- **Fibrillation** (**fib**-rih-**LAY**-shun), which is very fast uncoordinated heartbeats of the atria or ventricles. May reach 350 plus beats per minute.
- **Flutter**, which is very fast coordinated heartbeats. May reach up to 300 beats per minute.
- **Palpitation** (**pal**-pih-**TAY**-shun), which is an abnormal sensation in the chest. The patient feels like the heart is pounding. Heartbeats can be regular or irregular. Do not confuse with palpation (**pal**-**PAY**-shun), which means to feel.
- **Heart block**, which is the interruption of the electrical impulses which travel from the pacemaker through the conduction system to the Purkinje fibers. This results in failure of the ventricles to contract. Right bundle branch block (RBBB) and left bundle branch block (LBBB) are the most common heart blocks.

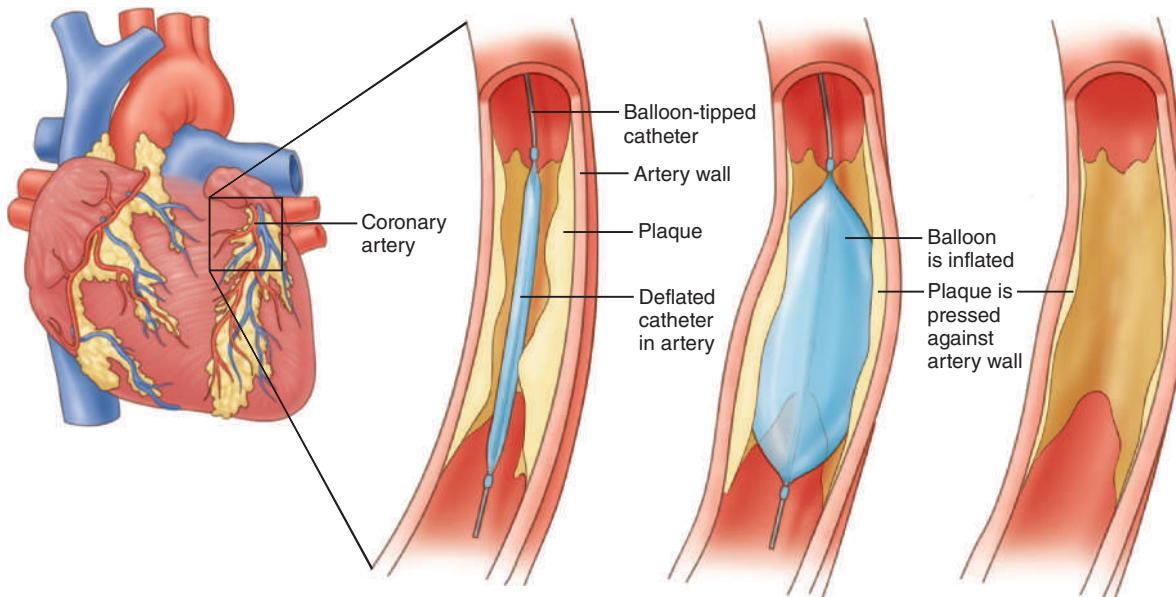
## Coronary Artery Disease

Coronary artery disease (CAD) is a complete or partial blockage within the coronary arteries resulting in decreased blood flow to the heart muscle (Figure 12-16). The blockage is caused by an accumulation of fatty plaques (atheroma) on the walls of the artery.

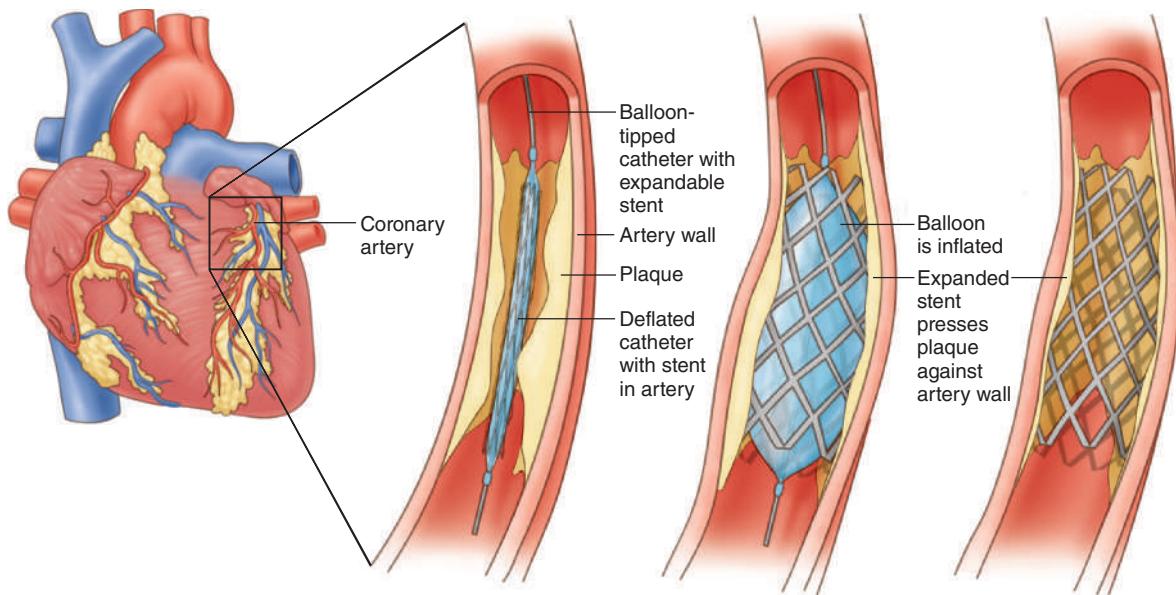
To improve the blood flow within the vessel, a balloon angioplasty may be performed. This pushes the plaque against the wall of the vessel (Figure 12-17). A stent, which is a wire-mesh tube, is inserted into the vessel to prevent the fat from accumulating again (Figure 12-18).



**Figure 12-16** Coronary artery disease caused by atherosclerosis.



**Figure 12-17** Balloon angioplasty flattens the fatty plaque against the vessel wall.



**Figure 12-18** A stent is used to prevent the reattachment of fatty plaque on the arterial wall.

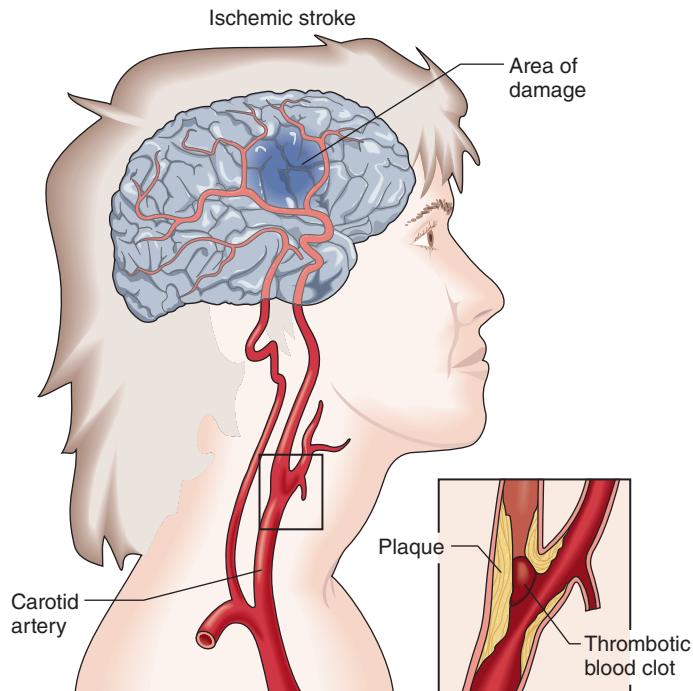
## Cerebrovascular Accident; Stroke

Cerebrovascular accident (CVA) is a lack of blood to the brain, depriving it of oxygen and nutrients (Figure 12-19). Types of strokes include ischemic and hemorrhagic.

**Ischemic Stroke—there are three types:**

**Thrombotic** (throm-BOT-ick): a thrombus (clot) blocks blood flow to the brain.

**Embolic** (em-BOL-ick): an embolus travels to a cerebral artery and blocks blood flow to the brain.



**Figure 12-19** An ischemic stroke is caused by the lack of blood to the brain. The obstruction, as shown in this figure, is due to plaque (atheroma) or thrombus. An embolus, not shown here, can also cause an obstruction.

**Transient ischemic attack (TIA):** a temporary loss of blood flow to the brain resulting in neural abnormalities, which last from a few seconds to a number of hours.

### Hemorrhagic (hem-eh-RADJ-ick) stroke

An aneurysm bursts and results in a lack of blood to brain tissue. Often the aneurysm involves the cerebral artery.

## Cardiac Arrest

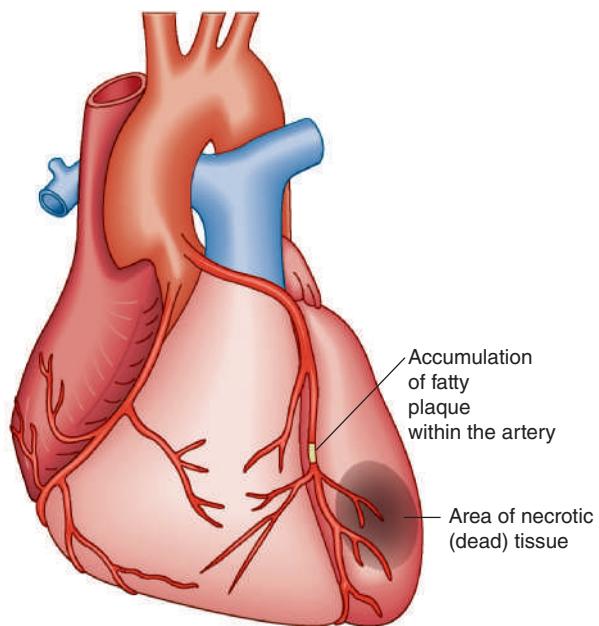
Cardiac arrest is when the heart unexpectedly stops pumping blood.

## Congestive Heart Failure

Congestive heart failure (CHF) is myocardial disease resulting in the failure of the heart to pump blood effectively through the blood vessels. This results in congestion (backing up) of blood in the blood vessels.

## Murmur (MER-mer)

An abnormal extra heart sound amongst normal heart sounds.



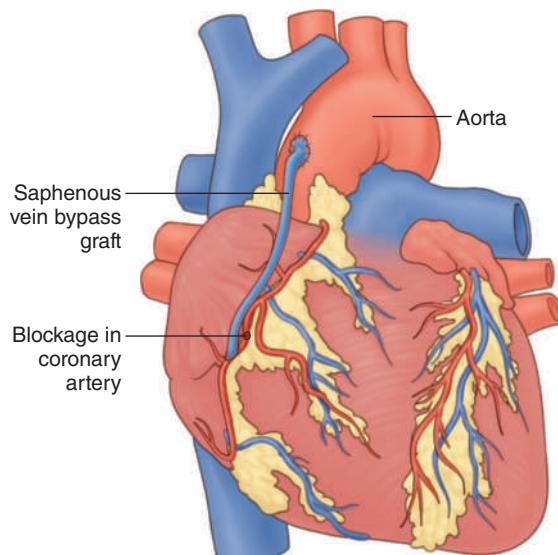
**Figure 12-20** Myocardial infarction (heart attack).

### Myocardial Infarction; Heart Attack

Myocardial infarction (MI) means death of the heart muscle. Look at Figure 12-20. When one or more of the coronary arteries are blocked because of coronary artery disease, blood flow to the heart muscle stops and the tissue dies. The heart is unable to function properly, and not enough blood is pumped to the body's tissues.

The primary symptom is **angina pectoris**, which means “pain over the chest area.”

The treatment is a coronary artery bypass graft (CABG), also known as bypass surgery (Figure 12-21). In this procedure, the chest is opened and a piece of vein from the



**Figure 12-21** Coronary artery bypass graft uses a transplanted vein to reroute blood past the blocked artery.

leg or chest is implanted into the heart to reroute the blood around the obstruction. This restores blood to the heart muscle.

## Valvular Disorders

### Valvular Stenosis

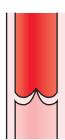
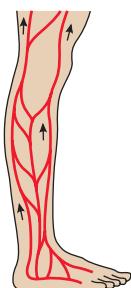
A narrowing of one of the heart valves, preventing the flow of blood through the heart. The name of the heart valve affected is the name given to the stenosis. Examples: Aortic stenosis, mitral valve stenosis, tricuspid stenosis.

### Valvular Insufficiency

The inability of one of the heart valves to close tightly, resulting in a backflow or **regurgitation** (ree-ger-jih-TAY-shun) of blood. Also known as **valvular incompetence** or **valvular regurgitation**. Like stenosis, the name of the heart valve affected is the name given to the insufficiency. Examples: mitral valve insufficiency and pulmonary valve insufficiency.

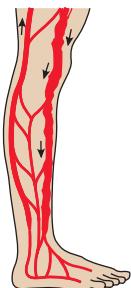
## Varicose Veins

Dilated and twisted veins, usually involving the saphenous veins of the lower leg (Figure 12-22). The cause is damaged valves in the veins. They do not close, allowing the blood to flow backward. The blood forms pools, which dilate the veins. Sclerotherapy is a treatment for uncomplicated varicose veins.



Valve closes, preventing backflow and pooling of blood.

**A. Normal veins**



Valves remain open, allowing pooling of the blood in the veins.

**B. Varicose veins**



**C.**

**Figure 12-22** Varicose veins.

## 12.9 Look-Alike and Sound-Alike Words

*Below is a list of look-alike and sound-alike words. Study the spelling and definitions of each set of words. Questions will follow in the Review Exercises.*

**TABLE 12-1 Look-Alike and Sound-Alike Words**

<b>arrhythmia</b>	abnormal heart rhythm
<b>erythremia</b>	increase in the number of red blood cells
<b>infarction</b>	death of tissue
<b>infection</b>	to contaminate with a disease
<b>venous</b>	pertaining to a vein
<b>Venus</b>	one of the planets
<b>palpation</b>	to feel
<b>palpitation</b>	fast heartbeat
<b>pericardium</b>	structure around the heart
<b>precordium</b>	area in front of the heart
<b>vain</b>	concerned about one's own appearance; conceited; futile; unsuccessful result
<b>vane</b>	a device used to show the way the wind blows; weathervane
<b>vein</b>	a type of blood vessel

## 12.10 Review Exercises

### EXERCISE 12-1 Look-Alike and Sound-Alike Words

*Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 12-1 if it helps you.*

1. Mr. Garcia, a 53-year-old-man, is admitted with an upper respiratory (**infection/infarction**) and pneumonia of two days' duration.
2. A diagnosis of renal (**infection/infarction**) due to narrowing of the renal arteries was made.
3. There are abnormal jugular (**venus/venous**) pulses; the carotid arterial pulses are normal.

4. On (**palpation/palpitation**) there was a mass noted over the breastbone.
5. Naleen was admitted with shortness of breath and (**palpations/palpitations**).
6. In open-heart surgery, a segment of the saphenous (**vain/vane/vein**) is removed and used as a graft.
7. In a (**vain/vane/vein**) attempt at hemostasis, the artery was clamped and ligated.
8. Previous pancarditis has resulted in inflammation of the (**precordium/pericardium**), the structure surrounding the heart.

### EXERCISE 12-2 Matching Word Parts with Meaning

Match word part in Column A with its meaning in Column B.

Column A	Column B
_____	<b>1.</b> dilat/o
_____	<b>2.</b> -sclerosis
_____	<b>3.</b> -stenosis
_____	<b>4.</b> pan-
_____	<b>5.</b> endo-
_____	<b>6.</b> isch/o
_____	<b>7.</b> vas/o
_____	<b>8.</b> coron/o
_____	<b>9.</b> phleb/o
_____	<b>10.</b> ather/o
	A. fatty debris
	B. vessel
	C. crown
	D. narrowing
	E. hold back
	F. widen
	G. vein
	H. hardening
	I. all
	J. within

### EXERCISE 12-3 Labeling

Using the body structures listed below, label Figure 12-23. Write your answer in the numbered spaces provided below, or if you prefer, in the diagram.

aorta

---

aortic semilunar valve

---

inferior vena cava

---

interventricular septum

---

left atrium

---

left ventricle

---

mitral valve

---

pulmonary semilunar valve \_\_\_\_\_

right atrium \_\_\_\_\_

right ventricle \_\_\_\_\_

superior vena cava \_\_\_\_\_

tricuspid valve \_\_\_\_\_

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

7. \_\_\_\_\_

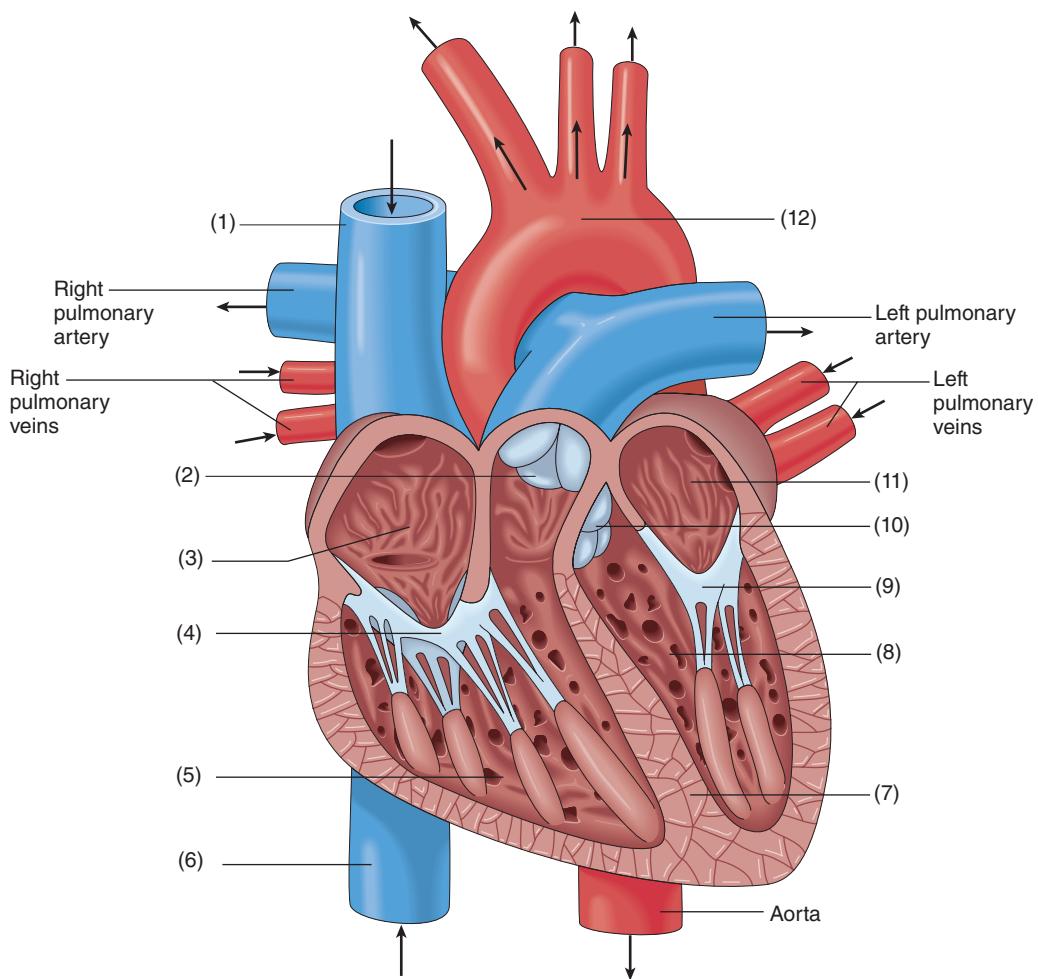
8. \_\_\_\_\_

9. \_\_\_\_\_

10. \_\_\_\_\_

11. \_\_\_\_\_

12. \_\_\_\_\_



**Figure 12-23** Heart and major blood vessels.

### EXERCISE 12-4 Definitions—Learning the Terms

Define the following terms.

1. **arteriosclerosis** \_\_\_\_\_
2. **atheroma** \_\_\_\_\_
3. **arteriostenosis** \_\_\_\_\_
4. **embolus** \_\_\_\_\_
5. **thrombus** \_\_\_\_\_
6. **ischemia** \_\_\_\_\_
7. **vasoconstriction** \_\_\_\_\_
8. **bradycardia** \_\_\_\_\_
9. **angioplasty** \_\_\_\_\_
10. **coronary arteries** \_\_\_\_\_
11. **carotid endarterectomy** \_\_\_\_\_
12. **cardiomegaly** \_\_\_\_\_
13. **cyanosis** \_\_\_\_\_
14. **diaphoresis** \_\_\_\_\_
15. **cardiac catheterization** \_\_\_\_\_

### EXERCISE 12-5 Matching—Anatomy and Physiology

Match the terms below with their descriptions that follow. Write your answer in the space provided.

atria	electrocardiography	pulmonary vein
bicuspid	epicardium	sphygmomanometer
carotid arteries	pericardium	systolic pressure
chordae tendineae	pulmonary artery	tricuspid
coronary arteries	pulmonary valve	ventricles
diastolic pressure		

1. blood vessel carrying deoxygenated blood from the right side of the heart to the lungs \_\_\_\_\_
2. lower chamber of the heart \_\_\_\_\_
3. left atrioventricular valve \_\_\_\_\_
4. right atrioventricular valve \_\_\_\_\_
5. pressure against the arterial wall when the ventricles contract  
\_\_\_\_\_
6. anchors atrioventricular valves to the heart wall \_\_\_\_\_
7. instrument that measures blood pressure \_\_\_\_\_
8. upper chambers of the heart \_\_\_\_\_
9. process of recording the electrical activity of the heart  
\_\_\_\_\_
10. semilunar valve \_\_\_\_\_
11. pressure against the arterial wall when the ventricles relax  
\_\_\_\_\_
12. blood vessel in the neck carrying oxygenated blood toward the brain  
\_\_\_\_\_
13. sac surrounding the heart \_\_\_\_\_
14. blood vessel supplying the heart with oxygen \_\_\_\_\_
15. blood vessel carrying oxygenated blood from the lungs to the left atrium  
\_\_\_\_\_
16. outermost wall of the heart \_\_\_\_\_

### EXERCISE 12-6 Blood Flow Through Body

*Write the structures through which blood passes, in proper sequence, starting from the right side of the heart and finishing in the right side of the heart.*

---

---

---

**EXERCISE 12-7 Definitions—Pathology**

Match the following conditions with their descriptions. Write your answer in the space provided.

aneurysm	flutter	myocardial ischemia
angina pectoris	hemorrhagic stroke	thrombotic stroke
bundle branch block	hypertension	tricuspid stenosis
cardiac arrest	murmur	valvular insufficiency
cerebrovascular accident	myocardial infarction	varicose veins
fibrillation		

1. chest pains \_\_\_\_\_
2. dilated, twisted veins of the leg \_\_\_\_\_
3. abnormal bulge in the wall of the artery \_\_\_\_\_
4. A stroke is also known as \_\_\_\_\_
5. condition where the heart muscle dies because of a lack of oxygen  
\_\_\_\_\_
6. hold back of blood to heart muscle \_\_\_\_\_
7. sudden stoppage of the heart \_\_\_\_\_
8. high blood pressure \_\_\_\_\_
9. fast uncoordinated heart beat \_\_\_\_\_
10. fast coordinated heart beat \_\_\_\_\_
11. loss of blood to the brain due to clot formation \_\_\_\_\_
12. loss of blood to the brain due to a burst blood vessel \_\_\_\_\_
13. an abnormal extra heart sound amongst normal heart sounds  
\_\_\_\_\_
14. electrical impulses leading to the Purkinje fibers are blocked  
\_\_\_\_\_
15. regurgitation of blood through a heart valve \_\_\_\_\_
16. narrowing of the right AV valve preventing the flow of blood through the heart  
\_\_\_\_\_

**EXERCISE 12-8 Definitions in Context**

Define the bolded terms in context. Use your medical dictionary if necessary.

**Report #1 ECHOCARDIOGRAPHY REPORT**

No **arrhythmia**. The right **atrium** is at the upper limits of normal. The **ventricle** is also normal. The **aortic valve** and **tricuspid** function normally. There was no evidence of a **thrombus** within the **coronary arteries**.

- a. echocardiography \_\_\_\_\_
- b. arrhythmia \_\_\_\_\_
- c. atrium \_\_\_\_\_
- d. ventricle \_\_\_\_\_
- e. aortic valve \_\_\_\_\_
- f. tricuspid \_\_\_\_\_
- g. thrombus \_\_\_\_\_
- h. coronary arteries \_\_\_\_\_

**Report #2 HISTORY AND PHYSICAL EXAMINATION**

Lynnel says she had a severe attack of **angina pectoris** about two years ago and was hospitalized for **myocardial ischemia**.

About one day ago, she started having difficulty breathing plus **nausea** and vomiting. Because her breathing was very difficult, she went to the emergency department of the hospital and was found to have a **myocardial infarction**.

On physical examination, Lynnel does appear older than her stated age of 56. Her **blood pressure** is **182/80**. Her **pulse** is 130, and she has **tachycardia**.

Neck veins are **distended**. Abdomen is soft, not distended. No masses can be felt. There is **edema** in the lower extremities.

**DIAGNOSES**

1. MYOCARDIAL INFARCTION
2. **ATHEROSCLEROSIS**
3. **CARDIOVASCULAR DISEASE DUE TO HYPERTENSION**

- a. angina pectoris \_\_\_\_\_
- b. myocardial ischemia \_\_\_\_\_

- c. nausea \_\_\_\_\_
- d. myocardial infarction \_\_\_\_\_
- e. blood pressure \_\_\_\_\_
- f. 182/80 \_\_\_\_\_
- g. pulse \_\_\_\_\_
- h. tachycardia \_\_\_\_\_
- i. distended \_\_\_\_\_
- j. edema \_\_\_\_\_
- k. atherosclerosis \_\_\_\_\_
- l. cardiovascular disease \_\_\_\_\_
- m. hypertension \_\_\_\_\_

### EXERCISE 12-9 Spelling

*Circle any words that are spelled incorrectly in the list below.*

Then correct the spelling in the space provided.

1. anurysm \_\_\_\_\_
2. arhythmia \_\_\_\_\_
3. atherosclerosis \_\_\_\_\_
4. ischemia \_\_\_\_\_
5. thromboflebitis \_\_\_\_\_
6. vesoconstriction \_\_\_\_\_
7. chordae tendineae \_\_\_\_\_
8. coronery \_\_\_\_\_
9. sphygmomanometer \_\_\_\_\_
10. embolous \_\_\_\_\_

### Animations

Visit the companion website to view the videos on **Electrical Stimulation of the Heart** and **Ischemic and Hemorrhagic Strokes**.

## 12.11 Pronunciation and Spelling

*Listen, read, and study, so you can speak and write.*

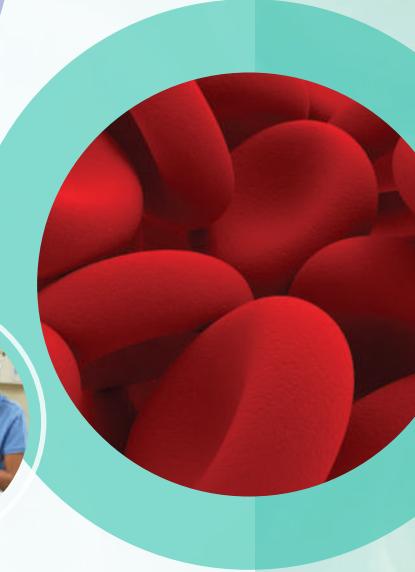
1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

Word	Pronunciation	Spelling
<b>aneurysm</b>	<b>AN-yoo-riz-um</b>	
<b>angioplasty</b>	<b>AN-jee-oh-plas-tee</b>	
<b>aorta</b>	<b>ay-OR-tah</b>	
<b>arrhythmia</b>	<b>ah-RITH-mee-ah</b>	
<b>arteries</b>	<b>AR-ter-eez</b>	
<b>arterioles</b>	<b>ar-TEER-ee-ohlz</b>	
<b>arteriosclerosis</b>	<b>ar-teer-ee-oh-skleh-ROH-sis</b>	
<b>atheroma</b>	<b>ath-er-OH-mah</b>	
<b>atherosclerosis</b>	<b>ath-er-oh-skleh-ROH-sis</b>	
<b>atrioventricular</b>	<b>ay-tree-oh-ven-TRICK-yoo-lar</b>	
<b>bicuspid</b>	<b>bye-KUS-pid</b>	
<b>bradycardia</b>	<b>brad-ee-KAR-dee-uh</b>	
<b>capillaries</b>	<b>ka-PILL-ah-reez</b>	
<b>cardiologist</b>	<b>kar-dee-OL-oh-jist</b>	
<b>cardiomyopathy</b>	<b>kar-dee-oh-my-OP-ah-thee</b>	
<b>chordae tendineae</b>	<b>KOR-dee TEN-din-ee</b>	
<b>coronary</b>	<b>KOR-uh-nehr-ee</b>	
<b>electrocardiogram</b>	<b>ee-leck-troh-KAR-dee-oh-gram</b>	
<b>embolus</b>	<b>EM-boh-lus</b>	
<b>endocardium</b>	<b>en-doh-KAR-dee-um</b>	
<b>epicardium</b>	<b>ep-ih-KAR-dee-um</b>	
<b>fibrillation</b>	<b>fib-rih-LAY-shun</b>	

Word	Pronunciation	Spelling
<b>infarction</b>	in-FARK-shun	
<b>ischemia</b>	iss-KEE-me-ah	
<b>myocardium</b>	my-oh-KAR-dee-um	
<b>palpitation</b>	pal-pih-TAY-shun	
<b>Purkinje</b>	per-KIN-jee	
<b>sphygmomanometer</b>	sfig-moh-man-OM-eh-ter	
<b>stethoscope</b>	STETH-oh-skope	
<b>tachycardia</b>	tack-ee-KAR-dee-ah	
<b>thrombophlebitis</b>	throm-boh-fleh-BYE-tis	
<b>thrombus</b>	THROM-bus	
<b>tricuspid</b>	trigh-KUS-pid	
<b>vasoconstriction</b>	vas-oh-kon-STRICK-shun	
<b>vasodilation</b>	vas-oh-dye-LAY-shun	
<b>veins</b>	VAYNZ	
<b>vena cava</b>	VE-nah KAY-vah	
<b>ventricle</b>	VEN-trih-kul	
<b>venules</b>	VEN-yoolz	

# CHAPTER 13

## Blood



### Chapter Outline

- 13.1** Major Components of Blood
- 13.2** Blood Composition
- 13.3** Blood Types
- 13.4** New Roots, Suffixes, and Prefixes
- 13.5** Learning the Terms
- 13.6** Pathology
- 13.7** Look-Alike and Sound-Alike Words
- 13.8** Review Exercises
- 13.9** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

- 1.** Name and describe the functions of the major components of blood.
- 2.** Pronounce, spell, define, and write the medical terms related to the blood.
- 3.** Describe common diseases of the blood.
- 4.** Listen, read, and study so you can speak and write.

### Introduction

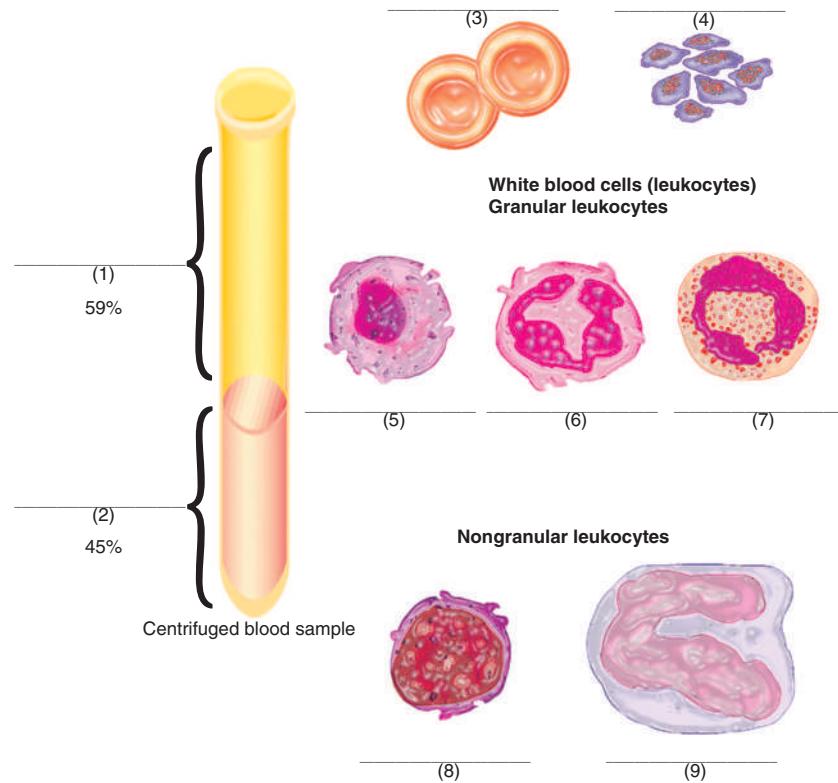
In the chapter on the skeletal system, you learned that blood cells are formed in the red bone marrow. In studying the cardiovascular system, you learned that blood carries oxygen and nutrients to the cells and carries away waste products. In this chapter, you will learn about the makeup of blood and its functions.

## 13.1 Major Components of Blood

### PRACTICE FOR LEARNING: Major Components of Blood

Write the words below in the correct spaces in Figure 13-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. plasma (**PLAZ-mah**)
2. formed elements
3. erythrocyte (**eh-RITH-roh-sight**)
4. thrombocyte (**THROM-boh-sight**)
5. basophil (**BAY-soh-fill**)
6. neutrophil (**NEW-troh-fill**)
7. eosinophil (**ee-oh-SIN-oh-fill**)
8. lymphocyte (**LIM-foh-sight**)
9. monocyte (**MON-oh-sight**)



**Figure 13-1** Formed elements of the blood.

## 13.2 Blood Composition

Whole blood is about 45% solid and 55% liquid, as illustrated in Figure 13-1. The solid portion is referred to as formed elements. Formed elements are produced in the bone marrow and consist of three types of blood cells: red blood cells (RBCs), white blood cells (WBCs), and platelets. RBCs are also called **erythrocytes**; WBCs are called **leukocytes**, and platelets are also called **thrombocytes**.

### In Brief

Blood consists of formed elements and plasma.

The liquid portion of blood is called plasma. Because plasma is more than 90% water, it is thin and almost colorless when it is separated from the blood cells.

### Formed Elements

Erythrocytes contain a protein called **hemoglobin** (HEE-moh-gloh-bin), abbreviated as Hgb. It has the ability to bind with oxygen and carbon dioxide. As erythrocytes circulate in the body, the hemoglobin in them transports oxygen to the organ cells and carries carbon dioxide away from the organ cells.

Leukocytes fight infections. They have the ability to move from the bloodstream into the site of infection in the tissues. New white blood cells replace old white cells that are destroyed in the fight against the infection. As illustrated in Figure 13-1, leukocytes are classified as either granular or nongranular. The granular leukocytes have a grain-like substance in the nucleus. They are further classified as either **eosinophils**, **basophils**, or **neutrophils**. The nongranular leukocytes are classified as either **monocytes** or **lymphocytes**.

Thrombocytes (platelets) initiate blood clotting when bleeding occurs. Platelets gather at the cut and combine with clotting factors in the plasma. This action causes a platelet plug to be formed where the vessel wall has been cut. The plug seals the cut to stop bleeding.

### In Brief

**Formed elements:** erythrocytes, leukocytes, thrombocytes

**Granular leukocytes:** basophils, neutrophils, and eosinophils

**Nongranular leukocytes:** lymphocytes, monocytes

**Erythrocytes** transport oxygen and carbon dioxide.

**Leukocytes** fight infection.

**Thrombocytes** are important in blood clotting.

Plasma carries many important solids. It transports proteins, fats, gases, salts, and hormones to their various places throughout the body and picks up waste materials from organ cells.

Proteins in the plasma function to maintain water balance in the blood. If too much water escapes from the blood and accumulates in the body tissues, it will cause pooling of water in body tissues. This is called **edema** (eh-DEE-mah).

Other proteins in plasma prevent excessive bleeding by making the blood clot. These proteins are called clotting factors. When clotting factors are removed from the plasma, the liquid that is left is called **serum** (SEER-um). In other words, serum is the clear fluid of plasma minus the clotting elements. Many blood tests are performed on serum.

### In Brief

**Plasma** is the liquid portion of the blood.

**Serum** is plasma without the clotting elements.

### PRACTICE FOR LEARNING: Blood Composition

Choose the correct answer from those in parentheses.

1. Red blood cells are also known as (leukocytes/platelets/erythrocytes).
2. The liquid portion of the blood is called (plasma/serum).
3. Plasma minus the clotting factors is called (formed elements/serum/blood).
4. Accumulation of water in body tissue is called (anemia/edema/congestion).
5. Platelets are also called (leukocytes/thrombocytes/ erythrocytes).
6. The oxygen-carrying component of red blood cells is (plasma/serum/ hemoglobin).
7. The function of white blood cells is (blood clotting/fighting infections).
8. The function of thrombocytes is (blood clotting/fighting infections).

Answers: 1. erythrocytes. 2. plasma. 3. serum. 4. edema. 5. thrombocytes.  
6. hemoglobin. 7. fighting infections. 8. blood clotting.

## 13.3 Blood Types

The body's immune system produces **antibodies** (AN-tee-bah-deez) to protect it against invaders such as viruses and bacteria. Any substance that stimulates the body's immune response to produce antibodies is referred to as an **antigen** (AN-tih-jen). (Antigen is an abbreviation for the term "antibody generator.")

There are two proteins that may or may not be on the surface of red blood cells. These proteins are called antigens. The body reacts to them as if they were foreign

bodies to be attacked, like viruses. In other words, antibodies are produced in response to these antigens. These proteins are referred to as type A and type B antigens. Blood is classified according to the presence or absence of these antigens. Type A blood has only type A antigens. Type B blood has only type B antigens. Type AB blood has both antigens. Type O blood has neither.

Persons who require a blood transfusion must receive the correct type of blood. If they receive blood that has an antigen that their blood does not recognize, antibodies will be formed because the antigen is seen as a foreign body. This reaction is called an antigen-antibody reaction.

The antigen-antibody reaction causes clumping of red blood cells and can be fatal. Blood must therefore be cross-matched before it is transfused into a patient.

There are several other blood antigens. The most important is the Rh antigen, which was first discovered by examining the blood of Rhesus monkeys. Most people are Rh positive (Rh+), meaning they have the Rh antigen. Those who lack it are Rh negative (Rh-).

### In Brief

Type A blood has only A antigens.

Type B blood has only B antigens.

Type AB blood has both antigens.

Type O has neither antigen.

Most people are Rh positive—they have the Rh antigen.

### PRACTICE FOR LEARNING: Blood Types

Answer the following questions on the space provided.

1. Define antigen. \_\_\_\_\_

\_\_\_\_\_

2. Name four blood types. \_\_\_\_\_

\_\_\_\_\_

3. What happens when a person is transfused with the wrong type of blood?

\_\_\_\_\_

Answers: 1. any substance that stimulates the body's immune response to produce antibodies. 2. A, B, AB, O. 3. antigen-antibody reaction occurs, causing the red blood cells to clump.

## 13.4 New Roots, Suffixes, and Prefixes

Use these additional roots and suffixes when studying the terms in this chapter.

ROOT	MEANING
megal/o	large
norm/o	normal
poikil/o	variation; irregular

SUFFIX	MEANING
-lysis	destruction; breakdown; separation
-poietin	hormone regulating the production of blood cells

## 13.5 Learning the Terms

### Roots

TERM	TERM ANALYSIS	DEFINITION
<b>hyperchromia</b> (high-per-KROH-mee-ah)	-ia = state of; condition hyper- = excessive	excessively pigmented (colored) red blood cells. The cause is high hemoglobin content
<b>hypochromia</b> (high-poh-KROH-mee-ah)	-ia = state of; condition hypo = below; deficient	underpigmented red blood cells. The cause is low hemoglobin content
<b>normochromia</b> (nor-moh-KROH-mee-ah)	-ia = state of; condition norm/o = normal	red blood cells that are normally pigmented

TERM	TERM ANALYSIS	DEFINITION
<b>erythropoietin</b> (eh-rith-roh-POY-eh-tin)	-poietin = hormone regulating the production of blood cells	hormone in the kidney that stimulates the production of red blood cells in the bone marrow

ROOT <b>hemat/o; hem/o</b>		MEANING <b>blood</b>
Term	Term Analysis	Definition
<b>hematologist</b> (hee-mah-TOL-oh-jist)	-logist = specialist; one who studies	a specialist in the study of the blood, its disorders and treatment
<b>hematology</b> (hee-mah-TOL-oh-jee)	-logy = study of	study of blood, blood disorders, and their treatment
<b>hemolysis</b> (hee-MOL-ih-sis)	-lysis = breakdown; separation; destruction	breakdown of blood

ROOT <b>leuk/o</b>		MEANING <b>white</b>
Term	Term Analysis	Definition
<b>leukocyte</b> (LOO-koh-sight)	-cyte = cell	white blood cell

ROOT <b>myel/o</b>		MEANING <b>bone marrow (also spinal cord)</b>
Term	Term Analysis	Definition
<b>myelogenous</b> (my-eh-LOJ-en-us)	-genous = produced by	produced in the bone marrow
<b>myelodysplastic syndrome</b> (my-eh-loh-dis-PLAS-tick SIN-drohm)	-plastic = pertaining to development or formation dys- = poor; bad; abnormal syndrome = group of signs and symptoms that indicates a specific disease	poor development of the bone marrow results in a group of bone marrow disorders that is characterized by insufficient production of one or more types of blood cells

ROOT <b>thromb/o</b>		MEANING <b>clot</b>
Term	Term Analysis	Definition
<b>thrombosis</b> (throm-BOH-sis)	-osis = abnormal condition	abnormal condition of blood clots
<b>thrombolysis</b> (throm-BOL-ih-sis)	-lysis = destruction; breakdown; separation	breakdown of clots

## Suffixes

SUFFIX -blast		MEANING immature; growing thing
Term	Term Analysis	Definition
<b>hemocytoblast</b> (hee-moh-SIGHT-oh-blast)	hem/o = blood cyt/o = cell	an immature blood cell that can develop into any type of mature blood cell. Also known as stem cells
<b>megalocytoblast</b> (meg-ah-loh-SIGHT-oh-blast)	megal/o = large cyt/o = cell	large immature cell

SUFFIX -cytosis		MEANING condition of cells; slight increase in the number of cells
Term	Term Analysis	Definition
<b>anisocytosis</b> (an-eye-soh-sigh-TOH-sis)	anis/o = unequal	increased variation in the size of cells, especially red blood cells
<b>leukocytosis</b> (loo-koh-sigh-TOH-sis)	leuk/o = white	abnormal increase in the number of white blood cells

**Note:** The increase in the number of white blood cells is not permanent. They are temporarily increased to fight an infection. After the infection has subsided, the number of white blood cells returns to normal. Compare with leukemia found in Section 13.6.

<b>poikilocytosis</b> (poy-kil-oh-sigh-TOH-sis)	poikil/o = variation; irregular	increased variation in the shape of cells, particularly red blood cells
--	---------------------------------	---

SUFFIX -emia		MEANING blood condition
Term	Term Analysis	Definition
<b>anemia</b> (ah-NEE-mee-ah)	an- = lack of; no; not	lack of red blood cells or hemoglobin content in the blood
<b>erythremia</b> (er-ih-THREE-mee-ah)	erythr/o = red	abnormal increase in the number of red blood cells
<b>septicemia</b> (sep-tih-SEE-me-ah)	septic/o = infection	microorganisms causing infection of the blood affecting the entire body; blood poisoning

SUFFIX -penia		MEANING deficient; decrease
Term	Term Analysis	Definition
<b>erythrocytopenia</b> (eh-rith-roh-sigh-toh-PEE-nee-ah)	erythr/o = red cyt/o = cell	decrease in the number of red blood cells. Also known as <b>erythropenia</b> (eh-rith-roh-PEE-nee-ah)
<b>pancytopenia</b> (pan-sigh-toh-PEE-nee-ah)	pan- = all cyt/o = cell	decrease in the number of all blood cells

SUFFIX -poiesis		MEANING production; manufacture; formation
Term	Term Analysis	Definition
<b>erythropoiesis</b> (eh-rith-roh-poy-EE-sis)	erythr/o = red	production of red blood cells

SUFFIX -stasis		MEANING stopping; controlling
Term	Term Analysis	Definition
<b>hemostasis</b> (hee-moh-STAY-sis)	hem/o = blood	stopping of bleeding

## 13.6 Pathology

### Anemia

Insufficient red blood cells and hemoglobin in the blood. The lack of hemoglobin makes the blood unable to carry enough oxygen to tissues. As a result, the patient becomes tired and pale. There are many different types of anemia. Some can be fatal, and others are benign. Common anemias are listed below.

#### Aplastic

Aplastic anemia is a condition where the bone marrow fails to produce a sufficient amount of blood cells: erythrocytes, leukocytes, and thrombocytes. This results in pancytopenia, a deficiency of all cells.

### Iron Deficiency Anemia

Iron deficiency anemia is caused by inadequate iron absorption or increased iron requirement. Iron is necessary for the production of hemoglobin. Hemoglobin is necessary in red blood cells to transport oxygen to body tissues.

### Megaloblastic (**meg-ah-loh-BLAS-tick**) Anemia

Megaloblastic anemia is characterized by large immature red blood cells in the bone marrow instead of the normal biconcave disc shape. Most often this is due to the lack or ineffective use of Vitamin B<sub>12</sub> or folate (a B vitamin also known as folic acid).

### Pernicious (**per-NISH-us**) Anemia

Pernicious anemia is caused by the lack of vitamin B<sub>12</sub>. Although Vitamin B<sub>12</sub> may be ingested in sufficient quantities, the intestine fails to absorb it.

### Sickle Cell

Sickle cell anemia is a hereditary condition where the red blood cells are sickle-shaped (crescent-shaped) rather than the typical biconcave disc shape. This abnormal shape reduces the ability of normal red blood cells to carry adequate oxygen to tissues.

## Hemophilia (**hee-moh-FEE-lee-ah**)

Hemophilia is a genetic condition characterized by a lack of clotting factors VIII and IX, which are necessary for blood to clot. The blood does not clot quickly and bleeding is prolonged. The patient can experience spontaneous or traumatic bleeding into skin, joints, or mouth. This can be fatal.

## Leukemia (**loo-KEE-mee-ah**)

Leukemia is a form of bone marrow cancer that results in a malignant increase in the number of white blood cells. The white blood cells eventually replace red blood cells, platelets, and normal functioning white blood cells. Oxygen delivery to tissues, blood clotting, and immunity are impaired as a result. Leukemic cells may metastasize to other organs such as the spleen, lymph nodes, and central nervous system.

## Multiple Myeloma (**my-eh-LOH-mah**)

This condition is a malignant neoplasm of the bone marrow. This results in bone destruction, as the tumor replaces bone.

## 13.7 Look-Alike and Sound-Alike Words

Below is a list of look-alike and sound-alike words. Study the spelling and definitions of each set of words. Questions will follow in the Review Exercises.

TABLE 13-1 Look-Alike and Sound-Alike Words

<b>hemostasis</b>	stoppage of blood
<b>homeostasis</b>	balanced yet varied state
<b>leukopenia</b>	deficiency of white blood cells
<b>leukemia</b>	malignant increase in the number of white blood cells
<b>hyperchromic</b>	excessively pigmented red blood cells
<b>hypochromic</b>	underpigmented red blood cells
<b>myogenous</b>	produced in muscle tissue
<b>myelogenous</b>	produced by bone marrow
<b>erythremia</b>	abnormal increase in the number of red blood cells
<b>erythema</b>	redness of the skin

## 13.8 Review Exercises

### EXERCISE 13-1 Look-Alike and Sound-Alike

Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 13-1 if it helps you.

1. At the end of the operation, (**homeostasis/hemostasis**) was achieved by tying the blood vessels. The patient left the operating room in good condition.
2. In a certain type of anemia, there is underdevelopment of the bone marrow with associated (**leukemia/leukopenia**).
3. In iron deficiency anemia, the erythrocytes are less than their normal color, they are (**hyperchromic/hypochromic**).
4. Ms. Nussbaum was admitted with a diagnosis of acute (**myelogenous/myogenous**) leukemia.
5. Gaylene was admitted with (**erythremia/erythema**) to the entire body because of a rash due to a drug allergy.

## EXERCISE 13-2 Matching Word Parts with Meaning

*Match the word part in Column A with its meaning in Column B.*

<b>Column A</b>	<b>Column B</b>
_____	<b>1.</b> hem/o
_____	<b>2.</b> -lysis
_____	<b>3.</b> -stasis
_____	<b>4.</b> -poiesis
_____	<b>5.</b> pan-
_____	<b>6.</b> -penia
_____	<b>7.</b> thromb/o
_____	<b>8.</b> -emia
_____	<b>9.</b> -cytosis
_____	<b>10.</b> -blast
	A. destruction
	B. condition of cells
	C. clot
	D. blood
	E. deficient
	F. blood condition
	G. stopping
	H. all
	I. production
	J. immature

### **EXERCISE 13-3 Definitions—Anatomy and Pathology**

*Define the following terms.*

1. formed elements \_\_\_\_\_
  2. plasma \_\_\_\_\_
  3. hemophilia \_\_\_\_\_
  4. edema \_\_\_\_\_
  5. anemia \_\_\_\_\_
  6. multiple myeloma \_\_\_\_\_
  7. type A blood \_\_\_\_\_
  8. hemoglobin \_\_\_\_\_
  9. antibodies \_\_\_\_\_
  10. antigens \_\_\_\_\_
  11. leukemia \_\_\_\_\_
  12. monocytes \_\_\_\_\_
  13. platelets \_\_\_\_\_

14. serum \_\_\_\_\_

15. eosinophils \_\_\_\_\_

#### EXERCISE 13-4 Definitions—Learning the Terms

Define the following terms.

1. hematology \_\_\_\_\_

2. myelogenous \_\_\_\_\_

3. thrombosis \_\_\_\_\_

4. thrombocyte \_\_\_\_\_

5. thrombus \_\_\_\_\_

6. hemocytoblast \_\_\_\_\_

7. leukocytosis \_\_\_\_\_

8. erythremia \_\_\_\_\_

9. pancytopenia \_\_\_\_\_

10. hemostasis \_\_\_\_\_

11. anisocytosis \_\_\_\_\_

12. poikilocytosis \_\_\_\_\_

13. megalocytoblast \_\_\_\_\_

14. myelodysplastic syndrome \_\_\_\_\_

#### EXERCISE 13-5 Spelling

Circle any words that are spelled incorrectly in the list below. Then correct the spelling in the space provided.

1. cerum \_\_\_\_\_

2. hemolysis \_\_\_\_\_

3. plattelets \_\_\_\_\_

4. myelogenous \_\_\_\_\_

5. arithrocytes \_\_\_\_\_

6. leukopoiesis \_\_\_\_\_
7. hemostasis \_\_\_\_\_
8. hemopillia \_\_\_\_\_
9. adema \_\_\_\_\_
10. myeloma \_\_\_\_\_

### 13.9 Pronunciation and Spelling

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

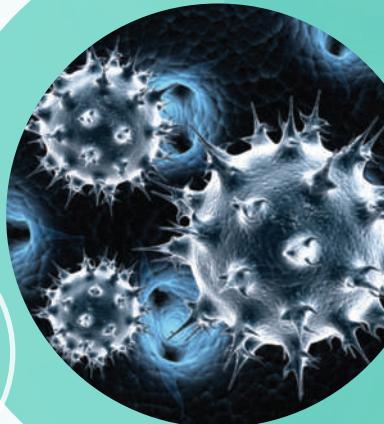
Word	Pronunciation	Spelling
<b>anemia</b>	ah-NEE-mee-ah	_____
<b>antibodies</b>	AN-tee- <b>BAH</b> -deez	_____
<b>anisocytosis</b>	an- <b>EYE</b> -soh-sigh-TOH-sis	_____
<b>basophil</b>	BAY-soh-fill	_____
<b>edema</b>	eh- <b>DEE</b> -mah	_____
<b>eosinophil</b>	ee-oh-SIN-oh-fill	_____
<b>erythremia</b>	er-ih- <b>THREE</b> -mee-ah	_____
<b>erythrocyte</b>	eh- <b>RITH</b> -roh-sight	_____
<b>erythrocytopenia</b>	eh- <b>rith</b> -roh-sigh-toh-PEE-nee-ah	_____
<b>erythropoiesis</b>	eh- <b>rith</b> -roh-poy-EE-sis	_____
<b>hematology</b>	hee-mah- <b>TOL</b> -oh-jee	_____
<b>hemoglobin</b>	HEE-moh- <b>gloh</b> -bin	_____
<b>hemolysis</b>	hee- <b>MOL</b> -ih-sis	_____
<b>hemophilia</b>	hee-moh- <b>FEE</b> -lee-ah	_____
<b>hemostasis</b>	hee-moh- <b>STAY</b> -sis	_____
<b>leukemia</b>	loo- <b>KEE</b> -mee-ah	_____
<b>leukocytes</b>	LOO-koh-sights	_____
<b>leukocytosis</b>	loo-koh-sigh-TOH-sis	_____

Word	Pronunciation	Spelling
<b>lymphocyte</b>	<b>LIM-foh-sight</b>	
<b>monocyte</b>	<b>MON-oh-sight</b>	
<b>myelodysplastic</b>	<b>my-eh-loh-dis-PLAS-tick</b>	
<b>myelogenous</b>	<b>my-eh-LOJ-en-us</b>	
<b>pancytopenia</b>	<b>pan-sigh-toh-PEE-nee-ah</b>	
<b>plasma</b>	<b>PLAZ-mah</b>	
<b>poikilocytosis</b>	<b>poy-kil-oh-sigh-TOH-sis</b>	
<b>serum</b>	<b>SEER-um</b>	
<b>thrombocyte</b>	<b>THROM-boh-sight</b>	
<b>thrombolysis</b>	<b>throm-BOL-ih-sis</b>	
<b>thrombosis</b>	<b>throm-BOH-sis</b>	



## CHAPTER 14

# Lymphatic and Immune Systems



### Chapter Outline

- 14.1** Major Organs of the Lymphatic System
- 14.2** Lymphatic System
- 14.3** Immune System
- 14.4** New Roots, Suffixes, and Prefixes
- 14.5** Learning the Terms
- 14.6** Pathology
- 14.7** Review Exercises
- 14.8** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

1. Locate and describe the organs of the lymphatic system.
2. Define terms relating to the immune system.
3. Pronounce, spell, define, and write the medical terms related to the lymphatic and immune systems.
4. Describe common diseases of the lymphatic and immune systems.
5. Listen, read, and study so you can speak and write.

### Introduction

The **lymphatic** (lim-FAH-tick) system is the body's other circulatory system. It works with the blood system to fight infection and disease, transport nutrients, and drain excess fluid from tissues.

## 14.1 Major Organs of the Lymphatic System

### PRACTICE FOR LEARNING: Major Organs of the Lymphatic System

Write the words below in the correct spaces on Figure 14-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. tonsils (**TON-silz**)
2. lymph vessels (**LIMF VESS-elz**)
3. thymus (**THIGH-mus**)
4. spleen (**SPLEEN**)
5. lymph nodes

## 14.2 Lymphatic System

As you saw in Figure 14-1, the lymphatic system consists of a vascular system, the lymph nodes, the thymus gland, the spleen, and the tonsils. The fluid traveling through the vascular system is called **lymph**.

The lymphatic system serves a number of important functions in the body. Of primary importance is the task of draining excess fluids away from body tissues and delivering them to the bloodstream. This system also transports nutrients to body tissues. Because of the presence of lymphocytes and monocytes, the lymphatic system also plays an important role in the body's defense against infection.

### In Brief

#### Parts of the lymphatic system

vascular system, lymph,  
lymph nodes, thymus gland, spleen

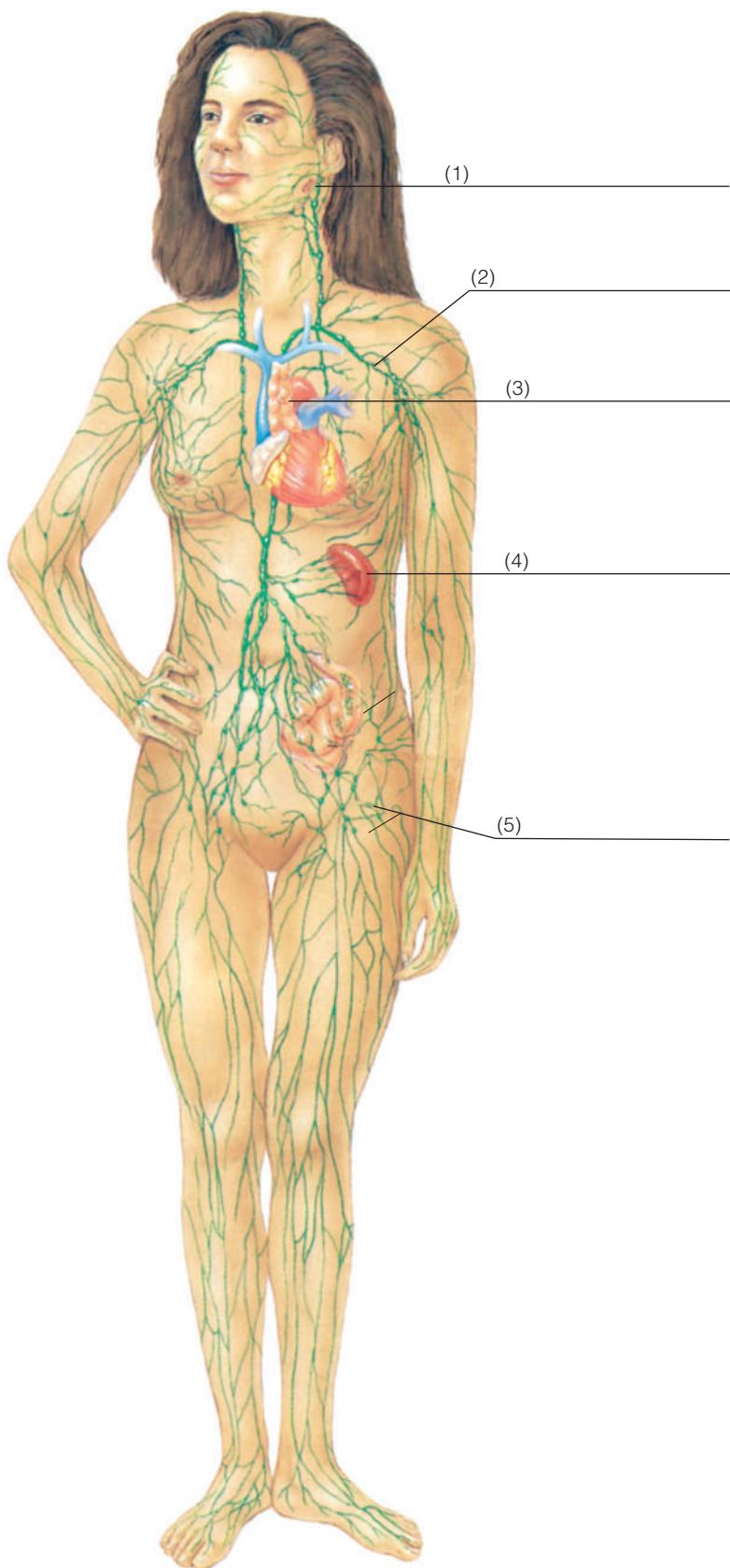
#### Functions of the lymphatic system

immunity,  
drains excess fluid, carries nutrients

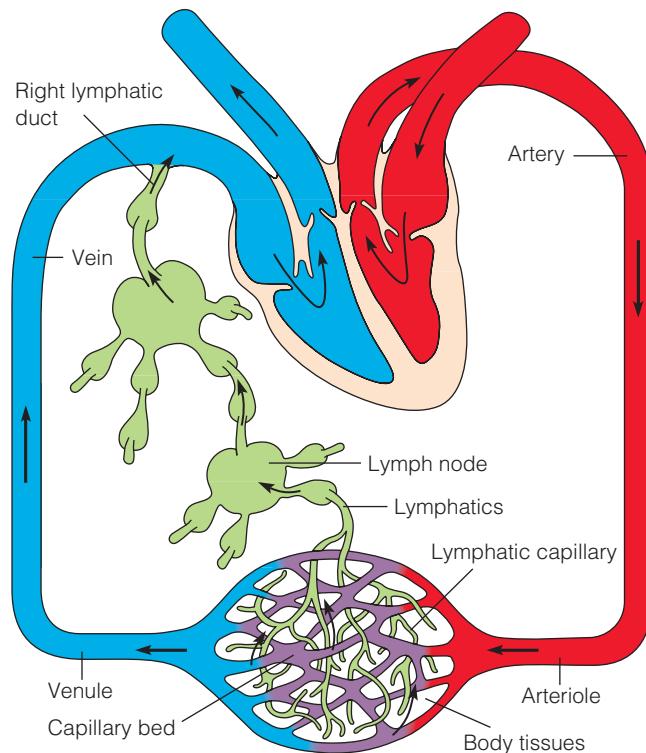
## Lymphatic Vessels

Look at Figure 14-2. You will see that the vascular system consists of three types of vessels: lymphatic capillaries, lymphatic vessels (lymphatics), and the right and left lymphatic ducts. (Left lymphatic duct is shown in Figure 14-3.)

The lymphatic capillaries are the smallest of these vessels. They are present in body tissues. The fluid in the body tissues is called interstitial (**in-ter-STISH-al**) fluid. Excess fluid and bacteria from body tissues seep into the lymphatic capillaries. Once inside the capillaries, the fluid is called lymph.



**Figure 14-1** The lymphatic system.



**Figure 14-2** Lymph vessels.

As illustrated in Figure 14-2, the lymph flows from the lymphatic capillaries, into larger vessels called lymphatics. The lymphatics ultimately drain into the largest vessels of the lymphatic system, called lymphatic ducts.

The two lymphatic ducts are shown in Figure 14-3. Lymph from the right side of the head, neck, and chest and from the right arm drains into the right lymphatic duct. Lymph from the rest of the body drains into the left lymphatic duct. Both of the lymphatic ducts drain into the bloodstream.

Lymph is cleaned by lymph nodes before it drains into the bloodstream. These nodes are located in clusters at various sites in the body. Look at Figure 14-3. You will see the principal clusters of nodes. They are called the cervical, submandibular, axillary, mediastinal, and inguinal nodes.

The lymph nodes act as filtration devices for lymph and contain a great number of white blood cells called **phagocytes** (FAY-goh-sights). Phagocytes (phag/o = to eat; -cyte = cell) eat bacteria.

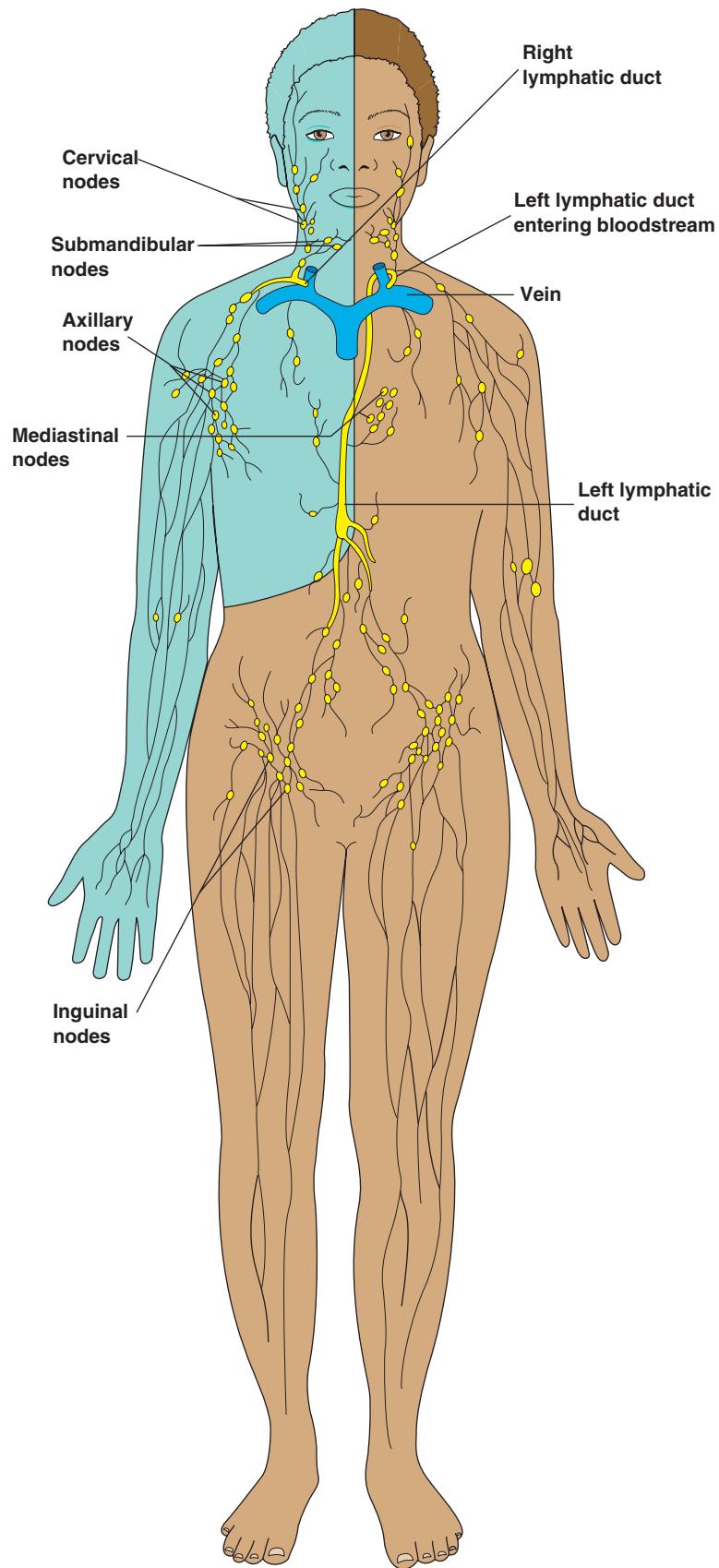
### In Brief

Lymph flows from the lymphatic capillaries → lymphatics → right and left lymphatic ducts → bloodstream

#### Lymph node clusters

cervical, submandibular, axillary, inguinal, mediastinal

**Lymph nodes** contain phagocytes that digest unwanted material.



**Figure 14-3** Lymphatic ducts and lymph nodes. Notice the body areas served by the two lymphatic ducts.

You can see the **thymus gland** in Figure 14-1. It is located near the heart in the thoracic cavity. It is important because it protects the body from disease. It also plays a role in the development of lymphocytes. Remember from Chapter 13 that lymphocytes are white blood cells that fight against foreign substances such as viruses and bacteria.

The **spleen** is also shown in Figure 14-1. It is located in the left side of the abdominal cavity. It produces and stores red blood cells and gets rid of old red blood cells. It also eliminates bacteria from the blood.

Tonsils are made of lymphatic tissue. Three pairs are located in the throat. The **palatine** (**PAL-ah-tine**) tonsils are normally referred to simply as tonsils. The **pharyngeal** (**far-IN-jee-al**) tonsils are commonly called the **adenoids** (**AD-eh-noids**). The **lingual** (**LING-gwal**) tonsils are at the base of the tongue. Because of their location, they filter bacteria from food and air.

### In Brief

The **thymus** is important in immunity.

The **spleen** stores and produces red blood cells, and gets rid of bacteria.

**Tonsils** filter bacteria.

### PRACTICE FOR LEARNING: Lymphatic System

Write the answers to the following statements in the space provided.

1. Write the name of the fluid circulating through the lymphatic vessels.

---

---

---

2. Write three functions of the lymphatic system.

---

---

---

3. Lymph node clusters under the lower jaw are called

---

4. The pharyngeal tonsils are commonly known as \_\_\_\_\_

5. List three functions of the spleen.

---

---

---

6. Where is the thymus located? \_\_\_\_\_

Answers: 1. lymph. 2. immunity, drains excess fluid, transports nutrients. 3. submandibular. 4. adenoids. 5. stores red blood cells; produces red blood cells; eliminates old red blood cells and bacteria. 6. near the heart in the thoracic cavity.

## 14.3 Immune System

The immune system is our protection against disease. This system includes the lymphoid organs (lymph nodes, spleen, and thymus). It also includes lymphocytes and antibodies. When a foreign substance, called an **antigen** (AN-tih-jen), invades the body, the immune response is turned on by two types of lymphocytes: T lymphocytes (T-cells) and B lymphocytes (B-cells).

T-cells recognize and kill cells that have been infected with a virus. They recognize and kill cancerous cells. T-cells are also known as killer or **cytotoxic** (sigh-toh-TOCK-sick) T-cells because of their function.

B-cells produce antibodies. These antibodies travel through the blood. They have the ability to attach to foreign cells, labeling them for destruction by phagocytes.

As mentioned in the previous chapter, antigen is a general term that refers to foreign substances such as bacteria and viruses, as well as to plant pollen and to red blood cells in transplanted tissues. Antigens stimulate the body's immune response to produce antibodies against substances not recognized by the body.

The specialized role of T-cells and antibodies in fighting antigens is made possible by the fact that each T-cell and each antibody binds to its own particular antigen-binding site.

### In Brief

#### Antigens

foreign substance that stimulates the production of antibodies

**Antibodies** inactivate antigens.

**Lymphocytes** are important in the immune response.

Types of lymphocytes

T lymphocytes (T-cells)

B lymphocytes (B-cells)

**T cells** kill virus-infected cells and cancerous cells.

**B cells** produce antibodies.

### PRACTICE FOR LEARNING: Immune System

Underline the correct answer in each sentence.

1. (T-cells/B-cells) produce antibodies.
2. (T-cells/B-cells) recognize cells infected with a virus.
3. Lymphocytes are (red blood cells/white blood cells/platelets).
4. Bacteria, viruses, pollen, and dust are examples of (antibodies/antigens/immunity).

Answers: 1. B-cells. 2. T-cells. 3. white blood cells. 4. antigens.

## 14.4 New Roots, Suffixes, and Prefixes

Use these additional roots and suffixes when studying the terms in this chapter.

ROOT	MEANING
scint/i	spark
tox/o	poison

SUFFIX	MEANING
-edema	accumulation of fluid in body tissues; swelling
-kines	movement
-stital	to place

## 14.5 Learning the Terms

Following these steps will make it easier for you to learn medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

### Roots

TERM	ROOT cyt/o	MEANING cell
Term	Term Analysis	Definition
cytokines (SIGH-toh-kighnz)	-kines = movement	proteins that signal cells to start the immune response. Examples are interferons and interleukins.
cytotoxic (sigh-toh-TOCK-sick)	-ic = pertaining to tox/o = poison	pertaining to an agent that kills cells

ROOT <b>immun/o</b>		MEANING <b>immunity; safe</b>
Term	Term Analysis	Definition
<b>immunodeficiency</b> (im-yoo-no-dee-FISH-en-see)	deficiency = lacking	inadequate immune response
<b>immunoglobulin</b> (Ig) (im-yoo-noh-GLOB-yoo-lin)	globulin = protein	proteins that have the ability to attach to foreign cells, labeling them for destruction by phagocytes
<b>immunology</b> (im-yoo-NOL-oh-jee)	-logy = study of	study of the immune system

ROOT <b>lymphaden/o</b>		MEANING <b>lymph node</b>
Term	Term Analysis	Definition
<b>lymphadenitis</b> (lim-fad-eh-NIGH-tis)	-itis = inflammation	inflammation of the lymph nodes
<b>lymphadenopathy</b> (lim-fad-eh-NOP-ah-thee)	-pathy = disease	disease of the lymph nodes, especially enlargement of the lymph nodes

ROOT <b>lymphangi/o</b>		MEANING <b>lymph vessels</b>
Term	Term Analysis	Definition
<b>lymphangitis</b> (lim-fan-JIGH-tis)	-itis = inflammation	inflammation of the lymph vessels

ROOT <b>lymph/o</b>		MEANING <b>lymph</b>
Term	Term Analysis	Definition
<b>lymphedema</b> (lim-feh-DEE-mah)	-edema = accumulation of fluid in body tissues	accumulation of fluid in body tissues due to obstruction of lymphatic structures
<b>lymphoid tissue</b> (LIM-foyd)	-oid = resembling; pertaining to	resembling or pertaining to lymph tissue

Term	Term Analysis	Definition
<b>lymphoscintigraphy</b> (lim-foh-sin-TIG-grah-fee)	-graphy = process of recording scint/i = spark	process of recording the lymphatic vessels or lymph nodes to produce images that detect metastatic tumors, lymphedema or lymph node blockage. A type of nuclear imaging process

ROOT <b>splen/o</b>		MEANING <b>spleen</b>
Term	Term Analysis	Definition
<b>splenomegaly</b> (splee-noh-MEG-ah-lee)	-megaly = enlargement	enlargement of the spleen
<b>splenorrhagia</b> (splee-noh-RAY-jee-ah)	-rrhagia = bursting forth	hemorrhage from the spleen
<b>splenorrhaphy</b> (splee-NOR-ah-fee)	-rrhaphy = suture	suture of the spleen

ROOT <b>thym/o</b>		MEANING <b>thymus gland</b>
Term	Term Analysis	Definition
<b>thymectomy</b> (thigh-MECK-toh-mee)	-ectomy = excision; surgical removal	excision of the thymus

ROOT <b>tonsill/o</b>		MEANING <b>tonsils</b>
Term	Term Analysis	Definition
<b>tonsillectomy</b> (ton-sih-LECK-toh-mee)	-ectomy = excision; surgical removal	excision of the tonsils

## Suffixes

SUFFIX -immune		MEANING immunity; safe
Term	Term Analysis	Definition
<b>autoimmune disease</b> (aw-toh-ih-MYOON)	auto- = self	an immune response to one's own body tissue; destruction of one's cells by the immune system

SUFFIX -stitial		MEANING to place
Term	Term Analysis	Definition
<b>interstitial fluid</b> (in-ter-STISH-al)	inter- = between	fluid placed between the tissue spaces

## 14.6 Pathology

### Autoimmune Disease

Normally, the immune system attacks only foreign cells. In autoimmune disease, the immune system attacks the body's own cells instead of foreign cells. Examples are rheumatoid arthritis and multiple sclerosis.

### HIV and AIDS

Infection with the human immunodeficiency virus (HIV). This virus obstructs the body's ability to fight off disease-causing microorganisms such as bacteria, viruses, parasites, and fungi.

With the appropriate drug treatment, a person can live with HIV for many years, functioning normally without major problems. Without the proper drug treatment, however, the disease progresses. The immune system becomes weakened and incapacitated. A diagnosis of **AIDS** (AYDZ) is given at this time. HIV infection and AIDS (acquired immunodeficiency syndrome) are the same disease. The label HIV is used when the disease is in its early stages. The label AIDS is used in the late stages of the disease.

## Hypersensitivity/Allergic Reactions

Abnormal inflammatory response or hypersensitivity to an allergen (any substance causing an allergic reaction such as pollen, dust, dander, and bee stings).

Allergic reactions occur when the body is exposed to a foreign substance that causes an immune response that is harmful to the body. The body's response can be mild or severe. It can include asthma, hay fever, hives (urticaria), allergic dermatitis, and allergic rhinitis. The most severe reaction is **anaphylactic** (**a**n-ih-fih-LACK-tick) **shock**. This is an extreme reaction to the allergen, such as a bee sting. It can be fatal.

## Lymphoma

Lymphomas are tumors of lymphoid tissue. The major categories of malignant lymphoma are Hodgkin (**HOJ-kin**) disease and non-Hodgkin lymphoma. Although possessing similar names, these conditions have different characteristics. Hodgkin disease is diagnosed by the presence of **Reed-Sternberg** cells in the lymph nodes. In non-Hodgkin lymphoma, Reed-Sternberg cells are not present. Non-Hodgkin lymphoma is the more common condition.

### 14.7 Review Exercises

#### EXERCISE 14-1 Matching Word Parts with Meaning

*Match the word part in Column A with its meaning in Column B.*

Column A	Column B
_____ <b>1.</b> -edema	A. lymph vessel
_____ <b>2.</b> -rrhaphy	B. bursting forth
_____ <b>3.</b> -immune	C. self
_____ <b>4.</b> lymphangi/o	D. between
_____ <b>5.</b> lymphaden/o	E. accumulation of fluid in body tissues
_____ <b>6.</b> -rrhagia	F. to place
_____ <b>7.</b> auto-	G. lymph gland
_____ <b>8.</b> inter-	H. enlargement
_____ <b>9.</b> -stitial	I. suture
_____ <b>10.</b> -megaly	J. safe

### EXERCISE 14-2 Anatomy and Pathology

Fill in the blanks with the most appropriate term listed below. Not all terms are used.

allergen	HIV	spleen
allergy	Hodgkin disease	STI
anaphylactic shock	HPV	T-cells
B-cells	lymph nodes	thymus
edema	phagocytes	tonsils

1. Structure that filters lymph of unwanted material \_\_\_\_\_
2. Leukocytes that eat unwanted material \_\_\_\_\_
3. Lymphoid organ that stores red blood cells \_\_\_\_\_
4. Structure in the throat that filters bacteria \_\_\_\_\_
5. White blood cells that kill cancerous cells \_\_\_\_\_
6. Cells that produce antibodies \_\_\_\_\_
7. Accumulation of fluid in body tissues \_\_\_\_\_
8. Any substance causing an allergic reaction \_\_\_\_\_
9. Extreme reaction to an allergen \_\_\_\_\_
10. Type of lymphoma \_\_\_\_\_
11. Microorganism causing AIDS \_\_\_\_\_

### EXERCISE 14-3 Fill in the Blank—Lymph Nodes

Write the location of the following lymph nodes.

- a. **submandibular** \_\_\_\_\_
- b. **axillary** \_\_\_\_\_
- c. **inguinal** \_\_\_\_\_
- d. **cervical** \_\_\_\_\_

### EXERCISE 14-4 Definitions—Learning the Terms

Define the following terms.

1. **immunodeficiency** \_\_\_\_\_
2. **lymphadenopathy** \_\_\_\_\_

3. **splenomegaly** \_\_\_\_\_
4. **lymphedema** \_\_\_\_\_
5. **interstitial fluid** \_\_\_\_\_
6. **immunoglobulins** \_\_\_\_\_
7. **cytotoxic** \_\_\_\_\_
8. **cytokines** \_\_\_\_\_

### EXERCISE 14-5 Building Medical Terms

*Build the medical words.*

1. study of the immune system \_\_\_\_\_
2. inflammation of the lymph glands \_\_\_\_\_
3. hemorrhage from the spleen \_\_\_\_\_
4. suture of the spleen \_\_\_\_\_
5. excision of the thymus \_\_\_\_\_

### EXERCISE 14-6 Spelling

*Circle any words that are spelled incorrectly in the list below. Then correct the spelling in the space provided.*

1. interstial fluid \_\_\_\_\_
2. lymphadenitis \_\_\_\_\_
3. imunology \_\_\_\_\_
4. tonsilectomy \_\_\_\_\_
5. thymectomy \_\_\_\_\_

### Animations

Visit the companion website to view the videos on **Lymph Nodes** and **Lymph**.

## 14.8 Pronunciation and Spelling

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

Word	Pronunciation	Spelling
<b>adenoids</b>	<b>AD-eh-noids</b>	
<b>autoimmune</b>	<b>aw-toh-ih-MYOON</b>	
<b>anaphylactic</b>	<b>an-ih-fih-LACK-tick</b>	
<b>Hodgkin disease</b>	<b>HOJ-kin</b>	
<b>immunodeficiency</b>	<b>im-yoo-no-dee-FISH-en-see</b>	
<b>immunoglobulin</b>	<b>im-yoon-oh-GLOB-yoo-lin</b>	
<b>immunology</b>	<b>im-yoo-NOL-oh-jee</b>	
<b>interstitial</b>	<b>in-ter-STISH-al</b>	
<b>lymph</b>	<b>LIMF</b>	
<b>lymphadenitis</b>	<b>lim-fad-eh-NIGH-tis</b>	
<b>lymphadenopathy</b>	<b>lim-fad-eh-NOP-ah-thee</b>	
<b>lymphangitis</b>	<b>lim-fan-JIGH-tis</b>	
<b>lymphatic</b>	<b>lim-FAH-tick</b>	
<b>lymphedema</b>	<b>lim-feh-DEE-mah</b>	
<b>lymphocytes</b>	<b>LIM-foh-sights</b>	
<b>lymphoma</b>	<b>lim-FOH-mah</b>	
<b>lymphoscintigraphy</b>	<b>lim-foh-sin-TIG-grah-fee</b>	
<b>spleen</b>	<b>SPLEEN</b>	
<b>splenomegaly</b>	<b>spee-noh-MEG-ah-lee</b>	
<b>splenorrhagia</b>	<b>spee-noh-RAY-jee-ah</b>	
<b>thymectomy</b>	<b>thigh-MECK-toh-mee</b>	
<b>thymus</b>	<b>THIGH-mus</b>	
<b>tonsillectomy</b>	<b>ton-sih-LECK-toh-mee</b>	
<b>tonsils</b>	<b>TON-silz</b>	



## CHAPTER 15

# Respiratory System



### Chapter Outline

- 15.1** Major Organs of the Respiratory System
- 15.2** Upper Respiratory Tract
- 15.3** Lower Respiratory Tract
- 15.4** Paranasal Sinuses
- 15.5** Pleural and Mediastinal Cavities
- 15.6** New Roots, Suffixes, and Prefixes
- 15.7** Learning the Terms
- 15.8** Pathology
- 15.9** Look-Alike and Sound-Alike Words
- 15.10** Review Exercises
- 15.11** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

- 1.** Locate and describe the organs of the respiratory system.
- 2.** Describe the functions of the respiratory structures.
- 3.** Pronounce, spell, define, and write the medical terms related to the respiratory system.
- 4.** Describe common diseases of the respiratory system.
- 5.** Listen, read, and study so you can speak and write.

### Introduction

When you studied the cardiovascular system, you learned that blood travels to the lungs to pick up oxygen and give off wastes and carbon dioxide.

It then carries the oxygen to the body's cells and picks up more wastes and carbon dioxide. This chapter is about the respiratory system. It is responsible for the ongoing process of **respiration** (*res*-pih-RAY-shun). Respiration means taking in oxygen and giving off carbon dioxide.

The lungs get oxygen by breathing it in from the air. This is called inhalation. It is also called inspiration. The lungs get rid of the carbon dioxide by breathing out. This is called exhalation. It is also called expiration.

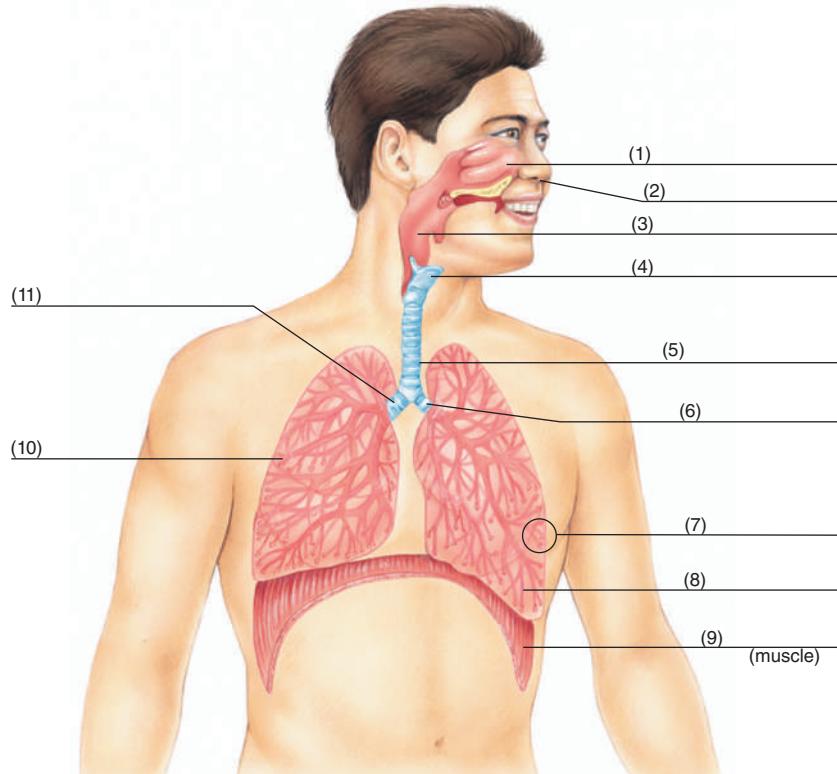
Various structures work together to make the passage of air into and out of the lungs possible. Together they are called the respiratory tract. As you will learn below, these structures are divided into two further categories: the upper respiratory tract (URT) and the lower respiratory tract (LRT).

## 15.1

## Major Organs of the Respiratory System

### PRACTICE FOR LEARNING: Major Organs of the Respiratory System

Write the words below in the correct spaces on Figure 15-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.



**Figure 15-1** Major organs of the respiratory system.

1. nasal cavity (**NAY-zal**)
2. nares (**NAH-reez**) (nostrils)
3. pharynx (**FAR-inks**)
4. larynx (**LAR-inks**)
5. trachea (**TRAY-kee-ah**)
6. left bronchus (**BRONG-kus**)
7. alveoli (al-**VEE-oh-lye**)
8. bronchiole (**BRONG-kee-ohl**)
9. diaphragm (**DYE-ah-fram**)
10. right lung
11. right bronchus (**BRONG-kus**)

## 15.2 Upper Respiratory Tract

### PRACTICE FOR LEARNING: **Upper Respiratory Tract**

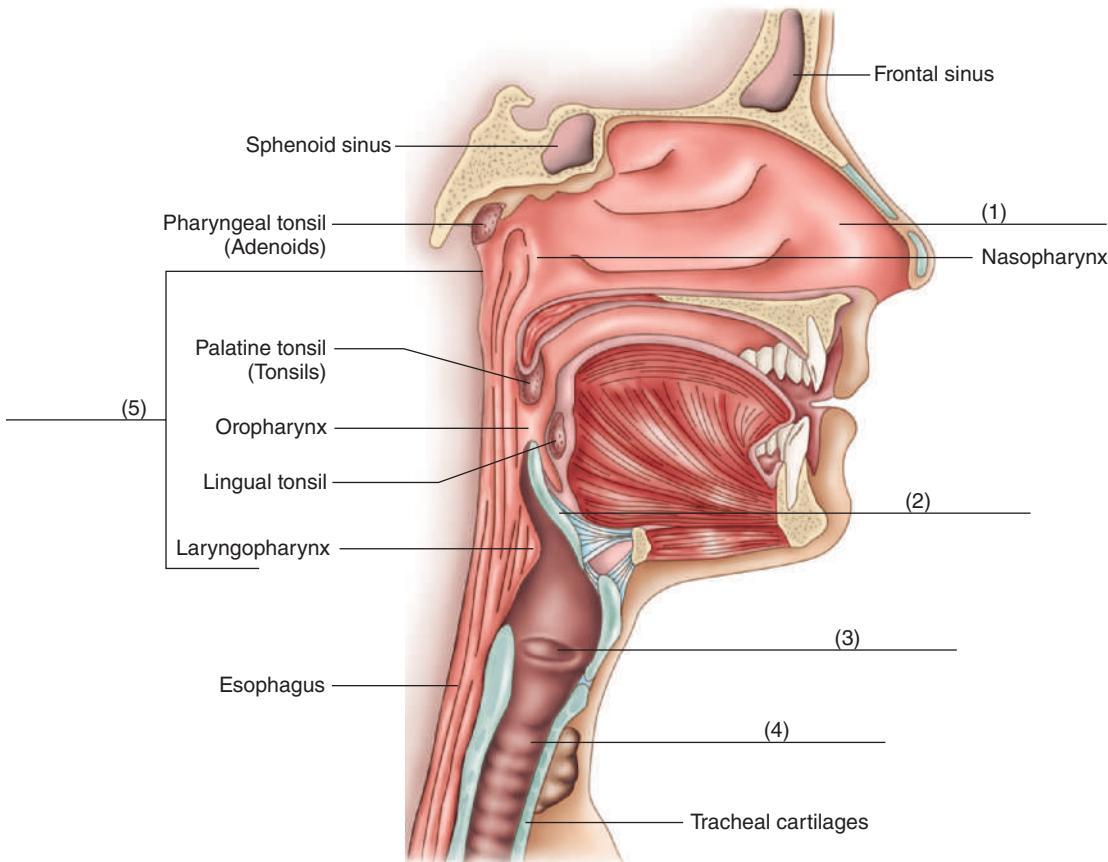
Write the words below in the correct spaces on Figure 15-2. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. nasal cavity (**NAY-zal**)
2. epiglottis (**ep-ih-GLOT-is**)
3. vocal cords (**VOH-kal KORDZ**)
4. trachea (**TRAY-kee-ah**)
5. pharynx (**FAR-inks**)

The URT is illustrated in Figure 15-2. It includes the respiratory structures located outside the thoracic cavity. These are the nasal cavity, pharynx, larynx, and upper trachea. Mucous membrane lines the URT.

### Nasal Cavity

The nasal cavity is divided into right and left by a wall called the **nasal septum**. The nasal septum is part bone and part cartilage. Air enters the nasal cavity through the nares (nostrils). The hairs inside the nares filter out dust particles from the air as it is inhaled. These hairs are called **cilia** (**SIL-ee-ah**). The nasal cavity warms and moistens air. It is lined with nerve cells called **olfactory** (**ol-FACK-toh-ree**) **neurons** that provide us with our sense of smell. From the nares, the cavity extends to the pharynx.



**Figure 15-2** Structures of the Upper Respiratory Tract.

## Pharynx

As you can see in Figure 15-2, the pharynx is the throat. There are three sections to the pharynx: the **nasopharynx** (**nay-zoh-FAR-inks**), behind the nose; the **oropharynx** (**or-oh-FAR-inks**) behind the mouth; and the **laryngopharynx** (**lah-ring-oh-FAR-inks**) behind the larynx. The nasopharynx transports air only. The oropharynx and laryngopharynx transport air and food. The pharynx also contains the tonsils and adenoids, which function as part of the immune system as they fight off microorganisms that may be harmful to the body.

## Larynx

The larynx is the voice box. It consists of the vocal cords, the epiglottis, and the Adam's apple (thyroid cartilage).

The vocal cords are folds of mucous membrane. As air moves out of the lungs, it goes past the vocal cords. They vibrate and produce sound.

The epiglottis swings up and down like a lid. It covers the opening of the larynx during swallowing so that food from the pharynx does not go down the respiratory tract.

The Adam's apple is a large shield of cartilage that protects the inner structures. It is a bump that you can feel on the front of the neck.

**In Brief**

**Nares** are the nostrils.

**Pharynx** is the throat.

**Larynx** is the voice box.

**PRACTICE FOR LEARNING: Upper Respiratory Tract**

Fill in the blanks with the most appropriate answer.

1. Name the structure in the larynx that prevents food from entering the respiratory tract. \_\_\_\_\_
2. Write the function of the tonsils. \_\_\_\_\_
3. Write another name for nares. \_\_\_\_\_
4. Write the function of cilia. \_\_\_\_\_

Answers: 1. epiglottis. 2. immunity. 3. nostrils. 4. filters out dust particles.

**15.3 Lower Respiratory Tract****PRACTICE FOR LEARNING: Lower Respiratory Tract**

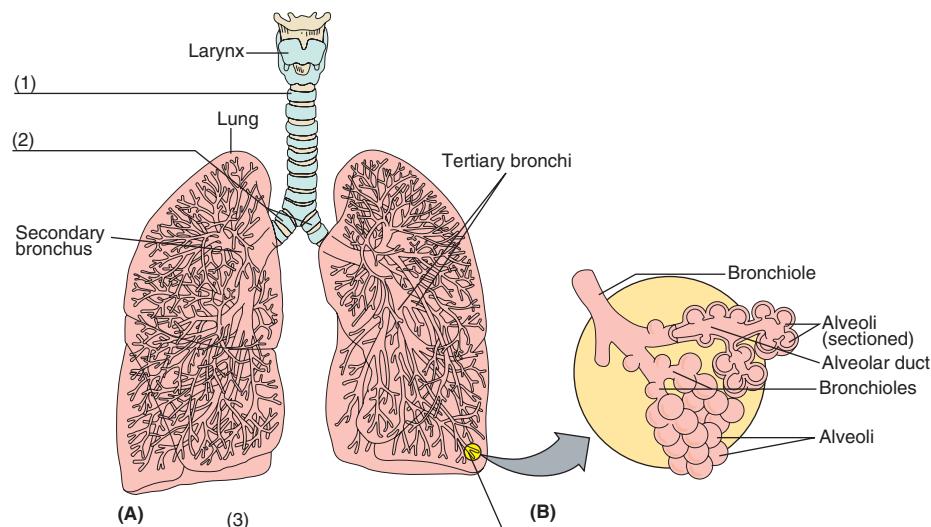
Write the words below in the correct spaces on Figure 15-3. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. trachea (TRAY-kee-ah)
2. primary bronchi (BRONG-keye)
3. bronchiole (BRONG-kee-ohl)

**Trachea, Bronchi, Bronchioles**

The lower respiratory tract is illustrated in Figure 15-3. It includes the lower trachea, bronchi, and bronchioles. The trachea is the windpipe. It extends from the larynx to the **bronchi**. It is lined with mucous membrane and cilia, which filter the air.

The trachea branches into two tubes called the primary bronchi. Like the trachea, the primary bronchi (singular bronchus) (**BRONG-kus**) are lined with mucous membrane and cilia. Each extends into a lung, and then branches into smaller and smaller bronchi. These small bronchi extend to tiny structures called bronchioles. The trachea and bronchi together form the tracheobronchial system. As you can see in Figure 15-3,



**Figure 15-3** Lower respiratory tract. A. Trachea, bronchi, and bronchioles. B. Bronchioles, alveolar duct, and alveoli.

the whole structure looks like an upside-down tree. As a result, it is often referred to as the tracheobronchial tree.

The tracheobronchial tree normally secretes mucus. This functions as a lubricant and protects against infection. When mucus and other matter are expelled from the trachea and the bronchus and through the mouth, it is called **sputum** (SPYOO-tum) or phlegm (**FLEM**). Laboratory examination of the sputum is helpful in diagnosing respiratory problems.

### In Brief

**Trachea** is the windpipe.

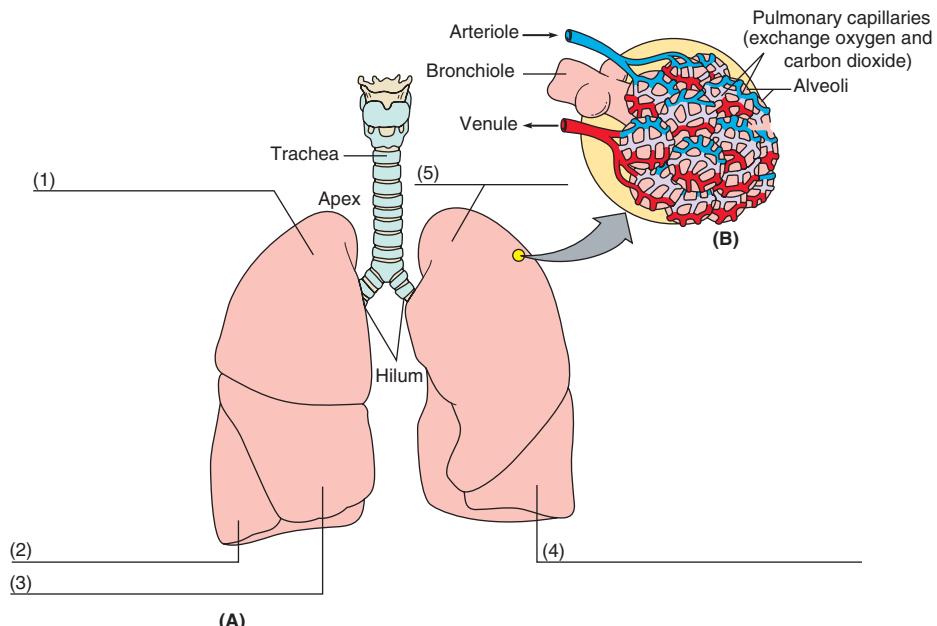
**Trachea** branches into the primary bronchi, which eventually connect to bronchioles.

## Lungs and Alveoli

### PRACTICE FOR LEARNING: Lung

Write the words below in the correct spaces on Figure 15-4. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. right superior lobe
2. right inferior lobe
3. right middle lobe
4. left inferior lobe
5. left superior lobe



**Figure 15-4** The lungs and alveoli. A. Structures of the lung. B. Pulmonary capillaries surrounding the alveoli.

The lungs lie in the thoracic cavity. The top of each lung is called the apex, and the bottom is the base. The right lung is divided into three lobes called the superior, middle, and inferior lobes. The left lung has no middle lobe (Figure 15-4A). Each lung is covered by a membrane called the **pleura** (PLOOR-ah).

Inside each lung are approximately 300 million **alveoli** (al-VEE-oh-lye) (Figure 15-3). They are like tiny balloons. When you inhale, the air goes down through the bronchioles and into the alveoli. They expand and fill up with air. The oxygen from the air is absorbed by the **pulmonary** (PUL-moh-ner-ee) **capillaries** that surround the alveoli (Figure 15-4B). The blood cells, specifically, the red blood cells, flowing through the capillaries take on the oxygen. The oxygenated blood continues on to the heart, to be pumped to the cells of the body. While the alveoli are giving off oxygen to the capillaries, they are also absorbing carbon dioxide from them. The carbon dioxide is expelled from the lungs during exhalation.

### In Brief

**Right lung** has three lobes.

**Left lung** has two lobes.

**Alveoli** are responsible for gas exchange with the pulmonary capillaries.

### PRACTICE FOR LEARNING: Respiratory Tract

In the space provided, name, in sequence, the structures through which air passes to the lungs. Start with the nasal cavity and end with the alveoli.

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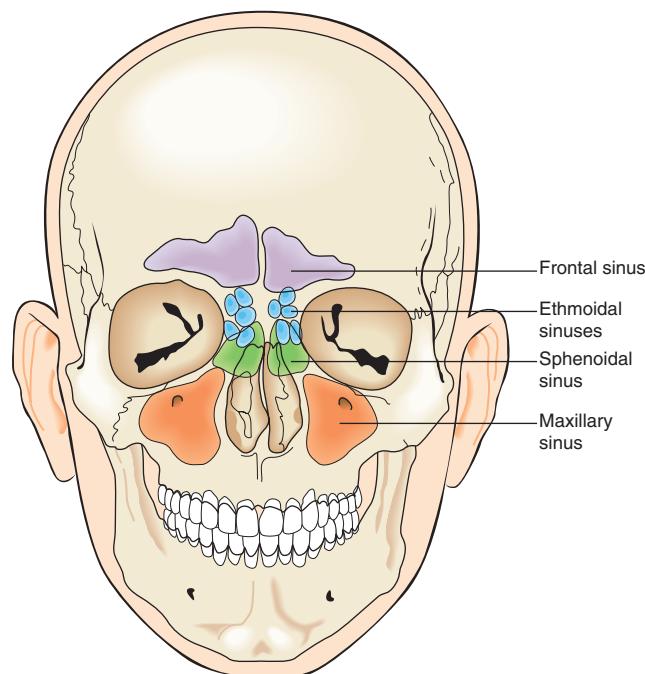
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Answer: nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles, alveoli.

## 15.4 Paranasal Sinuses

**Paranasal** (par-ah-NAY-zal) **sinuses** (Figure 15-5) are hollow spaces in the skull bones. They are named after the bones in which they lie. There are four paranasal sinuses: frontal, ethmoid, sphenoid, and maxillary. They are lined with mucous membrane, which helps moisten and warm the air that is breathed in. The paranasal sinuses also help in producing voice sounds.



**Figure 15-5** Paranasal sinuses.

## 15.5 Pleural and Mediastinal Cavities

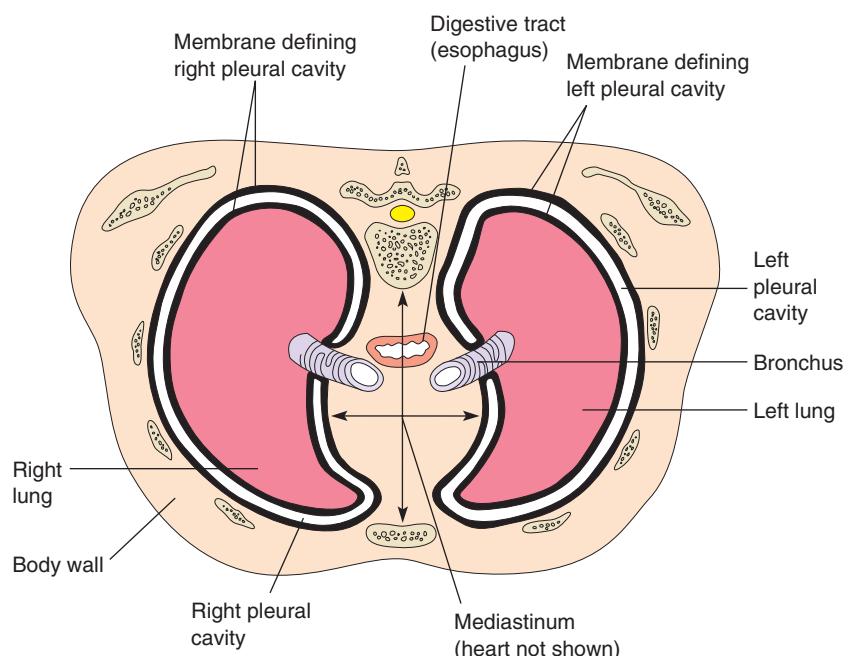
The thoracic cavity contains two smaller cavities called the **pleural** (PLOOR-al) and **mediastinal** (me-dee-as-TYE-nal) cavities (Figure 15-6). The mediastinal cavity is also known as the mediastinum (mee-dee-as-TYE-num).

As mentioned previously, the pleura surrounds the lungs. The pleura has an outer membrane and inner membrane. Between these two layers is an open space called the pleural cavity. This cavity is filled with fluid called pleural fluid. The fluid prevents friction between the two layers. The mediastinal cavity lies between the lungs and contains the heart, aorta, trachea, and esophagus.

### In Brief

**Pleural cavity** surrounds the lungs.

**Mediastinal cavity** is between the lungs.



**Figure 15-6** Mediastinal and pleural cavities.

### PRACTICE FOR LEARNING: Paranasal Sinuses, Pleural and Mediastinal Cavities

Fill in the blanks with the most appropriate answer.

1. Write the functions of the paranasal sinuses.

- \_\_\_\_\_
2. Where is the pleural cavity?
- \_\_\_\_\_

**3.** Where is the mediastinal cavity?

---

**4.** What does the pleural cavity contain?

---

**5.** What organs are in the mediastinal cavity?

---

Answers: 1. warms and moistens air and aids in producing voice sounds. 2. around the lungs. 3. between the lungs. 4. fluid. 5. heart, aorta, trachea, and esophagus.

## 15.6 New Roots, Suffixes, and Prefixes

Use these additional roots, suffixes, and prefixes when studying the medical terms in this chapter.

ROOT	MEANING
atel/o	incomplete; imperfect
py/o	pus

SUFFIX	MEANING
-lytic	pertaining to destruction, separation, or breakdown
-or	person or thing that does something

PREFIX	MEANING
eu-	normal; good
oligo-	scanty; few

## 15.7 Learning the Terms

Following these steps will make it easier for you to learn medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

## Roots

ROOT adenoid/o	MEANING adenoids	
Term	Term Analysis	Definition
<b>adenoidectomy</b> (ad-eh-noid-ECK-toh-mee)	-ectomy = excision; surgical removal	excision of the adenoids

ROOT bronchi/o; bronch/o	MEANING bronchus	
Term	Term Analysis	Definition
<b>chronic bronchitis</b> (KRAH-nick brong-KYE-tis)	chronic = disease lasting over a long period of time -itis = inflammation	inflammation of the bronchus lasting over a long period of time. Bronchitis is diagnosed as chronic when it lasts a total of three months in two consecutive years. Compare with <b>acute bronchitis</b> . Acute refers to sudden onset and short duration.
<b>bronchorrhea</b> (brong-koh-REE-ah)	-rrhea = flow; discharge	bronchial discharge
<b>bronchodilator</b> (brong-koh-DYE-lay-tor)	-or = person or thing that does something dilat/o = dilation; widening	drugs used to dilate the bronchus to relieve bronchospasm
<b>bronchospasm</b> (BRONG-koh-spazm)	-spasm = sudden, involuntary contraction	sudden, involuntary contraction of the bronchus

ROOT cost/o	MEANING rib	
Term	Term Analysis	Definition
<b>intercostal</b> (in-ter-KOS-tal)	-al = pertaining to inter- = between	pertaining to between the ribs
<b>infracostal</b> (in-frah-KOS-tal)	-al = pertaining to infra- = below	pertaining to below the ribs

ROOT laryng/o		MEANING larynx; voice box
Term	Term Analysis	Definition
<b>laryngotracheobronchitis</b> (lah-ring-goh-tray-kee-oh-brong-KYE-tis)	-itis = inflammation trache/o = trachea; windpipe	inflammation of the larynx and trachea. Also known as <b>croup (KROOP)</b> .  Croup is a disease of infants and young children.

ROOT muc/o		MEANING mucus (a sticky, thick secretion from mucous membrane)
Term	Term Analysis	Definition
<b>mucolytic</b> (myoo-koh-LIH-tick)	-lytic = pertaining to the breakdown or destruction	drugs used to break down thick mucus so it can be coughed up

ROOT nas/o (see also rhin/o)		MEANING nose
Term	Term Analysis	Definition
<b>nasopharyngeal</b> (nay-zoh-far-INN-jee-al)	-eal = pertaining to pharyng/o = pharynx; throat	pertaining to the nose and pharynx

ROOT ox/o		MEANING oxygen
Term	Term Analysis	Definition
<b>hypoxemia</b> (high-pock-SEE-mee-ah)	-emia = blood condition hypo- = below; abnormal decrease	abnormal decrease of oxygen levels in the blood
<b>hypoxia</b> (high-POCK-see-ah)	-ia = state of; condition hypo- = deficient; abnormal decrease	deficiency of oxygen to tissues

ROOT <b>pector/o</b> (see also <b>thorac/o</b> )		MEANING chest
Term	Term Analysis	Definition
<b>pectoral</b> (PECK-toh-rahl)	-al = pertaining to	pertaining to the chest

ROOT <b>pharyng/o</b>		MEANING throat; pharynx
Term	Term Analysis	Definition
<b>oropharyngeal</b> (or-oh-far-IN-jee-al)	-eal = pertaining to or/o = mouth	pertaining to the mouth and throat

ROOT <b>phren/o</b>		MEANING diaphragm
Term	Term Analysis	Definition
<b>phrenic</b> (FREN-ick)	-ic = pertaining to	pertaining to the diaphragm

ROOT <b>pleur/o</b>		MEANING pleura; pleural cavity
Term	Term Analysis	Definition
<b>pleural effusion</b> (PLOOR-al eh-FYOO-zhun)	-al = pertaining to effusion = movement of fluid out of the blood vessels and into the tissues	movement of fluid out of the blood vessels into the pleural cavity
<b>pleuritis</b> (ploor-EYE-tis)	-itis = inflammation	inflammation of the pleura; pleurisy
<b>pleurodynia</b> (ploor-oh-DIN-ee-ah)	-dynia = pain	pain in the pleural cavity; pleuralgia

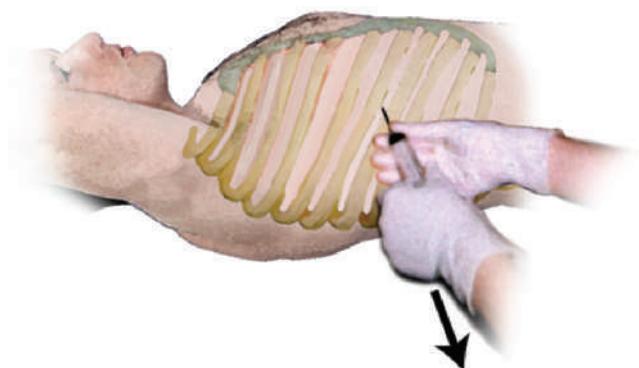
ROOT <b>pneumon/o; pulmon/o</b>		MEANING <b>lungs</b>
Term	Term Analysis	Definition
<b>pneumococcus</b> (noo-moh-KOCK-us)	-coccus = berry-shaped bacteria	berry-shaped bacteria attacking the lungs and other parts of the body. Illnesses can include: pneumonia, meningitis, middle ear infections, and septicemia. Plural form is pneumococci.
<b>pulmonary edema</b> (PUL-moh-ner-ee eh-DEE-mah)	-ary = pertaining to edema = accumulation of fluid in body tissues	accumulation of fluid in the lung tissue

ROOT <b>rhin/o</b>		MEANING <b>nose</b>
Term	Term Analysis	Definition
<b>otorhinolaryngology</b> (oh-toh-rye-noh-lar-in-GOL-oh-jee)	-logy = study of ot/o = ear laryng/o = voice box; larynx	the study of the ears, nose, and throat. Abbreviated ENT.
<b>rhinorrhea</b> (rih-noh-REE-ah)	-rrhea = discharge	discharge from the nose; runny nose
<b>rhinoplasty</b> (RYE-noh-plas-tee)	-plasty = surgical reconstruction; surgical repair	surgical repair of the nose; plastic surgery on the nose for cosmetic or reconstructive purposes; a nose job

ROOT <b>spir/o</b>		MEANING <b>breathing</b>
Term	Term Analysis	Definition
<b>spirometry</b> (spye-ROM-eh-tree)	-metry = process of measuring	process of measuring airflow and volume into and out of lungs

ROOT <b>steth/o</b>		MEANING <b>chest</b>
Term	Term Analysis	Definition
<b>stethoscope</b> (STETH-oh-skope)	-scope = instrument used to examine	instrument used to listen to chest sounds

ROOT <b>thorac/o</b>	MEANING chest	
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>thoracocentesis</b> (thoh-rah-koh-sen-TEE-sis)	-centesis = surgical puncture	surgical puncture to remove fluid from the pleural cavity (Figure 15-7). Also known as thoracentesis ( <b>thor</b> -ah-sen-TEE-sis) and pleurocentesis ( <b>ploor</b> -oh-sen-TEE-sis)

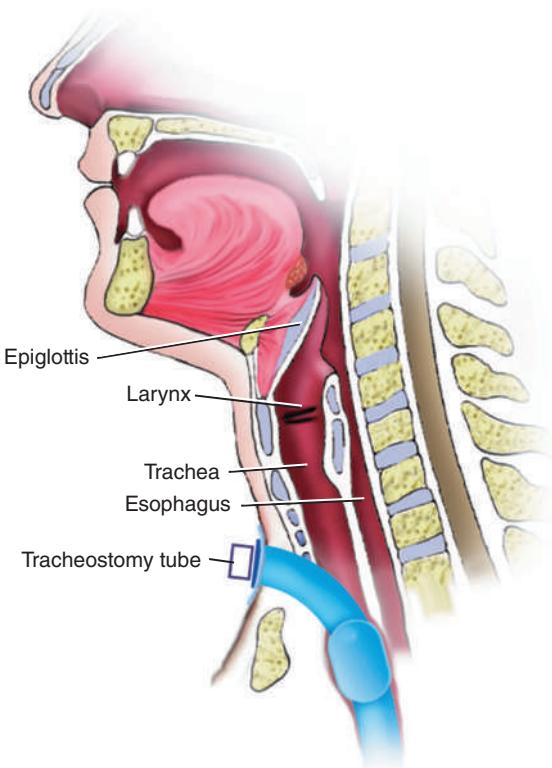


**Figure 15-7** Thoracocentesis.

<b>thoracotomy</b> (thor-ah-KOT-oh-mee)	-tomy = process of cutting	process of cutting into the chest
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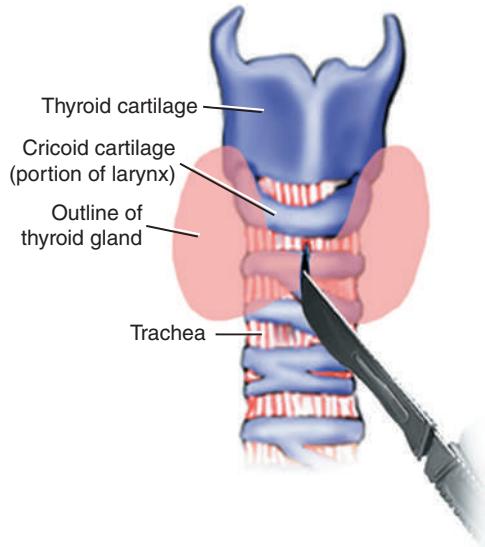
ROOT <b>tonsill/o</b>	MEANING tonsils	
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>tonsillectomy</b> (ton-sih-LECK-toh-mee)	-ectomy = surgical excision; removal	excision of the tonsils When the tonsils are removed with the adenoids, the operation is tonsillectomy and adenoidectomy (T&A).
<b>tonsillitis</b> (ton-sih-LYE-tis)	-itis = inflammation	inflammation of the tonsils

ROOT <b>trache/o</b>	MEANING <b>trachea; windpipe</b>	
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>endotracheal</b> (en-doh-TRAY-kee-al)	-eal = pertaining to endo- = within	pertaining to within the trachea
<b>tracheostomy</b> (tray-kee-OS-toh-mee)	-stomy = new opening	new opening into the trachea is created through the neck and a tube is inserted to assist breathing. The tracheostomy tube may be temporary or permanent (Figure 15-8).



**Figure 15-8** Tracheostomy.

<b>tracheotomy</b> (tray-kee-OT-oh-mee)	-tomy = process of cutting	process of cutting into the trachea (Figure 15-9)
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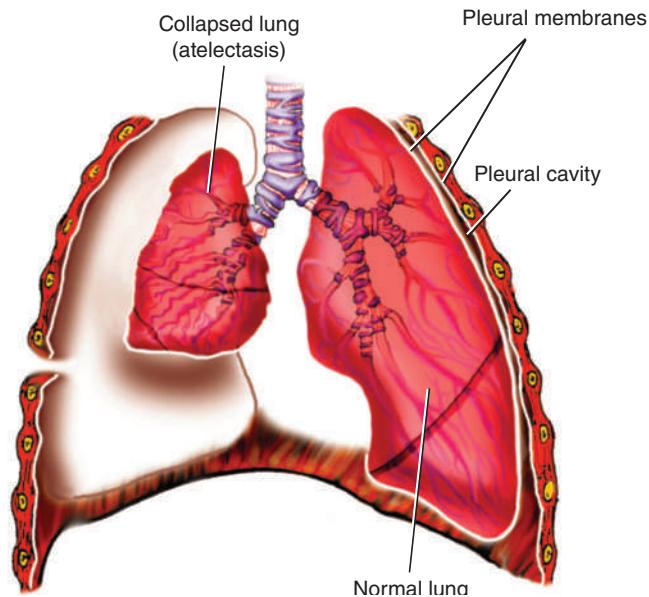


**Figure 15-9** Tracheotomy.

## Suffixes

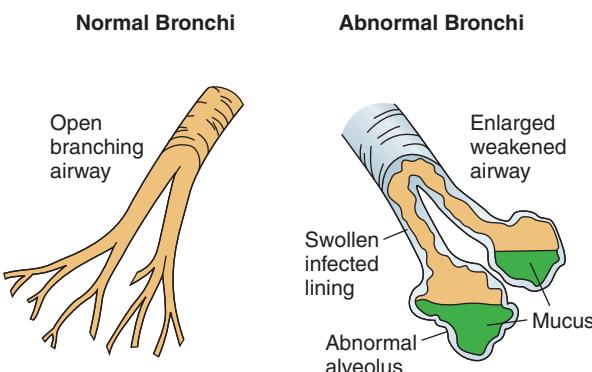
SUFFIX -capnia		MEANING carbon dioxide
Term	Term Analysis	Definition
<b>hypercapnia</b> (high-per-KAP-nee-ah)	hyper- = excessive; above normal	excessive levels of carbon dioxide in the blood

SUFFIX -ectasis		MEANING dilation; stretching; widening
Term	Term Analysis	Definition
<b>atelectasis</b> (at-eh-LECK-tah-sis)	atel/o = incomplete; imperfect	incomplete expansion of the lung; collapsed lung (Figure 15-10). If this condition happens in a newborn, it is called <b>hyaline</b> (HIGH-ah-leen) <b>membrane disease</b> .



**Figure 15-10** Atelectasis of right lung (collapsed lung).

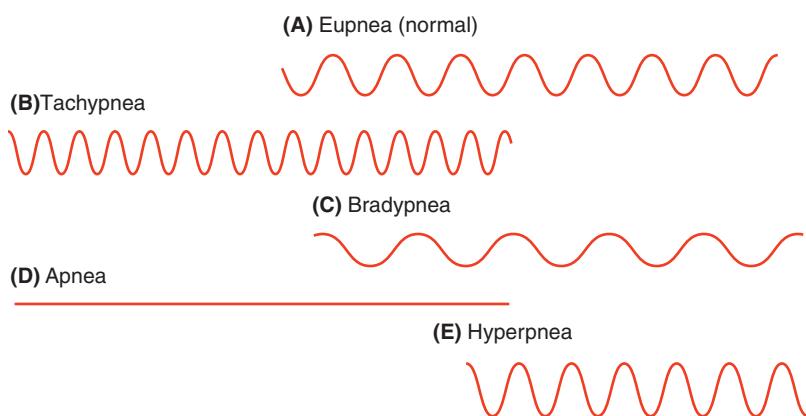
Term	Term Analysis	Definition
<b>bronchiectasis</b> (brong-kee-ECK-tah-sis)	bronchi/o = bronchus	dilation or widening of the bronchus (Figure 15-11)



**Figure 15-11** In bronchiectasis, the bronchi loses its elasticity and widens. Mucus accumulates in the alveoli, making breathing difficult.

SUFFIX -phonia	MEANING voice
<i>Term</i>	<i>Term Analysis</i>
<b>aphonia</b> (ah-FOH-nee-ah)	a- = no; not; lack of
<b>dysphonia</b> (dis-FOH-nee-ah)	dys- = difficult; bad; painful
	<i>Definition</i>
	loss of voice
	difficulty in speaking

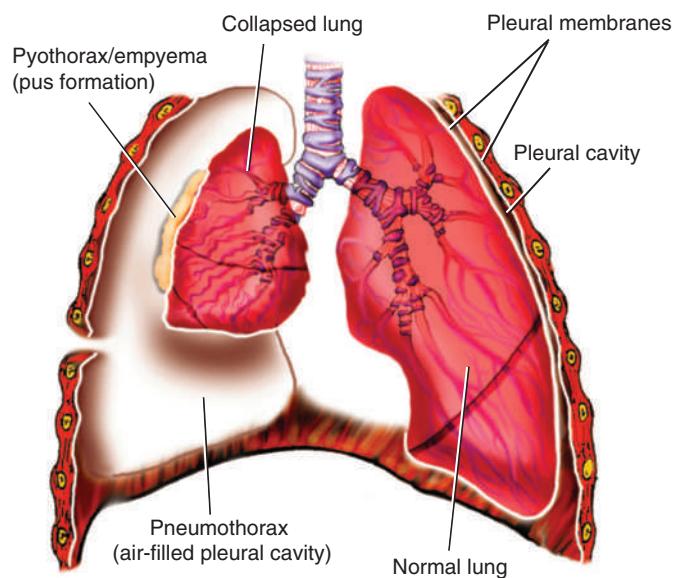
SUFFIX -pnea	Term Analysis	MEANING breathing
Term	Term Analysis	Definition
<b>apnea</b> (AP-nee-ah)	a- = no; not; lack of	no breathing (Figure 15-12D)
<b>bradypnea</b> (brad-ip-NEE-ah)	brady- = slow	slow breathing (Figure 15-12C)
<b>dyspnea</b> (DISP-nee-ah)	dys- = painful; difficult; bad	painful breathing
<b>eupnea</b> (yoop-NEE-ah)	eu- = normal; good	normal breathing (Figure 15-12A)
<b>hyperpnea</b> (high-perp-NEE-ah)	hyper- = abnormal increase; excessive	abnormal increase in depth and rate of breathing (Figure 15-12E)
<b>oligopnea</b> (ol-ih-gop-NEE-ah)	oligo- = scanty; few	infrequent breathing
<b>orthopnea</b> (or-thop-NEE-ah)	ortho- = straight	difficulty breathing except in the upright position
<b>tachypnea</b> (tack-ip-NEE-ah)	tachy- = fast	fast breathing (Figure 15-12B)

**Figure 15-12** Breathing patterns.

SUFFIX -ptysis	Term Analysis	MEANING spitting
Term	Term Analysis	Definition
<b>hemoptysis</b> (hee-MOP-tih-sis)	hem/o = blood	spitting up of blood

SUFFIX <b>-sphyxia</b>		MEANING pulse
Term	Term Analysis	Definition
<b>asphyxia</b> (as-FICK-see-ah)	a- = no; not; lack of	lack of oxygen to body tissues; can interfere with respiration and eventually lead to a loss of pulse

SUFFIX <b>-thorax</b>		MEANING chest
Term	Term Analysis	Definition
<b>hemothorax</b> (hee-moh-THOR-acks)	hem/o = blood	blood in the pleural cavity
<b>hydrothorax</b> (high-droh-THOR-acks)	hydr/o = water	fluid in the pleural cavity
<b>pneumothorax</b> (noo-moh-THOR-acks)	pneum/o = air	collection of air in the pleural cavity (Figure 15-13)
<b>pyothorax</b> (pye-oh-THOR-acks)	py/o = pus	pus in the pleural cavity (Figure 15-13); <b>empyema</b> (em-pye-EE-mah)



**Figure 15-13** Pneumothorax and pyothorax. External pressure from air or pus causes the lung to collapse.

## 15.8 Pathology

### Allergic rhinitis (rye-NYE-tis)

This condition is an allergic response to inhaled allergens (foreign substances). It is characterized by rhinorrhea, ophthalmorrhea, nasal pruritus (itchiness), and congestion. Also includes hay fever and seasonal rhinitis due to the inhalation of pollen and molds.

### Asthma (AZ-mah)

A bronchospasm that results in airway obstruction (Figure 15-14). Inhaled allergens, such as chemicals, pollen, dust, or mold, can irritate the airways. This can cause bronchospasm, which obstructs the airways and makes breathing difficult.

Although the bronchospasm can be reversed with the proper drug treatment, prolonged spasm of the bronchus can be fatal.

### Bronchogenic Carcinoma

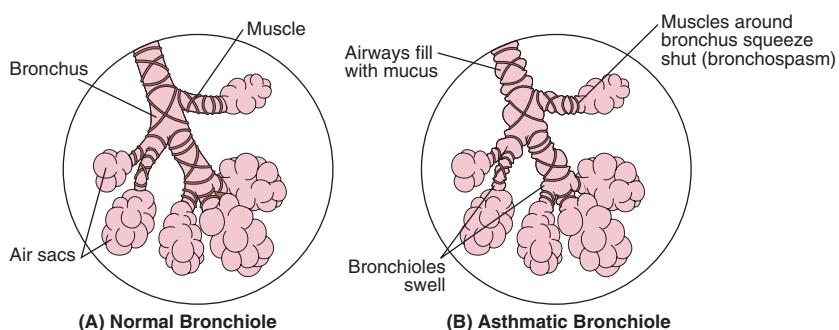
Malignant neoplasm of the lung arising from the bronchus or bronchioles.

Cigarette smoking is the cause of most lung cancers. Other factors may be radiation exposure and inhalation of carcinogenic agents such as asbestos.

Treatment includes surgery to remove the tumor. Radiotherapy and chemotherapy are also used to kill cancer cells.

### Chronic Obstructive Pulmonary Disease (COPD)

COPD is a chronic disease of the respiratory tract that obstructs air flow to the lungs and body tissues. The diagnosis is given to the patient when they have two or more of the



**Figure 15-14** Asthma. A. Normal bronchiole: muscles are relaxed and the airways are open. B. Asthmatic bronchiole: muscles tighten and airways fill with mucus.

following chronic conditions: chronic bronchitis, asthma, and emphysema (described below). Over time, these conditions weaken the lung, making breathing difficult.

### Cystic Fibrosis (**SIS-tick fye-BROH-sis**)

Cystic fibrosis (CF) is a genetic disease involving the lungs, pancreas, and sweat glands. The abnormal secretion of thick gel-like mucus from these organs causes damage to the lung, nutritional deficiency, and sweat gland abnormalities.

### Deviated Nasal Septum (**NAY-zal SEP-tum**)

This condition is a shift of the nasal septum away from the midline, usually caused by trauma.

### Emphysema (**em-fih-SEE-mah**)

Emphysema involves loss of elasticity and overexpansion (dilation) of the alveoli. Once this happens, they do not return to their normal size and the air becomes trapped in them. This obstructs the passage of oxygen from the lungs into body tissues. This leads to eventual destruction of the alveoli and loss of pulmonary function. Cigarette smoking is a major risk factor.

### Epistaxis (**ep-ih-STACK-sis**)

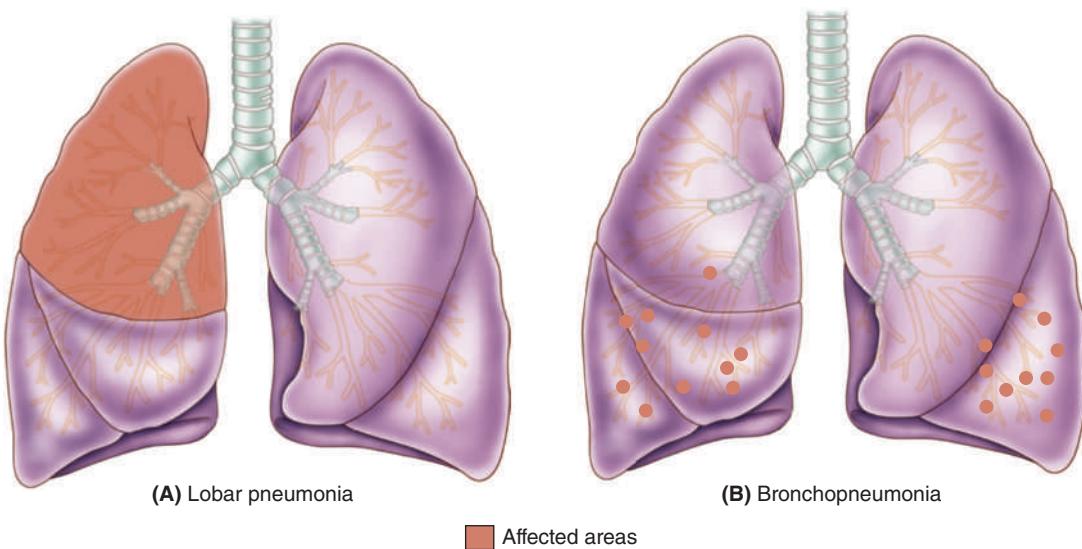
Bleeding from the nostrils or nosebleed. Trauma to the nose is the usual cause, although a dry climate can also cause bleeding. As for diseases, upper respiratory tract infection, allergies, drug intake, and blood disorders are common causes.

### Pneumoconiosis (**new-moh-koh-nee-OH-sis**), Black Lung

Accumulation of dust particles in the lung from long exposure and inhalation of irritants, often from an occupational environment. The numerous types of pneumoconioses are named for the type of dust inhaled. **Silicosis** (sill-ih-KOH-sis) is caused by the inhalation of silica dust found in quartz and sand. **Anthracosis** (an-thrah-KOH-sis) is caused by the inhalation of coal dust. It is also known as **black lung disease**. Asbestosis is caused by the inhalation of asbestos.

### Pneumonia (**noo-MOH-nee-ah**); Pneumonitis (**noo-mon-EYE-tiss**)

Pneumonia is inflammation of the lung caused by infection. As the condition progresses, the effects of the inflammatory process cause the lung to become solid. This is called **consolidation** (kon-sol-ih-DAY-shun). This hinders the exchange of oxygen and carbon



**Figure 15-15** Two types of pneumonia. A. Lobar pneumonia results in consolidation of a lobe of the lung. B. In bronchopneumonia there is consolidation around the bronchioles.

dioxide between blood vessels. Following a regime of antibiotic therapy, the pneumonia resolves, and the consolidation disappears. This is called **resolution**.

Pneumonia is described by the type of infectious material or the location of the pneumonia (Figure 15-15). For example, streptococcus pneumonia is caused by streptococcus bacteria, while lobar pneumonia is pneumonia affecting a lobe of the lung. **Aspiration pneumonia** does not describe the infectious material or location of the pneumonia. Aspiration pneumonia is caused by the intake (aspiration) of food, liquid, or vomit into the lung.

### Tuberculosis (too-ber-kyoo-LOH-sis)

Tuberculosis (TB) is caused by the **Mycobacterium** (*my-koh-back-TEER-ee-um*) **tuberculosis** bacteria, which is carried through the air and inhaled into the lungs. Most often TB is seen in patients with a weakened immune system caused by conditions such as AIDS.

### 15.9 Look-Alike and Sound-Alike Words

*Below is a list of look-alike and sound-alike words. Study the spelling and definitions of each set of words. Questions will follow in the Review Exercises.*

**TABLE 15-1 Look-Alike and Sound-Alike**

<b>breath</b>	(BREETH) air taken into the lungs (noun)
<b>breathe</b>	(BREETH) to take air into the lungs (verb)
<b>expiration</b>	to breathe out from the lung
<b>inspiration</b>	to draw air into the lungs
<b>perfusion</b>	to pour through (to perfuse blood through blood vessels)
<b>profusion</b>	abundance; excess
<b>hoarse</b>	harsh and rough in sound
<b>horse</b>	a four-legged, hoofed animal
<b>course</b>	sequence of events
<b>coarse</b>	rough; abrasive
<b>intracostal</b>	within the ribs
<b>intercostal</b>	between the ribs
<b>infracostal</b>	below the ribs
<b>mucous (adjective)</b>	pertaining to mucus. Mucous (adjective) describes membrane (noun). For example mucous membrane.
<b>mucus (noun)</b>	thick, sticky substance secreted from mucous membrane
<b>rales</b>	abnormal crackling sound heard on respiration
<b>rails</b>	a bar extending from one support to another to form a railing or guardrail

## 15.10 Review Exercises

### EXERCISE 15-1 Look-Alike and Sound-Alike Words

Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 15-1 if it helps you.

1. On examination there was decreased (**breath/breathe**) sounds in the lower third of the right lung.
2. The patient has recurring pain when he tries to (**breath/breathe**).
3. (**Inspiratory/Expiratory**) wheezing was noted when the patient took a deep (**breath/breathe**).

4. The head injury caused a (**perfusion/profusion**) of blood.
5. The lung scan showed normal (**profusion/perfusion**) of blood through the lungs.
6. The child was seen two days ago, and at that time had a barky cough and sounded (**hoarse/horse**).
7. The disease took its normal (**course/coarse**), and the patient was discharged seven days following admission.
8. Chest x-ray showed the lung tissue to be (**course/coarse**) and granular.
9. Lungs were noted to have (**rails/rales**) at the left base with decreased (**breath/breathe**) sounds.
10. Place the (**rales/rails**) in the upright position.
11. The patient was seen in the emergency room coughing up (**mucous/mucus**) and vomiting blood.
12. On examination, the (**mucus/mucous**) membrane showed redness and scarring.

### EXERCISE 15-2 Matching Word Parts with Meaning

Match the word part in Column A with its meaning in Column B.

Column A	Column B
_____	1. ox/o
_____	2. -ectasis
_____	3. pector/o
_____	4. phren/o
_____	5. oligo-
_____	6. pulmon/o
_____	7. rhin/o
_____	8. -ar
_____	9. eu-
_____	10. ortho-
_____	11. -phonia
_____	12. -pnea
_____	13. -sphyxia
	A. pertaining to
	B. diaphragm
	C. voice
	D. straight
	E. normal
	F. nose
	G. oxygen
	H. dilation
	I. chest
	J. few; scanty
	K. lung
	L. pulse
	M. breathing

### EXERCISE 15-3 Matching—Anatomy

Match the structure in Column A with its description in Column B.

Column A	Column B
_____	1. cilia
_____	2. olfactory neurons
_____	3. pharynx
_____	4. paranasal sinuses
_____	5. larynx
_____	6. alveoli
_____	7. trachea
_____	8. sputum
_____	9. epiglottis
_____	10. nares
	A. exchanges oxygen and carbon dioxide
	B. prevents food from entering the respiratory tract
	C. nostrils
	D. mucus and other matter ejected from the mouth
	E. throat
	F. filters out dust particles
	G. voice box
	H. windpipe
	I. warms and moistens air
	J. sense of smell

### EXERCISE 15-4 Pathology

Select the disease from the list below that best fits its description that follows.

pneumoconiosis \_\_\_\_\_

asthma \_\_\_\_\_

atelectasis \_\_\_\_\_

tuberculosis \_\_\_\_\_

croup \_\_\_\_\_

emphysema \_\_\_\_\_

pleurisy \_\_\_\_\_

pneumonia \_\_\_\_\_

bronchiectasis \_\_\_\_\_

cystic fibrosis \_\_\_\_\_

1. Bronchospasm resulting in airway obstruction \_\_\_\_\_

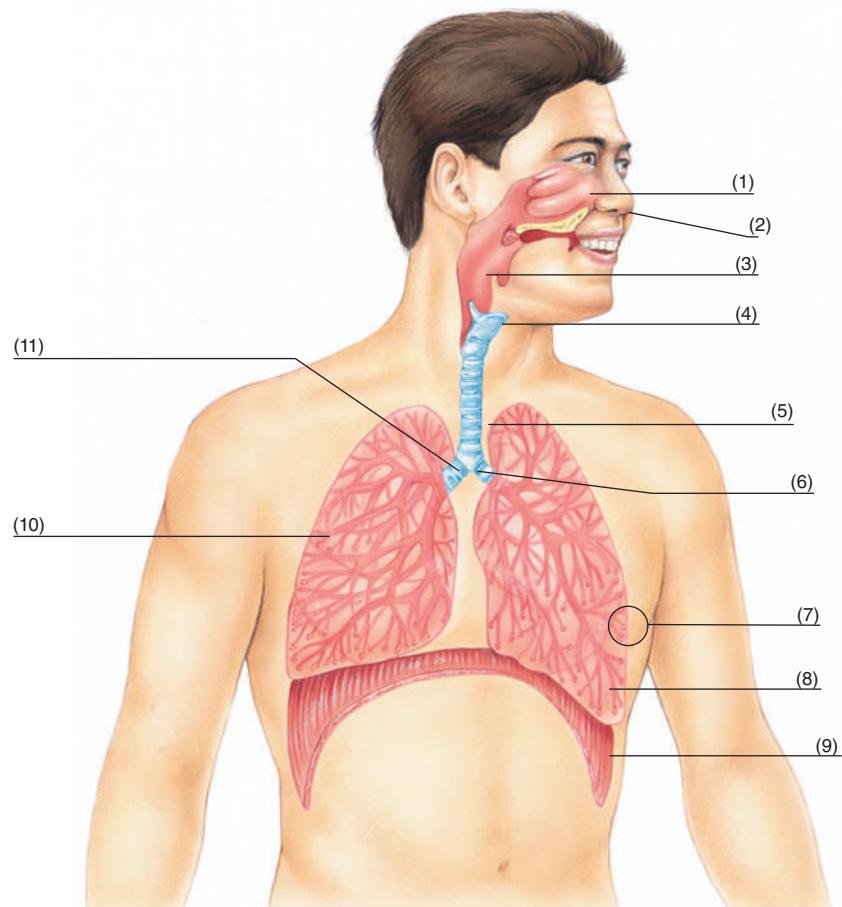
2. Overexpansion of the alveoli \_\_\_\_\_

3. Inflammation of the pleura \_\_\_\_\_

4. Widening of the bronchi traps mucus in the bronchial tubes, causing obstructed airflow \_\_\_\_\_
5. Inflammation of the lung \_\_\_\_\_
6. Inflammation of the larynx, trachea, and bronchus in young children  
\_\_\_\_\_
7. Incomplete expansion of the alveoli \_\_\_\_\_
8. A genetic disease involving the lungs, pancreas, and sweat glands  
\_\_\_\_\_
9. Caused by a type of *Mycobacterium* \_\_\_\_\_
10. Accumulation of dust particles in the lungs \_\_\_\_\_

### EXERCISE 15-5 Labeling—Respiratory Tract

Using the body structures listed below, label Figure 15-16. Write your answer in the numbered spaces provided below, or if you prefer, on the diagram.



**Figure 15-16** Structures of the respiratory system.

alveoli \_\_\_\_\_

bronchiole \_\_\_\_\_

diaphragm \_\_\_\_\_

larynx \_\_\_\_\_

left bronchus \_\_\_\_\_

nares \_\_\_\_\_

nasal cavity \_\_\_\_\_

pharynx \_\_\_\_\_

right bronchus \_\_\_\_\_

right lung \_\_\_\_\_

trachea \_\_\_\_\_

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_
10. \_\_\_\_\_
11. \_\_\_\_\_

### EXERCISE 15-6 Definitions—Anatomy

Define the following terms in the space provided.

1. **upper respiratory tract** \_\_\_\_\_
2. **paranasal sinuses**. Name four paranasal sinuses. \_\_\_\_\_  
\_\_\_\_\_

3. **olfactory neurons** \_\_\_\_\_
4. **mediastinum** \_\_\_\_\_
5. **nasal septum** \_\_\_\_\_
6. **nares** \_\_\_\_\_
7. **pulmonary capillaries** \_\_\_\_\_
8. **alveoli** \_\_\_\_\_
9. **mucous** \_\_\_\_\_
10. **mucus** \_\_\_\_\_

#### EXERCISE 15-7 Definitions—Learning the Terms

Define the following terms.

1. **bronchodilator** \_\_\_\_\_
2. **mucolytic** \_\_\_\_\_
3. **phrenic** \_\_\_\_\_
4. **pulmonary edema** \_\_\_\_\_
5. **otorhinolaryngology** \_\_\_\_\_
6. **rhinorrhea** \_\_\_\_\_
7. **stethoscope** \_\_\_\_\_
8. **thoracotomy** \_\_\_\_\_
9. **aphonia** \_\_\_\_\_
10. **dysphonia** \_\_\_\_\_
11. **orthopnea** \_\_\_\_\_
12. **bradypnea** \_\_\_\_\_
13. **hemoptysis** \_\_\_\_\_
14. **asphyxia** \_\_\_\_\_
15. **nasopharyngeal** \_\_\_\_\_
16. **eupnea** \_\_\_\_\_
17. **oligopnea** \_\_\_\_\_
18. **tonsillitis** \_\_\_\_\_

**EXERCISE 15-8 Building Medical Words**

I. Use the suffix *-pnea* to build medical words for the following definitions.

- a. fast breathing \_\_\_\_\_
- b. breathing only in the upright position \_\_\_\_\_
- c. no breathing \_\_\_\_\_
- d. slow breathing \_\_\_\_\_
- e. infrequent breathing \_\_\_\_\_
- f. abnormal increase in depth and rate of breathing  
\_\_\_\_\_
- g. difficult breathing \_\_\_\_\_
- h. normal breathing \_\_\_\_\_

II. Use *rhin/o* to build medical words for the following definitions.

- a. discharge from the nose \_\_\_\_\_
- b. surgical reconstruction of the nose \_\_\_\_\_

III. Use *trache/o* to build medical words for the following definitions.

- a. new opening into the trachea \_\_\_\_\_
- b. process of cutting into the trachea \_\_\_\_\_
- c. pertaining to within the trachea \_\_\_\_\_

IV. Use *-thorax* to build medical words for the following definitions.

- a. blood in the pleural cavity \_\_\_\_\_
- b. pus in the pleural cavity \_\_\_\_\_
- c. water in the pleural cavity \_\_\_\_\_
- d. air in the pleural cavity \_\_\_\_\_

**EXERCISE 15-9 Definitions in Context**

Define the bolded terms in context. Use your medical dictionary if necessary.

This 64-year-old female with advanced **COPD** was admitted to the hospital with a five-day history of increased **dyspnea** to the point that she was **SOB** (had shortness of breath) at rest.

There was evidence of right **inferior lobe pneumonia** on x-ray. Laboratory tests including **hemoglobin** and white blood cell count were normal. **Sputum** taken from the **oropharynx** was examined for growth of **streptococci** and **staphylococci**.

- a. COPD \_\_\_\_\_
- b. dyspnea \_\_\_\_\_
- c. SOB \_\_\_\_\_
- d. inferior lobe pneumonia \_\_\_\_\_
- e. hemoglobin \_\_\_\_\_
- f. sputum \_\_\_\_\_
- g. oropharynx \_\_\_\_\_
- h. streptococci \_\_\_\_\_
- i. staphylococci \_\_\_\_\_

### EXERCISE 15-10 Spelling

*Circle any words that are spelled incorrectly in the list below. Then correct the spelling in the space provided.*

- 1. diaphram \_\_\_\_\_
- 2. epiglottis \_\_\_\_\_
- 3. dispnea \_\_\_\_\_
- 4. plurisy \_\_\_\_\_
- 5. mediastinum \_\_\_\_\_
- 6. stethoscope \_\_\_\_\_
- 7. tackypnea \_\_\_\_\_
- 8. emphysema \_\_\_\_\_
- 9. plural cavity \_\_\_\_\_
- 10. asphixia \_\_\_\_\_

### Animations

Visit the companion website to view the videos on **Respiration Safeguards, Bronchial Structures, and Asthma**.

## 15.11 Pronunciation and Spelling

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

Word	Pronunciation	Spelling
<b>adenoidectomy</b>	<b>ad-eh-noid-ECK-toh-mee</b>	
<b>alveoli</b>	<b>al-VEE-oh-lye</b>	
<b>asthma</b>	<b>AZ-mah</b>	
<b>atelectasis</b>	<b>at-eh-LECK-tah-sis</b>	
<b>bradypnea</b>	<b>brad-ip-NEE-ah</b>	
<b>bronchiectasis</b>	<b>brong-kee-ECK-tah-sis</b>	
<b>bronchiole</b>	<b>BRONG-kee-ohl</b>	
<b>bronchitis</b>	<b>brong-KYE-tis</b>	
<b>bronchodilator</b>	<b>brong-koh-DYE-lay-tor</b>	
<b>bronchus</b>	<b>BRONG-kus</b>	
<b>cilia</b>	<b>SIL-ee-ah</b>	
<b>croup</b>	<b>KROOP</b>	
<b>diaphragm</b>	<b>DYE-ah-fram</b>	
<b>dysphonia</b>	<b>dis-FOH-nee-ah</b>	
<b>emphysema</b>	<b>em-fih-SEE-mah</b>	
<b>empyema</b>	<b>em-pye-EE-mah</b>	
<b>endotracheal</b>	<b>en-doh-TRAY-kee-al</b>	
<b>epiglottis</b>	<b>ep-ih-GLOT-is</b>	
<b>eupnea</b>	<b>yoop-NEE-ah</b>	
<b>hemothorax</b>	<b>hee-moh-THOR-acks</b>	
<b>hydrothorax</b>	<b>high-droh-THOR-acks</b>	
<b>hyperpnea</b>	<b>high-perp-NEE-ah</b>	
<b>hypoxia</b>	<b>high-POCK-see-ah</b>	
<b>laryngotracheobronchitis</b>	<b>lah-ring-goh-tray-kee-oh-brong-KYE-tis</b>	
<b>mediastinal</b>	<b>me-dee-as-TYE-nal</b>	
<b>larynx</b>	<b>LAR-inks</b>	

Word	Pronunciation	Spelling
<b>mucolytic</b>	<b>myoo-koh-LIH-tick</b>	
<b>nares</b>	<b>NAH-reez</b>	
<b>olfactory</b>	<b>ol-FACK-toh-ree</b>	
<b>oligopnea</b>	<b>ol-ih-GOP-nee-ah</b>	
<b>orthopnea</b>	<b>or-thop-NEE-ah</b>	
<b>otorhinolaryngology</b>	<b>oh-toh-rye-noh-lar-in- GOL-oh-jee</b>	
<b>pharynx</b>	<b>FAR-inks</b>	
<b>pleura</b>	<b>PLOOR-al</b>	
<b>pleurisy</b>	<b>PLOOR-ih-see</b>	
<b>pneumonia</b>	<b>noo-MOH-nee-ah</b>	
<b>stethoscope</b>	<b>STETH-oh-skope</b>	
<b>tonsillectomy</b>	<b>ton-sih-LECK-toh-mee</b>	
<b>trachea</b>	<b>TRAY-kee-ah</b>	
<b>tracheostomy</b>	<b>tray-kee-OS-toh-mee</b>	



# CHAPTER 16

# Urinary System



## Chapter Outline

- 16.1** Major Organs of the Urinary System
- 16.2** Structure and Function of the Urinary System
- 16.3** Urine Production in the Kidney
- 16.4** New Roots, Suffixes, and Prefixes
- 16.5** Learning the Terms
- 16.6** Pathology
- 16.7** Look-Alike and Sound-Alike Words
- 16.8** Review Exercises
- 16.9** Pronunciation and Spelling

## Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

1. Name and locate the organs of the urinary system.
2. Describe the structure and functions of the kidney, ureters, bladder, and urethra.
3. Describe how the kidneys produce urine.
4. Pronounce, spell, define, and write the medical terms related to the urinary system.
5. Describe common diseases of the urinary system.
6. Listen, read, and study so you can speak and write.

## Introduction

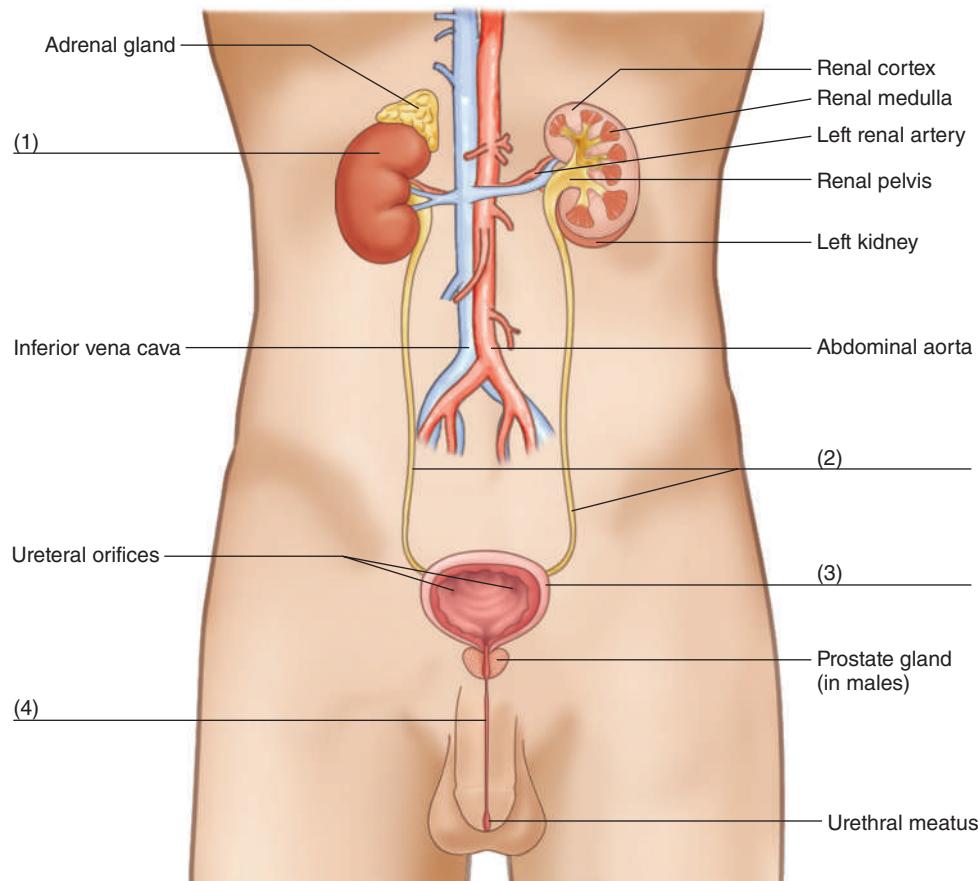
In previous chapters you learned that when the blood delivers oxygen to the cells, it also picks up carbon dioxide and other waste products. Through

the process of respiration, the carbon dioxide goes from the blood into the alveoli in the lungs. It is then exhaled from the body. The other waste products remain in the blood. The urinary system filters these waste products from the blood and excretes them from the body.

## 16.1 Major Organs of the Urinary System

### PRACTICE FOR LEARNING: Major Organs of the Urinary System

Write the words below in the correct spaces on Figure 16-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.



**Figure 16-1** Major organs of the urinary system.

1. **right** kidney (**KID**-nee)
2. ureters (yoo-**REE**-terz)
3. urinary bladder (**YOO**-rih-**nar**-ee **BLAH**-der)
4. urethra (yoo-**REE**-thrah)

The urinary system is illustrated in Figure 16-1. It consists of two kidneys, two tubes called ureters, a sac called the urinary bladder, and another tube called the urethra.

## 16.2 Structure and Function of the Urinary System

### Kidneys

The kidneys are each shaped like a bean. They are about the size of your fist. They are located at the back of the abdomen, one on each side of the lumbar vertebrae. The kidneys filter the blood to remove waste products. These waste products combine with water to form **urine** (**YOO**-rin). Urine flows out of the kidneys into the **renal pelvis** (**REE**-nal **PEL**-vis), which is the dilated portion of the ureter.

The kidneys also maintain a proper balance of electrolytes, water, and acids within body fluids. Electrolytes, such as sodium ( $\text{Na}^+$ ), potassium ( $\text{K}^+$ ), and calcium ( $\text{Ca}^+$ ), are important to muscle and nerve function. When the level of these electrolytes is too high, the kidney secretes them into the urine. When the body needs these products, they are held back in the body fluid.

### Ureters, Bladder, and Urethra

As you can see in Figure 16-1, the ureters are long, narrow tubes that connect the kidneys to a sac called the urinary bladder. Urine constantly flows through the ureters to the urinary bladder. The urine enters the bladder through ureteral orifices (**OR**-ih-fis-ez) in the wall of the urinary bladder. Orifice means opening. The bladder stores urine. When the bladder is full, the urine is squeezed out into the urethra. This act of emptying the bladder is called **voiding**, **urination**, or **micturition** (**mick**-too-RIH-shun). This action is regulated by the nervous system. Any dysfunction of the urinary bladder due to disease of the nervous system is called **neurogenic** (**noor**-oh-JEN-ick) **bladder**.

The urethra (Figure 16-1) carries urine out of the body. In females, the urethra is about 1.6 inches (4.1 cm) long. In males, it is approximately 8 inches (20.3 cm), running through the penis. In the male, the urethra also serves as part of the reproductive system for the transport of sperm. The external opening of the urethra is called the **urinary meatus** (mee-AY-tuss).

**In Brief****Kidneys**

Filter blood, remove waste products

Urine moves from the kidneys → ureters → urinary bladder  
→ urethra → out of the body

**Electrolytes**

sodium, potassium, calcium

**Function**

muscle and nerve function

**PRACTICE FOR LEARNING: Kidneys, Ureters, Bladder, and Urethra**

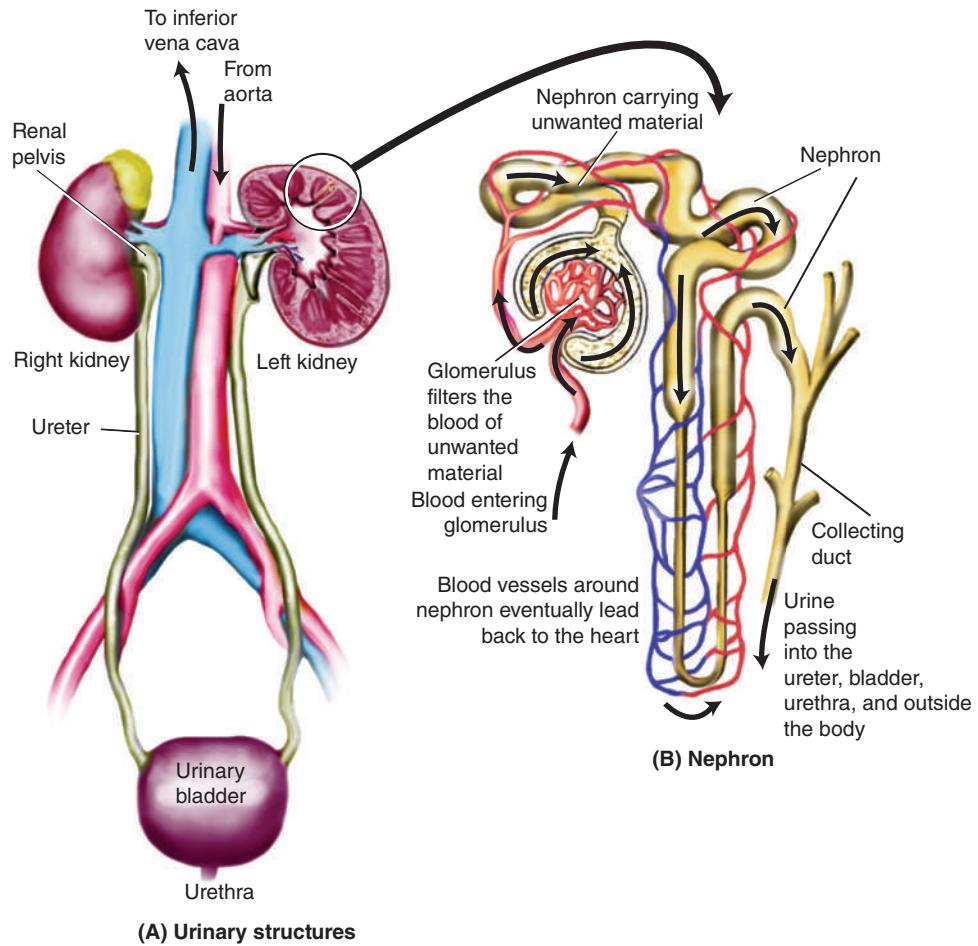
Choose the correct answer from the choices in parentheses.

1. The (bladder/ureter/urethra) is a long, narrow tube extending from the kidney for the passage of urine.
2. Urine is stored in the (ureter/urethra/bladder/kidney).
3. The (kidneys/ureters/bladder/urethra) filter waste products from the blood.
4. All blood goes to the (kidneys/ureters/bladder/urethra).
5. The (kidneys/ureters/bladder/urethra) is (are) part of the male reproductive system.

Answers: 1. ureter. 2. bladder. 3. kidneys. 4. kidneys. 5. urethra.

### 16.3 Urine Production in the Kidney

Inside each kidney, there are approximately one million **nephrons** (NEF-ronz) (Figure 16-2). These microscopic structures are responsible for filtering the blood and producing urine. Using your finger on Figure 16-2B, follow the path that blood flows through the kidneys. Start at the **glomerulus** (gloh-MER-yoo-luss), the first part of the nephron. It filters the blood of waste products and unnecessary nutrients. The filtered blood continues through the blood vessels returning to the heart. The unwanted material combines with water to form urine. The urine travels the length of the nephron and is excreted through the **collecting ducts**, ureters, and urethra to the outside of the body. Notice the blood vessels around the nephron. These are called the **peritubular capillaries**. The close proximity of the vessels to the nephron allows waste products and nutrients to move easily between the two.



**Figure 16-2** The nephron.

### In Brief

The **nephron** filters unwanted material from the blood. Filtered (cleaned) blood remains inside the blood vessels and returns to the heart. The unwanted material stays in the nephron and is excreted as urine.

## 16.4 New Roots, Suffixes, and Prefixes

Use these additional roots when studying the medical terms in this chapter.

ROOT	MEANING
<b>noct/o</b>	night
<b>urin/o</b>	urine

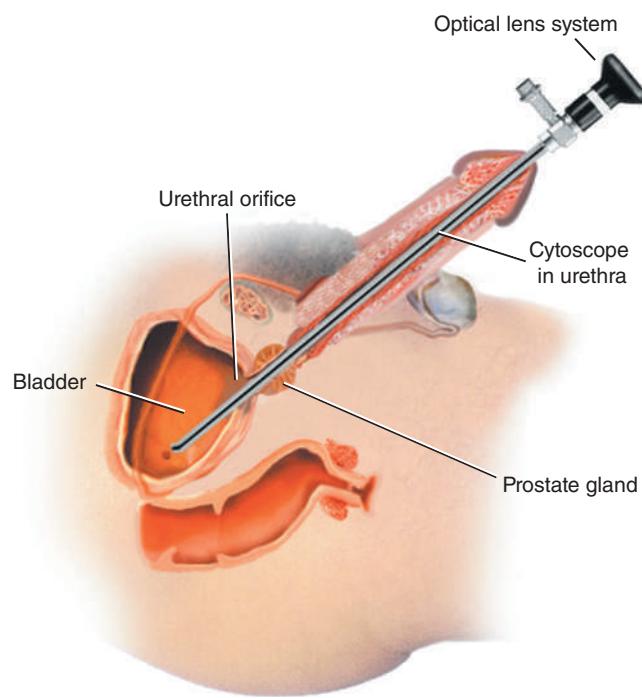
## 16.5 Learning the Terms

Following these steps will make it easier for you to learn medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

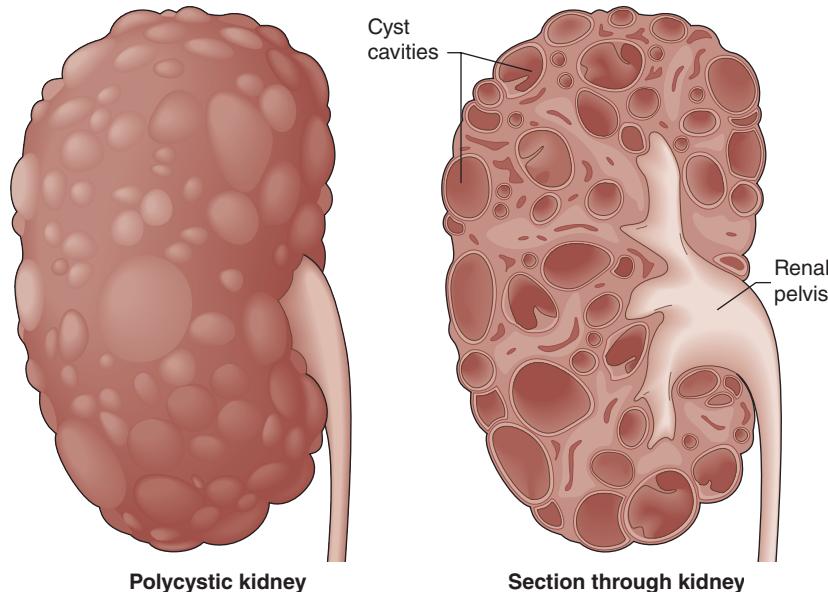
### Roots

ROOT <b>cyst/o</b> (see also <b>vesic/o</b> )		MEANING bladder; cyst (closed sac or cavity filled with fluid)
Term	Term Analysis	Definition
<b>cystitis</b> (sis-TYE-tis)	-itis = inflammation	inflammation of the bladder
<b>cystocele</b> (SIS-toh-seel)	-cele = hernia; <b>protrusion or displacement of an organ</b>	displacement of the bladder against the vaginal wall
<b>cystopexy</b> (SIS-toh-peck-see)	-pexy = surgical fixation	surgical fixation of the bladder to the abdominal wall
<b>cystoscopy</b> (sis-TOS-koh-pee)	-scopy = process of visually examining	process of visually examining the bladder (Figure 16-3).



**Figure 16-3** Cystoscopy.

Term	Term Analysis	Definition
<b>polycystic kidneys</b> (pol-ee-SIS-tick)	-ic = pertaining to poly- = many In this term, the root cyst/o = cyst	cysts gradually replace normal renal tissue. With the replacement of normal renal tissue with many cysts, the kidney is unable to function, resulting in renal failure. (Figure 16-4)



**Figure 16-4** Polycystic kidneys.

**ROOT**  
**glomerul/o**

**MEANING**  
**glomerulus (portion of the nephron that filters blood)**

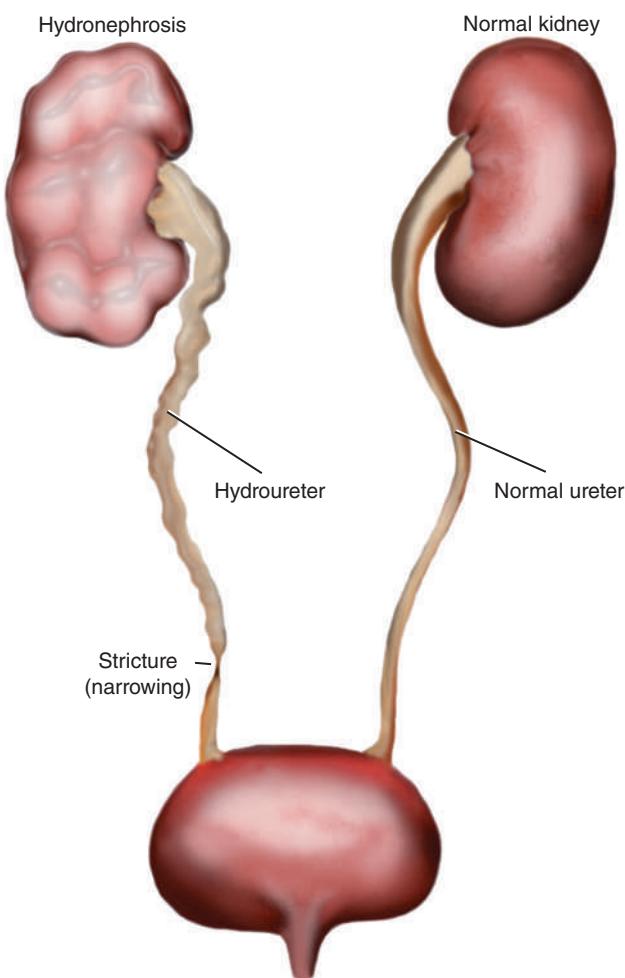
Term	Term Analysis	Definition
<b>glomerulonephritis</b> (glohm-mer-yoo-loh-neh-FRY-tis)	-itis = inflammation nephro/o = kidney	inflammation of the glomerulus and kidney; Bright disease

**ROOT**  
**meat/o**

**MEANING**  
**meatus (opening at the tip of the urethra)**

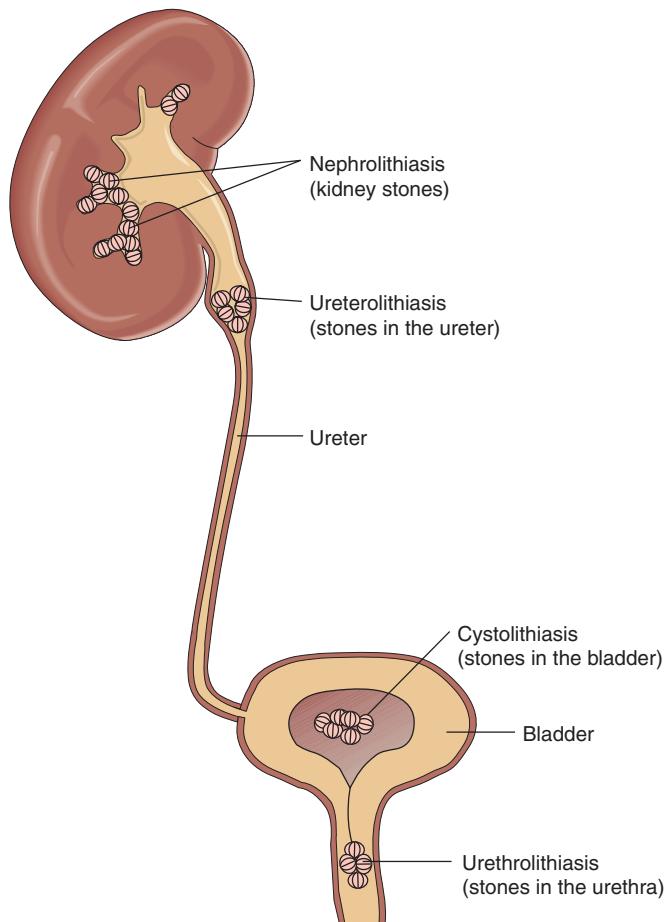
Term	Term Analysis	Definition
<b>meatotomy</b> (mee-ah-TOT-oh-mee)	-tomy = process of cutting	process of cutting into the urinary meatus (to widen the meatus)

ROOT <b>nephro/o</b> (see also ren/o)		MEANING kidney
Term	Term Analysis	Definition
<b>hydronephrosis</b> (high-droh-neh-FROH-sis)	-osis = abnormal condition hydr/o = water	accumulation of urine in the renal pelvis. This abnormality is due to a blockage of urine flowing through the ureters. This blockage is caused by a kidney stone or a stricture (narrowing) of the ureter. (Figure 16-5)



**Figure 16-5** Hydronephrosis.

<b>nephrolithiasis</b> (nef-roh-lih-THIGH-ah-sis)	-iasis = abnormal condition lith/o = stones	kidney stones, also known as renal calculi (Figure 16-6)
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**Figure 16-6** Stones along the urinary tract.

ROOT <i>pyel/o</i>	MEANING renal pelvis; kidney pelvis	
Term	Term Analysis	Definition
<b>intravenous pyelogram (IVP)</b> (in-trah-VEE-nus PYE-eh-loh-gram)	<i>-ous</i> = pertaining to <i>intra-</i> = within <i>ven/o</i> = vein <i>-gram</i> = record	an x-ray of the kidneys and ureters following administration of a contrast medium. A contrast medium highlights internal structures to improve visibility.
<b>pyelonephritis</b> (pye-eh-loh-neh-FRY-tis)	<i>-itis</i> = inflammation <i>nephro/o</i> = kidney	inflammation of the renal pelvis and kidney because of a urinary tract infection that spreads to the kidneys

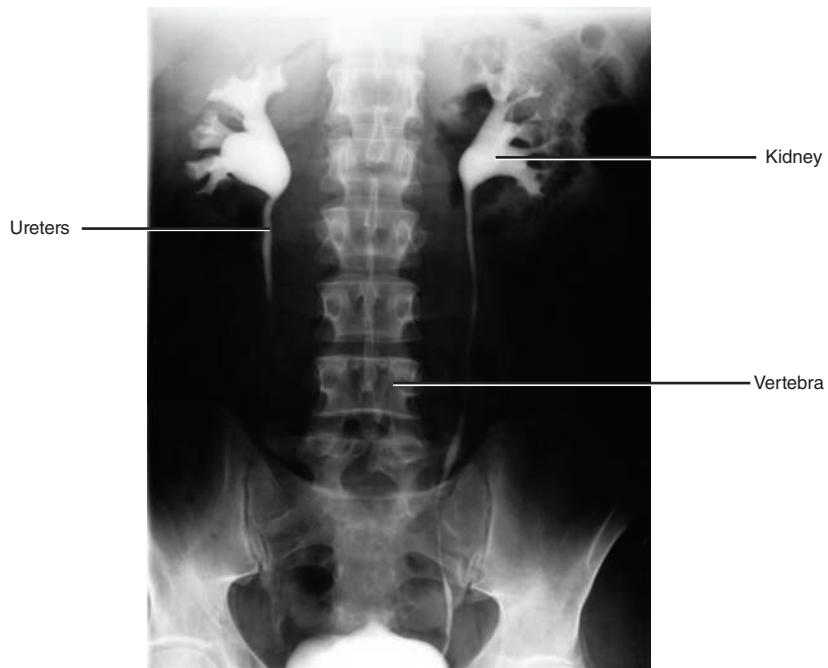
ROOT ren/o		MEANING kidney
Term	Term Analysis	Definition
<b>renal hypoplasia</b> (REE-nal high-poh-PLAY-zee-ah)	-al = pertaining to -plasia = formation; development hypo- = under; below normal; deficient	underdeveloped kidney

ROOT ureter/o		MEANING ureter
Term	Term Analysis	Definition
<b>ureteral</b> (yoo-REE-ter-al)	-al = pertaining to	pertaining to the ureter
<b>ureterectasis</b> (yoo-ree-ter-ECK-tah-sis)	-ectasis = dilation; stretching; widening	dilation of ureter
<b>ureterorrhagia</b> (yoo-ree-ter-oh-RAY-jee-ah)	-rrhagia = hemorrhage; bursting forth	bleeding from the ureter

ROOT urethr/o		MEANING urethra
Term	Term Analysis	Definition
<b>transurethral</b> (tranz-yoo-REE-thral)	-al = pertaining to trans- = through; across	pertaining to something moving through the urethra
<b>urethropexy</b> (yoo-REE-throh-peck-see)	-pexy = surgical fixation	surgical fixation of the urethra to nearby tissue
<b>urethrostenosis</b> (yoo-ree-troh-steh-NOH-sis)	-stenosis = narrowing	narrowing of the urethra

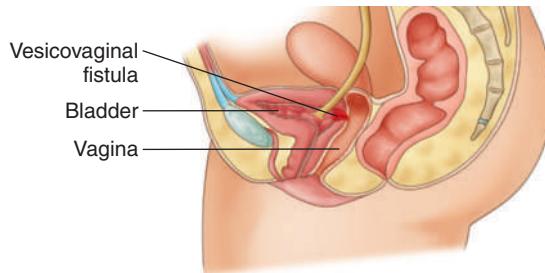
ROOT ur/o		MEANING urinary tract; urine; urination
Term	Term Analysis	Definition
<b>uremia</b> (yoo-REE-mee-ah)	-emia = blood condition	accumulation of waste products in the blood; also known as <b>azotemia</b> (az-oh-TEE-mee-ah). A toxic state when kidney failure causes the buildup of wastes in the blood.

Term	Term Analysis	Definition
<b>urologist</b> (yoo-ROL-ah-jist)	-logist = specialist	specialist in the study of the urinary system in females and the urinary and reproductive systems in males
<b>urogram</b> (YOO-roh-gram)	-gram = record	x-ray of the urinary tract (Figure 16-7)



**Figure 16-7** An excretory urogram showing the kidneys and ureters.

ROOT vesic/o		MEANING bladder
Term	Term Analysis	Definition
<b>vesical</b> (VES-ih-kal)	-al = pertaining to	pertaining to the bladder
<b>vesicovaginal fistula</b> (vess-ih-koh-VAH-jih-nal) <b>FISS</b> -tyoo-lah)	-al = pertaining to vagin/o = vagina fistula = abnormal passage	abnormal passage between the bladder and vagina allowing constant involuntary flow of urine from the bladder to the vagina (Figure 16-8)



**Figure 16-8** A vesicovaginal fistula results in the abnormal flow of urine from bladder into vagina.

### Helping You Remember

Do not confuse **vesical** with **vesicle**. *Vesical* means “pertaining to the bladder.” *Vesicle* means a “small sac containing liquid; a blister.”

SUFFIX -lysis	MEANING separation; breakdown; destruction	
Term	Term Analysis	Definition
<b>dialysis</b> (dye- <b>AL</b> -ih-sis)	dia- = through; complete	mechanical replacement of kidney function when the kidney is not working (Figure 16-9); hemodialysis ( <b>hee-moh-dye-AL-ih-sis</b> )

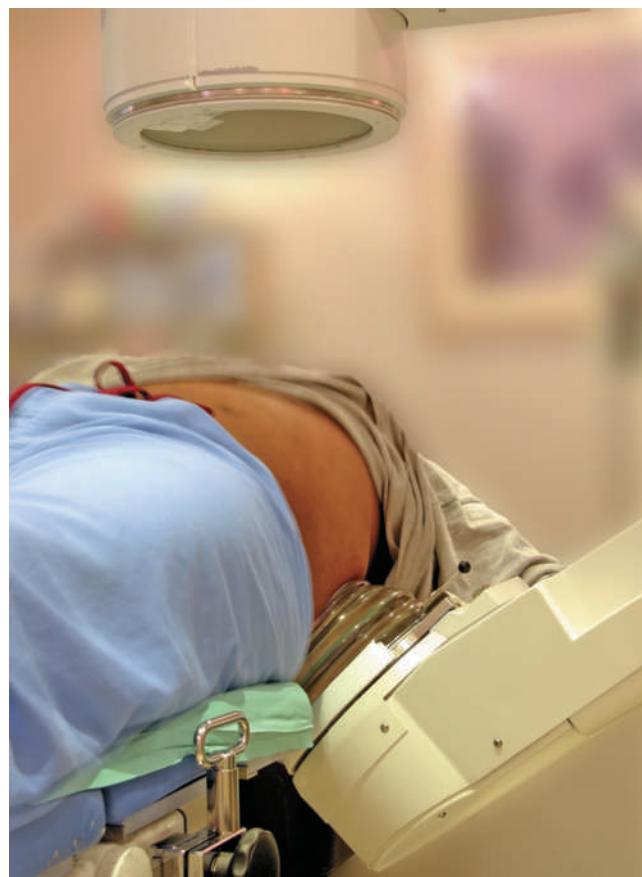


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**Figure 16-9** Hemodialysis. Mechanical replacement of kidney function when the kidney is not working. Once the patient's blood has been filtered, it is returned to the patient's body.

<b>urinalysis</b> (yoo-rih- <b>NAL</b> -ih-sis)	urin/o = urine ana- = apart	laboratory analysis of urine
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SUFFIX <b>-tripsy</b>	MEANING crushing	
Term	Term Analysis	Definition
<b>lithotripsy</b> (LITH-oh-trip-see)	lith/o = stone; calculus	crushing of kidney stones tiny enough to be eliminated without surgical removal. <b>Extracorporeal</b> (ex-trah-kor-por-ee-al) <b>shock wave</b> lithotripsy uses ultrasound to crush the stones, which are then passed into the urine. Extracorporeal means outside the body (Figure 16-10).



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**Figure 16-10** Extracorporeal shockwave lithotripsy uses ultrasound to destroy kidney stones.

SUFFIX -uria		MEANING urine; urination
Term	Term Analysis	Definition
<b>anuria</b> (ah-NOO-ree-ah)	an- = no; not; lack of	no urine formation; also known as <b>suppression</b> (suh-PRESH-un)
<b>dysuria</b> (dis-YOO-ree-ah)	dys- = painful; bad; difficult	painful urination
<b>hematuria</b> (hem-ah-TOO-ree-ah)	hemat/o = blood	blood in the urine
<b>nocturia</b> (nock-TOO-ree-ah)	noct/o = night	frequent urination at night
<b>oliguria</b> (ol-ih-GOO-ree-ah)	oligo- = scanty; deficient; few	decreased urination
<b>polyuria</b> (pol-ee-YOO-ree-ah)	poly- = many	excretion of large amounts of urine
<b>pyuria</b> (pye-YOO-ree-ah)	py/o = pus	pus in the urine

## Prefixes

PREFIX in-		MEANING no; not
Term	Term Analysis	Definition
<b>incontinence</b> (in-KON-tih-nens)	continence = to stop	no control over excretory functions such as urination or feces

## 16.6 Pathology

### Nephrotic (neh-FROT-ick) Syndrome

A group of conditions involving damaged glomeruli and abnormal protein filtration.

Under normal circumstances the glomeruli filter waste products and excess water from the blood. When the glomeruli are damaged, protein is filtered when it should not be. This condition may result in **hyperproteinuria** (high-per-proh-tee-NOOR-ee-ah),

excessive protein in the urine and **hypoproteinemia** (high-poh-proh-tee-NEE-mee-ah), decreased protein in the blood because the protein is being excreted in the urine. Edema, which is the abnormal accumulation of water in body tissues, can also be a problem.

## Renal Failure

Loss of kidney function. **Acute renal failure** comes on suddenly and is of short duration. **Chronic renal failure** comes on gradually and is of long duration. **End-stage renal disease** (ESRD) is the final stage of renal failure. Without adequate filtration, the waste products build up in the blood and death occurs because of uremia.

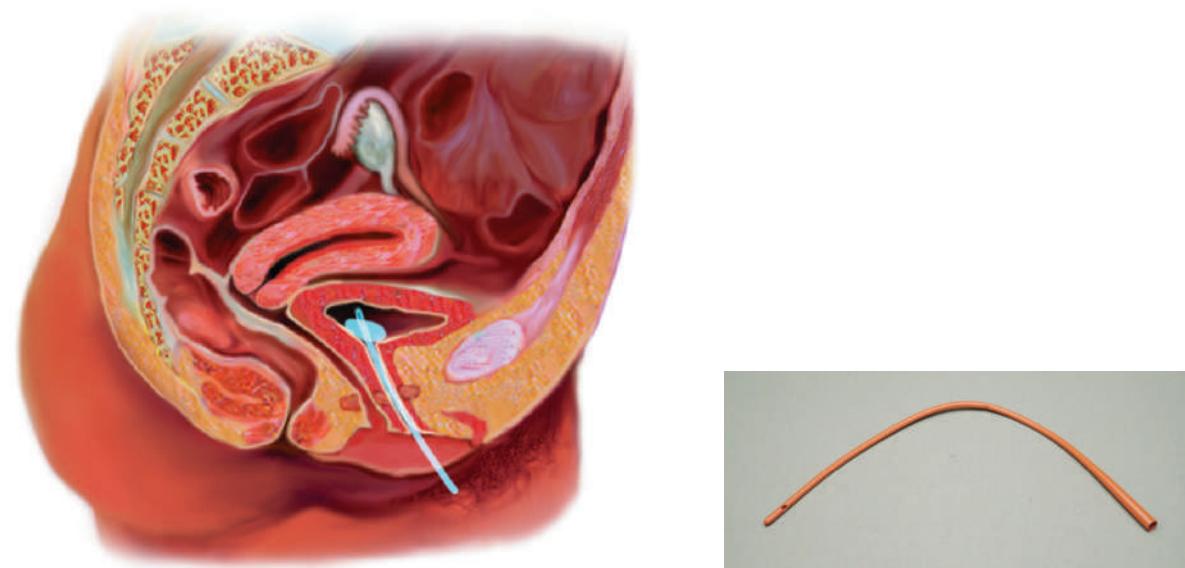
## Voiding Disorders

### Urinary Incontinence (in-KON-tih-nens)

Involuntary outflow of urine. Stress incontinence occurs when there is pressure on the bladder from coughing or laughing. Urge incontinence is the inability to stop the flow of urine once the urge has been felt.

### Urinary Retention

Inability of the bladder to empty completely during urination. If urine needs to be removed from the bladder before an effective treatment has been established, **catheterization** (kath-eh-ter-eye-ZAY-shun) may be done. This involves the insertion of a flexible tube (catheter) into the bladder to withdraw urine. The catheter is placed through the urethra and into the bladder (Figure 16-11A, and 11B).



**Figure 16-11** Catheterization. A. Catheter is placed in the bladder to drain urine. B. Catheter.

## 16.7 Look-Alike and Sound-Alike Words

*Below is a list of look-alike and sound-alike words. Study the spelling and definitions of each set of words. Questions will follow in the Review Exercises.*

**TABLE 16-1 Look-Alike and Sound-Alike Words**

<b>anuresis</b>	retention of urine in the bladder
<b>enuresis</b>	bedwetting at night
<b>creatine</b>	an amino acid found in tissues, especially muscles
<b>creatinine</b>	waste product excreted in the urine; elevated in kidney disease
<b>ureteral</b>	pertaining to the ureter
<b>urethral</b>	pertaining to the urethra
<b>vesical (adjective)</b>	pertaining to the bladder
<b>vesicle (noun)</b>	blister

## 16.8 Review Exercises

### EXERCISE 16-1 Look-Alike and Sound-Alike Words

*Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 16-1 if it helps you.*

1. The patient complains of severe (**anuresis/enuresis**) to the point that he was wearing pads at night.
2. Mr. Chavez was admitted with glomerulonephritis. His laboratory tests showed abnormal levels of urinary (**creatine/creatinine**).
3. This woman has had three previous attacks of right (**urethral/ureteral**) pain.
4. Repeat cystoscopies resulted in multiple (**vesicals/vesicles**) in the bladder.
5. After elevation of the (**vesical/vesicle**) neck, incontinence stopped.

### EXERCISE 16-2 Matching Word Parts with Meaning

*Match the word part in Column A with its meaning in Column B.*

Column A	Column B
_____ 1. dia-	A. opening at the tip of the urethra
_____ 2. -plasia	B. kidney

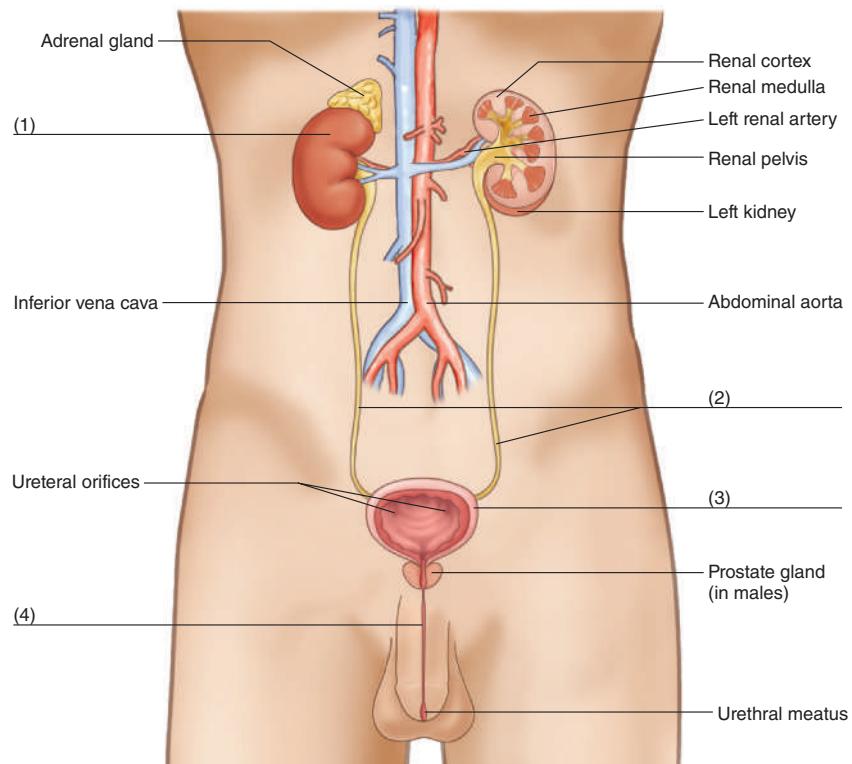
Column A	Column B
_____	<b>3.</b> py/o C. pus
_____	<b>4.</b> pyel/o D. stone
_____	<b>5.</b> vesic/o E. night
_____	<b>6.</b> meat/o F. through; complete
_____	<b>7.</b> noct/o G. bladder
_____	<b>8.</b> lith/o H. scanty
_____	<b>9.</b> oligo- I. formation; development
_____	<b>10.</b> nephro- J. renal pelvis

### EXERCISE 16-3 Labeling—Urinary Tract

Using the body structures listed below, label Figure 16-12. Write your answer in the numbered spaces provided below, or if you prefer, on the diagram.

kidney \_\_\_\_\_

ureter \_\_\_\_\_



**Figure 16-12** Major organs of the urinary system.

urethra \_\_\_\_\_

urinary bladder \_\_\_\_\_

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

#### EXERCISE 16-4 Definitions—Learning the Terms

Define the following terms.

1. **cystoscope** \_\_\_\_\_

2. **meatotomy** \_\_\_\_\_

3. **urethropexy** \_\_\_\_\_

4. **renal hypoplasia** \_\_\_\_\_

5. **dialysis** \_\_\_\_\_

6. **urethral** \_\_\_\_\_

7. **azotemia** \_\_\_\_\_

8. **anuria** \_\_\_\_\_

9. **dysuria** \_\_\_\_\_

10. **suppression** \_\_\_\_\_

11. **polyuria** \_\_\_\_\_

12. **pyuria** \_\_\_\_\_

13. **urologist** \_\_\_\_\_

#### EXERCISE 16-5 Building Medical Words

I. Use the suffix *-uria* to build medical words for the following definitions.

a. no urine formation \_\_\_\_\_

b. painful urination \_\_\_\_\_

c. blood in the urine \_\_\_\_\_

d. frequent urination at night \_\_\_\_\_

- e. decreased (infrequent) urination \_\_\_\_\_
- f. pus in the urine \_\_\_\_\_
- g. excretion of large amounts of urine \_\_\_\_\_

*II. Use the combining form cyst/o to build medical words for the following definitions.*

- a. inflammation of the bladder \_\_\_\_\_
- b. instrument used to visually examine the inside of the bladder  
\_\_\_\_\_

### EXERCISE 16-6 Definitions—Pathology

*Define the following diseases.*

- 1.** polycystic kidneys

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- 2.** incontinence

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- 3.** nephrolithiasis

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- 4.** renal failure

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- 5.** pyelonephritis

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- 6.** urinary retention

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**7.** nephrotic syndrome

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**8.** neurogenic bladder

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**9.** ureterorrhagia

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**10.** nephroptosis

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**EXERCISE 16-7 Definitions in Context**

*Define the bolded terms in the spaces provided. Use your medical dictionary if necessary.*

ADMISSION DIAGNOSIS: RIGHT HYDROURETER AND HYDRONEPHROSIS

HISTORY OF PRESENT ILLNESS

A 65-year-old man was admitted with abdominal pain. He had been having this pain off and on for the past two years. On admission, he was found to have **renal calculi**. A **urography** was performed that showed poor function on the right with a **hypoplastic** scarred kidney. The patient therefore underwent a **cystoscopy** and **MRI**, revealing a poorly positioned right kidney with a **stricture** involving the **distal** one-third of the ureter. The patient was admitted at this time for consideration of **nephrectomy**.

- a. **hydronephrosis** \_\_\_\_\_
- b. **renal calculi** \_\_\_\_\_
- c. **urography** \_\_\_\_\_
- d. **hypoplastic kidney** \_\_\_\_\_
- e. **cystoscopy** \_\_\_\_\_
- f. **MRI** \_\_\_\_\_
- g. **stricture** \_\_\_\_\_

h. **distal** \_\_\_\_\_

i. **nephrectomy** \_\_\_\_\_

### EXERCISE 16-8 Spelling

*Circle any words that are spelled incorrectly in the list below. Then correct the spelling in the space provided.*

**1.** glomairulus \_\_\_\_\_

**2.** cistitis \_\_\_\_\_

**3.** retention \_\_\_\_\_

**4.** urineation \_\_\_\_\_

**5.** nephrolithiasis \_\_\_\_\_

**6.** dialysis \_\_\_\_\_

**7.** vesical \_\_\_\_\_

**8.** incontinance \_\_\_\_\_

**9.** cathaterization \_\_\_\_\_

**10.** excretion \_\_\_\_\_

### Animations

Visit the companion website to view the video on **Cystoscopy**.

## 16.9 Pronunciation and Spelling

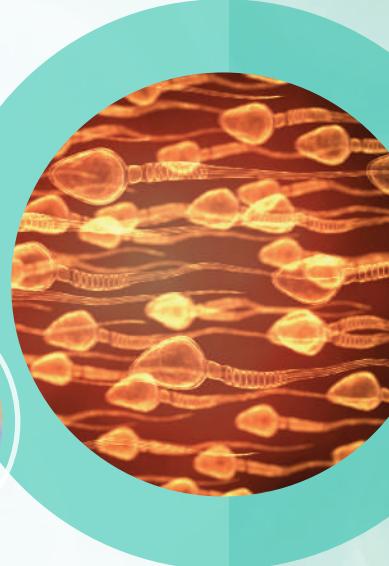
1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

Word	Pronunciation	Spelling
<b>anuria</b>	ah-NOO-ree-ah	_____
<b>bladder</b>	BLAH-der	_____
<b>catheterization</b>	kath-eh-ter-eye-ZAY-shun	_____
<b>cystitis</b>	sis-TYE-tis	_____

Word	Pronunciation	Spelling
cystoscope	SIS-toh-skope	
dialysis	dye-AL-ih-sis	
dysuria	dis-YOO-ree-ah	
glomerulonephritis	glow-mer-yoo-loh-neh-FRY-tis	
glomerulus	gloh-MER-yoo-luss	
hematuria	hem-ah-TOO-ree-ah	
hydronephrosis	high-droh-neh-FROH-sis	
incontinence	in-KON-tih-nens	
intravenous	in-trah-VEE-nus PYE-eh-loh-	
pyelogram	gram	
kidney	KID-nee	
meatotomy	mee-ah-TOT-oh-mee	
meatus	me-AY-tuss	
micturition	mick-too-RIH-shun	
nephrolithiasis	nef-roh-lith-THIGH-ah-sis	
nephrotic	neh-FROT-ick	
nocturia	nock-TOO-ree-ah	
oliguria	ol-ih-GOO-ree-ah	
polycystic	pol-ee-SIS-tick	
polyuria	pol-ee-YOO-ree-ah	
pyuria	pye-YOO-ree-ah	
renal hypoplasia	REE-nal high-poh-PLAY-zee-ah	
transurethral	tranz-yoo-REE-thral	
uremia	yoo-REE-mee-ah	
ureter	yoo-REE-ter	
ureteral	yoo-REE-ter-al	
ureterectasis	yoo-ree-ter-ECK-tah-sis	
urethra	yoo-REE-thrah	
urinalysis	yoo-rih-NAL-ih-sis	
urologist	yoo-ROL-ah-jist	

## CHAPTER 17

# Male Reproductive System



### Chapter Outline

- 17.1** Major Organs of the Male Reproductive System
- 17.2** Structure and Function of the Male Reproductive System
- 17.3** New Roots, Suffixes, and Prefixes
- 17.4** Learning the Terms
- 17.5** Pathology
- 17.6** Look-Alike and Sound-Alike Words
- 17.7** Review Exercises
- 17.8** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

1. Name and locate the organs of the male reproductive system.
2. Describe the structures and functions of the male reproductive system.
3. Pronounce, spell, define, and write the medical terms related to the male reproductive system.
4. Describe common diseases of the male reproductive system.
5. Listen, read, and study so you can speak and write.

### Introduction

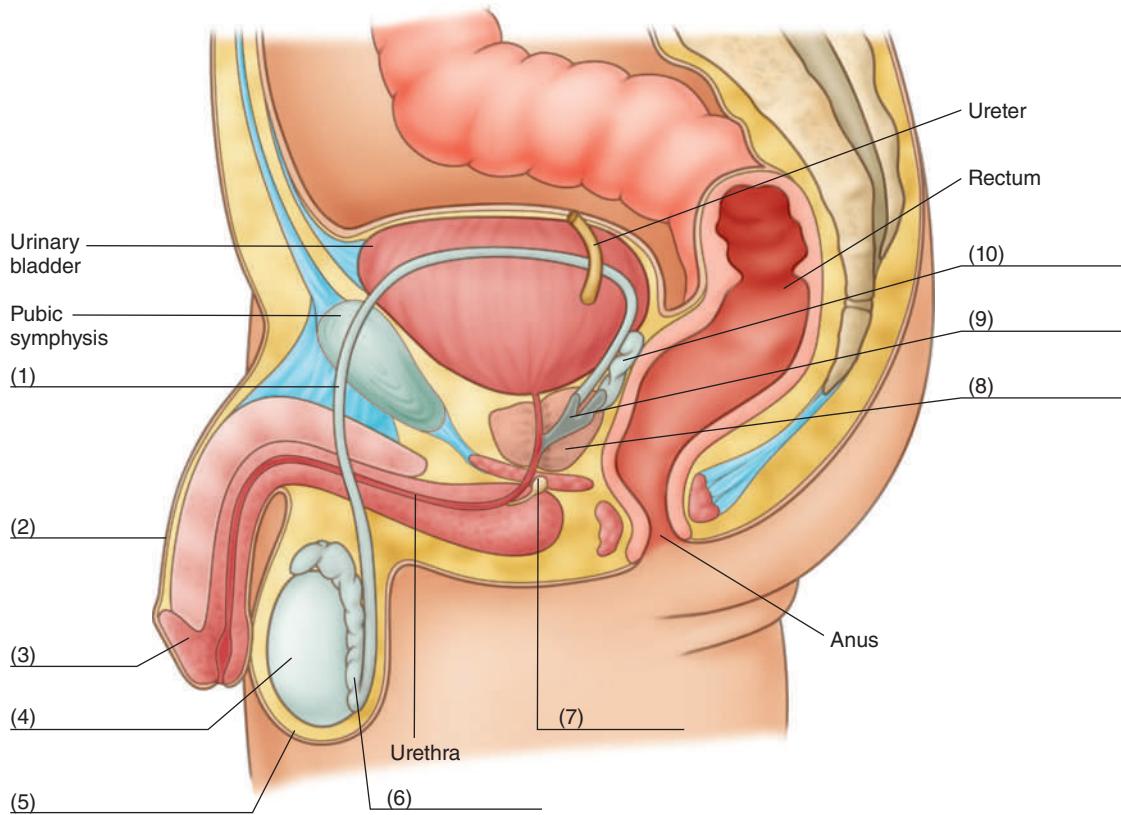
The male reproductive system performs three basic tasks. The first is to manufacture sperm that carries the genetic code of the male. The second is to produce the hormone **testosterone** (tess-**TOSS**-ter-ohn). The third is to deliver sperm and semen out of the male's body.

## 17.1 Major Organs of the Male Reproductive System

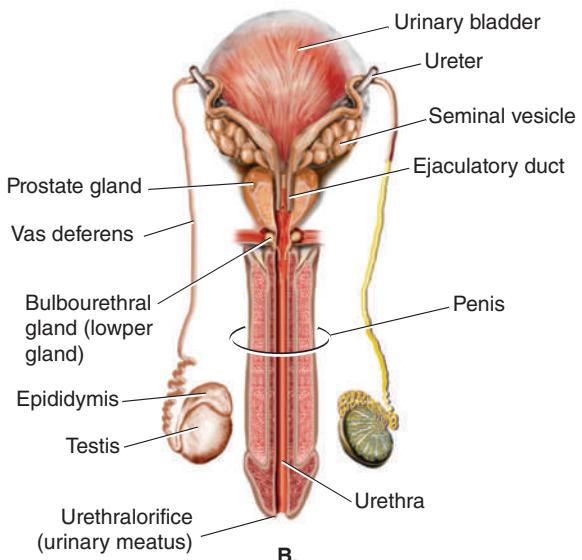
### PRACTICE FOR LEARNING: Major Organs of the Male Reproductive System

Write the words below in the correct spaces on Figure 17-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

- 1. vas deferens (VASS DEF-er-enz)**
- 2. penis (PEE-nis)**
- 3. glans penis (GLANZ)**
- 4. testis (TEST-tis)**
- 5. scrotum (SKROH-tum)**
- 6. epididymis (ep-ih-DID-ih-mis)**
- 7. bulbourethral gland (bul-boh-yoo-REE-thral GLAND)**
- 8. prostate (PROSS-tayt)**
- 9. ejaculatory duct (ee-JACK-yoo-lah-tor-ee DUCT)**
- 10. seminal vesicle (SEM-ih-nal VESS-ih-kul)**



**Figure 17-1** (A) Major organs of the male reproductive system.



**Figure 17-1** (B) The testicles and vas deferens are bilateral.

## 17.2 Structure and Function of the Male Reproductive System

Sperm is produced in the testes (**TESS-tees**) (singular testis). The testes are also called the **testicles** (**TESS-tih-kulz**). The sperm is mixed with **semen** (**SEE-men**). Semen is a fluid produced by specific male reproductive organs and then delivered out of the body through the reproductive tract. The other components of the male reproductive system are the accessory reproductive organs and **external genitalia** (**jen-ih-TAIL-ee-yah**). The entire male reproductive system is illustrated in Figure 17-1.

### Testes

The testes are located in an external skin sac called the **scrotum** (**SKROH-tum**). The production of sperm is called **spermatogenesis** (**sper-mah-toh-JEN-eh-sis**). The testes also produce the hormone **testosterone**. It is essential for spermatogenesis and for the development of secondary male gender characteristics such as facial hair, muscularity, and voice change at puberty.

### Epididymis, Vas Deferens, Seminal Vesicle, and Ejaculatory Duct

Using your finger, trace the entire reproductive tract on Figure 17-1B. It begins with the **epididymis** (**ep-ih-DID-ih-mis**), which is a coiled tube on the superior surface of each testicle. Sperm are stored there. The epididymis leads into a duct called the **ductus deferens** or **vas deferens**. This duct encircles the urinary bladder and joins with the duct of the **seminal vesicle** to form the **ejaculatory duct**. This duct joins the **urethra**, which passes through a hole in the **prostate gland**.

## Accessory Organs

The accessory organs can also be seen in Figure 17-1. They are the seminal vesicles, the prostate gland, and bulbourethral glands, which are also called **Cowper (KOW-per) glands**. The accessory organs secrete substances that together form the fluid in which sperm is ejaculated, called **semen**. This substance nourishes and protects sperm.

The prostate is the largest of the accessory organs. The prostate is located just inferior to the bladder. It is a doughnut-shaped gland with a hole in the middle through which the urethra passes. It secretes a milky substance that forms about 50% of the semen. The secretion contains enzymes, nutrients for sperm mobility, and prostate-specific antigen (PSA). PSA testing may be used as an indicator of prostatic cancer.

## External Genitalia

The scrotum and the penis are the external genitalia. The scrotum is the sac that holds the testicles. The penis is a sex organ used to deliver sperm into the female. The end of the penis is called the **glans penis**. It contains the opening for urination and ejaculation, called the **urethral orifice** (yoo-REE-thral OR-ih-fis). The urethral orifice is also called the urinary **meatus** (mee-AY-tuss). The glans is covered with loose skin called the foreskin or **prepuce** (PREE-pyoos). This skin may be removed by a surgical process called **circumcision** (ser-kum-SIZH-un).

### In Brief

#### Male reproductive organs

**Testes:** produces sperm and testosterone

**Epididymis:** stores sperm

**Vas deferens, ejaculatory duct, urethra:** transport sperm

**Accessory organs** seminal vesicles, prostate, and bulbourethral glands

**Function:** secretes semen to protect and nourish sperm

**External genitalia** scrotum and penis

**Scrotum:** holds the testicles

**Penis:** delivers sperm to female

## PRACTICE FOR LEARNING: Male Reproductive Structure and Function

1. Write the function for the following structures:

a. testicles \_\_\_\_\_

b. epididymis \_\_\_\_\_

- c. vas deferens \_\_\_\_\_
- d. seminal vesicles, prostate gland, and bulbourethral glands  
\_\_\_\_\_

2. From the list of words below, complete sentences a, b, c, and d. Not all terms are used.

Cowper

epididymis

glans penis

prepuce

scrotum

testicles

urethral orifice

ductus deferens

a. The end of the penis is called the \_\_\_\_\_.

b. The urinary meatus is also known as the \_\_\_\_\_.

c. The glans penis is covered with loose skin called

\_\_\_\_\_.

d. A sac containing the testicles is \_\_\_\_\_.

e. Another name for bulbourethral gland is \_\_\_\_\_.

Answers: 1. a. produce sperm and testosterone. b. stores sperm. c. transports sperm. d. all of these structures secrete fluid that together form semen.  
2. a. glans penis. b. urethral orifice. c. prepuce. d. scrotum. e. Cowper.

### 17.3 New Roots, Suffixes, and Prefixes

Use these additional roots and suffixes when studying the terms in this chapter.

ROOT	MEANING
crypt/o	hidden
varic/o	varicose vein

SUFFIX	MEANING
-cidal	to kill
-genesis	production; formation
-ism	condition; process
-pause	stopping

## 17.4 Learning the Terms

Following these steps will make it easier for you to learn medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the term to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

### Roots

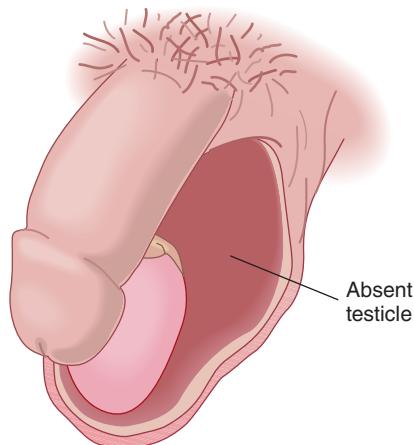
TERM	ROOT andr/o	MEANING male
TERM	TERM ANALYSIS	DEFINITION
androgenic (an-droh-JEN-ick)	-genic = producing	producing masculinizing effects
andropause (AN-droh-pawz)	-pause = stopping	decrease of the male hormone testosterone. May be referred to as <b>male menopause</b>

TERM	ROOT balan/o	MEANING glans penis
TERM	TERM ANALYSIS	DEFINITION
balanorrhea (bal-an-oh-REE-ah)	-rrhea = flow; discharge	discharge from the glans penis

ROOT mast/o		MEANING breast
Term	Term Analysis	Definition
<b>gynecomastia</b> (gye-nuh-koh-MAS-tee-ah)	-ia = condition gynec/o = woman	abnormal enlargement of the male breast

ROOT orchid/o; orchi/o (see also testicul/o)		MEANING testicle; testis
Term	Term Analysis	Definition
<b>cryptorchidism</b> (krip-TOR-kih-diz-um)	-ism = process crypt/o = hidden	undescended testicles (Figure 17-2).

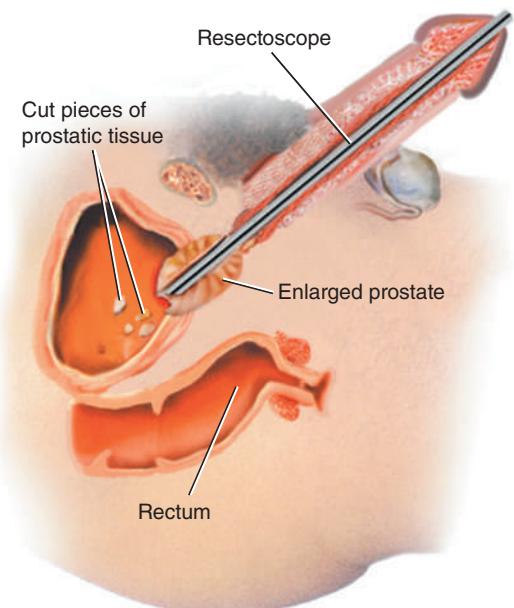
**Note:** During fetal development, one or both testicles may fail to descend into the scrotum, remaining instead in the abdominal cavity. If not treated, this condition results in sterility.



**Figure 17-2** Cryptorchidism.

<b>orchidectomy</b> (or-kih-DECK-tah-mee)	-ectomy = excision; surgical removal	surgical removal of both testicles; castration
<b>orchidopexy</b> (OR-kid-oh-peck-see)	-pexy = surgical fixation	surgical fixation of the testicle into the scrotum; treatment for cryptorchidism
<b>orchitis</b> (or-KYE-tis)	-itis = inflammation	inflammation of the testicle

ROOT <b>prostat/o</b>	MEANING <b>prostate</b>	
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>prostatitis</b> (pross-tah-TYE-tis)	-itis inflammation	inflammation of the prostate
<b>transurethral prostatectomy (TUP)</b> (tranz-yoo-REE-thral pros-teh-TECK- teh-mee)	-al = pertaining to trans- = through; across -ectomy = excision; surgical removal	partial excision of the prostate using a <b>resectoscope</b> (ree-SECK-toh-skohp) passed through the urethra. Unwanted prostatic tissue is removed by dissection. It is also known as transurethral resection of the prostate (TURP) (Figure 17-3). See benign prostatic hypertrophy in Section 17.5 that follows.



**Figure 17-3** Transurethral resection of prostate (TURP); also known as transurethral prostatectomy.

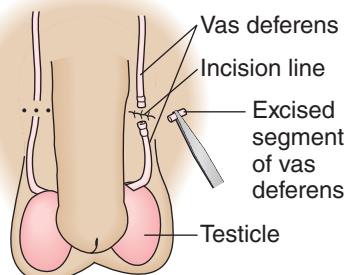
### Helping You Remember

Do not confuse prostate, a male reproductive gland, with prostrate, meaning “stretched out on the ground.”

ROOT <b>sperm/o; spermat/o</b>		MEANING <b>spermatozoa; sperm; seminal fluid</b>
Term	Term Analysis	Definition
<b>aspermogenesis</b> (ay-sper-mah-toh-JEN-eh-sis)	-genesis = production; formation a- = no; not; lack of	no production of spermatozoa
<b>Note:</b> The singular of spermatozoa is spermatozoon.		
<b>hematospermia</b> (hee-mah-toh-SPER-mee-ah)	-ia = condition hemat/o = blood	condition of blood in the seminal fluid
<b>oligospermia</b> (ol-ih-goh-SPER-mee-ah)	-ia = condition oligo- = deficient; scanty; few	deficient number of spermatozoa
<b>spermatocidal</b> (sper-mah-toh-SYE-dal)	-cidal = to kill	to kill or destroy spermatozoa; spermicidal

ROOT <b>testicul/o</b>		MEANING <b>testicle; testis</b>
Term	Term Analysis	Definition
<b>testicular</b> (tes-TICK-yoo-lar)	-ar = pertaining to	pertaining to the testicle

ROOT <b>vas/o</b>		MEANING <b>vessel; vas deferens</b>
Term	Term Analysis	Definition
<b>vasectomy</b> (vah-SECK-toh-mee)	-ectomy = excision; surgical removal	excision of the vas deferens or a portion of it (Figure 17-4)



**Figure 17-4** Vasectomy.

<b>vasovasostomy</b> (vay-soh-vah-ZOSS-toh-mee)	-stomy = new opening vas/o = vas deferens	a vasectomy reversal; reattachment of two ends of the vas deferens that were previously separated.
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## Suffixes

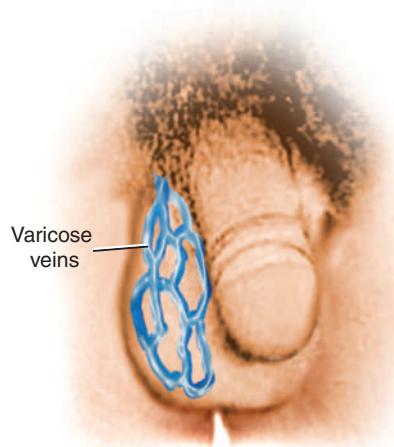
SUFFIX -cele		MEANING hernia; protrusion; displacement
Term	Term Analysis	Definition
<b>hematocele</b> <b>(HEE-mah-toh-seel)</b>	hemat/o = blood	accumulation of blood around the testicles
<b>hydrocele</b> <b>(HIGH-droh-seel)</b>	hydr/o = water	accumulation of fluid around the testicles (Figure 17-5)



**Figure 17-5** Hydrocele. A flashlight is shown behind the scrotum. If a hydrocele is present, a red glow will show up in the scrotum because the light will pass through it. If a tumor is present, no glow will show up.

**Note:** Hematocele can be used generally to describe any effusion of blood into a body cavity. Likewise, hydrocele can be used to describe the accumulation of fluid in any body cavity.

<b>varicocele</b> <b>(VAR-ih-koh-seel)</b>	varic/o = varicose veins; dilated, twisted veins	dilation of the testicular veins inside the scrotum (Figure 17-6)
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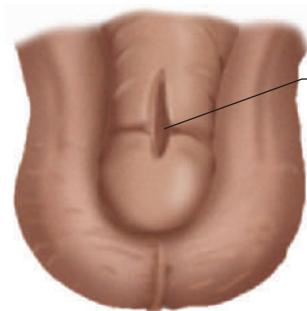
**Figure 17-6** Varicocele.

SUFFIX -potence	MEANING	
Term	Term Analysis	Definition
<b>impotence</b> (IM-poh-tens)	in- = no; not	inability to achieve or maintain an erection

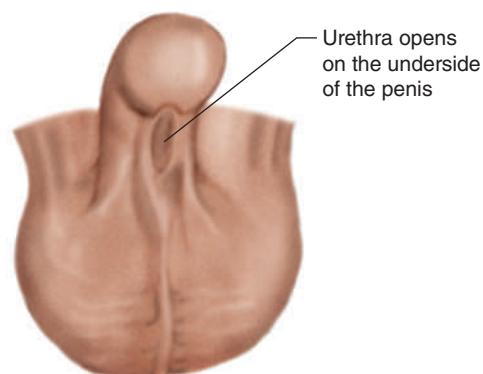
**Helping You Remember**

The prefix “in-” changes to “im-” in the word “impotence” because the suffix starts with “p.”

SUFFIX -spadias	MEANING	
Term	Term Analysis	Definition
<b>epispadias</b> (ep-ih-SPAY-dee-as)	epi- = on; upon; above	congenital opening of the meatus on the dorsum (top side) of the penis (Figure 17-7A)
<b>hypospadias</b> (high-poh-SPAY-dee-as)	hypo- = under	congenital opening of the urinary meatus on the ventral side (underside) of the penis; (Figure 17-7B)



Urethra opens on the upper side of the penis

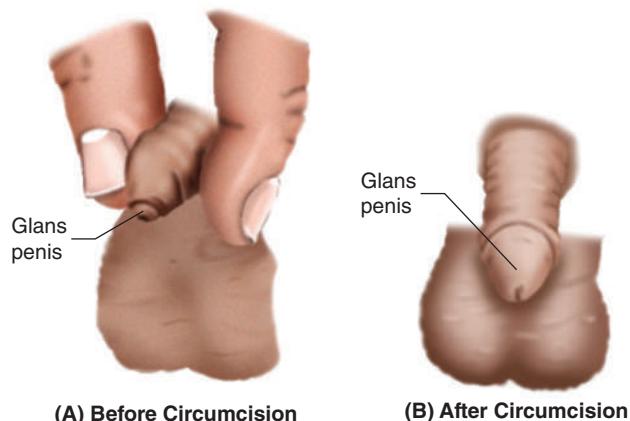


Urethra opens on the underside of the penis

**Figure 17-7** A. Epispadias. B. Hypospadias.

# Prefixes

PREFIX <b>circum-</b>	<i>Term Analysis</i>	<i>Definition</i>
<b>circumcision</b> (ser-kum-SIZH-un)	-ion = process cis/o = to cut	removal of the prepuce or foreskin (Figure 17-8)



**Figure 17-8** Circumcision.

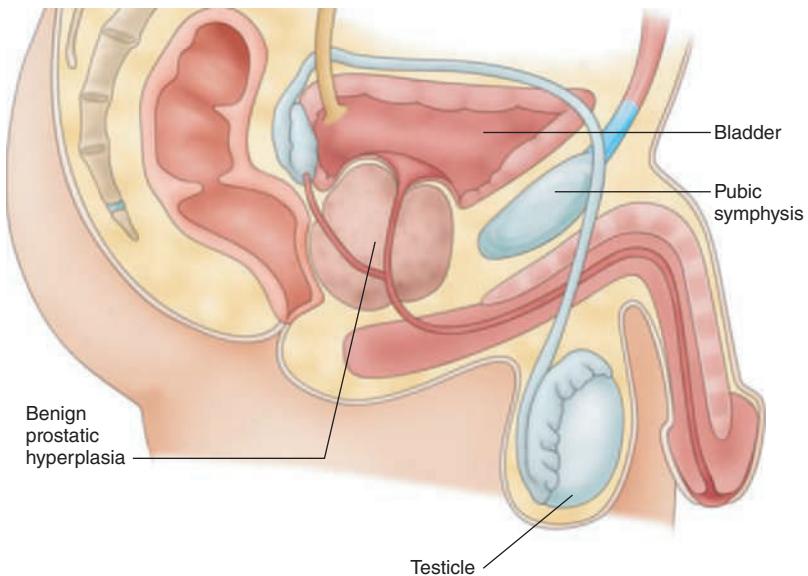
## 17.5 Pathology

## **Benign Prostatic Hypertrophy**

Benign prostatic hypertrophy (BPH) is also known as benign prostatic hyperplasia. This condition is a noncancerous enlargement of the prostate. The urethra goes through an opening in the prostate very much like a straw would go through a doughnut hole. If the prostate enlarges, it squeezes the urethra and obstructs the flow of urine (Figure 17-9). This causes urinary retention.

This condition frequently occurs in men over 60 years of age. Transurethral resection of the prostate (TURP) is a commonly performed treatment (Figure 17-3). Excess prostatic tissue obstructing the flow of urine is removed using a resectoscope inserted through the urethra. This is an effective procedure but requires hospitalization.

In recent years, alternative procedures have been developed to **ablate** (destroy) the obstructing prostatic tissue. The surgery is called ablation (ab-LAY-shun). The tissue is ablated using heat, laser, electricity, or microwaves. The removal of tissue unblocks the flow of urine. These procedures are considered **minimally invasive surgery**. This means the operation is less extensive with fewer and smaller incisions. The hospital stay is shorter, and there is less chance for complications.



**Figure 17-9** Benign prostatic hypertrophy.

## Carcinoma of the Prostate

Malignant tumor of the prostate is one of the most common types of cancer in men. A digital rectal examination (DRE) is helpful in detecting early prostatic cancer. A normal prostate feels solid and smooth. A cancerous prostate is described as **indurated** (IN-doo-rayt-ed) meaning hard. **Prostatic-specific antigen (PSA)** is a laboratory test that measures the level of PSA in the blood. PSA is a protein produced by the prostate gland. An elevated PSA may indicate prostatic cancer.

## Phimosis (fih-MOH-sis)

Tightened foreskin that cannot be pulled back. Secretions can accumulate between the foreskin and the penis, causing inflammation. May lead to penile cancer. Circumcision is the method of treatment.

## Sexually Transmitted Infection (STI)

Sexually transmitted infections, are also known as **venereal** (veh-NEER-ee-al) disease (VD) or sexually transmitted disease (STD). They occur in both men and women. A list of the most common STDs is found in Section 18.6 (the pathology section on the Female Reproductive System).

## Testicular Cancer

Malignant tumor of the testicles. It is most common in men between the ages of 15 and 40. When treated early, the cancer is curable.

## 17.6 Look-Alike and Sound-Alike Words

*Below is a list of look-alike and sound-alike words. Study the spelling and definitions of each set of words. Questions will follow in the Review Exercises.*

**TABLE 17-1 Look-Alike and Sound-Alike Words**

<b>prostate</b>	male reproductive gland
<b>prostrate</b>	stretched out on the ground
<b>glans</b>	refers to glans penis (end of the penis)
<b>glands</b>	a group of cells whose function is the production and secretion of a particular substance
<b>hyperplastic</b>	pertaining to an abnormal increase in the number of cells in tissues
<b>hypoplastic</b>	pertaining to an underdevelopment of an organ or tissue

## 17.7 Review Exercises

### EXERCISE 17-1 Look-Alike and Sound-Alike Words

*Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 17-1 if it helps you.*

- Physical examination at the time of admission revealed the (**prostrate/prostate**) to be smooth, benign, and enlarged.
- The patient was found (**prostrate/prostate**) outside his apartment having suffered an apparent heart attack.
- The (**glans/glands**) were swollen and there was evidence of lymphadenopathy.
- Examination of the patient's testicle revealed the gland to be approximately twice its normal size. The (**hyperplastic/hypoplastic**) testicle was noted three months ago.

### EXERCISE 17-2 Matching Word Parts with Their Meaning

*Match the word part in Column A with the meaning in Column B.*

Column A	Column B
_____ 1. orchid/o	A. male
_____ 2. hemat/o	B. glans penis

<b>Column A</b>	<b>Column B</b>
_____	<b>3.</b> varic/o
_____	<b>4.</b> -potence
_____	<b>5.</b> crypt/o
_____	<b>6.</b> andr/o
_____	<b>7.</b> -spadias
_____	<b>8.</b> circum-
_____	<b>9.</b> -cele
_____	<b>10.</b> balan/o
	C. power
	D. opening
	E. hernia
	F. around
	G. blood
	H. dilated, twisted veins
	I. hidden
	J. testicle

**EXERCISE 17-3 Definitions—Anatomy, Physiology, and Pathology**

*In the space provided, write the medical term that is described below.*

- 1.** structure producing sperm and testosterone \_\_\_\_\_
- 2.** structure that stores sperm \_\_\_\_\_
- 3.** three structures that secrete substances to nourish sperm  
\_\_\_\_\_, \_\_\_\_\_,  
\_\_\_\_\_
- 4.** the medical term meaning sperm production \_\_\_\_\_
- 5.** structure that encases the testicles \_\_\_\_\_
- 6.** noncancerous enlargement of the prostate \_\_\_\_\_
- 7.** tightened foreskin that cannot be pulled back \_\_\_\_\_
- 8.** another term for foreskin \_\_\_\_\_

**EXERCISE 17-4 Learning the Terms**

*Define the following medical words.*

- 1. androgenic** \_\_\_\_\_
- 2. balanorrhea** \_\_\_\_\_
- 3. cryptorchidism** \_\_\_\_\_
- 4. aspermatogenesis** \_\_\_\_\_
- 5. vasectomy** \_\_\_\_\_
- 6. transurethral** \_\_\_\_\_

7. **impotence** \_\_\_\_\_
8. **hypospadias** \_\_\_\_\_
9. **circumcision** \_\_\_\_\_
10. **congenital** \_\_\_\_\_

### EXERCISE 17-5 Building Medical Words

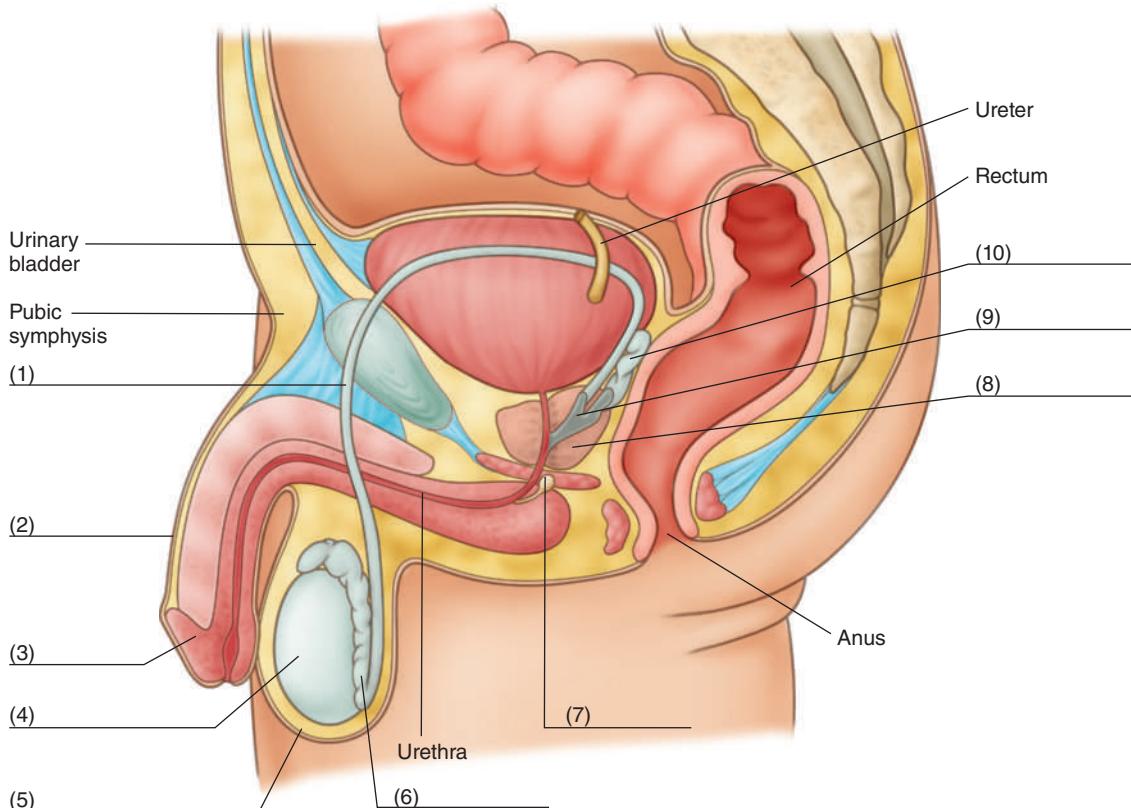
*Write the medical word for the following definitions.*

- a. accumulation of fluid around the testicle \_\_\_\_\_
- b. surgical fixation of the testicle \_\_\_\_\_
- c. deficient number of spermatozoa \_\_\_\_\_
- d. pertaining to the testicle \_\_\_\_\_
- e. accumulation of blood around the testicles \_\_\_\_\_
- f. dilation of testicular veins inside the scrotum \_\_\_\_\_
- g. opening of the urinary meatus on the underside of the penis  
\_\_\_\_\_
- h. inflammation of the testicle \_\_\_\_\_
- i. to kill or destroy spermatozoa \_\_\_\_\_
- j. producing masculinizing effects \_\_\_\_\_

### EXERCISE 17-6 Labeling—Male Reproductive System

*Using the body structures listed below, label Figure 17-10. Write your answer in the numbered spaces provided below, or if you prefer, on the diagram.*

- bulbourethral gland \_\_\_\_\_
- ejaculatory duct \_\_\_\_\_
- epididymis \_\_\_\_\_
- glans penis \_\_\_\_\_
- penis \_\_\_\_\_
- prostate \_\_\_\_\_
- scrotum \_\_\_\_\_
- seminal vesicle \_\_\_\_\_



**Figure 17-10** Major organs of the male reproductive system.

testis \_\_\_\_\_

vas deferens \_\_\_\_\_

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

7. \_\_\_\_\_

8. \_\_\_\_\_

9. \_\_\_\_\_

10. \_\_\_\_\_

### EXERCISE 17-7 Spelling

*Circle any words that are spelled incorrectly in the list below. Then correct the spelling in the space provided.*

1. prostatic \_\_\_\_\_
2. ressection \_\_\_\_\_
3. injured \_\_\_\_\_
4. epididmus \_\_\_\_\_
5. seminal vesical \_\_\_\_\_
6. balanorhea \_\_\_\_\_
7. cryptorchidism \_\_\_\_\_
8. impotence \_\_\_\_\_
9. genitalia \_\_\_\_\_
10. orifce \_\_\_\_\_

### Animations

Visit the companion website to view the video on **Male Reproductive System**.

## 17.8 Pronunciation and Spelling

1. Listen to each word on the audio file provided on the Student Companion Website.
2. Pronounce each word carefully.
3. Spell each word in the space provided.

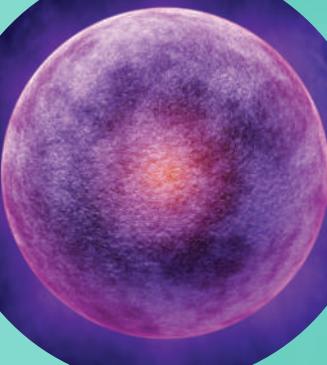
Word	Pronunciation	Spelling
<b>androgenic</b>	an-droh-JEN-ick	_____
<b>aspermato genesis</b>	ay-sper-mah-toh-JEN-eh-sis	_____
<b>balanorrhea</b>	bal-an-oh-REE-ah	_____
<b>benign prostatic hypertrophy</b>	be-NINE proh-STAT-ick HIGH-per-troh-fee	_____
<b>circumcision</b>	ser-kum-SIZH-un	_____

Word	Pronunciation	Spelling
<b>cryptorchidism</b>	krip-TOR-kih-diz-um	
<b>epididymis</b>	ep-ih-DID-ih-mis	
<b>glans penis</b>	GLANZ PEE-nis	
<b>hematocele</b>	HEE-mah-toh-seel	
<b>hypospadias</b>	high-poh-SPAY-dee-as	
<b>impotence</b>	IM-poh-tens	
<b>oligospermia</b>	ol-ih-goh-SPER-mee-ah	
<b>orchidopexy</b>	OR-kid-oh-peck-see	
<b>orchitis</b>	or-KYE-tis	
<b>prostate</b>	PROSS-tayt	
<b>prostatitis</b>	pross-tah-TYE-tis	
<b>semen</b>	SEE-men	
<b>scrotum</b>	SKROH-tum	
<b>spermatogenesis</b>	sper-mah-toh-JEN-eh-sis	
<b>testicles</b>	TESS-tih-kulz	
<b>testicular</b>	tes-TICK-yoo-lar	
<b>testes</b>	TESS-teez	
<b>testosterone</b>	tess-TOSS-ter-ohn	
<b>varicocele</b>	VAR-ih-koh-seel	
<b>vas deferens</b>	VASS DEF-er-enz	
<b>vasectomy</b>	vah-SECK-toh-mee	



## CHAPTER 18

# Female Reproductive System



### Chapter Outline

- 18.1** Major Organs of the Female Reproductive System
- 18.2** Structure and Function of the Female Reproductive System
- 18.3** Obstetrics
- 18.4** New Roots, Suffixes, and Prefixes
- 18.5** Learning the Terms
- 18.6** Pathology
- 18.7** Look-Alike and Sound-Alike Words
- 18.8** Review Exercises
- 18.9** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

1. Name and locate the organs of the female reproductive system.
2. Describe the structures and functions of the female reproductive system.
3. Define terms related to obstetrics.
4. Pronounce, spell, define, and write the medical terms related to the female reproductive system.
5. Describe common diseases of the female reproductive system.
6. Listen, read, and study so you can speak and write.

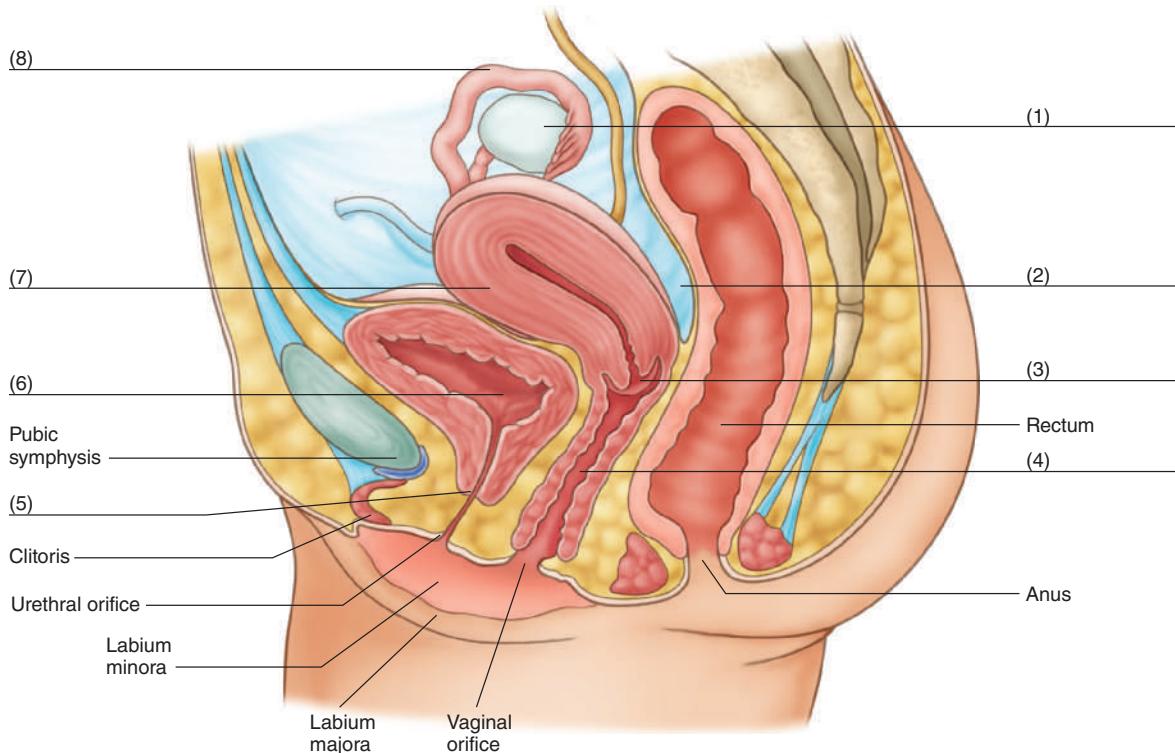
## Introduction

The female reproductive system consists of the **ovaries** (OH-vah-reez), the **uterus** (YOO-ter-us), the **uterine** or **fallopian** (fah-LOH-pee-an) **tubes**, the **vagina** (vah-JIGH-nah), the external **genitalia** (jen-ih-TAIL-ee-ah), and the **mammary** (MAM-ah-ree) **glands**. Figure 18-1 illustrates these structures (except for the external genitalia and mammary glands).

### 18.1 Major Organs of the Female Reproductive System

#### PRACTICE FOR LEARNING: Major Organs of the Female Reproductive System

Write the words below in the correct spaces on Figure 18-1. (Some urinary structures are also included.) To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.



**Figure 18-1** Major structures of the female reproductive system.

1. ovary (**OH-vah-ree**)
2. rectouterine pouch (**reck-toh-YOO-ter-in POWCH**)
3. cervix uteri (**SER-vicks YOO-ter-eye**)
4. vagina (vah-**JIGH-nah**)
5. urethra (yoo-**REE-thra**)
6. urinary bladder (**YOO-rih-nar-ee BLAH-der**)
7. uterus (**YOO-ter-us**)
8. fallopian tubes (fal-**LOH-pee-an TOOBZ**)

## 18.2 Structure and Function of the Female Reproductive System

### Ovaries

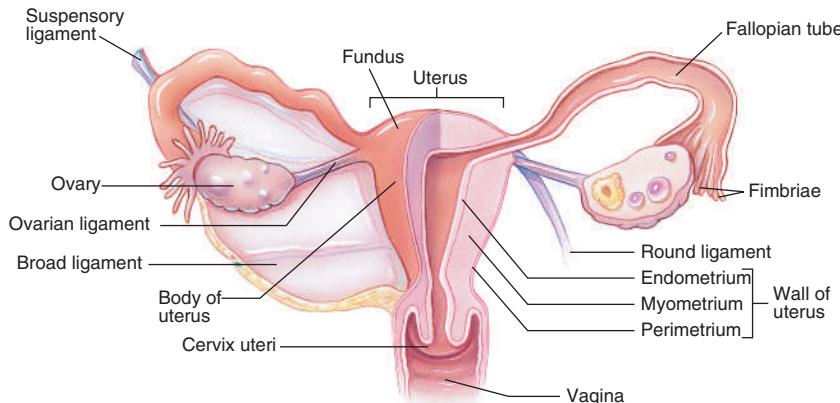
The ovaries are almond-shaped glands. They are located in the pelvic cavity. There is one on each side of the uterus. They are held in place by ligaments. The ovaries discharge the egg or **ovum** (**OH-vum**) (plural ova) and produce various hormones.

The ovaries of a newborn female contain a lifetime supply of immature eggs. Each egg is housed within a small sac called a follicle. Egg release from the follicle begins at puberty, which is the age at which sexual reproduction is possible. One egg is released into the pelvic cavity approximately every 28 days, and slowly makes its way to the fallopian tubes, also known as uterine tubes. This alternates from ovary to ovary each time. The process is called **ovulation** (**ov-yoo-LAY-shun**).

The ovaries release the hormones **estrogen** (**ES-troh-jen**) and **progesterone** (**pro-JES-teh-rohn**). Estrogen helps develop the secondary female characteristics such as the breasts and pubic hair. Progesterone stimulates the growth of blood vessels in the uterus. Estrogen also stimulates the thickening of the uterine lining to prepare for the implantation of a fertilized egg. If no fertilization takes place, this buildup of tissue is sloughed (**SLUFT**) off (discharged) in a process called **menstruation** (**men-stroo-AY-shun**) or **menses** (**MEN-seez**). Sometime between the ages of 45 and 55, all of the eggs either have been discharged or have degenerated. The reproductive cycle then ceases, and the woman is in **menopause** (**MEN-oh-pawz**).

### Fallopian Tubes

The fallopian tubes are shown in Figure 18-2. They link the ovaries and the uterus. The distal end of each tube is equipped with tiny finger-like projections called **fimbriae** (**FIM-bree-ee**). They sweep back and forth, creating waves in the fluid surrounding the ovary. The waves pull an ovum into the tube, and it is then transported to the uterus.



**Figure 18-2** Uterus, fallopian tubes, ovaries, and related structures.

Fertilization is the union of the ovum and sperm. Sperm enters the female reproductive tract following ejaculation by the male. Fertilization usually takes place inside the fallopian tube. If the ovum is fertilized, it begins to grow into a **fetus** (FEE-tus), the name given to the unborn baby. If it is not fertilized, the ovum breaks down within 24 hours after ovulation.

## Uterus

The uterus is a muscular, thick-walled organ. It is shaped like an inverted pear and is held in place in the pelvic cavity by ligaments (Figure 18-2). The superior, rounded portion of the uterus is called the **fundus** (FUN-dus). The middle portion is the body. The inferior portion is the **cervix uteri** (SER-vicks YOO-ter-eye), which projects into the vagina.

Inside the uterus is a hollow space in which the fetus develops. This space is enclosed by three walls: the **endometrium** (en-doh-MEE-tree-um), **myometrium** (my-oh-MEE-tree-um), and **perimetrium** (per-ih-MEE-tree-um). The endometrium is sloughed off during menstruation. The myometrium is the muscular wall. The perimetrium is the outermost wall.

In Figure 18-1, you can see the lowest point of the abdominal cavity. It is called the **rectouterine pouch**. It is also called the cul-de-sac of Douglas (kuhl-deh-sack of DUG-lash). It lies between the uterus and the rectum.

The uterine tubes, ovaries, and the ligaments holding the uterus in place are collectively called the **adnexa** (ad-NECK-sah).

## Vagina

The vagina can be seen in Figure 18-2. It is a muscular tube leading from the cervix uteri to the exterior. It is approximately 6 inches (15 cm) long and is lined with mucous membrane.

The vagina accepts the penis of the male during intercourse (coitus) (KOY-tuss). It is also called the birth canal.

**In Brief****Ovaries**

discharge ova and produce estrogen and progesterone

**Estrogen**

important in the development of female secondary sex characteristics

also thickens the uterine lining

**Progesterone**

stimulates the growth of blood vessels in the endometrium

**Fallopian tubes**

transport the egg to the uterus

**Uterus**

houses and protects the developing fetus

**Vagina**

birth canal; accepts the penis during coitus

## External Genitalia

The external genitalia, or **vulva** (VUL-vah), are illustrated in Figure 18-3.

The area from the vulva to the anus is called the **perineum** (per-ih-NEE-um).

The other parts of the external genitalia are the clitoris (KLIT-eh-riss) or (klih-TOR-iss), **labium majora** (LAY-bee-um mah-JOR-ah), **labium minora** (mih-NOR-ah), and **mons pubis** (MONZ PYOO-bis). Also included are **Bartholin** (BAR-toh-lin) **glands**. They secrete lubricants for intercourse.

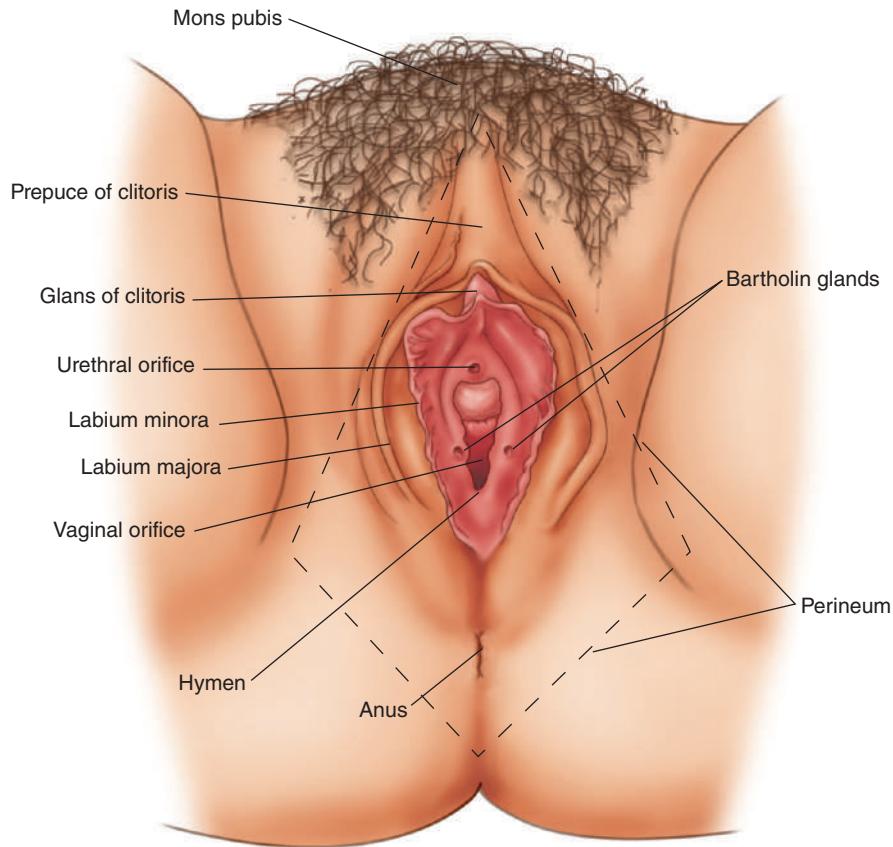
**In Brief****External genitalia**

consist of the clitoris, labium majora, labium minora, mons pubis, Bartholin glands, and perineum

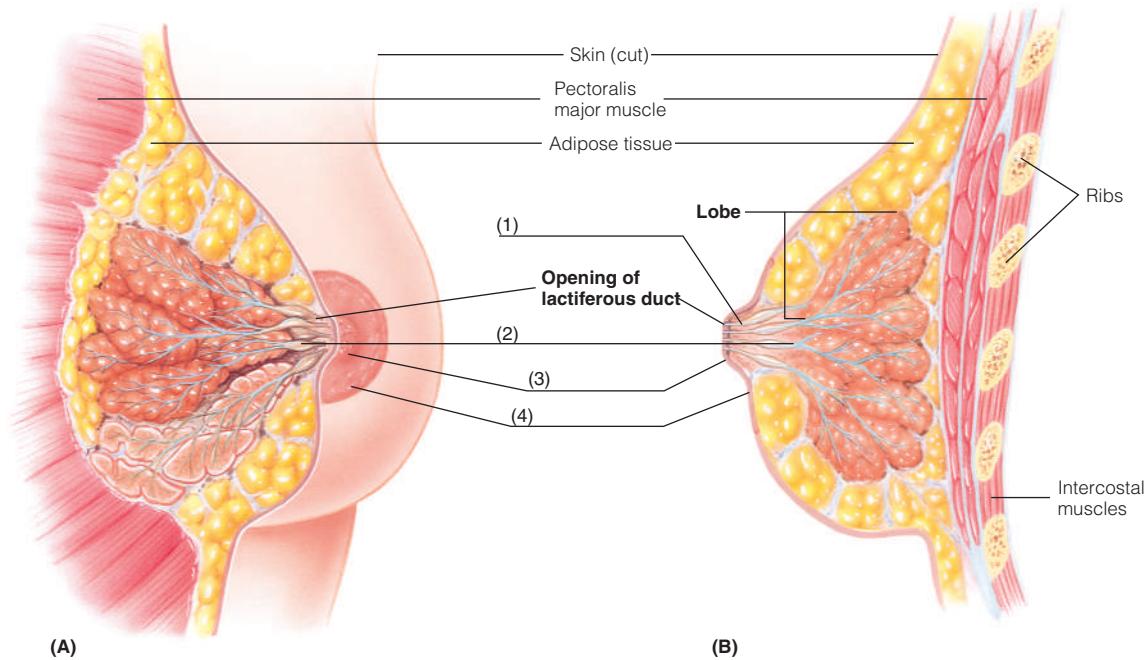
## Breasts

### PRACTICE FOR LEARNING: The Breasts

Write the words below in the correct spaces on Figure 18-4. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.



**Figure 18-3** External genitalia.



**Figure 18-4** The breast. A. Anterior view. B. Sagittal view.

1. lactiferous ducts (lack-TIF-er-us DUKTS)
2. lactiferous sinus (lack-TIF-er-us SIGH-nus)
3. nipple (NIH-pul)
4. areola (ah-REE-oh-lah)

Figure 18-4 illustrates the structures of the breast or mammary gland. The nipple is surrounded by a darker ring of skin called the **areola** (ah-REE-oh-lah).

The mammary glands produce milk after childbirth. Each gland consists of a number of **lobes** (LOHBZ), which contain many little sacs (lobules) that secrete milk. The milk is stored in **lactiferous** (lack-TIF-er-us) **sinuses**. It travels through the lactiferous (milk) ducts to tiny openings in the nipple. Oils produced by glands in the areola help minimize drying out of the skin around the nipple due to breastfeeding.

### PRACTICE FOR LEARNING: Female Reproductive Organs

Write the structure responsible for the functions listed below.

1. holds the fetus during pregnancy \_\_\_\_\_
2. lubricates the vagina for intercourse \_\_\_\_\_
3. acts as the birth canal \_\_\_\_\_
4. transports the egg to the uterus \_\_\_\_\_
5. secretes estrogen and progesterone \_\_\_\_\_
6. ovulation \_\_\_\_\_

Answers: 1. uterus. 2. Bartholin gland. 3. vagina. 4. fallopian tubes/uterine tubes. 5. ovaries. 6. ovaries.

### PRACTICE FOR LEARNING: Female Reproductive Organs

Match the structure in column A with its location in Column B. A letter can be used more than once.

Column A	Column B
_____	1. cul-de-sac of Douglas
_____	2. Bartholin gland
_____	3. areola
_____	4. ovary
_____	5. fundus
_____	6. fimbriae
_____	7. cervix

Answers: 1. A. 2. C. 3. B. 4. E. 5. F/E (uterus which is located in the pelvic cavity). 6. D/E. (fallopian tube which is located in the pelvic cavity). 7. F/E. (uterus which is located in the pelvic cavity).

## 18.3 Obstetrics

**Obstetrics** (ob-STET-ricks) is the branch of medicine dealing with pregnancy, childbirth, and the postpartum period. Childbirth is also known as **parturition** (par-tyoo-RISH-un). The postpartum period is also known as the **puerperium** (pyoo-er-PEER-ee-um). The specialist is called an **obstetrician** (ob-steh-TRIH-shun). **Gynecology** (gye-neh-KOL-eh-jee) is the medical-surgical specialty dealing with the female reproductive system in the nonpregnant state. The two specialities are combined and named Obstetrics and Gynecology. They are often abbreviated OB/GYN.

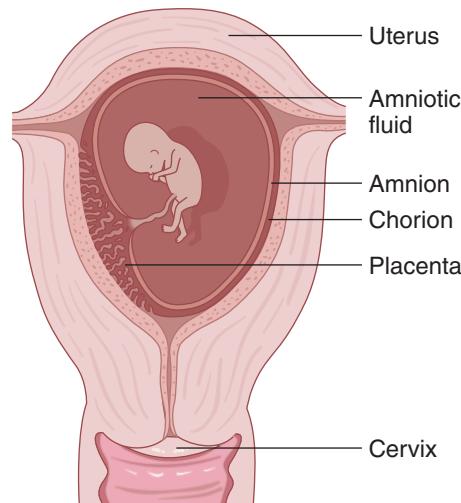
### Pregnancy

Conception or fertilization takes place in the fallopian tube. The fertilized egg is called the **zygote** (ZYE-goht). It implants in the wall of the uterus. The zygote is referred to as the embryo (EM-bree-oh) after the second week of pregnancy. After the eighth week, it is called the fetus (FEE-tus). Full development takes about 40 weeks. This is called the **gestation** (jess-TAY-shun) **period**.

At the beginning of pregnancy, the **placenta** develops and attaches high up on the uterine wall. The placenta is an organ. It allows for the exchange of nutrients and waste products between mother and developing embryo. This exchange is made possible by the **umbilical** (um-BILL-ih-kahl) **cord**, the lifeline between mother and baby.

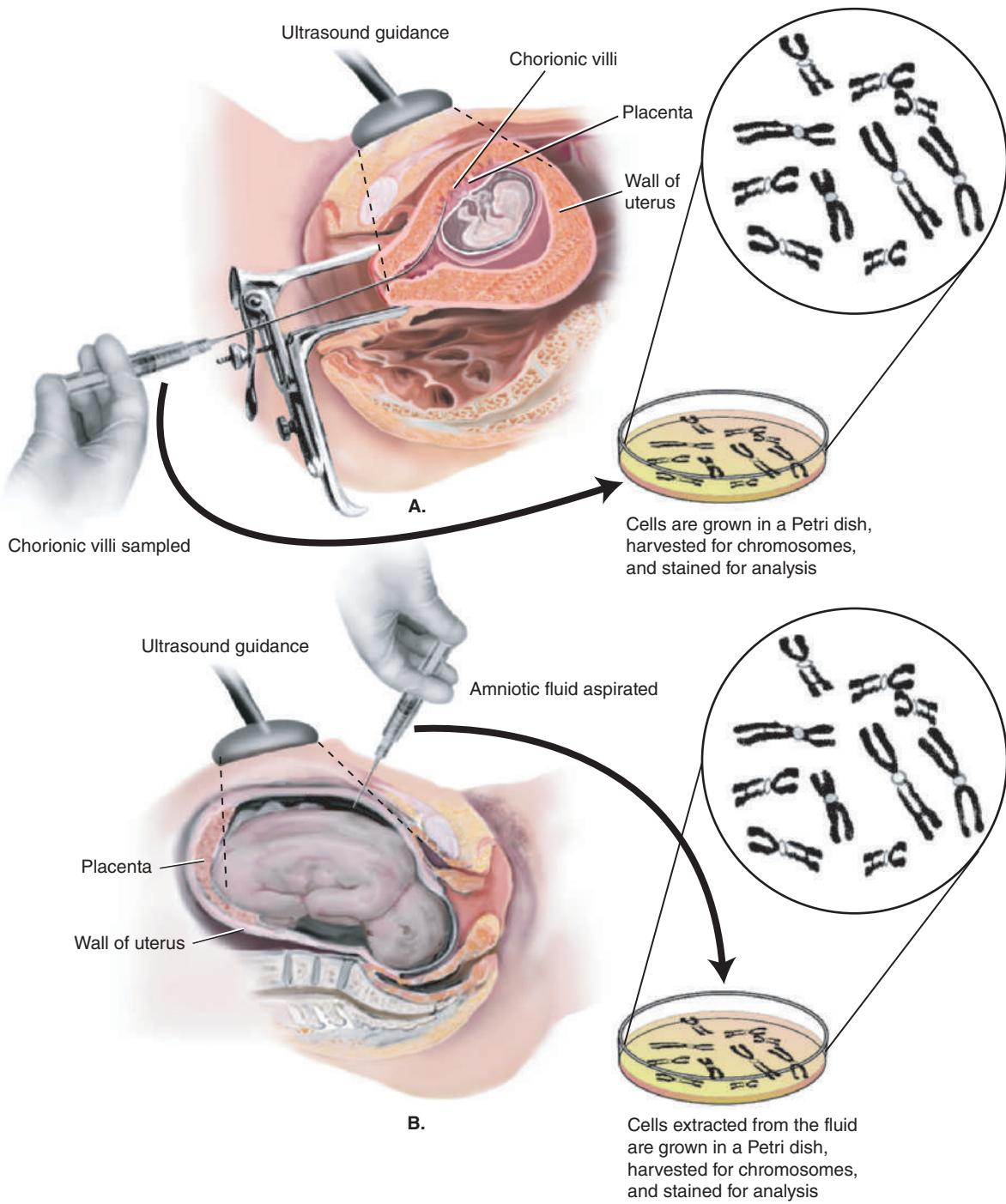
The placenta is made up of the **chorion** (KOR-ee-on) and the **amnion** (am-nee-on). The chorion is the outermost layer. The amnion is the innermost layer (Figure 18-5). The embryo (and later the fetus) is encased within the amnion. The amnion is filled with **amniotic fluid**, which protects the embryo.

The placenta secretes a hormone called **human chorionic gonadotropin** (kor-ee-ON-ick goh-nah-doh-TROH-fin). The abbreviation is **HCG**. A pregnancy test looks for the presence of HCG. When it is detected, pregnancy is confirmed.



**Figure 18-5** Placenta. Chorion is the outer layer. Amnion is the inner layer. Within the amniotic cavity the fetus floats while developing.

Fetal abnormalities are detected by two diagnostic procedures: **amniocentesis** (**a**m-nee-oh-sen-**T**EE-sis) and **chorionic** (**k**or-ee-**O**N-ick) **villi** **sampling** (CVS) (Figure 18-6). With amniocentesis, amniotic fluid is withdrawn from the amniotic sac during 15 to 18 weeks' gestation. In CVS, placental tissue is removed during 9 to 11 weeks' gestation. In both procedures, certain genetic and chromosomal abnormalities such as Down Syndrome can be detected through examination of the amniotic fluid and placental tissue.



**Figure 18-6** A. Chorionic villus sampling (9 to 11 weeks). B. Amniocentesis (15 to 18 weeks).

## Childbirth

At the end of the gestation period, the birth process begins. It is called parturition. The uterine muscles begin to contract and the uterus expands. This marks the beginning of labor. Occasionally, the contractions stop. This is called **uterine inertia** (YOO-ter-in in-ER-shee-ah). Ultimately, the contractions move the infant through the cervix and vagina. Normal delivery is head first. If the baby is turned around with the buttocks first, it is called a **breech** (BREECH) delivery. A **cesarean** (seh-ZER-ee-an) section (CS) may have to be performed. This involves removal of the baby through an incision in the abdomen and uterus.

After delivery, the placenta is expelled from the uterus. It is called the **afterbirth**. The condition of the newborn is evaluated immediately following delivery and again after 15 minutes. A rating called an **Apgar score** is made. This is done by evaluating each of the following on a 2-point scale: heart rate, respiration, muscle tone, reflex response, and color. The highest rating is 10.

## Postpartum Period

The **postpartum period** follows childbirth. It lasts for 6 to 8 weeks. It is also known as the puerperium. During this period, the uterus returns to normal size. This process is called **involution** (in-voh-LOO-shun).

### In Brief

#### Parturition

childbirth

#### Puerperium

postpartum period

#### Zygote

fertilized egg

#### Embryo

zygote after the second week of pregnancy

#### Gestation

length of pregnancy

#### Placenta

consists of amnion and chorion

secretes HCG

amniotic fluid protects the embryo

#### Diagnostic Procedures

amniocentesis

chorionic villus sampling

**PRACTICE FOR LEARNING: Obstetrics**

Choose the correct answer from the choices given.

- 1.** The postpartum period is also known as \_\_\_\_\_.  
postnatal period    parturition    involution    puerperium
- 2.** The fertilized egg is called \_\_\_\_\_.  
embryo    fetus    zygote    baby
- 3.** The organ responsible for nourishing the fetus and removing waste products is the \_\_\_\_\_.  
uterus    ovaries    placenta    mammary glands
- 4.** An Apgar score represents the \_\_\_\_\_.  
condition of the newborn    condition of the mother    dilation of the cervix
- 5.** Human chorionic gonadotrophin is secreted by the \_\_\_\_\_.  
uterus    ovaries    placenta    mammary glands

**Answers:** 1. puerperium. 2. zygote. 3. placenta. 4. condition of newborn. 5. placenta.

## 18.4 New Roots, Suffixes, and Prefixes

Use these additional roots, suffixes, and prefixes when studying the medical words in this chapter.

ROOT	MEANING
flex/o	bend
men/o	month; menses; menstruation
tub/o	tube
versi/o	turning; tilting; tipping

SUFFIX	MEANING
-an	pertaining to
-arche	beginning
-ine	pertaining to

PREFIX	MEANING
multi-	many
nulli-	none
primi-	first

## 18.5 Learning the Terms

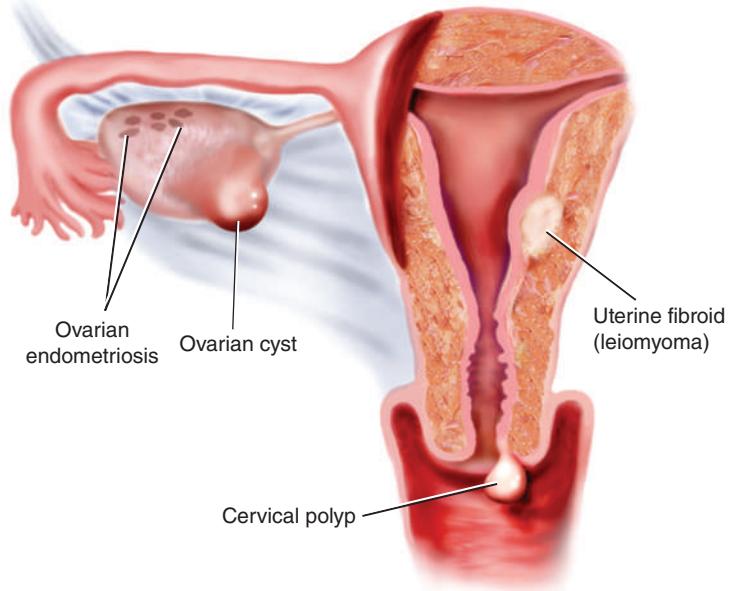
Following these steps will make it easier for you to learn medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

### Terms Pertaining to the Female Reproductive System

#### Roots

ROOT cervic/o	MEANING cervix; cervix uteri; neck of the uterus	
Term	Term Analysis	Definition
cervicitis (ser-vih-SIGH-tis)	-itis = inflammation	inflammation of the cervix
cervical dysplasia (SER-vih-kal dis-PLAY-see-ah)	-al = pertaining to -plasia = development; formation dys- = abnormal; bad; difficult	abnormal cellular development on the surface of the cervix uteri, indicating precancerous changes in its cells
cervical polyp (SER-vih-kal POL-up)	-al = pertaining to polyp = protruding balloon-like neoplasm attached to the mucous membrane by a thin stalk. A type of skin lesion.	abnormal growth extending from the mucous membrane of the cervix uteri (Figure 18-7); usually benign but can turn cancerous



**Figure 18-7** Cervical polyp, endometriosis, ovarian cyst, and uterine fibroid.

ROOT <b>colp/o</b> (see also <b>vagin/o</b> )		MEANING <b>vagina</b>
Term	Term Analysis	Definition
<b>colpopexy</b> (kol-poh-PECK-see)	-pexy = surgical fixation	surgical fixation of the vagina to a surrounding structure
<b>colporrhaphy</b> (kohl-POR-ah-fee)	-rrhaphy = suture	suturing of the vagina

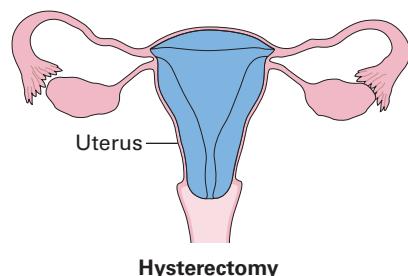
ROOT <b>episi/o</b>		MEANING <b>vulva; external genitalia</b>
Term	Term Analysis	Definition
<b>episiotomy</b> (eh-piz-ee-OT-oh-mee)	-tomy = process of cutting	surgical incision into the perineum. This enlarges the vaginal orifice and prevents tearing of the tissues as the infant moves out of the uterus.
<b>episiorrhaphy</b> (eh-piz-ee-OR-ah-fee)	-rrhaphy = suture	suturing of the vulva and perineum for repair of an episiotomy or laceration

ROOT fibr/o		MEANING fibers; fibrous tissue
Term	Term Analysis	Definition
<b>fibroadenoma</b> (fyeh-broh-ad-eh-NOH-mah)	-oma = mass, tumor aden/o = gland	abnormal masses in the breast that are round, firm, and rubbery; involves the fibrous connective tissue in a gland.

ROOT galact/o		MEANING milk
Term	Term Analysis	Definition
<b>galactorrhea</b> (geh-lack-toh-REE-ah)	-rrhea = flow or discharge	spontaneous flow of breast milk in a woman who is not breastfeeding

ROOT gynec/o		MEANING woman
Term	Term Analysis	Definition
<b>gynecologist</b> (gye-neh-KOL-eh-jist)	-logist = specialist	specialist in the study of diseases and treatment of the female genital tract

ROOT <b>hyster/o</b> (see also metr/o and uter/o)		MEANING uterus
Term	Term Analysis	Definition
<b>hysterectomy</b> (hiss-ter-ECK-toh-mee)	-ectomy = excision; surgical removal	surgical removal of the uterus (Figure 18-8)



**Figure 18-8** Hysterectomy.

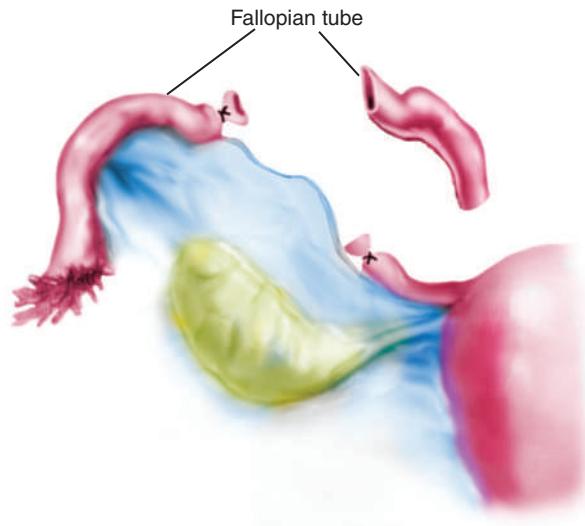
Term	Term Analysis	Definition
<b>hysterosalpingography</b> (hiss-tehr-oh-sal-ping-GOG-rah-fee)	-graphy = process of recording; producing images salping/o = fallopian tubes	x-ray of the uterus and fallopian tubes following injection of a contrast medium

ROOT labi/o		MEANING lips
Term	Term Analysis	Definition
<b>labial</b> (LAY-bee-al)	-al = pertaining to	pertaining to lips

ROOT lact/o		MEANING milk
Term	Term Analysis	Definition
<b>lactogenesis</b> (lack-toh-JEN-ih-sis)	-genesis = production; formation	production and secretion of milk from the breast

ROOT ligati/o		MEANING binding; tying
Term	Term Analysis	Definition
<b>tubal ligation</b> (TOO-bal lye-GAY-shun)	-ion = process -al = pertaining to tub/o = tube; fallopian tube	female sterilization by blocking the fallopian tubes. This prevents the sperm from fertilizing the egg. If no fertilization occurs, the woman cannot become pregnant. The tubes can be blocked by cutting and ligating (tying), clamping, cauterization (burning), or a combination of these procedures (Figure 18-9).

**Note:** A tubal ligation does not involve removal of the uterus or any other organs. Menstruation continues.



**Figure 18-9** Tubal ligation.

ROOT mamm/o; mast/o		MEANING breast
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>mammary</b> (MAM-ah-ree)	-ary = pertaining to	pertaining to the breast
<b>mastectomy</b> (mas-TECK-toh-mee)	-ectomy = excision; surgical removal	surgical removal of the breast
<b>mastopexy</b> (MAS-toh-peck-see)	-pexy = surgical fixation	surgical fixation of the breast

**Note:** Mastopexy is a type of plastic surgery performed on drooping breasts to improve their look and form.

ROOT men/o		MEANING menses; menstruation; month
<i>Term</i>	<i>Term Analysis</i>	<i>Definition</i>
<b>amenorrhea</b> (ah-men-oh-REE-ah)	-rrhea = discharge; flow a- = no; not	no menstruation
<b>dysmenorrhea</b> (dis-men-oh-REE-ah)	-rrhea = discharge; flow dys- = painful; difficult; bad	painful menstruation
<b>menarche</b> (men-AR-kee)	-arche = beginning	beginning of menstrual function
<b>menorrhea</b> (men-oh-REE-ah)	-rrhea = discharge; flow	normal menstruation
<b>menorrhagia</b> (men-oh-RAY-jee-ah)	-rrhagia = bursting forth; abnormal bleeding	excessive uterine bleeding during menstruation

ROOT metr/o		MEANING uterus
Term	Term Analysis	Definition
<b>metrorrhagia</b> (meh-troh-RAY-jee-ah)	-rrhagia = bursting forth; abnormal bleeding	abnormal uterine bleeding at times other than at the regular menstrual period
<b>menometrorrhagia</b> (men-oh-met-roh-RAY-jee-ah)	-rrhagia = bursting forth; abnormal bleeding	excessive bleeding during menses and at irregular intervals between periods

ROOT oophor/o (see also ovar/o)		MEANING ovary
Term	Term Analysis	Definition
<b>oophororrhagia</b> (oh-off-oh-RAY-jee-ah)	-rrhagia = bursting forth; abnormal bleeding	hemorrhaging from the ovary

ROOT ovari/o		MEANING ovary
Term	Term Analysis	Definition
<b>ovarian cyst</b> (oh-VAR-ree-an SIST)	-an = pertaining to cyst = closed sac or cavity containing fluid, semifluid, or solid material	abnormal cystic growth on the ovary (see Figure 18-7)
<b>ovarioorrhesis</b> (oh-var-ee-oh-RECK-sis)	-rrhexis = rupture	ruptured ovary

ROOT perine/o		MEANING perineum (area between the vagina and the anus)
Term	Term Analysis	Definition
<b>perineorrhaphy</b> (per-ih-nee-OR-ah-fee)	-rrhaphy = suture	suturing of the perineum following laceration of the area during delivery of the fetus

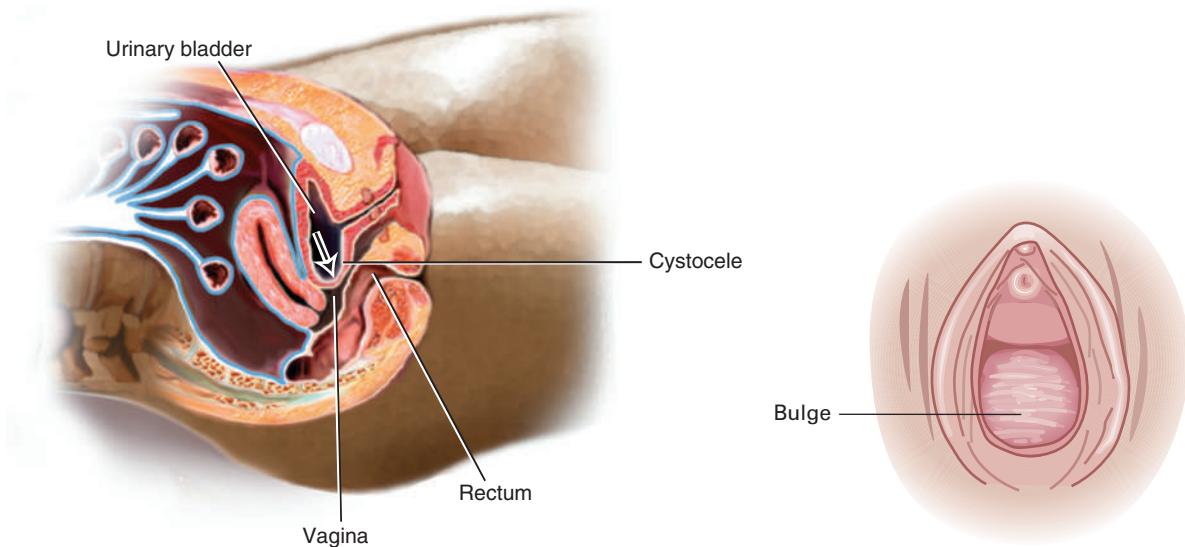
ROOT <b>salping/o</b> (see also -salpinx)		MEANING <b>fallopian tube; uterine tube</b>
Term	Term Analysis	Definition
<b>salpingo-oophorectomy</b> (sal-ping-goh-oh-off-oh -RECK-toh-mee)	-ectomy = excision; surgical removal oophor/o = ovary	surgical removal of the fallopian tubes and ovaries

ROOT <b>uter/o</b>		MEANING <b>uterus</b>
Term	Term Analysis	Definition
<b>intrauterine</b> (in-trah-YOO-ter-in)	-ine = pertaining to intra- = within	pertaining to within the uterus
<b>uterine fibroids</b> (YOO-ter-in FYE-broidz)	-ine = pertaining to fibroid = type of benign tumor	a benign tumor of the uterine muscle (see Figure 18-7); also known as fibroid, myoma, or fibromyoma (figh-broh-my-OH-mah)
<b>uterovesical</b> (yoo-ter-oh-VES-ih-kal)	-al = pertaining to vesic/o = bladder	pertaining to the uterus and bladder

ROOT <b>vagin/o</b>		MEANING <b>vagina</b>
Term	Term Analysis	Definition
<b>vaginomycosis</b> (vaj-ih-noh-mye-KOH-sis)	-osis = abnormal condition myc/o = fungus	fungal infection of the vagina

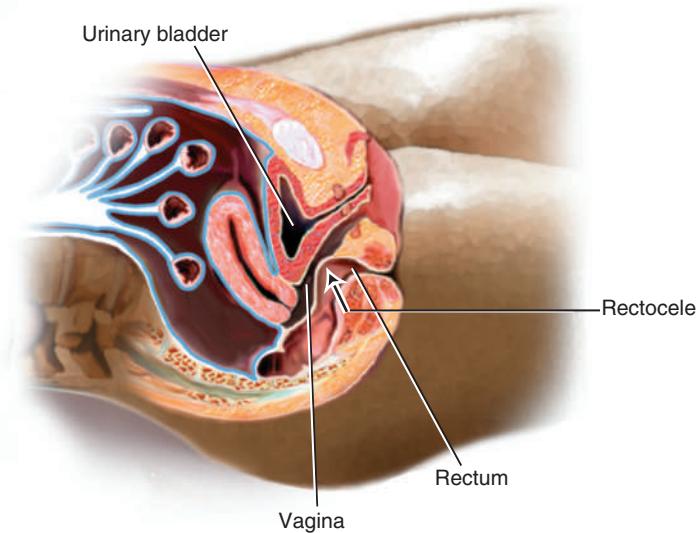
ROOT <b>vulv/o</b>		MEANING <b>vulva; external genitalia; pudendum</b>
Term	Term Analysis	Definition
<b>vulvorectal</b> (vul-voh-RECK-tal)	-al = pertaining to rect/o = rectum	pertaining to the vulva and rectum

SUFFIX -cele	MEANING hernia; protrusion; displacement	
Term	Term Analysis	Definition
<b>cystocele</b> (SIS-toh-seel)	cyst/o = bladder	protrusion of the bladder into the vaginal wall (Figure 18-10A and 18-10B)



**Figure 18-10** A. Cystocele, lateral view. Notice the protrusion of the bladder into the vaginal wall. B. Bulging of vaginal wall, characteristic of a cystocele.

<b>rectocele</b> (RECK-toh-seel)	rect/o = rectum	protrusion of the rectum into the vaginal wall (Figure 18-11)
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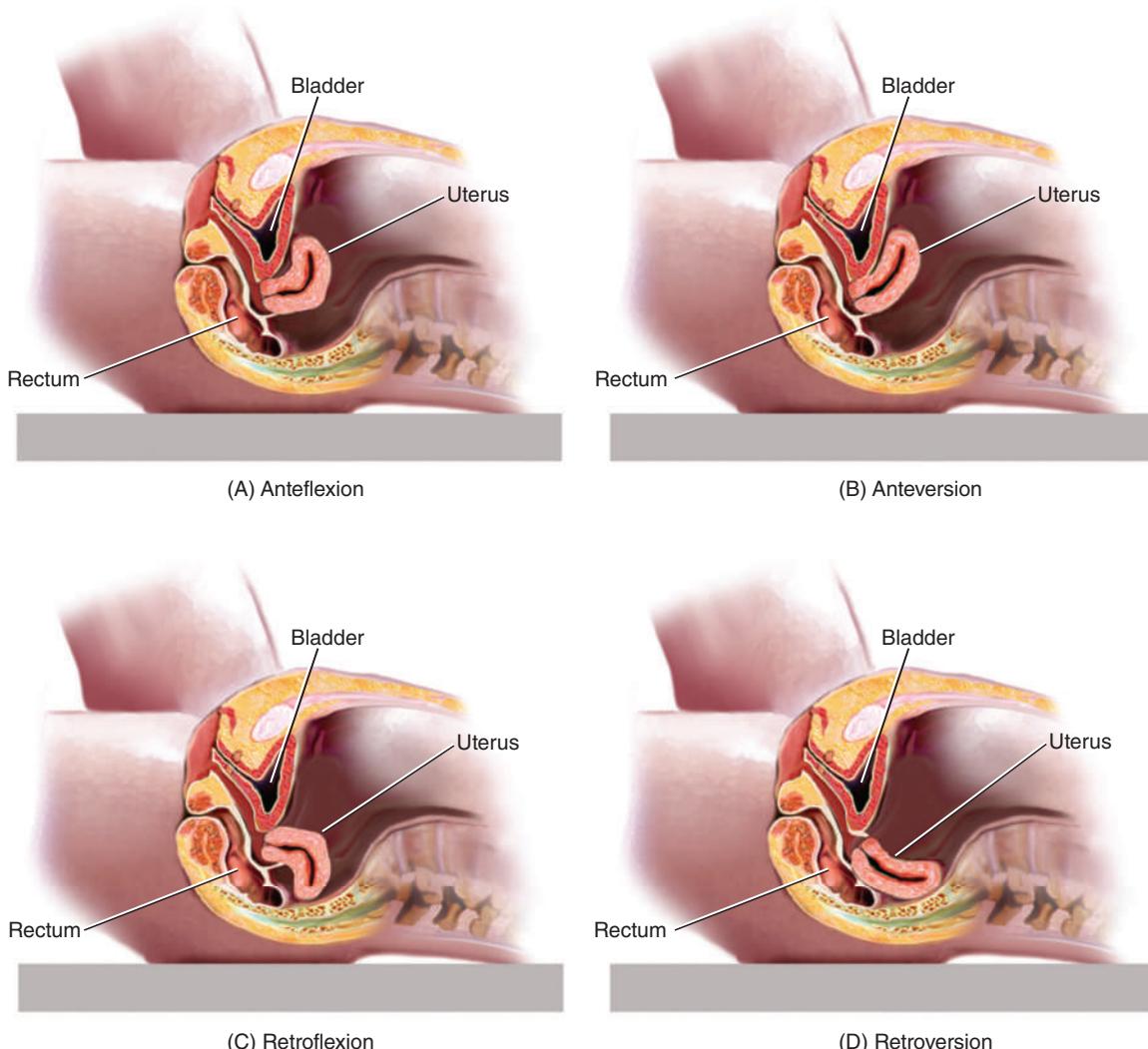
**Figure 18-11** Retrocele. Notice the protrusion of the rectum into the vaginal wall.

## Suffixes

SUFFIX -salpinx		MEANING fallopian tube; uterine tube
Term	Term Analysis	Definition
<b>hydrosalpinx</b> (high-dro-SAL-pinks)	hydr/o = water	accumulation of a watery fluid in the fallopian tube

PREFIX ante-		MEANING before
Term	Term Analysis	Definition
<b>anteflexion</b> (an-tee-FLECK-shun)	-ion = process flex/o = bending	bending forward of a part of an organ; normal position of the uterus (Figure 18-12A)
<b>anteversion</b> (an-tee-VER-zhun)	-ion = process versi/o = tilting; tipping	tilting forward of an organ or part of an organ; forward tilting of the uterus over the bladder (Figure 18-12B); normal position of the uterus.

PREFIX retro-		MEANING back; behind
Term	Term Analysis	Definition
<b>retroflexion</b> (ret-roh-FLECK-shun)	-ion = process flex/o = bending	bending back of a part of an organ. Abnormal position of the uterus (Figure 18-12C)
<b>retroversion</b> (ret-roh-VER-zhun)	-ion = process versi/o = tilting; tipping	tilting backward of an organ or part of an organ. Abnormal position of the uterus. (Figure 18-12D)



**Figure 18-12** Uterine positions. A. Anteflexion. B. Anteversion. C. Retroflexion. D. Retroversion. Anteflexion and anteversion are normal uterine positions.

## Terms Pertaining to Obstetrics

### Roots

**ROOT**  
**amni/o**

**MEANING**  
**amnion; sac in which the fetus develops in the uterus**

**amniocentesis**  
(am-nee-oh-sen-TEE-sis)

-centesis = surgical puncture

surgical puncture to withdraw fluid from the amnion for genetic analysis

ROOT nat/o		MEANING birth
<b>postnatal</b> (pohst- <b>NAY</b> -tal)	-al = pertaining to post- = after	pertaining to the period after birth of the newborn
<b>prenatal</b> (pree- <b>NAY</b> -tal)	-al = pertaining to pre- = before	pertaining to before birth (referring to the fetus); antenatal

ROOT top/o		MEANING place
<b>ectopic pregnancy</b> (eck- <b>TOP</b> -ick <b>PREG</b> -nan-see)	-ic = pertaining to ec- = out	pregnancy occurring in a place other than the uterus, such as the fallopian tube

## Suffixes

SUFFIX -gravida		MEANING pregnancy
<b>multigravida</b> (mul-tih- <b>GRAV</b> -ih-dah)	multi- = multiple	a woman who has been pregnant two or more times (written gravida II, gravida III, gravida IV, etc., or GI, GII, GIII, GIV, etc.)
<b>nulligravida</b> (nul-ih- <b>GRAV</b> -ih-dah)	nulli- = none	a woman who has never been pregnant
<b>primigravida</b> (prih-mih- <b>GRAV</b> -ih-dah)	primi- = first	a woman who is pregnant for the first time

SUFFIX -para		MEANING to bear; give birth
<b>multipara</b> (mul- <b>TIP</b> -ah-rah)	multi- = multiple	a woman who has given birth to two or more viable infants. Viable means that the fetus can live on its own outside the uterus. Written para II, para III, etc., or PII, PIII, etc.
<b>nullipara</b> (nul- <b>LIP</b> -ah-rah)	nulli- = none	a woman who has never given birth to a viable infant
<b>primipara</b> (prye- <b>MIP</b> -ah-rah)	primi- = first	a woman who has given birth to a viable infant for the first time (written para I or P1)

SUFFIX -partum		MEANING <b>labor; delivery; childbirth</b>
<b>antepartum</b> (an-tee-PAR-tum)	ante- = before	before birth (referring to the mother)
<b>postpartum</b> (pohst-PAR-tum)	post- = after	after birth (referring to the mother)

## 18.6 Pathology

### Diseases Relating to the Female Reproductive System

#### Breast Cancer

Breast cancer is a malignant tumor of the breast. If left untreated, the cancer can metastasize. This means that it spreads to the surrounding breast tissue, to the lymph nodes, and then to other parts of the body through the blood and lymph. Breast cancer is described in stages ranging from 0 to IV depending upon the size of the tumor, the lymph node involvement, and degree of **metastasis**. In stage 0, the tumor is small, there is no lymph node involvement, and no metastasis. In stage IV, there is lymph node involvement, and the tumor has spread to distant organs. Stages I to III are varying degrees of severity between stages 0 and IV.

The exact cause is unknown. Breast cancer is associated with several risk factors: family history, high estrogen levels, age, alcohol consumption, and obesity. Two breast cancer genes have been identified, **BRCA1** and **BRCA2**. Inheritance of either one of these genes can increase the chance of breast cancer, although cancer is not inevitable.

Treatment includes surgical removal of the tumor by **lumpectomy** (lump-ECK-toh-mee). The cancerous tissue is removed, but the remainder of the breast tissue is left intact. At the same time, lymph nodes are checked to see if the cancer has spread beyond the breast. This is followed by **radiation therapy** (radiotherapy) to kill cancer cells.

Another surgical procedure is **mastectomy**, the surgical removal of the breast. This involves excising the entire breast. The axillary lymph nodes may or may not be removed. Mastectomy is followed by chemotherapy and radiation therapy. If the mastectomy also includes removal of the pectoral muscles and axillary lymph nodes, it is called **radical mastectomy**.

#### Cervical Cancer

Cervical cancer involves the infiltration of cancer cells into the neck of the uterus. A sexually transmitted infection, **human papillomavirus** (pap-ih-LOH-mah-vye-rus) (HPV) causes most cases of cervical cancer.

### Endometriosis (**en-doh-mee-tree-OH-sis**)

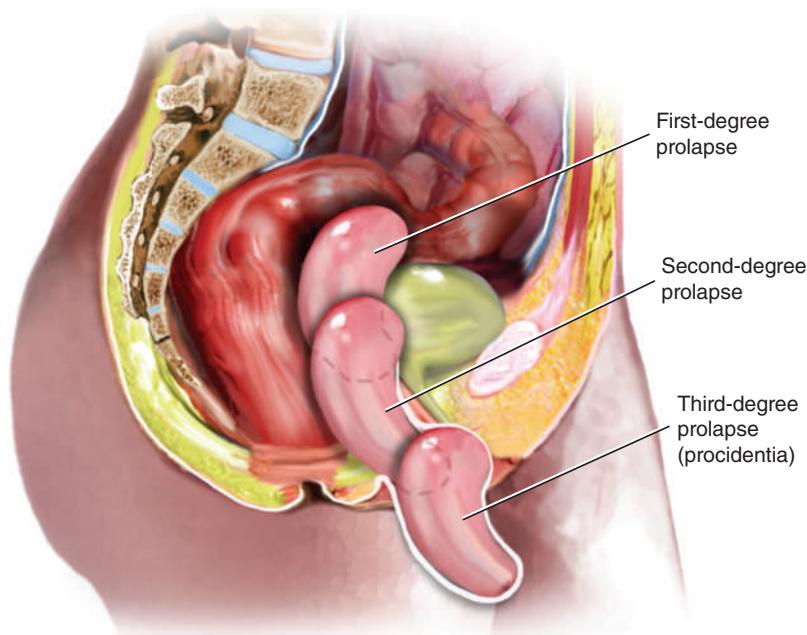
Endometrial tissue found at sites other than the uterus (Figure 18-7). The ectopic (out of place) endometrial tissue finds its way into the pelvic cavity by moving out of the uterus and through the open fallopian tubes. Other abnormal sites where the endometrium can be found include the ovaries, tubes, and abdominal cavity.

### Uterine (Endometrial) Cancer

Endometrial cancer is a malignant tumor of the endometrium, which lines the uterus. Uterine cancer is the most common cancer of the reproductive organs. The exact cause is unknown. A combination of surgery, radiation therapy, hormonal therapy, and chemotherapy is the most common treatment. A **total abdominal hysterectomy** (TAH) is done. In some cases, a total abdominal hysterectomy with **bilateral salpingo-oophorectomy** (BSO) is necessary. The abbreviation then becomes TAH-BSO. If the cancer is spreading, a **radical hysterectomy** may be performed. This includes removal of the nearby lymph nodes.

### Uterine Prolapse

Protrusion or displacement of the uterus through the vaginal canal. There are three stages (degrees) of prolapse, depending on how far into the vaginal canal the uterus has fallen. First degree: The uterus projects into the vaginal canal but not into the **introitus** (in-TROH-ih-tuss) (entrance to the vagina). Second degree: The uterus projects further into the vaginal canal up to the introitus. Third degree: The uterus and cervix project through the introitus. This stage is also known as **procidentia** (proh-sih-DEN-shah). These are illustrated in Figure 18-13.



**Figure 18-13** Uterine prolapse. First degree: The cervix projects into the vaginal canal but does not project into the introitus (entrance to the vagina). Second degree: The uterus projects further into the vaginal canal up into the introitus. Third degree: The uterus and cervix project through the introitus. This stage is also known as procidentia (proh-sih-DEN-shah).

### Sexually Transmitted Infections (STIs)

STIs, also known as venereal disease (VD) and sexually transmitted disease (STD), include any disease that has been transmitted through any type of sexual activity, including vaginal, oral, and anal sex.

The most common types of STIs are:

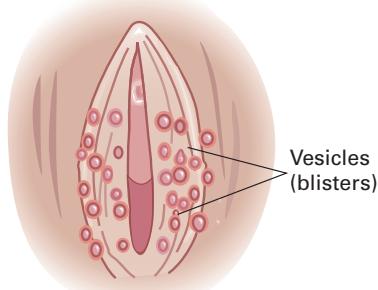
- acquired immunodeficiency syndrome (AIDS) caused by human immunodeficiency virus (HIV)
- chlamydia (klah-MID-ee-ah), caused by *Chlamydia trachomatis* (klah-MID-ee-ah tray-koh-MAH-tiss)
- genital herpes (JEN-ih-tahl HER-peez), caused by the herpes simplex virus (Figure 18-14)
- genital warts caused by the human papillomavirus (Figure 18-15)
- gonorrhea (gon-oh-REE-ah) caused by *Neisseria* (nigh-SEE-ree-ah) *gonorrhoeae*
- human immunodeficiency virus infection. If left untreated HIV infection will lead to AIDS.
- syphilis (SIF-ih-lis) caused by *Treponema pallidum* (trep-oh-NEE-mah PAL-ih-dum)
- trichomoniasis (trick-oh-mon-EYE-ah-sis) caused by *Trichomonas vaginalis*

In the early stages of these diseases, the patient is often asymptomatic (there are no symptoms). The patient may therefore spread the disease to other persons without knowing it. If left untreated, permanent damage to the reproductive organs may result.

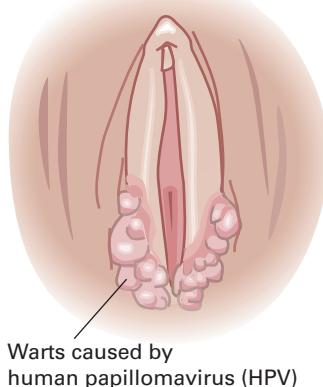
### Conditions Relating to Obstetrics

#### Abortion

Abortion is the termination of pregnancy before the embryo or fetus is viable. A **spontaneous abortion** is also known as a **miscarriage** and occurs because of an abnormality or genetic disorder. A **therapeutic abortion** or **induced abortion** is performed intentionally by drug intake or by mechanical means. An operation called **dilation and curettage** (kyoo-reh-TAZH) (D&C) may be performed. This involves the widening



**Figure 18-14** Genital herpes.



**Figure 18-15** Genital warts.

of the uterine cavity and the scraping of the uterine wall to remove the fetus. As an alternative, the fetus may be removed by suction. This is also known as **vacuum aspiration**.

### Abruptio Placentae (ab-RUP-she-oh plah-SEN-tee)

Premature detachment of the placenta from the uterine wall resulting in hemorrhage and premature labor and ending in termination of the pregnancy.

### Infertility and Assisted Reproductive Therapy

Infertility is defined as not having the ability to get pregnant despite having unprotected sex for at least one year. **Assisted reproductive therapy** (ART) gives the highest chance of pregnancy for most couples. Three types of ART are described below.

**Fertility medications** Drugs that stimulate follicle development in the ovaries.

**In vitro fertilization** In vitro fertilization (IVF) is the most common technique. IVF involves removal of mature eggs from a woman, fertilizing the eggs with a man's sperm in a dish in a laboratory, and implanting the fertilized egg in the uterus. The hope is that the fertilized egg will attach to the uterine wall and continue to develop into a fetus until delivery. **In vitro** means in a glass, test tube, or dish.

**Artificial insemination** **Artificial insemination** (in-SEM-ih-NAY-shun) is the introduction of sperm into the uterus by means other than sexual intercourse. This is performed during the ovulatory period of the menstrual cycle.

### Placenta Previa (PREH-vee-ah)

Placenta previa is the attachment of the placenta near the cervix uteri instead of high up on the uterine wall. This can cause hemorrhaging and premature labor that places mother and baby at risk. Cesarean section is necessary.

### Preeclampsia (pree-eh-KLAMP-see-ah) and Eclampsia

Preeclampsia is a condition that can occur after the twentieth week of pregnancy. It is characterized by hypertension, albuminuria (protein in the urine), and excessive edema. If left untreated, convulsion and coma might result, and the condition is then called **eclampsia**, which can be fatal. Treatment includes medication and delivery of the fetus.

### Premature Infant

A premature infant is one born before 37 weeks' gestation, which is more than three weeks before the due date.

### Stillbirth

A stillbirth (SB) is a fetus that has died in utero. Most common in full-term pregnancies.

### Uterine Inertia

Uterine inertia is the loss of uterine muscle contractions during labor.

## 18.7 Look-Alike and Sound-Alike Words

*Below is a list of look-alike and sound-alike words. Study the spelling and definitions of each set of words. Questions will follow in the Review Exercises.*

**TABLE 18-1 Look-Alike and Sound-Alike Words**

menorrhagia	excessive uterine bleeding during menstruation
menorrhalgia	painful menstruation
metrorrhagia	uterine bleeding at times other than at the regular menstrual period
perineal	pertaining to the perineum
peritoneal	pertaining to the peritoneum
peroneal	pertaining to the fibula or outer side of the leg
parametrium	connective tissue located beside the uterus
perimetrium	outermost wall of the uterus

## 18.8 Review Exercises

### EXERCISE 18-1 Look-Alike and Sound-Alike Words

*Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 18-1 if it helps you.*

1. The patient was admitted with excessive menstrual bleeding. It was decided that a hysterectomy would be a permanent solution for her (**menorrhagia/metrorrhagia**).
2. Dysmenorrhea and (**menorrhagia/menorrhalgia/metrorrhagia**) mean the same thing.
3. The third degree (**perineal/peritoneal/peroneal**) tear was a complication of delivery due to a very large fetal head.
4. The malignant cells have spread outside the uterine wall to the (**perimetrium/parametrium**).

### EXERCISE 18-2 Matching Word Parts with Meaning

*I. Match the word part in Column A with its meaning in Column B.*

<b>Column A</b>	<b>Column B</b>
_____	<b>1.</b> ante-
_____	<b>2.</b> episio-
_____	<b>3.</b> colp/o
_____	<b>4.</b> gynec/o
_____	<b>5.</b> salping/o
_____	<b>6.</b> ligati/o
_____	<b>7.</b> men/o
_____	<b>8.</b> -arche
_____	<b>9.</b> metr/o
_____	<b>10.</b> oophor/o
	A. vulva
	B. uterus
	C. binding; tying
	D. month
	E. ovary
	F. beginning
	G. fallopian tubes
	H. before
	I. woman
	J. vagina

*II. Match the word part in Column A with its meaning in Column B.*

<b>Column A</b>	<b>Column B</b>
_____	<b>1.</b> -rrhaphy
_____	<b>2.</b> nulli-
_____	<b>3.</b> lact/o
_____	<b>4.</b> top/o
_____	<b>5.</b> mamm/o
_____	<b>6.</b> -gravida
_____	<b>7.</b> myc/o
_____	<b>8.</b> -para
_____	<b>9.</b> versi/o
_____	<b>10.</b> primi-
	A. none
	B. milk
	C. tilting
	D. suture
	E. breast
	F. to give birth
	G. pregnancy
	H. first
	I. place
	J. fungus

### EXERCISE 18-3 Matching—Anatomy

*Match the term in Column A with its description in Column B.*

<b>Column A</b>	<b>Column B</b>
_____	<b>1.</b> estrogen
_____	<b>2.</b> ovum
_____	<b>3.</b> fimbriae
_____	<b>4.</b> cervix uteri
_____	<b>5.</b> endometrium
	A. discharge of endometrial tissue
	B. neck of the uterus
	C. inner lining of the uterus
	D. part of the external genitalia

- |       |                              |   |
|-------|------------------------------|---|
| _____ | <b>6.</b> rectouterine pouch | E. hormone responsible for the growth of blood vessels in the endometrium |
| _____ | <b>7.</b> labium majora      | F. egg  |
| _____ | <b>8.</b> progesterone       | G. houses and protects the developing fetus                               |
| _____ | <b>9.</b> uterus             | H. cul-de-sac of Douglas  |
| _____ | <b>10.</b> menstruation      | I. hormone responsible for developing female secondary characteristics    |
|       |                              | J. portion of the fallopian tube  |

#### EXERCISE 18-4 Matching—Pathology

Match the following terms with its description that is written below. Not all terms are used.

metastasize

---

endometriosis

---

endometrial cancer

---

breast cancer

---

uterine prolapse

---

Chlamydia

---

- 1.** ectopic endometrium \_\_\_\_\_
- 2.** the spread of cancer from one organ to another \_\_\_\_\_
- 3.** the most common cancer of the female reproductive system  
\_\_\_\_\_
- 4.** displacement of the uterus through the vaginal canal  
\_\_\_\_\_
- 5.** a sexually transmitted disease \_\_\_\_\_

### EXERCISE 18-5 Labeling—Female Reproductive Tract

Using the body structures listed below, label Figure 18-16. Write your answer in the numbered spaces provided below, or if you prefer, on the diagram.

cervix \_\_\_\_\_

fallopian tube \_\_\_\_\_

ovary \_\_\_\_\_

rectouterine pouch \_\_\_\_\_

urethra \_\_\_\_\_

urinary bladder \_\_\_\_\_

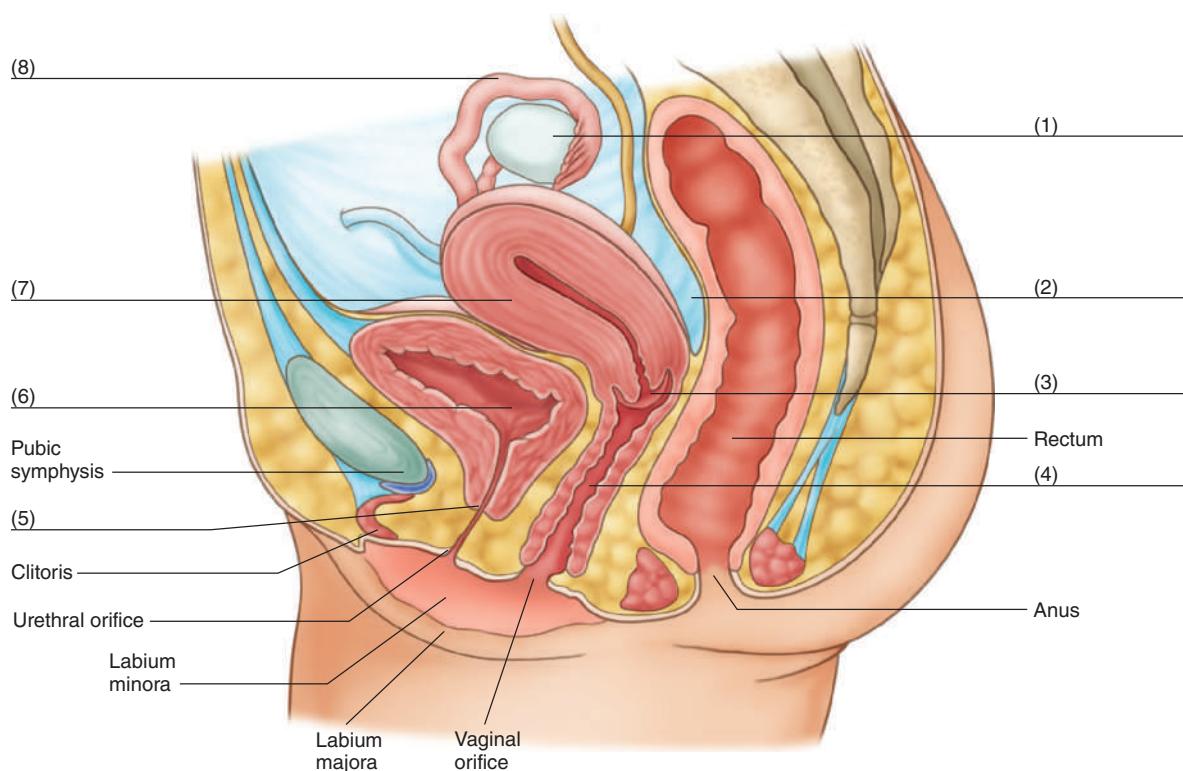
uterus \_\_\_\_\_

vagina \_\_\_\_\_

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_



**Figure 18-16** Major organs of the female reproductive system.

4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_

### EXERCISE 18-6 Definitions—Anatomy

Define the following terms:

1. **estrogen** \_\_\_\_\_
2. **adnexa** \_\_\_\_\_
3. **myometrium** \_\_\_\_\_
4. **fertilization** \_\_\_\_\_
5. **lactiferous ducts** \_\_\_\_\_
6. **perimetrium** \_\_\_\_\_
7. **lactiferous sinus** \_\_\_\_\_
8. **ovulation** \_\_\_\_\_
9. **fetus** \_\_\_\_\_
10. **fundus of the uterus** \_\_\_\_\_
11. **puerperium** \_\_\_\_\_
12. **parturition** \_\_\_\_\_
13. **zygote** \_\_\_\_\_
14. **chorion** \_\_\_\_\_
15. **Apgar score** \_\_\_\_\_

### EXERCISE 18-7 Physiology

Write one function for each of the following.

1. ovaries \_\_\_\_\_
2. fimbriae \_\_\_\_\_
3. Bartholin gland \_\_\_\_\_
4. mammary glands \_\_\_\_\_

5. amniotic fluid \_\_\_\_\_
6. progesterone \_\_\_\_\_
7. fallopian tubes \_\_\_\_\_
8. uterus \_\_\_\_\_
9. vagina \_\_\_\_\_

### EXERCISE 18-8 Definitions—Learning the Terms

*Define the following terms.*

1. **cervical polyp** \_\_\_\_\_
2. **colporrhaphy** \_\_\_\_\_
3. **episiotomy** \_\_\_\_\_
4. **fibroadenoma** \_\_\_\_\_
5. **salpingo-oophorectomy** \_\_\_\_\_
6. **gynecologist** \_\_\_\_\_
7. **labial** \_\_\_\_\_
8. **lactogenesis** \_\_\_\_\_
9. **tubal ligation** \_\_\_\_\_
10. **mastopexy** \_\_\_\_\_
11. **menorrhea** \_\_\_\_\_
12. **menorrhagia** \_\_\_\_\_
13. **metrorrhagia** \_\_\_\_\_
14. **hysterectomy** \_\_\_\_\_
15. **vaginomycosis** \_\_\_\_\_
16. **cystocele** \_\_\_\_\_
17. **hydrosalpinx** \_\_\_\_\_
18. **anteflexion** \_\_\_\_\_
19. **retroversion** \_\_\_\_\_
20. **cervicitis** \_\_\_\_\_
21. **multipara** \_\_\_\_\_
22. **amniocentesis** \_\_\_\_\_

**EXERCISE 18-9 Building Medical Words**

I. Use the combining form *men/o* to build medical words for the following definitions.

- a. no menstruation \_\_\_\_\_
- b. painful menstruation \_\_\_\_\_
- c. normal menstruation \_\_\_\_\_
- d. excessive uterine bleeding during menstruation \_\_\_\_\_

II. Use the combining form *metr/o* to build medical words for the following definitions.

- a. inner uterine wall \_\_\_\_\_
- b. uterine bleeding at times other than regular menstrual periods \_\_\_\_\_
- c. muscular uterine wall \_\_\_\_\_
- d. outermost wall of the uterus \_\_\_\_\_

III. Use the suffix *-gravid* to build medical words for the following definitions.

- a. woman who has been pregnant two or more times \_\_\_\_\_
- b. woman who has never been pregnant \_\_\_\_\_
- c. woman who is pregnant for the first time \_\_\_\_\_

**EXERCISE 18-10 Definitions in Context**

Define the bolded terms in the spaces provided. Use your medical dictionary if necessary.

1. **Laparoscopic tubal ligation** was performed following delivery.

- a. laparoscopic tubal ligation \_\_\_\_\_

2. At laparoscopy, the **uterus** was small and normal in appearance. Both **fallopian tubes** were normal in appearance. The fallopian tubes were clamped and **ligated**.

- b. uterus \_\_\_\_\_
- c. fallopian tubes \_\_\_\_\_
- d. ligated \_\_\_\_\_

3. There was one area of **endometriosis** near the **fimbrial** aspect of the right fallopian tube.

- e. endometriosis \_\_\_\_\_
- f. fimbrial \_\_\_\_\_

4. On examination, the uterus was enlarged, and an **ultrasound** confirmed the presence of **fibroids**.

g. ultrasound \_\_\_\_\_

h. fibroids \_\_\_\_\_

### EXERCISE 18-11 Spelling

*Circle any words that are spelled incorrectly in the list below. Then correct the spelling in the space provided.*

1. menstration \_\_\_\_\_
2. Bartolin cyst \_\_\_\_\_
3. epiziorhaphy \_\_\_\_\_
4. dismenorrhea \_\_\_\_\_
5. pereniorrhaphy \_\_\_\_\_
6. rectroflection \_\_\_\_\_
7. endometriosis \_\_\_\_\_
8. sphylis \_\_\_\_\_

### EXERCISE 18-12 Short Answer—Pathology

*State whether the following sentences are true or false. If false, explain why.*

1. In stage IV breast cancer there is no lymph node involvement and there is no metastasis to distant organs. \_\_\_\_\_
2. Removal of the breast including the pectoral muscles and axillary lymph nodes is called a radical mastectomy. \_\_\_\_\_
3. A miscarriage is also known as a spontaneous abortion.  
\_\_\_\_\_
4. Fertility medications stimulate the uterus to develop follicles.  
\_\_\_\_\_
5. Eclampsia is a complication of pregnancy that may cause death.  
\_\_\_\_\_
6. Uterine inertia is a complication of labor. \_\_\_\_\_
7. A primigravida is a woman who has given birth to a viable infant for the first time.  
\_\_\_\_\_

8. The amnion is the inner lining of the placenta. \_\_\_\_\_
9. After a total hysterectomy a woman cannot produce estrogen and progesterone. \_\_\_\_\_
10. A zygote is a fertilized egg. \_\_\_\_\_
11. Syphilis is caused by *Treponema pallidum*. \_\_\_\_\_
12. Genital warts are caused by herpes simplex. \_\_\_\_\_

## Animations

Visit the companion website to view the videos on **Amniocentesis; Mastectomies; and Secondary Sex Characteristics**.

### 18.9 Pronunciation and Spelling

1. Listen to each word on the audio file provided in the Student Companion Website.
2. Spell each word in the space provided.

Word	Pronunciation	Spelling
adnexa	ad-NECK-sah	
amenorrhea	ah-men-oh-REE-ah	
areola	ah-REE-oh-lah	
cervicitis	ser-vih-SIGH-tis	
cervix uteri	SER-vicks YOO-ter-eye	
Chlamydia	klah-MID-ee-ah	
colporrhaphy	kohl-POR-ah-fee	
cul-de-sac of Douglas	kuhl-deh-sack of DUG-lass	
cystocele	SIS-toh-seel	
dysmenorrhea	dis-men-oh-REE-ah	
endometriosis	en-doh-mee-tree-OH-sis	
endometrium	en-doh-MEE-tree-um	
episiorrhaphy	eh-piz-ee-OR-ah-fee	
estrogen	ES-troh-jen	

Word	Pronunciation	Spelling
<b>fallopian tubes</b>	fal-LOH-pee-an <b>TOOBZ</b>	
<b>fetus</b>	FEE-tus	
<b>genitalia</b>	jen-ih-TAIL-ee-ah	
<b>gynecologist</b>	gye-neh-KOL-oh-jist	
<b>hysterectomy</b>	hiss-ter-ECK-toh-mee	
<b>menstruation</b>	men-stroo-AY-shun	
<b>myometrium</b>	my-oh-MEE-tree-um	
<b>oophorrhagia</b>	oh-off-oh-RAY-jee-ah	
<b>parturition</b>	par-tyoo-RISH-un	
<b>obstetrician</b>	ob-steh-TRIH-shun	
<b>ovary</b>	OH-vah-ree	
<b>ovulation</b>	ahv-yoo-LAY-shun	
<b>ovum</b>	OH-vum	
<b>papillomavirus</b>	pap-ih-LOH-mah-vye-rus	
<b>perimetrium</b>	per-ih-MEE-tree-um	
<b>progesterone</b>	pro-JES-teh-rohn	
<b>retroflexion</b>	ret-roh-FLECK-shun	
<b>rectouterine pouch</b>	reck-toh-YOO-ter-in <b>POWCH</b>	
<b>salpingo-oophorectomy</b>	sal-ping-goh-oh-off-oh-RECK-toh-mee	
<b>syphilis</b>	SIF-ih-lis	
<b>uterine fibroids</b>	YOO-ter-in <b>FYE-broidz</b>	
<b>uterine inertia</b>	YOO-ter-in in-ER-shee-ah	
<b>uterovesical</b>	yoo-ter-oh-VES-ih-kal	
<b>uterus</b>	YOO-ter-us	
<b>vagina</b>	vah-JIGH-nah	

## CHAPTER 19

# Endocrine System



### Chapter Outline

- 19.1** Glands of the Endocrine System
- 19.2** Peripheral Endocrine Glands
- 19.3** Central Endocrine Glands
- 19.4** Abbreviations of Major Hormones
- 19.5** New Roots, Suffixes, and Prefixes
- 19.6** Learning the Terms
- 19.7** Pathology
- 19.8** Look-Alike and Sound-Alike Words
- 19.9** Review Exercises
- 19.10** Pronunciation and Spelling

### Learning Objectives

*After studying this chapter and completing the review exercises, you should be able to:*

1. Define endocrine glands and hormones.
2. Name the endocrine glands and the hormones they secrete.
3. Understand the function of these hormones in the body.
4. Describe the structure and location of the endocrine glands.
5. Pronounce, spell, define, and write the medical terms related to the endocrine system.
6. Describe common diseases related to the endocrine system.
7. Listen, read, and study so you can speak and write.

### Introduction

The endocrine (**EN-doh-krin**) system consists of several glands. You can see them in Figure 19-1. Glands are located in many areas of the body. They secrete powerful chemicals called **hormones** (**HOR-mohnz**) into the bloodstream. Hormones travel in the blood to various sites throughout

the body. They regulate organ function and keep the body in a balanced, normal state no matter what is happening outside it. This balance is called **homeostasis** (*hoh-mee-oh-STAY-sis*). One example of homeostasis is the regulation of body temperature. Hormones secreted by glands in the endocrine system maintain the body's normal temperature of about 98.6 degrees Fahrenheit (37 degrees Celsius) regardless of the outside temperature.

This chapter is organized under two major headings: **peripheral endocrine glands** and **central endocrine glands**. The peripheral endocrine glands are the **thyroid** (*THIGH-royd*), **parathyroids** (*par-ah-THIGH-roydz*), **adrenals** (*ah-DREE-nalz*), **pineal** (*PIN-ee-al*), **thymus** (*THIGH-mus*), and **pancreas** (*PAN-kree-as*). The first four have only one function: the production of hormones. The thymus produces hormones and functions in immunity. The pancreas also produces hormones and has important digestive functions. In this way, the thymus and pancreas are similar to other mixed-function organs, such as the kidneys, liver, ovaries, and testicles: They produce hormones as well as perform important work to maintain body function. The functions of these organs, except for the pancreas, have been taken up in their respective chapters.

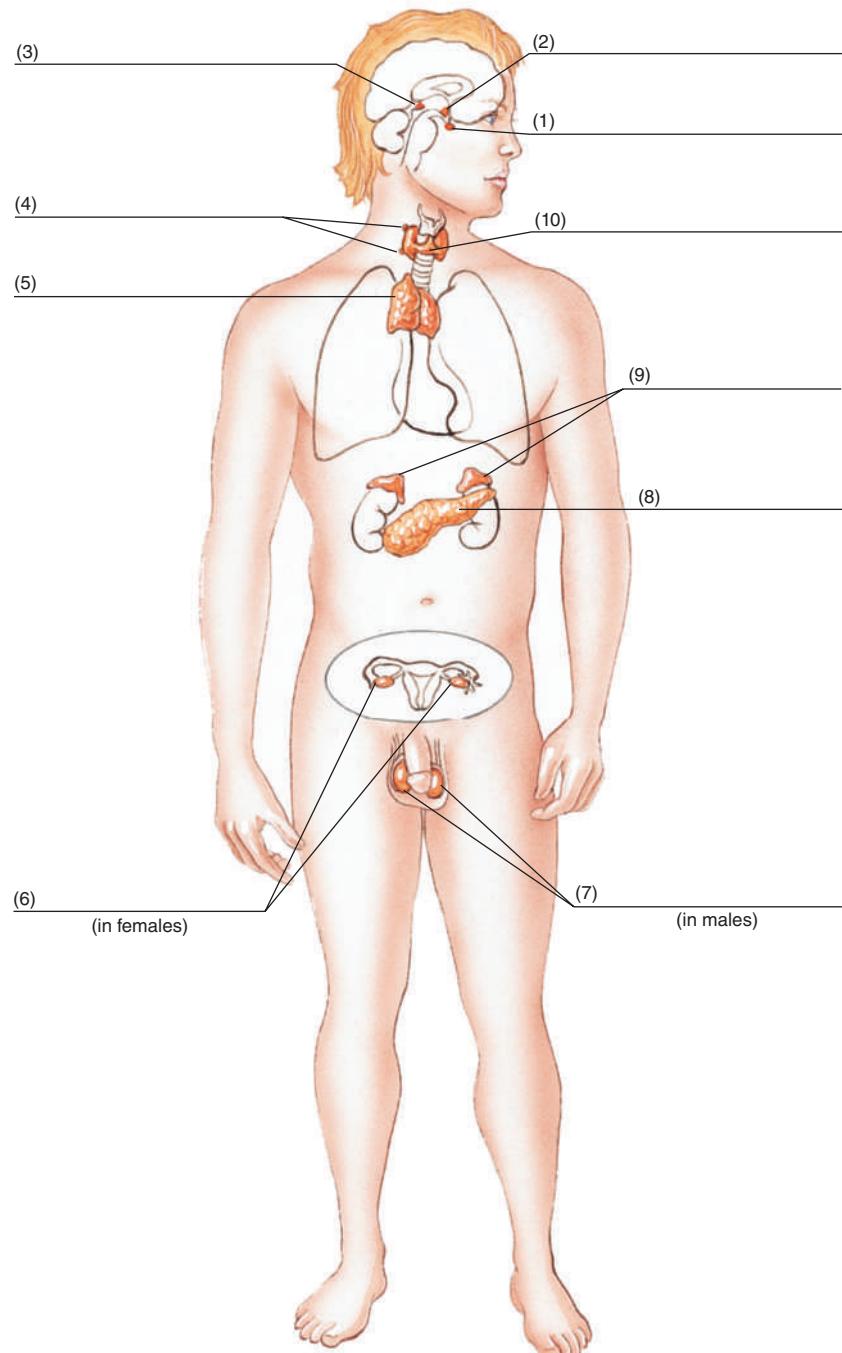
There are only two central endocrine glands: the **pituitary** (*pih-TOO-ih-tar-ee*) gland and the **hypothalamus** (*high-poh-THAL-ah-mus*). They are both in the brain.

## 19.1 Glands of the Endocrine System

### PRACTICE FOR LEARNING: Glands of the Endocrine System

Write the words below in the correct spaces on Figure 19-1. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. pituitary (*pih-TOO-ih-tar-ee*) gland
2. hypothalamus (*high-poh-THAL-ah-mus*)
3. pineal (*PIN-ee-al*) gland
4. parathyroid (*par-ah-THIGH-roid*) gland
5. thymus (*THIGH-mus*) gland
6. ovaries (*OH-vah-rees*)
7. testicles (*TESS-tih-kulz*)
8. pancreas (*PAN-kree-as*)
9. adrenal (*ah-DREE-nal*) glands
10. thyroid (*THIGH-royd*) gland



**Figure 19-1** Major organs of the endocrine system.

## 19.2 Peripheral Endocrine Glands

### Thyroid Gland

#### PRACTICE FOR LEARNING: Thyroid Gland

Write the words below in the correct spaces on Figure 19-2. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

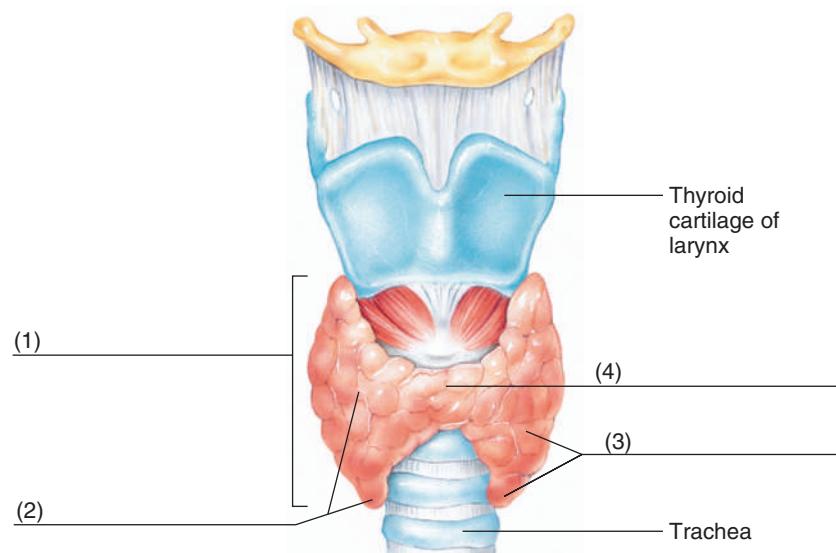
1. thyroid gland
2. right lobe
3. left lobe
4. isthmus (ISS-mus)

#### Location and Structure

Figure 19-2 illustrates the thyroid gland. It is located in the neck, below the larynx. It has right and left lobes connected by a structure called the **isthmus** (ISS-mus).

#### Function

The thyroid secretes the hormones T<sub>3</sub> and T<sub>4</sub>. T<sub>3</sub> is triiodothyronine (trigh-**e**ye-oh-doh-**T**HIGH-roh-nen). T<sub>4</sub> is thyroxine (thigh-**R**O**C**K-sin). Thyroxine is also spelled thyroxin. These hormones regulate how much energy is used by the body's cells to perform their functions. This is called the metabolic rate. Iodine must be consumed in order for the thyroid to produce T<sub>3</sub> and T<sub>4</sub>. A goiter (enlarged thyroid) will result if there is insufficient iodine in the diet.



**Figure 19-2** Thyroid gland.

**In Brief****Thyroid gland**

secretes T<sub>3</sub> and T<sub>4</sub>

**Location**

in the neck

**Function**

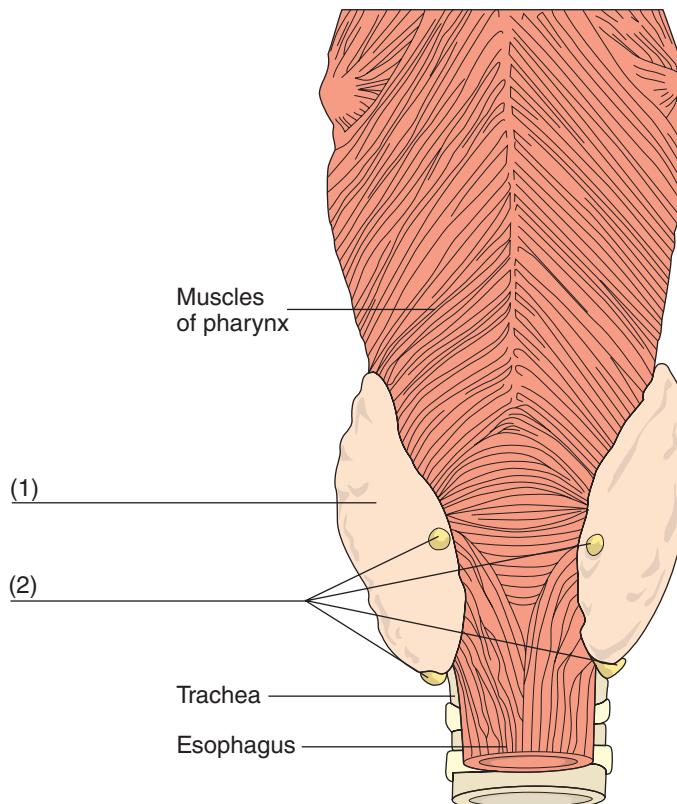
regulates metabolic rate

## Parathyroid Gland

### PRACTICE FOR LEARNING: Parathyroid Gland

Write the words below in the correct spaces on Figure 19-3. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

1. thyroid gland
2. parathyroid glands



**Figure 19-3** Parathyroid glands.

## Location and Structure

There are four parathyroid glands. As shown in Figure 19-3, there are two on each of the thyroid lobes. They are egg-shaped.

## Function

These glands secrete **parathormone** (par-ah-THOR-mohn) (PTH). PTH travels to the bone to help regulate calcium and phosphorus levels.

### In Brief

#### Parathyroid gland

secretes PTH

#### Location

embedded in the thyroid gland

#### Function

regulates calcium and phosphorus

## Thymus

### Location and Structure

The **thymus gland** (Figure 19-1) is located near the heart in the thoracic cavity. It consists of two lobes. Each lobe contains many smaller lobes called lobules (**LOB**-yoolz).

### Function

The thymus is both a lymphatic organ and an endocrine gland. As a lymphatic organ, the thymus protects the body from disease. As an endocrine gland, it secretes a hormone called **thymosin** (THIGH-moh-sin). Thymosin stimulates red bone marrow to produce T cells (T lymphocytes), which mature in the thymus gland.

### In Brief

#### Thymus

secretes thymosin

#### Location

near the heart

#### Function

stimulates red bone marrow to produce T cells

## Adrenal Glands

### PRACTICE FOR LEARNING: Adrenal Glands

Write the words below in the correct spaces on Figure 19-4. To help you, the number beside the word tells you where it goes on the figure. Be sure to pronounce each word as you write it. Repeat the pronunciation several times if you find the word hard to say.

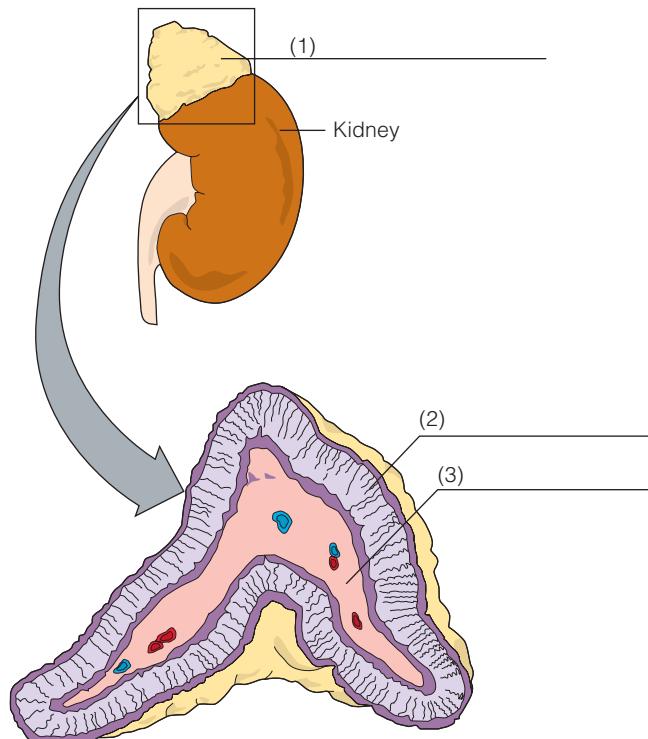
1. adrenal (ah-DREE-nal) gland
2. adrenal cortex (KOR-tecks)
3. adrenal medulla (meh-DULL-ah)

### Location and Structure

The adrenal glands sit on top of the kidneys, as shown in Figure 19-4. The outer and inner portions of each adrenal gland are actually separate glands. The outer portion is the adrenal cortex. The inner portion is the adrenal medulla. These glands are different in structure and function.

### Function

The adrenal cortex secretes the following hormones: **aldosterone** (al-DOS-ter-ohn), **cortisol** (KOR-tih-sol), estrogen, and **androgen** (AN-droh-jen).



**Figure 19-4** Adrenal gland.

Aldosterone regulates sodium and potassium levels. Cortisol (hydrocortisone) has several important functions. It regulates our immune system. It also plays a key role in how carbohydrates, fats, and proteins are used by the body.

Estrogens and androgens are the sex hormones. They are secreted in very small amounts to maintain secondary female and male sex characteristics such as hair growth and muscle bulk. These sex hormones are secreted in larger amounts by the ovaries and testicles.

The adrenal medulla produces **adrenaline** (ah-DREN-ah-len) (epinephrine) and **noradrenaline** (nor-ah-DREN-ah-len) (norepinephrine). These are called the “flight-or-fight” hormones. If a person is frightened enough to run away or angry enough to fight, these hormones prepare the body for the physical exertion needed during these times.

### In Brief

#### Adrenal cortex

secretes aldosterone, cortisol, and sex hormones

#### Location

on top of the kidneys

#### Function

##### aldosterone

regulates sodium and potassium

##### cortisol

regulates immune system and plays a role in the metabolism of carbohydrates, fats, and proteins

##### sex hormones

regulate male and female secondary sexual characteristics

#### Adrenal medulla

secretes adrenaline (epinephrine) and noradrenaline (norepinephrine)

#### Function

epinephrine and norepinephrine prepare the body for times of stress and fear

### PRACTICE FOR LEARNING: Thyroid, Parathyroids, Thymus, Adrenals

Choose the correct answer from the choices in parentheses.

1. Aldosterone is secreted by the (adrenal cortex/parathyroid/adrenal medulla) gland.
2. ( $T_4$ /Parathormone/Cortisol) regulates the metabolic rate.

3. (Aldosterone/Parathormone/Cortisol) regulates blood calcium.
4. (Aldosterone/Cortisol/Estrogen) regulates sodium and potassium levels.
5. (Epinephrine/Cortisol) prepares the body for flight-or-fight.
6. (Parathormone/Aldosterone/T<sub>3</sub>) is secreted by the thyroid gland.
7. (Epinephrine/Estrogen/T<sub>3</sub>) is secreted by the adrenal cortex.
8. The adrenal medulla secretes (aldosterone/sex hormones/norepinephrine/cortisol).
9. (Thyroxine/Triiodothyronine/Thymosin) stimulates red bone marrow to produce T cells.

Answers: 1. adrenal cortex. 2. T<sub>4</sub>. 3. parathormone. 4. aldosterone. 5. epinephrine. 6. T<sub>3</sub>. 7. estrogen. 8. norepinephrine. 9. thymosin.

## Pineal Gland

### Location and Structure

The **pineal** (**PIN-ee-al**) gland is shown in Figure 19-1. It looks like a pine cone and is located deep within the brain.

### Function

The pineal gland secretes **melatonin** (**mel-ah-TOH-nin**). This hormone plays a role in telling us when it is time to go to sleep and when it is time to wake up. It is also connected to mood. It may be involved in determining when we commence puberty and in regulating the ovarian cycles.

### In Brief

#### Pineal gland

secretes melatonin

#### Location

deep in the brain

#### Function

regulates sleep and waking patterns

## Pancreas

### Location and Structure

As described in Chapter 11, the **pancreas** (**PAN-kree-as**) is a long, fish-shaped organ lying behind the stomach.

## Function

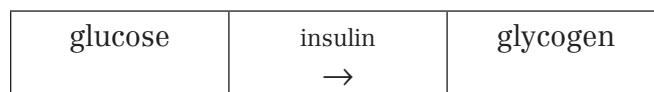
The pancreas has both digestive and endocrine functions. The digestive function involves the secretion of digestive enzymes to break down food.

The endocrine function involves cells in the pancreas called the **islets of Langerhans** (**LANG-er-hanz**). These islets are made up of **beta** and **alpha cells**. Beta cells produce and secrete the hormone **insulin** (**IN-suh-lin**), and alpha cells produce and secrete the hormone **glucagon** (**GLOO-kah-gon**).

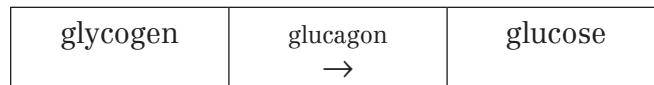
When there is too much sugar in the body, insulin lowers blood glucose (sugar) by:

1. stimulating the absorption of glucose by body cells
2. converting glucose to **glycogen** (**GLYE-koh-jen**)

Glycogen is the storage form of glucose and is stored in the liver.



The hormone glucagon increases blood sugar by converting glycogen back to glucose when the body requires energy to function.



Insulin and glucagon work together to regulate the amount of glucose in the blood. This balancing process is called **homeostasis** (**hoh-mee-oh-STAY-sis**).

### In Brief

#### Pancreas

secretes insulin and glucagon

#### Location

behind the stomach

#### Function

regulates blood sugar

#### Insulin and glucagon

are hormones

#### Glycogen

is the storage form of glucose

**PRACTICE FOR LEARNING: Pineal Gland and Pancreas**

Write the correct answers in the spaces provided.

- 1.** Which hormone is secreted by the pineal gland?

---

- 2.** Which hormones are secreted by the pancreas?

---

- 3.** Name one function of the pineal gland.

---

- 4.** Name one function of the pancreatic hormones.

---

- 5.** Name the hormone that changes glucose to glycogen.

---

- 6.** Name the hormone that changes glycogen to glucose.

---

- 7.** Which is a hormone? Glucose, glycogen, or glucagon?

---

**Answers:** 1. melatonin. 2. insulin and glucagon. 3. regulates sleep and waking patterns; it is also connected to moods. 4. regulates blood sugar levels. 5. insulin. 6. glucagon. 7. glucagon.

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### 19.3 Central Endocrine Glands

#### Pituitary Gland

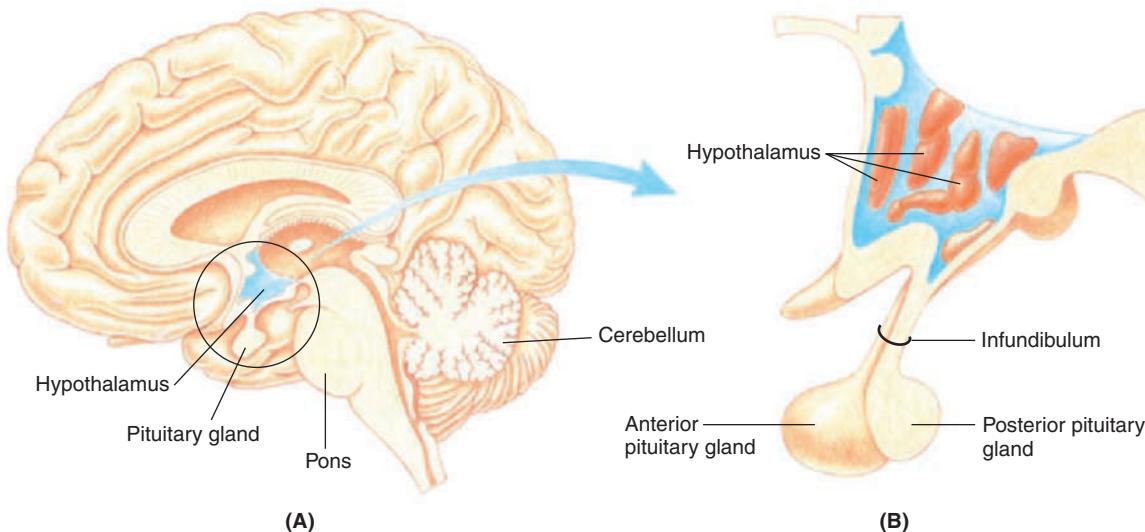
##### Location and Structure

The pituitary gland, also known as the **hypophysis** (high-POF-eh-sis), is about the size of a pea. It is located at the base of the brain. It hangs from the hypothalamus by a stalk called the **infundibulum** (in-fun-DIB-yoo-lum). This is illustrated in Figure 19-5.

The pituitary gland has two lobes: anterior and posterior.

##### Function

The anterior lobe of the pituitary gland secretes several hormones. Many of these hormones stimulate other glands to secrete their own hormones or, in the case of the breasts, milk. Because these hormones stimulate other glands, their names often end in the suffix **-tropic** (TROH-pick), which means “to nourish” or “to stimulate.” Following is a list of these hormones. (See also Figure 19-6.)



**Figure 19-5** (A) Hypothalamus. (B) Pituitary gland.

1. **Adrenocorticotropic** (ah-dree-noh-kor-tih-koh-TROH-pick) hormone (ACTH) stimulates the adrenal cortex.
2. **Growth hormone** (GH), or **somatotropic** (soh-mah-toh-TROH-pick) **hormone** (STH), stimulates growth in all body cells.
3. **Thyroid-stimulating hormone** (TSH), or **thyrotropic** (thigh-roh-TROH-pick) **hormone**, stimulates the thyroid gland.
4. **Gonadotropic** (goh-nah-doh-TROH-pick) **hormones** stimulate the gonads (ovaries and testicles). There are three gonadotropic hormones: **follicle-stimulating hormone** (FSH) and **luteinizing (LOO-tee-in-eye-zing) hormone** (LH) in the female, and **interstitial cell-stimulating hormone** (ICSH) in the male. FSH stimulates the monthly development of the egg in the follicle. LH triggers ovulation in females. ICSH regulates testosterone secretion.
5. **Prolactin** (proh-LACK-tin) (PRL), or **lactogenic hormone** (LTH), stimulates and maintains the secretion of breast milk.
6. **Melanocyte-stimulating hormone** (MSH) stimulates the skin to produce melanocytes.

### In Brief

#### Anterior pituitary

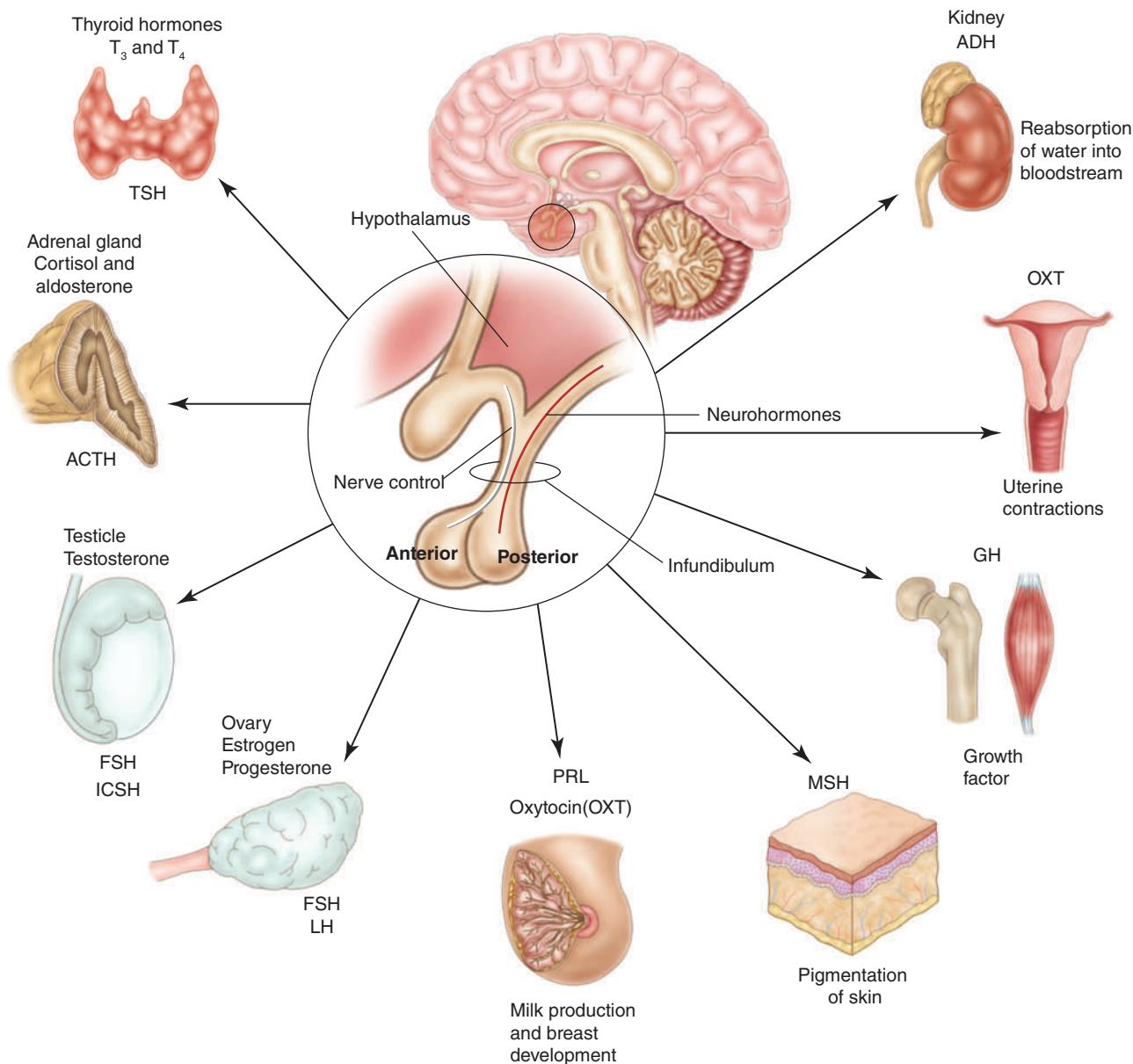
secretes ACTH, GH, TSH, FSH, LH, ICSH, PRL, MSH

#### Posterior pituitary

secretes ADH and OXT

#### Location

deep in the brain



**Figure 19-6** The pituitary gland secretes hormones that stimulate the activity of other endocrine glands. Abbreviations used in this figure are defined in Table 19-1.

The **posterior lobe of the pituitary** is an extension of the hypothalamus. It stores and secretes two hormones produced by the hypothalamus:

1. **Antidiuretic (an-tih-dye-yoo-RET-ick) hormone (ADH).** It prevents excessive loss of water.
2. **Oxytocin (ock-see-TOH-sin) (OXT).** It stimulates uterine contractions during labor, maintains labor during childbirth, and causes the production of milk from the mammary glands.

## Hypothalamus

### Location and Structure

The hypothalamus is illustrated in Figure 19-5. It works together with the pituitary gland. The hypothalamus is located deep in the central brain, below the thalamus. It is made up of neurons. Some of the neurons in the hypothalamus produce hormones and some do not. Thus, the hypothalamus is considered to be part of the endocrine system as well as the nervous system.

### Function

The hypothalamus produces **neurohormones** (NOO-roh-hor-monz). They are called neurohormones because the hormones are produced by neurons. The hypothalamus produces oxytocin and the antidiuretic hormone. These neurohormones are stored in the posterior pituitary (Figure 19-6).

#### In Brief

#### Hypothalamus

produces the antidiuretic hormone and oxytocin

#### Location

deep in the brain, under the thalamus

### PRACTICE FOR LEARNING: Pituitary Gland and Hypothalamus

Choose the correct answer from the choices in parentheses.

1. The (hypothalamus/pituitary gland) produces oxytocin.
2. FSH and LH are (thyroid-stimulating hormones/adrenocorticotrophic hormones/gonadotropic hormones).
3. The hormone responsible for milk production is (antidiuretic hormone/prolactin/oxytocin/gonadotropic hormone).
4. The adrenocorticotrophic hormone is secreted by the (adrenal gland/posterior pituitary gland/anterior pituitary gland).
5. The thyroid-stimulating hormone is secreted by the (thyroid gland/anterior pituitary gland/posterior pituitary gland).
6. ADH is produced by the (hypothalamus/posterior pituitary gland/anterior pituitary gland) and stored in the (hypothalamus/posterior pituitary gland/anterior pituitary gland).
7. Gonadotropic hormones stimulate the (thyroid gland/adrenal cortex/ovaries/adrenal medulla).

Answers: 1. hypothalamus. 2. gonadotropic. 3. prolactin. 4. anterior pituitary gland. 5. anterior pituitary gland. 6. hypothalamus; posterior pituitary gland. 7. ovaries.

## 19.4 Abbreviations of Major Hormones

Hormones are commonly indicated by abbreviations. Table 19-1 lists the major hormones and their abbreviations.

**TABLE 19-1 Abbreviations of Major Hormones**

adrenocorticotrophic hormone	ACTH
antidiuretic hormone	ADH
follicle-stimulating hormone	FSH
growth hormone	GH
interstitial cell-stimulating hormone	ICSH
lactogenic hormone	LTH
luteinizing hormone	LH
oxytocin	OXT
parathormone	PTH
prolactin	PRL
somatotropic hormone	STH
thyroid-stimulating hormone	TSH
thyroxine	T <sub>4</sub>
triiodothyronine	T <sub>3</sub>

## 19.5 New Roots, Suffixes, and Prefixes

ROOT	MEANING
calc/o	calcium
gonad/o	gonads (ovaries, testicles)
kal/o	potassium
natr/o	sodium
parathyroid/o	parathyroid
pituitar/o	pituitary gland
somat/o	body

SUFFIX	MEANING
<b>-dipsia</b>	thirst
<b>-gen</b>	producing; produced by

## 19.6 Learning the Terms

Following these steps will make it easier for you to learn medical terms:

1. Pronounce the term repeatedly until it is easy for you.
2. Write it down. Ensure the spelling is correct.
3. Also write the definition. If possible, relate the word to a word, thought, or picture that will help you remember it.
4. Analyze the term with the method taught in this text.

### Roots

ROOT acr/o	MEANING extremity; top	
<i>Term</i>	<i>Term Analysis</i>	
<b>acromegaly</b> (ack-roh-MEG-ah-lee)	-megaly = enlargement	enlargement of many skeletal structures, particularly the extremities

ROOT adrenal/o	MEANING adrenal gland	
<i>Term</i>	<i>Term Analysis</i>	
<b>adrenalitis</b> (ah-dree-nal-EYE-tiss)	-itis = inflammation	inflammation of the adrenal gland

ROOT andr/o	MEANING male	
<i>Term</i>	<i>Term Analysis</i>	
<b>androgen</b> (AN-droh-jen)	-gen = producing	substance producing male characteristics; an example is testosterone.

ROOT crin/o		MEANING to secrete
Term	Term Analysis	Definition
<b>endocrinologist</b> (en-doh-krih- <b>NOL</b> -oh-jist)	-logist = specialist endo- = within	specialist in the study of the diagnosis and treatment of diseases of the endocrine glands and their hormonal secretions

ROOT estr/o		MEANING female
Term	Term Analysis	Definition
<b>estrogen</b> (ESS-troh-jen)	-gen = producing	female sex hormone

ROOT gluc/o; glyc/o		MEANING glucose; sugar
Term	Term Analysis	Definition
<b>glucogenesis</b> (gloo-koh-JEN-eh-sis)	-genesis = production	production of glucose
<b>glycolysis</b> (glye-KOL-ih-sis)	-lysis = breakdown; separation; destruction	breakdown of sugars

ROOT glycogen/o		MEANING glycogen
Term	Term Analysis	Definition
<b>glycogenolysis</b> (glye-koh-jeh- <b>NOL</b> -ih-sis)	-lysis = breakdown	breakdown of glycogen to form glucose

ROOT home/o		MEANING same
Term	Term Analysis	Definition
<b>homeostasis</b> (hoh-mee-oh- <b>STAY</b> -sis)	-stasis = standing; stable	a balanced, yet sometimes varied state

**Note:** The function of the endocrine system is to regulate hormonal balance. It secretes more hormones when needed and fewer when there is an excess. In this way, a balance (homeostasis) is maintained.

ROOT pituitar/o		MEANING pituitary gland
Term	Term Analysis	Definition
<b>hyperpituitarism</b> (high-per-pih-TOO-ih-tahr-izm)	-ism = process; condition	condition of excess secretion of pituitary hormones

ROOT thyroid/o; thyroide/o		MEANING thyroid gland
Term	Term Analysis	Definition
<b>euthyroid</b> (yoo-THIGH-royd)	-oid = resembling eu- = good; normal	normal thyroid gland
<b>hyperthyroidism</b> (high-per-THIGH-royd-izm)	-ism = condition; process hyper- = excessive	condition characterized by excessive secretion of thyroid hormones

## Suffixes

SUFFIX -tropic; -trophic		MEANING nourish; stimulate
Term	Term Analysis	Definition
<b>adrenocorticotropic hormone</b> (ah-dree-noh-kor-tih-koh-TROH-pick)	adren/o = adrenal gland cortic/o = cortex; outer layer	chemical secreted by the anterior pituitary that stimulates the adrenal cortex to secrete its own hormones
<b>gonadotropic hormone</b> (goh-nah-doh-TROH-pick)	gonad/o = gonads; sex glands (ovaries and testicles)	chemicals secreted by the anterior pituitary that stimulates the ovaries or testicles to secrete their own hormones

**Note:** Examples of gonadotropic hormones are LH, FSH, and ICSH.

<b>somatotropic hormone</b> (soh-mah-toh-TROH-pick)	somat/o = body	chemical secreted by the anterior pituitary that stimulates the growth in all body cells; growth hormone
--	----------------	--

## Prefixes

PREFIX hyper-	MEANING increase; excessive
<i>Term</i>	<i>Term Analysis</i>
<b>hypercalcemia</b> (high-per-kal-SEE-mee-ah)	-emia = blood condition calc/o = calcium
<b>hyperkalemia</b> (high-per-kal-EE-mee-ah)	-emia = blood condition kal/o = potassium
<b>hyperglycemia</b> (high-per-ghigh-SEE-mee-ah)	-emia = blood condition glyc/o = sugar

PREFIX hypo-	MEANING decrease; deficient
<i>Term</i>	<i>Term Analysis</i>
<b>hyponatremia</b> (high-poh-nah-TREE-mee-ah)	-emia = blood condition natr/o = sodium
<b>hypoparathyroidism</b> (high-poh-par-ah-THIGH-roid-izm)	-ism = process; condition parathyroid/o = parathyroid
<b>hypopituitarism</b> (high-poh-pih-TOO-ih-tar-izm)	-ism = process; condition pituitar/o = pituitary gland
<b>panhypopituitarism</b> (pan-high-poh-pih-TOO-ih-tar-izm)	-ism = condition; process pan- = all pituitar/o = pituitary gland

PREFIX poly-	MEANING many; much
<i>Term</i>	<i>Term Analysis</i>
<b>polydipsia</b> (pol-ee-DIP-see-ah)	-dipsia = thirst
<b>polyuria</b> (pol-ee-YOO-ree-ah)	-uria = urination

**Note:** Polydipsia and polyuria are symptoms of diabetes mellitus.

## 19.7 Pathology

### Hypersecretion and Hyposecretion of Hormones from the Endocrine Glands

Hypersecretion (excess secretion) and hyposecretion (inadequate secretion) may indicate pathology. Often, hypersecretion is caused by the growth of a tumor on the gland. Hyposecretion can indicate congenital absence of the gland, tumors large enough to take over the gland, and infections. In addition, both hypersecretion and hyposecretion can be caused by autoimmune conditions (conditions in which the body turns against itself, thereby causing the disease).

### Major Abnormalities Caused by Hypersecretion and Hyposecretion of Endocrine Glands

#### Pituitary Gland

##### Hypersecretion of Growth Hormone

- **Acromegaly** in adults occurs after bones have stopped growing; there is enlargement of many skeletal structures, particularly the extremities.
- **Gigantism** in children occurs before the bones have stopped growing; there is abnormal growth in height, muscles, and organs.

##### Hyposecretion of Growth Hormone

- **Pituitary dwarfism** is a deficiency of growth hormone in childhood and results in an abnormally small but well-proportioned individual.

#### Hyposecretion of ADH

- **Diabetes insipidus** (dye-ah-BEE-teez in-SIP-ih-duss) is the deficiency of ADH resulting in polyuria, polydipsia, and severe chemical imbalance.

#### Hyposecretion of oxytocin

- **Uterine inertia** is the loss of uterine muscle contraction during labor.

#### Thyroid Gland

##### Hyperthyroidism

- **Graves disease** includes hyperthyroidism, goiter, and exophthalmia. Hyperthyroidism is excessive secretion of the thyroid hormones. It enlarges the thyroid gland (goiter) and has an effect on the tissues behind the eyeball, which pushes the eye outward (exophthalmia). Exophthalmia is also known as exophthalmos or exophthalmus. Graves disease is an autoimmune disorder.

Antibodies that normally protect the body attack the thyroid gland. This causes increased secretion of the thyroid hormone.

### Hypothyroidism

- **Cretinism** (**KRET-in-izm**) is hyposecretion of the thyroid hormone in infancy or during fetal development, causing low metabolic rate and reduced activity, physical growth, and mental growth.
- **Myxedema** (**micks-eh-DEE-mah**) is hyposecretion of thyroid hormone in adulthood, causing a slowing of the metabolic rate, weight gain, and slow movement.

### Parathyroid Gland

#### Hyperparathyroidism

- Increased secretion of parathormone results in excessive bone loss, which, over time, can lead to pathological fractures and urinary stones.

#### Hypoparathyroidism

- Reduced levels of PTH causes hypocalcemia and hypocalciuria. This reduced calcium can lead to severe muscle spasms, a condition called tetany (**TET-ah-nee**).

### Pancreas

#### Hyperinsulinism

- Increased insulin causes hypoglycemia. This results in the lack of glucose to body cells, particularly the brain, causing disorientation, unconsciousness, or death due to insulin shock.

#### Hypoinsulinism

**Diabetes mellitus** (**dye-ah-BEE-teez MEL-ih-tus**) (DM) is a disease in which the body is unable to use sugar to produce energy. One cause is insufficient insulin secreted from the pancreas. Another is the production of ineffective insulin. When either of these occurs, sugar is unable to move from the blood into body cells, where it is normally used to produce energy. The result is abnormally high levels of blood glucose. This is called **hyperglycemia**. It is a major symptom of diabetes. Other symptoms include polydipsia, polyuria, and polyphagia.

When the body does not have enough glucose, it will break down fats and proteins for fuel. Over a long period of time, this results in the buildup of toxic wastes called **ketones** (**KEE-tohnz**). The condition is called **ketoacidosis** (**kee-toh-ass-ih-DOH-sis**). The excess sugars and ketones in the blood cause many long-term complications of DM including retinopathy, which can cause blindness; neuropathy, which can cause numbness and tingling; and arteriosclerosis, which can cause heart attacks and gangrene of the lower extremities. Gestational diabetes can occur during pregnancy. However, blood glucose levels usually fall back to normal after delivery.

There are two major types of diabetes:

- Type 1 is an abrupt end to insulin production, often before the age of 25. The pancreatic cells do not produce enough insulin. This is thought to be due to an autoimmune reaction. Treatment involves regular injections of insulin.
- Type 2 is a reduction in insulin production, often after the age of 40. Genetic factors and obesity play a role in the majority of the cases. Being overweight requires the pancreas to work harder to produce more insulin. Over time, the pancreatic cells secrete less insulin. Treatment includes diet, exercise, weight loss, and if necessary, oral hypoglycemics or insulin.

### Adrenal Gland

- Hypersecretion of cortisol results in obesity and puffy appearance due to changes in carbohydrate and protein breakdown.
- Hypersecretion of epinephrine and norepinephrine causes hypertension, hyperglycemia, nervousness, and sweating. Complete exhaustion occurs.
- Hypersecretion of aldosterone causes abnormal imbalance of electrolytes (sodium, potassium, calcium, magnesium).
- Hyposecretion of aldosterone and cortisol cause Addison disease. Weakness, tiredness, dark pigmentation, and hypotension result.

## 19.8 Look-Alike and Sound-Alike Words

*Below is a list of look-alike and sound-alike words. Study the spelling and definitions of each set of words. Questions will follow in the Review Exercises.*

**TABLE 19-2 Look-Alike and Sound-Alike Words**

<b>hyper-</b>	increase; excessive
<b>hypo-</b>	decrease; deficient
<b>glycogenesis</b>	production of glycogen
<b>glucogenesis</b>	production of glucose
<b>hyperkalemia</b>	excessive potassium in the blood
<b>hypercalcemia</b>	excessive calcium in the blood
<b>polyuria</b>	excessive urination
<b>polyurea</b>	a chemical substance used as a protective coating in severe environments
<b>pancreas</b>	a fish-like gland situated behind the stomach
<b>pancrease</b>	a drug used to replace enzyme function in the pancreas

## 19.9 Review Exercises

### EXERCISE 19-1 Look-Alike and Sound-Alike Words

*Read the sentences carefully and circle the word in parentheses that correctly completes the meaning. Use Table 19-2 if it helps you.*

1. A tumor growing on the pituitary gland reducing hormone secretion is (**hyperpituitarism/hypopituitarism**).
2. The medical term for production of glucose is (**glycogenesis/glucogenesis/glycolysis/glucolysis**).
3. Reduced levels of parathormone causes (**hypocalcemia/hypokalemia**).
4. A common symptom of diabetes mellitus is (**polyurea/polyuria**).
5. You can take a course in (**polyurea/polyuria**) coating.
6. The (**pancreas/pancrease**) is an organ that secretes digestive enzymes and hormones.

### EXERCISE 19-2 Matching Word Parts with Meaning

*Match the word part in Column A with its meaning in Column B.*

Column A	Column B
_____ 1. home/o	A. male
_____ 2. estr/o	B. sugar
_____ 3. crin/o	C. female
_____ 4. natr/o	D. sodium
_____ 5. acr/o	E. thirst
_____ 6. -tropic	F. potassium
_____ 7. glyc/o	G. secrete
_____ 8. kal/o	H. same
_____ 9. andr/o	I. extremity
_____ 10. -dipsia	J. nourishment

**EXERCISE 19-3 Short Answers**

*I. Match the hormone with its endocrine gland (listed immediately below). The glands can be used more than once.*

- a. adrenal cortex
- b. adrenal medulla
- c. anterior pituitary
- d. pancreas
- e. posterior pituitary
- f. thyroid

**1.** aldosterone \_\_\_\_\_

**2.** antidiuretic hormone \_\_\_\_\_

**3.**  $T_3$  \_\_\_\_\_

**4.** cortisol \_\_\_\_\_

**5.** epinephrine \_\_\_\_\_

**6.** glucagon \_\_\_\_\_

**7.** follicle-stimulating hormone \_\_\_\_\_

**8.** insulin \_\_\_\_\_

**9.** prolactin \_\_\_\_\_

**10.** norepinephrine \_\_\_\_\_

*II. Match the hormone with its function (listed immediately below). One function can be used more than once.*

- a. plays a key role in the body's response to stress
- b. prevents excess loss of fluid
- c. regulates blood calcium and phosphorus
- d. regulates blood glucose levels
- e. regulates metabolic rate
- f. regulates sodium and potassium levels
- g. stimulates the adrenal cortex
- h. stimulates the development of the gonads
- i. stimulates uterine contractions

**1.** adrenocorticotropic hormone

---

**2.** oxytocin

---

**3.** T<sub>4</sub>

---

**4.** parathormone

---

**5.** aldosterone

---

**6.** cortisol

---

**7.** insulin

---

**8.** glucagon

---

**9.** antidiuretic hormone

---

**10.** follicle-stimulating hormone

---

#### EXERCISE 19-4 **Pathology**

*I. Answer the following questions on diabetes mellitus.*

**1.** Write one common symptom of diabetes mellitus.

---

**2.** Why is glucose important to body cells?

---

**3.** Define *ketones*.

---

**4.** What is the cause of diabetes mellitus?

---

5. Define *type 1 diabetes*.

---

---

6. Define *type 2 diabetes*.

---

---

*II. Select the correct answer and write it in the space provided.*

1. Hypersecretion of the growth hormone in children causes \_\_\_\_\_.

acromegaly      gigantism

2. Hyposecretion of ADH causes \_\_\_\_\_.

diabetes mellitus      diabetes insipidus

3. Hypothyroidism in adults is \_\_\_\_\_.

Graves disease      cretinism      myxedema

4. Hyperparathyroidism results in \_\_\_\_\_.

fractures      tetany      hypocalciuria

5. Hypoinsulinism causes \_\_\_\_\_.

diabetes mellitus      diabetes insipidus

6. A patient with a diagnosis of hypersecretion of cortisol exhibits \_\_\_\_\_.

darkened pigmentation      puffy appearance

### EXERCISE 19-5 Definitions

*Define the following terms:*

1. **tropic hormones** \_\_\_\_\_

2. **neurohormones** \_\_\_\_\_

3. **homeostasis** \_\_\_\_\_

4. **acromegaly** \_\_\_\_\_

5. **glycolysis** \_\_\_\_\_

6. **euthyroid** \_\_\_\_\_
7. **polydipsia** \_\_\_\_\_
8. **glucogenesis** \_\_\_\_\_
9. **estrogen** \_\_\_\_\_
10. **hyperkalemia** \_\_\_\_\_

### EXERCISE 19-6 Building Medical Words

I. Using the suffix *-emia*, build the medical word meaning

- a. excessive calcium in the blood \_\_\_\_\_
- b. excessive blood sugar \_\_\_\_\_
- c. decreased sodium in the blood \_\_\_\_\_
- d. excessive potassium in the blood \_\_\_\_\_

II. Using the suffix *-tropic*, build the medical word meaning

- a. stimulating the adrenal cortex \_\_\_\_\_
- b. stimulating the gonads \_\_\_\_\_

### EXERCISE 19-7 Definitions in Context

Define the bolded terms in the spaces provided. Use your medical dictionary if necessary.

1. A 34-year-old was referred for **hyperthyroidism**. The patient was first found to be hyperthyroid one year ago. He has all the classic symptoms of **Graves disease**, including **goiter**, **exophthalmia**, and weakness.
- a. hyperthyroidism \_\_\_\_\_
- b. Graves disease \_\_\_\_\_
- c. goiter \_\_\_\_\_
- d. exophthalmia \_\_\_\_\_
2. Three days after admission, the diagnosis of **adrenal insufficiency** was confirmed. Apparently, **hypopituitarism** was ruled out.
- e. adrenal insufficiency \_\_\_\_\_
- f. hypopituitarism \_\_\_\_\_

3. This elderly patient was admitted because of a slowly growing mass in the right lobe of his **thyroid**. A **thyroid scan** showed regions of a nonfunctioning thyroid. Thyroid function was within normal limits. **Biopsy** of the thyroid confirmed a **benign adenoma**.

g. thyroid \_\_\_\_\_

h. thyroid scan \_\_\_\_\_

i. biopsy \_\_\_\_\_

j. benign adenoma \_\_\_\_\_

#### EXERCISE 19-8 Labeling

Using the body structures listed below, label Figure 19-7. Write your answer on the numbered spaces provided below or, if you prefer, on the diagram.

adrenal glands \_\_\_\_\_

hypothalamus \_\_\_\_\_

ovaries \_\_\_\_\_

pancreas \_\_\_\_\_

parathyroid gland \_\_\_\_\_

pineal gland \_\_\_\_\_

pituitary gland \_\_\_\_\_

testicles \_\_\_\_\_

thymus gland \_\_\_\_\_

thyroid gland \_\_\_\_\_

1. \_\_\_\_\_

2. \_\_\_\_\_

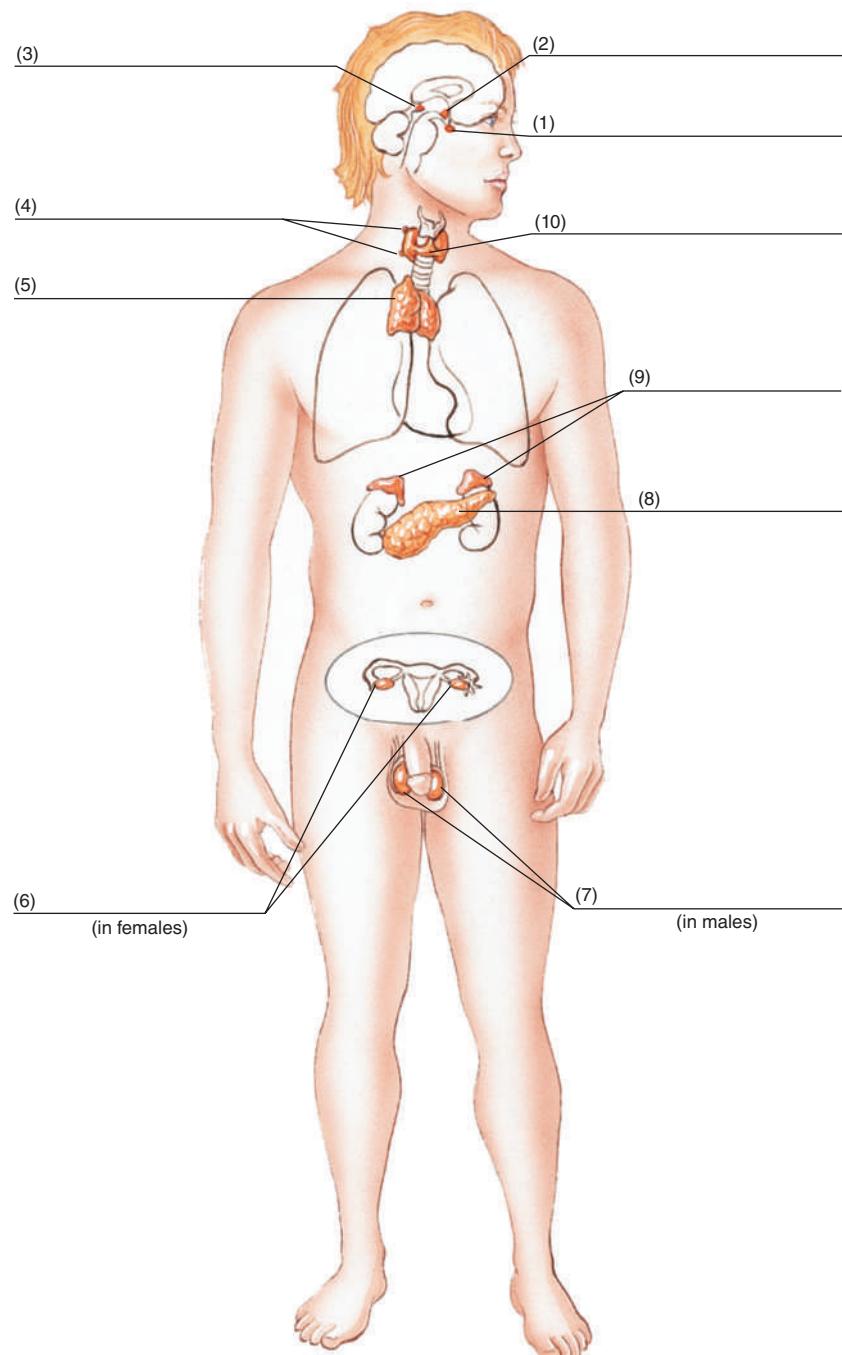
3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

7. \_\_\_\_\_



**Figure 19-7** Major organs of the endocrine system.

8. \_\_\_\_\_

9. \_\_\_\_\_

10. \_\_\_\_\_

**EXERCISE 19-9 Spelling**

Circle any words that are spelled incorrectly in the list below. Then correct the spelling in the space provided.

1. antidiuretic \_\_\_\_\_
2. lutienizing \_\_\_\_\_
3. aldosterone \_\_\_\_\_
4. pancrease \_\_\_\_\_
5. diabetis \_\_\_\_\_
6. cortisal \_\_\_\_\_
7. hypopituitarism \_\_\_\_\_
8. homeostasis \_\_\_\_\_
9. hyperkalemia \_\_\_\_\_
10. polydipsia \_\_\_\_\_

**EXERCISE 19-10 Abbreviations**

Write the meaning of the following abbreviations on the space provided.

1. ACTH \_\_\_\_\_
2. T<sub>3</sub> \_\_\_\_\_
3. ADH \_\_\_\_\_
4. T<sub>4</sub> \_\_\_\_\_
5. FSH \_\_\_\_\_
6. TSH \_\_\_\_\_
7. GH \_\_\_\_\_
8. STH \_\_\_\_\_
9. PRL \_\_\_\_\_
10. ICSH \_\_\_\_\_
11. PTH \_\_\_\_\_
12. LH \_\_\_\_\_

## Animations

Visit the companion website to view the videos on the **Endocrine System; Dual Role of the Pancreas**; and **Diabetic Retinopathy**.

### 19.10 Pronunciation and Spelling

*Listen, read, and study, so you can speak and write.*

1. Listen to each word on the audio file provided in the Student Companion Website.
2. Spell each word in the space provided.

Word	Pronunciation	Spelling
acromegaly	ack-roh-MEG-ah-lee	
adrenocorticotropic hormone	ah-dree-noh-kor-tih-koh-TROH-pick	
aldosterone	al-DOS-ter-ohn	
androgen	AN-droh-jen	
antidiuretic	an-tih-dye-yoo-RET-ick	
cortisol	KOR-tih-sol	
endocrine	EN-doh-krin	
endocrinologist	en-doh-krih-NOL-oh-jist	
estrogen	ESS-troh-jen	
euthyroid	yoo-THIGH-royd	
glucagon	GLOOkah-gon	
glycolysis	glye-KOL-ih-sis	
homeostasis	hoh-mee-oh-STAY-sis	
hormones	HOR-mohnz	
hypercalcemia	high-per-kal-SEE-mee-ah	
hyperglycemia	high-per-glye-SEE-mee-ah	
hyperkalemia	high-per-kah-LEE-mee-ah	
hyperthyroidism	high-per-THIGH-royd-izm	
hyponatremia	high-poh-nah-TREE-mee-ah	

Word	Pronunciation	Spelling
<b>hypopituitarism</b>	<b>high-poh-pih-TOO-ih-tar-izm</b>	
<b>hypothalamus</b>	<b>high-poh-THAL-ah-mus</b>	
<b>insulin</b>	<b>IN-suh-lin</b>	
<b>isthmus</b>	<b>ISS-mus</b>	
<b>oxytocin</b>	<b>ock-see-TOH-sin</b>	
<b>pancreas</b>	<b>PAN-kree-as</b>	
<b>panhypopituitarism</b>	<b>pan-high-poh-pih-TOO-ih-tar-izm</b>	
<b>parathyroid</b>	<b>par-ah-THIGH-roydz</b>	
<b>pineal</b>	<b>PIN-ee-al</b>	
<b>pituitary</b>	<b>pih-TOO-ih-tar-ee</b>	
<b>polydipsia</b>	<b>pol-ee-DIP-see-ah</b>	
<b>polyuria</b>	<b>pol-ee-YOO-ree-ah</b>	
<b>thymus</b>	<b>THIGH-mus</b>	
<b>thyroid</b>	<b>THIGH-royd</b>	
<b>thyroxine</b>	<b>thigh-ROCK-sin</b>	
<b>triiodothyronine</b>	<b>trigh-eye-oh-doh-THIGH-roh-nen</b>	

# APPENDIX A

## Pronunciations

It is very important that you know how to pronounce the medical terms you learn. If you cannot pronounce a term, it will be difficult for you to remember how to spell it, and accurate spelling is very important. However, the proper pronunciation of a medical term is not always obvious. Therefore, all difficult terms in the first appearance are followed by a common pronunciation.

The system of pronunciation used is quite simple. Each term is re-spelled using combinations of letters that are commonly known to have a particular sound. For instance when *tion* appears in a word, the pronunciation will be written *shun*. The long “u” sound is made with *yoo*. So the word “cute” would be written as *kyoot*. Long “i,” as in the word “hi,” is usually written as *eye*. However, that is confusing in some words, and so sometimes the letters *ey* or *igh* are used instead. The goal is to provide an easy guide to pronunciation that fits the particular word. Further examples are listed in Table A-1.

The syllables in the pronunciations are separated by hyphens (-). The most strongly emphasized syllable is written bold type with capital letters (e.g., **BOLD**). Any syllable with secondary emphasis is written in bold but without capitals (e.g., **bold**). To help you put this all together, here are a few examples.

**TABLE A-1 Pronunciation of Medical Terms**

a in <i>at</i> = ah
a in <i>rain</i> = ay
e in <i>pet</i> = eh
e in <i>meet</i> = ee
i in <i>skin</i> = ih
i in <i>pie</i> = eye, ey, or igh
o in <i>of</i> = uh
o in <i>boat</i> = oh
o in <i>boot</i> = oo
u in <i>under</i> = uh
u in <i>cute</i> = yoo
<b>tion</b> = shun



## APPENDIX B

# Plurals

Plurals are formed in various ways, depending on which letters are at the end of a term. Following are examples of how to change a specific singular ending to its plural form.

To form the plural of singular terms ending in *is*, change the *i* to an *e*, as shown in the following examples:

SINGULAR	PLURAL
<b>diagnosis</b> (dye-ag-NOH-sis)	<b>diagnoses</b> (dye-ag-NOH-seez)
<b>pelvis</b> (PEL-vis)	<b>pelves</b> (PEL-veez)
<b>neurosis</b> (noo-ROH-sis)	<b>neuroses</b> (noo-ROH-seez)

To form the plural of many singular words ending in *us*, change the *us* to an *i*, as shown in the following examples:

SINGULAR	PLURAL
<b>bronchus</b> (BRONG-kus)	<b>bronchi</b> (BRONG-kye)
<b>bacillus</b> (bah-SILL-us)	<b>bacilli</b> (bah-SILL-eye)
<b>calculus</b> (KAL-kyoo-lus)	<b>calculi</b> (KAL-kyoo-lye)
<b>embolus</b> (EM-boh-lus)	<b>emboli</b> (EM-boh-lye)

There are a few exceptions. For example, the plural of *virus* (**VYE-rus**) is *viruses* (**VYE-rus-ez**), and the plural of *sinus* (**SIGH-nus**) is *sinuses* (**SIGH-nus-ez**).

The plural of singular words ending in *a* is formed by adding an *e* to the word, as shown in the following examples. Modifiers in Latin must agree with the noun. For example, the plural of *vena cava* is *venae cavae*.

SINGULAR	PLURAL
<b>sclera</b> (SKLEHR-ah)	<b>sclerae</b> (SKLEHR-ee)
<b>scapula</b> (SKAP-yoo-lah)	<b>scapulae</b> (SKAP-yoo-lee)
<b>vena cava</b> (VEE-nah CAV-ah)	<b>venae cavae</b> (VEE-nee CAV-ee)

Singular terms ending in *um* are pluralized by changing the *um* to an *a*, as shown in the following examples:

SINGULAR	PLURAL
<b>acetabulum</b> (ass-eh-TAB-yoo-lum)	<b>acetabula</b> (ass-eh-TAB-yoo-lah)
<b>capitulum</b> (kah-PIT-yoo-lum)	<b>capitula</b> (kah-PIT-yoo-lah)
<b>septum</b> (SEP-tum)	<b>septa</b> (SEP-tah)
<b>diverticulum</b> (dye-ver-TICK-yoo-lum)	<b>diverticula</b> (dye-ver-TICK-yoo-lah)

To form the plural of singular words ending in *ix* or *ex*, change the *ix* or *ex* to *ices*, as shown in the following examples:

SINGULAR	PLURAL
<b>calix</b> (KAY-licks)	<b>calices</b> (KAY-lih-seez)
<b>cervix</b> (SER-vicks)	<b>cervices</b> (SER-vih-seez)
<b>index</b> (IN-decks)	<b>indices</b> (IN-dih-seez)
<b>varix</b> (VAR-icks)	<b>varices</b> (VAR-ih-seez)

Singular words ending in *oma* are made plural by the addition of *ta* or *s*, as shown in the following examples:

SINGULAR	PLURAL
<b>adenoma</b> (ad-eh- <b>NOH</b> -mah)	<b>adenomata</b> (ad-eh-no- <b>MAT</b> -ah) or <b>adenomas</b> (ad-eh- <b>NOH</b> -mahz)
<b>carcinoma</b> (kar-sih- <b>NOH</b> -mah)	<b>carcinomata</b> (kar-sin-oh- <b>MAT</b> -ah) or <b>carcinomas</b> (kar-sin- <b>OH</b> -mahz)
<b>fibroma</b> (figh- <b>BROH</b> -mah)	<b>fibromata</b> (figh-broh- <b>MAT</b> -ah) or <b>fibromas</b> (figh- <b>BROH</b> -mahz)

To form the plural of singular words ending in *nx*, change the *x* to *g* and add *es*, as shown in the following examples:

SINGULAR	PLURAL
<b>larynx</b> ( <b>LAR</b> -inks)	<b>larynges</b> ( <b>LAR</b> -in-jeez)
<b>phalanx</b> ( <b>FAH</b> -lanks)	<b>phalanges</b> (fah- <b>LAN</b> -jeez)

To form the plural of singular words ending in *on*, change the *on* to an *a* or simply add an *s*, as shown in the following example:

SINGULAR	PLURAL
<b>ganglion</b> ( <b>GANG</b> -glee-on)	<b>ganglia</b> ( <b>GANG</b> -glee-ah) or <b>ganglions</b> ( <b>GANG</b> -glee-onz)

To form the plural of singular words ending in *ax*, change the *ax* to *aces*, as shown in the following example:

SINGULAR	PLURAL
<b>thorax</b> (THOR-acks)	<b>thoraces</b> (THOR-ah-sees)

## APPENDIX C

# Word Part to Definition

WORD PART	DEFINITION	WORD PART	DEFINITION
<b>A</b>		<b>an/o</b>	anus
<b>a(n)-</b>	inadequate; no; not; lack of	<b>ana-</b>	apart; up
<b>ab-</b>	away from	<b>andr/o</b>	male; man
<b>abdomin/o</b>	abdomen	<b>angi/o</b>	vessel
<b>-ac</b>	pertaining to	<b>anis/o</b>	unequal size
<b>acetabul/o</b>	acetabulum; hip socket	<b>ankyl/o</b>	fusion of parts; stiffening; bent; crooked
<b>acr/o</b>	extremity; top	<b>ante-</b>	before
<b>acromi/o</b>	acromion	<b>anter/o</b>	front
<b>ad-</b>	toward	<b>anti-</b>	against
<b>aden/o</b>	gland	<b>aort/o</b>	aorta
<b>adenoid/o</b>	adenoids	<b>append/o</b>	appendix
<b>adip/o</b>	fat	<b>aque/o</b>	water
<b>adren/o</b>	adrenal gland	<b>-ar</b>	pertaining to
<b>adrenal/o</b>	adrenal gland	<b>-arche</b>	beginning
<b>aer/o</b>	air	<b>arteri/o</b>	artery
<b>against</b>	contra-	<b>arthr/o</b>	joint
<b>-aise</b>	ease	<b>articul/o</b>	joint
<b>-al</b>	pertaining to	<b>-ary</b>	pertaining to
<b>albin/o</b>	white	<b>-assay</b>	analysis of a mixture to identify its contents
<b>albumin/o</b>	albumin (a blood protein)	<b>-asthenia</b>	no strength
<b>-algia</b>	pain	<b>atel/o</b>	incomplete; imperfect
<b>all/o</b>	referring to another	<b>ather/o</b>	fatty debris; fatty plaque
<b>alveol/o</b>	air sacs; alveolus	<b>atri/o</b>	atrium (upper chambers of the heart)
<b>ambly/o</b>	dull; dim	<b>audi/o</b>	hearing
<b>ametr/o</b>	out of proportion	<b>audit/o</b>	hearing
<b>amni/o</b>	amnion; sac in which the fetus lies in the uterus	<b>aur/o</b>	ear
<b>-an</b>	pertaining to		

WORD PART	DEFINITION	WORD PART	DEFINITION
<b>auto-</b>	self	<b>-centesis</b>	surgical puncture to remove fluid
<b>axill/o</b>	armpit	<b>cephal/o</b>	head
<b>B</b>		<b>cerebell/o</b>	cerebellum
<b>bacteri/o</b>	bacteria	<b>cerebr/o</b>	brain
<b>balan/o</b>	glans penis	<b>cervic/o</b>	cervix; neck; neck of uterus; cervix uteri
<b>bil/i</b>	bile	<b>-chaliasia</b>	relaxation
<b>bilirubin/o</b>	bilirubin (a bile pigment)	<b>cheil/o</b>	lips
<b>bi/o</b>	life	<b>chem/o</b>	drug
<b>-blast</b>	immature; growing thing	<b>chol/e</b>	bile; gall
<b>blephar/o</b>	eyelid	<b>cholangi/o</b>	bile ducts
<b>brachi/o</b>	arm	<b>cholecyst/o</b>	gallbladder
<b>brady-</b>	slow	<b>choledoch/o</b>	common bile duct
<b>bronch/o</b>	bronchus	<b>cholesterol/o</b>	cholesterol
<b>bronchi/o</b>	bronchus	<b>chondr/o</b>	cartilage
<b>bronchiol/o</b>	bronchioles; small bronchi	<b>chori/o</b>	choroid
<b>bucc/o</b>	cheek	<b>chrom/o</b>	color
<b>burs/o</b>	bursa (sac filled with synovial fluid located around joints)	<b>-cidal</b>	to kill
<b>C</b>		<b>cili/o</b>	hair
<b>cac/o</b>	bad	<b>cis/o</b>	to cut
<b>calc/o</b>	calcium	<b>-clasis</b>	surgical fracture or refracture
<b>calcane/o</b>	heel	<b>-clast</b>	breakdown
<b>calic/o; calyc/o</b>	calix/calyx	<b>clavicul/o</b>	clavicle; collarbone
<b>-capnia</b>	carbon dioxide	<b>-cle</b>	small
<b>capsul/o</b>	capsule	<b>-clonus</b>	turmoil; violent action
<b>carcin/o</b>	cancer; cancerous	<b>-clysis</b>	washing; irrigation
<b>cardi/o</b>	heart	<b>coagulati/o</b>	to condense; to clot
<b>carp/o</b>	wrist	<b>-coccus</b>	berry-shaped
<b>cartilagin/o</b>	cartilage	<b>coccyg/o</b>	coccyx; tailbone
<b>catheter/o</b>	something inserted	<b>cochle/o</b>	cochlea
<b>caud/o</b>	tail	<b>col/o</b>	colon; large intestine
<b>caus/o</b>	burning	<b>colon/o</b>	colon
<b>cec/o</b>	cecum	<b>colp/o</b>	vagina
<b>-cele</b>	hernia (protrusion or displacement of an organ from the structure that normally contains it)	<b>coni/o</b>	dust
<b>cellul/o</b>	cell	<b>conjunctiv/o</b>	conjunctiva
		<b>constrict/o</b>	to draw together
		<b>-continence</b>	to stop
		<b>contra-</b>	against

WORD PART	DEFINITION	WORD PART	DEFINITION
<b>-conus</b>	cone-shaped	<b>dilat/o</b>	dilation; dilatation; to expand; widen
<b>core/o</b>	pupil	<b>dipl/o</b>	double
<b>corne/o</b>	cornea	<b>-dipsia</b>	thirst
<b>coron/o</b>	crown	<b>don/o</b>	donate
<b>corpor/o</b>	body	<b>dors/o</b>	back
<b>cortic/o</b>	cortex; outer covering; outer layer	<b>dorsi-</b>	back
<b>cost/o</b>	rib	<b>-drome</b>	to run
<b>crani/o</b>	skull	<b>duct/o</b>	to draw
<b>crin/o</b>	to secrete	<b>duoden/o</b>	duodenum (proximal portion of small intestine)
<b>-crine</b>	to secrete	<b>dur/o</b>	dura mater (outermost membrane surrounding the brain)
<b>-crit</b>	separate	<b>-dynia</b>	pain
<b>cry/o</b>	cold	<b>dys-</b>	bad; difficult; painful; poor
<b>crypt/o</b>	hidden		
<b>culd/o</b>	cul-de-sac		
<b>-cusis</b>	hearing		
<b>cutane/o</b>	skin		
<b>cyan/o</b>	blue		
<b>cycl/o</b>	ciliary body		
<b>-cytesis</b>	pregnancy		
<b>cyst/o</b>	bladder; sac		
<b>cyt/o</b>	cell		
<b>-cyte</b>	cell		
<b>-cytosis</b>	slight increase in the number of cells; condition of cells		
<b>D</b>			
<b>dacry/o</b>	tears; lacrimal duct	<b>electr/o</b>	electric
<b>de-</b>	lack of; removal	<b>-emesis</b>	vomit; vomiting
<b>dent/o</b>	tooth	<b>-emia</b>	blood condition
<b>derm/o</b>	skin	<b>emmetr/o</b>	in proper measure
<b>-derma</b>	skin	<b>en-</b>	inward
<b>dermat/o</b>	skin	<b>encephal/o</b>	brain
<b>-dermis</b>	skin	<b>endo-</b>	with; within
<b>-desis</b>	surgical binding; surgical fusion	<b>enter/o</b>	small intestine
<b>di-</b>	two	<b>epi-</b>	above; on; upon
<b>dia-</b>	complete; through	<b>epididym/o</b>	epididymis
<b>diaphor/e</b>	profuse sweating	<b>episi/o</b>	vulva; external genitalia; pudendum

WORD PART	DEFINITION	WORD PART	DEFINITION
<b>epitheli/o</b>	covering	<b>gluc/o</b>	sugar
<b>-er</b>	specialist; one who specializes; specialist in the study of	<b>glyc/o</b>	sugar
<b>erythemat/o</b>	red	<b>glycogen/o</b>	glycogen (storage form of sugar)
<b>erythem/o</b>	red	<b>-gnosis</b>	knowledge
<b>erythr/o</b>	red	<b>gonad/o</b>	gonads; sex glands
<b>eso-</b>	inward	<b>goni/o</b>	angle (especially of the anterior chamber)
<b>esophag/o</b>	esophagus	<b>-grade</b>	to step; to go
<b>-esthesia</b>	sensation	<b>-gram</b>	record; writing
<b>estr/o</b>	female	<b>granul/o</b>	granules
<b>ethm/o</b>	ethmoid bone; sieve	<b>-graph</b>	instrument used to record
<b>eu-</b>	normal; good	<b>-graphy</b>	process of recording; producing images
<b>ex-</b>	out; outside; outward	<b>-gravid/a</b>	pregnancy
<b>exo-</b>	out; outside; outward	<b>gynec/o</b>	female; woman
<b>extra-</b>	out; outside; outward		

**F**

<b>faci/o</b>	face
<b>fasci/o</b>	fascia
<b>femor/o</b>	femur; thigh bone
<b>fibr/o</b>	fibers; fibrous tissue
<b>fibul/o</b>	fibula
<b>flex/o</b>	bend
<b>-flux</b>	flow
<b>front/o</b>	frontal bone

**G**

<b>galact/o</b>	milk
<b>gastr/o</b>	stomach
<b>-gen</b>	producing; produced by
<b>-genesis</b>	production; formation; development
<b>-genic</b>	producing; produced by
<b>-genous</b>	produced by
<b>gingiv/o</b>	gums
<b>glen/o</b>	socket; pit; glenoid cavity
<b>gli/o</b>	glue
<b>glomerul/o</b>	glomerulus
<b>gloss/o</b>	tongue

**H**

<b>hem/o</b>	blood
<b>hemat/o</b>	blood
<b>hemi-</b>	half
<b>hepat/o</b>	liver
<b>herni/o</b>	hernia
<b>-hexia</b>	habit
<b>hiat/o</b>	hiatus, opening
<b>hidr/o</b>	sweat
<b>hist/o</b>	tissue
<b>histi/o</b>	tissue
<b>home/o</b>	same; constant
<b>humer/o</b>	humerus; upper arm
<b>hydr/o</b>	water
<b>hyper-</b>	abnormal increase; above; above normal; excessive
<b>hypo-</b>	abnormal decrease; below; below normal; under
<b>hyster/o</b>	uterus

**I**

<b>-ia</b>	condition; state of
<b>-iasis</b>	abnormal condition; process

WORD PART	DEFINITION	WORD PART	DEFINITION
<b>iatr/o</b>	physician	<b>K</b>	
<b>-ic</b>	pertaining to	<b>kal/o</b>	potassium
<b>-ician</b>	specialist; one who specializes; expert	<b>kerat/o</b>	cornea; hard; horn-like
<b>idi/o</b>	one's own; distinct; individual	<b>keratin/o</b>	hard; horn-like
<b>ile/o</b>	ileum (distal portion of the small intestine)	<b>-kines</b>	movement
<b>ili/o</b>	hip	<b>kinesi/o</b>	movement
<b>-immune</b>	immunity; safe	<b>-kinesia</b>	movement; motion
<b>immun/o</b>	immunity; safe	<b>-kinesis</b>	movement; motion
<b>in-</b>	no; not; in; into	<b>kyph/o</b>	humpback
<b>-ine</b>	pertaining to	 <b>L</b>	
<b>infer/o</b>	below; downward	<b>labi/o</b>	lip
<b>infra-</b>	below; under	<b>labyrinth/o</b>	inner ear; labyrinth
<b>inguin/o</b>	groin	<b>lacrim/o</b>	lacrimal apparatus; tears
<b>insulin/o</b>	insulin	<b>lact/o</b>	milk
<b>inter-</b>	between	<b>lapar/o</b>	abdominal wall; abdomen
<b>intestin/o</b>	intestine	<b>later/o</b>	side
<b>intra-</b>	within	<b>laryng/o</b>	larynx; voice box
<b>-ion</b>	process	<b>lei/o</b>	smooth
<b>-ior</b>	pertaining to	<b>-lepsy</b>	seizure
<b>ir/o</b>	iris	<b>leuk/o</b>	white
<b>irid/o</b>	iris	<b>ligati/o</b>	binding; tying
<b>is/o</b>	equal	<b>lingu/o</b>	tongue
<b>isch/o</b>	hold back	<b>lip/o</b>	fat
<b>ischio/o</b>	ischium (posterior portion of the hip bone)	<b>lipid/o</b>	fat
<b>-ism</b>	condition; process; state of	<b>-listhesis</b>	slipping
<b>-ist</b>	specialist; one who specializes; specialist in the study of	<b>-lith</b>	calculus; stone
<b>-itis</b>	inflammation (the redness, swelling, heat, and pain that occur when the body protects itself from injury)	<b>lith/o</b>	stone
<b>-ium</b>	structure	<b>lob/o</b>	lobe
 <b>J</b>		<b>-logist</b>	specialist; one who specializes; specialist in the study of
<b>jejun/o</b>	jejunum (medial portion of small intestine)	<b>-logy</b>	study of; process of study
		<b>lord/o</b>	swayback
		<b>lumb/o</b>	lower back; loins
		<b>-luxation</b>	dislocation
		<b>lymph/o</b>	lymph (clear, watery fluid)
		<b>lymphaden/o</b>	lymph glands; lymph nodes

WORD PART	DEFINITION	WORD PART	DEFINITION
<b>lymphangi/o</b>	lymph vessels	<b>muc/o</b>	mucus (a bodily secretion, of the mucous membrane, sometimes sticky and frequently thick)
<b>-lysis</b>	breakdown; destruction; separate; separation	<b>multi-</b>	multiple
<b>-lytic</b>	pertaining to destruction, separation, or breakdown	<b>muscul/o</b>	muscle
<b>M</b>		<b>my/o</b>	muscle
<b>magnet/o</b>	magnet	<b>myco/o</b>	fungus
<b>-malacia</b>	softening	<b>mydri/o</b>	dilation; dilatation; wide
<b>malleol/o</b>	malleolus (bony projection on the distal aspects of the tibia and fibula)	<b>-myein</b>	to shut
<b>mamm/o</b>	breast	<b>myel/o</b>	bone marrow; spinal cord
<b>mandibul/o</b>	mandible; lower jaw	<b>myelin/o</b>	myelin sheath
<b>mast/o</b>	breast	<b>myos/o</b>	muscle
<b>maxill/o</b>	maxilla; upper jaw	<b>myring/o</b>	tympanic membrane; eardrum
<b>meat/o</b>	meatus		
<b>medi/o</b>	middle		
<b>medull/o</b>	marrow; medulla; inner portion of an organ	<b>N</b>	
<b>megal/o</b>	large	<b>narc/o</b>	stupor
<b>-megaly</b>	enlargement	<b>nas/o</b>	nose
<b>melan/o</b>	black	<b>nat/o</b>	birth
<b>men/o</b>	menses; menstruation; month	<b>natr/o</b>	sodium
<b>ment/o</b>	mind	<b>necr/o</b>	death
<b>mening/o</b>	membrane; meninges	<b>neo-</b>	new
<b>meso-</b>	middle	<b>nephro/o</b>	kidney
<b>meta-</b>	beyond	<b>neur/o</b>	nerve
<b>metacarp/o</b>	metacarpals (bones of the hand)	<b>noct/o</b>	night
<b>metatars/o</b>	metatarsals (bones of the foot)	<b>norm/o</b>	normal
<b>-meter</b>	instrument used to measure	<b>nulli-</b>	none
<b>metr/o</b>	uterus	<b>nyct/o</b>	night
<b>-metrist</b>	one who measures		
<b>-metry</b>	process of measuring; to measure; measurement	<b>O</b>	
<b>mi/o</b>	contraction; less	<b>o/o</b>	egg
<b>mono-</b>	one	<b>occipit/o</b>	occiput (back part of the head)
<b>-mortem</b>	death	<b>ocul/o</b>	eye
		<b>odont/o</b>	teeth; tooth
		<b>-oid</b>	resembling
		<b>-ole</b>	small
		<b>olecran/o</b>	elbow; olecranon

WORD PART	DEFINITION	WORD PART	DEFINITION
<b>oligo-</b>	deficient; few; scanty	<b>path/o</b>	disease
<b>-oma</b>	mass; tumor	<b>-pathy</b>	disease
<b>onych/o</b>	nail	<b>-pause</b>	stoppage; cessation
<b>oophor/o</b>	ovary	<b>pector/o</b>	chest
<b>ophthalm/o</b>	eye	<b>pedicul/o</b>	lice
<b>-opia</b>	visual condition; vision	<b>ped/o</b>	child
<b>-opsia</b>	visual condition; vision	<b>pelv/i</b>	pelvis
<b>-opsy</b>	to view	<b>pelv/o</b>	pelvis
<b>-opt/o</b>	vision; sight	<b>-penia</b>	decrease; deficiency
<b>-or</b>	one who; person or thing that does something	<b>-pepsia</b>	digestion
<b>or/o</b>	mouth	<b>peri-</b>	around
<b>orchि/o</b>	testicle; testis	<b>perine/o</b>	perineum
<b>orchid/o</b>	testicle; testis	<b>peritone/o</b>	peritoneum
<b>orex/i</b>	appetite	<b>-pexy</b>	surgical fixation
<b>ortho-</b>	straight	<b>phac/o</b>	lens
<b>-ory</b>	pertaining to	<b>-phagia</b>	swallow; to eat
<b>-ose</b>	pertaining to	<b>phalang/o</b>	phalanx (one of three bones making up each finger or toe)
<b>-osis</b>	abnormal condition	<b>phall/o</b>	penis
<b>oste/o</b>	bone	<b>pharmac/o</b>	drug
<b>ot/o</b>	ear	<b>pharyng/o</b>	pharynx; throat
<b>-ous</b>	pertaining to	<b>-phasia</b>	speech
<b>ov/o</b>	egg	<b>phleb/o</b>	vein
<b>ovari/o</b>	ovary	<b>-phobia</b>	fear; irrational fear
<b>ox/o</b>	oxygen	<b>-phonia</b>	voice
<b>oxy-</b>	quick; sharp	<b>-phoresis</b>	transmission; carry
<b>P</b>			
<b>palpebr/o</b>	eyelid	<b>phot/o</b>	light
<b>pan-</b>	all	<b>phren/o</b>	diaphragm
<b>pancreat/o</b>	pancreas	<b>physi/o</b>	nature
<b>papill/o</b>	nipple-like; optic disc	<b>-physis</b>	to grow
<b>para-</b>	abnormal; beside; near	<b>pil/o</b>	hair
<b>-para</b>	give birth; part with child	<b>pine/o</b>	pineal gland
<b>parathyroid/o</b>	parathyroid gland	<b>pituitar/o</b>	pituitary gland
<b>pariet/o</b>	parietal bone; wall	<b>-plakia</b>	patches
<b>-partum</b>	labor; delivery; childbirth	<b>-plasia</b>	development; formation
<b>patell/o</b>	patella; kneecap	<b>-plasm</b>	development; formation
		<b>-plasty</b>	surgical repair or reconstruction

WORD PART	DEFINITION	WORD PART	DEFINITION
<b>-plegia</b>	paralysis (loss or impairment of motor function)	<b>Q</b>	
<b>pleur/o</b>	pleura; pleural cavity	<b>quadri-</b>	four
<b>-pnea</b>	breathing	<b>R</b>	
<b>pneum/o</b>	air; respiration; lungs	<b>radi/o</b>	x-ray; radius (one of the bones of the lower arm)
<b>pneumat/o</b>	air; respiration; lungs	<b>radicul/o</b>	nerve roots
<b>pneumon/o</b>	lungs	<b>ras/o</b>	scrape
<b>-poiesis</b>	production; manufacture; formation	<b>re-</b>	back
<b>-poietin</b>	a hormone that stimulates the production of blood cells	<b>rect/o</b>	rectum
<b>poikil/o</b>	variation; irregular	<b>ren/o</b>	kidney
<b>poli/o</b>	gray matter	<b>reticul/o</b>	network
<b>poly-</b>	many	<b>retin/o</b>	retina
<b>-porosis</b>	porous	<b>retro-</b>	backward; back; behind
<b>post-</b>	after	<b>rhabd/o</b>	rod-shaped; striped; striated
<b>poster/o</b>	back	<b>rhin/o</b>	nose
<b>-potence</b>	power	<b>rhythm/o</b>	rhythm
<b>practition/o</b>	practice	<b>-rrhage</b>	bursting forth
<b>-prandial</b>	meal	<b>-rrhagia</b>	bursting forth
<b>presby-</b>	old age	<b>-rrhaphy</b>	suture; sew
<b>primi-</b>	first	<b>-rrhea</b>	flow; discharge
<b>pro-</b>	before	<b>-rrhexis</b>	rupture
<b>proct/o</b>	rectum	 <b>S</b>	
<b>pronati/o</b>	pronation	<b>sacr/o</b>	sacrum
<b>prostat/o</b>	prostate; prostate gland	<b>salping/o</b>	eustachian tube; fallopian tubes; uterine tubes
<b>proxim/o</b>	near; close	<b>-salpinx</b>	fallopian tubes; uterine tubes
<b>pseudo-</b>	false	<b>sarc/o</b>	flesh
<b>-ptosis</b>	downward displacement; drooping; falling; prolapse; sagging	<b>-sarcoma</b>	malignant tumor of connective tissue
<b>-ptysis</b>	spitting	<b>scapul/o</b>	scapula
<b>pub/o</b>	pubis (portion of the hip bone)	<b>-schisis</b>	cleft; splitting
<b>pulmon/o</b>	lungs	<b>scint/i</b>	spark
<b>pupill/o</b>	pupil	<b>scler/o</b>	hardening
<b>py/o</b>	pus	<b>-sclerosis</b>	hardening
<b>pyel/o</b>	renal pelvis (upper dilated portion of the ureter)	<b>scoli/o</b>	curved; crooked
<b>pylor/o</b>	pylorus (distal portion of the stomach); pyloric sphincter		

WORD PART	DEFINITION	WORD PART	DEFINITION
<b>-scope</b>	instrument used to visually examine (a body cavity or organ)	<b>steth/o</b>	chest
<b>-scopy</b>	process of visually examining (a body cavity or organ)	<b>-stital</b>	to place
<b>seb/o</b>	sebum	<b>stom/o</b>	mouth
<b>sect/o</b>	to cut	<b>strept/o</b>	twisted
<b>secundi-</b>	second	<b>stomat/o</b>	mouth
<b>semi-</b>	half	<b>-stomy</b>	new opening
<b>septic/o</b>	infection	<b>sub-</b>	under
<b>sial/o</b>	saliva	<b>super/o</b>	above; toward the head
<b>sialaden/o</b>	salivary glands	<b>supra-</b>	above; beyond; excessive
<b>sigmoid/o</b>	sigmoid colon	<b>sym-</b>	together; with
<b>sinus/o</b>	sinuses	<b>synovi/o</b>	synovium; synovial membrane
<b>-sis</b>	condition; state of		
<b>skelet/o</b>	skeleton		
<b>somat/o</b>	body		
<b>son/o</b>	sound		
<b>-spadias</b>	opening; split		
<b>-spasm</b>	sudden, involuntary contraction		
<b>sperm/o</b>	spermatozoa; sperm; seminal fluid		
<b>spermat/o</b>	spermatozoa; sperm	<b>tachy-</b>	fast
<b>sphen/o</b>	sphenoid bone; wedge	<b>-taxia</b>	order
<b>spin/o</b>	backbone; spine; spinal column; vertebral column	<b>tele-</b>	distant
<b>spir/o</b>	breathing	<b>tempor/o</b>	temporal bone
<b>splen/o</b>	spleen	<b>ten/o</b>	tendon
<b>spondyl/o</b>	vertebra; backbone; spinal column; spine	<b>tend/o</b>	tendon
<b>-sphyxia</b>	pulse	<b>tendin/o</b>	tendon
<b>staped/o</b>	stapes	<b>tenosynovi/o</b>	tendon sheath (covering of a tendon)
<b>staphyl/o</b>	resembling a bunch of grapes	<b>tens/o</b>	stretch
<b>-stasis</b>	stable; stoppage; stopping; controlling	<b>tensi/o</b>	tension
<b>steat/o</b>	fat	<b>test/o</b>	testicle; testis
<b>-stenosis</b>	narrowing; stricture	<b>testicul/o</b>	testicle; testis
<b>stern/o</b>	sternum; breastbone	<b>tetra-</b>	four
		<b>thalam/o</b>	thalamus
		<b>thel/o</b>	nipple
		<b>-therapy</b>	treatment
		<b>-thermy</b>	heat
		<b>thorac/o</b>	chest; thorax
		<b>-thorax</b>	chest
		<b>thromb/o</b>	clot
		<b>thym/o</b>	thymus gland
		<b>thyro/o</b>	thyroid gland; shield
		<b>thyroid/o</b>	thyroid gland; shield
		<b>tibi/o</b>	tibia; shin

**WORD PART****DEFINITION**

<b>-tic</b>	pertaining to
<b>-ticia</b>	labor
<b>-tocin</b>	labor
<b>tom/o</b>	to cut
<b>-tome</b>	instrument used to cut
<b>-tomy</b>	to cut; incise; process of cutting; incision
<b>ton/o</b>	tension
<b>tonsill/o</b>	tonsils
<b>top/o</b>	place
<b>tox/o</b>	poison
<b>trabecul/o</b>	trabecula (strands of connective tissue)
<b>trache/o</b>	trachea; windpipe
<b>trans-</b>	across
<b>trigon/o</b>	trigone
<b>-tripsy</b>	crushing
<b>-trophy</b>	nourishment; growth
<b>-tropia</b>	turning
<b>-tropic; -trophic</b>	nourish; stimulate
<b>-tropion</b>	turning
<b>tub/o</b>	fallopian tube
<b>tympan/o</b>	tympanic membrane; eardrum

**U**

<b>-ule</b>	small
<b>uln/o</b>	ulna (one of the bones of the lower arm)
<b>ultra-</b>	excess; beyond
<b>-um</b>	structure
<b>ungu/o</b>	nail
<b>ure/o</b>	urea (end product of protein break down)
<b>ureter/o</b>	ureters
<b>urethr/o</b>	urethra

**WORD PART**

<b>-uria</b>	urine; urination
<b>urin/o</b>	urine
<b>ur/o</b>	urinary tract; urine; urination
<b>-us</b>	condition; thing
<b>uter/o</b>	uterus
<b>uve/o</b>	uvea (includes the choroid, ciliary body, and iris)

**V**

<b>vagin/o</b>	vagina
<b>valvul/o</b>	valve
<b>varic/o</b>	varicose vein; dilated, twisted vein
<b>vas/o</b>	vas deferens; vessel
<b>vascul/o</b>	vessel
<b>ven/o</b>	vein
<b>ventr/o</b>	front
<b>ventricul/o</b>	ventricle (lower chambers of the heart)
<b>versi/o</b>	turning; tilting; tipping
<b>vertebr/o</b>	vertebra
<b>vesic/o</b>	bladder
<b>viscer/o</b>	internal organs
<b>vitre/o</b>	glasslike; gel-like
<b>vulv/o</b>	vulva; external genitalia; pudendum

**X**

<b>xer/o</b>	dry
<b>xiph/o</b>	sword

**Y**

<b>-y</b>	process; condition
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**Z**

<b>zygomat/o</b>	cheekbone
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## APPENDIX D

# Definition to Word Part

DEFINITION	WORD PART	DEFINITION	WORD PART
<b>A</b>			
abdomen	<b>abdomin/o;</b>	angle (especially of the anterior chamber)	<b>goni/o</b>
abdominal wall	<b>lapar/o</b>	anus	<b>an/o</b>
abnormal	<b>lapar/o</b>	aorta	<b>aort/o</b>
abnormal condition	<b>para-</b>	apart	<b>ana-</b>
abnormal increase	<b>-iasis; -osis</b>	appendix	<b>append/o</b>
above	<b>hyper-</b>	appetite	<b>orex/i</b>
accumulation of a fluid	<b>epi-; hyper-;</b>	arm	<b>brachi/o</b>
acetabulum	<b>super/o; supra-</b>	armpit	<b>axill/o</b>
acromion	<b>-edema</b>	around	<b>circum-; peri-</b>
across		artery	<b>arteri/o</b>
adenoids	<b>acetabul/o</b>	aspiration	<b>-centesis</b>
adrenal gland	<b>acromi/o</b>	atrium	<b>atri/o</b>
after	<b>trans-</b>	away from	<b>ab-</b>
against			
air	<b>adenoid/o</b>	<b>B</b>	
air sacs	<b>adren/o;</b>	back	<b>dorsi-; dors/o;</b>
albumin (a blood protein)	<b>adrenal/o</b>		<b>poster/o; re-;</b>
all	<b>post-</b>		<b>retro-</b>
alveolus	<b>anti-; contra-</b>		<b>occipit/o</b>
amnion	<b>aer/o; pneum/o;</b>	back part of the head (occiput)	
analysis of a mixture to identify its contents	<b>pneumat/o</b>	backbone	<b>spin/o</b>
	<b>alveol/o</b>	backward	<b>retro-</b>
	<b>albumin/o</b>	bacteria	<b>bacteri/o</b>
	<b>pan-</b>	bad	<b>dys-; cac/o</b>
	<b>alveol/o</b>	bear (to)	<b>-para</b>
	<b>amni/o</b>	before	<b>ante-; pro-</b>
	<b>-assay</b>	beginning	<b>-arche</b>

DEFINITION	WORD PART	DEFINITION	WORD PART
behind	<b>retro-</b>	<b>C</b>	
below	<b>hypo-; infer/o;</b> <b>infra-;</b>	calcium	<b>calci/o; calc/o</b>
	<b>sub-</b>	calculus	<b>-lith</b>
below normal	<b>hypo-</b>	calix; calyx	<b>calic/o; calyc/o</b>
bend	<b>flex/o</b>	cancer	<b>carcin/o</b>
bent	<b>ankyl/o</b>	cancerous	<b>carcin/o</b>
berry-shaped	<b>-coccus</b>	capsule	<b>capsul/o</b>
beside	<b>para-</b>	carbon dioxide	<b>-capnia</b>
between	<b>inter-</b>	carry	<b>-phoresis</b>
beyond	<b>meta-; supra-;</b> <b>ultra-</b>	cartilage	<b>cartilagin/o;</b> <b>chondr/o</b>
bile	<b>bil/i; chol/e</b>	cecum	<b>cec/o</b>
bile vessel	<b>cholangi/o</b>	cell	<b>cellul/o; cyt/o;</b> <b>-cyte</b>
bilirubin (a bile pigment)	<b>bilirubin/o</b>	cerebellum	<b>cerebell/o</b>
binding	<b>ligati/o</b>	cervix	<b>cervic/o</b>
birth	<b>nat/o</b>	cervix uteri	<b>cervic/o</b>
black	<b>melan/o</b>	cessation	<b>-pause</b>
bladder	<b>cyst/o; vesic/o</b>	cheek	<b>bucc/o</b>
blood	<b>hem/o; hemat/o</b>	cheekbone	<b>zygomat/o</b>
blood condition	<b>-emia</b>	chest	<b>pector/o; steth/o;</b> <b>thorac/o;</b> <b>-thorax</b>
blue	<b>cyan/o</b>		
body	<b>corpor/o;</b> <b>somat/o</b>	child	<b>ped/o</b>
bone	<b>osse/o; oste/o</b>	childbirth	<b>-partum</b>
bone marrow	<b>myel/o</b>	cholesterol	<b>cholesterol/o</b>
bony projection on the distal aspects of the tibia and fibula	<b>malleol/o</b>	choroid	<b>chori/o</b>
brain	<b>cerebr/o;</b> <b>encephal/o</b>	ciliary body	<b>cycl/o</b>
breakdown	<b>-clast; -lysis</b>	clavicle	<b>clavicul/o</b>
breast	<b>mamm/o; mast/o</b>	clear, watery fluid	<b>lymph/o</b>
breastbone	<b>stern/o</b>	cleft	<b>-schisis</b>
breathing	<b>-pnea; spir/o</b>	close	<b>proxim/o</b>
bronchioles	<b>bronchiol/o</b>	clot	<b>thromb/o</b>
bronchus	<b>bronchi/o;</b> <b>bronch/o</b>	clot (to)	<b>coagulati/o</b>
burning	<b>caus/o</b>	coccyx	<b>coccyg/o</b>
bursa	<b>burs/o</b>	cochlea	<b>cochle/o</b>
bursting forth	<b>-rrhage; -rrhagia</b>	cold	<b>cry/o</b>
		collarbone	<b>clavicul/o</b>
		colon	<b>col/o; colon/o</b>

DEFINITION	WORD PART	DEFINITION	WORD PART
color	<b>chrom/o</b>	discharge	<b>-rrhea</b>
common bile duct	<b>choledoch/o</b>	disease	<b>path/o;</b> <b>-pathy</b>
complete	<b>dia-</b>	dislocation	<b>-luxation</b>
condense (to)	<b>coagulati/o</b>	displacement	<b>-cele</b>
condition	<b>-ia; -ism; -sis</b>	distant	<b>tele-</b>
condition of cells	<b>-cytosis</b>	distinct	<b>idi/o</b>
cone-shaped	<b>-conus</b>	donates	<b>don/o</b>
constant	<b>home/o</b>	double	<b>dipl/o</b>
contraction	<b>mi/o</b>	downward	<b>infer/o</b>
controlling	<b>-stasis</b>	downward displacement	<b>-ptosis</b>
cornea	<b>corne/o; kerat/o</b>	draw (to)	<b>duct/o</b>
cortex	<b>cortic/o</b>	draw together (to)	<b>constrict/o</b>
covering	<b>epitheli/o</b>	drooping	<b>-ptosis</b>
covering of a tendon	<b>tenosynovi/o</b>	drug	<b>pharmac/o;</b> <b>chem/o</b>
crooked	<b>ankyl/o; scoli/o</b>	dry	<b>xer/o</b>
crown	<b>coron/o</b>	dull	<b>ambly/o</b>
crushing	<b>-tripsy</b>	duodenum (proximal portion of small intestine)	<b>duoden/o</b>
cul-de-sac	<b>culd/o</b>	dura mater (outer-most membrane surrounding the brain)	<b>dur/o</b>
curved	<b>scoli/o</b>		
cut (to)	<b>cis/o; sect/o;</b> <b>tom/o;</b> <b>-tomy</b>		

**D**

death	<b>necr/o;</b> <b>-mortem</b>
decrease	<b>hypo-; -penia</b>
deficiency	<b>-penia</b>
deficient	<b>oligo-</b>
delivery	<b>-partum</b>
destruction	<b>-lysis</b>
development	<b>-plasia; -plasm;</b> <b>-genesis</b>
diaphragm	<b>phren/o</b>
difficult	<b>dys-</b>
digestion	<b>-pepsia</b>
dilated, twisted vein	<b>varic/o</b>
dilation (dilatation)	<b>dilat/o; -ectasis;</b> <b>mydri/o</b>
dim	<b>ambly/o</b>

**E**

ear	<b>aur/o; ot/o</b>
eardrum	<b>myring/o;</b> <b>tympan/o</b>
ease	<b>-aise</b>
eat (to)	<b>-phagia</b>
egg	<b>o/o; ov/o</b>
elbow	<b>olecran/o</b>
electric	<b>electr/o</b>
enlargement	<b>-megaly</b>
epididymis	<b>epididym/o</b>
equal	<b>is/o</b>
esophagus	<b>esophag/o</b>
ethmoid bone	<b>ethm/o</b>
eustachian tube	<b>salping/o</b>
excess	<b>ultra-</b>

**DEFINITION**

excessive  
excision  
expand (to)  
expert  
external genitalia  
extremity  
eye  
eyelid

**F**

face  
falling  
fallopian tube  
  
false  
fascia (band of tissue surrounding a muscle)  
fast  
fat  
  
fatty debris  
fatty plaque  
fear  
female  
femur  
few  
fibers  
fibrous tissue  
fibula  
first  
flesh  
flow  
formation

**WORD PART**

**hyper-**; **supra-**  
**-ectomy**  
**dilat/o**  
**-ician**  
**episi/o; vulv/o**  
**acr/o**  
**ocul/o;**  
**ophthalm/o**  
**blephar/o;**  
**palpebr/o**

**faci/o**  
**-ptosis**  
**salping/o;**  
**-salpinx;**  
**tub/o**  
**pseudo-**  
**fasci/o**  
  
**tachy-**  
**adip/o; lip/o;**  
**lipid/o;**  
**steat/o**  
**ather/o**  
**ather/o**  
**-phobia**  
**estr/o; gynec/o**  
**femor/o**  
**oligo-**  
**fibr/o**  
**fibr/o**  
**fibul/o**  
**primi-**  
**sarc/o**  
**-flux; -rrhea**  
**-genesis;**  
**-plasia; -plasm**  
**-poiesis**

**DEFINITION**

formed in  
four  
front  
frontal bone  
fungus  
fusion of parts

**G**

gall  
gallbladder  
gel-like  
give birth  
gland  
glans penis (tip of penis)  
glasslike  
glenoid cavity  
glomerulus  
glycogen (storage form of sugar)  
go (to)  
gonads  
good  
granules  
gray matter  
groin  
grow (to)  
growing thing  
growth  
gums

**H**

habit  
hair  
half  
hard  
hardening

**WORD PART**

**-genic**  
**quadri-; tetra-**  
**anter/o;**  
**ventr/o**  
**front/o**  
**myc/o**  
**ankyl/o**

**chol/e**  
**cholecyst/o**  
**vitre/o**  
**-para**  
**aden/o**  
**balan/o**  
**vitre/o**  
**glen/o**  
**glomerul/o**  
**glycogen/o**

**-grade**  
**gonad/o**  
**eu-**  
**granul/o**  
**poli/o**  
**inguin/o**  
**-physis**  
**-blast**  
**-trophy**  
**gingiv/o**

**-hexia**  
**cili/o; pil/o**  
**hemi-; semi-**  
**kerat/o;**  
**keratin/o**  
**-sclerosis;**  
**scler/o**

DEFINITION	WORD PART	DEFINITION	WORD PART
head	<b>cephal/o</b>	inner ear	<b>labyrinth/o</b>
hearing	<b>audi/o; -cusis</b>	instrument used to cut	<b>-tome</b>
heart	<b>cardi/o</b>	instrument used to measure	<b>-meter</b>
heat	<b>-thermy</b>	instrument used to record	<b>-graph</b>
heel	<b>calcane/o</b>	instrument used to visually examine a body cavity or organ	<b>-scope</b>
hernia (protrusion or displacement of an organ from the structure that normally contains it)	<b>-cele; herni/o</b>	insulin	<b>insulin/o</b>
hiatus	<b>hiat/o</b>	internal organ	<b>viscer/o</b>
hidden	<b>crypt/o</b>	intestine	<b>intestin/o</b>
hip	<b>ili/o</b>	inward	<b>en-; eso-</b>
hip socket	<b>acetabul/o</b>	iris	<b>irid/o; ir/o</b>
hold back	<b>isch/o</b>	irrational fear	<b>-phobia</b>
hormone that stimulates the production of blood cells	<b>-poietin</b>	irregular	<b>poikil/o</b>
horn-like	<b>kerat/o; keratin/o</b>	irrigation	<b>-clysis</b>
humerus	<b>humer/o</b>	ischium	<b>ischio/o</b>
humpback	<b>kyph/o</b>		
<b>I</b>			
ileum (distal portion of the small intestine)	<b>ile/o</b>	jejenum (medial portion of small intestine)	<b>jejun/o</b>
immature	<b>-blast</b>	joint	<b>arthr/o; articul/o</b>
immunity	<b>immun/o; -immune</b>		
imperfect	<b>atel/o</b>		
in; into	<b>in-</b>		
in proper measure	<b>emmetr/o</b>		
inadequate	<b>a(n)-</b>		
incise	<b>-tomy</b>		
incision	<b>-tomy</b>		
incomplete	<b>atel/o</b>		
individual	<b>idi/o</b>		
infection	<b>septic/o</b>		
inflammation (redness, swelling, heat, and pain that occur when the body protects itself from injury)	<b>-itis</b>		
<b>K</b>			
		kidney	<b>nephro/o; ren/o</b>
		kill (to)	<b>-cidal</b>
		kneecap	<b>patell/o</b>
		knowledge	<b>-gnosis</b>
<b>L</b>			
		labor	<b>-partum; -tocia; -tocin</b>
			<b>labyrinth/o</b>
		labyrinth	<b>de-</b>
		lack of	<b>lacrim/o</b>
		lacrimal apparatus	<b>dacry/o</b>
		lacrimal duct	<b>megal/o</b>
		large	<b>col/o</b>
		large intestine	<b>laryng/o</b>
		larynx	<b>phac/o; phak/o</b>
		lens	<b>mi/o</b>
		less	

DEFINITION	WORD PART	DEFINITION	WORD PART
lice	<b>pedicul/o</b>	membrane	<b>mening/o</b>
life	<b>bi/o</b>	meninges	<b>mening/o</b>
light	<b>phot/o</b>	menses	<b>men/o</b>
lips	<b>cheil/o; labi/o</b>	menstruation	<b>men/o</b>
little bronchi	<b>bronchiol/o</b>	metacarpals (bones of the hand)	<b>metacarp/o</b>
liver	<b>hepat/o</b>	metatarsals (bones of the foot)	<b>metatars/o</b>
lobe	<b>lob/o</b>	middle	<b>medi/o; meso-</b>
loins	<b>lumb/o</b>	milk	<b>galact/o; lact/o</b>
loss or impairment of motor function	<b>-plegia</b>	mind	<b>ment/o</b>
lower back	<b>lumb/o</b>	month	<b>men/o</b>
lower jaw	<b>mandibul/o</b>	motion	<b>-kinesia; -kinesis</b>
lungs	<b>pneum/o</b>	mouth	<b>or/o; stomat/o;</b> <b>stom/o</b>
	<b>pneumon/o;</b>	movement	<b>-kinesia;</b> <b>-kinesis; -kines</b>
	<b>pneumat/o</b>		<b>muc/o</b>
	<b>pulmon/o</b>		
lymph (clear, watery fluid)	<b>lymph/o</b>	mucus (a bodily secretion, of the mucous membrane, sometimes sticky and frequently thick)	
lymph gland	<b>lymphaden/o</b>	multiple	<b>multi-</b>
lymph node	<b>lymphaden/o</b>	muscle	<b>muscul/o;</b>
lymph vessel	<b>lymphangi/o</b>	myelin sheath	<b>myos/o</b>
<b>M</b>			<b>myelin/o</b>
magnet	<b>magnet/o</b>		
male	<b>andr/o</b>		
malignant tumor of connective tissue	<b>-sarcoma</b>		
malleolus	<b>malleol/o</b>	<b>N</b>	
man	<b>andr/o</b>	nail	<b>onych/o; ungu/o</b>
mandible	<b>mandibul/o</b>	narrowing	<b>-stenosis</b>
manufacture	<b>-poiesis</b>	nature	<b>physi/o</b>
many	<b>poly-; multi-</b>	near	<b>proxim/o; para-</b>
marrow	<b>medull/o</b>	neck	<b>cervic/o</b>
mass	<b>-oma</b>	neck of uterus	<b>cervic/o</b>
maxilla	<b>maxill/o</b>	nerve	<b>neur/o</b>
meal	<b>-prandial</b>	nerve roots	<b>radicul/o</b>
measurement	<b>-metry</b>	network	<b>reticul/o</b>
measure (to)	<b>-metry</b>	new opening	<b>-stomy</b>
meatus	<b>meat/o</b>	night	<b>noct/o; nyct/o</b>
medulla	<b>medull/o</b>	nipple	<b>thel/o</b>

DEFINITION	WORD PART	DEFINITION	WORD PART
nipple-like	<b>papill/o</b>	pancreas	<b>pancreat/o</b>
no	<b>a(n)-; in-</b>	paralysis	<b>-plegia</b>
no strength	<b>-asthenia</b>	parathyroid gland	<b>parathyroid/o</b>
none	<b>nulli-</b>	parietal bone	<b>pariet/o</b>
normal	<b>eu-; norm/o</b>	part with child	<b>-para</b>
nose	<b>nas/o; rhin/o</b>	patches	<b>-plakia</b>
not	<b>a(n)-; in-</b>	patella	<b>patell/o</b>
nourish, stimulate	<b>-tropic; -trophic</b>	pelvis	<b>pelv/i; pelv/o</b>
nourishment	<b>-trophy</b>	penis	<b>phall/o</b>
<b>O</b>			
occiput (back part of the head)	<b>occipit/o</b>	perineum	<b>perine/o</b>
old age	<b>presby-</b>	peritoneum	<b>peritone/o</b>
olecranon	<b>olecran/o</b>	person or thing that does something	<b>-or</b>
on	<b>epi-</b>	pertaining to	<b>-ac; -al; -an; -ar;</b>
one	<b>mono-</b>		<b>-ary;</b>
one's own	<b>idi/o</b>		<b>-eal; -ear; -ic;</b>
one who	<b>-or</b>		<b>ine;</b>
one who measures	<b>-metrist</b>		<b>-ior; -or; -ory;</b>
one who specializes; specialist	<b>-logist; -ician;</b> <b>-er; -or; -ist</b>		<b>-ose; -ous; -tic</b>
opening	<b>-spadias; hiat/o</b>		<b>-lytic</b>
optic disc	<b>papill/o</b>		
order	<b>-taxia</b>		
out	<b>e-; ec-; ex-; exo-;</b> <b>extra-</b>		
outer layer	<b>cortic/o</b>		
out of proportion	<b>ametr/o</b>		
outside	<b>e-; ec-; ex-; exo-;</b> <b>extra-</b>		
outward	<b>e-; ec-; ex-; exo-;</b> <b>extra-</b>		
ovary	<b>oophor/o; ovar/o</b>		
oxygen	<b>ox/o</b>		
<b>P</b>			
pain	<b>-algia; -dynia</b>	posterior portion of the hip bone	<b>ischio/o</b>
painful	<b>dys-</b>	potassium	<b>kal/o</b>

DEFINITION	WORD PART	DEFINITION	WORD PART
power	<b>-potence</b>	record	<b>-gram</b>
practice	<b>practition/o</b>	rectum	<b>proct/o; rect/o</b>
pregnancy	<b>-cytesis;</b> <b>-gravida</b>	red	<b>erythemat/o;</b> <b>erythem/o;</b> <b>erythr/o;</b>
process	<b>-iasis; -ion;</b> <b>-ism; -y</b>	referring to another	<b>all/o</b>
process of cutting	<b>-tomy</b>	relaxation	<b>-chalasis</b>
process of measuring	<b>-metry</b>	removal	<b>de-</b>
process of producing images	<b>-graphy</b>	renal pelvis	<b>pyel/o</b>
process of recording	<b>-graphy</b>	resembling	<b>-oid</b>
process of study	<b>-logy</b>	resembling a bunch of grapes	<b>staphyl/o</b>
process of visually examining a body cavity or organ	<b>-scopy</b>	respiration	<b>pneumat/o;</b> <b>pneum/o</b>
produced by	<b>-gen</b> <b>-genic;</b> <b>-genous</b>	retina	<b>retin/o</b>
producing	<b>-gen</b> ; <b>-genic</b>	rhythm	<b>rhythm/o</b>
production	<b>-genesis;</b> <b>-poiesis</b>	rib	<b>cost/o</b>
profuse sweating	<b>diaphor/e</b>	rod-shaped	<b>rhabd/o</b>
prolapse	<b>-ptosis</b>	run (to)	<b>-drome</b>
pronation	<b>pronati/o</b>	rupture	<b>-rrhexis</b>
prostate	<b>prostat/o</b>		
protrusion	<b>-cele</b>	<b>S</b>	
pubis (a portion of the hip bone)	<b>pub/o</b>	sac	<b>cyst/o</b>
pudendum	<b>episi/o; vulv/o</b>	sac filled with synovial fluid	<b>burs/o</b>
pulse	<b>-sphyxia</b>	located around joints	
pupil	<b>core/o; pupill/o</b>	sac in which the fetus lies in the uterus	<b>amni/o</b>
pus	<b>py/o</b>	sacrum	<b>sacr/o</b>
pyloric sphincter	<b>pylor/o</b>	safe	<b>immunity;</b> <b>-immune</b>
pylorus	<b>pylor/o</b>	sagging	<b>-ptosis</b>
		saliva	<b>sial/o</b>
		salivary gland	<b>sialaden/o</b>
<b>Q</b>		same	<b>home/o</b>
quick	<b>oxy-</b>	scanty	<b>oligo-</b>
		scapula	<b>scapul/o</b>
<b>R</b>		scrape	<b>ras/o</b>
radius (bone of lower arm)	<b>radi/o</b>	sebum	<b>seb/o</b>
reconstruction	<b>-plasty</b>	second	<b>secundi-</b>

DEFINITION	WORD PART	DEFINITION	WORD PART
secrete (to)	<b>crin/o; -crine</b>	spark	<b>scint/i</b>
seizure	<b>-lepsy</b>	specialist; specialist in the study of	<b>-ician; -logist;</b>
self	<b>auto-</b>	speech	<b>-er; -or; -ist</b>
seminal fluid	<b>sperm/o;</b> <b>spermat/o</b>	spermatozoa (sperm)	<b>-phasia</b>
sensation	<b>-esthesia</b>	sphenoid bone	<b>sperm/o;</b> <b>spermat/o</b>
separate	<b>-crit; -lysis</b>	spinal column	<b>sphen/o</b>
sew	<b>-rrhaphy</b>	spinal cord	<b>spin/o</b>
sex glands	<b>gonad/o</b>	spine	<b>myel/o</b>
sharp	<b>oxy-</b>	spitting	<b>spin/o</b>
shield	<b>thyro/o; thyroid/o</b>	spleen	<b>-ptysis</b>
shin	<b>tibi/o</b>	split	<b>splen/o</b>
shut (to)	<b>-myein</b>	splitting	<b>-spadias</b>
side	<b>later/o</b>	stable	<b>-schisis</b>
sieve	<b>ethm/o</b>	standing	<b>-stasis</b>
sight	<b>opt/o</b>	stapes	<b>-stasis</b>
sigmoid colon	<b>sigmoid/o</b>	state of	<b>staped/o</b>
sinuses	<b>sinus/o</b>	step (to)	<b>-ia; -ism; -sis</b>
skeleton	<b>skelet/o</b>	sternum	<b>-grade</b>
skin	<b>cutane/o;</b> <b>derm/o;</b> <b>-derma;</b> <b>dermat/o;</b> <b>-dermis</b>	stiffening	<b>stern/o</b>
		stimulate	<b>ankyl/o</b>
		stomach	<b>-tropic</b>
skull	<b>crani/o</b>	stone	<b>gastr/o</b>
slight increase in the number of cells	<b>-cytosis</b>	stop (to)	<b>-lith; lith/o</b>
slipping	<b>-listhesis</b>	stoppage; stopping	<b>-continence</b>
slow	<b>brady-</b>	straight	<b>-pause; -stasis</b>
small	<b>-ole; -ule; -cle</b>	stretching	<b>ortho-</b>
small bronchial tubes	<b>bronchiol/o</b>	striated	<b>-ectasis</b>
small intestine	<b>enter/o</b>	stricture	<b>rhabd/o</b>
smooth	<b>lei/o</b>	striped	<b>-stenosis</b>
socket	<b>glen/o</b>	structure	<b>rhabd/o</b>
sodium	<b>natr/o</b>	study of	<b>-ium; -um</b>
softening	<b>-malacia</b>	stupor	<b>-logy</b>
something inserted	<b>catheter/o</b>	sudden, involuntary	<b>narc/o</b>
sound	<b>ech/o; son/o</b>	contraction	<b>-spasm</b>
		sugar	<b>gluc/o; glyc/o</b>
		supination	<b>supinati/o</b>

**DEFINITION**

surgical binding  
surgical fixation  
surgical fracture  
surgical fusion  
surgical puncture to remove fluid  
surgical reconstruction  
surgical refracture  
surgical removal  
surgical repair  
suture (to sew)  
swallow  
swayback  
sweat  
sword  
synovial membrane  
synovium

**T**

tail  
tailbone  
tears  
teeth  
temporal bone  
tendon  
tendon sheath  
tension  
testicle  
  
testis

thalamus  
thigh bone  
thing  
thirst  
thorax  
throat  
thymus gland

**WORD PART**

**-desis**  
**-pexy**  
**-clasis**  
**-desis**  
**-centesis**  
**-plasty**  
**-clasis**  
**-ectomy**  
**-plasty**  
**-rrhaphy**  
**-phagia**  
**lord/o**  
**hidr/o**  
**xiph/o**  
**synovi/o**  
**synovi/o**

**DEFINITION**

thyroid gland  
tibia  
tilting  
tip of penis  
tipping  
tissue  
together  
tone  
tongue  
tonsil  
tooth  
top  
toward  
toward the head  
trabecula (strands of connective tissue)  
trachea  
transmission

**T**

treatment  
**caud/o**  
**coccyg/o**  
**dacry/o; lacrim/o**  
**odont/o**  
**tempor/o**  
**tend/o; tendin/o**  
**tenosynovi/o**  
**tensi/o; ton/o**  
**orchi/o; orchid/o;**  
**test/o; testicul/o**  
**orchi/o; orchid/o;**  
**test/o; testicul/o**  
**thalam/o**  
**femor/o**  
**-us**  
**-dipsia**  
**thorac/o**  
**pharyng/o**  
**thym/o**

**U**

ulna (bone of lower arm)  
umbilicus  
under  
unequal  
up  
upon

**WORD PART**

**thyr/o; thyroid/o**  
**tibi/o**  
**versi/o**  
**balan/o**  
**versi/o**  
**hist/o; histi/o**  
**sym-**  
**ton/o**  
**gloss/o; lingu/o**  
**tonsill/o**  
**dent/o; odont/o**  
**acr/o**  
**ad-**  
**super/o**  
**trabecul/o**  
  
**trache/o**  
**-phoresis**  
**-therapy**  
**trigon/o**  
**tub/o**  
**-oma**  
**-clonus**  
**-tropia;**  
**-tropion; versi/o**  
**strept/o**  
**di-**  
**ligati/o**  
**tympan/o;**  
**myring/o**

**uln/o**  
**umbilic/o**  
**hypo-; sub-;**  
**infra-**  
**anis/o**  
**ana-**  
**epi-**

DEFINITION	WORD PART	DEFINITION	WORD PART
upper arm	<b>humer/o</b>	view (to)	<b>-opsy</b>
upper dilated portion of the ureter	<b>pyel/o</b>	violent action	<b>-clonus</b>
upper jaw	<b>maxill/o</b>	vision	<b>-opia; -opsia;</b> <b>opt/o</b>
urea (end product of protein breakdown)	<b>ure/o</b>	visual condition	<b>-opia; -opsia</b>
ureter	<b>ureter/o</b>	voice	<b>-phonia</b>
urethra	<b>urethr/o</b>	voice box	<b>laryng/o</b>
urinary tract	<b>ur/o</b>	vomit	<b>-emesis</b>
urination	<b>ur/o; -uria</b>	vulva	<b>episi/o; vulv/o</b>
urine	<b>ur/o; -uria;</b> <b>urin/o</b>		
uterine tube	<b>salping/o;</b> <b>-salpinx</b>	wall	<b>pariet/o</b>
uterus	<b>uter/o; hyster/o;</b> <b>metr/o</b>	washing	<b>-clysis</b>
uvea	<b>uve/o</b>	water	<b>aque/o;</b> <b>hydr/o</b>
		wedge	<b>sphen/o</b>
		white	<b>albin/o;</b> <b>leuk/o</b>
<b>V</b>			<b>mydri/o</b>
vagina	<b>colp/o; vagin/o</b>	wide	<b>dilat/o</b>
valve	<b>valvul/o</b>	widen	<b>trache/o</b>
variation	<b>poikil/o</b>	windpipe	<b>endo-; sym-</b>
varicose vein	<b>varic/o</b>	with	<b>endo-; infra-;</b> <b>intra-</b>
vas deferens	<b>vas/o</b>	within	<b>e-</b>
vein	<b>phleb/o; ven/o</b>	without	<b>gynec/o</b>
ventricle (lower chambers of the heart)	<b>ventricul/o</b>	woman	<b>carp/o</b>
vertebra; vertebral column	<b>vertebr/o; spin/o</b> <b>spondyl/o</b>	wrist	<b>-gram</b>
vessel	<b>angi/o; vas/o;</b> <b>vascul/o</b>	writing	
		<b>X</b>	
		x-rays	<b>radi/o</b>



## APPENDIX E

# Abbreviations, Acronyms, and Symbols

### A

<b>99mTc</b>	technetium 99m
<b>AAT</b>	alpha <sub>1</sub> antitrypsin
<b>Ab</b>	antibody
<b>ABG</b>	arterial blood gases
<b>ABR</b>	auditory brainstem response
<b>ACh</b>	acetylcholine
<b>ACL</b>	anterior cruciate ligament
<b>ACTH</b>	adrenocorticotrophic hormone
<b>AD</b>	Alzheimer disease; right ear
<b>ADH</b>	antidiuretic hormone
<b>AED</b>	automatic external defibrillator
<b>AF; A-fib</b>	atrial fibrillation
<b>AFB</b>	acid-fast bacillus
<b>Ag</b>	antigen
<b>AIDS</b>	acquired immunodeficiency syndrome
<b>ALOC</b>	altered levels of consciousness
<b>ALP</b>	alkaline phosphatase
<b>ALS</b>	amyotrophic lateral sclerosis
<b>ALT</b>	alanine transaminase
<b>AM; a.m.</b>	morning
<b>AMD</b>	age-related macular degeneration
<b>ANA</b>	antinear antibody
<b>AP</b>	anteroposterior

### aPTT

<b>ARF</b>	activated partial thromboplastin time
<b>ART</b>	acute renal failure
<b>AS</b>	assisted reproductive therapy
<b>left ear</b>	left ear
<b>AST</b>	aspartate transaminase
<b>ATP</b>	adenosine triphosphate
<b>AV</b>	atrioventricular

### B

<b>BBB</b>	blood-brain barrier
<b>BM</b>	bowel movement
<b>BP</b>	blood pressure
<b>BPH</b>	benign prostatic hypertrophy
<b>BRCA1; BRCA2</b>	breast cancer genes
<b>BSE</b>	breast self-examination
<b>BSO</b>	bilateral salpingo-oophorectomy
<b>BUN</b>	blood urea nitrogen

### C

<b>C</b>	cervical
<b>C&amp;S</b>	culture and sensitivity
<b>Ca</b>	calcium
<b>CABG</b>	coronary artery bypass graft
<b>CAD</b>	coronary artery disease
<b>CAPD</b>	continual ambulatory peritoneal dialysis

<b>CBC</b>	complete blood count	<b>DNA</b>	deoxyribonucleic acid
<b>CBD</b>	common bile duct	<b>DRE</b>	digital rectal exam
<b>CD</b>	Crohn disease	<b>Dx</b>	diagnosis
<b>CF</b>	cystic fibrosis	<b>E</b>	
<b>CHD</b>	coronary heart disease	<b>EBV</b>	Epstein-Barr virus
<b>CHF</b>	congestive heart failure	<b>ECCE</b>	extracapsular cataract extraction
<b>CHO</b>	carbohydrate	<b>ECG; EKG</b>	electrocardiogram
<b>mCi</b>	millicurie	<b>EDB</b>	estimated date of birth
<b>µCi</b>	microcurie	<b>EECP</b>	enhanced external counterpulsation
<b>CK</b>	creatine kinase	<b>EEG</b>	electroencephalography
<b>CNS</b>	central nervous system	<b>EENT</b>	eyes, ears, nose, and throat
<b>CO<sub>2</sub></b>	carbon dioxide	<b>ENT</b>	ears, nose, throat
<b>COPD</b>	chronic obstructive pulmonary disease	<b>ELISA</b>	enzyme-linked immunosorbent assay
<b>CPAP</b>	continuous positive airway pressure	<b>EMG</b>	electromyography
<b>CPK</b>	creatine phosphokinase	<b>endo</b>	endoscopy
<b>CPR</b>	cardiopulmonary resuscitation	<b>ENT</b>	ears, nose, and throat
<b>CRF</b>	chronic renal failure	<b>EOM</b>	extraocular muscles
<b>CRP</b>	C-reactive protein	<b>ER</b>	emergency room
<b>CS</b>	cesarean section	<b>ERCP</b>	endoscopic retrograde cholangiopancreatography
<b>CSF</b>	cerebrospinal fluid	<b>ERS</b>	endoscopic retrograde sphincterotomy
<b>CT</b>	computed tomography	<b>ESL</b>	extracorporeal shockwave lithotripsy
<b>CTS</b>	carpal tunnel syndrome	<b>ESR</b>	erythrocyte sedimentation rate
<b>CVA</b>	cerebrovascular accident	<b>ESRD</b>	end-stage renal disease
<b>CVS</b>	cardiovascular system; chorionic villus sampling	<b>EUA</b>	examination under anesthesia
<b>CXR</b>	chest x-ray	<b>EXU</b>	excretory urogram
<b>D</b>		<b>F</b>	
<b>D</b>	dorsal	<b>FB</b>	foreign body
<b>D&amp;C</b>	dilation and curettage	<b>FBS</b>	fasting blood glucose
<b>dB</b>	decibels	<b>FEV<sub>1</sub></b>	forced expiratory volume
<b>DCIS</b>	ductal carcinoma in situ		
<b>DI</b>	diagnostic imaging; diabetes insipidus		
<b>dL</b>	deciliter		
<b>DM</b>	diabetes mellitus		

<b>FSH</b>	follicle-stimulating hormone	<b>HPV</b>	human papillomavirus
<b>FVC</b>	forced vital capacity	<b>H<sub>p</sub>SA</b>	<i>Helicobacter pylori</i> stool antigen
<b>G</b>		<b>HSV</b>	herpes simplex virus
<b>G</b>	gram	<b>Hz</b>	Hertz
<b>mg</b>	microgram	<b>I</b>	
<b>G</b>	gravida; pregnancy	<b>IBS</b>	irritable bowel syndrome
<b>G1, G2, G3</b>	first, second, third pregnancy	<b>ICD</b>	implantable cardioverter-defibrillator
<b>GB</b>	gallbladder	<b>I&amp;D</b>	incision and drainage
<b>GERD</b>	gastroesophageal reflux disease	<b>ICSH</b>	interstitial cell-stimulating hormone
<b>GGT</b>	gamma-glutamyl transpeptidase	<b>ICU</b>	intensive care unit
<b>GH</b>	growth hormone	<b>IDD</b>	insulin-dependent diabetes
<b>GI</b>	gastrointestinal	<b>IDDM</b>	insulin-dependent diabetes mellitus
<b>GIT</b>	gastrointestinal tract	<b>Ig</b>	immunoglobulin
<b>GTT</b>	glucose tolerance test	<b>IM</b>	intramuscular
<b>GU</b>	genitourinary	<b>IOL</b>	intraocular lens
<b>H</b>		<b>IOP</b>	intraocular pressure
<b>HAV</b>	hepatitis A virus	<b>IP</b>	interphalangeal
<b>HBV</b>	hepatitis B virus	<b>IPD</b>	intermittent peritoneal dialysis
<b>HCG</b>	human chorionic gonadotrophin	<b>IPPA</b>	inspection, palpation, percussion, and auscultation
<b>HCT</b>	hematocrit	<b>IPPB</b>	intermittent positive pressure breathing
<b>HCV</b>	hepatitis C virus	<b>IUD</b>	intrauterine device
<b>HD</b>	hemodialysis; Hodgkin disease	<b>IV</b>	intravenous
<b>HDL</b>	high density lipoprotein	<b>IVC</b>	inferior vena cava
<b>HDN</b>	hemolytic disease of the newborn	<b>IVF</b>	in vitro fertilization
<b>HEENT</b>	head, eyes, ears, nose, and throat	<b>IVP</b>	intravenous pyelogram
<b>HF</b>	heart failure	<b>IVU</b>	intravenous urography
<b>Hgb, Hb</b>	hemoglobin	<b>K</b>	
<b>HGH</b>	human growth hormone	<b>KKUB</b>	kidney, kidney, ureter, bladder
<b>HIV</b>	human immunodeficiency virus	<b>KUB</b>	kidney, ureter, bladder

<b>L</b>		
<b>L</b>	lumbar; liter	
<b>LAP</b>	leucine aminopeptidase	
<b>LAVH</b>	laparoscopic assisted vaginal hysterectomy	
<b>Ib</b>	pound	
<b>LASEK</b>	laser assisted subepithelial keratectomy	
<b>LASIK</b>	laser assisted in-situ keratomileusis	
<b>LBBB</b>	left bundle branch block	
<b>LCIS</b>	lobular carcinoma in situ	
<b>LDH</b>	lactate dehydrogenase	
<b>LDL</b>	low density lipoprotein	
<b>LEEP</b>	loop electrocautery excision procedure	
<b>LES</b>	lower esophageal sphincter	
<b>LFT</b>	liver function tests	
<b>LH</b>	luteinizing hormone	
<b>LLQ</b>	left lower quadrant	
<b>LNMP</b>	last normal menstrual period	
<b>LOC</b>	level of consciousness	
<b>LP</b>	lumbar puncture	
<b>LRT</b>	lower respiratory tract	
<b>LTH</b>	lactogenic hormone	
<b>LUQ</b>	left upper quadrant	
<b>LUTS</b>	lower urinary tract symptoms	
<b>M</b>		
<b>m</b>	meter; milli	
<b>MA</b>	mental age	
<b>MBJ</b>	muscles, bones, and joints	
<b>mcg</b>	microgram	
<b>mcL</b>	microliter	
<b>MCP</b>	metacarpophalangeal	
<b>MD</b>	muscular dystrophy	
<b>mEq</b>	milliequivalent	
<b>mg</b>	milligram (1/1000 gram)	
<b>mg%</b>	milligram percent	
<b>mg/dL</b>	milligrams per deciliter	
<b>Mg</b>	magnesium	
<b>MG</b>	myasthenia gravis	
<b>MI</b>	myocardial infarction	
<b> mL</b>	milliliter	
<b>mm</b>	millimeter (1/1000 meter)	
<b>mm Hg; mmHg</b>	millimeters of mercury	
<b>μ</b>	millimicron (1/1000 micron)	
<b>mmol</b>	millimole	
<b>MRI</b>	magnetic resonance imaging	
<b>MRSA</b>	methicillin-resistant <i>Staphylococcus aureus</i>	
<b>MS</b>	multiple sclerosis	
<b>MSH</b>	melanocyte stimulating hormone	
<b>MSS</b>	musculoskeletal system	
<b>MUGA</b>	multiple-gated acquisition scan (of heart)	
<b>N</b>		
<b>NAD</b>	no appreciable disease	
<b>NB</b>	newborn	
<b>ng</b>	nanogram	
<b>NG</b>	nasogastric	
<b>NHL</b>	non-Hodgkin lymphoma	
<b>NOS</b>	not otherwise specified	
<b>NS</b>	nervous system	
<b>NSAID</b>	nonsteroidal anti-inflammatory drugs	
<b>NTP</b>	normal temperature and pulse	
<b>NYD</b>	not yet diagnosed	
<b>O</b>		
<b>O<sub>2</sub></b>	oxygen	
<b>OA</b>	Osteoarthritis	

<b>OB/GYN</b>	Obstetrics and Gynecology	<b>PMN</b>	polymorphonuclear
<b>OD</b>	overdose; right eye; oculus dexter	<b>PNS</b>	peripheral nervous system
<b>ORIF</b>	open reduction and internal fixation	<b>PPD</b>	purified protein derivative
<b>OS</b>	left eye; oculus sinister	<b>PRL</b>	prolactin
<b>os</b>	opening bone	<b>PSA</b>	prostatic-specific antigen
<b>OSS</b>	organs of special sense	<b>PT</b>	prothrombin time
<b>OXT</b>	oxytocin	<b>PTA</b>	prior to admission
<b>oz</b>	ounce	<b>PTC</b>	percutaneous transhepatic cholangiography
<b>P</b>		<b>PTH</b>	parathormone
<b>P</b>	-para (given birth); pulse; phosphorus	<b>PYO</b>	pyrexia of unknown origin
<b>P1, P2, P3</b>	given birth 1, 2, or 3 times	<b>R</b>	
<b>PA</b>	posteroanterior	<b>R</b>	respiration
<b>PaCO<sub>2</sub></b>	partial pressure of carbon dioxide	<b>RA</b>	rheumatoid arthritis
<b>PaO<sub>2</sub></b>	partial pressure of oxygen	<b>RBBB</b>	right bundle branch block
<b>PCL</b>	posterior cruciate ligament	<b>RBC</b>	red blood cell
<b>PCP</b>	<i>Pneumocystis carinii</i>	<b>RDS</b>	respiratory distress syndrome
<b>PD</b>	Parkinson disease; peritoneal dialysis	<b>RF</b>	rheumatoid factors
<b>PEEP</b>	positive end-expiratory pressure	<b>Rh</b>	rhesus
<b>PERRLA</b>	pupils equal, round, react to light and accommodation	<b>RIA</b>	radioimmunoassay
<b>PET</b>	positron-emission tomography	<b>RICE</b>	rest, ice, compression, elevation
<b>PFT</b>	pulmonary function test	<b>RLQ</b>	right lower quadrant
<b>pH</b>	a measure of the alkalinity or acidity of a substance	<b>ROM</b>	range of motion
<b>physio</b>	physiotherapy	<b>RP</b>	retrograde pyelogram
<b>PID</b>	pelvic inflammatory disease	<b>RS</b>	respiratory system
<b>PIP</b>	proximal interphalangeal (joint)	<b>RUQ</b>	right upper quadrant
<b>PM; p.m.</b>	afternoon	<b>S</b>	
<b>PMI</b>	point of maximum impulse; point of maximum intensity	<b>S</b>	sacral
		<b>S</b>	second
		<b>SAP</b>	serum alkaline phosphatase
		<b>SB</b>	stillbirth
		<b>SIADH</b>	syndrome of inappropriate antidiuretic hormone
		<b>SLR</b>	straight leg raising

<b>SOB</b>	shortness of breath	<b>U</b>	
<b>sp gr</b>	specific gravity	<b>UA</b>	urinalysis
<b>stat</b>	immediately	<b>URT</b>	upper respiratory tract
<b>STD</b>	sexually transmitted disease	<b>US</b>	ultrasound
<b>STH</b>	somatotrophic hormone	<b>UTI</b>	urinary tract infection
<b>STI</b>	sexually transmitted infection	<b>V</b>	
<b>SVC</b>	superior vena cava	<b>VD</b>	vomiting and diarrhea; venereal disease
<b>T</b>		<b>V/Q scan</b>	ventilation/perfusion scan (Q stands for quotient)
<b>T</b>	thoracic; temperature	<b>VF; V-fib</b>	ventricular fibrillation
<b>T&amp;A</b>	tonsillectomy and adenoidectomy	<b>W</b>	
<b>TB</b>	tuberculosis	<b>WBC</b>	white blood cell
<b>T<sub>3</sub></b>	triiodothyronine	<b>Wt</b>	weight
<b>T<sub>4</sub></b>	thyroxine; thyroxin		
<b>TAH</b>	total abdominal hysterectomy		
<b>TAH-BSO</b>	total abdominal hysterectomy and bilateral salpingo-oophorectomy	<b>Symbols</b>	
<b>TFT</b>	thyroid function test	=	equal
<b>TIA</b>	transient ischemic attack	≠	unequal
<b>TLC</b>	tender loving care	+	plus; positive
<b>TM</b>	tympanic membrane	-	minus; negative
<b>TMJ</b>	temporomandibular joint	↑	above; increase
<b>TPR</b>	temperature, pulse, and respiration	↓	below; decrease
<b>TRUS</b>	transrectal ultrasound	♂	male
<b>TSH</b>	thyroid-stimulating hormone	♀	female
<b>TUP</b>	transurethral prostatectomy	>	is greater than
<b>TUR</b>	transurethral resection	<	is less than
<b>TURP</b>	transurethral resection of prostate	%	percent
<b>Tx</b>	treatment	:	ratio
		,	foot
		"	inches
		Ā	with
		Ā	without
		#	pound

## APPENDIX F

# Glossary of Diagnostic Tests

### A

**abdominal x-ray:** x-ray of the kidneys, ureters, and bladder (KUB) without the use of contrast medium. Also known as **flat plate of abdomen.**

**Achilles jerk; ankle jerk:** a test in which a tap on the Achilles tendon causes plantar flexion of the foot.

**allergy testing:** skin tests that show the body's response to foreign substances (antigens).

**anteroposterior (AP) view:** x-rays enter the body from the front to the back.

**antiglobulin test (Coombs' test)**

**(KOOMZ):** laboratory test used to detect abnormal antibodies on the surface of red blood cells.

**antinuclear antibody (ANA):** a blood test used to detect unusual antibodies called antinuclear antibodies, which cause tissue damage and are an indicator of autoimmune disease.

**arterial blood gases (ABG):** a laboratory test that measures the amount of oxygen and carbon dioxide in the blood.

**arthroscopy:** a surgical method of looking into a joint without making a large incision. A small incision is made near the joint and an arthroscope is inserted. The arthroscope has a video camera attached, which allows the surgeon to view the entire joint cavity. Surgery is performed by inserting surgical instruments into

additional small incisions. Recovery time is minimal and hospital stay is reduced.

**aspiration biopsy:** tissue is removed without a surgical incision. A needle is placed into tissue such as bone marrow, and the material is aspirated (withdrawn) into the needle. The tissue is then examined.

**audiometry:** a test that measures hearing ability.

**auditory brainstem response (ABR):** a test that helps determine the cause of hearing loss by measuring nervous impulses to the brainstem after the cochlea is stimulated by sound.

### B

**Babinski (bah-BIN-skee) reflex:** dorsiflexion (backward flexion) of the toes when the sole of the foot is stimulated. This is a normal response in newborns and infants but it indicates nerve dysfunction in others.

**barium enema:** barium is placed into the rectum as a contrast medium followed by x-rays of the large bowel.

**barium studies:** an x-ray procedure used to diagnose digestive-tract problems. Barium sulfate is used as a contrast medium. As barium settles in the organs, it will appear white on the x-ray film.

**barium swallow:** barium is taken by mouth, followed by x-rays of the pharynx and esophagus.

**biopsy:** removal of a piece of tissue for examination under a microscope.

**bleeding time:** a test used to measure the time it takes for bleeding to stop following a small puncture wound to the skin.

**blood glucose levels:** a test used to determine the amount of glucose (sugar) in the blood. It is also known as serum glucose level. The amount of glucose in the blood is expressed as milligrams per deciliter (mg/dL). Normal blood glucose level is 70 to 100 mg/dL.

**blood urea nitrogen (BUN):** a test that measures the amount of urea in the blood. Urea is a waste product that is carried in the blood to the kidney, where it is filtered by the nephrons and excreted in urine.

**bone scan:** a picture of the bone is produced using a special camera after the patient has been injected with radioactive phosphate. The radioactive phosphate is picked up by the diseased bone and shows up as dark areas called *hot spots* on the scan.

**breath test:** a procedure used to diagnose ulcers caused by the bacteria *Helicobacter pylori*.

## C

**cardiac count:** a catheter is inserted into a vein in the arm or femur and pushed upward into the heart. An x-ray of the blood vessels of the heart (angiography) is performed at the same time as the catheterization so that the placement of the catheter can be monitored. Diagnostic information such as levels of oxygen and carbon dioxide, or indicators of coronary artery disease and disorders of the heart valves, is obtained.

**cardiac enzymes:** a test for myocardial infarction by measuring cardiac enzymes such as creatine phosphokinase (CPK) and lactate dehydrogenase (LDH). During a myocardial infarction, the damaged

cells release CPK and LDH into the bloodstream. High levels of these enzymes in the blood are a good indicator of myocardial infarction.

**Cardiolite scan:** this test uses a radiopharmaceutical, known as a tracer, to produce images of the heart muscle. An exercise test is used with it to diagnose coronary heart disease. While the patient is exercising on a treadmill, the tracer is injected into a vein in the arm. The tracer travels through the blood, to the coronary arteries, and is picked up by the heart muscle. Healthy areas of the heart that have sufficient blood supply pick up the tracer immediately and appear as *hot spots* on the scan. Areas that do not have sufficient blood supply pick up the tracer slowly and appear as *cold spots* on the scan.

**catheter:** a tube-shaped, flexible, surgical instrument that can be inserted into a body cavity for the withdrawal or introduction of fluid.

**catheterization:** the process of passing a catheter into a body cavity.

**centesis:** surgical puncture to remove excess fluid or to remove fluid for diagnostic purposes. The type of centesis is named after its location. Abdominocentesis (abdomen). Arthrocentesis (joint). Cardiocentesis (heart).

**chest x-ray:** an image is taken of the internal structures of the chest. The pictures can be taken in different body positions.

**cholangiography:** x-ray of the bile ducts following injection of a contrast medium.

**coagulation time:** measurement of the time it takes blood to clot in a test tube. Also known as clotting time.

**cold spot:** a term used to describe areas on a scan where there is low uptake into the tissues of a radioactive substance that has been injected into the body.

**colposcopy** (kol-POS-koh-peel): process of visually examining the vagina and cervix

using a special magnifying device called a colposcope.

**complete blood count (CBC):** a general screening test during routine physical examinations. Several tests are done on a sample of blood including hematocrit, hemoglobin, white blood cell count, and platelet count.

**computed tomography (kom-PYOO-ted toh-MOG-rah-fee):** a procedure utilizing an x-ray beam passing through a body part. The beam visually cuts the part into many slices at various depths. This information is computer analyzed and a series of pictures is assembled into one image of the part. CT scans allow for clearer visualization than conventional x-ray. Common body parts studied in this fashion include the brain, abdomen, kidneys, and chest. Abbreviation: **CT scan**.

**c-reactive protein (CRP):** the liver produces CRP only when there is an inflammatory process within the body. This test is performed to diagnose inflammation within the body.

**contrast medium:** a dye that is placed into the patient's body to improve the visibility of an x-ray.

**count:** any test that involves the calculation of the total number of something in a sample.

**creatinine kinase (CK); creatine phosphokinase (CPK):** a laboratory test to evaluate the levels of CPK in the blood. CPK is an enzyme found in cardiac and skeletal muscle tissue. When muscle is damaged, the cells release CPK. CPK spills into the blood, elevating normal blood levels.

**creatinine clearance:** a test of blood and urine to assess kidney function. It measures the kidney's ability to clear creatinine from the blood. Creatinine is a waste product produced by the breakdown of creatine (a protein found in muscle). Creatinine is excreted in the urine.

**culture:** a method of identifying bacteria.

Microorganisms or living tissue cells are placed in an environment that stimulates growth. As the microorganism multiplies, it can be easily identified.

**culture and sensitivity (C&S):** a test to measure a microorganism's sensitivity to antibiotics. The microorganism is cultured and exposed to various antibiotics. The antibiotic that is most effective in killing the microorganism is the one used to treat the patient.

**culture specimen:** a sample of microorganisms or living tissue cells taken from an area of the body for laboratory examination. Culture specimens can be taken from sputum (mucus and other material brought up through the respiratory tract), blood, urine, throat, cervix uteri, and stool.

**cystoscopy:** visual examination of the bladder using a cystoscope. The cystoscope is placed through the urethra and into the bladder with or without anesthetic. A tiny camera inside the cystoscope shows the inside of the organs on a television monitor. Other instruments can be used with the cystoscope to perform biopsies, remove calculi, or burn (cauterize) abnormal tissue.

## D

**differential; white blood cell**

**differential:** a count of each different type of white blood cell (eosinophils, basophils, neutrophils, lymphocytes, and monocytes).

**digital rectal exam (DRE):** palpation (feeling) of the prostate and other structures by placing a gloved finger through the anal canal and into the rectum.

**dilation and curettage (dye-LAY-shun and kyoo-reh-TAZH):** a surgical procedure used to determine the cause of uterine bleeding or other conditions. The cervical opening is widened with an instrument

called a dilator. This is followed by the insertion of a second instrument called a **curet** (kyoo-RET), which has jagged edges on one side. The curet is used to scrape the endometrial lining from the uterine wall so that it may be examined. Abbreviation: **D&C**.

**Doppler (DOP-ler) ultrasound:** the use of ultrasound to measure the speed and direction of blood flow through a blood vessel.

**drawer test:** a test to determine the stability of the anterior and posterior cruciate ligaments that support and stabilize the knee joint.

## E

**echocardiography:** a procedure that produces an image of the heart using ultrasound waves.

**electrocardiography (ECG; EKG):** a measurement of the electrical activity of the heart. The record produced is called an electrocardiogram. It is a *snapshot* of how well the conduction system is working.

**electrocochleography** (ee-leck-troh-kock-lee-OG-rah-fee): a process for recording the electrical activity of the cochlea.

**electroencephalography** (ee-leck-troh-en-sef-ah-LOG-rah-fee): a procedure used to record the electrical impulses of the brain. Abbre. **EEG**.

**electrolytes:** substances capable of producing an electrical charge. They are found in blood, body tissues, and urine. They are important in muscle and nerve function. Examples include calcium, sodium, potassium, chloride, and magnesium.

**electromyography** (ee-leck-troh-my-OG-rah-fee): a procedure used to record the electrical impulses produced by a muscle when it is at rest and when it is moving. This is done by inserting tiny needle electrodes into the muscle. Abbreviation: **EMG**.

**electrophoresis:** a test on blood or urine that utilizes an electrical current to separate proteins in a mixture. This allows different protein components and quantities to be determined.

**ELISA (enzyme-linked immunosorbent assay):** blood test to screen patients for antibodies to HIV.

**endoscope:** any instrument utilizing a narrow flexible tube with a tiny video camera attached to view inside body organs and cavities. Endoscopes are named using the root of the organ or cavity being viewed. Examples include *gastroscope*, instrument used to view the inside of the stomach; *bronchoscope*, instrument used to view the inside of the bronchus; *laparoscope*, instrument used to view the inside of the abdominal cavity; and *cystoscope*, instrument used to view the bladder.

**endoscopic retrograde cholangiopancreatography (ERCP):** the bile ducts and pancreas are studied using an endoscope. The endoscope is inserted through the mouth, into the stomach, and into the duodenum. A contrast medium is introduced through the endoscope. It flows backward (retrograde) and highlights the biliary ducts and pancreas. X-rays are taken.

**endoscopy:** the process of visually examining a body cavity or organ using an instrument called an endoscope. Biopsies and tissue repair can also be done by inserting cutting devices through the endoscope. Endoscopies are named using the root of the organ or cavity being viewed.

**enzymes:** proteins within cells that act as a catalyst in chemical reactions.

**erythrocyte count:** see red blood cell count.

**erythrocyte sedimentation rate (ESR):** a test that measures the time it takes for red blood cells to settle out of plasma to the bottom of a test tube.

**excretory urography (EXU):** examination of the kidneys, ureters, and bladder following

injection of a contrast medium into a vein. Also known as **intravenous urography** (IVU) or **intravenous pyelography** (IVP).

**exercise stress test:** an electrocardiogram obtained while the patient is exercising.

**exophthalmometry:** the process of measuring the forward protrusion of the eyeball as seen in exophthalmia.

## F

**fasting blood sugar (FBS):** laboratory test that measures blood glucose levels after the patient has fasted for at least eight hours.

**fluoroscopy** (floo-ROSS-kah-pee): an x-ray of moving structures, such as the movement of substances through the digestive tract. The image is produced on a fluorescent screen rather than on a single x-ray film. This procedure has the advantage of allowing observation of structures as they move. Fluoroscopy is used with barium studies to observe how well barium flows through the gastrointestinal tract.

**frozen section:** during surgery, a piece of tissue is removed and quickly frozen for microscopic examination. Frozen sections are done when a quick diagnosis is needed to eliminate the need for two operations, one for diagnosis and one for treatment.

**funduscopic** (fun-DOS-ka-pee): the process of visually examining the interior of the eye. Also known as **ophthalmoscopy** (ahf-thal-MOS-koh-pee).

## G

**gastric analysis:** contents of the stomach are analyzed for acid levels, appearance, and volume.

**Gleason score:** a grading system for prostatic cancer. A grade of 1 to 5 is assigned based upon the microscopic appearance of the abnormal prostatic

growth. Grade 1 is less severe, grade 5 more severe cancer indication. Also known as Gleason grade.

**glucose tolerance test (GTT):** a test that monitors the body's ability to utilize glucose after a measured amount of a sweet drink has been taken by the patient. The blood sugar is measured before and after the drink. Blood sugar should return to normal after three hours.

**glycated hemoglobin test:** a test that measures the amount of glucose attached to hemoglobin. The more glucose attached to hemoglobin, the higher the blood glucose level.

## H

**Heaf test:** see tuberculin skin test.

**hematocrit (HCT):** a laboratory test to determine the percentage of erythrocytes per volume of blood.

**hemoccult** (hee-moh-KULT) **test:** an examination of stool for blood. It is called a hemoccult (*hem/o* blood; *occult* hidden) because the blood is difficult to see. A small amount of stool is placed on a special hemoccult card. Guaiac (GWEE-ack), a special substance, is then added to the stool to reveal any hidden blood.

**hemoglobin (Hgb, Hb):** a test to determine the total amount of hemoglobin in a sample of blood.

**HIDA scan:** a procedure used to produce an image of the liver, gallbladder, and biliary ducts following injection of radiopharmaceutical into a vein. The radiopharmaceutical travels to the liver and is excreted by the biliary ducts. It is traced by a special scanner that takes the images.

**Holter monitor:** an electrocardiogram taken while the patient is going about a typical daily routine.

**hot spot:** a term used to identify areas on a scan where there is high uptake into the

tissue of the radiopharmaceutical that has been injected into the body.

**I**

**immunoelectrophoresis** (ih-myoo-noh-ee-leck-troh-for-EE-sis): a procedure utilizing an electric current to identify and measure immunoglobulins in a sample of blood. Immunoglobulins are proteins that function as antibodies. Under normal conditions, they are present in the blood in predictable amounts. They are classified into IgG, IgA, IgM, IgD, and IgE.

**J**

**jerk:** a sudden, involuntary response to a stimulus; a sudden reflex.

**K**

**knee jerk:** see reflex, patellar.

**L**

**laparoscopy** (lap-eh-ROSS-keh-pee): process of viewing the inside of the abdomen using a laparoscope that is passed through a small incision in the abdominal wall.

**lateral decubitus view:** an x-ray position; x-rays enter the body from the side while the patient is lying down.

**lateral view:** an x-ray position; x-rays enter the body from either the right or left side of the chest.

**leukocyte count:** see white blood cell count.

**lipid tests:** a measurement of the amount of lipids (fats) in a sample of blood. Types of lipids are cholesterol, triglycerides, phospholipids, high-density lipoprotein, and low-density lipoproteins.

**liver function tests (LFTs):** a group of blood tests measuring the level of liver enzymes in the blood. These enzymes are normally in hepatic cells but are released when the liver is diseased or damaged. ALT, AST, ALP, and LDH are some of the

more common enzymes. The enzymes are known by their abbreviations. Look at the Abbreviation Glossary for the meanings of these abbreviations.

**lumbar puncture (LP); spinal tap:** an examination of the cerebrospinal fluid for microorganisms or blood. A needle is inserted into the subarachnoid space below the third lumbar vertebra. Cerebrospinal fluid is withdrawn and analyzed.

**lung perfusion and ventilation scan:** a type of nuclear medicine test that produces an image of blood and air flow to the lungs. A radiopharmaceutical is injected into a vein and eventually settles in the arterioles of the lungs. A special camera is used to detect the radiopharmaceutical, and a series of pictures are made of the thorax. These pictures are seen on a special screen called an oscilloscope. A normal scan will show even distribution of the radiopharmaceutical throughout the lungs. An abnormal scan will show no radiopharmaceutical, which suggests decreased blood flow to that part of the lung.

**lymphangiography:** an x-ray of the lymphatic system following injection of a contrast medium into the feet. A fluoroscope (a type of x-ray that displays movement onto a television monitor) is used. The flow of the contrast medium is followed as it travels from the feet upward toward the abdomen. Once the dye has been completely injected, x-rays are taken of the lymphatic system.

**lymphoscintigraphy** (lim-foh-sin-TIG-grah-fee): a type of nuclear imaging process that records the lymphatic vessels or lymph nodes to detect metastatic tumors, lymphedema, or lymph node blockage.

**M**

**magnetic resonance imaging (MRI):** a picture of a body structure produced by

the use of electromagnetic energy rather than conventional x-ray, ultrasound, or radioactive substances. No contrast medium is used. MRIs provide clear pictures of soft-tissue abnormalities such as edema and tumors.

**mammography:** process of taking x-rays of the breast.

**Mantoux test:** see tuberculin skin test.

**MUGA scan (multiple-gated acquisition scan):** an image is produced of the heart muscle following injection of technetium 99m ( $^{99m}\text{Tc}$ ), a radioactive substance. It can provide information on blood flow through the heart and how well the ventricles pump blood out of the heart.

**myelography:** x-ray of the spinal cord following injection of a contrast media into the subarachnoid space.

## 0

**oblique view:** an x-ray position; x-rays enter the body on a slant in order to visualize behind structures.

**ophthalmoscopy:** see **funduscopy**.

**otoscopy (oh-TOSS-kah-pee):** the process of viewing the middle and inner ear using an otoscope. Video otoscopy is a recent advancement providing color images of the ear that can be copied and enlarged.

## P

**Pap smear:** a laboratory test that allows examination of cells from the cervix uteri for disease, especially cancerous cells.

**patch test:** a test in which a small amount of a substance called an **allergen (AL-er-jen)** is placed on the skin and covered with a patch. If the patient is sensitive to the allergen, there will be an allergic reaction. The patient will develop a raised, itchy bump called a **wheel (WEEL)**. A wheel looks like a mosquito bite. It may be redder or paler than the surrounding skin.

**patellar reflex:** extension of the lower leg when the area below the patella (kneecap) is tapped; also called knee jerk.

**pelvic ultrasound:** the use of ultrasound to obtain an image of the abdomen and pelvis. This procedure is used during pregnancy to assess fetal size and development as well as placental location. As well, ovarian tumors and other pelvic masses can be detected using ultrasound.

**percutaneous transhepatic**

**cholangiography (PTC):** the bile ducts undergo an x-ray exam following injection of a contrast medium through the skin and into the liver.

**plantar reflex:** toes curl under when the sole of the foot (plantar aspect) is stroked.

**platelet count:** a test that measures the number of platelets in a sample of blood. The normal value is 150,000 to 400,000 per microliter of blood.

**positron emission tomography (POZ-electron ee-MISH-un toh-MOG-rah-fee) (PET**

**scan):** a procedure in which a picture is taken of internal body structures to study how cells function in certain body areas. A radioactive substance is injected into a vein and traced as it travels through the body. PET scans are helpful in diagnosing and treating such diseases as cancer, Alzheimer, schizophrenia, and stroke.

**posteroanterior(PA) view:** x-rays enter the body from back to front.

**prostate-specific antigen (PSA):** a test to determine the level of PSA in the blood. PSA is a protein produced by the prostate gland. PSA is removed from the body in semen, although a small amount enters the bloodstream and can be measured. An elevated PSA level may indicate prostatic cancer, benign prostatic hypertrophy, or prostatitis.

**prothrombin time (PT):** a laboratory test that measures the time it takes for a clot to form.

**pulmonary arteriography:** a procedure in which images of the pulmonary blood vessels are taken following injection of a contrast medium into the vascular system.

**pulmonary function test (PFT):** a series of tests on lung performance using a spirometer, an instrument to record breathing ability. It measures total lung capacity (TLC), which is the total volume of air the lungs can hold. Some of the test measurements are obtained by normal, quiet breathing, and other tests require forced inhalation or exhalation.

**pulse oximetry (PULSS-ock-SIM-eh-tree):** a procedure used to measure the percentage of hemoglobin saturated with oxygen. An instrument called an oximeter (ock-SIM-eh-ter) is used. It has a probe that attaches to the patient's fingertip. The probe is linked to a computerized unit. The probe emits a light that is absorbed by hemoglobin in various degrees, depending upon the amount of oxygen present. The computerized unit can then calculate the percentage of hemoglobin that is oxygenated.

**punch biopsy:** a circular piece of tissue is removed with a sharp instrument.

## R

**radioactive iodine uptake:** a test used to assess thyroid function. Radioactive iodine is taken orally. Eventually, it is taken up by the thyroid. A high uptake of radioactive iodine indicates too much thyroxine is being produced.

**radioimmunoassay (RIA):** a test used to identify antibodies the immune system has formed in response to the presence of antigens.

**radiopharmaceutical:** a radioactive substance combined with a chemical that is easily absorbed by the target organ.

**range of motion (ROM):** an assessment of the degree to which a joint can be moved in any direction, including adduction, abduction, flexion, extension, dorsiflexion,

and plantar flexion. Range is measured in degrees. Limited joint movement may be 55 degrees, or full-range movement, 360 degrees.

**red blood cell count (RBC):** a test that measures the number of red blood cells in a sample of blood. The normal value is 4.7 to 6.1 million cells per microliter for men and 4.2 to 5.4 million cells per microliter for women.

**red blood cell morphology:** a study of red blood cells to determine abnormalities of size, shape, color, and structure.

**reflex:** a sudden, involuntary response to a stimulus.

**refraction test:** a common test used to study the bending of light rays as they pass through the eye, in order to clearly identify errors of refraction. The unit of measurement of the refractive power of the lens is diopter (dye-OP-ter).

**retrograde urography:** an x-ray of the urinary structures following injection of a contrast medium into the bladder through the urethra. The contrast medium flows backward (retrograde) highlighting urinary structures.

**rheumatoid factors (RF):** proteins present in the blood of patients with rheumatoid arthritis.

**Romberg (ROM-bergz) sign:** swaying or loss of balance when the patient is asked to stand erect with the feet together and the eyes closed. Indicates nerve dysfunction.

## S

**scan (nuclear medicine):** an image of a body organ is taken after a radiopharmaceutical has been introduced into the body. The radiopharmaceutical is known as a tracer. The tracer travels through the bloodstream to the body organ being studied. An area where there is high uptake of the radiopharmaceutical is known as a *hot spot*. An area where there is little or no uptake of the radiopharmaceutical is

called a *cold spot*. The tracer gives off small amounts of radiation that is detected using a special camera (gamma camera). Images of the radioactivity are produced. The image is called a scan. Scans are commonly taken on bone, brain, liver, lung, thyroid, and heart.

**scratch test:** test to identify substances a person is allergic to. Potential allergens are applied to scratches made on the skin surface. If there is an allergic reaction, the patient will develop a raised, red area on the skin.

**scrotal transillumination:** a bright light is held behind the scrotum. A scrotum filled with watery fluid will shine red because the light will pass through it. More solid abnormalities such as testicular tumors are seen as dark shadows because the light will not pass through.

**semen analysis:** a laboratory test to evaluate infertility. Semen is collected in a specimen container and analyzed microscopically. The sperm in the semen is counted and examined for size, shape, and mobility. Semen is examined for pH (balance of acids and bases), thickness, appearance, and volume.

**serum alkaline phosphatase (SAP):** a blood test used to measure the levels of alkaline phosphatase, which is important in the building of new bone.

**serum calcium (Ca) and serum phosphorus (P):** measurement of calcium or phosphorus in the blood (serum).

**shave biopsy:** tissue that extends above the level of its surroundings is removed with a **scalpel** (SKAL-pel), a sharp knife.

**skeletal x-ray:** x-ray of the bone without the use of a contrast medium. The bone shows up clearly as a white object against a black background.

**small bowel series:** barium is taken by mouth, followed by x-rays of the small bowel (duodenum, jejunum, and ileum).

**smear:** a laboratory test used to identify microorganisms. The specimen is placed

on a slide and stained using the **Gram stain** method. The Gram stain will highlight the microorganism so that it is visible and can be identified.

**spirometry** (speye-**ROM**-eh-tree): the process of measuring breathing ability using a spirometer.

**stool analysis:** an examination of stool (feces) to identify fats, microorganisms, occult (hidden) blood, and other abnormal substances.

## T

**thallium scan:** an image of the heart and its blood vessels is obtained following injection of a radioactive substance that includes thallium-201. Normal myocardial tissue absorbs the radioactive substance while diseased tissue does not.

**thrombocyte count:** see platelet count.

**thyroid function test (TFT):** this laboratory test measures thyroxine, triiodothyronine, and thyroid-stimulating hormone in the blood.

**tine test:** see tuberculin skin test.

**transillumination** (tranz-ih-loo-mih-NAY-shun): passing light through body tissues for the purpose of examining the part.

**transrectal ultrasound (TRUS):** the use of ultrasound to produce an image of the prostate. The well-lubricated transducer (instrument that emits the sound waves) is inserted into the rectum. An image is produced as the transducer is moved along the prostate.

**transvaginal ultrasound:** a procedure in which the transducer (instrument that emits the sound waves) is placed inside the vagina. The echogram is clearer and the details are sharper.

**tuberculin skin test:** tuberculin such as PPD (purified protein derivative of *mycobacterium tuberculosis*) is injected intradermally. This is called the *Mantoux test*. Another method is to apply the tuberculin to the skin. This is done by

making many punctures in the skin. These are called the *Heaf* and *tine tests*. An inflammatory reaction will occur if the patient is sensitive to the tuberculin. This causes the localized area of skin to become red and swollen. This positive reaction means the person has prior or present contact with *Mycobacterium tuberculosis*.

**tuning fork test:** a vibrating tuning fork is placed against the bones of the skull sending vibrations that can be heard if there is no hearing loss. Types include Weber and Rinne (**RIN-ay**).

**tympanometry** (tym-pah-NOM-eh-tree): measures how well sound can pass through the eardrum to the middle ear.

## U

**ultrasound/ultrasonography (US):** an image is produced using high frequency sound waves rather than x-rays, magnetic fields, or radioisotopes. An instrument called a transducer passes sound waves through the organ. These waves are reflected back from the organ and recorded on an oscilloscope (special screen). Because tissues of different density will be reflected at different rates, an image is formed. No contrast medium is placed into the body. The record of the ultrasound is called an echogram or sonogram.

**upper gastrointestinal series:** barium is taken by mouth, followed by x-rays of the upper digestive tract, from the pharynx to the ileum.

**uric acid:** a measurement of uric acid in the urine. Uric acid is a waste product of protein breakdown that is removed from the body in the urine. High amounts of uric acid in the urine can cause kidney stones.

**urinalysis** (yoo-rih-NAL-ih-sis) (**UA**): laboratory urinalysis of urine. It is one of the most common tests performed to evaluate the general health of a person. This test includes macroscopic (seen with the naked eye) observations of the urine

and microscopic (seen with the help of a microscope) observations. The urine is analyzed for the presence of such elements as albumin (a protein), bacteria, bilirubin, blood, ketones, glucose, pus, white blood cells, and casts (clumps of cellular matter that have formed as if in a mold). The color, pH (balance between acids and bases), and specific gravity (the amount of wastes, minerals, and other substances) are also noted in urine.

**urinary catheterization:** insertion of a catheter into the urethra for the removal of urine.

## V

**visual acuity** (ah-KYOO-eh-tee): a noninvasive method of judging how good the patient's eyesight is. A **Snellen** (SNEL-en) chart is used. This chart contains different letters of different sizes. The patient stands 20 feet from the chart, covers one eye, and reads each letter. How well the patient sees the letters is an indication of visual acuity. It is measured as a fraction; 20/20 vision is normal.

**visual fields:** a noninvasive test used to examine the patient's peripheral vision.

**voiding cystography** (sis-TOG-raf-fee): a procedure in which x-rays of the bladder and urethra are taken while the patient is voiding. A contrast medium is placed directly into the urinary structures.

## W

**Western Block:** a blood test to screen patients for antibodies to HIV.

**white blood cell count (WBC):** a test used to measure the number of white blood cells in a sample of blood. The normal value is 5000 to 10000 cells per microliter of blood.

## X

**x-ray:** an image taken of internal structures using x-rays.

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