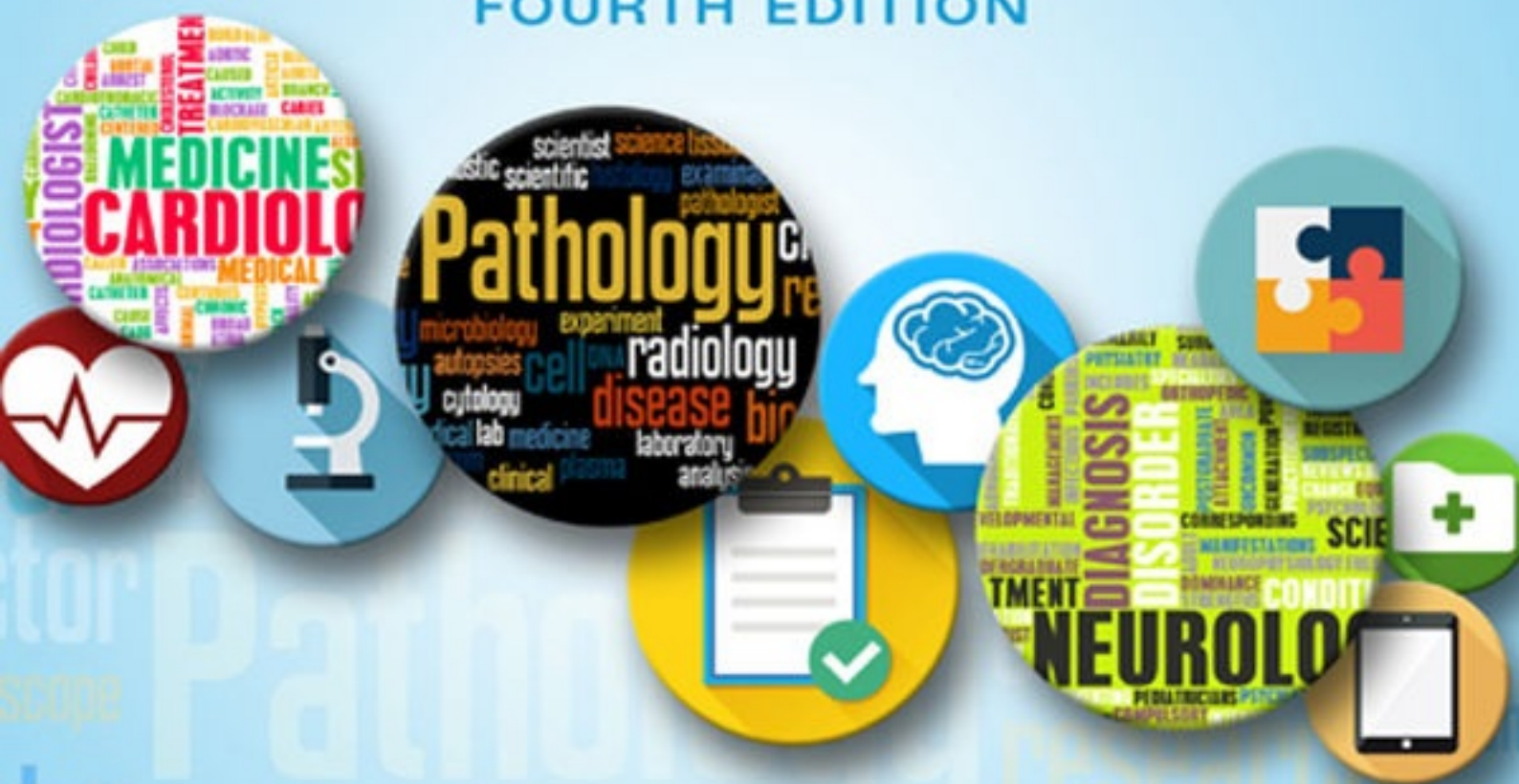


A SHORT COURSE IN

Medical Terminology

FOURTH EDITION



JUDI L. NATH
KELSEY P. LINDSLEY

Wolters Kluwer



A Short Course in
**MEDICAL
TERMINOLOGY**

FOURTH
EDITION

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*This book is dedicated
to my students and colleagues
at Lourdes University,
who continue to provide inspiration
and support. Thank you!*

-JUDI L. NATH

*This book is dedicated to my parents,
who have always loved and supported me
and who accepted dishwashing
in exchange for rent
while I was working on this book.*

-KELSEY P. LINDSLEY



New to This Edition

This new edition builds on the foundation established in the previous three editions. The reader will find the writing style of this edition easy to follow, with special focus given to ensuring that each page is user friendly and accessible to all levels of learning. As educators, we wanted to be sure that students found the content manageable, interesting, and understandable.

APPROACH AND CONTENT ORGANIZATION

This section outlines the global changes that were made throughout the entire textbook as well as the chapter-by-chapter changes. We begin with those changes across the chapters.

Global Changes

- The narrative has been modernized to make the text more user-friendly and approachable for students.
- The chapter headings have been standardized to appear in a consistent order so material is presented utilizing a consistent style.
- The topics in the study table were also standardized so that the order follows a predictable sequence.
- Study Tables may contain terms that are not in the narrative; however, all bold-faced terms in the narrative are found in the Study Tables. The book would become unwieldy with text if the terms in the tables were also in the narrative. We have selected the most relevant terms for inclusion in the tables.
- The end-of-chapter exercises have been standardized, so that from chapter-to-chapter exercises are presented in the same order.
- Chapter 15 The Special Senses of Sight and Hearing has been moved to appear directly after Chapter 7 The Nervous System. This order

makes sense from a functional perspective and matches other current anatomy and physiology books. Rearranging the topics in this manner also allows the book to be used in tandem with an anatomy and physiology course.

- All terminology has been updated per current medical usage. *Stedman's Medical Dictionary*, *Terminologia Anatomica*, *Terminologia Histologica*, *Terminologia Embryologica*, and leading medical journals were used to standardize the medical terms, so that they are current and match terms used in common practice.
- Pronunciations match *Stedman's Medical Dictionary*. Although *Stedman's Medical Dictionary* uses a diacritic format whereby signs and symbols are used with letters to indicate pronunciations, the pronunciations given in this book are those used for oral communication so we used phonetic pronunciations.
- Appendixes A through E have been updated so the information is the most current, nationally recognized.
- The artwork has been updated and revised extensively to be accurate and contemporary. We also improved the text–art integration to enhance the student learning experience.
- Citations from image captions have been removed, so that the reader is not distracted from the image and its learning opportunity.
- Unnecessarily long table titles were shortened to make table titles easier for students to read and understand.
- More photos were added for realism and interest.
- The phrase “word elements” was changed to “word parts” to avoid ambiguities when some word parts served double functions, as in sometimes a word part was a root and a prefix. This change also enabled consistency.
- Quick Checks were updated to provide benchmarks within the chapter for students to assess retention of information.
- Sidebar Information was updated with interesting facts. It is also designed so that it is a “pointable feature” and there is at least one per chapter.
- Material from Crossword Puzzles and Chapter Quizzes has been folded into the End-of-Chapter Exercises.

Revised Table of Contents

- Chapter 1 Analyzing Medical Terms
- Chapter 2 Common Prefixes and Suffixes
- Chapter 3 Organization of the Body
- Chapter 4 The Integumentary System
- Chapter 5 The Skeletal System
- Chapter 6 The Muscular System
- Chapter 7 The Nervous System
- Chapter 8 The Special Sense of Sight and Hearing
- Chapter 9 The Endocrine System
- Chapter 10 The Cardiovascular System
- Chapter 11 The Lymphatic System and Immunity
- Chapter 12 The Respiratory System
- Chapter 13 The Digestive System
- Chapter 14 The Urinary System
- Chapter 15 The Reproductive System

Basic Chapter Outline Template

1. Learning Outcomes (changed from learning objectives)
2. Introduction
3. Word Parts Related to the XXX System
4. Structure and Function
5. Quick Check (at least one per chapter)
6. Disorders Related to the XXX System
7. Diagnostic Tests, Treatments, and Surgical Procedures
8. Practice and Practitioners
9. The XXX System Abbreviation Table
10. Sidebar (at least one per chapter)
11. The XXX System Study Table (alphabetized within subheadings)

- Structure and Function
 - Disorders
 - Diagnostic Tests, Treatments, and Surgical Procedures
 - Practice and Practitioners
12. End-of-Chapter Exercises—not all exercises may be present, but the order of exercises is maintained
- Exercise X-X Labeling
 - Exercise X-X Word Parts
 - Exercise X-X Word Building
 - Exercise X-X Matching
 - Exercise X-X Multiple Choice
 - Exercise X-X Fill in the Blank
 - Exercise X-X Abbreviations
 - Exercise X-X Spelling
 - Exercise X-X Case Study

Chapter-by-Chapter Changes

Chapter 1 Analyzing Medical Terms

- New Art: Figure 1-1
- New Word Parts: non-
- New Terms: etymology and language sense
- Deleted Word Part: cleric
- Added new Quick Check

Chapter 2 Common Prefixes and Suffixes

- Changed chapter title from Common Suffixes and Prefixes to Common Prefixes and Suffixes and changed the order of presentation in the chapter so that prefixes are introduced before suffixes and to match the new chapter title
- New Word Parts: a-, an-, anti-, -cele, -cyte, de-, dis-, -eal, -edema, -emesis, -emia, -ism, -lith, -lysis, -oid, -opsy, -pathy, -phobia, -plasia, -poesis, -rrhea, -sclerosis, -stasis, -stenosis, -stomy, tic, and–tome

- Added new Quick Check

Chapter 3 Organization of the Body

- Changed chapter title from The Body's Organization to Organization of the Body
- New Art: Figures 3-1, 3-2, 3-3, 3-4, 3-5, 3-6, and 3-7
- New Word Parts: gastr/o and thorac/o
- New Terms: abdominal cavity, anatomy, caudal, cephalad, cervix, coccyx, coronal plane, cranial, lumbus, pelvic cavity, physiology, sacrum, thorax, and ventral
- Deleted Terms: anatomical terms of location, dorsal cavity, and midsagittal
- Added new Quick Check

Chapter 4 The Integumentary System

- New Art: Figures 4-1, 4-6, and 4-10
- New Word Parts: adipo- and -oma
- New Terms: arrector pili muscles, benign, bulla, carcinoma, decubitus ulcers, edema, erythematous, fissure, hypodermis, integumentary system, malignant, plaque, pruritic, prurigo, and wheal

Chapter 5 The Skeletal System

- New Art: Figures 5-1, 5-2, 5-8, 5-9, 5-10, 5-11, 5-12, 5-13, 5-14, and new images for Table 5-3
- New Terms: appendicular skeleton, axial skeleton, carpal bones, closed fracture, compound fracture, compact bone, cranial suture, cranium, epiphyseal plate, hip bone, joint, kinesiologists, lateral malleolus, ligaments, tendons, medial malleolus, neoplasms, occupational therapists, open fracture, osseous tissue, physical therapists, simple fracture, spongy bone, sternum, synovial fluid, synovial joint, tarsal bones, thoracic cage, and vertebral column
- New Abbreviations: MRI and NSAID
- Deleted Abbreviations: CTS and LE
- Deleted Terms: chondrodynia and dactylomegaly
- Deleted Word Parts: cheir/o and -desis

Chapter 6 The Muscular System

- Deleted Table 6-2 because it is in Chapter 5
- Reorganized comparative art in Figure 6-1
- Added new Sidebar on dysphagia and dysphasia
- New Art: Figures 6-2 and 6-5
- New Abbreviations: ALS, FX, MD, NSAID, and PT
- Deleted Abbreviations: CTD, DMD, and DTR
- New Terms: agonist, Duchenne dystrophy, dysphagia, fascicle, muscle fibers, paresis, skeletal muscle, and striated muscle
- Deleted Terms: myoparesis, tenalgia, tenontoplasty, tendoplasty, and tenoplasty

Chapter 7 The Nervous System

- New Art: Figures 7-1, 7-3, 7-5, 7-6, 7-8, and Labeling Exercise 7-1
- New Abbreviations: AD, CSF, CT, DM, MRI, and PD
- Deleted Abbreviations: IQ, OBS, PERRLA, SAD, and TENS
- New Terms: demyelination, lesion, seizure, sympathetic nervous system, and parasympathetic nervous system
- Term Changes: changed brain stem to brainstem per *Terminologia Anatomica*, changed petit mal seizure to absence seizure
- Added a new sidebar on the difference between psychiatrist and psychologist
- Deleted Terms: subsystems

Chapter 8 The Special Senses of Sight and Hearing

- New Art: Figures 8-2, 8-3, 8-4, 8-8, 8-9, and Labeling Exercise 8-1
- New Abbreviations: EOM, LASIK, and O.D.
- Deleted Abbreviations: ASL, dB, ECCE, ERG, ICCE, and PVD
- New Terms: auditory tube, cones, external acoustic meatus, deaf, extra-ocular muscles, eyebrows, eyelashes, eyelids, lacrimal ducts, lacrimal fluid, lacrimal glands, lacrimal sac, laser-assisted in situ keratomileusis (LASIK), lateral angle of eye, medial angle of eye, orbit, refraction, rods, and scleral buckle

- Term Changes: inner canthus changed to medial angle of the eye, outer canthus changed to lateral angle of the eye, outer ear changed to external ear, inner ear changed to internal ear, external auditory canal changed to external acoustic meatus, and eustachian tube changed to auditory tube per *Terminologia Anatomica*
- Deleted Word Parts: dacryocyst/o, irit/o, and phak/o

Chapter 9 The Endocrine System

- New Art: Figure 9-1, 9-3, 9-4, 9-5, 9-6, 9-7, and Labeling Exercise 9-1
- New Abbreviations: T₃, T₄, CT, PTH, and GTT
- Deleted Abbreviations: BS, IDDM, and NIDDM
- New Terms: corticosteroids, fasting blood sugar (FBS), goiter, exophthalmos, hypothalamus, pineal gland, glands, polydipsia, polyuria, and thyroid-stimulating hormone (TSH)

Chapter 10 The Cardiovascular System

- New Art: Figures 10-5, 10-6, and 10-7
- Deleted Abbreviations: CP, ICU, Rh⁺, and Rh⁻
- New Terms: apex, atrioventricular valves, coronary artery disease, embolus, heartbeat, pulmonary circuit, and systemic circuit
- Deleted Terms: arteritis, cardiodynia, cardiomalacia, pericardial sac, and phagocyte

Chapter 11 The Lymphatic System and Immunity

- New Art: Figures 11-1, 11-2, 11-3, 11-4, and Labeling Exercise 11-1
- New Abbreviations: EBV
- Deleted Abbreviations: CBC, HLA, and RIA
- Deleted Figure: former Figure 10-1
- New Terms: allergy, autoimmune disease, elephantiasis, immunization, lymph node, lymphography, pathogen, systemic lupus erythematosus, vaccination, and vaccine

Chapter 12 The Respiratory System

- Changed The Nose heading to The Nose, Nasal Cavity, and Paranasal Sinuses; changed The Pharynx heading to The Pharynx and Tonsils; added new section on The Diaphragm

- Added new Sidebar on the common cold viruses
- New Word Part: adeno-
- New Art: Figures 12-1, 12-3, 12-4, 12-6, 12-7, 12-8, 12-9, and Labeling Exercise 12-1
- New Abbreviations: BP, c/o, F, ICU, P, T and A, URI, VC, and WBC
- Deleted Abbreviations: T&A changed to T and A
- Deleted Figure: former Figure 11-4
- New Table 12-2 Pulmonary Volumes and Capacities
- New Terms: cyanosis, lungs, nasal cavity, nasal septum, nose, paranasal sinuses, tonsils, and ventilation

Chapter 13 The Digestive System

- New Art: Figures 13-1, 13-2, 13-3, 13-5, and Labeling Exercise 13-1
- Changed common bile duct to bile duct per *Terminologia Anatomica*
- New Abbreviations: NG and UGIS
- Deleted Abbreviations: GB, GBS NGT, and UGI
- New Terms: absorption, bile duct, digestion, elimination, esophagogastroduodenoscopy, irritable bowel syndrome, and lower esophageal sphincter
- Deleted Terms: common bile duct and fundus

Chapter 14 The Urinary System

- New Art: Figures 14-1, 14-3, and Labeling Exercise 14-1
- Changed perirenal fat to perinephric fat or pararenal fat body per *Terminologia Anatomica*
- Added information on the nephron, glomerulus, and glomerular filtration rate
- New Abbreviations: ARF and CRF
- Deleted Abbreviations: BPH and PSA
- New Terms: antibiotic, calyx, kidney transplant, micturition, nephropexy, renal corpuscle, renal cortex, renal medulla, renal pelvis, and renal tubule

Chapter 15 The Reproductive System

- New Art: Figures 15-1, 15-4, 15-6, 15-7, and Labeling Exercise 15-1
- New Sidebar on meiosis and mitosis
- Changed amniotic sac to amnion per *Terminologia Anatomica*
- Changed spermatozoon and spermatozoa to sperm per *Terminologia Histologica*
- New Abbreviations: A, C-section, EDC, EDD, G, HIV, P, Pap smear, STD, and STI
- Deleted Abbreviations: DUF, HRT, HSG, IUD, PMS, TAH, and VD
- New Terms: abortus, amnion, amniotic fluid, amniotic sac, clitoris, glans, foreskin, fundus, labium majus, labium minus, umbilical cord, urologist, and vulva

OTHER RESOURCES

Online ancillary materials complement the text and provide additional support for student learning.

Student Resources:

- Question Bank, with a variety of exercise types to reinforce chapter material
- Educational Games, such as crossword puzzles, hangman, and word-building challenges
- Audio Glossary
- Flash Cards, including Flash Card Generator
- Chapter Quizzes
- Final Exam

Instructor Resources:

- PowerPoint slides and Lesson Plans include useful information to facilitate presentation of material by instructors.
- Test Generator, with more than 500 questions to test students' knowledge of terms, their meanings, and abbreviations.
- Handouts include additional puzzles and games for additional student practice.



Author's Preface

Welcome to the field of medical terminology. This workbook-textbook is written to teach the language of medicine in an engaging and meaningful way. It is written to represent the real world so that you can move seamlessly from the classroom to actual practice. The approach is based on research that demonstrates how students learn best. To that end, we used a three-pronged approach: (1) immersion—the terms are presented in context; (2) chunking—the material is given in manageable units; and (3) practice—exercises that allow you to check your knowledge. Learning word parts is also an essential component of learning the terms. If you learn the tables of word parts, you will be well on your way to knowing medical terms you have never encountered, because you can figure out the terms by breaking them into their component word parts. This will be quite useful, because not every word you will encounter in your careers is found in this book, but you will be equipped with the knowledge to understand their meaning. We also encourage you to pay special attention to the analysis sections in the Study Tables, as these provide interesting, foundational information for forming medical terms.

While learning medical terminology, you will also learn some basic anatomy (body structures), physiology (body functions), and pathology (body diseases). Because medical terms describe the human body in health and in disease, attaining an elementary understanding of these topics will help you retain a working memory of medical language.

Learning medical terms can be easy if you approach the subject from a proper perspective. Begin by telling yourself that medical terms do not make up a separate language. Medical terms are simply words that you can add to your vocabulary. As with all words, medical words are meant to convey information.

As you enter a medical profession, you will be communicating with other medical professionals and with patients. Therefore, your job will include

choosing words and sentence structures that convey accurate information and reflect a professional attitude. That is to say, both your communication skills and your attitude toward patients are very important. As you are about to discover, learning medical terminology can be easy at times and challenging at others. However, if you use the textbook and its ancillaries to their fullest, you will be well on your way to mastering medical terminology.

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User's Guide


LEARNING OUTCOMES

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

- Recognize prefixes.
- Recognize suffixes.
- Define all of the prefixes and suffixes presented in this chapter.
- Analyze and define new terms introduced in this chapter.
- Pronounce, define, and spell each term introduced in this chapter.

A Short Course in Medical Terminology, Fourth Edition, was developed to provide an easy, efficient, and effective way to learn medical terminology. This User's Guide introduces the features of the book that help the learning experience.

A **logical organization** guides students through the basics of medical terminology, word parts, and word analysis.



Analyzing Medical Terms

LEARNING OUTCOMES
Upon completion of this chapter, you should be able to:


- Discuss the purpose of medical terminology.
- Recognize each of the four word parts of medical terms: prefixes, roots, suffixes, and combining forms.
- Define the commonly used prefixes, roots, and suffixes introduced in this chapter.
- Divide medical terms into word parts.
- Understand how word parts are put together to make medical terms.
- Recognize the importance of proper spelling, pronunciation, and use of medical terms.

INTRODUCTION

There are many ways and various books to help you learn medical terminology. This book is intended for a short course in medical terminology and focuses on medical terms, their definitions, and brief exercises to help you quickly gauge your understanding. That means this book can be worked through in as little as 8 weeks. Our goal is to give you all the basics you will need to be successful in your career, while allowing you to have a little fun learning. Every word in the medical field is not found in this book, but all the Latin and Greek word parts are found here. These word parts can be combined to make thousands of medical terms, and understanding the basic word parts is the first step toward understanding complete words. While it is possible to memorize the definitions of individual medical words, understanding just the parts that make up the medical word is easier and faster than learning every word because there are fewer word parts than complete words. In fact, approached the right way, medical terminology may be the easiest subject in your program. Learning it takes a bit of thought and an open mind; but it need not involve sweating or ripping out your hair in frustration.

Why is medical terminology important? Can't medical professionals just use simple words like "gut" and "cut"? Unfortunately, these aren't always specific enough. Gut can refer to the stomach, small intestine, large intestine, or any part of your digestive system. If you have pain in one of these areas, you would want to be able to easily identify a single area and have all medical professionals recognize that specific area. The term "cut" could mean just an incision, or in other cases it could mean cutting off a body part. For example, "She cut her hand" indicates an incision, but "Cut the hand distal to the wrist" could mean an amputation. Luckily medical terminology allows us to specifically identify places in the body and even what type of cut it is with words (see Figure 1-1).

1



Common Prefixes and Suffixes

LEARNING OUTCOMES
Upon completion of this chapter, you should be able to:

- Recognize prefixes.
- Recognize suffixes.
- Define all of the prefixes and suffixes presented in this chapter.
- Analyze and define new terms introduced in this chapter.
- Pronounce, define, and spell each term introduced in this chapter.

INTRODUCTION

Chapter 1 presented the four word parts used in medical terminology: prefixes, roots, suffixes, and combining forms. This chapter focuses on prefixes and suffixes.

In Chapter 1, we learned that a prefix is a word part that comes at the beginning of a word. Note that the word *prefix* itself contains a prefix, *pre-*. The second part of the word *prefix* is "fix," which gives us a perfect definition of prefix: something affixed (attached) to the front of or before (*pre-*) something else. Most of the prefixes occurring in medical terms are also found in everyday English, though we have all used many of the prefixes contained in this chapter, we may have done so without realizing that they are prefixes. For example, when we are admitted to an anteroom, we may stop to think that the prefix *ante-* means "before," and that an *anteroom* is so called because it is a room we enter before entering another room.

We also learned in Chapter 1 that a suffix is the part that comes at the end of a word. The word *fix* comes from the Latin word *suffixum*, which may be translated as "to fasten to the end of." Although the suffix is located last in a medical term, it often comes first in its definition. For example, *pendicitis* means "inflammation (-itis) of the appendix." Therefore, the suffix, *-itis*, provides us with the first word of the defining phrase. The term *gastrectomy* is another example. It is defined as "removal of the stomach." The definition begins with the meaning of the suffix, *-ectomy*, which means "removal of."

WORD ROOTS INTRODUCED IN THIS CHAPTER

Table 2-1 lists common word roots with their meanings to get you started on your task of learning hundreds of medical terms. You may wish to memorize the roots given in the table now, because there are just a few. Or if you prefer, just give them a quick glance now and, as you go through the chapter, refer back to this table whenever you run across a term with a root you do not recognize.

9

Chapters 1 and 2 introduce the basics of word building and set the foundation for learning terms.

Chapters 3–15 offer an overview of each body system and introduce terms that identify the structure and function of that system along with terms that name system disorders, diagnostic tests, treatments, surgical procedures, practice, and practitioners.

Each chapter opens with a statement of **learning outcomes**. These are measurable educational aims and objectives that indicate what you should be able to do after completing the chapter.

An introduction and a tabular presentation of **Word Parts** related to a specific body system are presented next.

TABLE 3-1



WORD PARTS RELATED TO BODY ORGANIZATION

Word Part	Meaning
anter/o	front, anterior
cerv/o	neck
chondr/o	cartilage
cyt/o, -cyte	cell
dors/o	back
gastr/o	stomach, abdomen
inguin/o	groin
my/o	muscle
myel/o	spinal cord
neur/o	nerve, neuron
poster/o	posterior, back
proxim/o	near
super/o	superior
thorac/o	chest (thorax)
trans-	across

Word Parts Exercises offer you an opportunity to quickly review the word parts before moving on to new material.

Word Parts Exercise

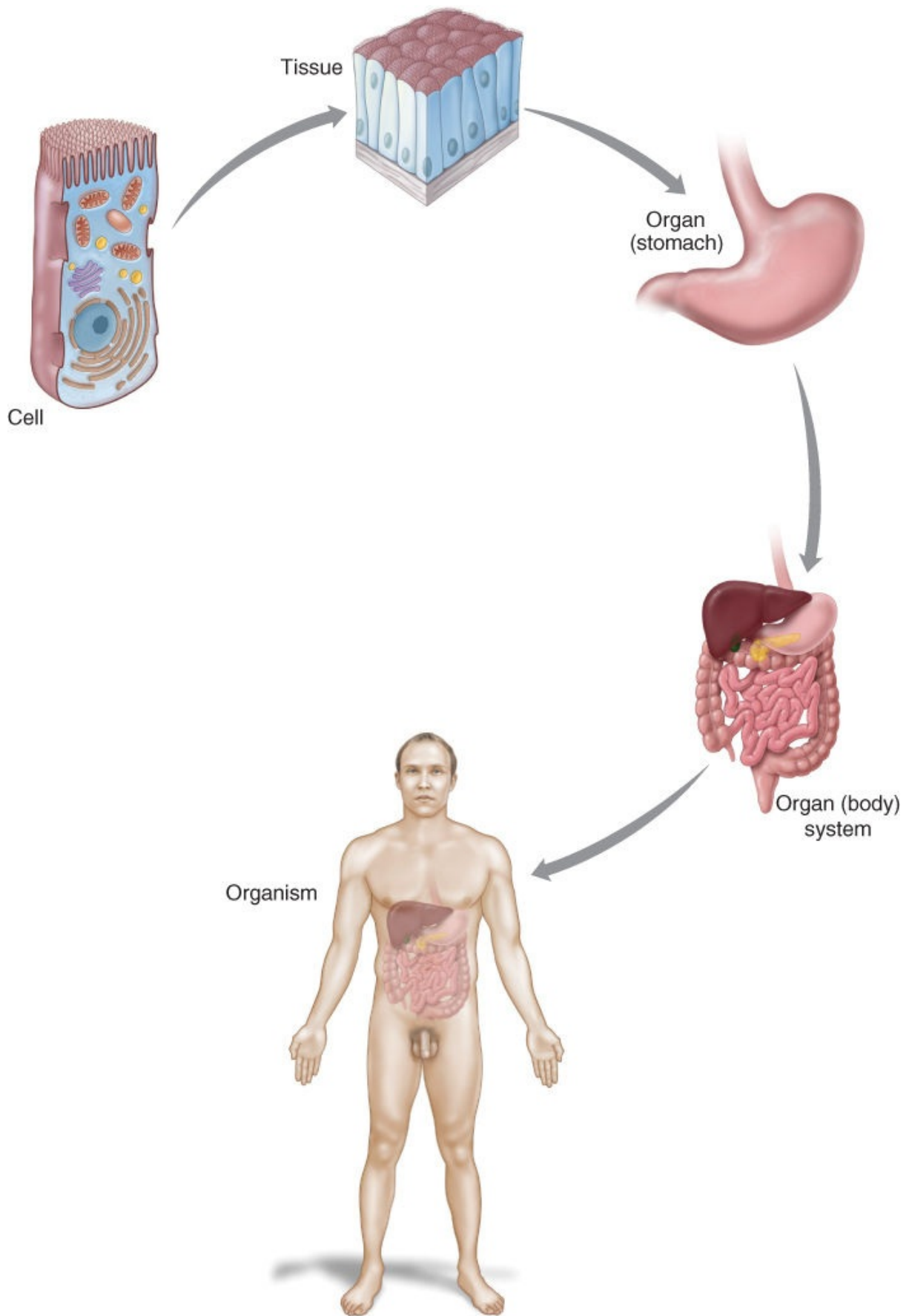


After studying [Table 3-1](#), write the meaning of each of the word parts.

WORD PART	MEANING
1. trans-	1. _____
2. dors/o	2. _____
3. proxim/o	3. _____
4. chondr/o	4. _____
5. anter/o	5. _____
6. my/o	6. _____
7. super/o	7. _____
8. cerv/o	8. _____
9. inguin/o	9. _____
10. myel/o	10. _____

Structure and Function sections with **full-color illustrations** help you learn

basic anatomy and physiology using tight text–art integration.



Quick Checks exercises help reinforce your knowledge of term parts before

studying disorders related to the body systems.




Quick Check

Fill in the **Suffix**, and write the resulting word in the **Term** column. The word that appears in boldface type in the **Meaning** column is a clue.

PREFIX	ROOT	SUFFIX	TERM	MEANING
sub-	cutane/o	_____	_____	adjective meaning “below the skin”
no prefix	melan/o	_____	_____	a pigment-producing cell
no prefix	seb/o	_____	_____	adjective referring to sebum, which may be described as an oil or fat

All body system chapters include an **Abbreviations Table**, which lists common abbreviations and their meanings used in the chapter.

Abbreviation Table  THE INTEGUMENTARY SYSTEM	
ABBREVIATION	MEANING
BSA	body surface area
I&D	incision and drainage
SLE	systemic lupus erythematosus
UV	ultraviolet

Sidebars appear throughout to highlight interesting facts about medical terms and words in general.

Doesn't topical mean “relating to a particular topic,” such as a topic in the news? Occasionally, the meaning of an English word changes when a segment of the population begins using it to mean something other than its traditional meaning. The word *topical* is such a word. However, its “medical” meaning most likely came first, given that its medical use dates back to the 17th century. Still, dictionaries include the notation *medical* alongside it, probably because English speakers may do a mental double take when encountering its medical use for the first time. Medical terms that fall into this category are identified throughout this book so that, as a medical professional, you will be aware of the possible confusion their use may cause, especially among patients.

All body system chapters include a **Study Table** summarizing terms for reinforcement of the material in an easy-to-reference format. Some terms in the table are not found in the running narrative, but are important to include, or the terms are used in the end-of-chapter case study.

Study Table**THE INTEGUMENTARY SYSTEM**

TERM AND PRONUNCIATION	ANALYSIS	MEANING
Structure and Function		
adipose tissue (AD-ih-pohs TISH-yoo)	from the Latin word <i>adeps</i> (fat)	fatty tissue
arrector pili muscles (uh-REK-tor PYE-lye MUS-elz)	from the Latin meaning “that which raises” + <i>pilus</i> (hair) + <i>musculus</i> (muscle)	bundles of smooth muscle fibers attached to hair follicles that cause the hairs to stand on end causing characteristic “goose bumps”
avascular (ay-VAS-kyuh-lahr)	<i>a-</i> (without); from the Latin word <i>vasculum</i> (small vessel)	without blood vessels
corium (KO-ree-uhm)	Latin for skin	synonym for dermis
cutaneous (cue-TAYN-ee-uhs)	from the Latin word <i>cutis</i> (skin)	adjective referring to the skin
cuticle (CUE-tih-kuhl)	from the Latin word <i>cutis</i> (skin)	the thin band of tissue that seals the nail to the skin
dermis (DUR-mis)	from the Greek word <i>derma</i> (skin)	inner layer of skin
epidermis (ep-ih-DUR-mis)	<i>epi-</i> (upon); <i>dermis</i> (skin)	outer layer of the skin
free edge (FREE EJ)	from German <i>frei</i> (free)	distal region at which the nail ends
hair follicles (HAIR FAWL-ik-uhlz)	from the Latin word <i>folliculus</i> (a small sac)	small sacs in the skin from which hair grows
hypodermis (high-poh-DER-mis)	from the Greek word <i>hypo</i> (under); <i>dermis</i> (skin)	layer immediately beneath the epidermis; also called the subcutaneous layer
integumentary system (in-teg-yoo-MEN-tuh-ree SIS-tem)	from the Latin word <i>integumentum</i> (a covering)	the membrane covering the body, including the epidermis, dermis, hair, nails, and glands
keratin (KERR-uh-tin)	from the Greek word <i>keras</i> (horn)	protein that forms hair, nails, and the tough outer layer of skin

End-of- Chapter Exercises and a **Case Study** close out each chapter to maximize learning. Exercises include figure labeling, word building, matching, multiple choice, fill-in-the-blank, short answer, true/false, and spelling. The Case Study provides real world application of medical terms and gives you an opportunity to interact with the chapter material as you would in a clinical setting.

END-OF-CHAPTER EXERCISES

EXERCISE 1-1



DEFINING TERMS

Combine the suffix *-logy* with the proper root to indicate the following medical specialties:

1. Specialty dealing with heart disease _____
2. Specialty that deals with the problems of aging and diseases in the elderly _____
3. Specialty dealing with blood diseases _____
4. Specialty dealing with skin ailments _____
5. Specialty dealing with nervous system disorders _____
6. Specialty dealing with mental disorders _____

EXERCISE 1-2



ANALYZING TERMS

Analyze the following terms by putting the roots and suffixes in the appropriate columns. Then, write a definition for each term.

TERM	ROOT	SUFFIX	DEFINITION
1. neuropathy	_____	_____	_____
2. psychology	_____	_____	_____
3. pathogenic	_____	_____	_____
4. neuralgia	_____	_____	_____
5. systemic	_____	_____	_____
6. psychiatrist	_____	_____	_____
7. pediatrician	_____	_____	_____
8. iatrogenic	_____	_____	_____
9. cardialgia	_____	_____	_____
10. neuritis	_____	_____	_____

EXERCISE 10-9



CASE STUDY

Read the case and answer the questions that follow.

BRIEF HISTORY: The patient is a 56-year-old male who had been complaining of recurrent chest pain when performing mild activities at home. The chest pain subsides when he lies down. He also has experienced shortness of breath (SOB) when carrying in the groceries and climbing up one set of stairs. He has a history of high BP.

EMERGENCY ROOM VISIT: The patient arrives at the emergency room with angina pectoris that is relieved by rest, a BP of 180/110 mm Hg, and SOB. An EKG is performed, which indicates that the patient is having atrial arrhythmias and an MI. He is given aspirin and started on antiarrhythmics, diuretics, vasodilators, and oxygen. He is admitted to the CCU for observation and treatment.

DIAGNOSIS: Hypertension, an MI, and atrial fibrillation.

1. Define angina pectoris. _____
2. What does the acronym SOB stand for? _____
3. What is hypertension? _____
4. What is an EKG? _____
5. What type of pharmacologic intervention is used with this patient? Define each drug classification. _____
6. What is an MI? What are the two roots in myocardial, and what do they mean?

7. Define atrial fibrillation. _____



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Analyzing Medical Terms

LEARNING OUTCOMES

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

- Discuss the purpose of medical terminology.
- Recognize each of the four word parts of medical terms: prefixes, roots, suffixes, and combining forms.
- Define the commonly used prefixes, roots, and suffixes introduced in this chapter.
- Divide medical terms into word parts.
- Understand how word parts are put together to make medical terms.
- Recognize the importance of proper spelling, pronunciation, and use of medical terms.

INTRODUCTION

There are many ways and various books to help you learn medical terminology. This book is intended for a short course in medical terminology and focuses on medical terms, their definitions, and brief exercises to help you quickly gauge your understanding. That means this book can be worked through in as little as 8 weeks. Our goal is to give you all the basics you will need to be successful in your career, while allowing you to have a little fun learning. Every word in the medical field is not found in this book, but all the

Latin and Greek word parts are found here. These word parts can be combined to make thousands of medical terms, and understanding the basic word parts is the first step toward understanding complete words. While it is possible to memorize the definitions of individual medical words, understanding just the parts that make up the medical word is easier and faster than learning every word because there are fewer word parts than complete words. In fact, approached the right way, medical terminology may be the easiest subject in your program. Learning it takes a bit of thought and an open mind; but it need not involve sweating or ripping out your hair in frustration.

Why is medical terminology important? Can't medical professionals just use simple words like "gut" and "cut"? Unfortunately, these aren't always specific enough. Gut can refer to the stomach, small intestine, large intestine, or any part of your digestive system. If you have pain in one of these areas, you would want to be able to easily identify a single area and have all medical professionals recognize that specific area. The term "cut" could mean just an incision, or in other cases it could mean cutting *off* a body part. For example, "She cut her hand" indicates an incision, but "Cut the hand distal to the wrist" could mean an amputation. Luckily medical terminology allows us to specifically identify places in the body and even what type of cut it is with words (see [Figure 1-1](#)).

ANNALS OF POST-LITERACY



FIGURE 1-1 This cartoon demonstrates the value of standardized medical terms.

The foundation of medical terminology is rooted in learning the four basic word parts: **prefixes**, **roots**, **suffixes**, and **combining forms**. You'll learn how to distinguish among these word parts in order to combine them into meaningful medical terms.

First, let's examine some medical term characteristics. Most medical terms are derived from Latin and Greek languages. While this may make them seem "foreign," 75% of *all English words* are derived from Latin and Greek. When you look up a term in the dictionary, its **etymology**, or word origin, is usually given along with its definition. For example, *dementia* is an impairment of cognitive function marked by memory loss. It comes from the

Latin word, *demens*, which means “out of one’s mind.”

ACQUIRING AND USING LANGUAGE SENSE

Accurate communication in any specialty field depends on *language sense*. **Language sense** is knowing what words mean and forecasting the effects their combinations will produce. This is a two-part definition. First, we have to understand what the word we’re using means. Second, we have to trust that the person listening to what we’re saying also understands the meaning of the words that we’re using. While this is important in everyday language, it is especially important with medical terminology where misunderstanding can have drastic effects on patients.

Who decides what the “correct” anatomic term is? A system of anatomic naming known as *Terminologia Anatomica* is considered the international standard for terminology that deals with human anatomy. It was created by the Federative Committee on Anatomical Terminology and first published in 1998. It is essentially an anatomy dictionary that gives the Latin base of the word along with the accepted English term. It has standardized anatomy-related terminology and is a great resource.

What does language sense have to do with learning medical terms? First, words have parts, and examining those parts forces the learner to see and hear words in a new way. That is, the person becomes conscious of words as words. You’ll have to think about each part of the word and then put it all together to understand how the parts make up the whole. Second, the ability to use words well involves learning the phonetic and grammatical codes that make complex communication possible. This means using proper pronunciation and using medical terminology correctly in a sentence. Medical terminology is probably one of your first exposures to clinical culture. So congratulations! This is your first step toward success in the medical field!

MEDICAL TERM PARTS

Nearly every medical term contains one or more *roots*. It may also contain one or more *prefixes* and one or more *suffixes*. When you start combining parts into words, you will also use a *combining form* of a root. This means a single medical term may consist of one part or several parts, but every part of a term behaves in one of three ways: root, prefix, or suffix. The good—and maybe surprising—news is that these three parts also make up all other English words. The even better news is that as an English speaker, you already know a lot of these parts, especially prefixes and suffixes.

Here is the order of word parts used in forming words: prefixes first, roots second, and suffixes last, assuming a word contains all three parts. If a **prefix** is present, it appears at the beginning of the term. A root is next. The **root** is

found in the middle of the word, and they form words by adding prefixes or suffixes to them. **Suffixes** are always the endings of words. A **combining form** is used in combination with another word part that is distinct from a prefix or suffix that adjusts the sense or function of the word.

Some words, such as *nontraditional*, contain all three word parts. The prefix is **non-** (not), the root is **tradition** (established customs or norms), and the suffix **-al** (makes the word an adjective meaning “relating to”). This word is thus an adjective meaning “not relating to customs or norms.”

EXAMPLE: There are movements that encourage women to seek *nontraditional* occupations such as firefighting.

Some words contain only two parts, such as *traditionist*. Tradition is the root and **-ist** is the suffix that refers to “adhering to a system of beliefs or customs.” So, a traditionist is a person with established beliefs or customs.

EXAMPLE: Mr. Brown, who asked that boys in his classroom removed their hats, was considered a traditionist.

Other words contain other combinations, such as *nontraditionalist* (the prefix **non-** = not; the root **tradition** = established customs or norm; the suffix **-al** = adjective form meaning relating to; and another suffix **-ist** = refers to adhering to a system of beliefs or customs). So, a *nontraditionalist* is a person without established beliefs or customs.

EXAMPLE: Mrs. Brown, who didn’t mind boys wearing hats in her classroom, was considered a nontraditionalist.

Here is a medical term that has two roots: psychopath (**psycho** and **path**). *Psychopath* is a medical term that has become a common English word. It refers to a person who has a severe psychological disorder. One might contend that *path* is a suffix because in the term psychopath, it comes last. If we consider that the word part *path* comes to us from the English word **pathos**, which means sorrow, suffering, or tragedy, then maybe we ought to identify it as a root. However, as it comes at the end of some terms, is it not also a suffix? The best answer to that question is, “Who cares?” You may call it a root or a suffix, and it doesn’t really matter as long as you know what it means and where it goes in a particular term. The bottom line is that prefix, root, and suffix identification is a convenient way to look at and decipher terms; and most of the time, assigning the labels of prefix, root, and suffix to a word’s parts leads to an acceptable definition. If the parts vary a little now and then, don’t despair; the universe will go on.

ANALYZING TERMS

Learning to pick out prefixes, roots, and suffixes, as is done for you in **Table 1-1**, will permit you to define many, or even most, medical terms. Before going any further, we must deal with what has been traditionally referred to as a fourth word part: the **combining form**. A combining form is simply a root that includes one or more vowels tacked onto the end of it to make a root–suffix combination pronounceable, as in the word *psychology*. The main root is *psych* (mind), and the suffix is *-logy* (study of). But “psychlogy” doesn’t flow as well as *psychology*, thus we insert the “o” to create a more English-sounding word. So, as the example shows, the combining form concept is all about vowels, consonants, and pronunciation. A problem thus arises. That problem is that we remember a word (or a word part, for that matter) in two ways: by recalling the sound it makes when we hear it spoken and by the sound a visual combination of its letters makes when we see it written.

TABLE 1-1 ANALYSIS OF EXAMPLE WORDS

Term	Prefix	Root	Suffix	Term Meaning
cardialgia		cardi (heart)	-algia (pain)	pain in the heart; also, heartburn (a digestive disorder)
cardiology		cardio (heart)	-logy (study of)	study of the heart and its disorders
carditis		card (heart)	-itis (inflammation)	inflammation of the heart
diagnosis	dia- (across; through)	<i>gnosis</i> (Greek word meaning “knowledge”)		discovery of the cause of signs and symptoms
				disease caused by health

iatrogenic disease	iatro (physician); gen (origin, cause)	-ic (adjective suffix)	care (whether an individual worker, particular institution, or the system as a whole)
psychopath	psycho (mind); path (disease)		person with a (serious) mental disease

When I asked a colleague how she pronounced the prefix **iatro-**, which means physician, she said, “eye-a-tro.” Another colleague pronounced it, “eye-at-ur,” and a French friend of mine insisted on, “eye-att-re” with a clipped final vowel sound, as in *Louvre*.

This book will introduce roots with their potential combining vowels added with forward slashes (/) separating them from the rest of the root.

EXAMPLE: card/i/o

By the way, it would make equal sense to introduce them as follows:

EXAMPLE: card; cardi; cardio (all three are, phonetically speaking, roots.)

You can learn a great deal from **Table 1-1**. To begin with, the terms **cardialgia**, **cardiology**, and **carditis** not only show the three forms of the root for heart (**card**, **cardi**, and **cardio**) but also introduce you to three important suffixes: **-algia**, **-logy**, and **-itis**.

- -algia = pain
- -logy = study of
- -itis = inflammation

These three suffixes occur in many medical terms. For example, when you learn a new root, such as **neur/o**, which means nerve, you will know the meanings of **neuralgia**, **neurology**, and **neuritis**:

- neuralgia = pain in a nerve
- neurology = the study of the nervous system; also the specialty dealing with diagnosis and treatment of nervous system disorders

- neuritis = inflammation of a nerve



Quick Check

Using your knowledge of prefixes, roots, and suffixes, see if you know which word parts make up a medical word you may not yet know. Intracranial means pertaining to the area within the skull.

Intracranial: prefix = _____ root = _____ suffix = _____

Discerning readers may have noted that the suffix *-logy* is in the same category as the suffix *-path*. Although they both may be regarded as suffixes, we might also note that *-logy* is a root that comes to us from the Greek word *logos*, meaning “word”—not as in “a” word so much as in “the” word, that is, an explanation of things. That final meaning is why we define it as “study of” in **Table 1-1**. You may also recognize this root in common English words such as logic and logical.

In summary, you now know the first part of the definition of every term ending with any of the three suffixes introduced in the table. For *-algia*, the definition will begin with “pain in...” It is important to note here that a second suffix, *-dynia*, also denotes pain. These two suffixes are sometimes interchangeable and sometimes not. Eventually, you will become familiar with instances in which one or the other is appropriate or at least most common.

For *-logy*, the definition will usually begin with “study of...”

For *-itis*, the definition will begin with “inflammation of...”

The term **diagnosis** introduces the prefix **dia-**, which means through, across, or between. You may have noticed that *dia-* appears in words you already know and use frequently, such as *diameter*, a straight line running *through* the center point of a circle; *diagonal*, a straight line running between opposite corners of a rectangle; and *dialogue*, people speaking words to each other across a space.

The word *dialogue* provides an example of how words change meaning when speakers or writers misunderstand their origins. This word has also come to refer to a conversation between two people because someone mistakenly interpreted the prefix to be *di*, meaning two, and other writers and speakers followed suit.

The medical term **diagnosis** refers to the determination of the presence of

a disease or other disorder *through* consideration of signs, symptoms, and medical test results. That definition might seem to stretch the point of the word “through” until you learn that *gnosis* is the Greek word for knowledge. In other words, diagnosis is a procedure leading to a judgment “through knowledge.” The verb **diagnose** represents a departure in one respect from the etymology of the term diagnosis. As with all back-formed verbs, clarity is easily lost. In this case, fuzziness comes about because “knowledge” (a noun) identifies something we know, whereas declaring (a verb) that we know it is something else entirely.

Iatr/o is a root that means physician, and **gen/o** (from a Greek word *gennao*, meaning the production of something) refers to origin or cause. The addition of **-ic** to *gen* forms **genic**, an adjective suffix meaning “originating from” or “caused by.” Thus, an *iatrogenic disorder* is, literally speaking, “a disorder caused by a physician.” In general use, the term *iatrogenic* refers to a disorder, disease, or ailment caused by any medical treatment or practitioner, such as a side effect from a drug or complications following surgery.

Another form of the root *iatr/o* is **iatr**, which may be coupled with other roots and several suffixes: **y**, **ic**, **ics**, **ist**, and **ician**. Here are examples of words formed from *iatr*, *y*, *ic*, *ist*, and *ician*:

Term	Part	Meaning
psychiatry	psych + iatr + y	specialty dealing with disorders of the mind (in this case the y does not act as an adjective suffix)
psychiatric	psych + iatr + ic	adjective form of psychiatry
psychiatrist	psych + iatr + ist	specialist in psychiatry
geriatrics	ger + iatr + ics	specialty in disorders of the elderly
pediatrician	ped + iatr + ician	specialist in children’s disorders

The root *psycho* comes from the Greek word *psyche*, which means soul or mind. The suffixes **-ist** and **-ician** mean practitioner, and the suffixes **-y** and **-ics** mean practice. The final two items in the list introduce two new roots:

ger/o and **ped/o**, the meanings of which you may deduce from the meanings of the terms **geriatrics** and **pediatrician**. The root *ger/o* (also sometimes **ger/onto**) comes from the Greek word *geron*, which means old man. The root *ped/o* is derived from the Greek word *pais*, which means child.

See **Tables 1-2, 1-3, and 1-4**, which list a sampling of roots, suffixes, and prefixes. Study these so you can start building and defining terms.

TABLE 1-2 WORD ROOTS TO BEGIN BUILDING TERMS

Word Root	Meaning
arthr/o	joint
card/i/o	heart
derm/o/ato	skin
gen/o	origin, cause, formation
ger/o/onto	old age
hem/a/ato	blood
iatr/o	physician
muscul/o	muscle
natal	birth; born
neur/o	nerve
os/teo	bone
path/o	disease
ped/ia	child

phren/o	diaphragm, mind
psych/o	mind
skelet/o	skeleton
tend/o, ten/o	tendon

TABLE 1-3 PREFIXES TO BEGIN BUILDING TERMS

Prefix	Meaning
epi-	upon, following, or subsequent to
micro-	small
peri-	around
post-	after
pre-	before

TABLE 1-4 SUFFIXES TO BEGIN BUILDING TERMS

Suffix	Meaning
-al	adjective suffix
-algia	pain
-dynia	pain
-gen, -genesis	origin, cause, formation
-ic	adjective suffix denoting of

-itis	inflammation
-logy	study of
-pathy	disease
-scope	viewing, an instrument used for viewing

END-OF-CHAPTER EXERCISES

EXERCISE 1-1

DEFINING TERMS

Combine the suffix *-logy* with the proper root to indicate the following medical specialties.

- Specialty dealing with heart disease _____
- Specialty that deals with the problems of aging and diseases in the elderly _____
- Specialty dealing with blood diseases _____
- Specialty dealing with skin ailments _____
- Specialty dealing with nervous system disorders _____
- Specialty dealing with mental disorders _____

EXERCISE 1-2

ANALYZING TERMS

Analyze the following terms by putting the roots and suffixes in the appropriate columns. Then, write a definition for each term.

TERM	ROOT	SUFFIX	DEFINITION
1. neuropathy _____	_____	_____	_____
2. psychology _____	_____	_____	_____

3. pathogenic _____
4. neuralgia _____
5. systemic _____
6. psychiatrist _____
7. pediatrician _____
8. iatrogenic _____
9. cardialgia _____
10. neuritis _____

EXERCISE 1-3



FILL IN THE BLANK

Fill in the blank with the correct answers.

1. The prefix *peri-* denotes _____.
2. The suffix *-logy* means _____.
3. The word root *derm/o* refers to _____.
4. The medical term *osteoarthritis* contains two _____ and one _____.
5. The suffix *-logy* is derived from the Greek word _____, which means _____.
6. Tendonitis refers to the _____ of a _____.
7. A prenatal examination is one that occurs _____ the birth of a child.
8. _____ is indicated by the suffixes *-algia* and _____.
9. Inflammation is indicated by the suffix _____.
10. The study of mental and emotional disorders is called _____.



Common Prefixes and Suffixes

LEARNING OUTCOMES

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

- Recognize prefixes.
- Recognize suffixes.
- Define all of the prefixes and suffixes presented in this chapter.
- Analyze and define new terms introduced in this chapter.
- Pronounce, define, and spell each term introduced in this chapter.

INTRODUCTION

Chapter 1 presented the four word parts used in medical terminology: prefixes, roots, suffixes, and combining forms. This chapter focuses on prefixes and suffixes.

In Chapter 1, we learned that a prefix is a word part that comes at the beginning of a word. Note that the word *prefix* itself contains a prefix, pre-. The second part of the word *prefix* is “fix,” which gives us a perfect definition of prefix: something affixed (attached) to the front of or before (pre-) something else. Most of the prefixes occurring in medical terms are also found in everyday English. Although we have all used many of the prefixes contained in this chapter, we may have done so without realizing that they are prefixes. For example, when we are admitted to an anteroom, we may not stop to think that the prefix ante- means “before,” and that an *anteroom* is so

called because it is a room we enter before entering another room.

We also learned in Chapter 1 that a suffix is the part that comes at the end of a word. The word *suffix* comes from the Latin word *suffixum*, which may be translated as “to fasten to the end of.” Although the suffix is located last in a medical term, it often comes first in its definition. For example, *appendicitis* means “inflammation (-itis) of the appendix.” Therefore, the suffix, -itis, provides us with the first word of the defining phrase. The term *gastrectomy* is another example. It is defined as “removal of the stomach.” The definition begins with the meaning of the suffix, -ectomy, which means “removal of.”

WORD ROOTS INTRODUCED IN THIS CHAPTER

Table 2-1 lists common word roots with their meanings to get you started on your task of learning hundreds of medical terms. You may wish to memorize the roots given in the table now, because there are just a few. Or if you prefer, just give them a quick glance now and, as you go through the chapter, refer back to this table whenever you run across a term with a root you do not recognize.

TABLE 2-1 COMMON WORD ROOTS AND MEANINGS

Word Root	Meaning
arter/i/o	artery
arthr/o	joint
card/i/o	heart
derm/at/o	skin
gen/i/o	origin, cause, formation
ger/o/onto	old age
hem/a/t/o	blood
iatr/o	physician

muscul/o	muscle
neur/o	nerve, nerve tissue
oste/o	bone
path/o	disease
ped/i/o	child
phren/o	diaphragm, mind
psych/o	mind
skelet/o	skeleton
spin/o	spine
tend/i/n/o	tendon

CATEGORIES OF PREFIXES

Not all medical terms include a prefix, but when one is present, it is critical to the term's meaning. For example, hyperglycemia (high blood sugar) and hypoglycemia (low blood sugar) are conditions that are exact opposites. Confusing those two prefixes creates errors. Two other similar-sounding prefix pairs prone to creating errors are ante- and anti-. The prefix *ante-* means "before," and the prefix *anti-* means "against."

Term	Part	Meaning
hypoglycemia	prefix: hypo- = low root: glyc/o- = sugar suffix: -emia = condition	low blood sugar
antecubital	prefix: ante- = before	anterior to the elbow

	root: cubitum = elbow		
	prefix: anti- = against		
anticoagulant	root: coagulant = substance that causes blood to clot		preventing coagulation (clotting)

Dividing prefixes into functional categories makes them easier to learn. There are five logical divisions:

- Prefixes of time or speed
- Prefixes of direction
- Prefixes of position
- Prefixes of size or number
- Prefixes of negation

Seeing prefixes in words we already know helps us learn their meanings quickly and enables us to understand medical terms we encounter later on. For that reason, common English words are included as examples in some of the following paragraphs and tables.

Prefixes of Time or Speed

Prefixes denoting time or speed are used in everyday English. Prehistoric and postgraduate are common words with a prefix relating to time. Prefixes denoting speed, such as tachy- (fast) and brady- (slow), are often used to describe heart rate. **Table 2-2** lists prefixes related to time or speed.

TABLE 2-2 PREFIXES OF TIME OR SPEED

Prefix	Refers to	Example	Meaning
ante-, pre-	before	antepartum, premature	before birth, before full development
brady-	abnormally slow rate of speed	bradycardia	abnormally slow heartbeat
neo-	new	neonatal	newborn (adjective)

post-	after	postscript	a written thought added after the main message
tachy-	rapid, abnormally high rate of speed	tachycardia	abnormally fast heartbeat

Prefixes of Direction

The word abnormal is an example of a word containing a prefix that signifies direction. We use such prefixes in everyday life without bothering to analyze them. For example, we normally would not take the time to think about the prefix *contra-* (against) in the word contradiction, yet we understand its meaning. Prefixes related to direction are listed in **Table 2-3**.

TABLE 2-3 PREFIXES OF DIRECTION

Prefix	Refers to	Example	Meaning
ab-	away from, outside of, beyond	abnormal	not normal
ad-	toward, near to	adjective	toward a noun
con-, sym-, syn-	with, within	congenital, sympathetic, synthetic	with (or at) birth, with feeling toward, with the same idea or purpose
contra-	against	contraband	substance against the law
dia-	across, through	diameter	a line through the middle

Prefixes of Position

Infrastructure (*infra-* means inside or below), interstate (*inter-* means

between), and paralegal (*para-* means alongside) are all words we frequently use that include prefixes of position. Having these prefix meanings already in our working vocabularies makes it easier to learn their medical uses. Prefixes of position are commonly used during diagnostic and treatment procedures. **Table 2-4** lists prefixes relating to position.

TABLE 2-4 PREFIXES OF POSITION

Prefix	Refers to	Example	Meaning
ec-, ecto-, ex-, exo-	outside	extraction	removal to the outside
en-	inside	encephalopathy	disease inside the head, brain disease
endo-	within	endoscopy	visual examination of the inside of some part of the body
epi-	upon, subsequent to	epigastric	adjective referring to something above the stomach
extra-	beyond	extracellular	adjective referring to something outside a cell or cells
hyper-	above, beyond normal	hyperglycemia	high blood sugar
hypo-	low, below, below normal	hypogastric	region beneath the stomach
infra-	inside or below	infrarenal	adjective referring to something below the kidneys
inter-	between	interosseous	between bones
intra-	inside, within	intracerebral	inside the cerebrum

meso-	middle	mesothelioma	tumor arising from the mesothelium
meta-	beyond	metacarpal	the bone beyond the carpus; one of five bones in either hand
pan-	all or everywhere	pancarditis	general inflammation of the heart
para-	alongside, near	paraplegia	paralysis of the lower half of the body
peri-	around	perivascular	in the tissues surrounding a vessel
retro-	backward, behind	retrosternal	adjective referring to something behind the sternum

Prefixes of Size and Number

A semiannual (semi- means “half,” annual means “yearly”) sale is one that occurs every 6 months. The unicorn (uni- means “one”) is a fictitious creature that has one horn. Prefixes of size and number are very common. **Table 2-5** lists prefixes related to size and number.

TABLE 2-5 PREFIXES OF SIZE AND NUMBER

Prefix	Refers to	Example	Meaning
bi-	two	biannual	twice per year
di-, dipl-	two, twice	diplopia	double vision
hemi-	half	hemiplegia	paralysis of one body side
macro-	big	macrocyte	big cell

micro-	small	microscope	instrument to view small objects
mono-	one	monocyte	cell with one nucleus
olig-, oligo-	a few, a little	oliguria	scant urine production
pan-	all or everywhere	pancarditis	whole heart inflammation
poly-	many	polydactyly	more than five hand or foot digits
quadri-	four	quadriplegia	paralysis of all four limbs
semi-	half, partial	semiannual	occurring every half year
tetra-	four	tetradactyl	having only four hand or foot digits
tri-	three	triceps	three-headed muscle
uni-	one	unicellular	one-celled

Prefixes of Negation

Negation means absence or opposite of something. These include words like antidepressant (anti- means “against”) and decriminalize (de- means “without”). **Table 2-6** lists prefixes related to negation.

TABLE 2-6 PREFIXES OF NEGATION

Prefix	Refers to	Example	Meaning
a-, an-	not	anuria	not able to urinate
anti-	against, opposed	antibiotic	drug that inhibits microbes

de-	without	dehumidifier	device that removes water
dis-	remove	disable	put out of action



Quick Check

Define each prefix and state whether it refers to time, speed, position, direction, number, or negation.

1. anti- _____
2. hyper- _____
3. tachy- _____

CATEGORIES OF SUFFIXES

Dividing suffixes into functional categories makes them easier to learn than they would be otherwise. A suffix adds to or changes a root in one of four different ways. Suffixes:

- Signify a medical condition.
- Signify a diagnostic term, test information, or surgical procedure.
- Name a medical practice or practitioner.
- Convert a noun to an adjective.

The suffix *-stenosis*, for example, indicates a narrowing or blockage in a body part, which is a condition. Consider the term *arteriostenosis*. Because the root *arter/i/o* means artery, we may conclude that *arteriostenosis* is a narrowing of an artery. Note how this term is divided into word parts:

Term	Part	Meaning
arteriostenosis	root: <i>arter/i/o</i> = artery suffix: <i>-stenosis</i> = narrowing	narrowing of an artery

Suffixes Signifying Medical Conditions

The suffix -porosis, which means porous, is added to the root oste/o, to form the term osteoporosis, which means “a porous condition of bone.” See [Table 2-7](#) for more examples.

TABLE 2-7 SUFFIXES THAT SIGNIFY MEDICAL CONDITIONS

Suffix	Meaning of the Suffix	Example	Meaning of the Example
-algia, -dynia	pain	arthralgia, arthrodynia	pain in a joint
-cele	protrusion, hernia	rectocele	hernia of the rectum
-cyte	cell	leukocyte	white blood cell
-ectasis, -ectasia	expansion or dilation	angiectasis	dilation of a vessel
-edema (also a standalone word)	excessive fluid	angioedema	fluid buildup that causes swelling under the skin
-emesis	vomiting	hematemesis	vomiting of blood
-emia	blood	uremia	urea in the blood
-iasis	condition or state	cholelithiasis, sometimes also spelled “chololithiasis”	stones in the gallbladder or bile ducts
-ism	a condition of, a process, or a state of	hypothyroidism	condition characterized by thyroid hormone deficiency

-itis	Inflammation	appendicitis	inflammation of the appendix
-lith	stone, calculus, calcification	pneumolith	a stone in the lung
-lysis	disintegration, breaking down	hemolysis	rupture of red blood cells
-malacia	softening	osteomalacia	softening of the bones
-megaly	enlargement	gastromegaly	enlargement of the stomach
-oid	resembling or like	opioid	substance that resembles opium
-oma	tumor	gastrooma	tumor of the stomach
-osis	abnormal condition	osteoporosis	condition of porous bones
-pathy	disease	myopathy	disease of the muscle
-penia	reduction of size or quantity	leukopenia	low number of white blood cells
-phobia	fear	carcinophobia	fear of cancer
-plasia	abnormal formation	neoplasia	abnormal growth of cells
-plegia	paralysis	hemiplegia	paralysis on one side of the body
-pnea	breathing	tachypnea	rapid breathing

-poiesis	producing	erythropoiesis	production of red blood cells
-porosis	porous condition	osteoporosis	porous
-ptosis	downward displacement	nephroptosis	downward displacement of a kidney
-rrhage	flowing forth	hemorrhage	significant discharge of blood from blood vessels
-rrhea	discharge	rhinorrhea	discharge from the nose (runny nose)
-rrhexis	rupture	hysterorrhexis	rupture of the uterus
-sclerosis	hardness	atherosclerosis	hardening of the arteries
-spasm	muscular contraction	angiospasm	muscular contraction of a vessel
-stasis	level, unchanging	thermostasis	a constant, consistent internal body temperature
-stenosis	a narrowing	arteriostenosis	narrowed arteries

Suffixes Signifying Diagnostic Terms, Test Information, or Surgical Procedures

Suffixes that form terms related to test information, diagnoses, and procedures are often attached to a root that signifies a body part. The term appendectomy is an example. The suffix -ectomy means “removal of,” and append is the root for appendix. Thus, the term means “removal of the appendix.” **Table 2-8** lists common suffixes that signify diagnostic terms, test information, or surgical procedures.

TABLE 2-8 SUFFIXES THAT SIGNIFY DIAGNOSTIC TERMS, TEST INFORMATION, OR SURGICAL PROCEDURES

Suffix	Refers to	Example
-centesis	surgical puncture	thoracentesis
-desis	surgical binding	arthrodesis
-ectomy	surgical removal	appendectomy
-gen, -genic, - genesis	origin, producing	osteogenic
-gram	a recording, usually by an instrument	electrocardiogram
-graph	instrument for making a recording	electrocardiograph
-graphy	act of graphic or pictorial recording	electrocardiography
-meter	instrument for measuring	audiometer
-metry	act of measuring	audiometry
-opsy	examination	autopsy
-pexy	surgical fixation	hysteropexy
-plasty	surgical repair	rhinoplasty
-rrhaphy	suture	herniorrhaphy
-scope	instrument for viewing	arthroscope
-scopy	act of viewing	arthroscopy

-stomy	artificial or surgical opening	tracheostomy
-tome	instrument for cutting	dermatome
-tomy	incision	colotomy
-tripsy	crushing	lithotripsy

Suffixes That Name a Medical Practice or Practitioner

Some suffixes relating to a medical practice or practitioner are derived from the Greek word *iatros*, which means “physician” or “medical treatment.” This Greek word is the source of the root *iatr/o*. For practical purposes, you may consider the root *iatr* as an integral part of the suffixes *-iatric* and *-iatr*, as in the terms *geriatrics*, *psychiatric*, *psychiatry*, *psychiatrist*, *pediatrics*, and *pediatrician*. Although both *-ician* and *-ist* are used in referring to a specialist, the suffix *-ist* is perhaps the more common one. An example is gerontologist, a physician who diagnoses and treats disorders of aging.

Terms denoting a field or medical specialty may also end with the suffix *-logy*. **Table 2-9** lists the suffixes for medical practice and practitioners.

TABLE 2-9 SUFFIXES THAT SIGNIFY MEDICAL PRACTICE AND PRACTITIONERS

Suffix	Refers to	Example
-ian	specialist	pediatrician
-iatrics	medical specialty	pediatrics
-iatry	medical specialty	psychiatry
-ics	medical specialty	orthopedics
-ist	specialist in a field of study	orthopedist
-logy	study of	gynecology

Root, prefix, or suffix? The word part **gen** can act as a suffix or a root, but, as is the case with **iatro-**, it combines nicely with several suffixes and may be considered as a part of them. Terms formed with **-genic** are adjectives, because of the **-ic** ending. As we will see later, **-ic** can act as a suffix by itself, too.

Suffixes That Denote Adjectives

As with suffixes that signify medical practice and practitioners, suffixes used to create adjective forms are not governed by a clear set of rules. Nevertheless, there are some rules that come into play, such as the rules of English pronunciation. For example, we replace the final letter, *x*, in the word *appendix* with a *c* to form the adjective *appendicitis* because “appendixitis” does not sound much like an English word.

In creating adjectives, we also sometimes change noun terms that name specialties. For example, *psychiatry* and *pediatrics* are the names of specialties. Dropping the *y* from *psychiatry* and adding the adjective suffix *-ic* converts the specialty name to an adjective:

psychiatric medicine

psychiatric hospital

With *pediatrics*, on the other hand, all we need to do to form the adjective is drop the *s*:

pediatric medicine

pediatric hospital

Examples of adjective suffixes are listed in **Table 2-10**.

TABLE 2-10 SUFFIXES THAT DENOTE ADJECTIVES

Suffix	Refers to	Example
-ac, -al, -an, -aneous, -ar, -ary, -eal, -eous, -iac, -iatric, -ic, -ical, -oid, -otic, -ous, -tic, -ular	converts a root or noun to an adjective	geriatric, orthopedic, ocular

Prefixes and suffixes presented in this chapter will become familiar as you progress through the next chapters on body systems. Review the following study tables and do the self-testing exercises.

Study Table



COMMON PREFIXES

PREFIX	MEANING	EXAMPLE
a-, an-	not	anemic
ab-	away from, outside of, beyond	abnormal
ad-	toward, near to	addiction
ante-, pre-	before	ante partum, premature
anti-	against, opposed	antibiotic
bi-	two	bipolar
brady-	abnormally slow rate of speed	bradycardia
con-, sym-, syn-	with	congenital, sympathetic, synarthrosis
contra-	against	contralateral
de-	not	deodorant
di-, diplo-	two, twice	dipole
dia-	across, through	diagnosis
dis-	remove	disinfect
dys-	painful, bad, difficult	dyspnea
ec-, ecto-	outside, away from	ectopy
en-	inside	endosteum
endo-	within	endoderm
epi-	upon, subsequent to	epigastric
ex-, exo-	outside	exoskeleton
extra-	beyond	extrasystole
hemi-	half	hemiplegia
hyper-	above, beyond normal	hypergastric

hypo-	below, below normal	hypogastric
infra-	inside or below	infrastructure
inter-	between	intercostal
intra-	inside	intracerebral
macro-	big	macrophage
meso-	middle	mesothelium
meta-	beyond	metacarpal
micro-	small	microscope
mono-, uni-	one	monocyte
neo-	new	neoplasm
olig-, oligo-	a few, a little	oliguria
pan-	everywhere	pandemic
para-	alongside, near	paraplegia
peri-	around	perimeter
post-	after	postsynaptic
quadri-	four	quadriceps
retro-	backward, behind	retroperitoneal
semi-	half, partial	semiconscious
tachy-	rapid	tachycardia
tetra-	four	tetradactyl
tri-	three	triceps
uni-	one	unilateral

Study Table COMMON SUFFIXES

SUFFIX

MEANING

EXAMPLE

-ac, -al, -an, -aneous, -ar, -ary, -eal, -eous, -iac, -iatric, -ic, -ical, -oid, -otic, -ous, -tic, -ular	converts a root or a noun term to an adjective	geriatric, orthopedic, ocular, dental, cutaneous, cyanotic, atrial, cardiac, ureteral
-algia, -dynia	pain	urodynia
-cele	protrusion, hernia	rectocele
-centesis	surgical puncture	thoracentesis
-cyte	cell	leukocyte
-desis	surgical binding	arthrodesis
-ectasis, -ectasia	expansion or dilation	angiectasis
-ectomy	surgical removal	appendectomy
-edema	excessive fluid in intracellular tissues	angioedema
-emesis	vomiting	hematemesis
-emia	blood	uremia
-genic	origin, producing	osteogenic
-gram	a recording, usually by an instrument	electrocardiogram
-graph	instrument for making a recording	electrocardiograph
-graphy	act of graphic or pictorial recording	electrocardiography
-ian, -iatrist, -ist, -logist, -logy, -ics, -iatry, -iatics	specialty of, study of, practice of	geriatrist, pediatrician, gynecology
-iasis	condition or state	cholelithiasis
-ism	a condition of, a process, or a state of	gigantism, hyperthyroidism
-itis	inflammation	appendicitis
-lith	stone, calculus, calcification	pneumolith
-lysis	disintegration	hemolysis

-malacia	softening	osteomalacia
-megaly	enlargement	gastromegaly
-meter	device for measuring	audiometer
-metry	act of measuring	audiometry
-oid	resembling or like	android, mucoid
-oma	tumor	gastroma
-opsy	visual examination	biopsy
-osis	abnormal condition	osteoporosis, arthrosis
-pathy	disease	cardiopathy
-penia	reduction of size or quantity	leukopenia
-pexy	surgical fixation	hysteropexy
-phobia	fear	claustrophobia
-plasia	abnormal formation	chondroplasia
-plasty	surgical repair	rhinoplasty
-plegia	paralysis	hemiplegia
-pnea	breath, respiration	tachypnea
-poiesis	producing	erythropoiesis
-porosis	porous condition	osteoporosis
-ptosis	downward displacement	nephroptosis
-rrhage	flowing forth	hemorrhage
-rrhaphy	suture	herniorrhaphy
-rrhea	discharge	diarrhea
-rrhexis	rupture	hysterorrhexis
-sclerosis	hardness	arteriosclerosis

-scope	instrument for viewing	arthroscope
-scopy	act of viewing	arthroscopy
-spasm	muscular contraction	arteriospasm
-stasis	level, unchanging	hemostasis
-stenosis	a narrowing	arteriostenosis
-stomy	permanent opening	colostomy
-tome	instrument for cutting	osteotome
-tomy	incision	osteotomy
-tripsy	crushing	lithotripsy

END-OF-CHAPTER EXERCISES

EXERCISE 2-1



ADDING PREFIXES OF TIME OR SPEED

Form a new word by adding each prefix in the list to the word appearing next to it. Then write the meaning of the new word in the space to the right. Refer to a dictionary as needed.

PREFIX	WORD	NEW WORD	MEANING
1. ante-	room	_____	_____
2. neo-	classic	_____	_____
3. post-	glacial	_____	_____
4. pre-	dominant	_____	_____
5. tacho-	meter	_____	_____

EXERCISE 2-2



ADDING PREFIXES OF DIRECTION

Form a new word by adding each prefix in the list to the word appearing next to it. Then write the meaning of the new word in the space to the

right. Refer to a dictionary as needed.

PREFIX	WORD	NEW WORD	MEANING
1. ab-	normal	_____	_____
2. ad-	joining	_____	_____
3. con-	centric	_____	_____
4. contra-	lateral	_____	_____
5. dia-	gram	_____	_____
6. sym-	pathetic	_____	_____
7. syn-	thesis	_____	_____

EXERCISE 2-3



ADDING PREFIXES OF POSITION

Form a new word by adding each prefix in the list to the word or word part appearing next to it. Then write the meaning of the new word in the space to the right. Refer to a dictionary as needed.

PREFIX	WORD/WORD PART	NEW WORD	MEANING
1. ec-	centric	_____	_____
2. ecto-	morph	_____	_____
3. en-	slave	_____	_____
4. endo-	cardial	_____	_____
5. epi-	demic	_____	_____
6. ex-	change	_____	_____
7. exo-	sphere	_____	_____
8. extra-	terrestrial	_____	_____

- | | | | | |
|-----|--------|------------|-------|-------|
| 9. | hyper- | sensitive | _____ | _____ |
| 10. | hypo- | thesis | _____ | _____ |
| 11. | infra- | structure | _____ | _____ |
| 12. | inter- | collegiate | _____ | _____ |
| 13. | intra- | mural | _____ | _____ |
| 14. | meso- | sphere | _____ | _____ |
| 15. | meta- | physics | _____ | _____ |
| 16. | pan- | orama | _____ | _____ |
| 17. | para- | legal | _____ | _____ |

EXERCISE 2-4

ADDING PREFIXES OF SIZE OR NUMBER

Form a new word by adding each prefix in the list to the word or word part appearing next to it. Then write the meaning of the new word in the space to the right. Refer to a dictionary as needed.

PREFIX	WORD/WORD PART	NEW WORD	MEANING
1. bi-	annual	_____	_____
2. hemi-	sphere	_____	_____
3. macro-	cosm	_____	_____
4. micro-	scope	_____	_____
5. mono-	rail	_____	_____
6. olig-	archy	_____	_____
7. quadri-	lateral	_____	_____
8. semi-	annual	_____	_____

	-lysis	_____	_____
	-genesis	_____	_____
3. hem/o, hemat/o	-oma	_____	_____
	-osis	_____	_____
	-algia	_____	_____
	-ectasis	_____	_____
4. neur/o	-itis	_____	_____
	-oma	_____	_____
	-dynia	_____	_____
	-oma	_____	_____
	-malacia	_____	_____
5. oste/o	-penia	_____	_____
	-porosis	_____	_____
	-itis	_____	_____
6. psych/o	-osis	_____	_____

EXERCISE 2-6



COMBINING ROOTS AND SUFFIXES

THAT DENOTE DIAGNOSTIC TERMS,
TEST INFORMATION, OR SURGICAL
PROCEDURES

Build new words by combining the correct form of each of the roots with the suffixes appearing next to it. Suffixes and their definitions may be found in the Common Suffixes Study Table in this chapter. Then write the meaning of the new word in the space to the right. Refer to a medical dictionary as needed.

ROOT	SUFFIX	NEW WORD	MEANING
------	--------	----------	---------

	-genic	_____	_____
	-gram	_____	_____
1. card/i/o	-graph	_____	_____
	-graphy	_____	_____
	-pathy	_____	_____
	-rrhaphy	_____	_____
2. dermat/o	-plasty	_____	_____
3. hemat/o	-genesis	_____	_____
	-metry	_____	_____
4. neur/o	-ectomy	_____	_____
	-genic	_____	_____
	-genesis	_____	_____
	-rrhaphy	_____	_____
	-plasty	_____	_____
5. oste/o	-genesis	_____	_____
	-ectomy	_____	_____
	-tomy	_____	_____
6. path/o	-gen	_____	_____
	-genic	_____	_____
	-genesis	_____	_____
7. psych/o	-genic	_____	_____
	-genesis	_____	_____
	-metry	_____	_____

-pathy _____

EXERCISE 2-7



**COMBINING ROOTS AND SUFFIXES
ASSOCIATED WITH A MEDICAL
PRACTICE OR PRACTITIONER**

Build new words by combining the correct form of each of the roots with the suffixes appearing next to it. Suffixes and their definitions may be found in the Common Suffixes Study Table in this chapter. Then write the meaning of the new word in the space to the right. Refer to a medical dictionary as needed.

ROOT	SUFFIX	NEW WORD	MEANING
1. card/i/o	-logy	_____	_____
	-logist	_____	_____
2. derm/o, dermat/o	-logy	_____	_____
	-logist	_____	_____
	-iatrics	_____	_____
3. ger/o/nt/o	-logy	_____	_____
	-logist	_____	_____
4. hem/o, hemat/o	-logy	_____	_____
	-logist	_____	_____
5. neur/o	-logy	_____	_____
	-logist	_____	_____
6. oste/o	-logy	_____	_____
	-logist	_____	_____
7. path/o	-logy	_____	_____
	-logist	_____	_____

8. psych/o **-logy** _____

-iatry _____

-iatrist _____

EXERCISE 2-8



**COMBINING ROOTS AND SUFFIXES
THAT DENOTE ADJECTIVES**

Build new words by combining the correct form of each of the roots with the suffixes appearing next to it. Suffixes and their definitions may be found in the Common Suffixes Study Table in this chapter. Then write the meaning of the new word in the space to the right. Refer to a medical dictionary as needed.

ROOT	SUFFIX	NEW WORD	MEANING
1. card/i/o	-ac	_____	_____
2. hem/o, hemat/o	-toxic	_____	_____
3. derm/o, dermat/o	-al	_____	_____
	-ic	_____	_____
	-iatic	_____	_____
4. ger/o, geront/o	-al	_____	_____
	-al	_____	_____
5. neur/o	-ic	_____	_____
	-al	_____	_____
6. spin/o	-ous	_____	_____
	-al	_____	_____
7. oste/o	-oid	_____	_____

EXERCISE 2-9**MATCHING SUFFIXES WITH MEANINGS**

Match the suffix in Column 1 with its definition in Column 2.

COLUMN 1	COLUMN 2
1. _____-cyte	A. morbid impulse toward a specific object or thought
2. _____-edema	B. vomiting
3. _____-emesis	C. a stone, calculus, calcification
4. _____-sclerosis	D. a condition, a process or state of
5. _____-tome	E. disease
6. _____-ism	F. visual examination
7. _____-lith	G. cell
8. _____-lysis	H. disintegration
9. _____-opsy	I. excessive fluid in intracellular tissues
10. _____-pathy	J. instrument for cutting
11. _____-phobia	K. level, unchanging
12. _____-poiesis	L. a narrowing
13. _____-stomy	M. hardness
14. _____-stasis	N. permanent opening
15. _____-stenosis	O. producing

EXERCISE 2-10**FILL IN THE BLANK**

For each of the following questions or statements, write the answer in the space provided.

1. What two suffixes mean “pain?” _____
2. *Ang/i/o* is a root meaning “blood vessel.” What term means “dilation of a blood vessel?” _____
3. Angioid means “resembling blood vessels.” What part of speech is angioid? _____
4. Define angiorrhaphy _____
5. What suffix would you add to the root *ang/i/o* to form a term meaning “the act of making a pictorial record of blood vessels?”

6. What is an angioma? _____
7. What does *-plasty* mean? _____
8. What term denotes a skin specialist? _____
9. Does a gerontologist treat young or old patients?

10. What is the difference in meaning between *gerontology* and *geriatrics*?

11. The prefixes *ab-* and *ad-* are opposites; which one means “toward?”

12. The prefix *pre-* means “before”; what other prefix means the same thing? _____
13. Write a brief definition of bradycardia _____
14. What does the prefix *extra-* mean in the word extrasensory?

15. What prefix would you use in a term that means “high blood pressure?”

16. Given the meaning of *anti-*, what would be the purpose of an anticoagulant? _____
17. Given the meaning of the prefix *tri-*, how many cusps does the tricuspid valve have? _____
18. What does the prefix *micro-* tell us about the purpose of a microscope?

19. Write a medical term by combining the prefix *endo-* with the root

card/i/o, meaning “heart,” and the suffix that means “inflammation.”
Using only your knowledge of these three word parts, write the best
definition you can for the term _____.

20. The suffix -pnea, meaning “breathing” or “respiration,” can follow both
tachy- and dys-. Define the terms tachypnea and dyspnea
-



Organization of the Body

LEARNING OUTCOMES

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

- Discuss the levels of body organization.
- Describe the anatomic position and cite the directional terms used in relation to the body.
- Name the body planes.
- Name the body cavities.
- Name the divisions of the abdomen and back.
- Pronounce, define, and spell each term introduced in this chapter.

INTRODUCTION

Learning about how the human body is constructed will help you retain new medical terms by creating a mental picture of where things are. To begin, it is also useful to know the difference between the terms *anatomy* and *physiology*. **Anatomy** comes to us from the Greek word *anatome*, which means “dissection.” You may have recognized the word part “tome,” which indicates that anatomy has something to do with cutting. **Physiology**, on the other hand, is one of the many “ology” words; in this case, it means study of how the body’s parts work together. In short, anatomy reveals the “what it is” and physiology the “how it works.”

The “what it is” begins with chemicals that act together to form cells. The

cells process the food we eat and the air we breathe. Cells also reproduce themselves, each cell according to the DNA code it contains.

WORD PARTS RELATED TO BODY ORGANIZATION

Table 3-1 lists many of the word parts that make up terms related to the body as a whole. Not surprisingly, many of them have to do with how the body is divided or where things are located.

Word Part	Meaning
anter/o	front, anterior
cerv/o	neck
chondr/o	cartilage
cyt/o, -cyte	cell
dors/o	back
gastr/o	stomach, abdomen
inguin/o	groin
my/o	muscle
myel/o	spinal cord
neur/o	nerve, neuron
poster/o	posterior, back
proxim/o	near
super/o	superior

thorac/o

chest (thorax)

trans-

across

Word Parts Exercise

After studying [Table 3-1](#), write the meaning of each of the word parts.

WORD PART	MEANING
1. trans-	1. _____
2. dors/o	2. _____
3. proxim/o	3. _____
4. chondr/o	4. _____
5. anter/o	5. _____
6. my/o	6. _____
7. super/o	7. _____
8. cerv/o	8. _____
9. inguin/o	9. _____
10. myel/o	10. _____

LEVELS OF ORGANIZATION

The body is divided into different levels of organization, starting with the smallest level: cells, tissues, organs, organ (body) systems, and finally

organism, which is the body as a whole. Each level is further examined under its own heading (see [Figure 3-1](#)).

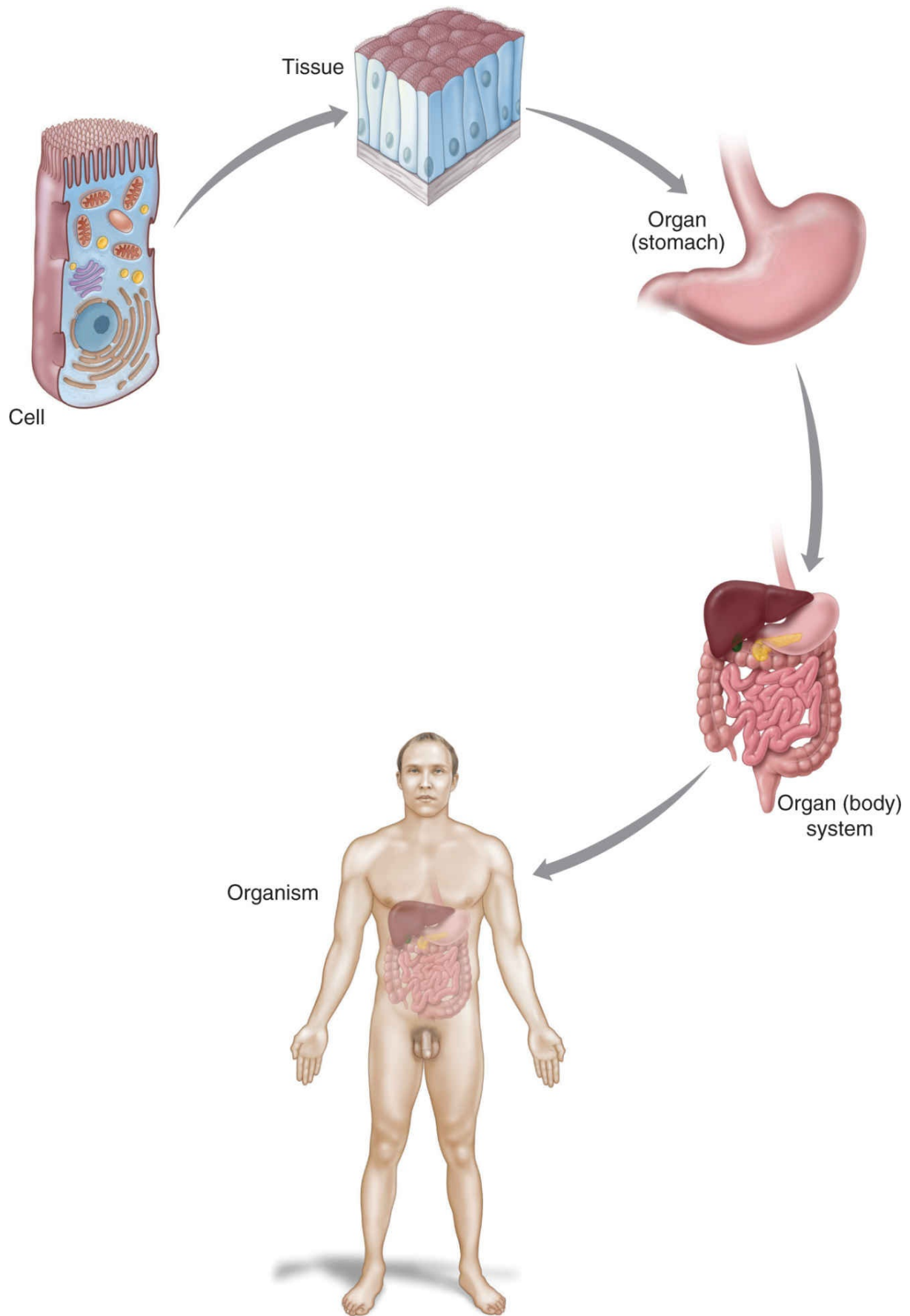


FIGURE 3-1 The levels of organization in the body beginning with the cell

and ending with the organism.

Cells

A human body is said to have 10 trillion to 100 trillion cells, depending on whom you ask. Of course, no one has ever actually counted the number of cells in a body, but as all the estimates are in the trillions, it's easy to appreciate the body's complexity as a functioning whole. Cells work both individually and together. Although cells differ from one another and consist of different components, they do have some common elements (see [Figure 3-2](#)):

- A *cell membrane* that allows certain substances in and out
- A *nucleus* that directs activities within the cell
- *Mitochondria* that generate energy for the cell
- *Cytoplasm* that is a watery fluid that fills the spaces outside the nucleus

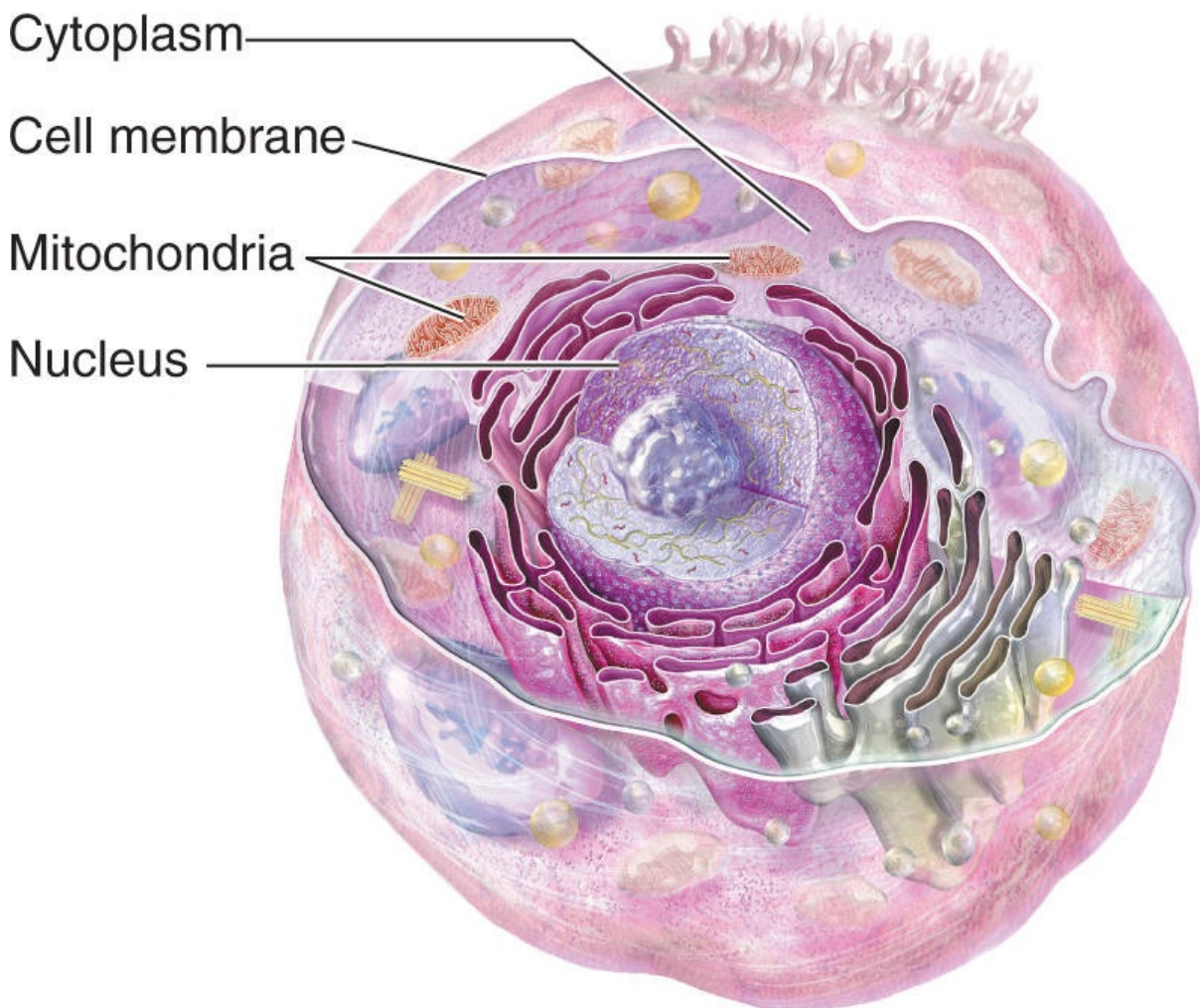


FIGURE 3-2 Basic structure of a cell. The basic structure of a cell includes the cell membrane, nucleus, mitochondria, and the cytoplasm.

Tissues

Cells make up tissues, which are composed of similar cells working together to perform similar tasks. The four types of body tissues are muscle, connective, nerve, and epithelial.

Organs

Tissues with common functions come together to form the body's organs, which perform specialized functions. Examples of organs are the brain, stomach, and heart.

Systems

A group of organs forms an organ (body) system, and each system has its own special purpose. Therefore, the rest of this book discusses each system in a chapter of its own.

NAVIGATING THE BODY

Health care professionals need to be familiar with directional and positioning terms. These terms are frequently used during patient examinations, diagnostic procedures, and treatments.

Anatomic Position

Directional terms in the field of human anatomy differ from plain language in two ways: first, unlike terms of location, directional terms are language-specific; second, directional terms are specified relative to the anatomic position. In the **anatomic position**, the body is erect and facing forward, and the arms are at the sides with the palms of the hands facing forward (see **Figure 3-3**). Left and right are from the subject's perspective, not the observer's perspective.

The inhabitants of Pormpuraaw, a remote Aboriginal community in Australia, have no words for "left" or "right." Instead, they speak of everything in terms of absolute directions (north, south, east, and west). They say things such as, "There's an ant on your southwest leg." To say hello in Pormpuraaw, one asks, "Where are you going?" An appropriate response might be, "A long way to the south-southwest. How about you?" The Pormpuraawans not only know instinctively which direction they are facing, they also spontaneously use their spatial orientation to represent both position and time.

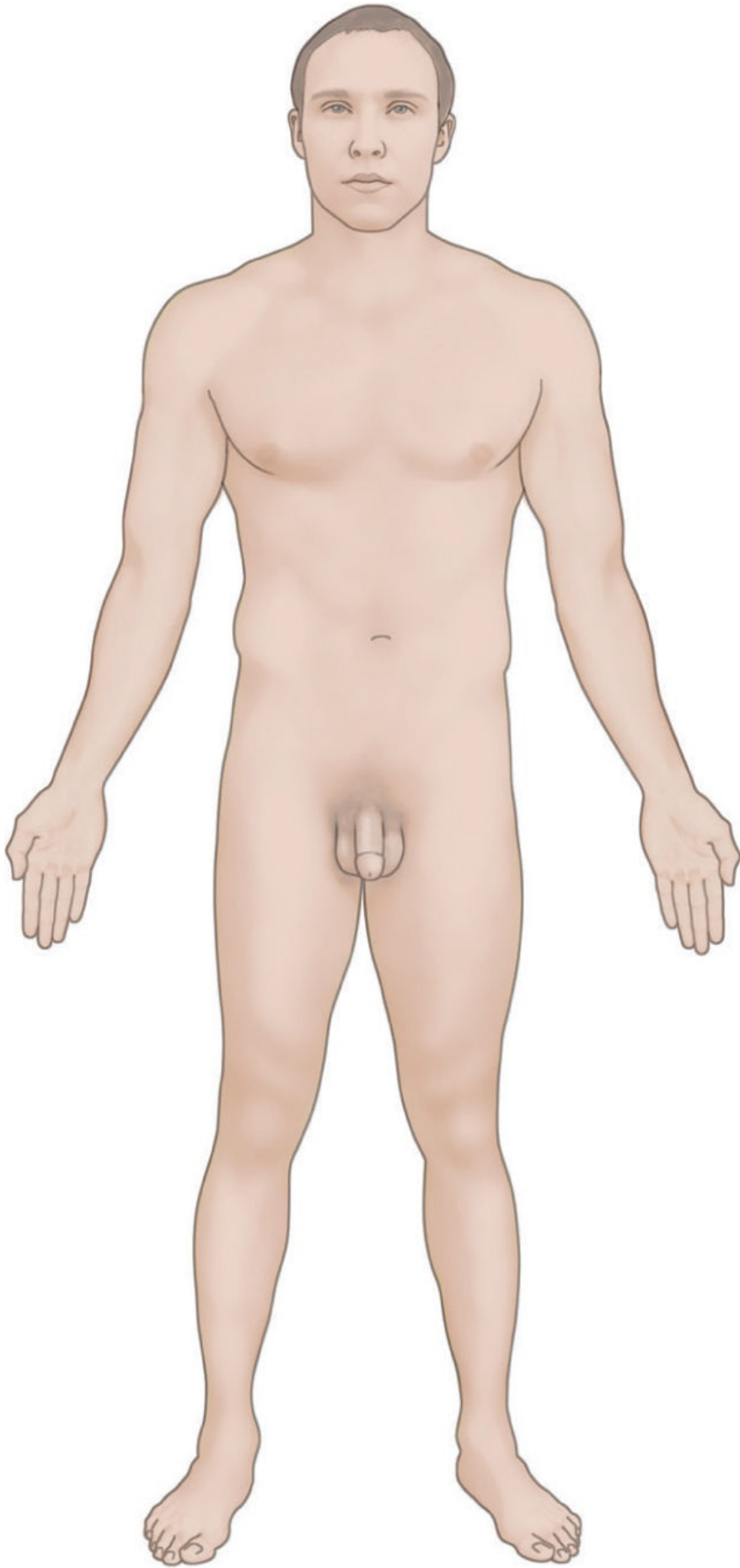


FIGURE 3-3 Anatomic position. In the anatomic position, the person is standing erect, and palms and body are facing forward.

Directional Terms

Directional terms are adjectives that help describe a complaint, symptom, body part, or process. These terms often have another term that is its opposite, and it is helpful to memorize these terms with their opposite in order to differentiate and understand them. **Superior** means above or nearer to the head. Two other words, **cranial** and **cephalic**, also mean “toward the head.” For example, “The bruise is superior to the eyebrow.” **Inferior** and **caudal** mean below or toward the feet, as in “The mouth is inferior to the nose.” **Anterior** is a directional term that relates to the front of the body. An example of the use of *anterior* would be, “The rash covered the entire anterior of the left thigh.” **Ventral**, usually used in veterinary anatomy, pertains to the front (anterior) or undersurface of an animal. **Posterior** specifies the back or toward the back of the body. **Dorsal**, generally used in veterinary anatomy, pertains to the back (posterior) or upper surface of an animal. **Medial** means toward the midline of the body, and **lateral** means away from the body’s midline or toward the side. You may see the adjective *lateral* used for descriptive purposes as in, “The tumor is located on the lateral wall of the left lung.” The final two directional terms are *proximal* and *distal*. **Proximal** refers to something nearer to the body trunk or point of attachment to the body: The shoulder is *proximal* to the elbow. **Distal** means further from the body trunk or point of attachment: The wrist is *distal* to the shoulder and the elbow. See **Figure 3-4** for an illustration showing directional terms.

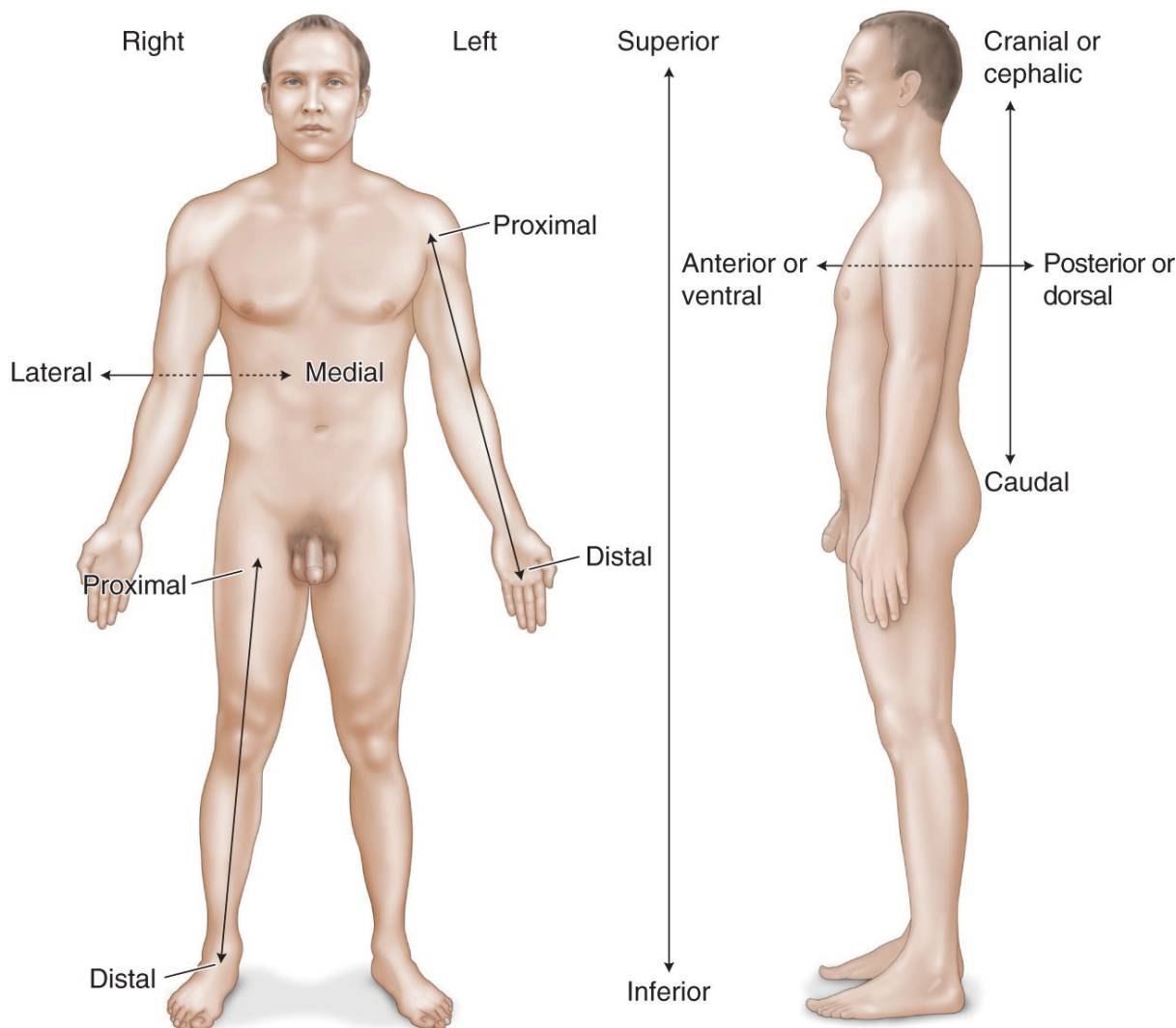


FIGURE 3-4 Directional terms describe the body part in relationship to another.

Two terms are used for placing patients in a lying down position. Both are common English words that have been adopted by medical terminology. The two terms are *supine* and *prone*. **Supine** refers to a position in which the patient is lying face up. (It means the same thing in plain English, but it can also mean lazy or simply reluctant to act.) Noticing that the word “up” is included in the first syllable of the word “supine” will help you remember its meaning of “face up” in medical terms.

Prone is the opposite of supine and means that the patient is lying face down. Prone, too, means the same thing in plain English with another meaning: “tending toward,” as in “Smith is prone to making poor choices.” Both supine and prone are frequently used in the operating room and in X-ray reports. For example, “The patient was placed in the supine position.” This means that the patient was placed on the operating table on his or her back, lying face up. See **Table 3-2** for body position and direction terms.

TABLE 3-2 BODY POSITION AND DIRECTIONAL TERMS

Term	Direction	Example
anterior	toward the front	The eyes are on the anterior surface of the face.
ventral	toward the belly or undersurface	The nipples were on the ventral body surface.
posterior	toward the back	The spine is on the posterior side of the body.
dorsal	toward the back or upper surface	The vertebrae are on the dorsal surface.
superior	above; toward the head	The neck is superior to the chest.
cranial	relating to the head	The brain is in the cranial cavity.
cephalic	relating to the head	The neck is cephalic to the hips.
inferior	below; toward the soles of the feet	The knee is inferior to the hip; the stomach is inferior to the chest.
caudal	pertaining to the tail	The coccyx is caudal to the sacrum.
proximal	near the point of attachment to the trunk	The elbow is proximal to the wrist.
distal	farther from the point of attachment to the trunk	The fingers are distal to the wrist.
lateral	pertaining to the side; away from the middle	The eyes are lateral to the nose.
medial	toward the middle of the body	The nose is medial to the eyes.

prone	lying flat and face downward	The patient was placed on the operating table in a prone position.
supine	lying flat and face upward	The patient was placed on the operating table in a supine position.



Quick Check

Give a term that has an opposite meaning to the term given.

1. distal _____
2. inferior _____
3. anterior _____
4. dorsal _____

Body Planes

Body planes are imaginary surfaces within the body (see [Figure 3-5](#)). The anatomic position is always their reference point. Three planes are frequently used to locate structural arrangements.

- **Frontal (coronal):** The frontal (coronal) plane separates the front (anterior) of the body from the back (posterior).
- **Sagittal:** The sagittal plane is any vertical plane that divides the body or organ into unequal left and right sides.
- **Transverse (horizontal):** This transverse (horizontal) plane separates the body into upper (superior) and lower (inferior) planes, cutting “across” the body.

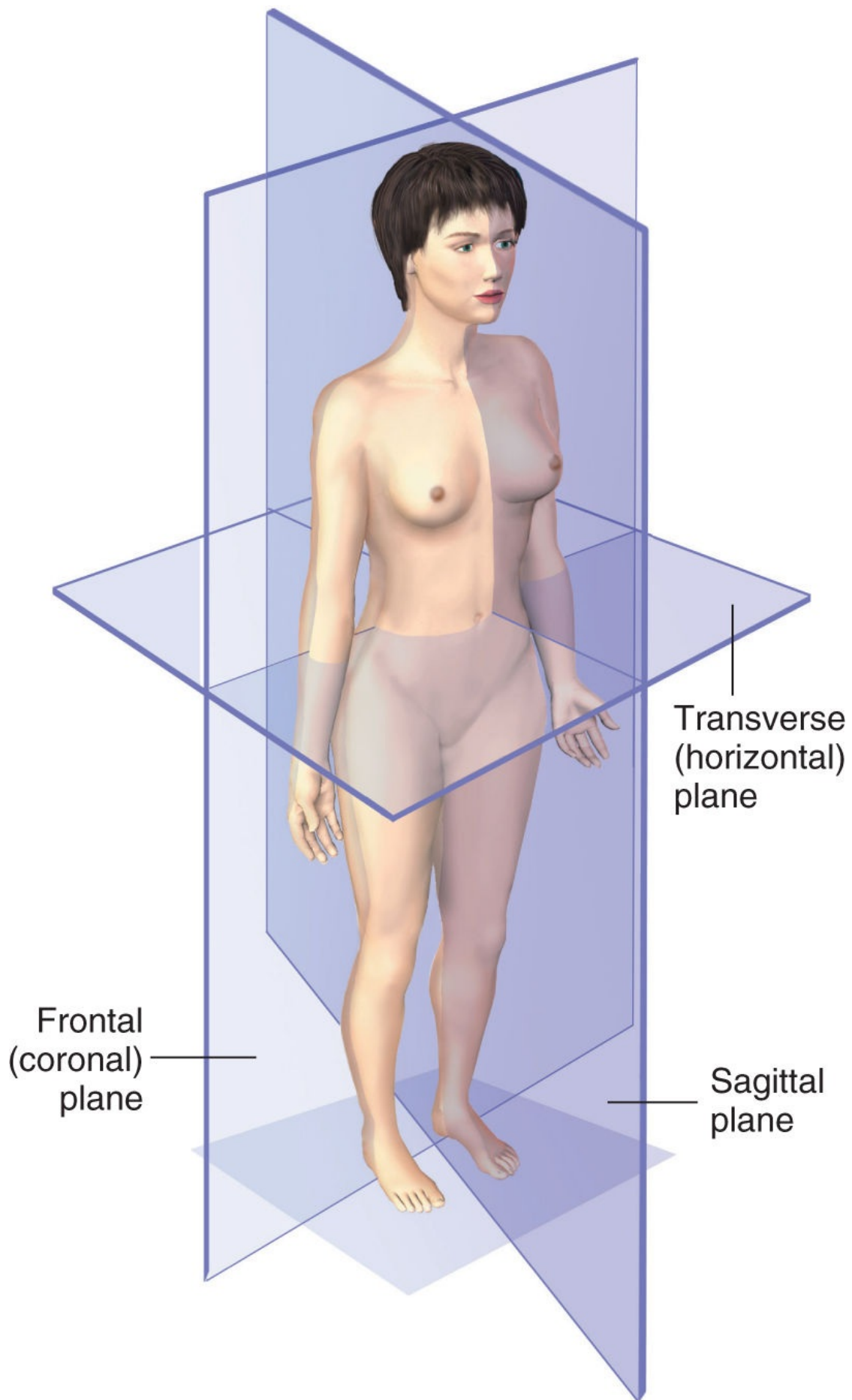


FIGURE 3-5 Body planes divide the body into halves in different ways for reference purposes.

Aren't some of these terms just plain English? Yes. Alert readers will have noticed that at least some of the adjectives identifying body planes are also present in contexts outside of medicine.

BODY CAVITIES AND DIVISIONS

A body cavity is defined as a hollow space that contains body organs. The body has several major cavities, including the cranial, spinal, thoracic, and abdominopelvic. The **cranial cavity** houses the brain, and the **spinal cavity** houses the spinal cord.

The **thoracic cavity** contains the lungs, whereas the **abdominopelvic cavity** contains digestive and reproductive organs. The abdominopelvic cavity is divided into a superior **abdominal cavity** and an inferior **pelvic cavity**. The diaphragm is the muscle of breathing known and it physically divides the thoracic and abdominopelvic cavities (see **Figure 3-6**).

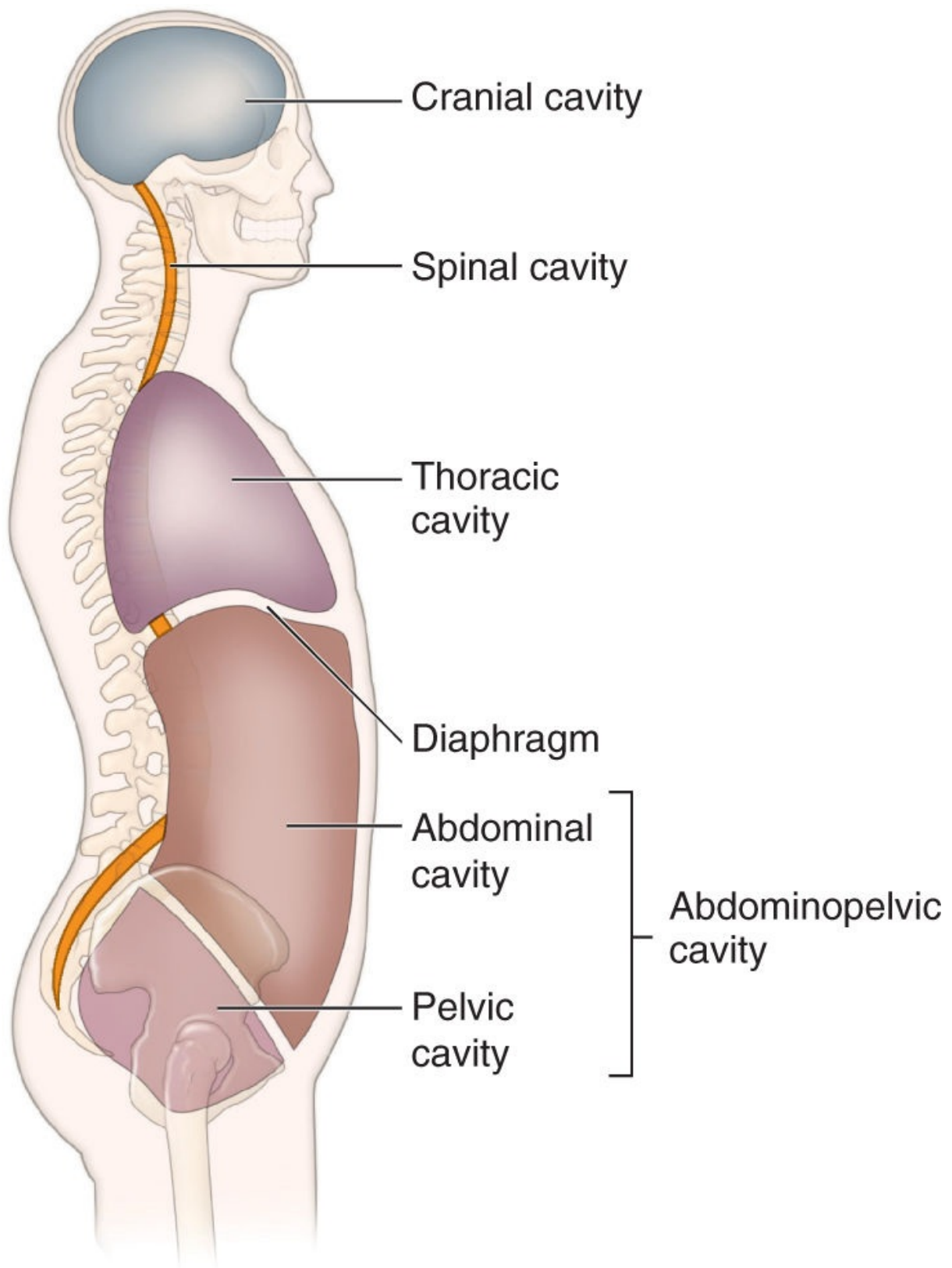
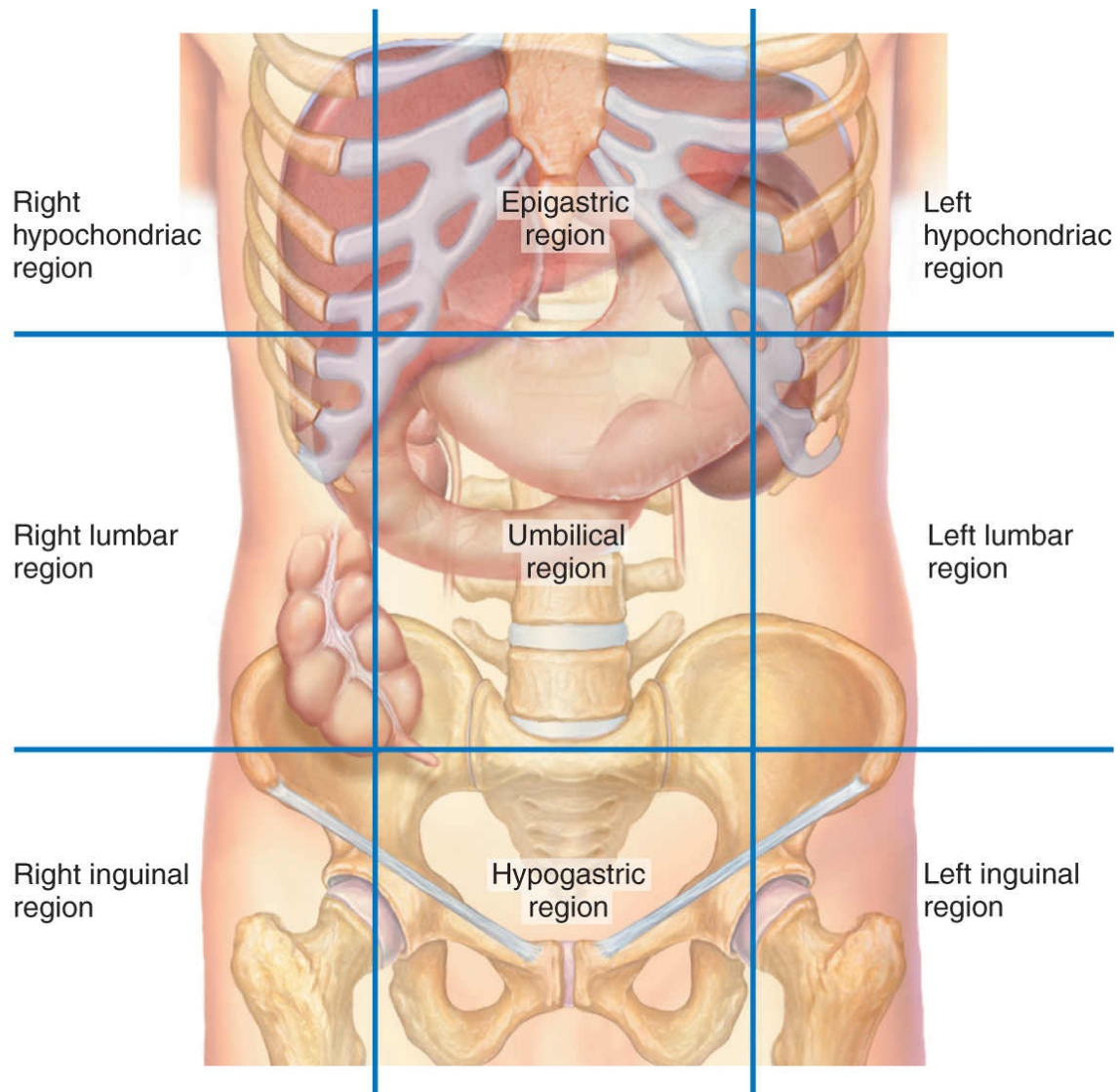


FIGURE 3-6 The major body cavities shown in lateral view.

Divisions of the Abdominopelvic Cavity

A person documenting a physical examination or a surgical procedure needs

to describe incisions, procedures, and location of organs. In order to do this effectively, the abdominopelvic cavity is divided into two different ways: either nine regions or four quadrants (see **Figure 3-7A, B**; **Tables 3-3** and **3-4**).



A

FIGURE 3-7 Abdominopelvic cavity. **A.** The nine regions of the abdominopelvic cavity.

TABLE 3-3 NINE REGIONS OF THE ABDOMEN

Region	Description
left hypochondriac region	left lateral region just below the ribs
left lumbar region	left lateral region in the middle row
left inguinal region	left lower region of the lower row by the groin
epigastric region	middle region in the upper row

umbilicus	middle region in the middle row
hypogastric region	middle section in the lower row
right hypochondriac region	right lateral region just below the ribs
right lumbar region	right lateral region in the middle row
right inguinal region	right lower region of the lower row by the groin

TABLE 3-4 FOUR QUADRANTS OF THE ABDOMEN

Term	Organs in Quadrant
right upper quadrant (RUQ)	right lobe of liver, gallbladder, portions of the pancreas, small intestines, and colon
left upper quadrant (LUQ)	left lobe of liver, spleen, stomach, portions of the pancreas, small intestines, and colon
right lower quadrant (RLQ)	contains portions of small intestine and colon, right ovary and uterine tube, appendix, and right ureter
left lower quadrant (LLQ)	contains portions of small intestine and colon, left ovary and uterine tube, and left ureter

Nine Regions

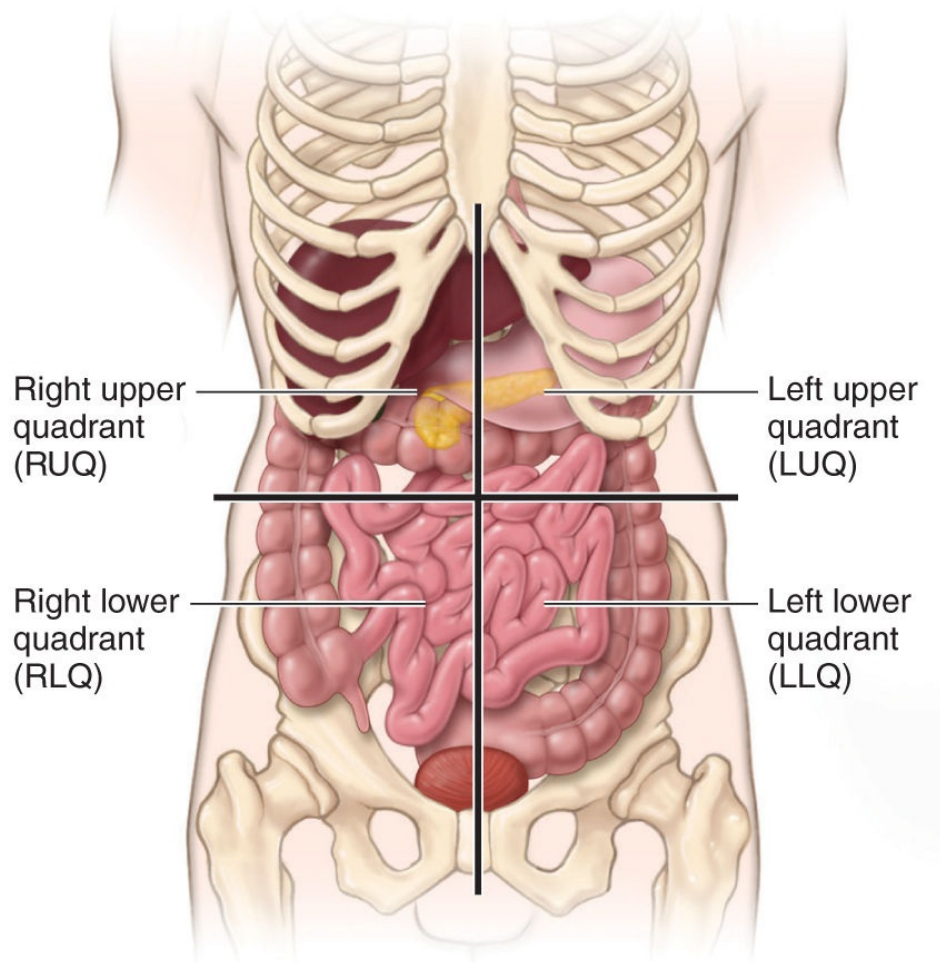
Regions are used to describe the location of underlying organs. Note that in the following list, the number in parentheses refers to two sides within the region, a left and a right, and counts as two regions (see [Figure 3-7A](#) and [Table 3-3](#)). The regions are named as follows:

- Hypochondriac (2): There are right and left hypochondriac regions. *Chondr-* means “cartilage,” and you will recall that the prefix *hypo-* means “below.” Hence, these areas are below the cartilage of the ribs on the left and right sides.
- Epigastric: This area is just superior to the stomach. *Epi-* is a prefix that means “beside” or “upon.” This area is above the stomach and is situated between the left and right hypochondriac regions.
- Lumbar (2): There are right and left lumbar regions. They are located at waist level on either side of the navel.
- Umbilical: If you look at the nine regions as a tic-tac-toe chart, the umbilical region is the middle section. It contains the umbilicus (navel).
- Hypogastric: This is the bottom square in the middle column of the tic-tac-toe chart, just inferior to the umbilical section.
- Inguinal (2): There are right and left inguinal regions. They lie on either side of the hypogastric section. Inguinal also refers to the “groin” area.

Doesn't the word hypochondriac have another definition? Yes, someone with imaginary pains is called a hypochondriac, and the reason for this usage came about because the left side hypochondriac region is roughly where a hypersensitive person might interpret any discomfort as a heart attack.

Four Quadrants

Four quadrants identify the abdomen (see **Figure 3-7B** and **Table 3-4**). The center point is the navel. The quadrants are abbreviated as follows: right upper quadrant (RUQ), left upper quadrant (LUQ), right lower quadrant (RLQ), and left lower quadrant (LLQ).



B

FIGURE 3-7 B. The four quadrants of the abdominopelvic cavity.
(continued)

Regions of the Spinal Column

The spinal column is a series of vertebrae that extend from the head to the coccyx. The five regions include the cervical (C), thoracic (T), lumbar (L), sacral (S), and coccyx (Co). They are labeled with a capital letter that corresponds to the name of the region (see [Figure 3-8](#); [Table 3-5](#)).

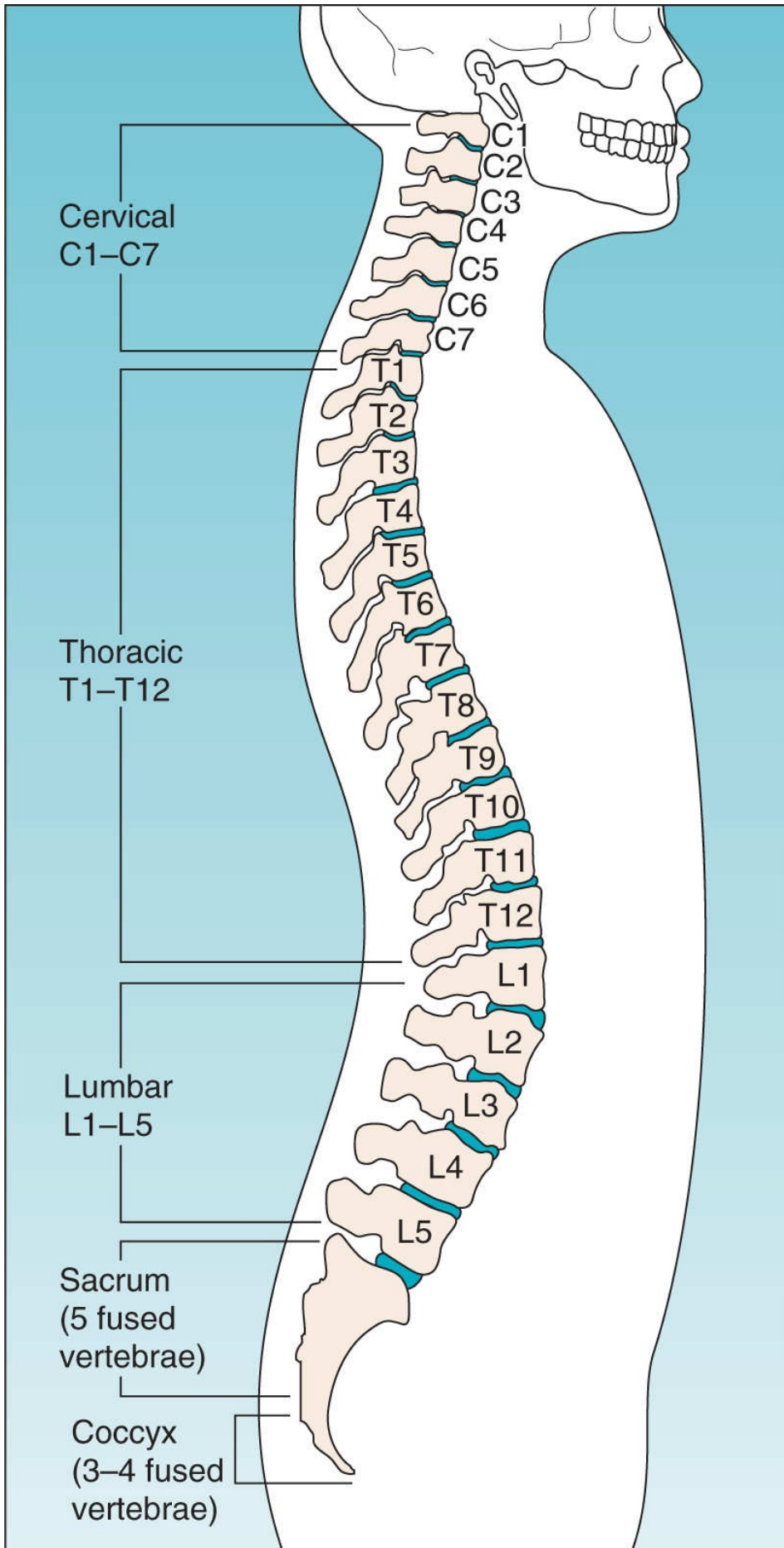


FIGURE 3-8 The regions of the spinal column show the locations of the vertebrae.

TABLE 3-5 REGIONS OF THE SPINAL COLUMN	
Region	Location
cervical	neck
thoracic	chest
lumbar	lower back below waist
sacral	lower back
coccyx	tailbone

The terms for each region describe a part of the back. The cervical section describes the cervix (meaning neck). The thoracic section describes the thorax (meaning chest), the lumbar section describes the lumbus (meaning loin, or part of the side and back between the ribs and the pelvis), the sacral region describes the sacrum (lower back), and the coccygeal region describes the coccyx (tailbone). It is important to recognize which word is the body part and which word is the adjective describing the region in which that body part is located.

Notice that lumbar is used to describe abdominopelvic regions and is also used to describe a section of the back. The lumbar is “the part of the back and sides between the ribs and the pelvis,” so it makes sense that it could be used to describe both of these divisions.

Abbreviation Table BODY ORGANIZATION

ABBREVIATION	MEANING
LLQ	left lower quadrant (of abdomen)
LUQ	left upper quadrant (of abdomen)
RLQ	right lower quadrant (of abdomen)

RUQ

right upper quadrant (of abdomen)

Study Table BODY POSITION AND DIRECTIONAL TERMS

TERM AND PRONUNCIATION	ANALYSIS	MEANING
anterior; ventral (an-TEER-ee-er; VEHN-trahl)	Latin word for former; from Latin word <i>venter</i> (belly)	toward the front of the body
posterior; dorsal (poss-TEE-ree-ohr; dawr-SUHL)	from the Latin word <i>posterus</i> (following); from the Latin word <i>dorsum</i> (back)	toward the back of the body
superior; cephalic (soo-PEER-ee-ohr; se-FAL-ik)	from the Latin word <i>superus</i> (above); from the Latin word <i>cephalicus</i> (head)	above; toward the head
inferior; caudal (ihn-FEER-ee-ohr; KAW-dul)	Latin word for lower; from the Latin word <i>cauda</i> (tail of an animal)	below; toward the feet
proximal (PROX-ih-mahl)	from the Latin word <i>proximus</i> (nearest)	near the point of attachment to the trunk
distal (DIS-tahl)	from the Latin word <i>distantem</i> (distant)	farther from the point of attachment to the trunk
lateral (LAT-eh-rah)	from the Latin word <i>lateralis</i> (lateral)	away from the middle
medial (MEE-dee-ahl)	from the Latin word <i>medialis</i> (middle)	toward the midline of the body
prone (PROWN)	from the Latin word <i>pronus</i> (bending down)	lying flat and face down
supine (soo-PAHYN)	from the Latin word <i>supinus</i> (bending backwards)	lying flat and face up

Study Table BODY CAVITIES AND DIVISIONS

TERM AND PRONUNCIATION	ANALYSIS	MEANING
cervical (SUR-vi-kuhl)	from the Latin word <i>cervix</i> (neck)	adjective for neck
cervix (SUR-viks)	Latin for neck	neck
coccygeal (kok-SIJ-ee-uhl)	from the Greek word <i>kokkyx</i> (cuckoo)	adjective for tailbone
coccyx (KOK-siks)	from the Greek word <i>kokkyx</i> (cuckoo) as it resembles the cuckoo's beak	the small bone at the end of the vertebral column; tailbone
epigastric (ep-i-GAS-trik)	<i>epi-</i> (on); from the Latin <i>gastricus</i> (stomach)	area superior to the stomach
hypochondriac (hy-poh-KON-dree-ak)	<i>hypo-</i> (below); from the Latin <i>chondriacus</i> (upper abdomen)	below the ribs; also used as a noun to refer to a person whose illnesses are imaginary
hypogastric (hy-poh-GAS-tric)	<i>hypo-</i> (below); from the Latin <i>gastricus</i> (stomach)	inferior to the stomach
inguinal (IN-gwin-uhl)	from the Latin word <i>inguinalis</i> (of the groin)	groin
lumbar (LUHM-bahr)	from the Latin word <i>lumbus</i> (loin)	adjective for lumbus
lumbus (LUHM-bus)	Latin for loin	area between the ribs and pelvis
sacral (SAY-krahl)	from Latin <i>os sacrum</i> (holy bone)	adjective for sacrum
sacrum (SAY-krum)	from Latin <i>os sacrum</i> (holy bone), as this was often the part of an animal that was offered as a sacrifice	five fused bones of the lower spinal column
thoracic (tho-RASS-ik)	from the Latin word <i>thorax</i> (breast)	adjective for chest
thorax (THOR-ax)	Latin word for breast or chest	chest
umbilicus (um-BILL-ih-kuhs)	Latin word for navel or center	navel, belly button

END-OF-CHAPTER EXERCISES

EXERCISE 3-1**MATCHING**

Insert the letter from the right-hand column that matches each numbered item in the left-hand column.

A. PLANES OF THE BODY

- | | |
|---------------------------|---|
| 1. _____ frontal plane | a. divides the body into upper and lower |
| 2. _____ sagittal plane | b. divides the body into left and right |
| 3. _____ transverse plane | c. divides the body into anterior and posterior |

B. DIRECTIONAL TERMS

- | | |
|--------------------|--|
| 1. _____ superior | a. lying flat and face up |
| 2. _____ lateral | b. near the point of attachment to the trunk |
| 3. _____ posterior | c. toward the front; away from the back of the body |
| 4. _____ medial | d. below; toward the soles of the feet |
| 5. _____ distal | e. lying flat and face down |
| 6. _____ prone | f. above; toward the head |
| 7. _____ supine | g. toward the side; away from the middle |
| 8. _____ inferior | h. near the back; toward the back of the body |
| 9. _____ anterior | i. farther from the point of attachment to the trunk |
| 10. _____ proximal | j. toward the middle of the body |

EXERCISE 3-2**FILL IN THE BLANK**

Select the correct word from the list to correctly complete the sentence.

anterior distal dorsal inferior lateral

medial posterior proximal superior ventral

1. The wrist is _____ to the elbow.
2. The shoulder is _____ to the wrist.
3. The lungs are _____ to the spinal cord.
4. The nose is _____ to the eyes.
5. The head is _____ to the neck.
6. The ears are _____ to the nose.
7. The shoulder blades are on the _____ side of the body.
8. The chin is _____ to the forehead.

EXERCISE 3-3



WORD BUILDING

Add the correct prefix or suffix to the word root to make a new term. Select from the following word parts: *-itis*, *-ic*, *-al*, *hypo-*, *hyper-*, *epi-*, and *trans-*. The first exercise is an example.

WORD ROOT	ADD PREFIX OR SUFFIX	MEANING	TERM
1. gastr/o	hypo- -ic	below the stomach	hypogastric
2. dors/o	_____	pertaining to the back	_____
3. chondr/o	_____	inflammation of the cartilage	_____
4. thorac/o	_____	across the chest or thorax	_____
5. neur/o	_____	inflammation of a nerve	_____
6. cardi/o	_____	pertaining to the region above or upon the heart	_____

EXERCISE 3-4**SHORT ANSWER**

Write the answers to the following questions.

1. What word describes the position of the ear in relation to the nose?

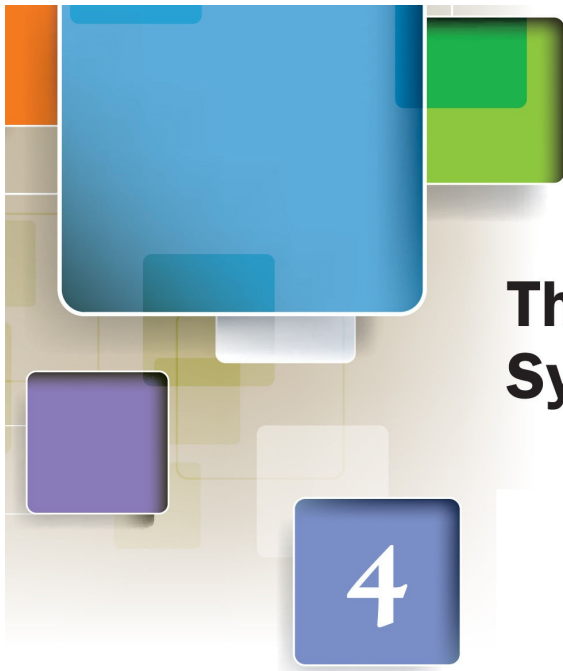
2. What does posterior mean? _____
3. What word describes the position of the elbow in relation to the wrist?

4. When the body is in the anatomic position, which direction are the palms of the hands facing? _____
5. What is a synonym for anterior? _____

EXERCISE 3-5**TRUE OR FALSE**

True or False? Circle the correct answer.

1. Prone is lying face up. TRUE FALSE
2. The left hypochondriac region is above the left lumbar region. TRUE FALSE
3. The little toe is medial to the big toe. TRUE FALSE
4. The diaphragm is a muscle. TRUE FALSE
5. There are five regions of the spinal column. TRUE FALSE
6. The sacrum is also called the tailbone. TRUE FALSE
7. The sagittal plane divides the body into right and left portions. TRUE FALSE
8. In the anatomic position, the body is horizontal. TRUE FALSE
9. The opposite of lateral is proximal. TRUE FALSE
10. The terms ventral and anterior both mean front. TRUE FALSE



The Integumentary System

LEARNING OUTCOMES

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

- Name the two main layers of the skin.
- Name the major structures and functions of the integumentary system.
- Pronounce, spell, and define medical terms related to the integumentary system and its disorders.
- Interpret abbreviations associated with the integumentary system.

INTRODUCTION

The largest organ of the body is the skin, which covers more than 20 square feet on average and weighs about 24 lb. It is the main part of the integumentary system, which also includes hair, nails, sebaceous (oil) glands, and sudoriferous (sweat) glands.

Integumentum is Latin for “covering” or “shelter”; thus, the skin, nails, and hair that cover our bodies are called, collectively, the **integumentary system**. The adjective relating to the skin specifically is **cutaneous**.

WORD PARTS RELATED TO THE INTEGUMENTARY SYSTEM

Word parts related to hair, skin, nails, and color are presented in **Table 4-1**. It’s a good idea to study those word parts, along with the others given in the table, before you go any further. That way, as you go through the text, you can

practice deciphering terms using context *and* etymology (study of a word's origin).

TABLE 4-1  **WORD PARTS RELATED TO THE INTEGUMENTARY SYSTEM**

Word Part	Meaning
adip/o	fat
cutane/o	skin
-cyte, cyt/o	cell
derm/o, dermat/o	skin
-oma	tumor
onych/o	nail
pil/o	hair
seb/o	sebum (oil; fat)
sudor-	sweat

WORD PART NAMING A COLOR, POSITION, OR OTHER FEATURE	MEANING
albin/o	white
cirrh/o	yellow
cyan/o	blue
epi-	upon

erythr/o	red
fer/o	to carry
ichthy/o	dry, scaly (fishlike)
jaund/o	yellow
kerat/o	horny tissue or cells
melan/o	black
myc/o	fungus
scler/o	hard
sub-	below
xanth/o	yellow
xer/o	dry

Word Parts Exercise

After studying Table 4-1, write the meaning of each of the word parts.

WORD PART	MEANING
1. dermat/o	1. _____
2. myc/o	2. _____
3. -cyte, cyt/o	3. _____

4. sudor-	4. _____
5. erythr/o	5. _____
6. xer/o	6. _____
7. fer/o	7. _____
8. sub-	8. _____
9. seb/o	9. _____
10. epi-	10. _____
11. albin/o	11. _____
12. cyan/o	12. _____
13. ichthy/o	13. _____
14. cutane/o	14. _____
15. kerat/o	15. _____
16. dermat/o	16. _____
17. onych/o	17. _____
18. melan/o	18. _____
19. pil/o	19. _____
20. scler/o	20. _____
21. cirrh/o, jaund/o, xanth/o	21. _____

STRUCTURE AND FUNCTION

The skin consists of two layers: the **epidermis** and **dermis**. A layer of connective tissue called the **hypodermis** or *subcutaneous layer* lies beneath (deep to) the dermis. Although the hypodermis is not, technically speaking, part of the integumentary system, it is mentioned in this chapter because it connects the dermis to the muscles and tissues beneath it. Also found that deep to the dermis is **adipose (fat) tissue** (see **Figure 4-1**).

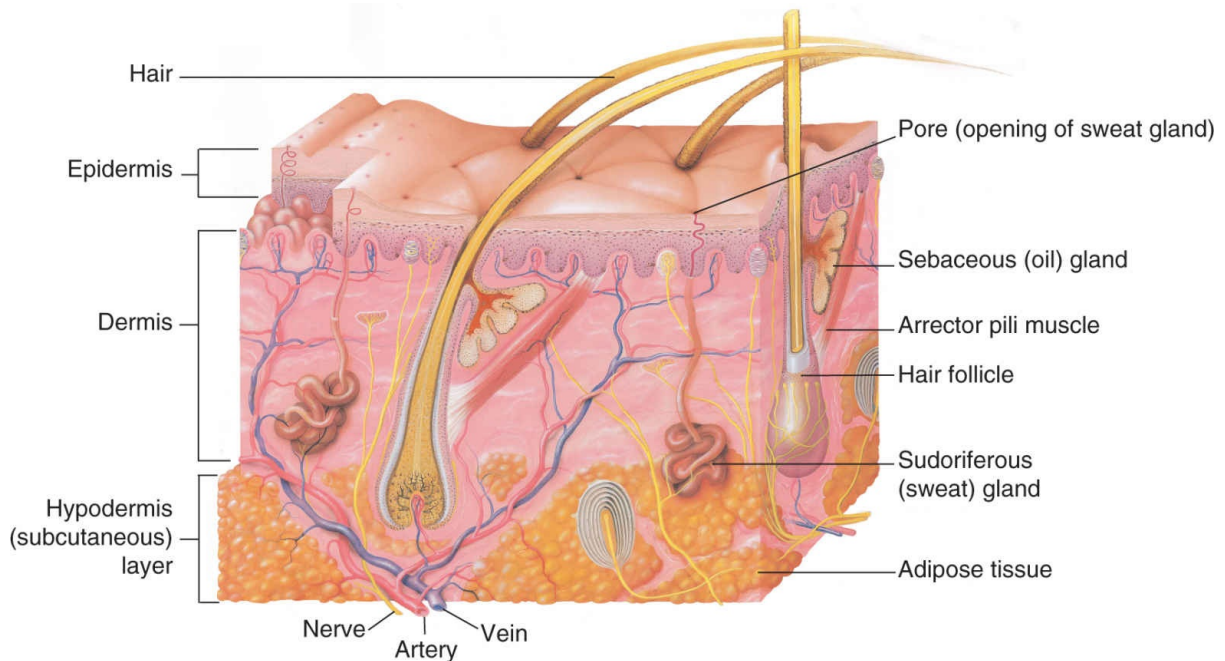


FIGURE 4-1 The layers of the skin with accessory structures.

The epidermis is the outside layer of skin. It is made up of epithelial tissue, which is also found in other parts of the body covering organs and body cavities. The epidermis protects the body from the outside world, a pretty big job for something only 0.05 mm thick on our eyelids to 1.5 mm thick on the palms of our hands and the soles of our feet. It does not contain blood vessels and is therefore said to be **avascular**, which is also a characteristic of epithelial tissue found elsewhere in the body.



Quick Check

Fill in the **Suffix**, and write the resulting word in the **Term** column. The word that appears in boldface type in the **Meaning** column is a clue.

PREFIX	ROOT	SUFFIX	TERM	MEANING
--------	------	--------	------	---------

sub-	cutane/o	_____	_____	adjective meaning “below the skin”
no prefix	melan/o	_____	_____	a pigment-producing cell
no prefix	seb/o	_____	_____	adjective referring to sebum, which may be described as an oil or fat

Unlike the epidermis, the dermis (sometimes also called the **corium**) contains blood vessels and nerves. So if you get a scratch that hurts and/or bleeds, you will know that you have injured the dermis. The dermis also contains accessory organs, including glands, hair, and nails.

The **sebaceous glands** secrete **sebum**, which is an oily fluid, onto the hair shaft. Sebum moves along the hair shaft toward the surface of the epidermis and lubricates both the skin and hair. The **sudoriferous glands** produce sweat, a watery fluid that evaporates to help cool the body. Sweat reaches the skin surface through an opening called a **pore**. These glands are found over most of the body but are most numerous in the palms of the hands, soles of the feet, forehead, and armpits.

Hair follicles produce the hair distributed over much of the body (see **Figure 4-1**). Hair fibers are composed of a hard protein called **keratin**. Bundles of smooth muscle fibers known as **arrector pili muscles**, pull the hairs erect, causing “goose bumps.” Like skin, hair color is determined by the pigment **melanin**, which is a brown–black pigment produced from special cells called **melanocytes**. These melanocytes surround the hair shaft. When a small quantity of melanin is present, the hair color will be light or blonde, and as the quantity of melanin increases, the hair darkens. Gray hair occurs as melanin production decreases with age. In addition to providing color, melanin also protects the skin against ultraviolet (UV) radiation or sunlight.

Like hair, **nails** are also composed of the protein keratin. The **free edge** is the portion of the nail that grows beyond the tips of the fingers or toes. The **lunula** (a Latin word meaning “little moon”) is the whitish crescent region of the nail. The **cuticle** is the thin band of tissue that seals the nail to the skin (see **Figure 4-2**).

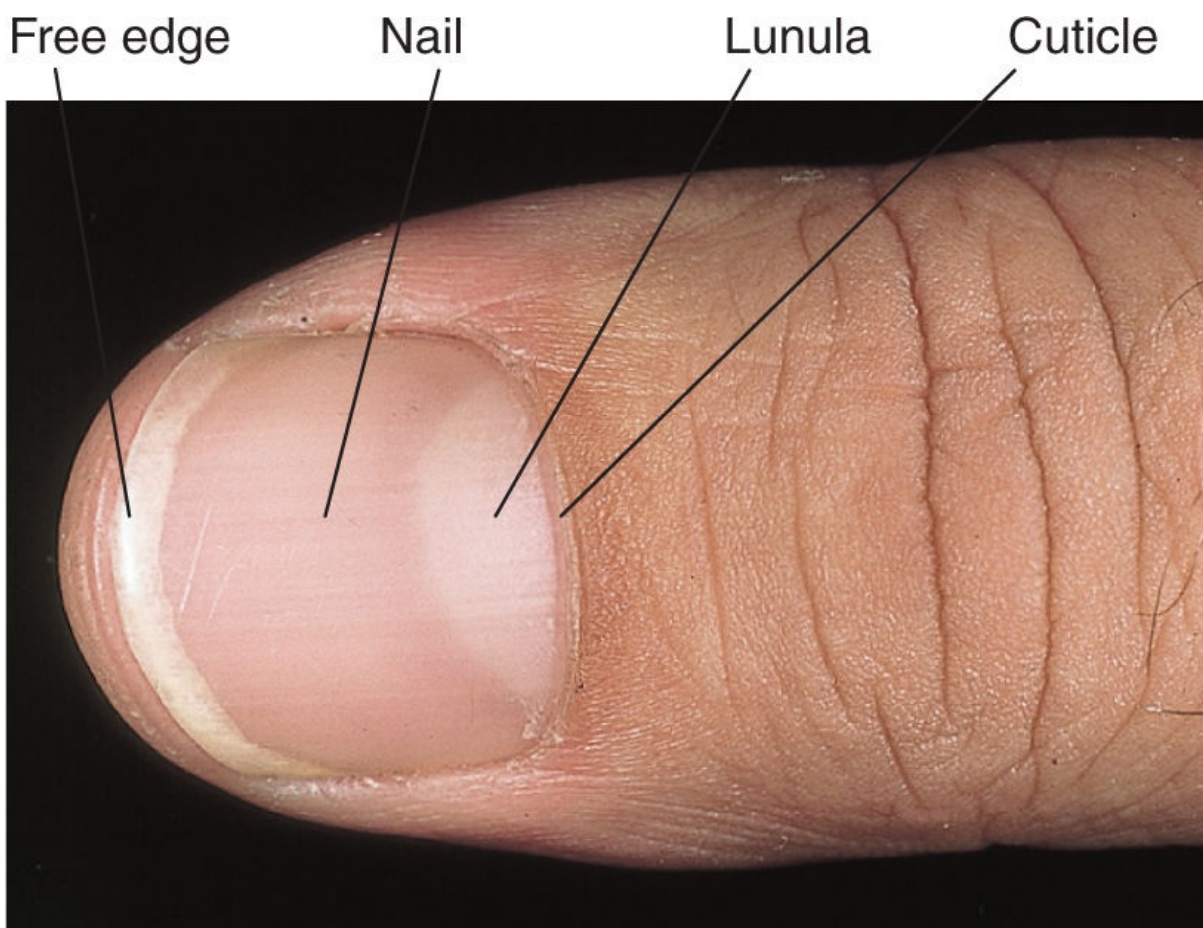


FIGURE 4-2 Surface view of a nail.

DISORDERS RELATED TO THE INTEGUMENTARY SYSTEM

Because the skin is visible in its entirety, diagnosing some of its abnormalities is relatively uncomplicated. Moreover, the skin can sometimes provide clues to underlying bodily disorders, which may be signaled by changes in color, by the development of **lesions** (a vague term meaning a wounds or injuries), or by the appearance of other skin rashes.

Burns

A burn is an injury to the skin caused by heat from any source. The severity of a burn is classified by the depth of the layers of skin involved (see **Table 4-2**). The body surface area (BSA) is used to express the extent of skin damage.

TABLE 4-2 CLASSIFICATION OF BURNS

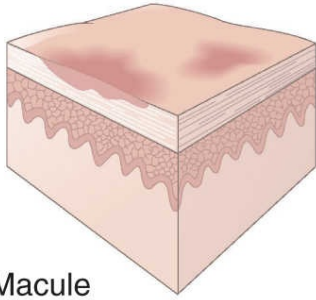
Burn Type	Skin Layers Involved
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first degree	erythema (redness); superficial damage to epidermis; no blisters
second degree	blisters; erythema
third degree	charring; damage to the epidermis, dermis, hypodermis, muscle, and bone

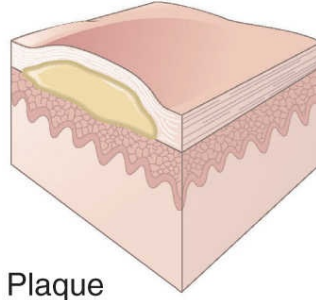
Skin Lesions

A lesion may have many different causes and appearances. They may be flat, elevated, or depressed, and each variation has its own medical term (see **Figure 4-3**).

Flat

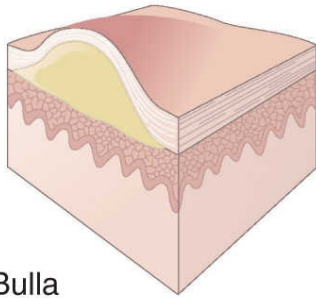


Macule

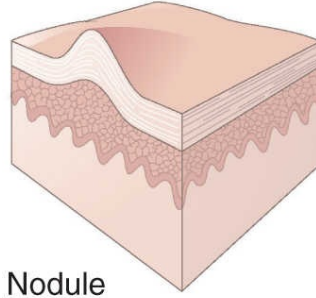


Plaque

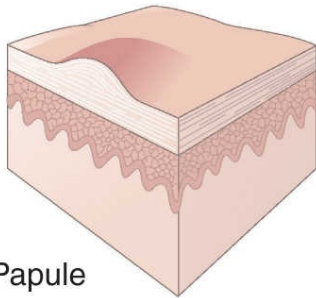
Elevated



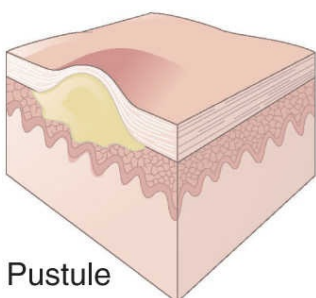
Bulla



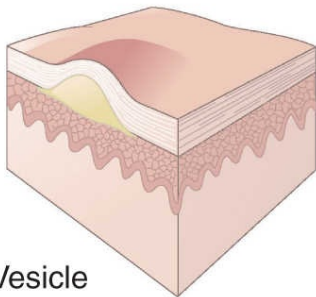
Nodule



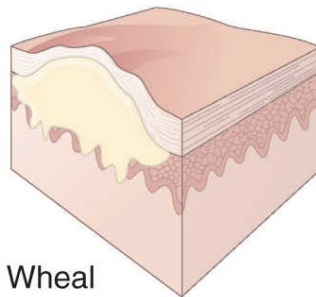
Papule



Pustule

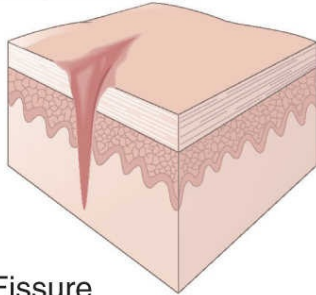


Vesicle

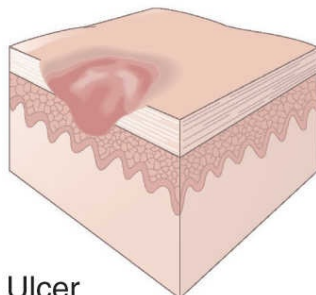


Wheal

Depressed



Fissure



Ulcer

FIGURE 4-3 Illustrations of some of the more common skin lesions.

Flat lesions:

- **Macule:** Flat, colored spot <1 cm in diameter. A freckle is an example
- **Plaque:** Flat or lightly raised lesion more than 1 cm in diameter

Elevated lesions:

- **Bulla:** Raised, fluid-filled lesion or blister >1 cm in diameter
- **Nodule:** Solid, raised lesion larger than a papule, 0.6 to 2 cm in diameter
- **Papule:** Small, circular, solid elevation of the skin <1 cm in diameter. Warts and pimples are examples
- **Pustule:** Small, circular, pus-filled elevation of the skin, usually <1 cm in diameter
- **Vesicle:** Small, circular, fluid-filled elevation of the skin <1 cm in diameter
- **Wheal:** Smooth, rounded, slightly raised area often associated with itching

Depressed lesions:

- **Fissure:** Crack or break in the skin; a slit of any size
- **Ulcer:** An open sore or crater that extends to the dermis resulting from destruction of the skin

Inflammatory Disorders

Many skin disorders are characterized by inflammation. Inflammation of the skin known as **contact dermatitis** can be caused by exposure to an allergen or by direct contact with a chemical or plant. Poison ivy, for example, may be the diagnosis if the skin is red (**erythematous**), is covered with tiny vesicles, and is itchy. The word **pruritus** is a synonym for itchy. It comes from the Latin verb *prurio*, which means “to itch.” There is no corresponding root, although two other terms come from this same verb. They are **pruritic** (relating to pruritus) and **prurigo** (a chronic skin disease marked by a persistent eruption of papules that itch intensely).

Eczema is the generic term for inflammation of the skin (see **Figure 4-4**). **Psoriasis** is an inherited inflammatory condition of the skin (see **Figure 4-5**). Neither of these terms is derived from actual roots, although the suffix *-iasis*

is a common one that, as you may recall from Chapter 2, means condition. **Scleroderma**, as its etymology indicates, is taut, thick, leather-like skin.



FIGURE 4-4 Eczema.

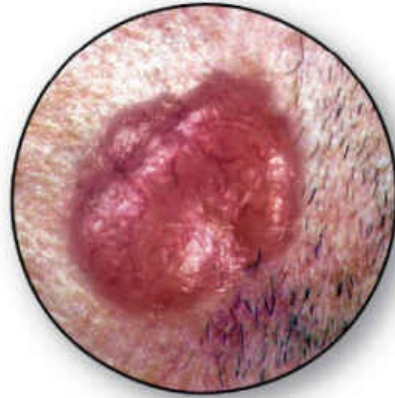
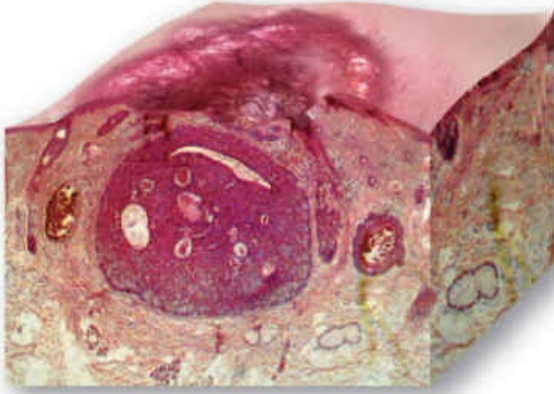


FIGURE 4-5 Psoriasis.

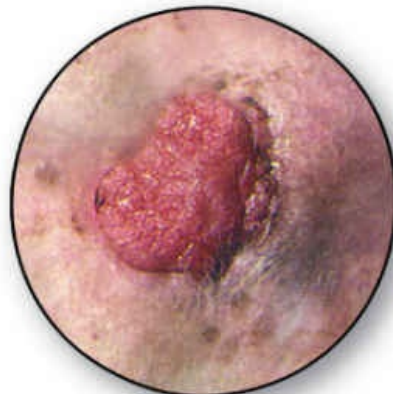
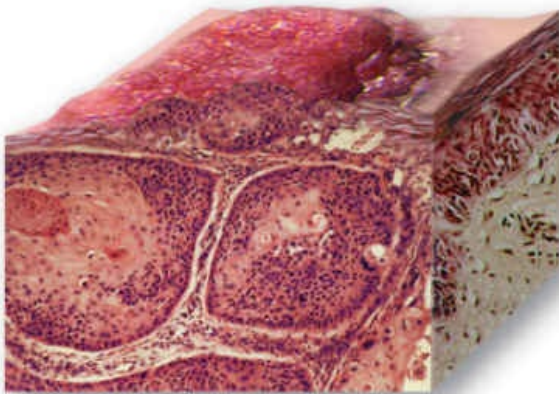
Skin Cancer

Three types of **malignant** (spreading) skin cancers are *basal cell carcinoma*, *squamous cell carcinoma*, and *malignant melanoma* (see **Figure 4-6**). The term, *malignant*, comes from the Latin *malignans*, meaning malicious, and is used to describe an invasive, destructive type of cancer. The suffix *-oma* means tumor. Carcinoma is a cancer derived from epithelial cells and is the

most commonly occurring type of cancer. The word carcinoma comes from the Greek words *karkinos* (cancer) and *-oma*. **Malignant melanoma** (also called **melanoma**) is a serious form of skin cancer. Cancer can also be **benign** (nonspreading). *Benign* comes from the Latin *benignus* (kind) and means the cancer is nonmalignant.



Basal cell carcinoma, the most common skin cancer, begins as a papule, enlarges, and develops a central crater. This crater usually only spreads locally.



Squamous cell carcinoma begins as a firm, red nodule or scaly, crusted flat lesion. If not treated, this cancer can spread.



Malignant melanoma can arise on normal skin or from an existing mole. If not treated promptly, it can spread downward into other areas of the skin, lymph nodes, or internal organs.

FIGURE 4-6 Three types of skin cancer.

Skin Infections

Skin is our protective barrier. When it breaks down, bacteria, viruses, fungi, and parasites have an opportunity to invade our bodies. Many infections, however, can be more annoying than they are serious. The following are examples.

- **Impetigo:** caused by bacteria (*Staphylococcus aureus*) (see **Figure 4-7**)

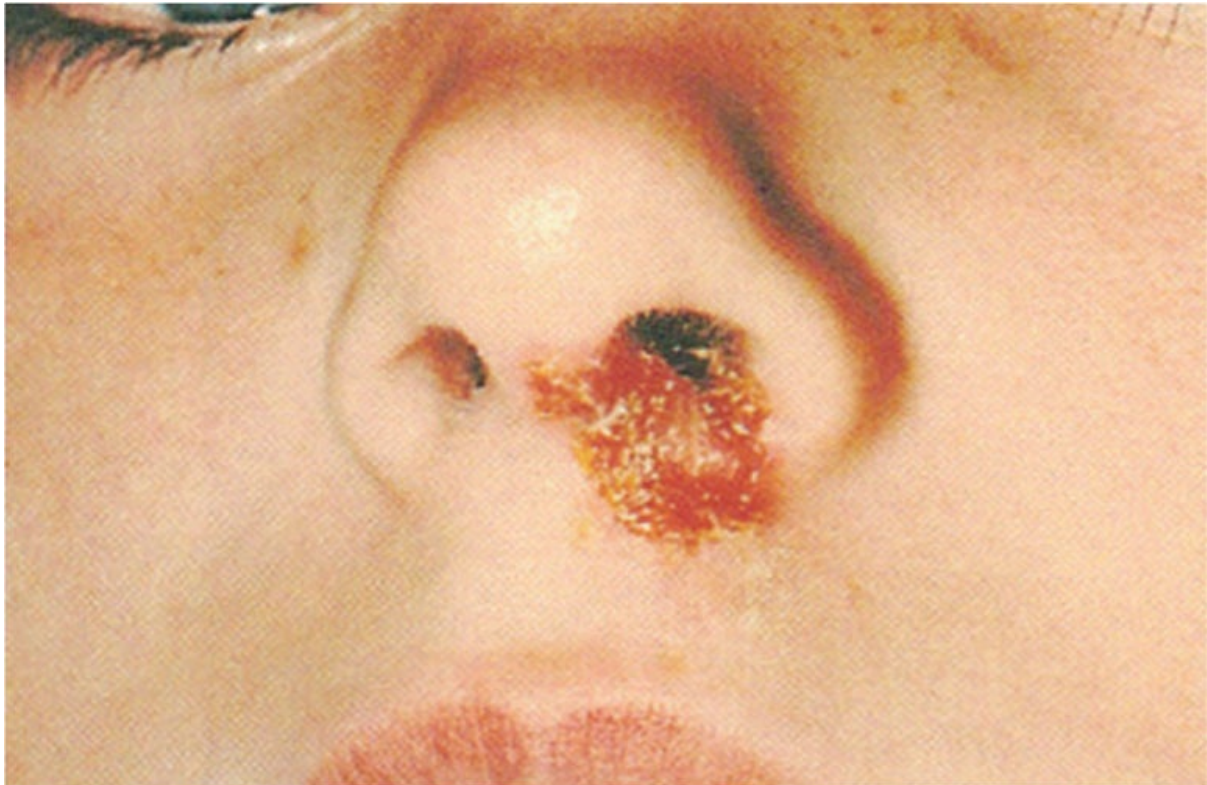


FIGURE 4-7 Impetigo.

- **Scabies:** caused by an egg-laying mite (see **Figure 4-8**)



FIGURE 4-8 Scabies.

- **Tinea:** caused by a fungus (see **Figure 4-9**)



FIGURE 4-9 Tinea (ringworm).

- **Shingles (herpes zoster):** caused by a virus; symptoms include pain and a vesicular rash that develops along the path of a nerve (see **Figure 4-10**)



FIGURE 4-10 Shingles (herpes zoster).

Other Skin Disorders

Some skin and nail disorders fail to fit previously mentioned categories. They include **decubitus** (from a Latin verb that means “to lie down”) **ulcers**, also known as *bedsores*; **acne**, a disease of the sebaceous glands common in teens and young adults; **vitiligo**, depigmented blotches or macules that appear on the skin (see **Figure 4-11**); and **paronychia**, an infection of the skin around the nails (see **Figure 4-12**).

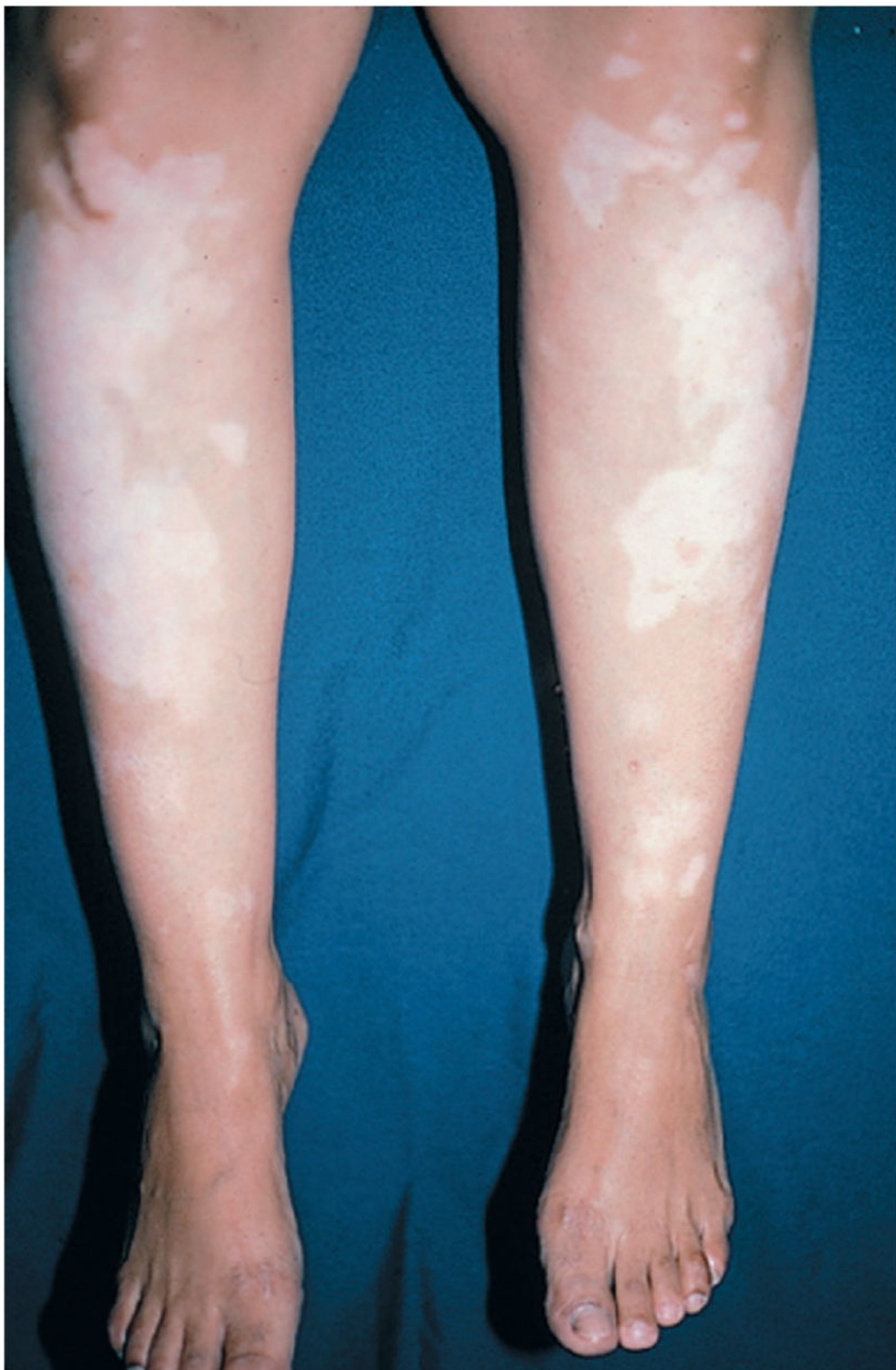


FIGURE 4-11 Vitiligo.



FIGURE 4-12 Paronychia.

Alopecia is the technical term for baldness. It is not formed from a standard root, although the *-ia* suffix is standard. Other skin conditions include **erythema** (redness) and **ichthyosis** (dryness and scaling of skin that resembles a fish), both of which are formed from standard Greek roots and suffixes. Edema, if you recall from Chapter 2, comes from a Greek word that means *swelling*. It is a standard medical term referring to swelling that occurs anywhere in the body.

DIAGNOSTIC TESTS, TREATMENTS, AND SURGICAL PROCEDURES

Surgical procedures may be performed on the integumentary system for diagnosis or treatment of abnormal conditions. These procedures may include a **biopsy**, which involves the surgical removal of a small piece of skin for examination, or cryogenic surgery, also called **cryosurgery** or **cryotherapy**. The root *cry/o-* comes from the Greek word *kryos* meaning “cold.” In medicine, cryogenic techniques are commonly used to destroy abnormal tissues such as warts, moles, and tumors. Cryogenic surgery often involves the use of liquid nitrogen, which evaporates, or “boils,” at -321°F .

In the case of burns and some ulcerated areas, dead tissue prevents new,

healthy tissue from growing. In such cases, a surgical procedure known as **debridement** may be used to remove dead tissue. Once again, the standard word parts you learned are absent from this term, which comes from a French adverb meaning “unbridled.” That French word describes the purpose of debridement, which is to “unbridle” the body of dead tissue so that new, healthy tissue will be free to replace it.

Nonsurgical treatments include medications applied to the surface of the skin. The term often used to identify this type of treatment is “topical,” meaning on top of the skin.

Doesn't topical mean “relating to a particular topic,” such as a topic in the news? Occasionally, the meaning of an English word changes when a segment of the population begins using it to mean something other than its traditional meaning. The word *topical* is such a word. However, its “medical” meaning most likely came first, given that its medical use dates back to the 17th century. Still, dictionaries include the notation *medical* alongside it, probably because English speakers may do a mental double take when encountering its medical use for the first time. Medical terms that fall into this category are identified throughout this book so that, as a medical professional, you will be aware of the possible confusion their use may cause, especially among patients.

Classifications of topical medications are listed as follows:

- **Antibiotics** are used to prevent bacterial infection
- **Antifungals** are used to kill fungi
- **Antipruritics** are used to relieve itching
- **Antiseptics** are used to kill or inhibit bacteria
- **Scabicides** are used to kill scabies mites

Other treatments may include oral or injected medication. An example of an oral medication is a steroid, such as prednisone, which is used to treat many inflammatory skin conditions. Medicines that treat inflammation are called **anti-inflammatory**. Some medications can be given in a **transdermal** manner, which is a method of administering medication through unbroken skin by a patch or ointment.

Surgical options include **dermatoplasty** (plastic surgery repair for the skin), and **incision and drainage (I&D)** that involves cutting a wound open and allowing it to drain.

Nail treatments include **onychectomy**, the surgical removal of a nail, and **onychotomy**, an incision into a nail.

An antipruritic is used to relieve itching. Another medication that is easily confused with this is an antipyretic, which is used to reduce fever. Antipruritic and antipyretic are easy to mix up, but have very different purposes.

PRACTICE AND PRACTITIONERS

The physician who specializes in the diagnosis and treatment of skin disorders is called a **dermatologist** (dermato + log + ist). The study of the skin and its related conditions is called **dermatology** (dermato + logy).

Abbreviation Table THE INTEGUMENTARY SYSTEM

ABBREVIATION	MEANING
BSA	body surface area
I&D	incision and drainage
SLE	systemic lupus erythematosus
UV	ultraviolet

Study Table THE INTEGUMENTARY SYSTEM

TERM AND PRONUNCIATION	ANALYSIS	MEANING
Structure and Function		
adipose tissue (AD-ih-pohs TISH-yoo)	from the Latin word <i>adeps</i> (fat)	fatty tissue
arrector pili muscles (uh-REK-tor PYE-lye MUS-elz)	from the Latin meaning “that which raises” + <i>pilus</i> (hair) + <i>musculus</i> (muscle)	bundles of smooth muscle fibers attached to hair follicles that cause the hairs to stand on end causing characteristic “goose bumps”
avascular (ay-VAS-kyuh-lahr)	<i>a-</i> (without); from the Latin word <i>vasculum</i> (small vessel)	without blood vessels
corium (KO-ree-uhm)	Latin for skin	synonym for dermis
cutaneous (cue-TAYN-ee-uhs)	from the Latin word <i>cutis</i> (skin)	adjective referring to the skin
cuticle (CUE-tih-kuhl)	from the Latin word <i>cutis</i> (skin)	the thin band of tissue that seals the nail to the skin
dermis (DUR-mis)	from the Greek word <i>derma</i> (skin)	inner layer of skin

epidermis (ep-ih-DUR-mis)	<i>epi-</i> (upon); <i>dermis</i> (skin)	outer layer of the skin
free edge (FREE EJ)	from German <i>frei</i> (free)	distal region at which the nail ends
hair follicles (HAIR FAWL-ik-uhlz)	from the Latin word <i>folliculus</i> (a small sac)	small sacs in the skin from which hair grows
hypodermis (high-poh-DER-mis)	from the Greek word <i>hypo</i> (under); <i>dermis</i> (skin)	layer immediately beneath the epidermis; also called the subcutaneous layer
integumentary system (in-teg-yoo-MEN-tuh-ree SIS-tem)	from the Latin word <i>integumentum</i> (a covering)	the membrane covering the body, including the epidermis, dermis, hair, nails, and glands
keratin (KERR-uh-tin)	from the Greek word <i>keras</i> (horn)	protein that forms hair, nails, and the tough outer layer of skin
lunula (LOO-new-luh)	from the Latin word <i>luna</i> (moon)	white, crescent-shaped area of a nail
melanin (MEL-uh-nihn)	from the Greek word <i>melas</i> (black)	dark pigment present in skin and other parts of the body
melanocytes (muh-LAN-uh-sites)	from the Greek word <i>melas</i> (black); <i>-cyte</i> (cell)	cells that produce melanin
nail (NAILS)	from Old English <i>naegel</i> (nail)	translucent plates covering the distal ends of the fingers and toes
pore (POR)	from the Greek word <i>poros</i> (passageway)	an opening
sebaceous glands (se-BAY-shus GLANDZ)	from the Latin word <i>sebum</i> (tallow and by extension, grease, oil, fat)	oil-producing glands
sebum (SEE-bum)	Latin for tallow or grease	oily secretion
subcutaneous (sub-ku-TAY-nee-us)	<i>sub-</i> (beneath); <i>cutane</i> (skin); <i>-ous</i> (adjective suffix)	beneath the skin
sudoriferous glands (soo-doe-RIFF-uh-russ GLANDZ)	from two Latin words: <i>sudor</i> (sweat) and <i>fero</i> (to carry)	sweat-producing glands
Disorders		
abscess (AB-sehs)	from the Latin word <i>abscessus</i> (a going away)	localized collection of pus in any body part; frequently associated with swelling and inflammation
	from modern Latin from Greek <i>aknas</i> , a	inflammatory papular and pustular eruption of the

acne (ak-nee)	misreading of <i>akmas</i> (highest point or peak)	skin
albinism (al-BY-nih-zum)	from the Latin word <i>albus</i> (white) and <i>-ism</i> (condition)	partial or total absence of pigment of the skin, hair, and eyes
alopecia (al-oh-PEE-shee-uh)	from the Greek word <i>alopekia</i> (literally, fox mange)	partial or complete loss of hair; baldness
benign (buh-NINE)	from the Latin word <i>benignus</i> (kind)	nonmalignant type of tumor
bullae (BUHL-uh)	Latin for bubble	raised, fluid-filled lesion >1 cm in diameter
carcinoma (kahr-suh-NOH-muh)	from the Greek words <i>karkinos</i> (cancer) and <i>-oma</i> (tumor)	malignant neoplasm derived from epithelial cells
comedo (KOM-eh-do)	Latin for glutton	blackhead; dilated hair follicle filled with bacteria; primary lesion in acne
contact dermatitis (KON-takt dur-muh-TY-tiss)	<i>dermat/o</i> (skin); <i>-itis</i> (inflammation)	inflammation of the skin
cyanosis (SY-uh-no-siss)	<i>cyan/o</i> (blue); <i>-osis</i> (abnormal condition)	abnormal condition signaled by bluish discoloration of tissue
cyst (sist)	from the Greek word <i>kystis</i> (bladder)	closed sac or pouch in or under the skin that contains fluid or solid material
decubitus ulcers (dih-KYOO-bi-tuhs UHL-serz)	from the Latin word <i>decumbere</i> (to lie down); from the Latin word <i>ulcus</i> (sore)	chronic ulcers that appear in pressure areas over a bony prominence in immobilized patients
dermatomycosis (DUR-matt-oh-MI-ko-sis)	<i>dermat/o</i> (skin); <i>myc/o</i> (fungus); <i>-osis</i> (abnormal condition)	fungal infection of the skin
diaphoresis (dy-ah-for-EE-sis)	Greek for perspiration	synonym for perspiration
ecchymosis (ek-ee-MOH-sis)	<i>ec-</i> (out); from <i>chymos</i> (Greek word for juice); <i>-osis</i> (abnormal condition)	a purple patch more than 3 mm in diameter caused by blood under the skin; see also petechiae
eczema (EK-zee-ma)	from the Greek word <i>eczeo</i> (boil over)	inflammatory condition of the skin characterized by erythema (redness), vesicles, and crusting with scales
epidermitis (epp-ih-dur-MY-tiss)	<i>epi-</i> (upon); <i>-dermis</i> (skin); <i>-itis</i> (inflammation)	inflammation of the epidermis
erythema (ehr-ih-THEE-ma)	Greek for flush	abnormal redness of the skin
erythematous (err-ih-		

THEE-muh-tus)	from the Greek word <i>erythema</i> (flush)	relating to or marked by erythema
excoriation (ex-COR-ee-ay-shun)	from the Latin verb <i>excorio</i> (to skin)	scratch mark; linear break (caused most often from scratching) in the skin surface
fissure (FISH-er)	from the Latin word <i>fissura</i> (cleft)	a break in the skin
hemangioma (heeman-jee-OH-ma)	<i>hem/o</i> (blood); <i>angi/o</i> (vessel); <i>-oma</i> (tumor)	benign tumor of blood vessels; birthmark
herpes zoster (HER-peeZ ZAHS-tuhr)	from the Greek word <i>herpo</i> (to creep)	viral infection producing the eruption of highly painful vesicles that may follow a nerve path; also called <i>shingles</i>
hyperhidrosis (hyper-HY-droh-sis)	<i>hyper-</i> (above normal); <i>hidr</i> (sweat); <i>-osis</i> (condition)	profuse sweating; increased or excessive perspiration; may be caused by heat, menopause, or infection
ichthyosis (ik-thee-OH-sis)	<i>ichthy/o</i> (fishlike); <i>-osis</i> (abnormal condition)	abnormally dry skin; scaly; resembling fish skin
impetigo (im-peh-TYE-goh)	from the Latin verb <i>impeto</i> (attack)	inflammatory skin disease with pustules that rupture and become crusted
keloid (KEE-loid)	from the Greek word <i>kelis</i> (tumor) and <i>-oid</i> (like)	overgrowth of scar tissue
lesions (LEE-zhunz)	from the Latin verb <i>laedo</i> (to injure)	wound, injury, or pathologic change in body tissue
macule (MAK-yul)	from the Latin word <i>macula</i> (spot)	flat, discolored area that is flush with the skin; birthmark or freckle
malignant (muh-LIG-nuhnt)	from the Latin word <i>malignans</i> (malicious)	locally invasive and destructive growth
malignant melanoma (muh-LIG-nuhnt (mel-uh-NO-muh)	from the Latin word <i>malignans</i> (malicious) + <i>melan/o</i> (black); <i>-oma</i> (tumor)	tumor of the melanocytes; skin cancer characterized by dark-pigmented, irregular-shaped lesion; another name for <i>melanoma</i>
melanoma (mel-uh-NO-muh)	<i>melan/o</i> (black); <i>-oma</i> (tumor)	tumor of the melanocytes; skin cancer characterized by dark-pigmented, irregular-shaped lesion; another name for <i>malignant melanoma</i>
nevus (NEE-vuhs)	Latin for birthmark	mole; pigmented skin blemish that is usually benign but may become cancerous
nodule (NOD-yul)	from the Latin word <i>nodus</i> (knot)	a small node or circumscribed swelling
onychomalacia (ON-ih-ko-muh-LAY-shee-uh)	<i>onych/o</i> (nail); <i>-malacia</i> (softening)	softening of the nails

onychopathy (on-ih-KOP-uh-thee)	<i>onych/o</i> (nail); <i>-pathy</i> (disease)	any disease of the nails
papule (pap-yul)	from the Latin word <i>papula</i> (pimple)	small, circumscribed solid elevation of the skin
paronychia (pahr-oh-NIK-ee-uh)	<i>para-</i> (alongside); <i>onych/o</i> (nail); <i>-ia</i> (condition)	infection around a nail
petechiae (peh-TEE-kee-ee)	from the Italian word <i>petecchia</i> (small hemorrhagic spots)	tiny hemorrhagic spots on the skin <3 mm in diameter; see also ecchymosis
plaque (PLAK)	from the French from the Dutch word <i>plak</i> (plate)	flat or slightly raised lesion >1 cm in diameter
polyp (PAHL-ip)	from the Latin word <i>polypus</i> (a growth on a stem)	a mass of tissue that bulges outward from the skin's surface on a stem or stalk of mucous membrane
prurigo (proo-RYE-goh)	from the Latin verb <i>prurio</i> (to itch)	a chronic disease of the skin marked by a persistent eruption of papules that itch intensely
pruritic (proo-RIT-ik)	from the Latin verb <i>prurio</i> (to itch)	relating to pruritus (itching)
pruritus (pru-RYE-tis)	from the Latin verb <i>prurio</i> (to itch)	itching
psoriasis (soh-RYE-ih-sis)	Greek for being itchy	chronic skin disease characterized by itchy, red, silvery-scaled patches
pustule (PUST-yul)	from the Latin word <i>pustula</i> (pimple)	small (up to 1 cm in diameter) circumscribed elevation of the skin containing pus
scabies (SKAY-beez)	from the Latin verb <i>scabo</i> (to scratch)	contagious infection caused by a mite
scleroderma (sklehr-oh-DER-muh)	<i>scler/o</i> (hardness); <i>-derma</i> (skin)	chronic disease characterized by thickening and hardening of the skin
shingles (SHING-elz)	from the Latin word <i>cingulum</i> (girdle)	viral infection producing the eruption of highly painful vesicles that may follow a nerve path; another name for <i>herpes zoster</i>
systemic lupus erythematosus (SLE) (sis-TEM-ik LOO-pus err-ih-THEE-muh-tus)	from the Latin word <i>lupus</i> (wolf)	inflammatory disease characterized by scaly red patches on the skin, especially the face, and affecting connective tissue in organs
tinea (TIN-ee-uh)	Latin for worm	any fungal infection of the skin (tinea barbae = beard; tinea capitis = head; tinea pedis = athlete's foot)
ulcer (UL-ser)	from the Latin word <i>ulcus</i> (a sore)	an open sore or lesion of the skin; a lesion through the skin or a mucous membrane resulting from

		loss of tissue
urticaria (ur-tih-KAR-ee-uh)	from the Latin word <i>uro</i> (to burn)	hives; allergic reaction of the skin characterized by eruption of pale red elevated patches
verruca (ve-ROO-kuh)	Latin for wart	wart; caused by a virus
vesicle (VES-ih-kal)	from the Latin word <i>vesicula</i> (blister)	small, fluid-filled, raised lesion; a blister
vitiligo (vit-il-EYE-go)	from the Latin word <i>vitium</i> (blemish)	localized loss of skin pigmentation characterized by milk-white patches
wheel (WHEEL)	from the Old English verb <i>hwelian</i> (to form pus)	smooth, rounded, slightly elevated area often associated with itching
Diagnostic Tests, Treatments, and Surgical Procedures		
antibiotics (an-tee-BYE-ah-tiks)	<i>anti-</i> (against); <i>biotic</i> (organism)	agents that kill bacteria
antifungals (an-tee-FUNG-ulz)	<i>anti-</i> (against); <i>fungal</i> (fungus)	agents that kill fungi
anti-inflammatory (an-tee-ih-FLAM-ah-tor-ee)	<i>anti-</i> (against); <i>inflammatory</i> (inflammation)	agent that reduces inflammation
antipruritics (an-tee-pryu-RIH-tiks)	<i>anti-</i> (against); <i>pruritic</i> (itching)	agents that reduce itching
antipyretics (an-tee-PYE-reh-tiks)	<i>anti-</i> (against); <i>pyretic</i> (burning)	agents that reduce fever
antiseptic (an-tih-sep-tik)	<i>anti-</i> (against); <i>septic</i> (poison)	agent that inhibits the growth of infectious agents
biopsy (BUY-op-see)	<i>bi-</i> (from the Greek combining form of <i>bio</i> [life]); <i>-opsis</i> (sight)	process of removing tissue for diagnostic examination
cryosurgery (kry-oh-SUR-juh-ree)	<i>cryo-</i> (cold); surgery (common English word)	an operation using freezing temperature to destroy tissue
cryotherapy (kry-oh-THER-uh-pee)	<i>cryo-</i> (cold); <i>therapia</i> (Latin word for service done to the sick)	the use of cold in the treatment of a disease
debridement (deh-BREED-ment)	<i>de-</i> (removal); <i>bridement</i> (from the word <i>bridle</i> , the part of the riding harness by which a rider controls the horse)	removal of necrotic or dead tissue from a wound or burn
dermatoplasty (dur-MAT-oh-plass-tee)	<i>dermat/o</i> (skin); <i>-plasty</i> (surgical repair)	plastic surgery repair performed on the skin

incision and drainage (I&D)	from the Latin <i>incidere</i> (cut into)	cutting open of a wound or lesion, such as an abscess, and letting out or draining the contents, such as pus
onychectomy (on-ih-KEK-toh-mee)	<i>onych/o</i> (nail); <i>-ectomy</i> (excision)	surgical removal of a nail
onychotomy (on-ih-KOT-oh-mee)	<i>onych/o</i> (nail); <i>-tomy</i> (incision)	incision into a nail
scabicides (SKAY-bih-sides)	<i>scabies</i> (see above); <i>-cide</i> (destruction)	agents lethal to mites
transdermal (trans-DUR-muhl)	<i>trans-</i> (across); <i>derm/o</i> (skin); <i>-al</i> (adjective suffix)	a method of administering medication through the unbroken skin via patch or ointment
Practice and Practitioners		
dermatologist (dur-MUH-tol-uh-jist)	<i>dermat/o-</i> (skin); <i>-logist</i> (specialty of)	physician who specializes in dermatology
dermatology (dur-MUH-tol-uh-jee)	<i>dermat/o-</i> (skin); <i>-logy</i> (study of)	study of the skin and diseases of the skin

END-OF-CHAPTER EXERCISES

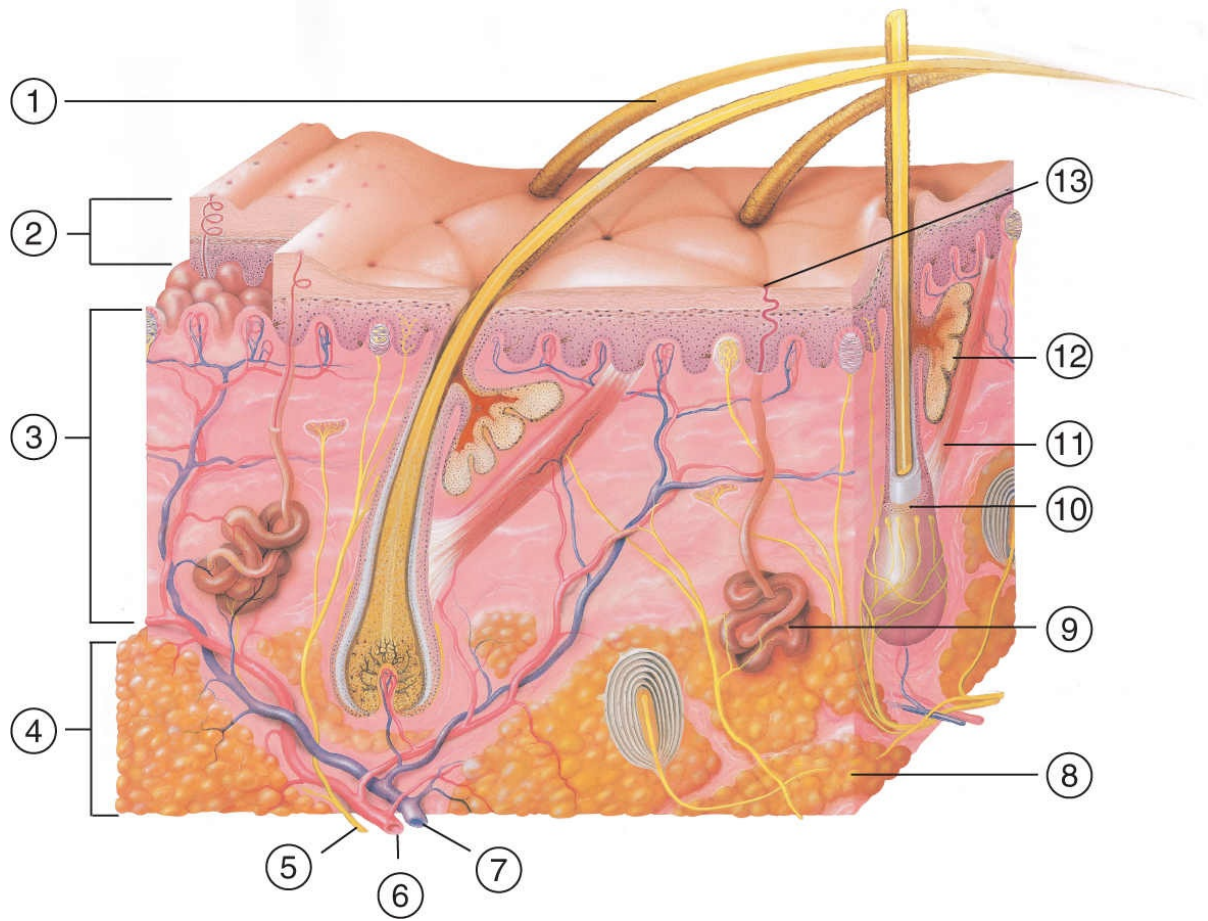
EXERCISE 4-1



LABELING: SKIN

Using the following list, choose the correct terms to label the diagram correctly.

- adipose tissue
- arrector pili muscle
- artery
- dermis
- epidermis
- hair
- hair follicle
- hypodermis (subcutaneous) layer
- nerve
- pore (opening of sweat gland)
- sebaceous (oil) gland
- sudoriferous (sweat) gland
- vein



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____

EXERCISE 4-2



WORD PARTS

Break each of the following terms into its word parts: prefix, root, or suffix. Give the meaning of each word part and then define the term.

EXAMPLE transdermal

prefix: trans-, across

root: derm, skin

suffix: al, adjective suffix

definition: a method of administering medication through unbroken skin

1. avascular

prefix: _____

root : _____

definition : _____

2. *epidermis*

prefix:

root : _____

definition : _____

3. *melanocyte*

root : _____

suffix : _____

definition : _____

4. *scabicide*

root : _____

suffix : _____

definition : _____

5. *dermatomycosis*

root : _____

root : _____
suffix : _____
definition : _____

6. *onychectomy*

root : _____
suffix : _____
definition : _____

7. *ecchymosis*

prefix: _____
root : _____
suffix : _____
definition : _____

8. *antiseptic*

prefix: _____
root : _____
definition : _____

EXERCISE 4-3



WORD BUILDING

Use the word parts listed to build the terms defined.

dermat/o -ia ichthy -logy sub-
-oma -plasty -malacia -tomy para-
-osis hem/o hyper- -itis
cutaneous angi/o hidr onych/o

1. _____ plastic surgery repair performed on the skin
2. _____ benign tumor of blood vessels
3. _____ inflammation of the skin
4. _____ beneath the skin

5. _____ incision into a nail
6. _____ the study of the skin and diseases of the skin
7. _____ softening of the nails
8. _____ infection around a nail
9. _____ dry, scaly, fishlike skin
10. _____ profuse sweating; increased perspiration

EXERCISE 4-4



MATCHING

Match the term with its definition.

- | | |
|-------------------------|---|
| 1. _____
nevus | a. birthmark |
| 2. _____
verruca | b. thickened scar |
| 3. _____
macule | c. blackhead |
| 4. _____
alopecia | d. mole |
| 5. _____
keloid | e. wart |
| 6. _____
comedo | f. baldness |
| 7. _____
diaphoresis | g. profuse sweating; increased perspiration |
| 8. _____
erythema | h. abrasion of upper skin layers |
| 9. _____
excoriation | i. flat, discolored spot |

10. _____
hemangioma
11. _____
cyst
12. _____
abcess
- j. redness of the skin
- k. localized collection of pus in any part of the body
- l. a closed sac or pouch in or under the skin that contains fluid or solid material

EXERCISE 4-5



MULTIPLE CHOICE

Choose the correct answer for the following multiple-choice questions.

- If **myc/o** is the root for fungus, what is the term that means “condition of the nail caused by fungus”?
 - mycosis
 - onychomycosis
 - trichomycosis
 - onychomalacia
- If **ichthy** is the root word for dry, fishlike, what is the term for a condition of being extremely dry?
 - ichthyioma
 - ichthyosis
 - ichthyema
 - ichthiitis
- The term to describe a lesion of the skin containing pus is
 - verruca
 - pustule
 - bulla
 - macule
- A large blister filled with fluid is called a _____.
 - hemangioma
 - furuncle
 - cutis

- d. bulla
5. The medical term for natural or abnormal baldness that may be total or partial is _____.
- a. dermoplasty
 - b. alopecia
 - c. urticaria
 - d. transdermal
6. The term that best describes the thin band of tissue that seals the nail to the skin is _____.
- a. corium
 - b. follicle
 - c. cuticle
 - d. epidermis
7. The term that best describes the cell that produces the pigment that provides color to the skin and hair is _____.
- a. keratocyte
 - b. melanocyte
 - c. erythrocyte
 - d. leukocyte
8. Which term describes a fungal infection of the skin?
- a. analgesic
 - b. dermatomycosis
 - c. dermatitis
 - d. abscess
9. A viral infection that produces the eruption of highly painful vesicles that may follow a nerve path is _____.
- a. shingles
 - b. verruca
 - c. herpes zoster
 - d. a and c

10. An antipruritic reduces _____.
- a. fever
 - b. infection
 - c. inflammation
 - d. itching
11. An antibiotic kills _____.
- a. fungi
 - b. viruses
 - c. scabies
 - d. bacteria
12. The term *cyst* comes from the Greek word *kystis* meaning _____.
- a. pus
 - b. bladder
 - c. hill
 - d. bump
13. Corium is a synonym for _____.
- a. cuticle
 - b. dermis
 - c. nail
 - d. lunula
14. Diaphoresis is a synonym for _____.
- a. perspiration
 - b. exhalation
 - c. excretion
 - d. inhalation
15. A macule is a _____.
- a. small node
 - b. scratch mark

- c. flat, discolored area that is flush with the skin
- d. fluid-containing sac beneath the skin

EXERCISE 4-6

FILL IN THE BLANK

Fill in the blank with the correct answer.

1. A firm scar that forms in the healing of a sore or wound is a(n) _____.
2. A _____ is a small slit or crack-like lesion.
3. _____ is a condition with a bluish discoloration of tissue.
4. A chronic disease characterized by thickening and hardening of the skin is called _____.
5. Absence or loss of hair is a condition called _____.
6. Partial or complete absence of pigment of the skin, hair, and eyes is termed _____.
7. A loss of skin pigmentation with milk-white skin patches is a condition known as _____.
8. _____, or hives, is an allergic reaction of the skin characterized by pale red eruptions.
9. The removal of a small piece of living tissue for examination under a microscope is called a(n) _____.
10. A(n) _____ is a mass of tissue that bulges outward and grows on a stem or stalk.

EXERCISE 4-7

ABBREVIATIONS

Write out the term for the following abbreviations.

1. _____ BSA
2. _____ I&D

Write the abbreviation for the following terms.

3. _____ systemic lupus erythematosus
4. _____ ultraviolet

EXERCISE 4-8**SPELLING**

Select the correct spelling of the medical term.

1. _____ is the surgical removal of a nail.
 - a. Onychectomie
 - b. Onichektomy
 - c. Onchyectomy
 - d. Onychectomy

2. _____ plantaris is commonly known as a plantar wart.
 - a. Verrooca
 - b. Veruca
 - c. Verucca
 - d. Verruca

3. A _____ is a smooth, rounded, slightly elevated area often associated with itching.
 - a. wheel
 - b. weal
 - c. wheal
 - d. weel

4. _____ is characterized by eruption of pale red elevated patches.
 - a. Urticaria
 - b. Uticaria
 - c. Uticarria
 - d. Urtikaria

5. _____ is an inflammatory condition of the skin characterized by erythema, vesicles, and crusting with scales.
 - a. Excema
 - b. Ecksema

- c. Exzema
 - d. Eczema
6. The removal of necrotic (dead) tissue from a wound or burn is called _____.
- a. debreedment
 - b. dibreedment
 - c. debridement
 - d. dibridement
7. A chronic skin disease characterized by itchy, silvery-scaled patches is _____.
- a. soriasis
 - b. psoriasis
 - c. psorasis
 - d. soariasis
8. A _____ is a specialist who diagnoses and treats skin diseases.
- a. dermatologist
 - b. dermatologyst
 - c. dermatolocist
 - d. dermatologist
9. The adjective meaning *itchy* is _____.
- a. pruritic
 - b. puritic
 - c. pyretic
 - d. pruitic
10. An _____ is an abnormal redness of the skin.
- a. erythema
 - b. erathema
 - c. airethema

d. erythema

EXERCISE 4-9



CASE STUDY

Read the case and write a definition for each underlined term in the appropriate space. Think about some of the statements the dermatologist believes are important enough to include in the report. For example, who diagnosed what? What do pets and children have to do with a diagnosis?

CHIEF COMPLAINT: Rash on the face

PRESENT ILLNESS: A 29-year-old white female states that last week she started having some itching on her forehead. She went to the doctor who prescribed erythromycin, an (1) antibiotic. Two days later, the rash covered her entire face. The patient was diagnosed with (2) impetigo and was admitted to the hospital for treatment.

CONSULTATION: Dr. Smith, a (3) dermatologist, saw the patient. The chart was reviewed, and the patient was examined. The patient is married and has no children and no pets. She developed (4) dermatitis on her forehead 2 weeks ago that has spread to her entire face. The rash has become more (5) erythematous, and she now has (6) pustules on her forehead, nose, and cheeks. Facial (7) edema persists, and she is almost unable to open her eyes. She has been given additional antibiotics and an (8) antipruritic medication. She developed (9) pruritus on her feet, which was thought to be a reaction to the antibiotic, so the medication was changed to another antibiotic.

IMPRESSION: Impetigo; allergic response to erythromycin. Patient responds to change in antibiotic. Continue with current antibiotic regimen and continue to monitor patient. Thank you for allowing me to participate in this interesting case. I will follow patient and provide additional suggestions if warranted.

Dr. Smith

Term	Definition
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____

5. _____

6. _____

7. _____

8. _____

9. _____

10. Why did Dr. Smith ask about children and pets?



The Skeletal System

5

LEARNING OUTCOMES

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

- Name the major structures and functions of the skeletal system.
- Differentiate between the axial and appendicular skeleton.
- State the medical terms that name the three types of joints.
- Pronounce, spell, and define medical terms related to the skeletal system and its disorders.
- Interpret abbreviations associated with the skeletal system.

INTRODUCTION

Our skeletons form the basic structures of our bodies, much like the framework of concrete and steel does in a tall building. Buildings constructed in earthquake zones are designed to move and sway so they won't fall down when the earth moves beneath them. We look upon such buildings as marvels of modern engineering, perhaps without giving a thought to the human skeleton, which allows us to walk, run, talk, gesture, throw things, and even draw up plans for tall buildings.

WORD PARTS RELATED TO THE SKELETAL SYSTEM

Many terms having to do with the skeletal system are made up of the word parts listed in **Table 5-1**. Other word parts you have already learned are also used to make up some terms in this chapter. Prefixes you learned in Chapter

2, such as dia- (through), epi- (outside), endo- (inside), and peri- (around), for example, will be evident in terms introduced under the “Structure and Function” heading. Important word parts to know for this chapter are related to the Greek words, *osteon* for bone and *mys* for muscle. It is also important to know that not every term has a root. The reason is simple: we borrow freely from Greek and Latin, and if you stop to think about that practice, you will realize that every word or word fragment we use is—in a narrow sense at least—a potential root. In other words, prefixes and suffixes can sometimes form the central idea of a term.

TABLE 5-1 WORD PARTS RELATED TO THE SKELETAL SYSTEM

Word Part	Meaning
-algia	pain
amphi-	both sides
ankyl/o	stiff, fused, closed
arthr/o	joint
brachi/o	arm
calcane/o	calcaneus, heel bone
carp/o	wrist
cervic/o	neck
chondr/o	cartilage
cost/o	rib
crani/o	cranium
dactyl/o	finger, toe

-ectomy	surgical removal
electr/o	electricity
femur/o	femur, thighbone
-gram	written record of
humer/o	humerus, upper arm bone
-itis	inflammation
kinesi/o	movement
-kinesia	movement
kyph/o	hump
-logy	study of
lord/o	swayback, curve
lumb/o	lower back
-malacia	softening
muscul/o	muscle
my/o	muscle
myel/o	bone marrow
-oma	tumor
orth/o	correct, straight

os/te/o	bone
ped/o	foot, child
pelv/o	pelvis
phalang/o	bones of fingers and toes
-physis	growth
-plasty	surgical repair
-porosis	porous
-scopy	to visually examine
spondyl/o	vertebrae
syn-	joined together
thorac/o	thorax, chest
vertebr/o	vertebrae
zygo-	joined (yoked) together

Word Parts Exercise

After studying [Table 5-1](#), write the meaning of each of the word parts.

WORD PART	MEANING
1. lord/o	1. _____
2. zygo-	2. _____

3. carp/o	3. _____
4. ped/o	4. _____
5. os/te/o	5. _____
6. phalang/o	6. _____
7. -algia	7. _____
8. crani/o	8. _____
9. syn-	9. _____
10. -itis	10. _____
11. my/o, muscul/o	11. _____
12. -scopy	12. _____
13. kinesi/o	13. _____
14. orth/o	14. _____
15. femur/o	15. _____
16. -malacia	16. _____
17. -plasty	17. _____
18. arthr/o	18. _____
19. pelv/o	19. _____
20. -physis	20. _____

21. brachi/o	21. _____
22. dactyl/o	22. _____
23. cost/o	23. _____
24. myel/o	24. _____
25. electr/o	25. _____
26. thorac/o	26. _____
27. humer/o	27. _____
28. -porosis	28. _____
29. anky/o	29. _____
30. spondyl/o, vertebr/o	30. _____
31. -gram	31. _____
32. -kinesia	32. _____
33. amphi-	33. _____
34. calcane/o	34. _____
35. kyph/o	35. _____
36. cervic/o	36. _____
37. -logy	37. _____
38. chondr/o	38. _____
39. lumb/o	39. _____

40. -ectomy

40. _____

41. -oma

41. _____

Isn't it true that some people have more than 206 bones? The response 206 was deemed correct on a Jeopardy television program, so it must be true! All joking aside, the exact number of bones can vary slightly from one person to another because some people have extra ribs, vertebrae, or sesamoid bones that develop around joints.

STRUCTURE AND FUNCTION

The human skeleton begins to form about 6 weeks after fertilization and continues to grow and develop until the person is around 25 years old. Its approximately 206 bones have many functions.

The skeleton serves as a rigid but articulating (movable at joints) framework for muscles and other tissues. It also protects our vital organs by forming a shield against jarring and bumps. Its less obvious jobs are to store minerals and to make blood cells.

The skeleton is divided into two parts: the **axial skeleton** and **appendicular skeleton** (see [Figure 5-1](#)). The words axial and appendicular are adjective forms of the words axis and appendix. Axis is the Latin word for "axle," but has become a common English word meaning an imaginary straight line, such as the one between the north and south poles of the earth. The axial skeleton has an axis running from the middle of the top of your head to the bottom of your spine. The axial skeleton therefore includes the bones on this axis: the skull, chest, and spinal column.

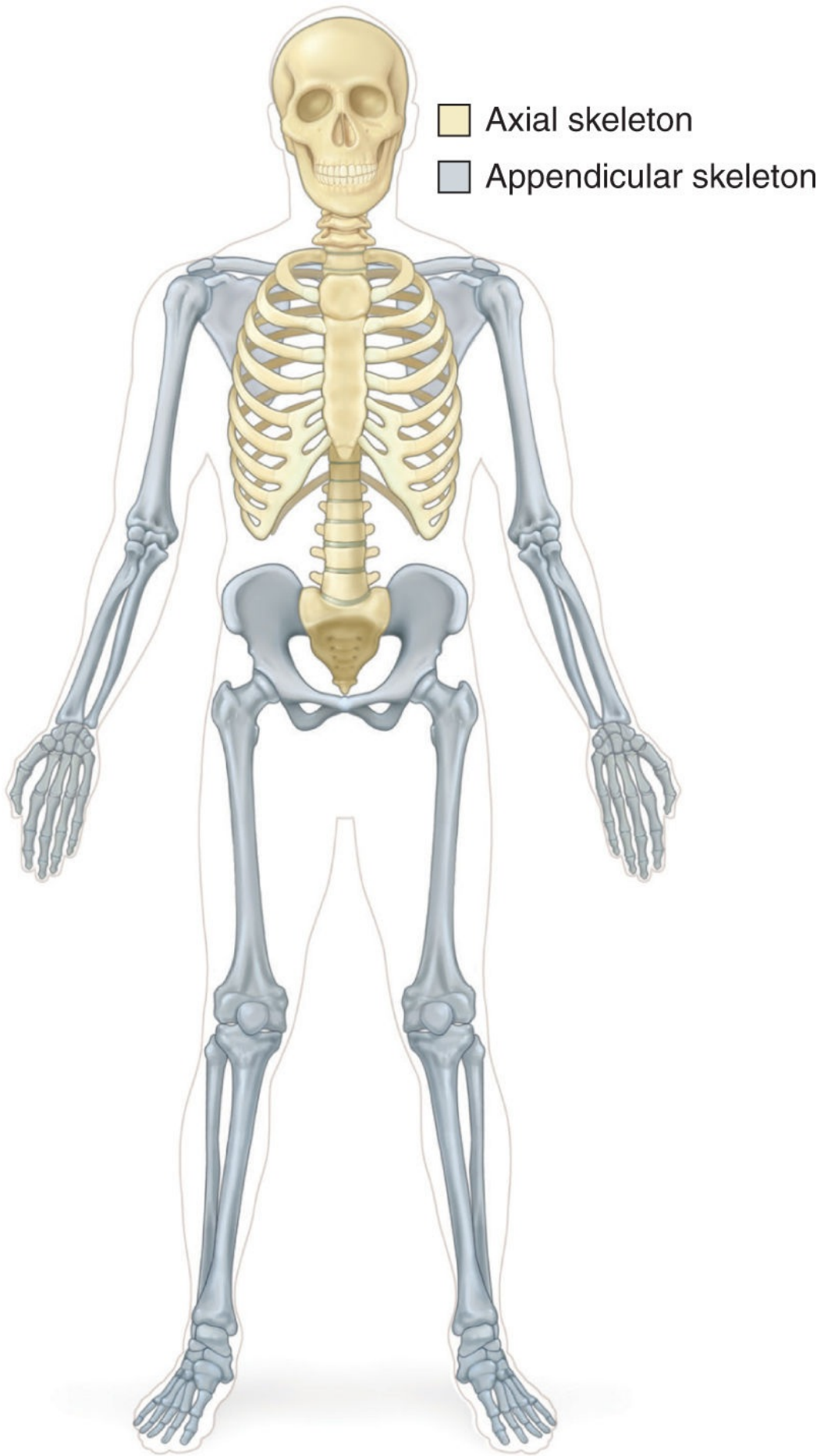


FIGURE 5-1 Axial and appendicular skeletons. The axial skeleton is shown in yellow, and the appendicular skeleton is shown in gray.

The appendicular skeleton comprises the arms and legs, along with the shoulder and pelvic bones. Although the appendicular skeleton has nothing to do with the body's "appendix," those two body parts do have a common classic word origin: the Latin word *appendix* refers to something attached to something else. Thus, the appendicular skeleton is attached to the axial skeleton, and the appendix is attached to the large intestine.

The skeletal system depends on *ligaments*, *tendons*, and *joints* to allow for movement. Ligament comes from the Latin word *ligamentum*, meaning "a band" or "banding." **Ligaments** are bands of tissue that connect two bones together. Tendon comes from a different Latin word, the verb *tendere*, which means to stretch, which is what tendons do. **Tendons** attach muscles to bone. The difference between these two connective tissues is that ligaments connect two bones, whereas tendons connect a muscle to a bone. Strictly speaking, of course, these two terms belong to the muscular system, but they are mentioned here because their function is essential to the skeleton. **Joints**, also called *articulations*, are the places where bones come together. They are not separate structures or tissues.

Ossification is bone formation and it begins early in fetal development when the skeleton is composed mostly of cartilage. During the second and third months of fetal development, cartilage hardens and turns into bone. Bone is made up of **osseous tissue**, a form of connective tissue with mature bone cells called **osteocytes**.

The bones of the skeleton are of different shapes, sizes, and makeup. They may be essentially flat, such as those found in the cranium and ribs. They may also be short, such as those in the wrist and ankles, or long, such as those found in the arms, legs, hands, and feet.

Long bones have subparts that are named. The term **diaphysis** is the shaft of a long bone, and the term **epiphysis** is the name given to each end of a long bone. The **epiphyseal plate** is the growth area of a long bone. The term for the inside of the diaphysis is **medullary cavity**. Because it is a cavity, it is hollow, and *medullary* means that the cavity contains marrow. *Marrow* is the tissue that produces blood cells.

Compact bone is hard, dense bone and makes up the diaphysis. **Spongy bone** is mesh-like bone tissue and is found in the epiphyses.

Most bone surfaces are covered with a membrane called the **periosteum**.

The inner surface of the medullary cavity is lined with a thin layer of cells called the **endosteum** (see [Figure 5-2](#)).

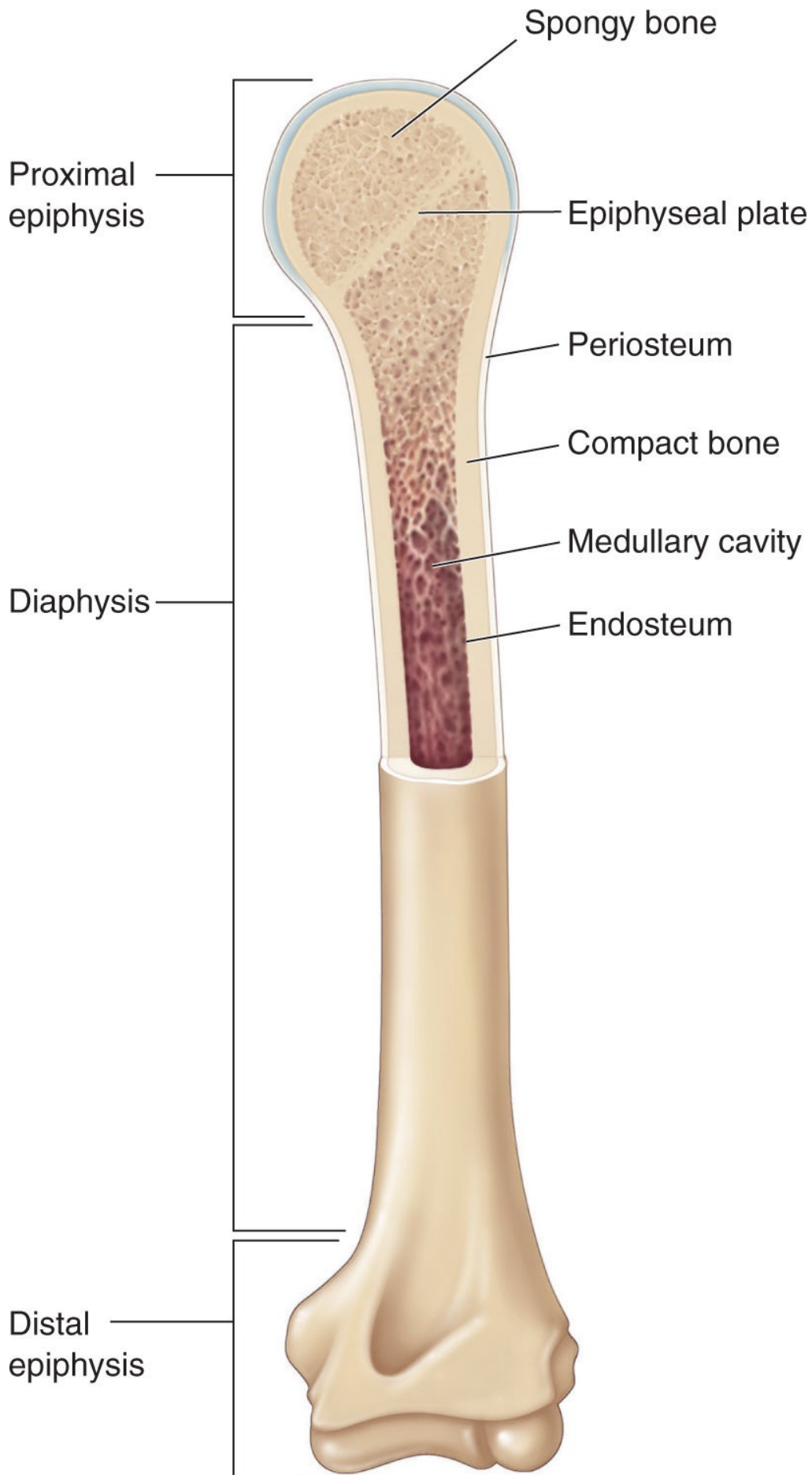


FIGURE 5-2 Parts of a long bone.

By now, you are probably familiar with the prefixes *peri-* and *endo-*. But if you didn't automatically identify those prefixes, as meaning around and inside, you may benefit from a review of Chapter 2, [Table 2-8](#).

The Axial Skeleton

The axial skeleton is composed of the bones of the **cranium** (head), thorax, and **vertebral column** (series of vertebrae from the cranium to the coccyx). Cranial bones enclose and protect the brain. The six main cranial bones include the **frontal bone**; two **parietal bones**, one on each side; two **temporal bones**, on the sides of the head; and the **occipital bone** (see [Figure 5-3](#)).

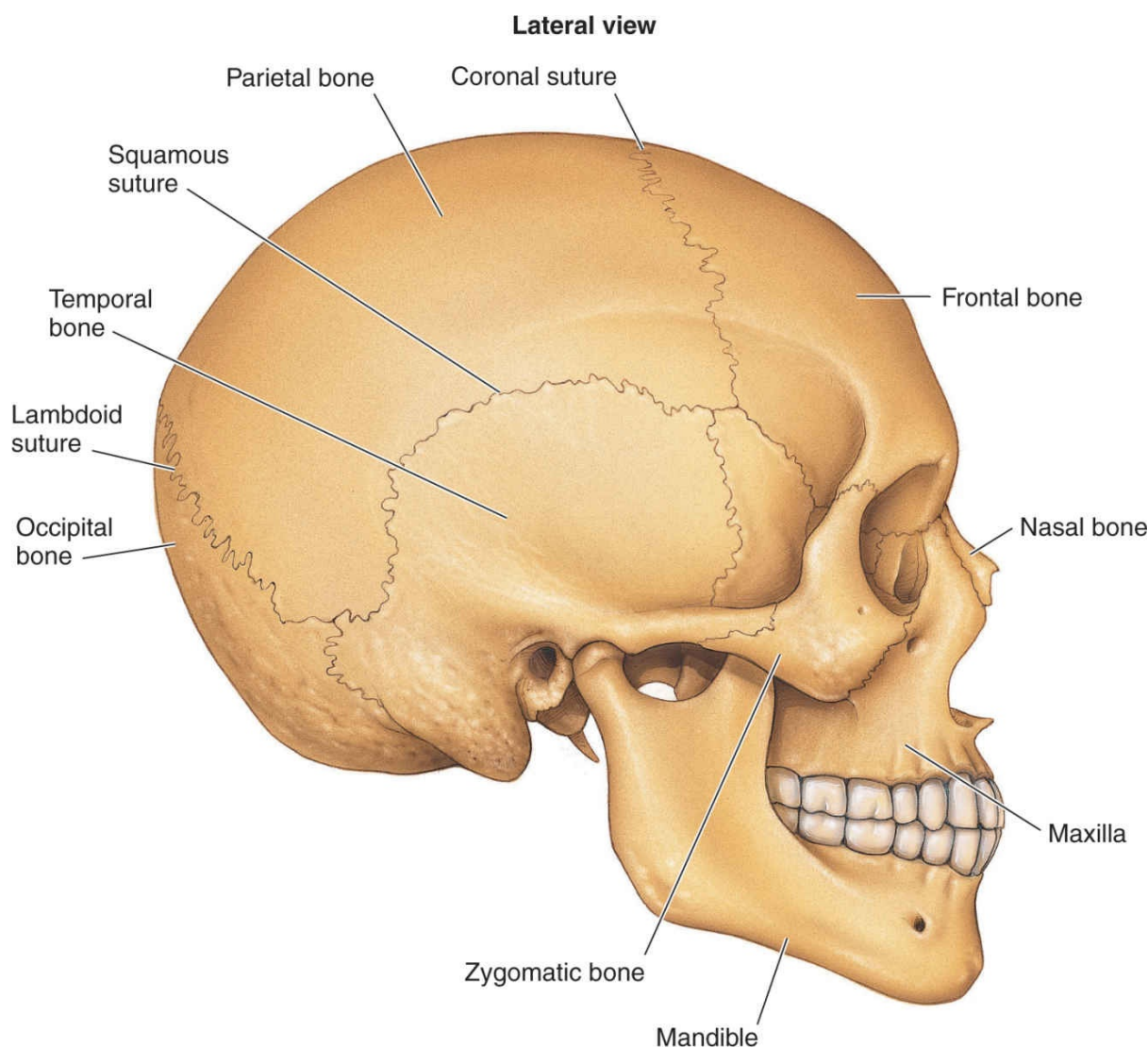


FIGURE 5-3 The bones of the cranium, face, and the associated sutures.

The main facial bones are the *nasal bone*, *zygomatic bones*, the *maxilla*, and the *mandible*. The **nasal bone** forms the bridge of the nose, and the two **zygomatic bones** form the cheeks. The **maxilla** is the immovable upper jawbone, and the **mandible** is the movable lower jawbone.

The cranial bones are joined by **cranial sutures**, which are fibrous membranes that join them. These include the *coronal suture*, *squamous suture*, and *lambdoid suture*.

Isn't *maxilla* Latin for jawbone? Yes. So where does the word *mandible* come from if we already have a Latin word for jawbone? *Mandible* comes from the Latin word *mandibula*, which means "to chew," and the mandible moves while chewing.

The skeleton of the **thorax** (*thorax*, breastplate) is known as the **thoracic cage**. The thoracic cage includes the 12 thoracic vertebrae, 12 ribs, costal (rib) cartilages, and the sternum. Parts of the flat **sternum** are the manubrium, body, and xiphoid process. The major organs inside the thoracic cage are the

heart and lungs (see [Figure 5-4](#)).

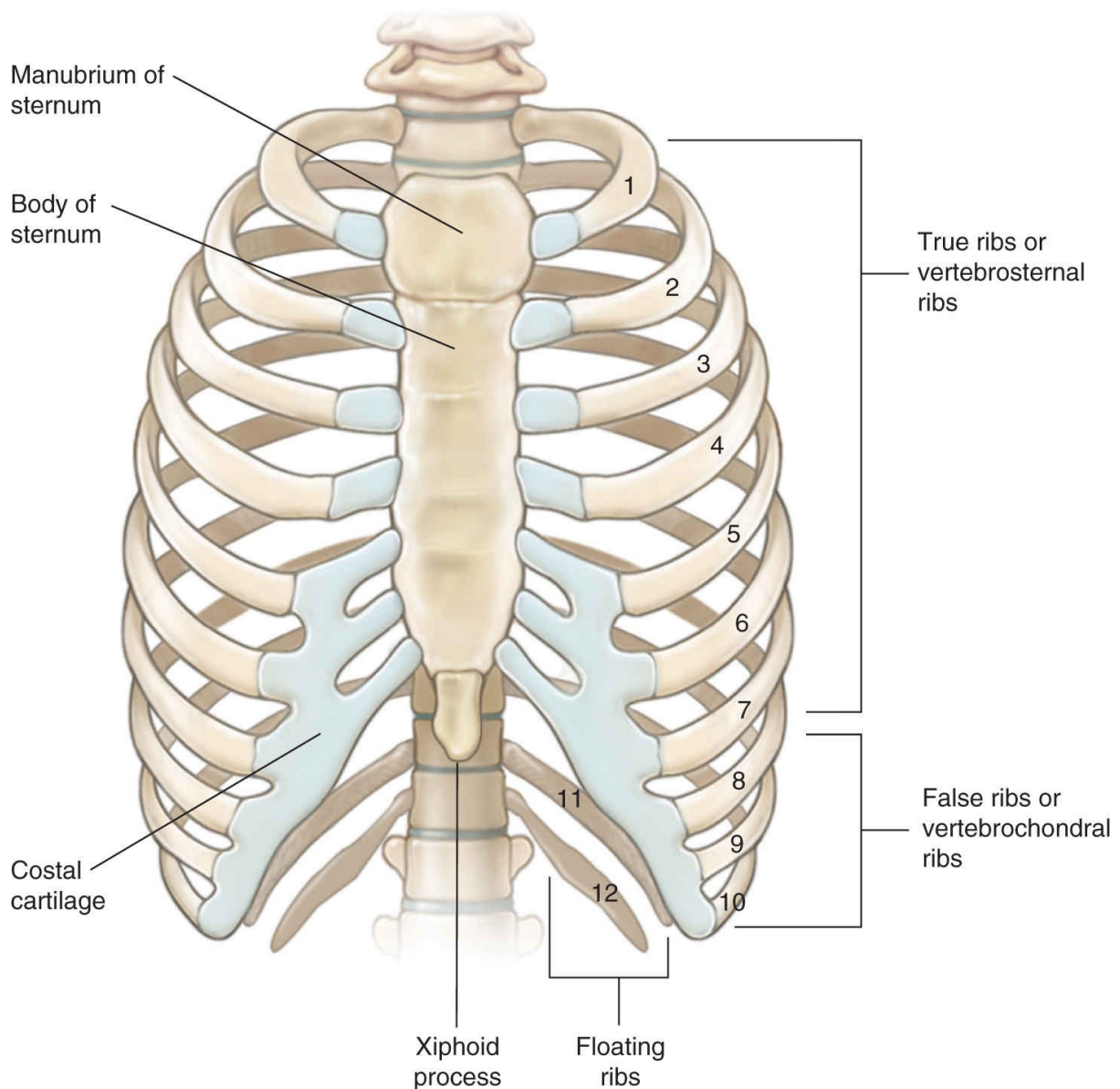


FIGURE 5-4 The thoracic cage.

Rib pairs are attached to their correspondingly numbered **vertebrae** (back bones). Ribs 1 to 7 are called *true ribs* or *vertebrosteral ribs* because their cartilages attach directly to the sternum. Ribs 8 to 12 are the five lower ribs that do not attach directly to the sternum. Ribs 8 to 10 are called *false ribs* or *vertebrochondral ribs*. The last two rib pairs (11 and 12) “float,” which means that they are attached only to the vertebrae (see **Figure 5-4**).

The spinal column includes five sections of vertebrae (*vertebra*, singular). The naming of a vertebra consists of a prefix letter (C for cervical, T for thoracic, and L for lumbar), followed by a number indicating the placement on the column. There are 7 cervical vertebrae, 12 thoracic vertebrae, and 5 lumbar vertebrae. At the base of the spinal column are the sacrum and coccyx. The **sacrum** is formed by five fused sacral vertebrae, and the **coccyx** contains

three to five fused coccygeal vertebrae (see [Figure 5-5](#)).

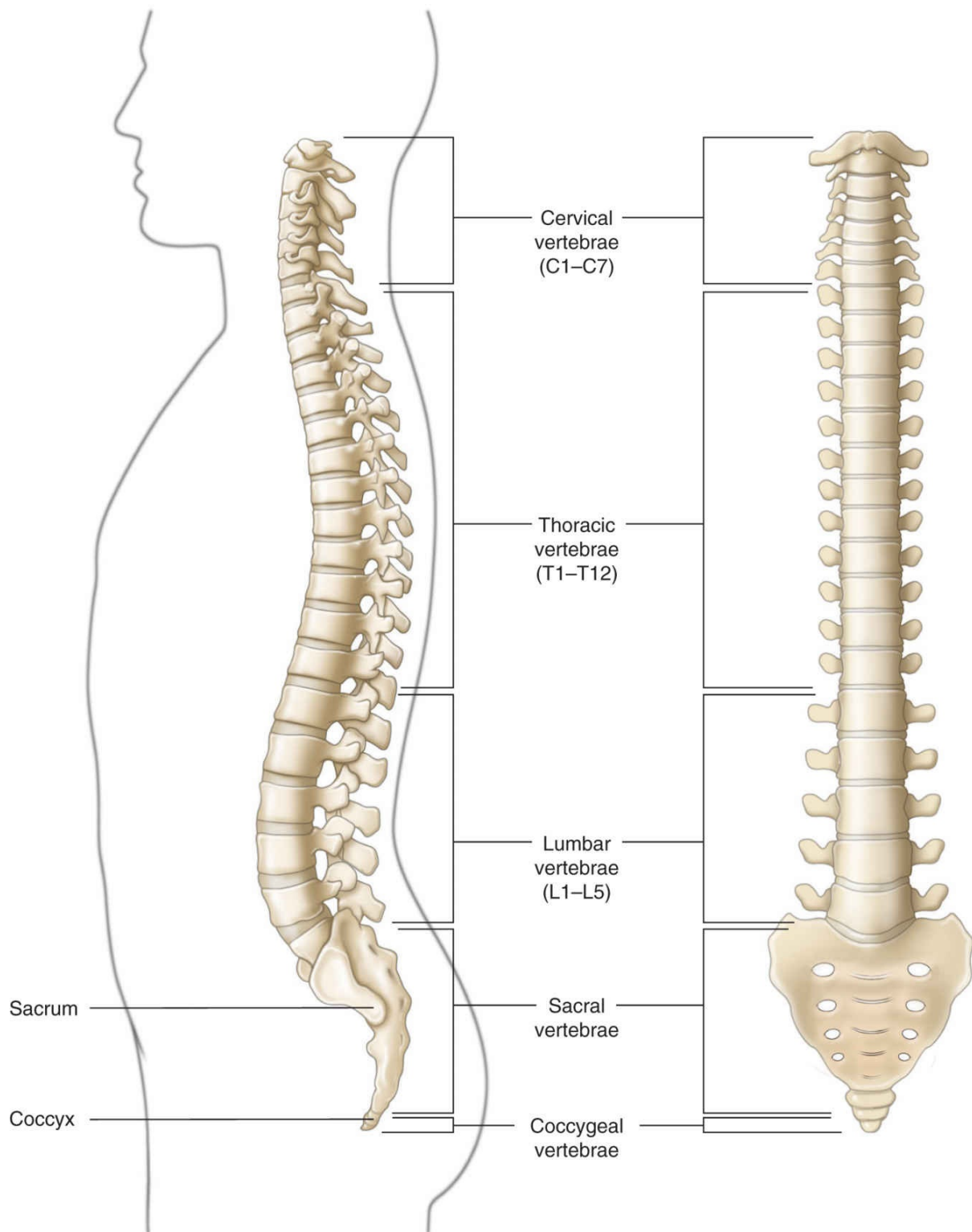


FIGURE 5-5 The vertebral column in sagittal (anteroposterior) and anterior views.

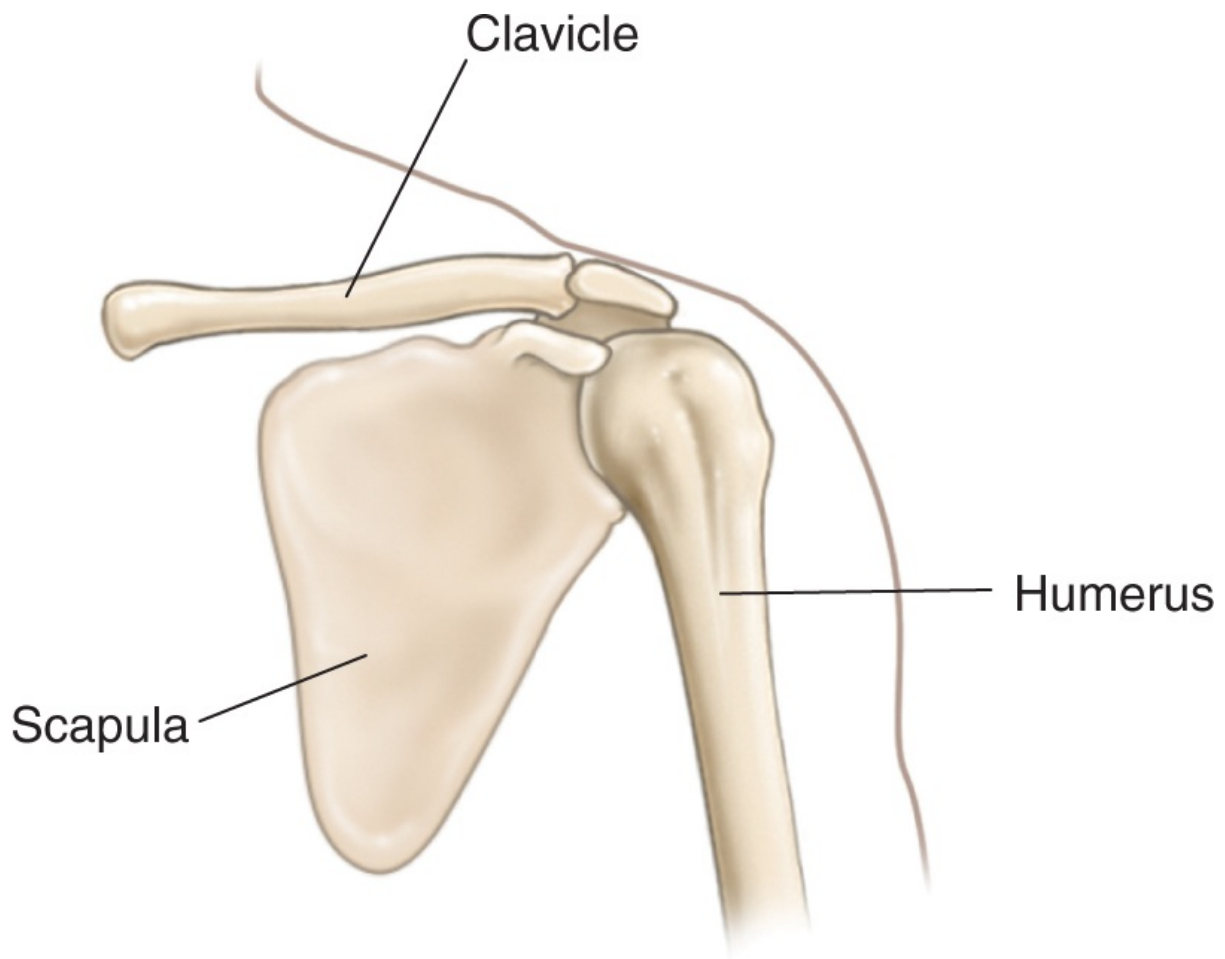
Isn't the cervix part of the female reproductive system? The word *cervix* is Latin for "neck." The words cervix and cervical refer not only to the "neck" of the uterus, part of the female reproductive system (see Chapter 15), but also to the neck to which the head is attached.

The sacrum is joined to the hip bones and, therefore, is part of the pelvic

girdle, which is part of the appendicular skeleton. Although the sacrum is not part of the axial skeleton, it is mentioned here because of its association with the vertebral column.

The Appendicular Skeleton

As mentioned previously, the appendicular skeleton consists of the body's appendages (upper limbs and lower limbs) and the areas to which these appendages are attached: the shoulder and pelvic girdles. An upper limb is also called an *upper extremity*, and a lower limb is also called a *lower extremity*. Shoulder bones, although associated with the chest, are part of the appendicular skeleton. The main bones of the *shoulder girdle* are the **clavicle** (collarbone) and the **scapula** (shoulder blade) (see [Figure 5-6](#)).



Anterior–posterior view

FIGURE 5-6 The bones of the shoulder girdle show the articulation with the humerus.

The long arm bone extending from the shoulder and ending at the elbow is called the **humerus**, not because it is the “funny bone” but because *humerus* is the Latin word for “shoulder.” However, there is a connection with the word “humorous.” The phrase “funny bone” was most probably coined as a joke because the ulnar nerve, which causes the pins-and-needles sensation when it is struck, is located where the humerus joins the elbow (see **Figures 5-6 and 5-7**).

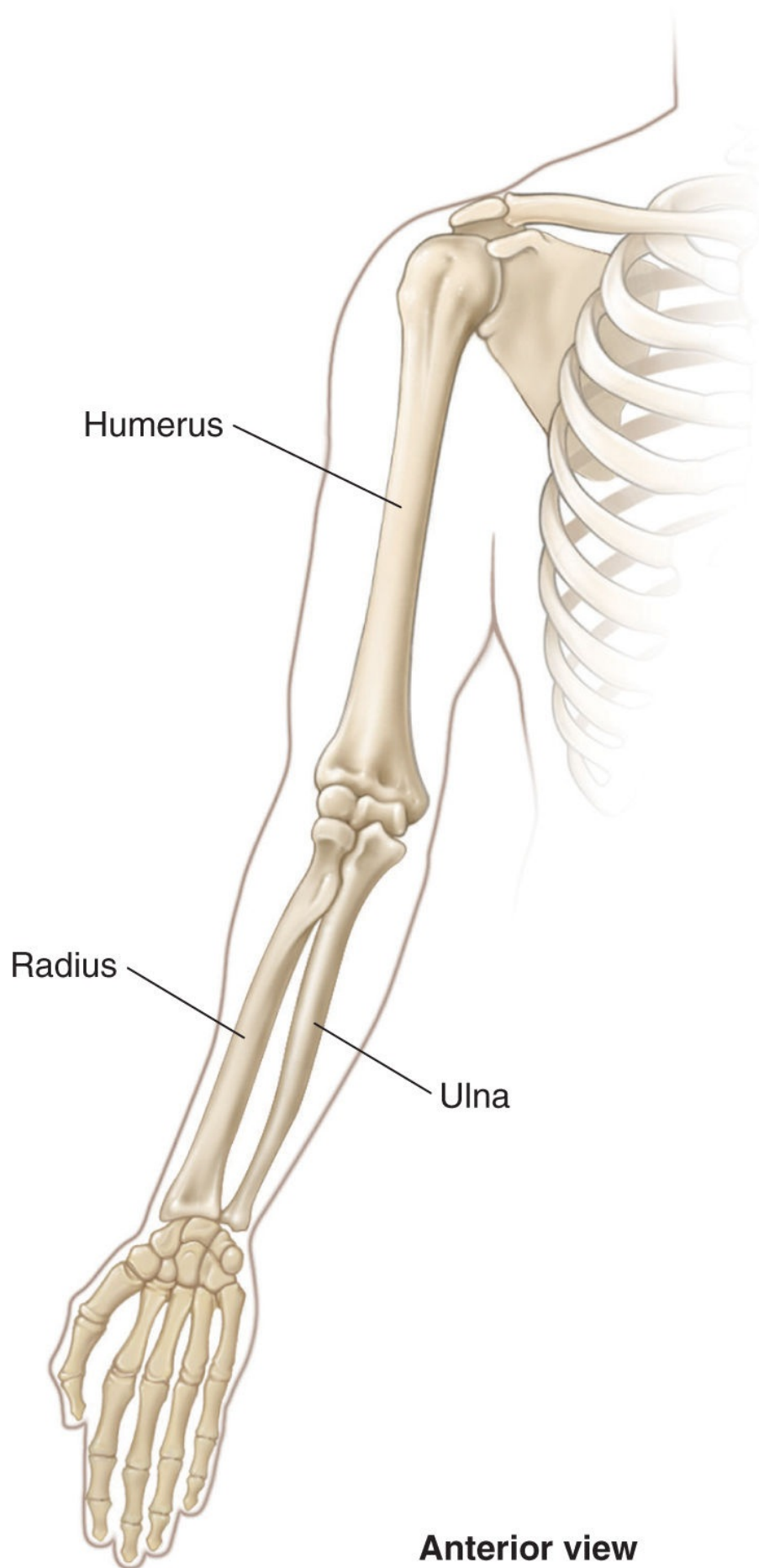
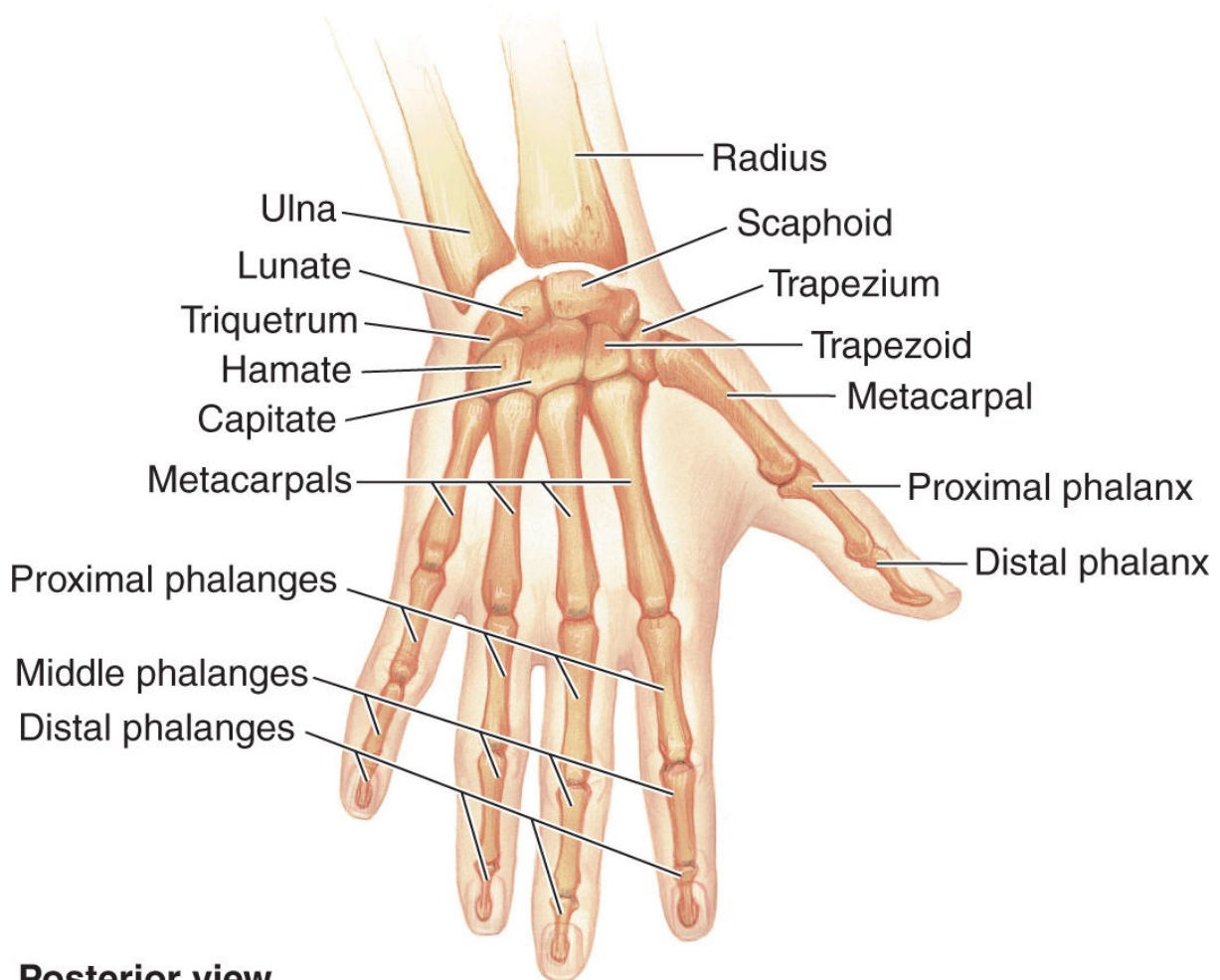


FIGURE 5-7 Bones of the upper limb. The arm contains the humerus, and the forearm is made up of the radius and ulna.

The forearm consists of the **ulna** and **radius**, which extend from the elbow to the wrist (see **Figure 5-7**). The wrist includes eight bones, arranged in two rows, called **carpal bones** (*karpos*, wrist). These bones are the *scaphoid*, *lunate*, *triquetrum*, *pisiform*, *trapezium*, *trapezoid*, *capitate*, and *hamate*. The five **metacarpals** are the hand bones that lie “beyond” the carpal bones, connecting the wrist to the fingers. The 14 **phalanges** are the bones that make up the fingers. The term *phalanges* is the plural form of *phalanx*, which is Greek for “line of soldiers.” The bones of the wrist and hand are shown in **Figure 5-8**.



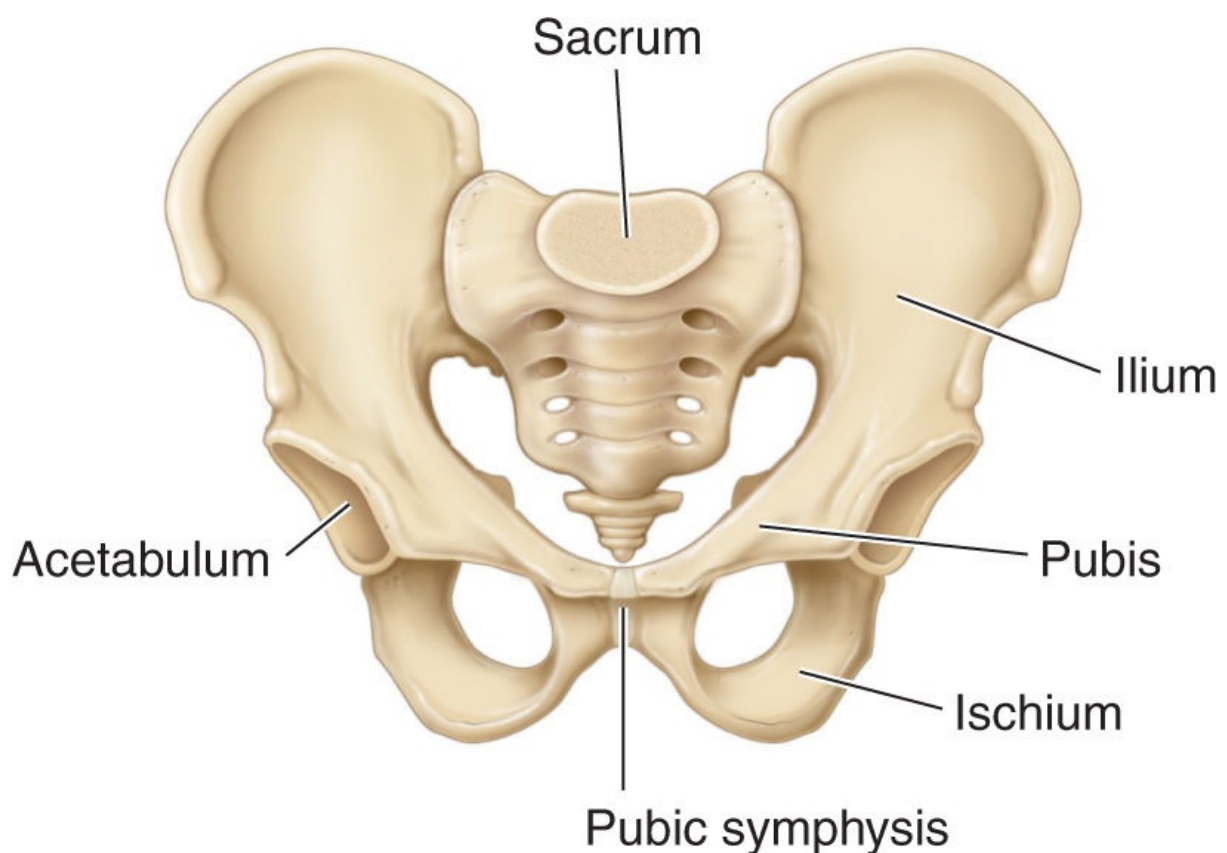
Posterior view

FIGURE 5-8 Wrist and hand bones. Eight carpal bones form the wrist. Five metacarpals and 14 phalanges form the hand. The pisiform is not visible in this view.

The pelvic girdle, so named because it surrounds and protects the pelvic organs, consists of the two hip bones (right and left), joined anteriorly at the

pubic symphysis and posteriorly at the sacrum. The **hip bone, also called the *os coxae*, is a fusion of three bones: the ilium, the ischium, and the pubis.**

The **femur**, Latin for “thigh,” is a long bone that extends from the hip to the knee, and the **tibia** and **fibula** are long bones that extend from the knee to the ankle. The femur attaches to the hip bone at the *acetabulum* (see **Figures 5-9** and **5-10**). The tibia, Latin for “shin,” is the shin bone or heavy bone of the leg; the fibula, from the Latin word *figibula*, meaning “fastener,” does not bear the body’s weight, but together with the tibia, it is connected to the **talus** (ankle bone) (see **Figure 5-11**). The **patella** (kneecap) is a “floating” bone that is imbedded in the tendon of the thigh muscle. It offers protection to the knee joint (see **Figure 5-10**).



Anterior view

FIGURE 5-9 The bones of the pelvic girdle.

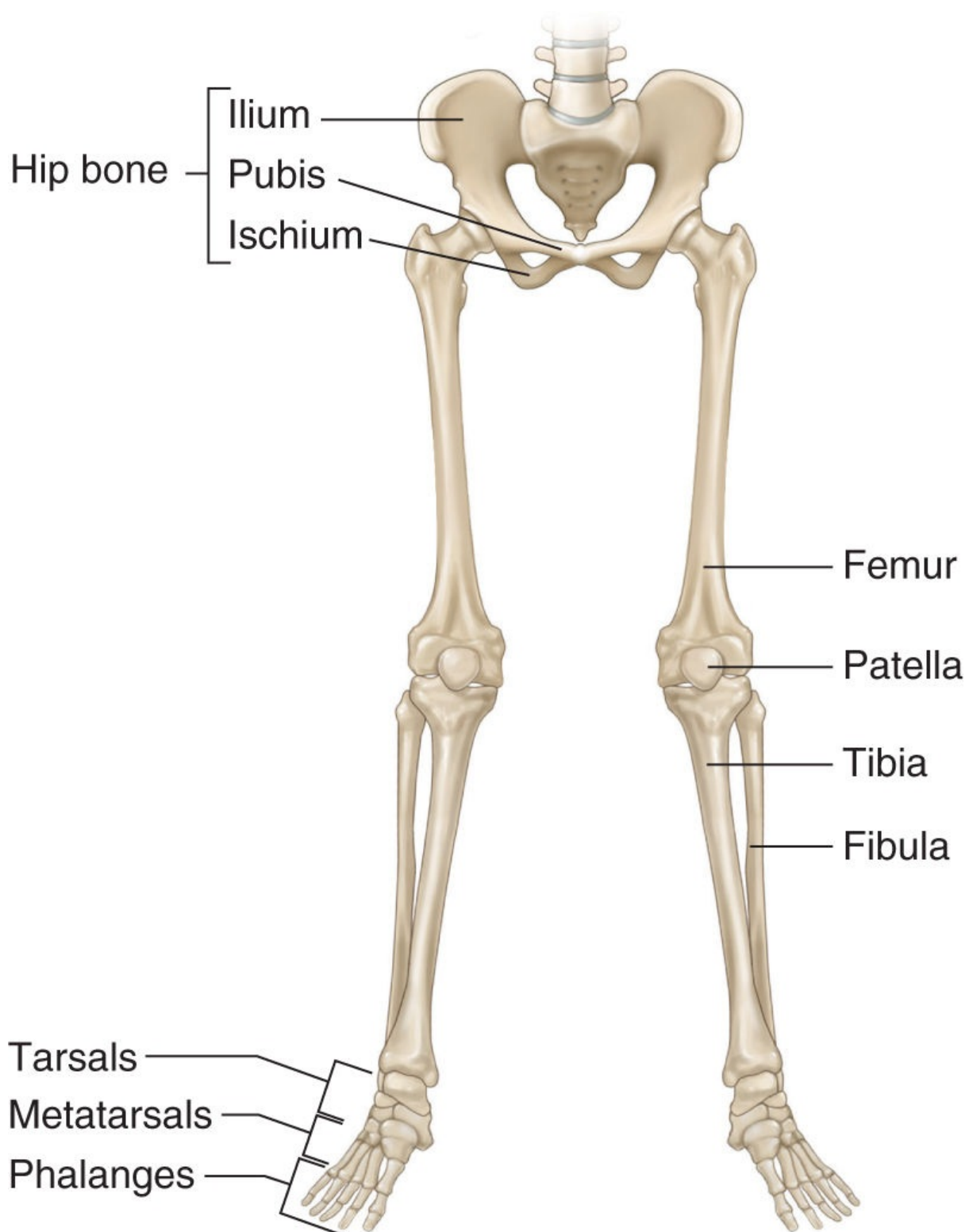


FIGURE 5-10 Bones of the pelvic girdle and lower limb.

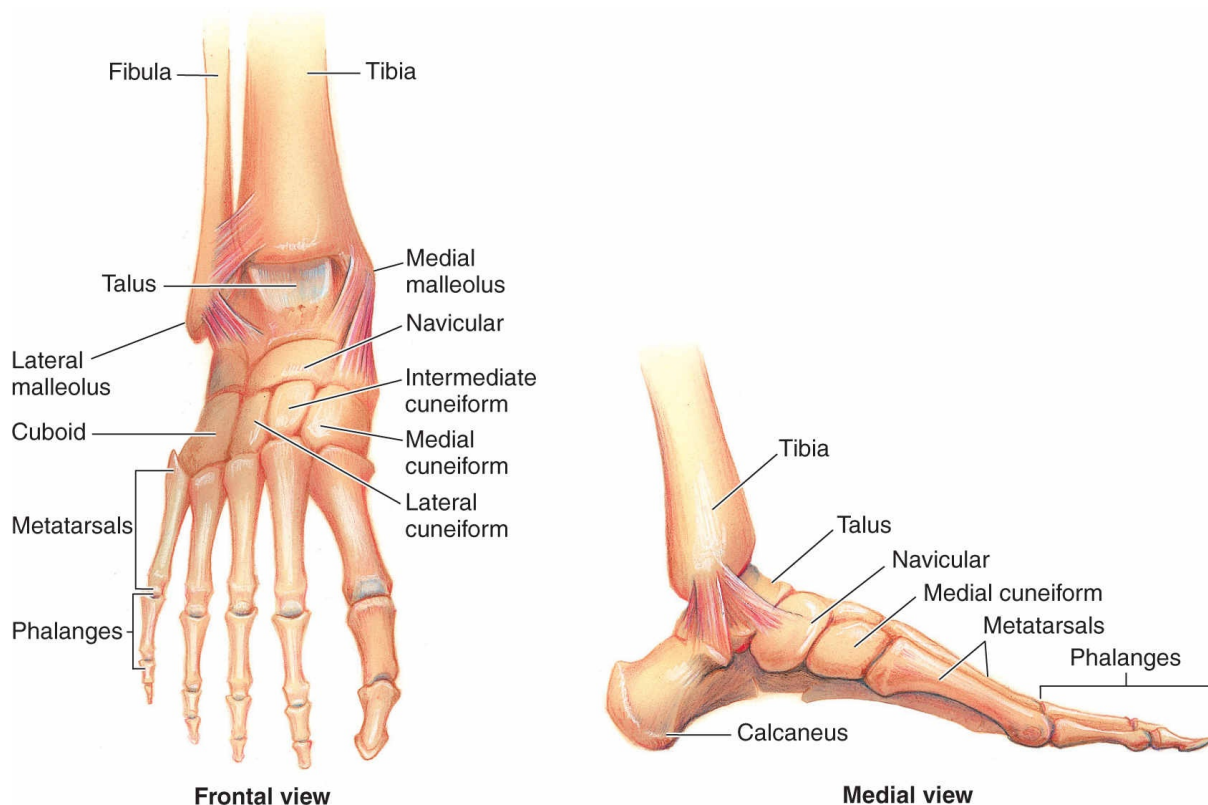


FIGURE 5-11 Bones of the ankle and foot.

Tarsus (from the Greek *tarsos*, meaning “a flat surface”) is sometimes used as a technical name for the ankle. The seven **tarsal bones** of the ankle and the five **metatarsals** of the foot correspond with the carpal bones and metacarpals of the wrist and hand. The tarsal bones are the *talus*; *calcaneus*; *navicular*; *medial*, *lateral*, and *intermediate cuneiforms*; and *cuboid*. Just like the fingers, the bones making up the toes are also called **phalanges**. The bony protrusion at the distal end of the fibula is called the **lateral malleolus**; the bony process on the tibia is the **medial malleolus**. The heel bone, or **calcaneus**, is the largest bone in the foot. **Figure 5-11** shows the bones of the ankle and foot.

Joints

A **joint**, or *articulation*, is the place where bones come together. Some joints, such as the knee and elbow, are highly movable, and some have little or no movement. A joint with no movement is called a **synarthrosis**. Any of the suture joints in the cranium would be a good example of a synarthrosis. A joint with little movement is called an **amphiarthrosis**. The vertebral bodies within the vertebral column are examples of amphiarthroses. A joint that is freely movable is called a **diarthrosis** or a **synovial joint**. Examples of diarthroses are the shoulder, knee, and ankle.

The spaces within each synovial joint are filled with a viscous liquid called **synovial fluid**. Although the spaces in even a large joint are so tiny that less than 1/100th of an ounce of synovial fluid is needed to fill it, the fluid is needed to lubricate the joint as it moves and to cushion it against shock. Synovial joints permit a variety of movements and are further classified based on *how* they move. The knee and elbow joints, for example, are “hinge joints” that allow *flexion* (decreasing the angle at a joint causing bending of the limb) and *extension* (increasing the angle at a joint causing straightening of the limb). The “ball-and-socket joint” of the shoulder provides the greatest range of motion (ROM) including rotation.

Cartilage, a precursor of bone tissue, is classified as connective tissue, but it is mentioned here because cartilage enables movement in the synovial joints.

Bursae (*bursa*, singular) are found wherever tendons or ligaments impinge on other tissues. Bursae are spaces within connective tissue filled with synovial fluid.

Figure 5-12 shows the various movements at synovial joints, and **Table 5-2** describes their various movements.

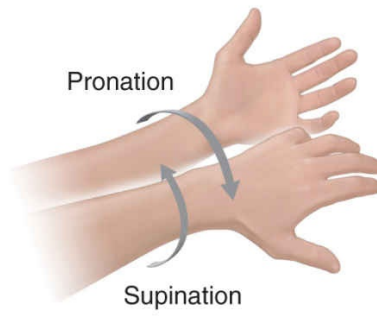
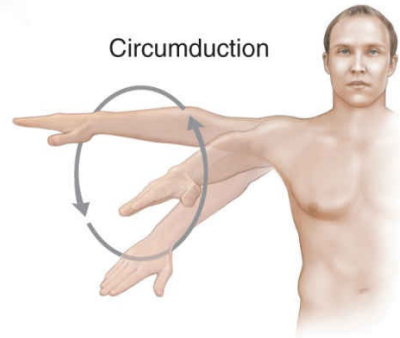
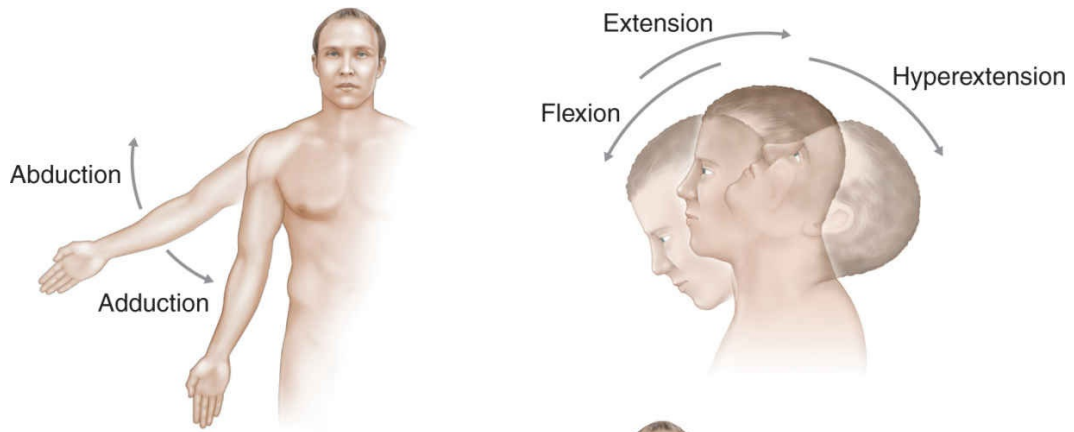


FIGURE 5-12 Movements at joints.

TABLE 5-2 MOVEMENTS OF SYNOVIAL JOINTS

Movement	Description
abduction	movement away from the midline of the body
adduction	movement toward the midline of the body
flexion	decreasing the angle of a joint; movement that bends a limb
extension	increasing the angles of a joint; movement that straightens a limb
hyperextension	excessive extension beyond the anatomic position
circumduction	movement in a circular direction from a central point
rotation	turning a body part on its own axis
pronation	turning the palm posteriorly
supination	turning the palm anteriorly
dorsiflexion	bending the sole foot upward toward the shin
plantar flexion	bending the sole of the foot downward or pointing the toes downward
eversion	turning the sole of the foot outward
inversion	turning the sole of the foot inward



Quick Check



Fill in the blank with the correct answer.

1. Osseous tissue consists of special mature bone cells called _____.
2. A diarthrosis is a joint that has free movement. It is also called a _____ joint.
3. The facial bones include the nasal bone, the two zygomatic bones, the maxilla, and the _____.

DISORDERS RELATED TO THE SKELETAL SYSTEM

A **sprain** is a tear in a ligament or the fibrous tissue that connects bones. A **fracture** (Fx) is a broken bone. However, all fractures are not the same. Some are simple breaks, and some are not. If the fracture is a **simple fracture (closed fracture)**, there is no open skin. If the broken bone protrudes through the skin, it is called a **compound fracture (open fracture)**.

COMMON TYPES OF FRACTURES

Fracture	Description	Example
Simple (closed)	break in which there is no open skin	 simple (closed)
Compound (open)	broken bone protrudes through the skin	 compound (open)

Comminuted break in which the bone is crushed or splintered



Spiral break is S-shaped, usually caused by a twisting injury



Transverse break is straight across the shaft of the bone, at a right angle to the long axis



Greenstick Incomplete break in which the bone bends



Bone disorders arising from disease include conditions such as **osteomyelitis**, an inflammation caused by bacteria. **Osteoporosis** is a bone disorder characterized by a decrease in bone density and mass. Two other bone disorders are **rickets**, causing bowed legs in children, and **osteomalacia**, which is bone softening in adulthood. These two conditions result from vitamin deficiency and lack of calcium absorption. **Neoplasms** or tumors of the bone may be primary or secondary (from other sites in the body).

Osteosarcoma is a tumor of the bone. **Chondrosarcoma** is a tumor that arises in cartilage.

Joint disorders include **arthritis**, a general term used to denote joint inflammation. General wear and tear on joints results in **osteoarthritis**. **Rheumatoid arthritis** (RA) also results in inflammation, but has a different cause than osteoarthritis. RA is attributed to an immunologic abnormality that results in inflammation with subsequent tissue destruction (see **Figure 5-13**).

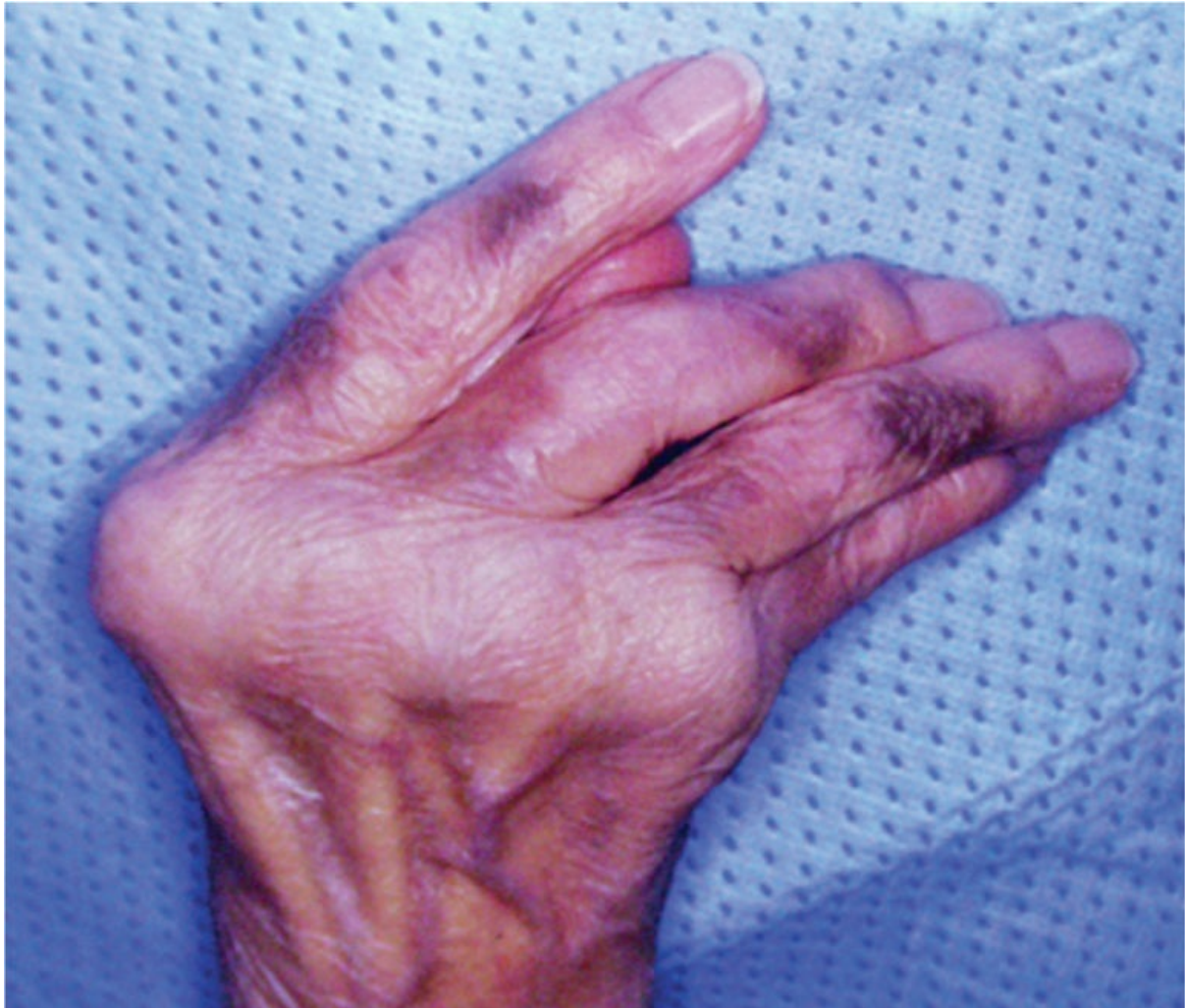


FIGURE 5-13 Advanced rheumatoid arthritis. These hands show joint swelling and finger deformity.

The spine has a number of conditions that affect it. A disc that protrudes into the vertebral canal and puts pressure on the spinal nerve is called a **herniated disc**. Compression fractures of the vertebrae may produce **kyphosis** (humpback) and loss of height. **Lordosis** is an abnormal curvature in the lumbar region. **Scoliosis** is a sideways curvature of the spine that may occur in any region of the spine (see **Figure 5-14**).

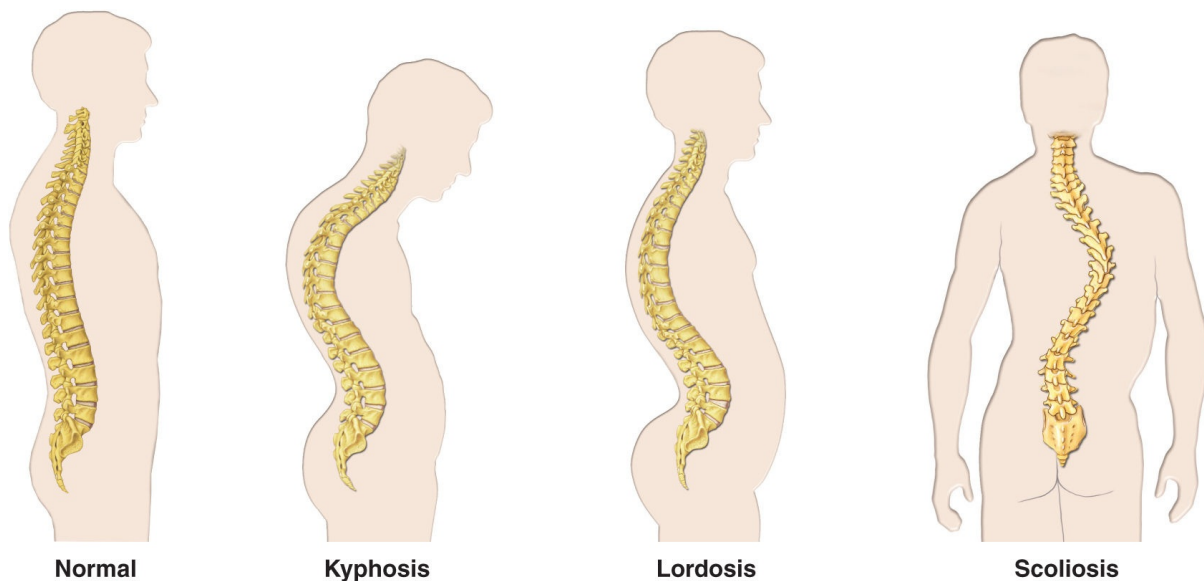


FIGURE 5-14 Abnormal curvatures of the spine can cause pain and disfigurement.

DIAGNOSTIC TESTS, TREATMENTS, AND SURGICAL PROCEDURES

Treatment of a fracture consists of **reduction** (realignment) of the broken bone. In some cases, **traction** (Tx) (using elastics or pulley and weights to maintain alignment) may be needed. Casts and splints are used to immobilize a broken bone during the healing process.

Symptomatic treatments (just treating the symptoms but not the problem) are also common with skeletal system conditions. For osteoarthritis, treatment may include medication for pain and inflammation and/or physical therapy. For conditions like RA, treatments consist of medication, rest, and physical therapy. Another option is **arthrocentesis**, which drains fluid and relieves the pressure in the joint.

PRACTICE AND PRACTITIONERS

A number of specialists work in the branch of **orthopedics** (*orthopedic medicine*), all of them engaged in the diagnosis and treatment of patients with musculoskeletal disorders. **Orthopedic surgeons** coordinate patient care with **physical therapists** (professionals who treat disorders with physical methods), **occupational therapists** (professionals who rehabilitate through performance of activities of daily living), **kinesiologists** (professionals who aid by studying body movements), or other practitioners in sports medicine. A **rheumatologist** is a physician who specializes in the treatment of joint disorders and arthritic conditions.

What is the difference between occupational therapy and physical therapy? The goal of occupational therapy is for the individual to be able to take care of themselves and complete activities of daily living, such as getting in and out of the car, getting dressed, or being able to push a grocery cart in the store. This type of therapy is common for people who recently had surgery, such as total hip replacement (THR) or total knee arthroplasty (TKA), or after something like a stroke. Physical therapy focuses on muscle groups to help the individual improve strength, balance, and ROM. Physical therapy is common after sports injuries, like an anterior cruciate ligament (ACL) tear.

Abbreviation Table THE SKELETAL SYSTEM

ABBREVIATION	MEANING
ACL	anterior cruciate ligament
C (C1–C7)	cervical
CT	computed tomography
Fx	fracture
L (L1–L5)	lumbar
MRI	magnetic resonance imaging
NSAID	nonsteroidal anti-inflammatory drug
RA	rheumatoid arthritis
ROM	range of motion
S	sacral
T (T1–T12)	thoracic
THR	total hip replacement
TKA	total knee arthroplasty
TKR	total knee replacement
Tx	traction

Study Table THE SKELETAL SYSTEM

TERM AND

PRONUNCIATION	ANALYSIS	MEANING
Structure and Function		
amphiarthrosis (AM-fee-ar-THRO-sihs)	<i>amphi-</i> (both sides); <i>arthr/o</i> (joint); <i>-osis</i> (abnormal condition)	joint with little movement
appendicular skeleton (APP-ehn-DIHK-yu-lahr SKEL-uh-tun)	adjective referring to something that is added or attached	bones of the limbs, including the shoulder girdle and pelvic girdle
axial skeleton (AX-ee-uhl SKEL-uh-tun)	adjective form of axis, a common English word	articulated bones of the head, vertebral column, and thorax
brachial (BRAY-kee-uhl)	<i>brachi/o</i> (arm); <i>-al</i> (adjective suffix)	having to do with an arm
bursae (BUR-see; <i>bursa</i> , singular)	a Latin word meaning “purse”	saclike connective structure found in some joints that contains synovial fluid; protects moving parts from friction
calcaneus (kal-KAY-nee-uhs)	Latin word for heel	the heel bone
carpal (KAR-pahl) bones	adjective form of carpus (wrist)	wrist bones
cartilage (CAR-tih-lij)	from the Latin word <i>cartilagin</i> (gristle)	dense, flexible connective tissue
cervical (SUR-vih-kuhl)	<i>cervic/o</i> (neck); <i>-al</i> (adjective suffix)	adjective describing the vertebrae (C1–C7) in the neck region; also used in connection with the uterus, which is part of the female reproductive system
cervix (SUR-vix)	Latin word for neck	neck (also the neck of the uterus)
clavicle (KLAV-ih-cuhl); the adjective is clavicular (kla-VIK-yu-luhr)	from the Latin word <i>clavicula</i> (a small key)	the collarbone
coccyx (KOK-six); the adjective is coccygeal (kok-SIH-jee-uhl)	from the Greek word <i>kokkyx</i> (cuckoo)	the tailbone, made up of the four fused vertebrae at the base of the spinal column
compact (KOM-pakt) bone	common English word	type of dense bone
cranial bones (KRAY-nee-uhl)	<i>crani/o</i> from the Greek word <i>kranion</i> (skull); <i>-al</i> (adjective form)	collectively, and along with other minor bones, the frontal bone, two parietal bones, two temporal bones, and the occipital bone
cranial sutures (KRAY-nee-uhl SOO-churz)	from the Latin word <i>sutura</i> (seam)	fibrous membrane forming an immovable joint that joins the skull bones

cranium (KRAY-nee-um)	from medieval Latin, <i>kranion</i> (skull)	the bones of the head
diaphysis (dye-AFF-ih-sihs)	a Greek word (growing between)	shaft of the long bone
diarthrosis (dy-ar-THRO-sihs)	a Greek word (articulation)	synonym for synovial joint
endosteum (ehn-DOST-ee-um)	<i>endo-</i> (inside); <i>oste/o</i> (Greek word for bone)	inner membrane layer of the bone
epiphyseal (ep-ih-FIZ-ee-ul) plate	relating to an epiphysis (bone end)	disk of cartilage between the metaphysis and epiphysis of an immature long bone; growth plate
epiphysis (eh-PIFF-ih-sihs)	<i>epi-</i> (upon); <i>-physis</i> (growth)	end of the long bone (proximal, distal)
extension (ehx-TEN-shun)	a common English word	to straighten a joint
femur (FEE-muhr)	a Latin word (thigh)	thighbone
fibula (FIHB-yu-lah)	a Latin word (clasp)	the lateral leg bone
flexion (FLEHX-shun)	from the Latin verb <i>flecto</i> (bend)	bending a joint
frontal bone (FRUN-tuhl)	frontal (adjective form of English noun: front)	one of the six main cranial bones
hip bone	from the Old English, <i>hype</i>	large flat bone formed by the fusion of the ilium, ischium, and pubis
humerus (HUE-muh-ruhs)	Latin for shoulder	the long bone extending from the shoulder to the elbow
ilium (IL-ee-uhm)	Latin for flank	one of the three bones fused together to form the hip bone
ischium (IS-kee-uhm)	Latin for hip	one of the three bones fused together to form the hip bone
joint	from the Latin word <i>iunctus</i> (connected, associated)	place where two bones come together
lateral malleolus (LAT-er-ul mahl-ee-OHL-us)	from the Latin words, <i>lateralis</i> (side) and <i>malleus</i> (hammer)	projection on the lateral side of the lower end of the fibula
ligaments (LIG-uh-ments)	from the Latin word <i>ligamentum</i> (a tie or binding)	tissue that connects two bones

lumbar (LUM-bar)	from the Latin word <i>lumbus</i> (loin); <i>-ar</i> (adjective suffix)	adjective describing the vertebrae (L1–L5) in the lower vertebral column
mandible (MAN-dih-buhl); the adjective is mandibular (man-DIB-yu-luhr)	from the Latin verb <i>mandere</i> (to chew)	the lower jawbone
maxilla (MAX-ih-luh); the adjective is maxillary (MAX-ih-lahr-ee)	Latin for jawbone	the bone above the upper teeth
medial malleolus (mee-DEE-ul mahl-ee-OHL-us)	from the Latin words <i>medialis</i> (middle) and <i>malleus</i> (hammer)	projection on the medial side of the lower end of the tibia
medulla (MUH-duhl-uh)	Latin for marrow	soft, marrow-like structure
medullary cavity (MED-yul-her-ee)	an adjective form of <i>medulla</i> (Latin for marrow)	bone marrow cavity
metacarpals (MEHT-uh-KAR-puhl)	<i>meta-</i> (beyond); carp from <i>carpus</i> (wrist); <i>-al</i> (adjective suffix)	the five bones extending from the wrist to the first knuckle in each hand
metatarsals (MEH-tah-TAHR-sahlz)	<i>meta-</i> (beyond); tarsal from <i>tarsos</i> (flat surface); <i>-al</i> (adjective suffix)	the bones between the tarsals and the phalanges (toes) of the foot
nasal bone (NAY-zuhl)	<i>nas/o</i> (nose); <i>-al</i> (adjective suffix)	a facial bone (nose)
occipital bone (ox-SIP-it-uhl)	<i>occiput</i> (Latin for back of the head); <i>-al</i> (adjective suffix)	one of the six main cranial bones
os coxae (OSS COX-ay)	<i>os</i> (Latin for bone); <i>coxae</i> (Latin: genitive case for hip)	hip bone
osseous tissue (OSS-ee-us)	from the Latin word <i>osseus</i> (bony); <i>-ous</i> (adjective suffix)	bone tissue
ossification (OSS-ihf-ih-KAY-shun)	<i>os</i> (bone); <i>facio</i> (Latin verb for make)	bone formation
osteocytes (OSS-tee-oh-syt)	<i>oste/o</i> (bone); <i>-cyte</i> (cell)	mature bone cells
osteogenesis (oss-tee-oh-JENN-uh-sis)	<i>oste/o</i> (bone); <i>-genesis</i> (origin)	formation of bone
parietal bones (puh-RY-uh-tuhl)	from a Latin word <i>paries</i> (wall) and <i>-al</i> (adjective suffix)	two of the six main cranial bones

patella (pah-TELL-ah)	Latin for small plate	kneecap
pectoral girdle (pek-TOR-uhl)	from <i>pectus</i> , a Latin word (chest); <i>-al</i> (adjective suffix)	the shoulder girdle
periosteum (pair-ee-OST-ee-um)	<i>peri-</i> (around); <i>oste/o</i> (bone)	membrane that surrounds the outside of the bone
phalanges (FAY-lanj-es)	plural of the Greek word <i>phalanx</i> (a column of soldiers)	fingers (singular form is phalanx)
pubis (PYU-bihs)	short for “os pubis”; from the Latin word <i>pubertas</i> (grown up)	one of the three bones fused together to form the hip bone
radius (RAY-dee-uhs); the adjective is radial (RAY-dee-uhl)	a Latin word (a rod or a spoke of a wheel)	one of the two bones (the other is the ulna) extending from the elbow to the wrist
sacrum (SAK-rum); the adjective is sacral (SAK-ruhl)	short for “os sacrum,” a Latin word meaning “sacred”	bone formed from five vertebrae fused together near the base of the vertebral column
scapula (SKAP-yu-luh); plural is scapulae (SKAP-yu-lay); the adjectival form is scapular (SKAP-yu-luhr)	Latin for shoulder blade	the shoulder blade
spongy (SPUN-jee) bone	common English words	type of bone tissue
sternum (STUR-nuhm)	from the Greek word <i>sternon</i> (chest)	the breastbone; parts include the manubrium, body, and xiphoid process
synarthrosis (syn-AR-thr-oh-sihs)	<i>syn-</i> (together); <i>arthr/o</i> (joint); <i>-osis</i> (condition)	joint with no movement
synovial (sy-NOH-vee-ahl) joint	<i>syn-</i> (together); Latin <i>ovum</i> (egg); <i>-al</i> (adjective suffix)	freely movable joint; diarthrosis
talus (TAY-luhs)	Latin for ankle	the bone in the ankle that articulates with the tibia and fibula
tarsal (TAR-sahl) bones	from the Greek word <i>tarsos</i> (a flat surface, sole of the foot)	the bones of the sole of the foot
tarsus (TAR-suhs)	from the Greek word <i>tarsos</i> (a flat surface)	ankle
tendons (TEN-duhnz)	from the Latin verb <i>tendere</i> (to stretch)	connective tissue that connects muscle to bone
temporal bones (TEMP-uh-ruhl)	from the Latin <i>tempus</i>	two of the six main cranial bones; located on the

	(time, temple)	side of the head near the ears
thoracic (tho-RASS-ik) cage	from the Greek word <i>thorax</i> (breastplate, the chest)	skeleton of the thoracic consisting of the thoracic vertebrae, ribs, costal (rib) cartilages, and sternum
thorax (THOR-ax)	from the Greek word <i>thorax</i> (breastplate, the chest)	chest
tibia (TIH-bee-ah); the adjective form is tibial (TIH-bee-al)	Latin for flute	shin bone
ulna (ULL-nah); the adjective is ulnar (ULL-nahr)	Latin for forearm	one of the two bones (the other is the radius) extending from the elbow to the wrist
vertebrae (VUR-tuh-bray); singular is vertebrae (VUR-tuh-bruh)	from the Latin verb <i>verto</i> (to turn)	one of the 33 segments making up the vertebral column
vertebral (VER-te-brul) column	from the Latin verb <i>verto</i> (to turn)	series of vertebrae extending from the cranium (head) to the coccyx (tailbone)
xiphoid process (ZEYE-foyd)	from the Greek word <i>xipho</i> (sword), <i>-oid</i> (resemblance to)	bony, dagger-like structure at the lower end of the sternum
zygomatic bones (ZI-go-MAT-ik)	from the Greek word <i>zygoma</i> (bolt or bar); <i>-tic</i> (adjective suffix)	a facial bone (cheek, one of two)
Disorders		
arthralgia (ar-THRAL-jee-uh)	<i>arthr/o</i> (joint); <i>-algia</i> (pain)	pain in a joint
arthritis (ar-THRY-tuhs)	<i>arthr/o</i> (joint); <i>-itis</i> (inflammation)	inflammation of a joint
arthrochondritis (ARTH-roh-konn-DRY-tihs)	<i>arthr/o</i> (joint); <i>chondr/o</i> (cartilage); <i>-itis</i> (inflammation)	inflammation of joint cartilage
arthropathy (ar-THROP-ah- thee)	<i>arthr/o</i> (joint); <i>-pathy</i> (disease or disorder)	any disorder of a joint
arthrosis (ar-THROW-sihs)	<i>arthr/o</i> (joint); <i>-osis</i> (abnormal condition of)	degenerative joint changes
brachialgia (BRAY-kee-AL-jee-uh)	<i>brachi/o</i> (arm); <i>-algia</i> (pain)	pain in the arm
bursitis (burr-SY-tihs)	<i>burs/o</i> (bursa); <i>-itis</i> (inflammation)	inflammation of a bursa
	<i>carp/o</i> (wrist); <i>-al</i> (adjective)	condition characterized by wrist pain, caused by

carpal tunnel syndrome (KAR-puhl TUN-uhl SINN-druhm)	suffix); <i>syn-</i> (together); from the Greek <i>dromos</i> (a running)	chronic entrapment of the median nerve within the carpal tunnel
chondromalacia (konn-droh-muh-LAY-she-uh)	<i>chondr/o</i> (cartilage); <i>-malacia</i> (softening)	softening of cartilage
chondropathy (kon-DROP-ah-thee)	<i>chondr/o</i> (cartilage); <i>-pathy</i> (disease or disorder)	disease of cartilage
chondrosarcoma (KONN-droh-sar-KOH-ma)	<i>chondr/o</i> (cartilage); <i>sarc/o</i> (flesh); <i>-oma</i> (tumor)	malignant tumor arising from the cartilage
closed fracture (FRAK-chur)	from the Latin word <i>fractura</i> (a break)	break in the bone in which the skin is intact at the site; also called simple fracture
compound fracture (KOM-pound FRAK-chur)	from the Latin word <i>fractura</i> (a break)	break in the bone where the bone comes through the skin; also called open fracture
costalgia (koss-TAL-jee-uh)	<i>cost/o</i> (rib); <i>-algia</i> (pain)	rib pain
costochondritis (KOSS-toh-kon-DRY-tihs)	<i>cost/o</i> (rib); <i>chondr/o</i> (cartilage); <i>-itis</i> (inflammation)	inflammation of rib cartilage
dactylalgia (DAKK-tihl-AL-jee-uh)	<i>dactyl/o</i> (finger, toe); <i>-algia</i> (pain)	pain in the fingers
dactylodynia (DAKK-tihl-oh-DINN-ee-uh)	<i>dactyl/o</i> (finger, toe); <i>-dynia</i> (pain)	pain in the fingers
fracture (FRAK-chur)	from the Latin word <i>fractura</i> (break)	break in a bone
herniated disc (HER-nee-ay-ted disk)	from the Latin word <i>hernia</i> (rupture); <i>disc/o</i> (disk)	protrusion of a fragmented intervertebral disc in the intervertebral foramen with potential compression of a nerve
kyphosis (ky-FOH-sis)	<i>kyph/o</i> (humped); <i>-sis</i> (condition)	humpback; anteriorly concave curvature of the thoracic and sacral region of the spine
lordosis (lohr-DOH-sis)	from the Greek word <i>lordosis</i> (a bending backwards)	swayback; abnormal anteriorly convex curvature of the lumbar part of the spine
megadactyly (meg-uh-DAKK-tuh-lee)	<i>mega-</i> (enlargement); <i>dactyl/o</i> (finger, toe)	enlargement of one or more fingers or toes
neoplasms (NEE-oh-plazumz)	<i>neo-</i> (new); <i>plasma</i> (thing formed)	abnormal tissue that grows rapidly
open fracture	<i>open</i> (exposed)	bone break in which the skin is lacerated and there is an open wound; also called compound fracture

ostealgia (oss-tee-AL-jee-uh)	<i>oste/o</i> (bone); <i>-algia</i> (pain)	pain in a bone; also called osteodynia
osteitis (oss-tee-EYE-tihs)	<i>oste/o</i> (bone); <i>-itis</i> (inflammation)	inflammation of bone
osteochondritis (OSS-tee-oh-konn-DRY-tihs)	<i>oste/o</i> (bone); <i>chondr/o</i> (cartilage); <i>-itis</i> (inflammation)	inflammation of bone and associated cartilage
osteodynia(oss-tee-oh-DINN-ee-uh)	<i>oste/o</i> (bone); <i>-dynia</i> (pain)	pain in a bone; also called ostealgia
osteomalacia (OSS-tee-oh-muh-LAY-she-uh)	<i>oste/o</i> (bone); <i>-malacia</i> (softening)	softening of bone
osteomyelitis (OSS-tee-oh-my-eh-LY-tihs)	<i>oste/o</i> (bone); <i>myel/o</i> (marrow); <i>-itis</i> (inflammation)	inflammation of bone marrow
osteopenia (oss-tee-oh-PEEN-ee-uh)	<i>oste/o</i> (bone); <i>-penia</i> (deficiency)	abnormally low bone density
osteoporosis (OSS-tee-oh-puh-RO-sihs)	<i>oste/o</i> (bone); <i>por/o</i> (porous); <i>-sis</i> (condition)	atrophy and thinning of bone tissue
osteosarcoma (OSS-tee-oh-sar-KOH-ma)	<i>oste/o</i> (bone); <i>sarc/o</i> (fleshlike); <i>-oma</i> (tumor)	highly malignant tumor of the bone
rheumatoid arthritis (ROO-mah-toid ar-THRY-tuhs)	from the Greek word <i>rheuma</i> (flux); <i>-oid</i> (resemblance of)	systemic autoimmune disease occurring more often in women that affects the connective tissue; involves many joints, especially those of the hands and feet
rickets (RIH-kehts)	common English word; might be an alteration of the Greek word <i>rhakhitis</i>	disease due to vitamin D deficiency characterized by deficient calcification and soft bones associated with skeletal deformities
scoliosis (skohl-ee-OH-sis)	<i>scoli/o</i> (twisted); <i>-sis</i> (condition)	lateral curvature of the spine; S-shaped curvature
simple fracture (FRAK-chur)	from the Latin word <i>fractura</i> (a break)	break in the bone in which the skin is intact at the site; also called closed fracture
sprain (SPRAYN)	common English word; unknown origin	injury to a ligament
syndrome (SIN-drum)	<i>syn-</i> (together); from the Greek <i>dromos</i> (running)	collection of signs and symptoms occurring together and characterizing a medical condition
Diagnostic Tests, Treatments, and Surgical Procedures		
analgesics (an-al-GEE-ziks)	<i>an-</i> (absence); from the Greek word <i>gesis</i>	medication used to relieve pain

	(sensation)	
anti-inflammatory (AN-ty-in-FLAMM-ah-tohr-ee)	<i>anti-</i> (against); inflammatory (common English word)	medication used to reduce inflammation (e.g., used to reduce joint inflammation in arthritis)
arthrectomy (ar-THREK-tuh-mee)	<i>arthr/o</i> (joint); <i>-ectomy</i> (surgical removal)	excision of a joint
arthrocentesis (arth-roh-senn-TEE-sihs)	<i>arthr/o</i> (joint); <i>-centesis</i> (surgical puncture for aspiration)	removing fluid from a joint through a needle puncture
arthrogram (ARTH-roh-gram)	<i>arthr/o</i> (joint); <i>-gram</i> (record or picture)	imaging of a joint after injecting a contrast dye to aid visualization
arthrometry (arth-ROM-uh-tree)	<i>arthr/o</i> (joint); <i>-metry</i> (process of measuring)	measurement of the amount of movement in a joint
arthroplasty (ARTH-roh-plass-tee)	<i>arthr/o</i> (joint); <i>-plasty</i> (surgical repair)	surgical repair of a joint
arthroscope (ARTH-roh-skope)	<i>arthr/o</i> (joint); <i>-scope</i> (instrument for viewing)	device used in arthroscopy
arthroscopy (ahr-THRAW-skoh-pee)	<i>arthr/o</i> (joint); <i>-scopy</i> (use of instrument for viewing)	examination of the interior of a joint
arthrotomy (ar-THRAWT-uh-mee)	<i>arthr/o</i> (joint); <i>-tomy</i> (cutting operation)	surgical incision into a joint
carpectomy (kar-PEK-tuh-me)	<i>carp/o</i> (wrist); <i>-ectomy</i> (surgical removal)	excision of part of the wrist
chondroplasty (KONN-droh-plass-tee)	<i>chondr/o</i> (cartilage); <i>-plasty</i> (surgical repair)	surgical repair of cartilage
computed tomography (CT) scan	from the Greek <i>tomos</i> (slice, section) and <i>graphy</i> (image)	noninvasive imaging test; imaging anatomical information from a cross-sectional plane of the body
costectomy (koss-TEK-tuh-mee)	<i>cost/o</i> (rib); <i>-ectomy</i> (surgical removal)	excision of a rib
magnetic resonance imaging (MRI)	from Latin <i>resonantia</i> (echo)	a diagnostic radiograph in which the magnetic nuclei of a patient are aligned in a magnetic field; these signals are converted into tomographic images
myelogram (MY-el-loh-gram)	<i>myel/o</i> (bone marrow); <i>-gram</i> (record or picture)	X-ray of the spinal column using contrast medium
narcotic (nahr-KAH-tik)	<i>narc/o</i> (sleep)	drug derived from opium with potent analgesic effects; potential effects of dependency through prolonged use

nonsteroidal anti-inflammatory drug (NSAID)	from the Greek <i>stereos</i> (solid lipid)	medication that exerts analgesic and anti-inflammatory actions
osteotomy (oss-TECK-tuh-mee)	<i>oste/o</i> (bone); <i>-ectomy</i> (surgical removal)	surgical removal of bone
osteoplasty (OSS-tee-oh-plass-tee)	<i>oste/o</i> (bone); <i>-plasty</i> (surgical repair)	surgical repair of bone
osteorrhaphy (OSS-tee-oh-raff-ee)	<i>oste/o</i> (bone); <i>-rrhaphy</i> (surgical suturing)	suturing together the parts of a broken bone
osteotomy (oss-tee-AW-tuh-mee)	<i>oste/o</i> (bone); <i>-tomy</i> (cutting operation)	surgical cutting of bone
reduction (ree-DUK-shun)	common English word	correcting a fracture by realigning the bone pieces
traction (TRAK-shun)	common English word	using elastics or pulley and weights to maintain alignment; a pulling or dragging force exerted on a limb in a distal direction
vertebrectomy (ver-tuh-BREKK-tuh-mee)	from the Latin word <i>verto</i> (to turn); <i>-ectomy</i> (surgical removal)	excision (resectioning) of a vertebra
Practice and Practitioners		
kinesiologist (ki-nee-see-ol-UH-jist)	<i>kinesis</i> (Greek for movement); <i>-logist</i> (one who studies a certain field)	practitioner who studies movement and the involved structures
occupational therapist (ok-YOU-pey-shun-uhl THER-uh-pist)	<i>occupationem</i> (Latin for business); <i>therapia</i> (Latin for curing the sick)	practitioner who works to increase independent function through therapy
orthopedics (or-thoh-PEE-diks)	<i>orth/o</i> (straight or correct); <i>ped-</i> (child); <i>-ic</i> (adjective suffix)	the medical specialty concerned with the development, preservation, restoration, and function of the musculoskeletal system
orthopedic surgeon (or-thoh-PEE-dik SUR-juhn)	<i>orth/o</i> (straight or correct); <i>ped-</i> (child); <i>-ic</i> (adjective suffix)	a physician in the field of orthopedics (can be MD or DO)
physical therapist (FIZ-i-kul THER-uh-pist)	<i>physicalis</i> (Latin for nature); <i>therapia</i> (Latin for curing the sick)	practitioner who works to restore correct muscle movement and ability
rheumatologist (ROO-mah-tah-logist)	<i>rheumat/o</i> (flux); <i>-logist</i> (one who studies a certain field)	physician who treats joint and connective tissue disorders such as arthritis
rheumatology (ROO-mah-tah-log-gee)	<i>rheumat/o</i> (flux); <i>-logy</i> (the study of)	field of specialty that deals with joints and connective tissue disorders

END-OF-CHAPTER EXERCISES

EXERCISE 5-1



LABELING: SKELETON

Using the following list, choose the correct terms to label the diagram correctly.

calcaneus femur metacarpals phalanges sternum

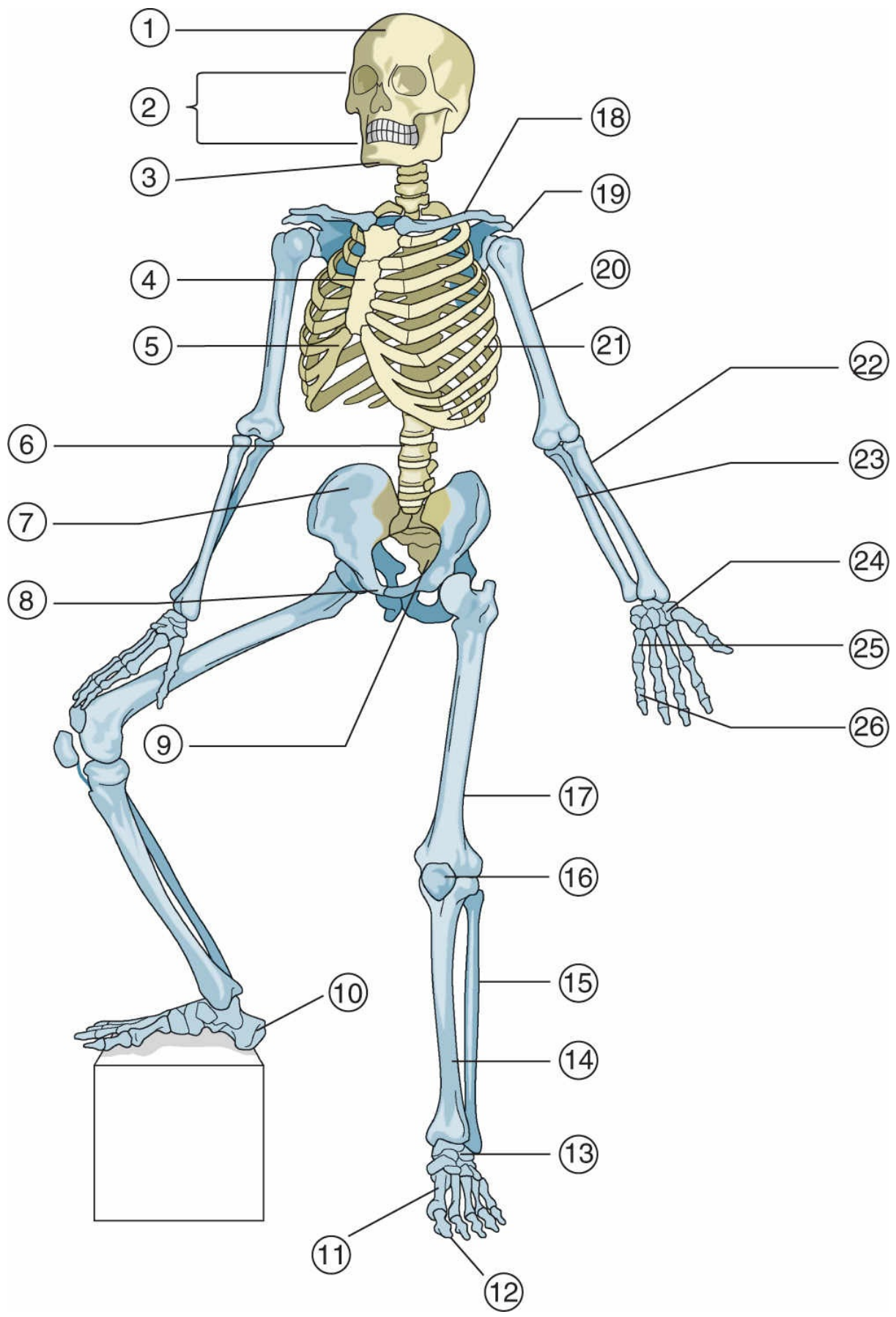
carpal bones fibula metatarsals radius tarsal bones

clavicle humerus patella ribs tibia

costal cartilage ilium pubis sacrum ulna

cranium mandible phalanges scapula vertebral column

facial bones



1. _____

2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____
24. _____
25. _____
26. _____

EXERCISE 5-2



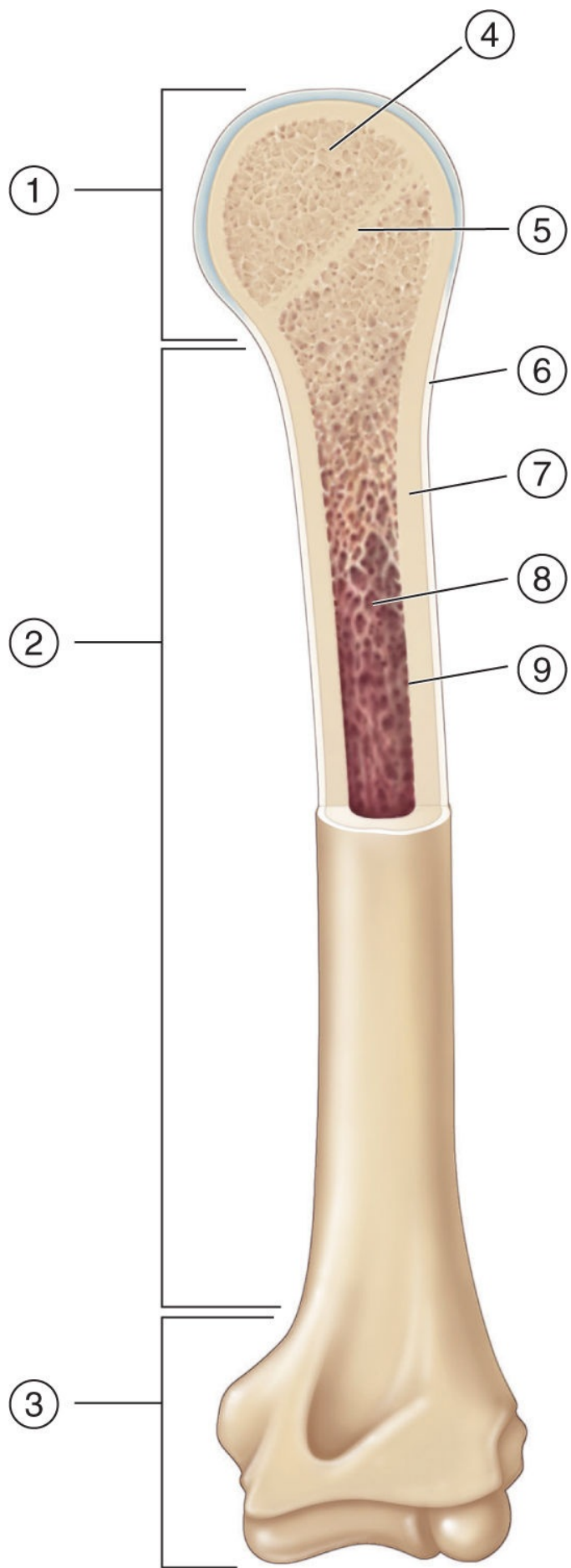
LABELING: LONG BONE

Using the following list, choose the correct terms to label the diagram correctly.

compact bone endosteum periosteum

diaphysis epiphyseal plate proximal epiphysis

distal epiphysis medullary cavity spongy bone



1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

EXERCISE 5-3



WORD PARTS

Break each of the following terms into its word parts: prefix, root, or suffix. Give the meaning of each word part and then define the term.

1. *osteorrhaphy*

root: _____

suffix: _____

definition: _____

2. *arthrocentesis*

root: _____

suffix: _____

definition: _____

3. *brachialgia*

root: _____

suffix: _____

definition: _____

4. *osteochondritis*

root: _____

root: _____

suffix: _____

definition: _____

5. *carpectomy*

root: _____

suffix: _____

definition: _____

6. *chondrosarcoma*

root: _____

root: _____

suffix: _____

definition: _____

7. *dactylomegaly*

root: _____

suffix: _____

definition: _____

EXERCISE 5-4



WORD BUILDING

Use the word parts listed to build the terms defined.

-algia -dynia -itis myel/o sarc/o

arthr/o -ectomy kinesi/o -oma -scopy

cardi/o electr/o -logy oste/o

chondr/o -gram -malacia -plasty

cost/o inter- my/o -porosis

1. _____ inflammation of the bone and bone marrow

2. _____ visual examination of a joint

3. _____ abnormal softening of cartilage

4. _____ imaging of a joint

5. _____ pain in a joint

6. _____ the study of movement of body parts
7. _____ surgical repair of cartilage
8. _____ pertaining to the area between the ribs
9. _____ inflammation of the bone
10. _____ a highly malignant tumor of the bone
11. _____ surgical repair of a joint
12. _____ X-ray of the spine
13. _____ inflammation of the cartilage
14. _____ bones with diminished density; porous
15. _____ pain in the ribs

EXERCISE 5-5

MATCHING

Match the term in the first column with its definition in the second column.

- | | |
|--------------------------|---------------------------------------|
| 1. _____ abduction | a. backward bending of hand or foot |
| 2. _____ rotation | b. bending the foot toward the ground |
| 3. _____ plantar flexion | c. straightening a limb |
| 4. _____ extension | d. motion around a central axis |
| 5. _____ dorsiflexion | e. motion away from the body |
| 6. _____ flexion | f. bending motion |
| 7. _____ adduction | g. motion toward the body |

EXERCISE 5-6

MULTIPLE CHOICE

Choose the correct answer for the following multiple choice questions.

1. The formation of a bone is called _____.
 - a. osteoporosis
 - b. osteology
 - c. orthogenesis
 - d. osteogenesis
2. The bony structure that forms the upper part of the sternum is the _____.
 - a. manubrium
 - b. mandible
 - c. temporomandibular joint
 - d. maxilla
3. An abnormal outward curvature of the thoracic spine is called _____.
 - a. spondylosis
 - b. lumbago
 - c. lordosis
 - d. kyphosis
4. The cartilaginous lower portion of the sternum is called the _____.
 - a. xiphoid process
 - b. sacroiliac
 - c. olecranon process
 - d. pelvic girdle
5. The collar bone is the _____.
 - a. ischium
 - b. ulna
 - c. clavicle
 - d. zygomatic
6. The bones of the hands are the _____.

- a. tarsals
 - b. metacarpals
 - c. metatarsals
 - d. calcaneus
7. The bones of the fingers and toes are the _____.
- a. metatarsals
 - b. carpal
 - c. phalanges
 - d. fibulas
8. The heel bone is the _____.
- a. ilium
 - b. zygomatic
 - c. ulna
 - d. calcaneus
9. The bones of the spine are the _____.
- a. vertebrae
 - b. temporals
 - c. maxilla
 - d. scapula
10. The shoulder blade is the _____.
- a. scapula
 - b. sternum
 - c. maxilla
 - d. scoliosis
11. Which term does not belong with the others?
- a. scoliosis
 - b. rickets
 - c. RA

- d. diaphysis
12. Which term does not belong with the others?
- a. humerus
 - b. fibula
 - c. radius
 - d. ulna
13. Which term does not belong with the others?
- a. deltoid muscle
 - b. patella
 - c. sternum
 - d. carpal bone
14. Which term does not belong with the others?
- a. sclerosis
 - b. kyphosis
 - c. scoliosis
 - d. lordosis
15. Which term does not belong with the others?
- a. cervical
 - b. parietal
 - c. thoracic
 - d. lumbar

EXERCISE 5-7



FILL IN THE BLANK

Fill in the blank with the correct answer.

1. The word that means “inflammation of a joint” is _____.
2. Aspiration of fluid from a joint by a needle puncture is a(n) _____.
3. The physician who treats disorders of the skeletal system is called a(n) _____.

4. A break in the bone where the bone comes through the skin is called an open fracture or a _____ fracture.
5. Bone marrow can be found in the _____ cavity.
6. A(n) _____ connects tissue to bone.
7. A(n) _____ is the protrusion of a fragmented intervertebral disc in the intervertebral foramen and can cause compression of a nerve.

EXERCISE 5-8



ABBREVIATIONS

Write out the term for the following abbreviations.

1. _____ ACL
2. _____ CT
3. _____ C1
4. _____ TKA
5. _____ L5
6. _____ RA
7. _____ NSAID
8. _____ MRI

Write the abbreviation for the following terms.

9. _____ total hip replacement
10. _____ fracture
11. _____ traction
12. _____ range of motion
13. _____ thoracic vertebra 12
14. _____ total knee replacement
15. _____ magnetic resonance imaging

EXERCISE 5-9



SPELLING

Select the correct spelling of the medical term.

1. A practitioner who studies movement and the involved structures is a _____.

- a. kinesiologist
 - b. kinisiologist
 - c. kynesiologist
 - d. kiniseologist
2. Suturing together the parts of a broken bone is called _____.
- a. osteorhaphy
 - b. osteorrhaphy
 - c. osteorafy
 - d. osteoraphy
3. The measurement of the amount of movement in a joint is _____.
- a. athrometry
 - b. arthrometry
 - c. athrometry
 - d. arthrometry
4. _____ are used to relieve pain.
- a. Analjesics
 - b. Analgisics
 - c. Analgezics
 - d. Analgesics
5. RA stands for _____.
- a. rhumatoid arthritis
 - b. rhuematoid arthritis
 - c. rheumatoid arthritis
 - d. rheumitoid arthritis
6. _____ is an adjective which means having to do with an arm.
- a. Brakial

- b. Breakial
 - c. Braychial
 - d. Brachial
7. _____ is a condition where the bone tissue atrophies and thins.
- a. Osteoporosis
 - b. Ostioporosis
 - c. Osteopourosis
 - d. Osteoporosys
8. The long bone that extends from the shoulder to the elbow and is Latin for “shoulder” is the _____.
- a. humerous
 - b. humeres
 - c. humerus
 - d. humeris
9. The posterior part of the hip bone is the _____.
- a. ischium
 - b. ishium
 - c. ichium
 - d. ischiem
10. Another name for the kneecap is the _____.
- a. patela
 - b. patella
 - c. pattela
 - d. pattella

EXERCISE 5-10



CASE STUDY

The underlined medical terms refer to a physician, a condition, or a treatment. Replace the underlined terms with a description.

Mrs. Smith, an 82-year-old woman, was out walking her dog on a cold day.

She slipped on a patch of ice, fell, and incurred painful injuries. In the emergency room, Dr. Farley Burrows, an orthopedic surgeon (1), examined her. Mrs. Smith had limited ROM (2) in her right wrist and was experiencing pain in her left hip. Dr. Burrows ordered x-rays, which revealed a comminuted fracture (3) in the wrist and compression fracture (4) in the hip. He then performed a reduction (5) of the wrist bone and ordered that Mrs. Smith be admitted to the hospital and placed in traction (6) to maintain realignment of her hip.

Write your descriptions of each of the underlined terms or phrases in the spaces.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____



The Muscular System

6

LEARNING OUTCOMES

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

- Name the three types of muscle tissue.
- Define terms related to muscle names and functions.
- Describe the types of muscle movement.
- Pronounce, spell, and define medical terms related to the muscular system and its disorders.
- Interpret abbreviations associated with the muscular system.

INTRODUCTION

In the preceding chapter, you learned that there are approximately 206 bones in the human body. The total number of muscles is harder to calculate because of the various ways to distinguish them. But it is safe to say that there are approximately three times as many muscles as there are bones. Moreover, muscles make up about half of our total body weight.

We normally think of muscles as necessary for lifting objects, running, jumping, throwing a ball, or swinging a golf club. Even though that is true, muscles are also needed for seeing, talking, eating, digesting, breathing, smiling, frowning, blinking, and so on. And let's not forget the muscle that pumps blood through our bodies (the heart), which is discussed in Chapter 10. This is because while the heart's structure is a muscle, its function is better related to the cardiovascular system than to the muscular system.



WORD PARTS RELATED TO THE MUSCULAR SYSTEM

The parts presented in **Table 6-1** are often found in terms related to the muscular system. The two main word parts are my/o and muscul/o, which both mean muscle. Other word roots refer to the movement of muscles such as kine- and kinesi/o.

TABLE 6-1  COMMON WORD PARTS RELATED TO THE MUSCULAR SYSTEM

Word Part	Meaning
fasci/o	fibrous membrane
fibr/o	fiber
hemi-	half
kine-, kinesi/o	movement

ligament/o	ligament
muscul/o	muscle
my/o	muscle
para-	alongside, near
-paresis	partial or incomplete paralysis
-plegia	paralysis
quadri-	four
sthen/o	strength
tend/o, tendin/o	tendon
ton/o	tone

Word Parts Exercise

After studying Table 6-1, write the meaning of each of the word parts.

WORD PART	MEANING
1. ligament/o	1. _____
2. tend/o, tendin/o	2. _____
3. ton/o	3. _____
4. -plegia	4. _____
5. muscul/o	5. _____

6. kine-, kinesi/o	6. _____
7. -paresis	7. _____
8. sthen/o	8. _____
9. my/o	9. _____
10. quadri-	10. _____
11. fasci/o	11. _____
12. fibr/o	12. _____
13. hemi-	13. _____
14. para-	14. _____

STRUCTURE AND FUNCTION

Muscles can be characterized by their location, cell characteristics (striated or nonstriated), and control of movement (voluntary or involuntary). The three types of muscle tissue are skeletal, smooth, and cardiac (see [Figure 6-1](#)).

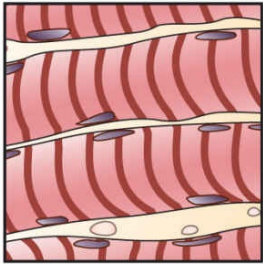
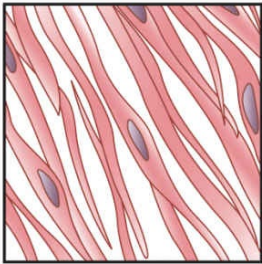
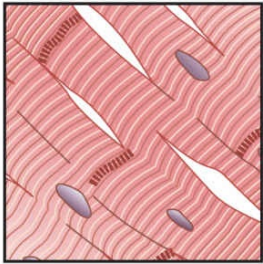
Comparison of the different types of muscle			
	Skeletal	Smooth	Cardiac
Location	Attached to bones	Wall of hollow organs, vessels, respiratory passageways	Wall of heart
Cell characteristics	 <p>Long and cylindrical, multinucleated, heavily striated</p>	 <p>Tapered at each end, single nucleus, nonstriated</p>	 <p>Branching networks, single nucleus, lightly striated</p>
Control	Voluntary	Involuntary	Involuntary

FIGURE 6-1 A comparison of the three types of muscle tissue.

Skeletal Muscle

Of the three types, **skeletal muscle** is the largest group, comprising more than 600 separate muscles. Skeletal muscle is so named because it attaches muscles to bone. These voluntary muscles are made up of **muscle fibers**, the name for *muscle cells* in muscle tissue with a rich blood vessel network. A bundle of muscle fibers is called **fascicle**. **Fascia** encloses muscle and groups of muscles. **Tendons** are made of connective tissue that connects muscle to bone (see **Figure 6-2**). **Ligaments** are bands of fibrous connective tissue that connect bones to bones or bones to other structures and offer support to muscles.

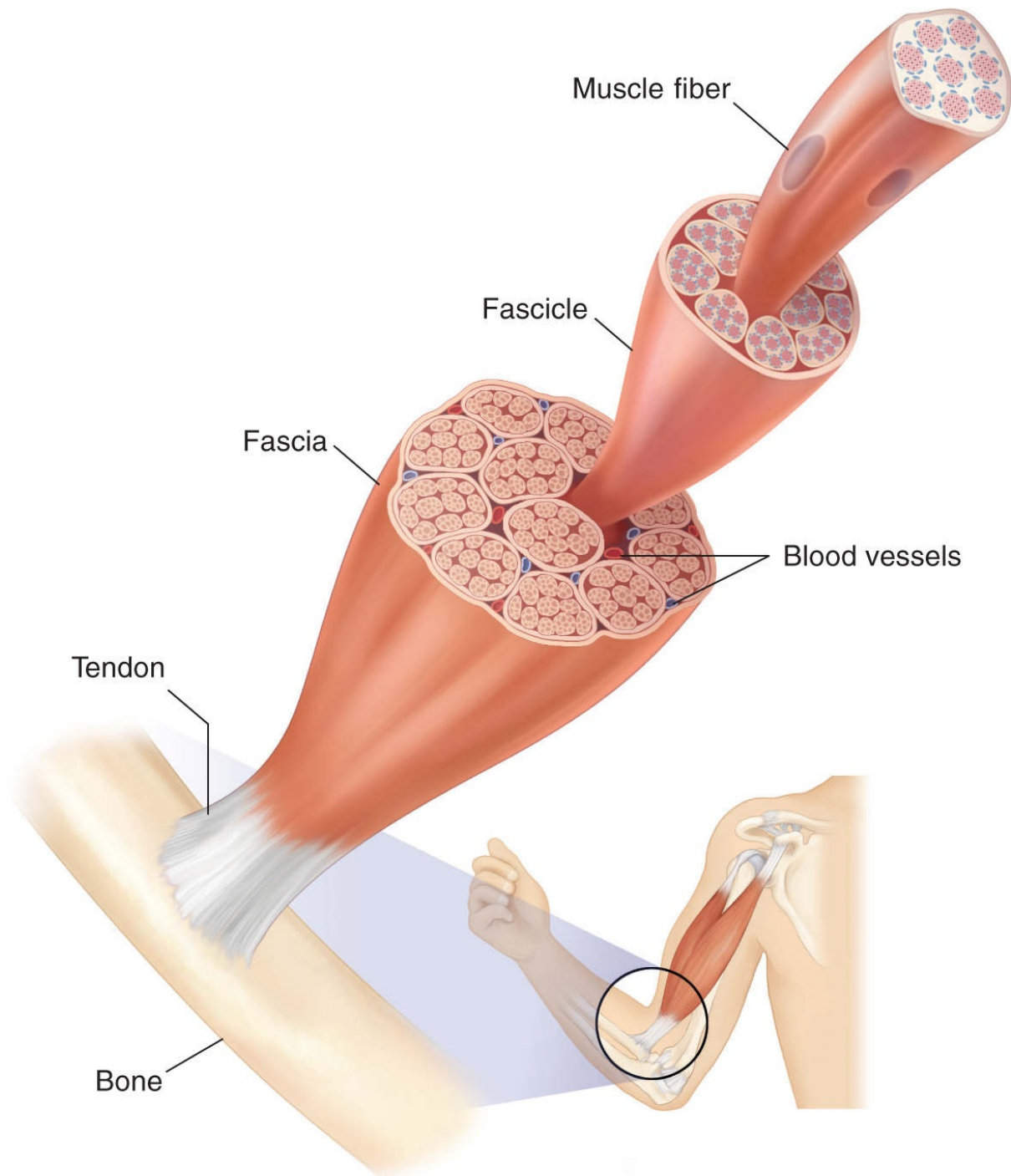


FIGURE 6-2 Components of skeletal muscle tissue. Tendons attach skeletal muscles to bone.

Contractions of skeletal muscles pull on bones at joints to produce movement. The muscle that is responsible for the main movement is considered the **prime mover** or **agonist**. The muscle that opposes the movement is the **antagonist**. For example, in the arm, the biceps brachii (anterior arm muscle) is the prime mover, and the triceps brachii (posterior arm muscle) is its antagonist. After contracting, muscle tension lessens, and muscles then relax (see [Figure 6-3](#)). Review [Table 5-2](#) in the previous

chapter, which describes muscle movements at a joint.

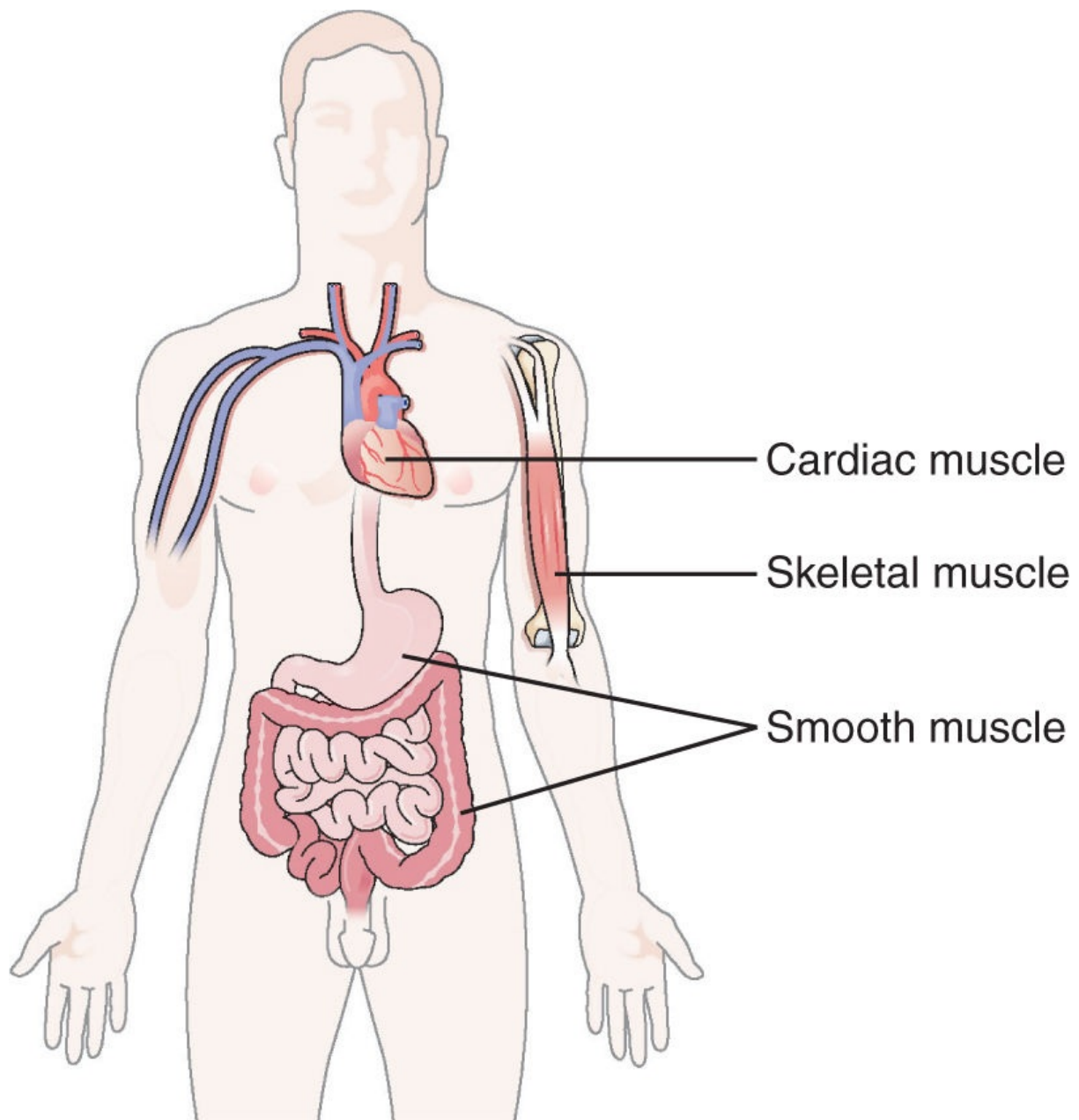


FIGURE 6-3 The three types of muscle tissue and their locations.

Skeletal muscle is also known as **striated muscle** because the dark and light bands in the muscle fibers create a striated (striped) appearance. Skeletal muscle is unlike smooth or cardiac muscle because skeletal muscle is voluntary. It also produces heat, which is generated by rapid, small contractions (shivering), and these muscles maintain posture.

Smooth Muscle

Smooth muscle, which acts involuntarily, lines blood vessels, respiratory passageways, the digestive tract, and walls of hollow internal organs (see

Figure 6-3). In blood vessels, smooth muscle contractions regulate the diameter of the vessels to help control blood flow. In respiratory passageways, smooth muscle regulates air flow; and in the digestive tract, smooth muscle contracts to move substances through passageways with wavelike motions. Smooth muscle is also known as **nonstriated muscle** because it lacks the striped appearance that skeletal muscle has.

Cardiac Muscle

Cardiac muscle, also known as heart muscle, forms the wall of the heart (see **Figure 6-3**). It acts involuntarily and has a lightly striated appearance. Cardiac muscle is responsible for the heart's pumping action. This subject is discussed in detail in Chapter 10.



Quick Check

Name the three types of muscle tissue and give an example of where each type may be located.

MUSCLE TISSUE TYPE	LOCATION
1. _____	_____
2. _____	_____
3. _____	_____

DISORDERS RELATED TO THE MUSCULAR SYSTEM

Disorders of the muscular system often involve other systems. However, the terms introduced in the following discussion are specific to the muscular system only.

Most muscle disorders are caused by physical trauma, such as those occurring in sports or accidents. Others are chronic and are listed first.

Chronic Disorders

Muscular dystrophy (MD) is a hereditary, progressive degenerative disorder that causes skeletal muscle weakness. The most common childhood MD is **Duchenne dystrophy**, which affects only males.

Myasthenia gravis (MG) is an immunologic disorder characterized by fluctuating weakness, especially of the facial and external eye muscles. Signs and symptoms can include drooping eyelids, double vision, difficulty talking, and **dysphagia** (difficulty swallowing).

Two words that students commonly mix up are dysphagia and dysphasia. Considering the words are only one letter apart, it's easy to do. The root word of dysphagia is the Greek word *phage*, meaning "eater." So dysphagia is difficulty swallowing. The root word of dysphasia is the Greek word *phase*, meaning "to speak." So dysphasia is difficulty speaking.

Fibromyalgia is a disorder characterized by widespread aching and stiffness of muscles and soft tissues, fatigue, tenderness, and sleep disorders. The cause of fibromyalgia is unknown, and it may coexist with other chronic diseases.

Amyotrophic lateral sclerosis (ALS), also called *Lou Gehrig's disease*, is considered a neurologic disease that affects the nerves and nervous system, but its signs and symptoms are seen in the muscles. It is a fatal, progressive degeneration of the nerve tracts of the spinal cord leading to muscular **atrophy**, which is muscle shrinking and wasting.

Cumulative Trauma and Sports Injuries

Cumulative trauma disorders (CTDs) are often caused by repetitive, work-related motions that damage muscles, tendons, joints, or nerves. A common one is **carpal tunnel syndrome**, which is a painful condition of the hand and fingers caused by compression of the median nerve in the wrist (see **Figure 6-4**).

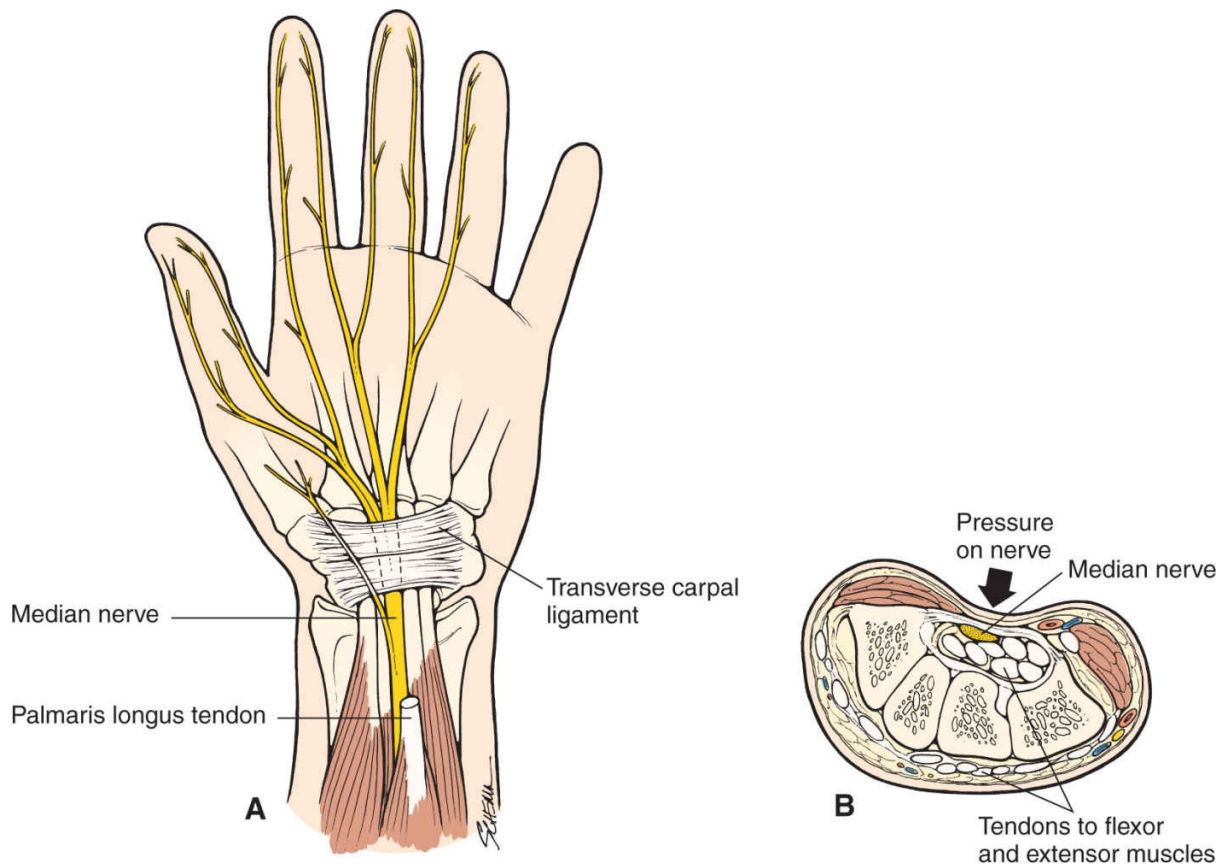


FIGURE 6-4 Carpal tunnel syndrome. **A.** Pressure on the median nerve as it passes through the carpal (wrist) bones causes numbness and weakness in the areas of the hand supplied by the nerve. **B.** Cross-section of the wrist shows compressing of the median nerve.

The rotator cuff of the shoulder is formed by four muscles and reinforcing tendons of the shoulder joint. When these muscles become inflamed and swollen from overuse, a **rotator cuff injury** occurs.

Epicondylitis is an inflammation of an epicondyle, a bony projection on the distal humerus. When the lateral epicondyle is affected, it is termed “tennis elbow” because it is common in tennis players. When the medial epicondyle is affected, it is known as “golfer’s elbow” because it is common in golfers (see **Figure 6-5**).

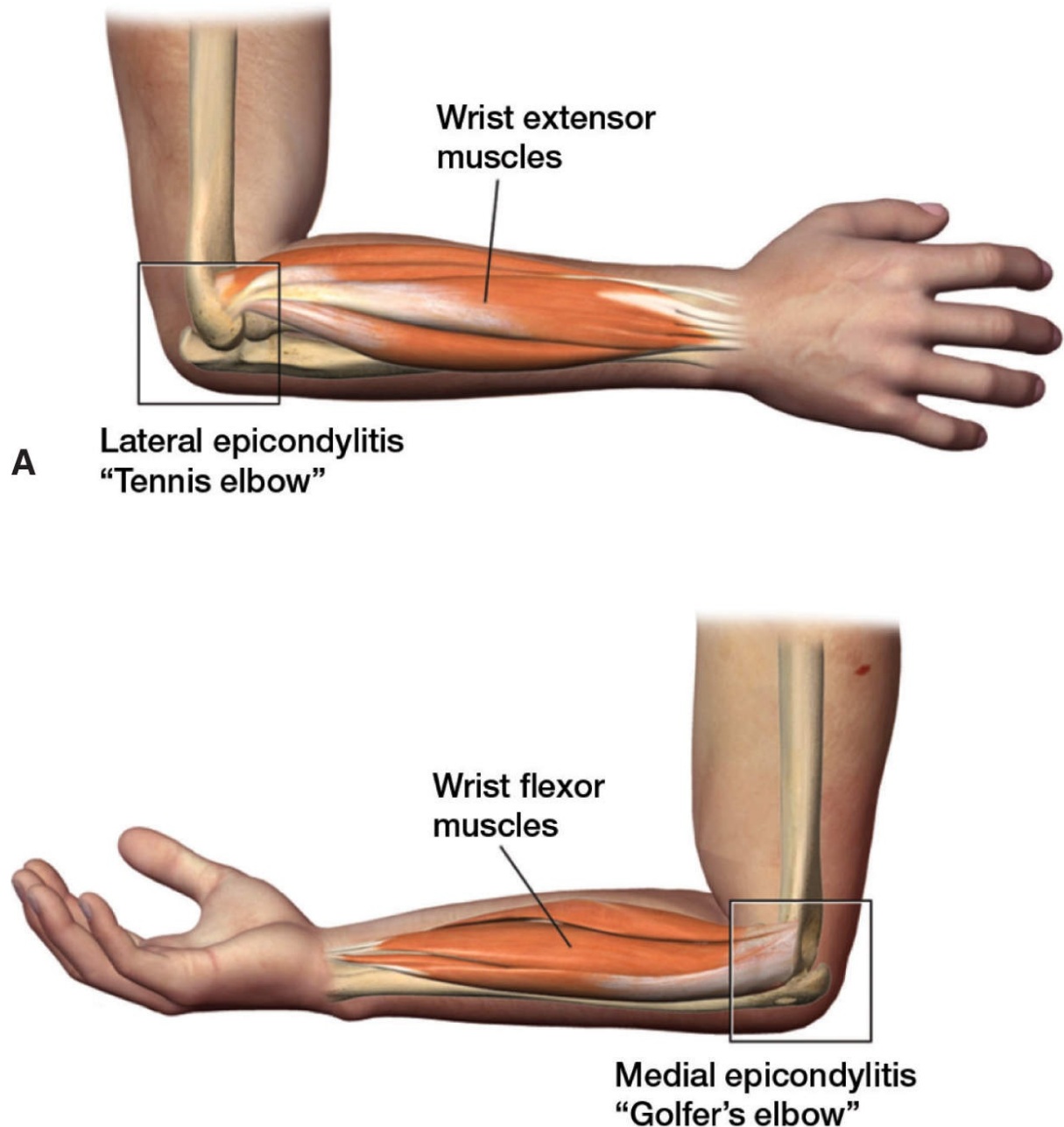


FIGURE 6-5 Epicondylitis. **A.** Tennis elbow (lateral epicondylitis). **B.** Golfer's elbow (medial epicondylitis).

Plantar fasciitis is an inflammation of the plantar fascia (connective tissue in the arch of the foot) that can cause intense pain when walking or running. It may be caused by long periods of weight bearing, sudden changes in activity, or obesity.

Sports injuries often occur to overstressed or poorly conditioned muscles. However, injuries can occur to professional athletes in good physical condition. Two examples are *hamstring injuries* and *shin-splints*. A **hamstring injury** is a strain or tear in one of the hamstring muscles (group of

three posterior thigh muscles). This injury is common among sprinters, track hurdlers, baseball players, or football players. **Shin-splints** is tenderness and pain in the muscles in the lower leg following athletic overexertion. It may include a stress fracture (Fx) (small crack in the bone) of the tibia or an inflammation of the periosteum. Shin-splints is actually a collective term describing the pain rather than the condition.

Paralysis and Paresis

Paralysis is the loss of voluntary muscle movement caused by injury or disease. **Paresis** is partial or incomplete paralysis. Below are examples.

- **Hemiparesis:** weakness or paralysis affecting one side of the body
- **Hemiplegia:** total paralysis of one side of the body
- **Paraplegia:** paralysis of both legs and generally the lower trunk
- **Quadriplegia:** paralysis of all four extremities

DIAGNOSTIC TESTS, TREATMENTS, AND SURGICAL PROCEDURES

Unfortunately for many of the chronic muscle conditions, there is no cure, only treatment of symptoms. For MD, steroids are used to reduce inflammation.

Like MD, there is no cure for MG. Treatment consists of antiacetylcholinesterase medications to keep the neurotransmitter acetylcholine at certain body sites to continue activating muscles. Steroids can reduce muscle inflammation in MG as well. Because there is also an immune component to this disease, immunosuppressant agents (drugs that reduce the body's immune response to itself) can be used to suppress immune reactions.

Amyotrophic lateral sclerosis is a progressive disease of the nervous system that also affects muscles. As nerve cells that control the body's muscles die, the person's ability to control their muscles vanishes. Current treatments cannot reverse this, so treatments are only to slow progression and to make the person more comfortable. As of 2017, the only approved drug to slow progression is Rilutek (riluzole). Other treatments consist of breathing therapy as the muscles needed to breathe start atrophying, occupational and physical therapy for skeletal muscles, and nutritional support.

Treatment of sports injuries commonly consists of rest, ice, compression (bandaging), and elevation, abbreviated "RICE." Intramuscular (IM) injections for pain are sometimes given.

PRACTICE AND PRACTITIONERS

Myology is the branch of science concerned with study of muscles and their accessory structures, including tendons, bursae, and fasciae. The medical specialists who treat disorders of the muscular system are similar to (and in some cases the same as) the specialists who treat disorders of the skeletal system, as discussed in Chapter 5. This includes **orthopedic surgeons, kinesiologists, occupational therapists, and physical therapists**. Many conditions involve joints as well as muscles, and orthopedic physicians diagnose and treat patients with joint disorders.

What is the difference between an abbreviation and an acronym? We speak each letter of an abbreviation, like ALS, and we pronounce an acronym from the sound its letter combination makes. Because RICE spells a common word, it is often pronounced. Most acronyms do not start out as common English words. So, is RICE an acronym? Even though many health care workers treat it as an acronym, it remains an abbreviation and its pronunciation as a word includes the potential for confusing the general population.

Abbreviation Table THE MUSCULAR SYSTEM

ABBREVIATION	MEANING
ALS	amyotrophic lateral sclerosis
EMG	electromyography
Fx	fracture
IM	intramuscular
MD	muscular dystrophy
MG	myasthenia gravis
NSAID	nonsteroidal anti-inflammatory drug
PT	physical therapy
RICE	rest, ice, compression, elevation
ROM	range of motion

Study Table THE MUSCULAR SYSTEM

TERM AND PRONUNCIATION	ANALYSIS	MEANING
Structure and Function		
agonist (AG-on-ist)	from the Greek, <i>agon</i> (contest)	muscle that moves a body part when it contracts
antagonist (an-TAG-oh-nihst)	a common English word	something (or in common use, someone) opposing or resisting the action of another
cardiac muscle (KAHR-dee-ak MUHS-uhl)	<i>cardi/o</i> (heart); <i>-ac</i> (adjective); from the Latin word <i>musculus</i> (muscle)	involuntary, striated heart muscle
fascia (FASH-ee-ah)	the Latin word for <i>band</i>	fibrous sheath of connective tissue that covers a muscle
fascicle (FAS-ih-kul)	from the Latin, <i>fasciculus</i> (<i>bundle</i>)	bundle of muscle fibers
ligament (LIG-ah-ment)	from the Latin noun <i>ligamen</i> (string)	a fibrous connective tissue connecting bones, cartilage, or other tissue structures
muscle fiber (MUHS-ul FIGH-bur)	from the Latin, <i>fibra</i> (fiber)	the term for a muscle cell
nonstriated muscle (non-STRY-ay-ted MUHS-uhl)	non- (adjective); from the Latin verb <i>striare</i> (to groove)	muscle that lacks the overlapping myofilaments (muscle proteins) that are found in striated (skeletal) muscles
prime mover	two common English words; from the Latin <i>primus</i> , meaning first	muscle that has the principal responsibility for a given movement
smooth muscle (smooth MUHS-uhl)	common English word; from the Latin word <i>musculus</i> (muscle)	involuntary, unstriated muscle of the internal organs and blood vessels
skeletal muscle (SKEL-uh-tuhl MUHS-uhl)	<i>skeleton</i> (modern Latin for skeleton); <i>-al</i> (adjective); <i>musculus</i> (Latin word for muscle)	voluntary, striated muscle connected to the bony framework of the body
striated muscle (STRY-ay-ted MUHS-ul)	from the Latin verb <i>striare</i> (to groove)	muscle with overlapping myofilaments (muscle proteins); also called skeletal muscle
tendon (TEN-dun)	from the Latin verb <i>tendo</i> (stretch)	a nonstretching fibrous cord that is part of the muscle complex, such as the Achilles tendon, associated with appendicular muscles
tone, tonicity	from the Greek word <i>tonos</i>	tension present in resting muscles
Disorders		
amyotrophic lateral sclerosis (ay-my-oh-TROH-fik)	<i>a-</i> (deficient); <i>my/o</i> (muscle); lateral (side); <i>scler/o</i> (hard); <i>-osis</i> (abnormal condition)	a progressive degeneration of the nerve tracts of the spinal cord, causing muscular atrophy; also called Lou Gehrig's disease

asthenia (as-THEEN-ee-ah)	<i>a-</i> (deficient); <i>sthenos</i> (Greek word for strength)	weakness
atonia (AY-toh-nee-ah)	<i>a-</i> (deficient); <i>tonia</i> (tone)	flaccidity; lack of muscle tone; relaxation of muscle
atrophy (a-TROH-fee)	<i>a-</i> (deficient); <i>-trophy</i> (from the Greek word <i>trophé</i> meaning “nourishment”)	wasting of the muscles
carpal tunnel syndrome	carpal (a wrist bone); tunnel (common English word); syndrome (a Greek word meaning “running together”)	entrapment of the median nerve in the wrist with chronically swollen and inflamed tendons
dysphagia (dis-FEY-juh)	<i>dys-</i> (Greek for bad); <i>-phage</i> (Greek word for eater)	difficulty swallowing
epicondylitis (EP-ih-KON-dih-LYE-tis)	<i>epi-</i> (around); <i>condyl</i> (rounded end surface of a bone); <i>-itis</i> (inflammation)	inflammation of the tissues around the elbow; golfer’s or tennis elbow
fibromyalgia (FY-broh-MY-al-jee-ah)	<i>fibr/o</i> (fiber); <i>my/o</i> (muscle); <i>-algia</i> (pain)	a chronic disorder characterized by widespread aching and stiffness of muscles and soft tissues, accompanied by fatigue
hamstring injury	hamstring muscle	strain or tear of the hamstring muscle group (posterior femoral muscle group)
hemiparesis (hem-ee-PAH-ree-sis)	<i>hemi-</i> (half); <i>-paresis</i> (paralysis)	weakness affecting one side of the body
hemiplegia (hem-ee-PL EE-jee-ah)	<i>hemi-</i> (half); <i>-plegia</i> (paralysis)	total paralysis of one side of the body
muscular dystrophy (DIS-tro-fee)	muscular (common English word); <i>dys-</i> (difficult); <i>-trophy</i> (from the Greek word <i>trophé</i> meaning “nourishment”)	group of inherited muscle disorders that cause muscle weakness without affecting the nervous system
myalgia (mahy-AL-juh)	<i>my/o</i> (muscle); <i>-algia</i> (pain)	muscle pain
myasthenia gravis (MY-ahs-THEE-nee-ah GRA-viss)	<i>my/o</i> (muscle); asthenia (from the Greek word <i>astheneia</i> meaning “weakness”)	an immunologic disorder characterized by fluctuating weakness, especially of the facial and external eye muscles
myocele (MY-oh-seel)	<i>my/o</i> (muscle); <i>-cele</i> (hernia)	hernia of a muscle
myalgia (my-AL-jee-a)	<i>my/o</i> (muscle); (pain); <i>-algia</i> (pain)	muscle pain
myoma (my-OH-muh)	<i>my/o</i> (muscle); <i>-oma</i> (tumor)	benign neoplasm of muscle tissue
myositis (my-oh-SY-tih)	<i>my/o</i> (s) (muscle); <i>-itis</i> (inflammation)	inflammation of muscle
myospasm (MY-oh-spaz-uhm)	<i>my/o</i> (muscle); <i>-spasm</i> (involuntary motion)	involuntary contraction of a muscle

paralysis (pah-RAL-ih-sis)	<i>para-</i> (not normal); <i>-lysis</i> (loosening)	loss of voluntary muscle movements caused by an injury or disease
paraplegia (PAR-ah-PLÉE-jee-ah)	<i>para-</i> (not normal); <i>-plegia</i> (paralysis)	paralysis of both legs and the lower trunk
paresis (puh-REE-sis)	from the Greek <i>parienai</i> (a letting go or slackening)	partial or incomplete paralysis
periostitis (PEHR-ee-os-TY-tihs)	<i>peri-</i> (around); <i>oste/o</i> (bone); <i>-itis</i> (inflammation)	inflammation of the periosteum or the covering that surrounds the bone
plantar fasciitis (FASH-ee-eye-tis)	plantar (sole of the foot); fasci- (from <i>fascia</i> , Latin for band); <i>-itis</i> (inflammation)	inflammation of the plantar fascia causing foot and heel pain
quadriplegia (kwah-drah-PLÉE-jee-ah)	<i>quadri</i> (four); <i>-plegia</i> (paralysis)	paralysis of all four extremities
rotator cuff injury	rotator cuff (four muscles in the shoulder); injury (common English word)	inflammation of the muscles and associated structures in the shoulder (rotator cuff) caused by overuse
shin-splints	two common English words used in an uncommon expression	term given to describe pain in the anterior portion of the lower leg during running, walking, and other similar activities
tendonitis (ten-doe-NY-tiss); also sometimes spelled tendinitis (TEN-dih-NY-tiss)	<i>tendon/o</i> (tendon); <i>-itis</i> (inflammation)	inflammation of a tendon
Diagnostic Tests, Treatments, and Surgical Procedures		
electromyography (ee-LEK-troh-my-OG-rafee)	<i>electr/o</i> (electricity); <i>my/o</i> (muscle); <i>-graphy</i> (process of writing)	abbreviation is EMG; records the strength of muscle contractions by means of electrical stimulation
myectomy (my-EKK-tuh-mee)	<i>my/o</i> (muscle); <i>-ectomy</i> (excision)	excision of part of a muscle
physical therapy	common English phrase	treatment to prevent disability and restore function through the use of heat, exercise, and massage to improve circulation, strength, flexibility, and muscle strength
skeletal muscle relaxants	<i>skelet/o</i> (skeleton); <i>-al</i> (adjective suffix); relaxant: that which relaxes	medications used to reduce muscle spasm
tendinoplasty (TEN-dih-no-plass-tee)	<i>tendin/o</i> (tendon); <i>-plasty</i> (surgical repair)	surgical repair of a tendon
tenorrhaphy (TEN-oh-		

raff-ee)	<i>ten/o</i> (tendon); <i>-rrhaphy</i> (suturing)	suturing of a tendon
tenotomy (ten-AW-tuh-mee)	<i>ten/o</i> (tendon); <i>-tomy</i> (incision)	incision into a tendon
Practice and Practitioners		
kinesiology (kih-nee-see-AWL-uh-jee)	<i>kinesi/o</i> (movement); <i>-logy</i> (study of)	study of muscle motion
kinesiologist (kih-nee-see-AWL-uh-jist)	<i>kinesi/o</i> (movement); <i>-logist</i> (one who studies)	a specialist in kinesiology
myology (my-AWL-uh-jee)	<i>my/o</i> (muscle); <i>-logy</i> (study of)	study of muscles
occupational therapist (ok-YOU-pey-shun-uhl THER-uh-pist)	<i>occupationem</i> (Latin for business); <i>therapia</i> (Latin for curing the sick)	practitioner who works to increase independent function through therapy
orthopedic (or-thoh-PEE-dik)	<i>orth/o</i> (straight); <i>pedics</i> (child); note: the word was coined in the 18th century, originating with the study of skeletal disorders in children	pertaining to orthopedics or the study of the musculoskeletal system
orthopedic surgeon (or-thoh-PEE-dik SUR-juhn)	<i>orth/o</i> (straight); <i>pedics</i> (child); surgeon (common English word)	a physician in the field of orthopedics (can be MD or DO)
physical therapist (FIZ-i-kul THER-uh-pist)	<i>physicalis</i> (Latin for nature); <i>therapia</i> (Latin for curing the sick)	practitioner who works to restore correct muscle movement and ability

END-OF-CHAPTER EXERCISES

EXERCISE 6-1



WORD PARTS

Break each of the following terms into its word parts: prefix, root, or suffix. Give the meaning of each word part and then define the term.

1. *fibromyalgia*

root: _____

root: _____

suffix: _____

definition: _____

2. *periostitis*

prefix: _____

root: _____

suffix: _____

definition: _____

3. *tendinoplasty*

root: _____

suffix: _____

definition: _____

4. *myology*

root: _____

suffix: _____

definition: _____

5. *electromyography*

root: _____

root: _____

suffix: _____

definition: _____

6. *epicondylitis*

prefix: _____

root: _____

suffix: _____

definition: _____

7. *hemiplegia*

prefix: _____

root: _____

definition: _____

8. *paralysis*

prefix: _____

suffix: _____

definition: _____

EXERCISE 6-2



WORD BUILDING

Use the word parts listed to build the terms defined.

-algia -cele fasci/o fibr/o
hemi- -itis kinesi/o -logist

-logy muscul/o my/o neur/o
para- -paresis -pathy -plegia

tendin/o ten/o -tomy -trophy

1. _____ incision into a tendon
2. _____ physician who diagnoses and treats diseases of the nervous system
3. _____ paralysis of both legs and the lower part of the body
4. _____ hernia of a muscle
5. _____ slight paralysis of one side of the body
6. _____ inflammation of the fascia
7. _____ pain resulting from movement
8. _____ a chronic disorder characterized by widespread aching
9. _____ any disease of the muscle
10. _____ inflammation of a muscle

EXERCISE 6-3



MATCHING

Match the term with its definition.

1. _____ antagonist a. fibrous sheath of connective tissue that covers a muscle

- | | |
|-------------------------|--|
| 2. _____
myoma | b. surgical repair of a tendon |
| 3. _____
tenorrhaphy | c. hernia of a muscle |
| 4. _____
tenoplasty | d. something opposing or resisting the action of another |
| 5. _____
myocele | e. flaccidity; lack of muscle tone; relaxing of muscle |
| 6. _____
atonia | f. suturing of a tendon |
| 7. _____ fascia | g. involuntary contraction of a muscle |
| 8. _____
myospasm | h. a type of muscle structure associated with appendicular muscles |
| 9. _____
atrophy | i. benign neoplasm of muscle tissue |
| 10. _____
tendon | j. a type of muscle tissue connecting bones, cartilage, or other tissue structures |
| 11. _____ prime mover | k. wasting of the muscles |
| 12. _____
ligament | l. muscle that has the principal responsibility for a given movement |

EXERCISE 6-4



MULTIPLE CHOICE

Choose the correct answer for the following multiple choice questions.

- The three types of muscle tissue are _____.
 - smooth, cardiac, deltoid
 - cardiac, epicardium, skeletal
 - cardiac, skeletal, smooth
 - skeletal, trapezius, deltoid

2. Physicians in which of the following medical specialty(ies) take care of muscular disorders?
 - a. neurology
 - b. orthopedic
 - c. neurology and orthopedics
 - d. chiropractic and orthopedics
3. Kinesiology is the study of _____.
 - a. dance
 - b. movement
 - c. aerobics
 - d. athletics
4. A person who is quadriplegic is paralyzed in _____ limbs.
 - a. one
 - b. two
 - c. three
 - d. four
5. Carpal tunnel syndrome affects the _____.
 - a. wrist
 - b. knee
 - c. elbow
 - d. ankle
6. A muscle antagonist is _____.
 - a. a muscle that resists the action of another
 - b. a muscle that has the principal responsibility for a given movement
 - c. a type of muscle that connects one muscle to another
 - d. none of the above
7. Which muscular disease is usually diagnosed in childhood and affects males?

- a. MG
 - b. multiple sclerosis
 - c. MD
 - d. paraplegia
8. This is a progressive degeneration of the nerve tracts of the spinal cord, causing muscular atrophy, also known as Lou Gehrig's disease:
- a. ALS
 - b. asthenia
 - c. multiple sclerosis
 - d. paraplegia
9. This type of muscle has fibers with noticeable overlapping myofilaments and is involuntary.
- a. cardiac
 - b. nonstriated
 - c. smooth
 - d. skeletal
10. This is an immunologic disorder characterized by fluctuating weakness, especially of the facial and external eye muscle.
- a. MG
 - b. fibromyalgia
 - c. MD
 - d. paraplegia

EXERCISE 6-5



FILL IN THE BLANK

Fill in the blank with the correct answer.

1. _____ is the medical term for tennis elbow.
2. The term, which is also the Latin word for string, that names what connects bones to bones to support muscles is _____.
3. Pointing the toes downward is called _____.
4. _____ is the term for weakness.

5. A hernia of a muscle is called _____.
6. _____ causes intense pain in the heel region and sole of the foot upon walking.
7. A(n) _____ records the strength of muscle contractions.
8. The surgical repair of a tendon is called _____.
9. _____ is the study of muscles.
10. Muscle pain is called _____.

EXERCISE 6-6



ABBREVIATIONS

Write out the term for the following abbreviations.

1. _____ MD
2. _____ RICE
3. _____ CTD
4. _____ MG

Write the abbreviation for the following terms.

5. _____ electromyography
6. _____ amyotrophic lateral sclerosis
7. _____ intramuscular
8. _____ fracture
9. _____ muscular dystrophy

EXERCISE 6-7



SPELLING

Select the correct spelling of the medical term.

1. _____ means weakness.
 - a. Athenia
 - b. Athena
 - c. Asthenia
 - d. Asthena
2. _____ is a chronic disorder characterized by widespread

aching and stiffness of muscles and soft tissues, accompanied by fatigue.

- a. Fibromyalgia
 - b. Fibromylgia
 - c. Fibromyalga
 - d. Fibomyalgia
3. The name of this disorder comes from the root word meaning *muscle* and the Greek word meaning *weakness*.
- a. myathenia gravis
 - b. myasthenia gravis
 - c. myasthenia graviss
 - d. myathenia graviss
4. _____ means difficulty swallowing.
- a. Disphagia
 - b. Disfagia
 - c. Dysfagia
 - d. Dysphagia
5. _____ is also known as Lou Gehrig's disease.
- a. Amotrophic lateral sclerosis
 - b. Amyotrophic lateral sklerosis
 - c. Amotrophic lateral sclarosis
 - d. Amyotrophic lateral sclerosis
6. The muscle movement that closes the angle of a joint is called _____.
- a. flextion
 - b. flexsion
 - c. flexion
 - d. flexon
7. Cardiac muscle is considered lightly _____, and skeletal muscle is considered heavily _____.

- a. stryated
 - b. striatted
 - c. striated
 - d. strieted
8. _____ describes paralysis of all four extremities.
- a. Quadraplegia
 - b. Quadriplegia
 - c. Quadraplesia
 - d. Quadripleisia
9. An _____ surgeon is a physician who specializes in the musculoskeletal system.
- a. orthopedic
 - b. orthapedic
 - c. orthopaedik
 - d. orthopedik
10. A _____ is the connective tissue connecting bones and cartilage.
- a. ligament
 - b. ligument
 - c. legament
 - d. lighment

EXERCISE 6-8



CASE STUDY

PHYSICAL THERAPY PROGRESS NOTE

CHIEF COMPLAINT: Cervical neck pain with limited movement and right shoulder pain with limited ROM.

PROGRESS: The patient states that he is the same as he was the last time he was in for therapy.

AGGRAVATING FACTORS: Working.

PAIN/DISCOMFORT LEVEL: The patient states that the pain is 5/10.

TREATMENT: Treatment today consisted of moist heat and ultrasound of the cervical spine; therapeutic exercise to the neck and shoulder for 45 minutes.

PATIENT'S PROGRESS: The patient is doing well with his cervical spine exercises. His neck flexion and neck extension and rotation are relatively improved. His radiating pain is reduced. His right shoulder is very painful. He has pain on flexion and abduction. He has pain on resisted abduction. He has rotator cuff tendonitis, probably caused by impingement.

QUESTIONS

1. What medical terms are associated with the patient's limited neck movements? Define each one.

2. What does "tendonitis" mean?

3. Explain what ROM is.

4. What does NSAID stand for?



The Nervous System

LEARNING OUTCOMES

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

- Name the major structures and functions of the nervous system.
- Name the parts of a neuron.
- Name the major divisions of the nervous system.
- Pronounce, spell, and define medical terms related to the nervous system.
- Interpret abbreviations associated with the nervous system.

INTRODUCTION

The nervous system, one of the most complex systems in the body, coordinates the body's involuntary and voluntary actions. It works in conjunction with the endocrine system to maintain **homeostasis**, a term that means "a state of equilibrium." The nervous system also works together with the muscular system to control the body's voluntary and involuntary muscles.

The nervous system has two main divisions: the **central nervous system (CNS)** and the **peripheral nervous system (PNS)**. The CNS consists of the brain and spinal cord. The PNS consists of all the nerves outside the CNS, including the cranial nerves and spinal nerves (see **Figure 7-1**). The PNS is further divided into the *somatic nervous system* and the *autonomic nervous system*. The autonomic nervous system is then further divided into the *sympathetic nervous system* (fight or flight responses) and the *parasympathetic nervous system* (rest and digest responses), depending on

what type of involuntary functions it controls (see [Figure 7-2](#)).

Posterior view

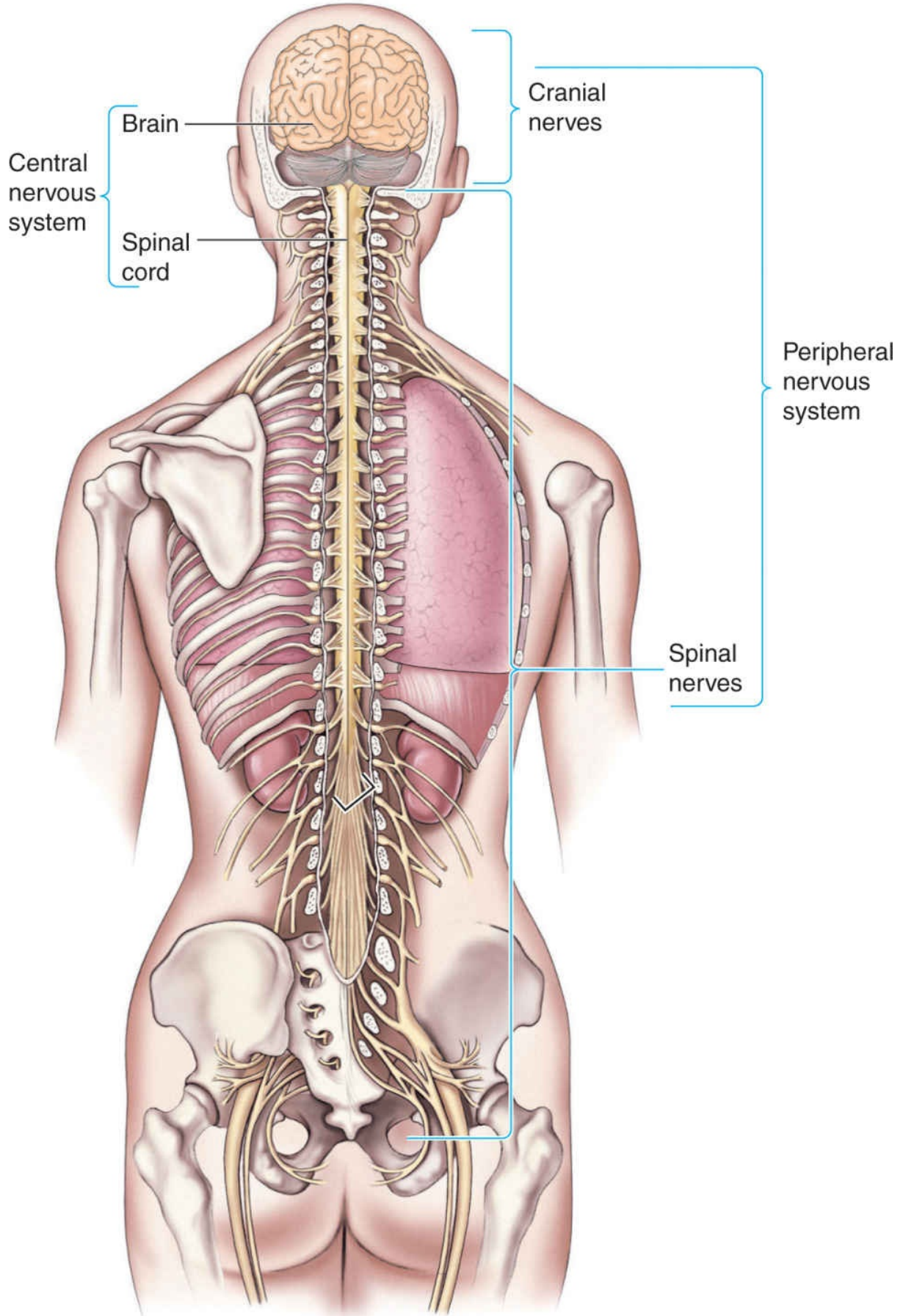


FIGURE 7-1 A posterior view of the nervous system. The central nervous system consists of the brain and spinal cord, and the peripheral nervous system consists of the cranial nerves and spinal nerves.

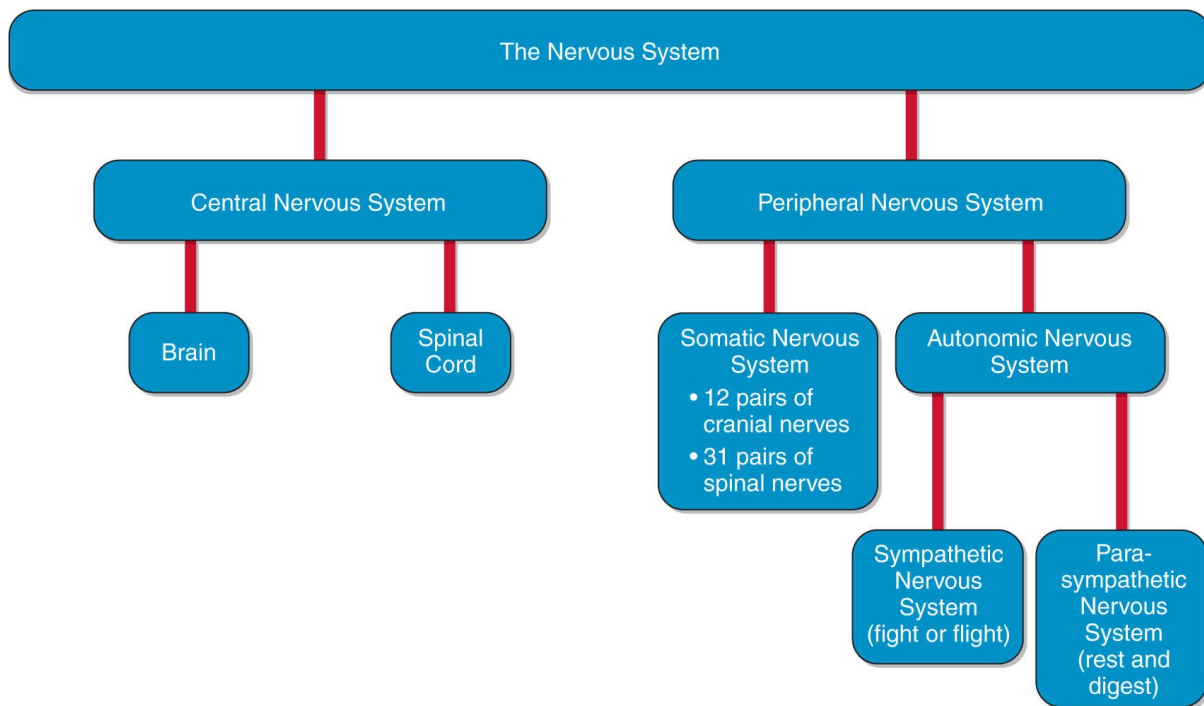


FIGURE 7-2 The divisions of the nervous system. The chart shows the divisions and subdivisions, but all components work together.

WORD PARTS RELATED TO NERVOUS SYSTEM

The CNS's control center is the brain, so many of the word parts used to describe structures of the nervous system are located in the head. Cephal/o is the word root for head, and encephal/o is the word root for brain. Another word root for brain is cerebr/o, which refers specifically to the cerebrum (the largest part of the brain). Both psych/o and ment/o refer to the mind, the part of the brain responsible for consciousness and higher functions. **Table 7-1** lists word parts that make up nervous system terms. Some suffixes that you already learned are also listed.

TABLE 7-1  WORD PARTS RELATED TO THE NERVOUS SYSTEM

Word Part	Meaning
arachn/o	spider
cephal/o	head
cerebell/o	cerebellum

cerebr/o	cerebrum; also, the brain in general
cortic/o	outer layer or covering
crani/o	cranium, skull
encephal/o	brain
gangli/o	swelling or knot
ganglion/o	swelling or knot
gli/o	glue
hydr/o	water
iatr/o	physician; to treat
-mania	morbid attraction to or impulse toward
meningi/o	membrane
ment/o	referring to the mind
-mnesia	memory
myel/o	in connection with the nervous system, refers to the spinal cord and medulla oblongata
neur/o	nerve, nerve tissue
-oid	resembling
-paresis	slight paralysis
-phasia	speech

-phobia	fear
-plegia	paralysis
psych/o	mind
schiz/o	to split
spin/o	spine

Word Parts Exercise

After studying Table 7-1, write the meaning of each of the word parts.

WORD PART	MEANING
1. -paresis	1. _____
2. cortic/o	2. _____
3. ment/o	3. _____
4. -plegia	4. _____
5. -mnesia	5. _____
6. iatr/o	6. _____
7. -phobia	7. _____
8. encephal/o	8. _____
9. cerebr/o	9. _____
10. hydr/o	10. _____

11. meningi/o	11. _____
12. gangli/o	12. _____
13. –mania	13. _____
14. myel/o	14. _____
15. neur/o	15. _____
16. arachn/o	16. _____
17. schiz/o	17. _____
18. cephal/o	18. _____
19. psych/o	19. _____
20. –oid	20. _____
21. cerebell/o	21. _____
22. spin/o	22. _____
23. –phasia	23. _____
24. gli/o	24. _____

STRUCTURE AND FUNCTION

Nerve tissue, together with its associated connective tissue and blood vessels, makes up both the CNS and the PNS. Nerve tissue is composed of fundamental units called **neurons** (nerve cells), which are separated, supported, and protected by specialized cells called **neuroglia**. Neurons carry electrical messages that coordinate the exchange of information between the body's internal and external environments, and the neuroglia offer protection and support to the nerve tissue. Neurons are grouped together to carry out the

highly complex sensing and processing actions required for everything we do.

The three main parts of a neuron cell are its *cell body*, *dendrites*, and *axon*. The **cell body** contains the nucleus and receives nerve impulses (action potentials) from other cells through the dendrites. The **nucleus** is an organelle found in the central region of the cell body that contains genetic material. The **dendrites**, which project outward from the cell body, act as antennae that receive and transmit messages between the neuron and muscles, skin, other neurons, or glands. The cell body passes these messages to the **axon**, which conducts nerve impulses away from the cell body. Axons are covered by **myelin**, a white fatty material that provides protection and insulation (see **Figure 7-3**). The connecting points for these message transfers are called **synapses**. Synaptic connections can occur between two nerve cells. The stimulus between the two cells is usually a chemical called a **neurotransmitter**. For example, hormones are typical neurotransmitters.

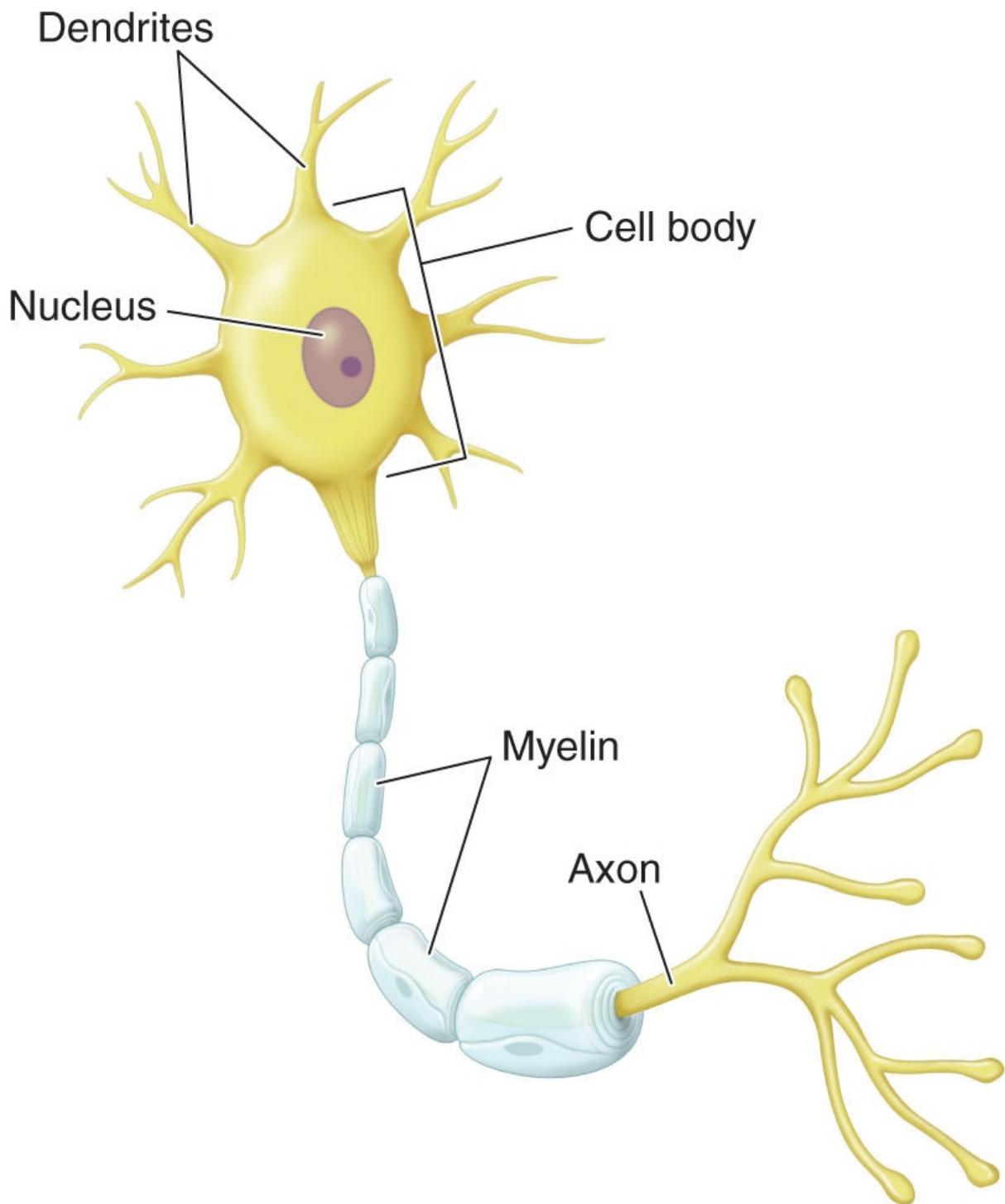


FIGURE 7-3 Structure of a typical neuron.

Groups of neuron cell bodies within the PNS are called **ganglia** (*ganglion*, singular). Groups of neuron cell bodies within the CNS are called **nuclei** (*nucleus*, singular). Groupings of axons are called **nerves**, wherever they occur in the body.

Central Nervous System

The CNS is the body's control center. All messages originate and/or terminate

either in the brain or in the spinal cord. The brain and spinal cord also interpret the messages and determine the body's responses.

The brain is a large organ that plays a role in many activities, both mental and physical. For example, regions of the brain control bodily functions, such as breathing and temperature regulation, whereas other regions influence walking and other deliberate activities.

The brain is separable into left and right hemispheres each with four lobes: **frontal lobe**, **parietal lobe**, **occipital lobe**, and **temporal lobe** (see **Figure 7-4**). The names of the lobes relate to their location relative to the skull and the overlying skull bones. For example, *frontal* relates to the front part of the head, *parietal* refers to the sides of the head, *occipital* identifies the back of the head, and *temporal* refers to the temples or area posterior to the eyes on each side of the head.

- | | |
|---------------|----------------|
| Frontal lobe | Temporal lobe |
| Parietal lobe | Occipital lobe |

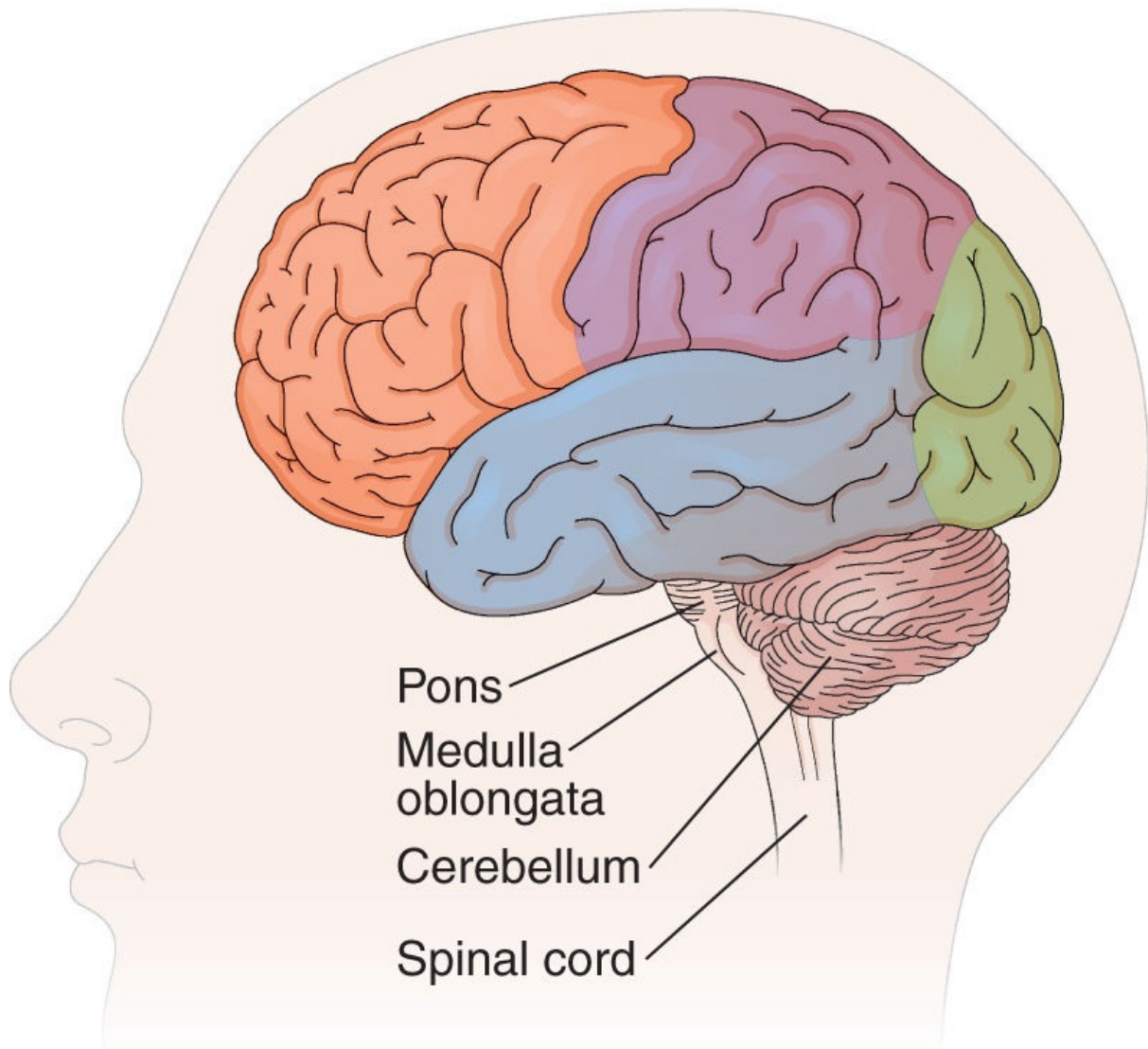


FIGURE 7-4 Lateral view of the four brain lobes and pons, medulla oblongata, cerebellum, and spinal cord.

The major parts of the brain include the following (see **Figures 7-4** and **7-5**):

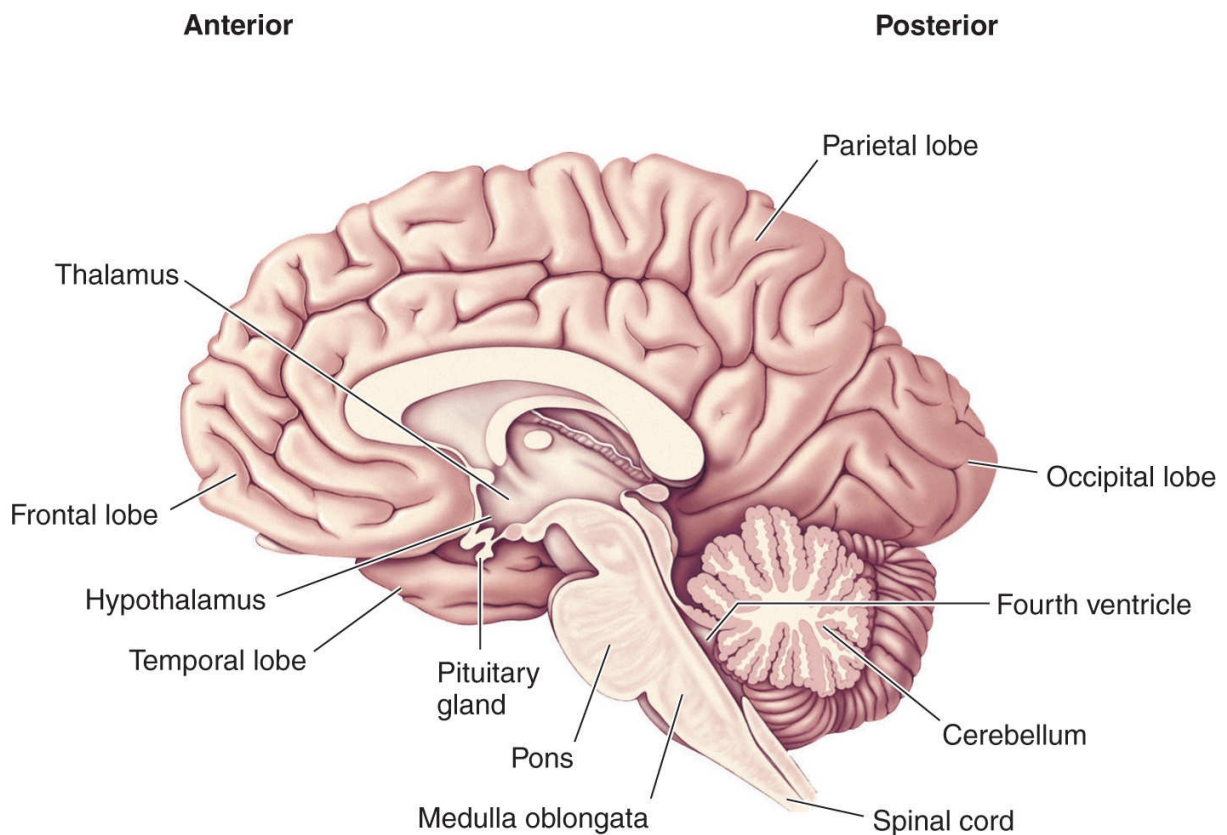


FIGURE 7-5 A sagittal section of the brain showing important structures.

- **Cerebrum:** The cerebrum, the largest part of the brain, is where memories and conscious thoughts are stored. It also directs some willed bodily movements. An outer layer of gray matter called the **cerebral cortex** controls higher mental functions.
- **Cerebellum:** The cerebellum, like the larger cerebrum located superiorly to it, also has left and right hemispheres. The cerebellum coordinates voluntary muscles and maintains our balance.
- **Diencephalon:** The diencephalon is the link between the cerebral hemispheres and the brainstem. It contains both the *thalamus* and the *hypothalamus*. The **thalamus** processes sensory information. The **hypothalamus** coordinates the autonomic nervous system and the pituitary gland. It releases hormones, controls body temperature, and is involved with mood.
- **Brainstem:** The brainstem connects the brain to the spinal cord. It is made up of the *midbrain*, *pons* (Latin for *bridge*), and *medulla oblongata*. The **midbrain** processes visual and audible sensory information. Visual tracking, such as moving the eyes to read or follow a moving object, is an example of a midbrain function. It also transmits hearing impulses to the brain. The **pons** passes

information to the cerebellum and the thalamus to control subconscious activities such as regulating breathing. The **medulla oblongata** sends sensory information to the thalamus to direct the autonomic functions of the heart, lungs, and other body organs. The interconnected cavities within the brain are the **ventricles**. The fourth ventricle is shown in [Figure 7-5](#).

The **spinal cord** is the portion of the CNS that is found within the vertebrae that conducts nerve impulses to and from the brain and the body. The brain and spinal cord are surrounded by membranes called **meninges**, which absorb physical shocks that could otherwise damage nerve tissue (see [Figure 7-6](#)). The outer layer is the **dura mater**, a dense collection of collagen fibers. The middle layer is the **arachnoid mater**, which is thin, delicate, and weblike. The inner layer, called the **pia mater**, is in direct contact with nerve tissue. Together, the arachnoid and pia mater are two layers of a structure that is called the **leptomeninges**. Cerebrospinal fluid (CSF) is the colorless liquid that circulates in and around the brain and spinal cord that transports nutrients.

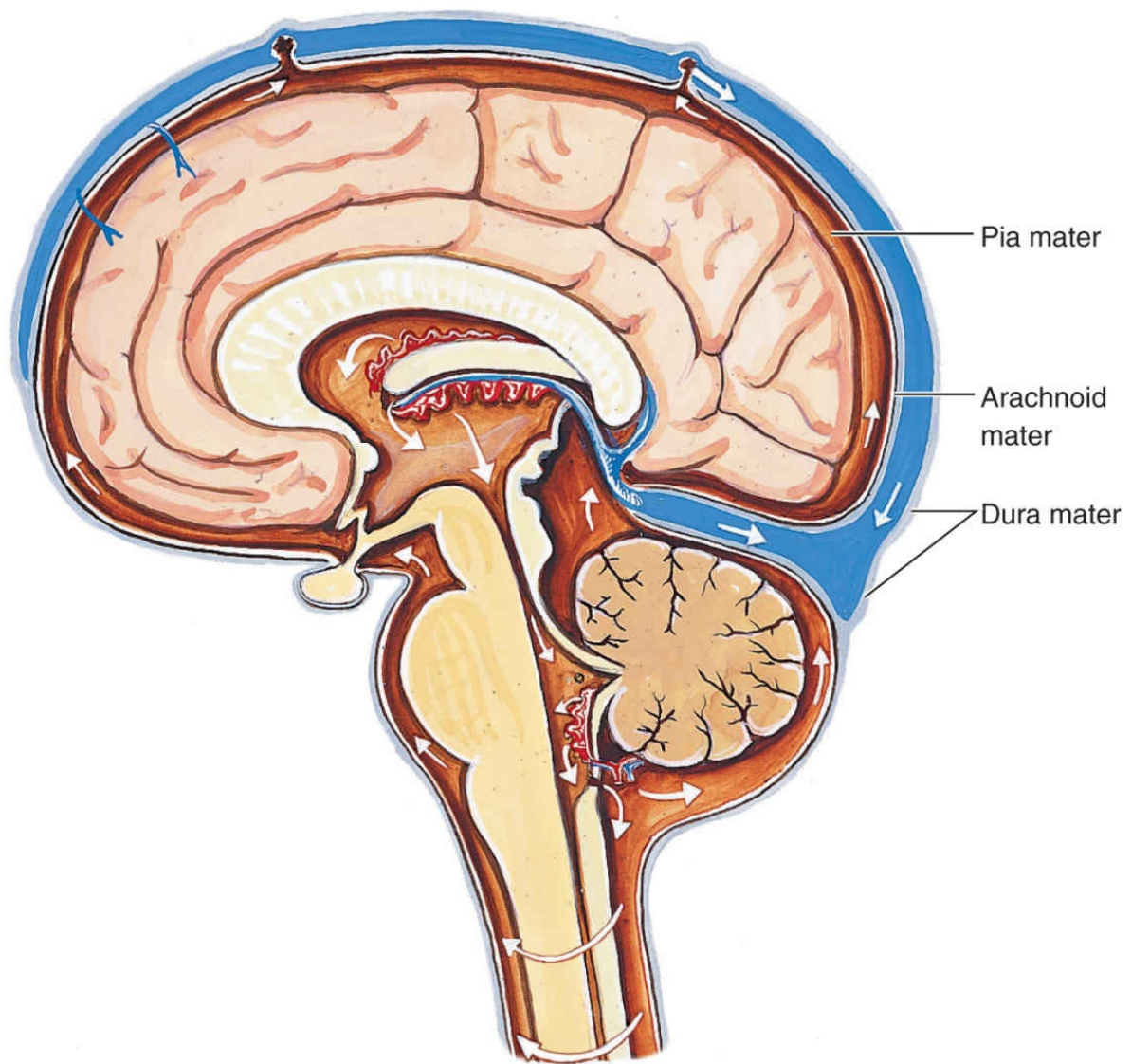


FIGURE 7-6 The meninges protect the brain and spinal cord. Arrows indicate the flow of cerebrospinal fluid.

Peripheral Nervous System

The PNS includes 12 pairs of cranial nerves and 31 pairs of spinal nerves that run along the periphery of the body (see [Figure 7-1](#)). The cranial and spinal nerves convey directions from the CNS to the PNS and carry information from the PNS back to the CNS. The PNS controls skeletal muscles by means of the cranial and spinal nerves.

Recall that the PNS is divided into the somatic nervous system and the autonomic nervous system. The **somatic nervous system** controls voluntary movement, whereas the **autonomic nervous system** controls involuntary muscles, the smooth and cardiac muscles, and glands. Recall also that the autonomic nervous system is made up of sympathetic and parasympathetic divisions. The **sympathetic nervous system** controls quick responses and is

often called the “fight or flight” division because this system increases heart rate and dilates airways during periods of stress. The **parasympathetic nervous system** controls responses that do not need to be fast and is often called the “rest and digest” division. The parasympathetic nerves counterbalance such changes and return the body to a homeostatic state when the danger has passed (see **Figure 7-2**).

These two divisions of the autonomic nervous system are complementary. The sympathetic nervous system can be thought of as the gas pedal, and the parasympathetic nervous system can be thought of as the brake pedal.



Quick Check

Fill in the blanks.

1. The CNS consists of the _____ and the _____.
2. The nervous system works in conjunction with the endocrine system to maintain _____, a term that means “a state of equilibrium.”
3. The major parts of the brain include the cerebrum, cerebellum, diencephalon, and _____.

DISORDERS RELATED TO THE NERVOUS SYSTEM

Disorders of the nervous system can result from trauma, vascular insults, tumors, systemic degenerative diseases, and seizures. Behavioral disorders are treated as a separate category.

Trauma

Head injuries can produce skull fractures, hemorrhage, swelling, and direct damage to the brain itself. Brain injury may be relatively mild, involving bruises to brain tissues, or it can be severe, causing tissue destruction and massive swelling. A few common types of brain trauma include the following:

- **Concussion** is an injury to the brain resulting from violent shaking or a hit to the head. A concussion may cause temporary loss of consciousness followed by a short period of amnesia (loss of memory). Dizziness, nausea, and headache are common with a concussion.
- **Epidural hematoma** occurs when blood collects between the dura

mater and the skull, causing pressure on the blood vessels and interrupting blood flow to the brain. This condition is caused by a skull fracture or a hit to the head (see **Figure 7-7**).

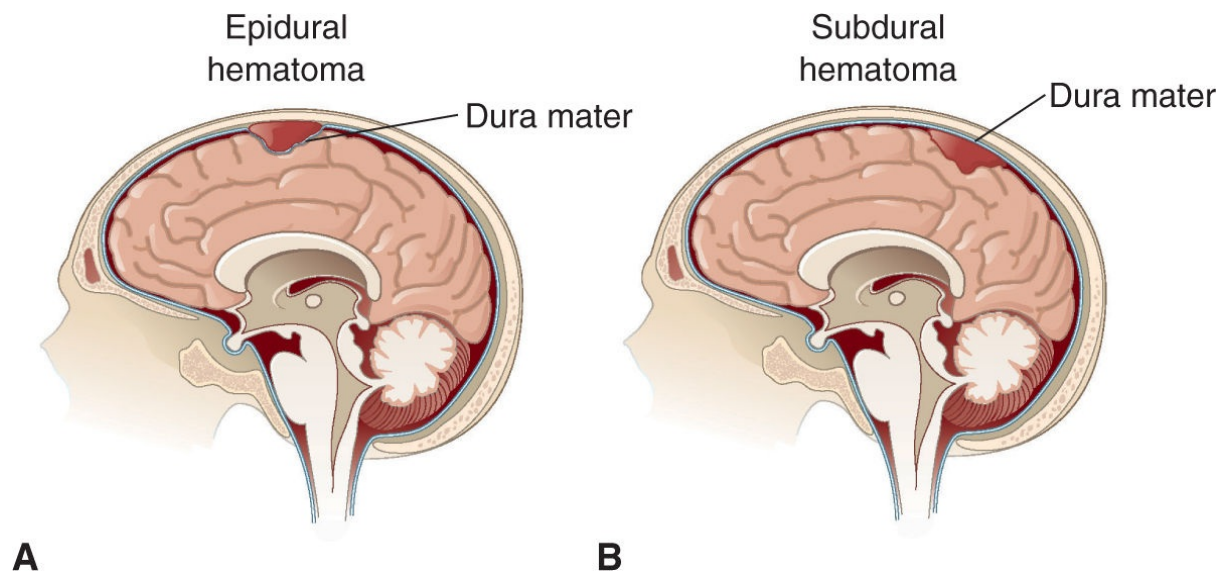


FIGURE 7-7 Hematoma. **A.** Epidural hematoma occurs with a traumatic brain injury when blood accumulates between the dura mater and the skull. **B.** Subdural hematoma occurs between the dura mater and arachnoid mater.

- **Subdural hematoma** is a collection of blood trapped in the subdural space, the area beneath the dura mater. It may result from a hit to the front or back of the head (see **Figure 7-7**).

Vascular Insults

A vascular insult is an injury to the blood vessels.

- **Cerebrovascular accident (CVA):** Also known as a stroke, a CVA results from an interruption of oxygen caused by blood vessel blockage or rupture, causing hemorrhage (bleeding) (see **Figure 7-8**).

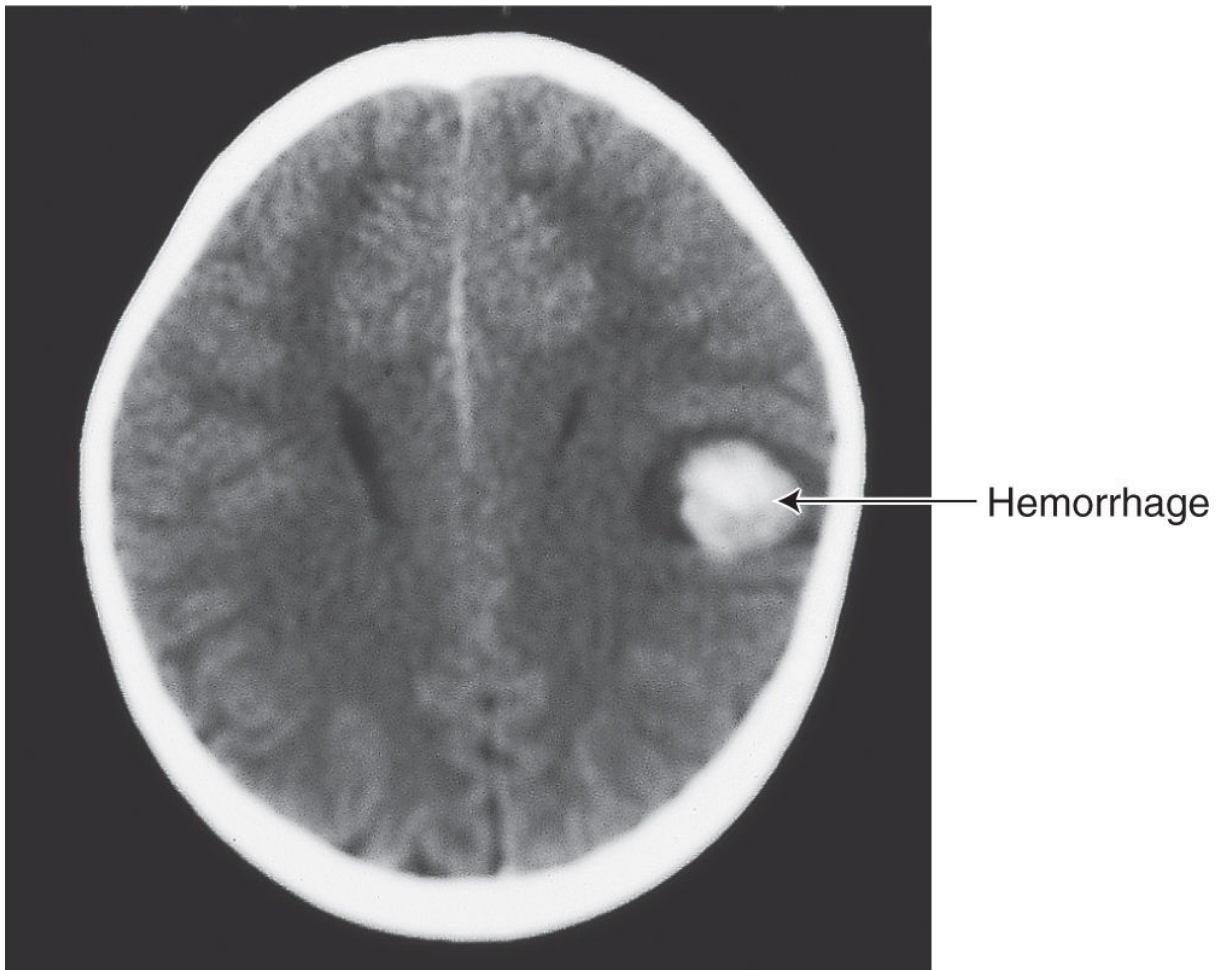


FIGURE 7-8 Cerebrovascular accident. Computed tomography scan of the brain shows a large hemorrhage in the brain of a 4-year-old boy.

- **Transient ischemic attack (TIA):** A TIA is a temporary interruption in the blood supply to the brain. This is sometimes called a “mini-stroke,” but can indicate serious problems and be a forewarning of a stroke.
- **Cerebral aneurysm:** An aneurysm is a localized dilation (widening) of an artery caused by weakness in the vessel wall.

Does not the word “insult” refer to a verbal attack, such as when someone calls someone else a name that causes hurt feelings? Yes, it does, but in the phrase “vascular insult,” it means something else. The Latin verb *insulto* literally means “to physically jump on.” So a vascular insult is a physical event related to that Latin meaning.

Tumors

Tumors are **lesions** (regions in an organ that are damaged) or neoplasms that may cause localized dysfunction, producing an increase in intracranial pressure (ICP). It is important for the pressure within the cranium to stay within its normal range, as a high ICP usually leads to death if it is not

relieved. Tumors may be benign or malignant. Two examples of tumors occurring in the nervous system include *astrocytomas* and *meningiomas*. An **astrocytoma** is a tumor derived from a star-shaped type of neuroglia called an astrocyte. A **meningioma** is a tumor derived from the meninges surrounding the brain and spinal cord.

Systemic Degenerative Diseases

Degenerative diseases develop slowly over time. A progressive deterioration may start out affecting individual body functions and end up involving other body systems. Examples of systemic degenerative diseases include *multiple sclerosis* (MS), *Parkinson's disease* (PD), and *Alzheimer's disease* (AD).

- **MS** is a progressive degenerative disease with symptoms caused by **demyelination**, a patchy loss of the myelin sheath.
- **PD** usually develops after age 60 and occurs with the loss of the neurotransmitter **dopamine** (DA), which inhibits transmission of nerve impulses. When these nerve impulses are no longer inhibited by DA, signs such as tremors and muscle rigidity occur. This can affect posture, balance, speech, and other activities of daily living.
- **AD** is a degenerative, eventually fatal condition involving atrophy of the cerebral cortex, producing a progressive loss of intellectual function.

Seizures

A **seizure** occurs when there is an abnormal, uncontrolled burst of electrical activity in the brain. Seizures may result from trauma, tumors, fevers, medications, or other causes. Some seizures go unnoticed when the signs are very subtle. Other seizures can cause loss of consciousness or involuntarily body movements.

Epilepsy is a chronic disorder characterized by recurrent seizures that result from the excessive discharge of neurons in the brain. Two basic types of epileptic seizures are *grand mal seizures* and *absence seizures*. A **grand mal seizure**, also called a *generalized tonic-clonic seizure*, is severe and characterized by alternating contraction and relaxation of muscles, which produces jerking movements of the face, trunk, and/or extremities. An **absence seizure** (formerly called a *petit mal seizure*) is a milder form of seizure that lasts only a few seconds and does not include convulsive movements. The term *mal* comes from the French language and means “evil.”

Behavioral Disorders

Some behavioral disorders are related to the nervous system. They may be caused by physical changes, substance abuse, medications, or any combination thereof. The categories include anxiety, mood, and psychotic disorders.

- **Anxiety disorders** are characterized by feelings of apprehension or uneasiness, sometimes associated with the anticipation of danger. Common examples include **obsessive–compulsive disorder (OCD)**, which may be signaled by repetitive behaviors; **posttraumatic stress disorder (PTSD)**, which is the development of long-term symptoms following a psychologically traumatic event; and the various **phobias**, which are persistent, irrational fears of specific situations or things.
- **Mood disorders** are a group of mental disorders involving a disturbance of internal emotional states. They include **depression**, which is characterized by loss of interest or pleasure in activities; and **bipolar disorder**, which is characterized by unusual shifts in mood, energy, and activity.
- **Psychotic disorders** are more serious than anxiety or mood disorders because they feature a loss of contact with reality and a deterioration of normal social functioning. An example of a psychosis is **schizophrenia**, which is characterized by abnormal thoughts, hallucinations, delusions, and withdrawal. **Paranoia** is another example characterized by jealousy, delusions of persecution, or perceptions of threat or harm.

Diagnostic Tests, Treatments, and Surgical Procedures

When evaluating the health of a person's nervous system, medical professionals use various procedures. Sometimes, a patient's mental health is determined by a qualified professional observing and talking with the patient. Other times, diagnostic tests to evaluate the condition of the brain and its function are used. Some examples of diagnostic procedures are listed below.

- **Computed tomography (CT)** is a noninvasive radiologic test that uses a computer to produce cross-sectional images of the soft-tissue structures of the brain and spinal cord. This procedure can reveal problems such as brain tumors and aneurysms.
- **Magnetic resonance imaging (MRI)** uses radio waves and a very strong magnetic field to produce images of the neural soft tissues. It is used to visualize disease-related changes in the brain or spinal cord that conventional X-ray procedures cannot detect. For example, MRI

is able to isolate damaged areas of the brain caused by MS.

- **Electroencephalography (EEG)** is the measurement of electrical activity in the brain and the visual trace (electroencephalogram) of that activity. It is used to document increased electrical events of the brain caused by seizures.
- **Lumbar puncture (LP)** requires the insertion of a needle into the subarachnoid space (the area between the arachnoid mater and pia mater) between the third and fourth or fourth and fifth lumbar vertebrae to withdraw CSF for analysis (see **Figure 7-9**).

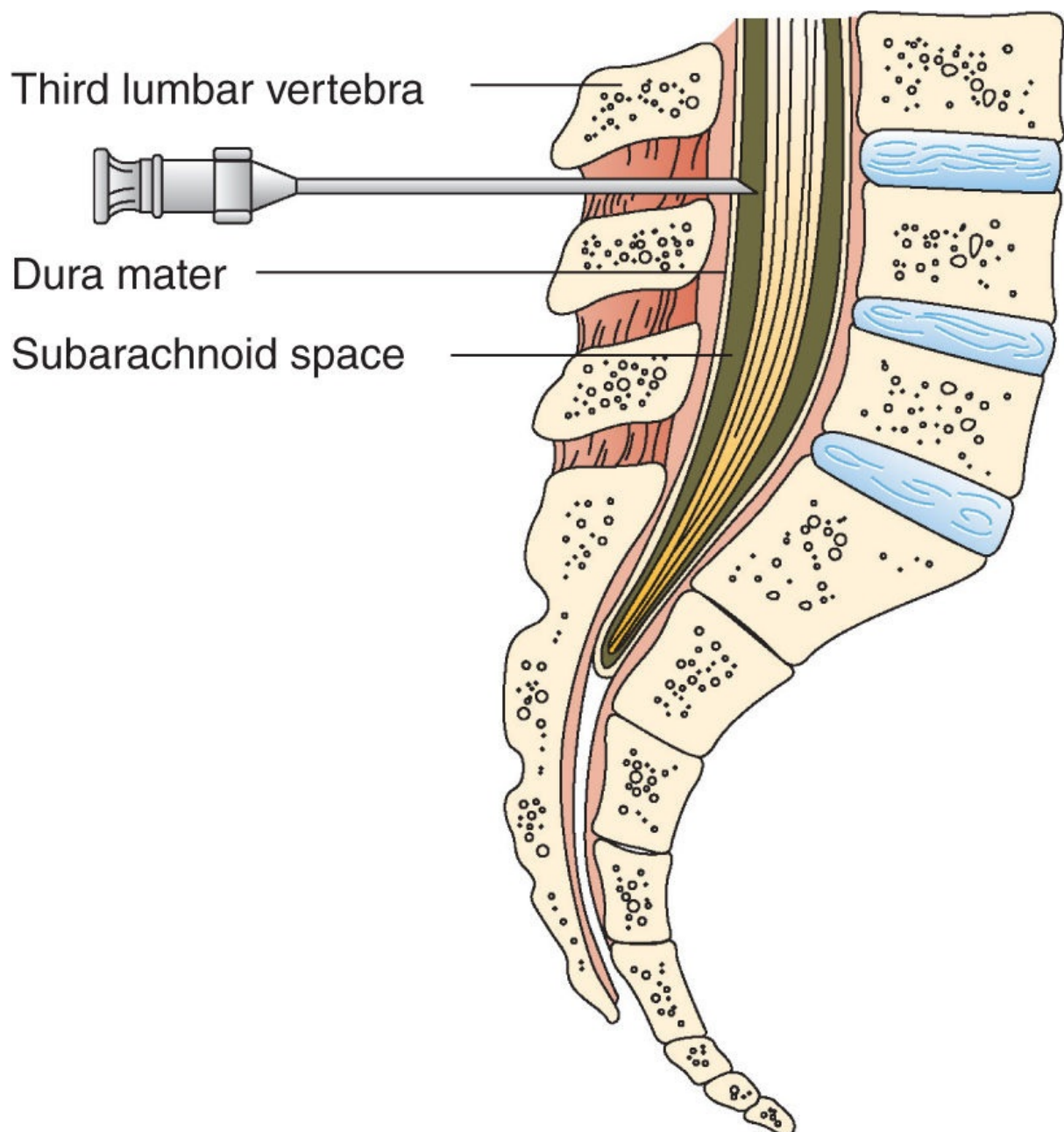


FIGURE 7-9 Shows the location for a lumbar puncture between L3 and L4.

PRACTICE AND PRACTITIONERS

The medical specialists who diagnose and treat the nervous system are *neurologists*, *neurosurgeons*, *psychiatrists*, and *psychologists*. **Neurologists** are medical specialists trained in the diagnosis and treatment of neuromuscular disorders. **Neurosurgeons** are physicians specialized in operations on the brain, spinal cord, spinal column, and peripheral nerves. **Psychiatrists** are physicians who treat behavioral and mental health disorders. The health care professional with an advanced academic degree who treats mental and behavioral disorders is a **psychologist**.

What's the difference between a psychiatrist and a psychologist? Using word parts, we can break each word up: psych-olog-ist and psych-iatr-ist. Remember that -logy means "study of" and iatr/o means "physician." The degrees that each profession receives are different: a psychologist has a doctorate degree in the form of a PhD or PsyD, whereas a psychiatrist has an MD or DO and is a medical doctor, meaning they can prescribe medications (unlike a psychologist). This is a key difference and means the two practitioners are not interchangeable; however, they often work together to treat patients.

Abbreviation Table THE NERVOUS SYSTEM

ABBREVIATION	MEANING
AD	Alzheimer's disease
CNS	central nervous system
CSF	cerebrospinal fluid
CT	computed tomography
CVA	cerebrovascular accident
DA	dopamine
ECT	electroconvulsive therapy
EEG	electroencephalography
ICP	intracranial pressure
LP	lumbar puncture
MRI	magnetic resonance imaging
MS	multiple sclerosis

OCD	obsessive–compulsive disorder
PD	Parkinson’s disease
PNS	peripheral nervous system
PTSD	posttraumatic stress disorder
TIA	transient ischemic attack

Study Table THE NERVOUS SYSTEM

TERM AND PRONUNCIATION	ANALYSIS	MEANING
Structure and Function		
autonomic nervous system (aw-to-NOM-ik NER-vuhs SIS-tuhm) (ANS)	autonomy (self-sufficiency); -ic (adjective suffix)	the parts of the PNS that carry messages between the CNS and organs that function autonomously
arachnoid mater (ah-RAK-noyd MAY-turh)	from the Greek word <i>arachne</i> (spider, cobweb); -oid (resembling)	delicate weblike layer of the meninges; middle layer
axon (AX-ohn)	axo- (axis); -n noun ending	the part of a neuron that conducts electrical impulses away from the cell body
brainstem (BREYN stem)	common English words	the part of the brain that controls functions, including heart rate, breathing, and body temperature; includes midbrain, pons, and medulla oblongata
cell body (sel BOD-ee)	common English words	the main part of a neuron that contains the nucleus
central nervous system (SEN-truhl NER-vuhs SIS-tuhm) (CNS)	common English words	the division of the nervous system that includes the brain and spinal cord
cerebellum (SERR-uh-bell-uhm)	<i>cerebr/o</i> (brain)	the part of the brain that controls the skeletal muscles
cerebral cortex (seh-REE-bruhl KOR-tex)	<i>cerebr/o</i> (brain); -al (adjective suffix)	the gray matter surrounding the cerebrum
cerebrospinal fluid (seh-REE-bro-SPY-nuhl) (CSF)	<i>cerebr/o</i> (brain); from Latin word <i>spina</i> ; fluid (common English word)	the fluid in and around the brain and spinal cord

cerebrum (seh-REE-bruhm)	<i>cerebr/o</i> (brain)	the largest part of the brain; controls conscious thought and stores memories
dendrite (DEN-dryte)	from the Greek word <i>dendrites</i> (relating to a tree)	process extending from a neuron cell body
diencephalon (dy-en-SEFF-uh-lohn)	<i>di-</i> (two); <i>encephal/o</i> (of or relating to the brain); <i>-on</i> (noun suffix)	the part of the brain containing both the thalamus and the hypothalamus
dura mater (DOO-ruh MAY-tuhr)	Latin words meaning “hard mother”	the outer meninx, the fibrous membrane protecting the CNS
frontal lobe (FRUN-tahl loh)	common English words	the front part of the brain from which voluntary muscle movements and other sensory and motor tasks are directed
ganglion (GANG-lee-ohn); plural: ganglia (GANG-lee-uh)	a Greek word meaning “swelling” or “knot”	a group of neuron cell bodies grouped together in the PNS
homeostasis (hoh-meh-oh-STEY-sis)	<i>homos</i> (Greek for “same”); <i>stasis</i> (Greek for “existence”)	tendency toward equilibrium; remaining normal
hypothalamus (HY-po-thal-uh-muhs)	<i>hypo-</i> (below, deficient); from the Greek word <i>thalamus</i> (a bed, a bedroom)	the hormone and emotion center of the brain that controls autonomic functions
leptomeninges (LEPP-toh-ME-ninks)	<i>lepto-</i> (light, slender, thin frail); meninx is plural form of <i>mening/o</i> (membrane)	collective term for the arachnoid mater and pia mater
medulla oblongata (meh-DUH-luh ohb-lohng-GAH-tuh)	a Latin word (marrow); from the Latin <i>oblongatus</i> (oblong)	the part of the brainstem that sends sensory information to the thalamus to direct the autonomic functions of the heart, lungs, and other organs
meninges (meh- NIHN-jees)	<i>mening/o</i> (membrane)	three-layer membrane surrounding the brain and spinal cord
mesencephalon (mez-ehn-SEFF-ah-lon)	<i>mes/o</i> (middle); <i>encephal/o</i> (brain); <i>-on</i> (noun suffix)	the middle part of the brain between the diencephalon and the pons; also called the midbrain
midbrain (MID-brain)	<i>mid</i> = middle	the middle part of the brain between the diencephalon and the pons; also called the mesencephalon
myelin (MY-eh-lin)	<i>myel/o-</i> (bone marrow; spinal cord)	a fatty white envelope of cells providing protection and electrical insulation to neurons
nerve (nurv)	<i>nervus</i> , Latin for nerve; common English word	a whitish, cordlike structure composed of one or more bundles of nerve fibers outside the CNS, together with their connective tissues and

		nourishing blood vessels
neuroglia (new-ROG-lee-uh)	<i>neur/o</i> (nerve); from the Greek <i>glia</i> (glue)	cells within both the CNS and PNS, which, although they are external to neurons, form an essential part of nerve tissue
neuron (NUHR-ohn)	<i>neur/o</i> (nerve); <i>-on</i> (noun suffix)	a nerve cell, including the cell body and its axon
neurotransmitter (NOO-roh-TRANS-mitt-ehr)	<i>neur/o</i> (nerve); from the Latin <i>trans</i> (across); <i>mittere</i> (to send)	chemical released by the presynaptic cell (cell before the synapse) that is then picked up by the postsynaptic cell (cell after the synapse) to effect an action
nucleus (NEW-klee-uhs); plural: nuclei (NEW-klee-eye)	a Latin word meaning “kernel”	central region of neuron cell body that contains genetic information; a group of neuron cell bodies grouped together in the CNS
occipital lobe (AWK-sihp-ih-tuhl lobb)	from Latin word <i>occiput</i> (back of the head)	the part of the brain that processes information from the sense of sight and other sensory and motor tasks
parasympathetic nervous system (par-uh-sim-puh-THET-ik NER-vuhs SIS-tuhm)	<i>para-</i> (beside); <i>sympatheia</i> (Greek meaning community of feeling); <i>-ic</i> (adjective)	division of the ANS responsible for rest and digest responses
parietal lobe (pah-RY-uh-tuhl lobb)	from the Latin adjective <i>parietalis</i> (walls); <i>-al</i> (adjective suffix)	the part of the brain that processes information from the sense of touch and other sensory and motor tasks
peripheral nervous system (puh-RIFF-uh-ruhl NER-vuhs SIS-tuhm) (PNS)	<i>peri-</i> (surrounding); from the Greek word <i>pherein</i> (to carry); nervous system (common English words)	made up of neurons, neuroglia, and associated tissue, including the cranial and spinal nerves and the sensory and motor nerves that extend throughout the body
pia mater (PEE-ah MAY-turh)	Latin words meaning “tender mother”	inner layer of the meninges
pons (POHNS)	a Latin word meaning “bridge”	the part of the brainstem that passes information to the cerebellum and the thalamus to regulate subconscious somatic activities
psychomotor (SY-ko-mo-tuhr)	<i>psych/o</i> (of the mind); from the Latin word <i>motor</i> (mover)	an adjective used to indicate the relation between psychic activity and muscular movement
somatic nervous system (so-MAT-ik NER-vuhs SIS-tuhm)	<i>somat/o</i> (body, bodily); <i>-ic</i> (adjective suffix)	the parts of the PNS that carry nerve impulses for conscious activity rather than habitual activity
sympathetic nervous system (sim-puh-THET-ik NER-vuhs SIS-tuhm)	<i>sympatheia</i> (Greek meaning community of feeling); <i>-ic</i> (adjective)	division of the ANS responsible for fight or flight responses

spinal nerves (SPY-nahl)	from the Latin word <i>spina</i> (spine)	the 31 pairs of nerves located along the spinal cord	
synapse (SIH-naps)	<i>syn-</i> (together); from the Greek word <i>hapto</i> (clasp)	the connecting point between nerve cells or between a nerve cell and a receptor or effector cell	
temporal lobe (TEM-puh-ruhl lobe)	from the Latin word <i>temporalis</i> (time, temple)	the part of the brain that processes information from the senses of hearing, smell, and taste, and other sensory and motor tasks	
thalamus (THAL-uh-muhs)	from the Greek word <i>thalamus</i> (bed, bedroom)	part of the brain that processes sensory information	
ventricles (VEN-trik-uhls)	from the Latin word <i>ventriculus</i> , dim. of <i>venter</i> (belly)	cavities within the brain	
Disorders			
absence seizure (ABB-sens SEE-zhur)	from the Latin word <i>absentia</i> , absent	seizure characterized by impaired awareness; milder form of seizure lasting only a few seconds and does not include convulsive movements; formerly known as <i>petit mal seizures</i>	French words meaning “small illness”
Alzheimer’s disease (ALZ-hy-mur) (AD)	named after German physician Alois Alzheimer, who first described it in 1906	a disease that may begin in late middle life, characterized by progressive mental deterioration that includes loss of memory and visual and spatial orientation	
amnesia (am-NEE-zah)	<i>a-</i> (without); <i>-mnesia</i> (memory)	loss of memory	
aneurysm (AN-ur-izm)	from the Greek <i>ana</i> (up) and <i>eurys</i> (broad)	localized dilation of an artery due to vessel wall weakness	
anxiety disorder	common English words	a feeling of apprehension or uneasiness that results from anticipation of danger	
aphasia (uh-FAY-jhah)	<i>a-</i> (absence of); from the Greek word <i>phases</i> (speech)	loss of speech	
astrocytoma (A-stroh-sy-TOH-mah)	from the Greek word <i>astron</i> (star); <i>cyt/o</i> (cell); <i>-oma</i> (tumor)	star-shaped tumor that usually develops in the cerebrum; frequently in people younger than 20 years old	
ataxia (ah-TAK-see-ah)	<i>a-</i> (without); from the Greek word <i>taxis</i> (order)	lack of muscular coordination	
bipolar disorder	<i>bi-</i> (twice, double); from the Latin word <i>polus</i> (the end of an axis)	disorder characterized by manic episodes alternating with depressive episodes	
	<i>cerebr/o</i> (brain); <i>-al</i>		

cerebral thrombosis (seh-REE-bruhl throm-BO-sihs)	(adjective suffix); <i>thromb/o</i> (of or relating to a blood clot); <i>-sis</i> (abnormal condition)	blood clot in the brain
cerebrovascular accident (seh-REE-bro-VAS-ku-lahr) (CVA)	<i>cerebr/o</i> (brain); <i>vascul/o</i> (blood vessel); <i>-ar</i> (adjective suffix)	a synonym for <i>cerebral stroke</i> , an acute clinical event, related to impairment of cerebral circulation, lasting more than 24 hours
cerebrovascular disease (seh-REE-bro-VAS-ku-lahr)	<i>cerebr/o</i> (brain); <i>vascul/o</i> (blood vessel); <i>-ar</i> (adjective suffix)	brain disorder involving a blood vessel
concussion (kuhn-KUHSH-uhn)	from the Latin word <i>concussionem</i> (a shaking)	brain injury resulting from a hit to the head or violent shaking
delirium (duh-LEER-ee-uhm)	from the Latin word <i>deliro</i> (to be crazy)	altered state of consciousness
delusion (deh-LOO-zhun)	from the Latin word <i>ludere</i> (to play)	false belief or wrong judgment despite evidence to the contrary
dementia (duh-MEN-shah)	from Latin <i>de</i> (apart, away); <i>mens</i> (mind)	impaired intellectual function
demyelination (deemy-uh-lin-AY-shun)	from the Greek word <i>myelos</i> (marrow, inner part of the brain)	loss of myelin
depression (dih-PRESH-un)	from the Latin word <i>depressio</i>	prolonged period where there is a loss of interest or pleasure in almost all activities
dopamine (DOH-puh-meen) (DA)	from the acronym for the amino acid dioxyphenylalanine (DOPA)	neurotransmitter in the CNS and PNS; depletion of dopamine causes PD
dysphasia (DISS-fay-jhah)	<i>dys-</i> (bad, difficult); from the Greek word <i>phases</i> (speaking)	impaired speech
encephalitis (en-seff-uh-LY-tiss)	<i>encephal/o</i> (of or pertaining to the brain); <i>-itis</i> (inflammation)	inflammation of the brain
epidural hematoma (EH-pih-dur-ahl hee-mah-TOH-ma)	<i>epi-</i> (above); <i>dural</i> (relating to the dura mater); <i>hemat/o</i> (blood); <i>-oma</i> (tumor)	a collection of blood in the space between the skull and dura mater
epilepsy (EPP-ih-lepp-see)	from the Greek <i>epilepsia</i> (seizure)	CNS disorder often characterized by seizures
glioblastoma (GLY-oh-blass-TOH-mah)	<i>glio</i> (glue); from the Greek word <i>blastos</i> (germ); <i>-oma</i> (tumor)	a cerebral tumor occurring most frequently in adults

glioma (gly-OH-muh)	<i>glio-</i> (glue); <i>-oma</i> (tumor)	tumor of glial tissue
grand mal seizure (grahn-mahl SEE-zhur)	French words meaning “big illness”	type of severe seizure with tonic–clonic convulsion; also called tonic–clonic seizure
hallucination (hah-LOO-sih-nay-shun)	from the Latin word <i>alucinator</i> (to wander in mind)	subjective perception of an object or voice when no such stimulus exists
hemiparesis (heh-mee-puh-REE-suhs)	<i>hemi-</i> (one-half); <i>-paresis</i> (slight paralysis)	partial paralysis of one side of the body
hemiplegia (hehm- ee- PLEE-jee-ah)	<i>hemi-</i> (one-half); <i>-plegia</i> (paralysis)	paralysis of one side of the body
Huntington’s disease (HUN-ting-tuhnz)	named after American physician George Huntington who described the disorder in 1872	hereditary disorder of the CNS
hydrocephalus (hy-dro-SEFF-uh-lehs)	<i>hydro-</i> (water); <i>cephal/o</i> (of or pertaining to the head)	excessive CSF in the brain
hyperesthesia (hy- per-ess-THEE-zyuh)	<i>hyper-</i> (extreme or beyond normal); <i>esthesi/o</i> (sensation)	abnormal sensitivity to touch
kleptomania (klep-toh-MAY-knee-yah)	from the Greek word <i>klepto-</i> (to–steal); from the Latin <i>-mania</i> (insanity)	uncontrollable impulse to steal
lesion (LEE-zhun)	from the Latin, <i>laedo</i> (to injure)	wound or injury; pathologic tissue change
meningioma (meh-nihn-jee-OH-muh)	<i>mening/o</i> (membrane); <i>-oma</i> (tumor)	benign tumor of the meninges
meningitis (meh-nihn-JY-tis)	<i>mening/o</i> (membrane); <i>-itis</i> (inflammation)	inflamed meninges
mood disorder	two common English words	a group of mental disorders involving a disturbance of mood not due to any other mental disorder
multiple sclerosis (skleh-RO-sihs) (MS)	multiple (from the English word meaning “many”); <i>scler/o</i> (hardness); <i>-osis</i> (abnormal condition)	disease of the CNS characterized by demyelination and the formation of plaques in the brain and spinal cord
myasthenia gravis (MY-ahs-THEE-nee-ah GRA-viss)	<i>my/o</i> (muscle); <i>astheneia</i> (weakness)	muscle weakness, lack of strength
myelitis (my-eh-LY-	<i>myel/o</i> (bone marrow or	inflammation of the spinal cord

tiss)	spine); <i>-itis</i> (inflammation)	
myelomeningocele (MY-loh-mih-NIHN-gee-oh-seel)	<i>myel/o</i> (bone marrow or spine); <i>meningi/o</i> (membrane); <i>-cele</i> (hernia)	protrusion of the membranes of the brain or spinal cord through a defect in the cranium or vertebral column
neuralgia (nuh-RALL-jah)	<i>neur/o</i> (nerve); <i>-algia</i> (pain)	pain in a nerve
neuropathy (nuh-ROP-ah-thee)	<i>neur/o</i> (nerve); <i>-pathy</i> (disease)	a disease involving the cranial, central, or autonomic nervous systems
obsessive–compulsive disorder (OCD)	common English words	type of anxiety disorder characterized by persistent thoughts and impulses with repetitive responses that interfere with daily activities
paralysis (pah-RALL-ih-sihs)	<i>para-</i> (abnormal, alongside); <i>-lysis</i> (destruction)	loss of one or more muscle functions
paranoia (pah-ah-NOY-ya)	<i>para-</i> (abnormal, alongside); from Greek word <i>noeo</i> (to think)	a serious mental disorder characterized by unreasonable suspicion or jealousy, along with a tendency to interpret everything others do as hostile
paraplegia (pah-ah-PLLEE-jee-ah)	<i>para-</i> (abnormal, alongside); <i>-plegia</i> (paralysis)	paralysis of the lower extremities and, often, the lower trunk of the body
paresthesia (per-ess-THEE-zyuh)	<i>para-</i> (abnormal); <i>esthesi/o</i> (sensation)	numbness
Parkinson’s disease (PAR-kin-suhn) (PD)	named for English physician James Parkinson, who described it in 1817	disease of the nerves in the brain due to an imbalance of dopamine; also called parkinsonism
phobia (FOH-bee-ah)	<i>phob/o</i> (exaggerated fear); <i>-ia</i> (noun suffix)	a fear of something that is not a hazard from a statistical point of view
plegia (PLEE-jee-uh)	<i>-plegia</i> (paralysis)	paralysis
poliomyelitis (pohl-ee-oh-MY-eh-LY-tiss)	<i>polio-</i> (denoting gray color); <i>myel/o</i> (bone marrow or spine); <i>-itis</i> (inflammation)	inflamed gray matter of the spinal cord
posttraumatic stress disorder (PTSD) (pohst-truh-MAT-ik stres dis-AWR-der)	<i>post-</i> (after); <i>trauma</i> (Greek for wound); <i>-ic</i>	development of characteristic long-term symptoms following a psychologically traumatic event that is generally outside the range of usual human experience
psychosis (sy-KO-sihs)	<i>psych/o</i> (mind); <i>-sis</i> (condition of)	a serious disorder involving a marked distortion of, or sharp break from, reality; general term covering severe mental or emotional disorders
psychotic disorder	<i>psych/o</i> (mind); <i>-ic</i>	a mental and behavioral disorder causing gross distortion or disorganization of a person’s mental

(sahy-KOT-ik dis-AWR-der)	(adjective)	capacity, affective response, and capacity to recognize reality
quadriplegia (kwad-rih-PLÉE-jee-ah)	<i>quadr/i</i> (four); <i>-plegia</i> (paralysis)	paralysis of all four limbs
schizophrenia (skits-oh-FREN-ee-ah)	<i>schiz/o</i> (denoting split or double sided); from the Greek word <i>phren</i> (mind)	a severe mental illness characterized by auditory hallucinations, paranoia, and an inability to distinguish reality from fiction
seizure (SEE-zhur)	from the French word <i>seisir</i> (to grasp); common English word	sudden disturbance in brain function sometimes producing a convulsion
somnambulism (sahm-NAM-bu-lih-sm)	from Latin words <i>somnus</i> (sleep) and <i>ambulo</i> (walk); <i>-ism</i> (a medical condition)	sleep walking
subdural hematoma (SUB-dur-ahl hee-mah-TOH-ma)	<i>sub-</i> (beneath); <i>dura</i> (hard); <i>-al</i> (adjective suffix); <i>hemat/o</i> (blood); <i>-oma</i> (tumor)	a collection of blood trapped in the space beneath the dura mater, between the dura and arachnoid layers of the meninges
syncope (SIN-kuh-pee)	from the Greek word <i>syncope</i> (a cutting short, a swoon)	fainting
transient ischemic attack (TRANS-ee-ent IH-skee-mik) (TIA)	from Greek <i>isch</i> , (to restrict), and the suffix <i>-emia</i> (blood)	temporary interruption in the blood supply to the brain
vertigo (VER-tih-goh)	from the Latin word <i>verto</i> (turn)	dizziness
Diagnostic Tests, Treatments, and Surgical Procedures		
antianxiety agent	<i>anti-</i> (against); from the Greek word <i>angho</i> (to squeeze, embrace, throttle)	drug used to suppress anxiousness and relax muscles
anticonvulsant agent	<i>anti-</i> (against); from the Latin <i>con</i> (with) and <i>vulsus</i> (to tear up)	drug used to decrease seizure activity
antipsychotic agent	<i>anti-</i> (against); <i>psych/o</i> (mind); <i>-tic</i> (adjective suffix)	drug given to patients to affect behavior and treat psychiatric disorders
computed tomography (CT)	<i>tomos</i> (Greek “to slice”); <i>-graph</i> (instrument for recording)	X-ray imaging using cross-sectional planes of the body
craniectomy (KRAY-nee-ek-tuh-mee)	<i>crani/o</i> (cranium); <i>-ectomy</i> (excision)	excision of part of the skull

craniotomy (KRAY-nee-aw-tuh-mee)	<i>crani/o</i> (cranium); <i>-tomy</i> (cutting operation)	incision into the skull
electroconvulsive therapy (ECT) or electroshock therapy (EST)	<i>electr/o</i> (electric); from the Latin words <i>con</i> (with) and <i>vulsus</i> (to tear up)	a controlled convulsion produced by passing an electric current through the brain
electroencephalography (ee-LEK-tro-en-sef-ah-LAH-grah-fee) (EEG)	<i>electr/o</i> (electric); <i>encephal/o</i> (brain); <i>-graphy</i> (process of recording)	record of the electrical activity of the brain
lobotomy (lo-BAWT-uh-mee)	<i>lob/o</i> (lobe); <i>-tomy</i> (cutting operation)	incision into a lobe
lumbar puncture (LP)	from the Latin word <i>lumbus</i> (loin)	insertion of a needle into the subarachnoid space between the third and fourth or fourth and fifth lumbar vertebrae to withdraw fluid for diagnosis
magnetic resonance imaging (MRI)	common English words	uses radio waves and a very strong magnetic field to produce images of the soft tissue
myelography (my-eh-LOG-rah-fee)	<i>myel/o</i> (bone marrow or spine); <i>-graphy</i> (process of recording)	radiography of the spinal cord and nerve roots
neuroplasty (NURR-oh-plass-tee)	<i>neur/o</i> (nerve); <i>-plasty</i> (repair)	surgery to repair a nerve
sedatives	from the Latin <i>sedeo</i> (sit); from the Greek word <i>hypnotikos</i> (causing one to sleep)	drugs used to induce calming effect or sleep
Practice and Practitioners		
neurologist (nuhr-AWL-ih-gihst)	<i>neur/o</i> (nerve); <i>-logist</i> (practitioner)	a medical specialist who treats nervous system disorders
neurology (nuhr-AWL-uh-jee)	<i>neur/o</i> (nerve); <i>-logy</i> (the study of)	medical specialty dealing with the nervous system
neurosurgeon (NOO-roh-sur-juhn)	<i>neur/o</i> (nerve); from the Greek word <i>kheirourgos</i> (working or done by hand)	surgeon who specializes in operations on the nervous system
psychiatrist (sy-KY-ah-trist)	<i>psych/o</i> (mind); <i>iatr/o</i> (of or pertaining to medicine or a physician); <i>-ist</i> (one who specializes in)	a medical doctor who specializes in the diagnosis and treatment of psychological disorders
psychologist (sy-KOL-oh-jist)	<i>psych/o</i> (mind); <i>-logist</i> (one who studies a certain field)	a (nonmedical) doctor of psychology who specializes in the diagnosis and treatment of psychological disorders

END-OF-CHAPTER EXERCISES

EXERCISE 7-1

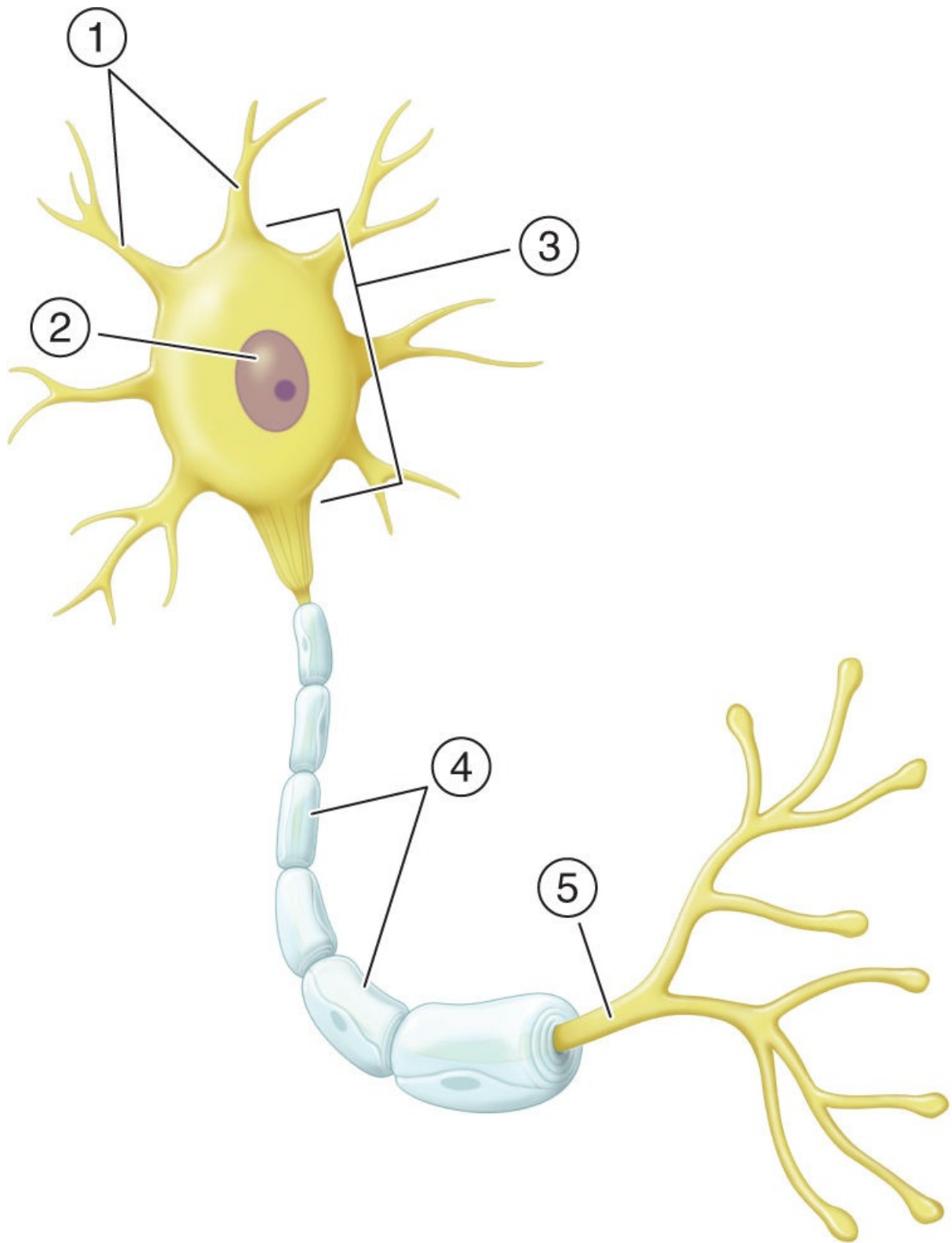


LABELING

Label the parts of the motor neuron. Select from the terms listed in the table.

axon dendrites nucleus

cell body myelin



1. _____
2. _____
3. _____
4. _____

5. _____

EXERCISE 7-2



WORD PARTS

Break each of the following terms into its word parts: root, prefix, or suffix. Give the meaning of each word part and then define each term.

1. *psychosis*

root: _____

suffix: _____

definition: _____

2. *electroencephalography*

root: _____

root: _____

suffix: _____

definition: _____

3. *astrocytoma*

root: _____

root: _____

suffix: _____

definition: _____

4. *cerebrovascular*

root: _____

root: _____

suffix: _____

definition: _____

5. *encephalitis*

root: _____

suffix: _____

definition: _____

6. *epidural*

prefix: _____
root: _____
suffix: _____
definition: _____

7. *psychiatrist*

root: _____
root: _____
suffix: _____
definition: _____

8. *meningioma*

root: _____
suffix: _____
definition: _____

EXERCISE 7-3



WORD BUILDING

Use the word parts listed to build the terms defined.

neur/o -oma sympathetic -noia

-paresis para- -plasty esthesia

gli/a -itis -tomy hemi-

di- -on lob/o encephala/o

1. _____ inflammation of the brain
2. _____ tumor of glial tissue
3. _____ partial paralysis of one side of the body
4. _____ incision into a lobe
5. _____ cells that are a part of nerve tissue and are external to neurons
6. _____ division of the ANS responsible for rest and digestive responses

7. _____ a mental disorder characterized by unreasonable suspicion or jealousy
8. _____ surgery to repair a nerve
9. _____ the part of the brain containing both the thalamus and the hypothalamus
10. _____ numbness

EXERCISE 7-4



MATCHING

Match the term in the first column with its definition in the second column.

- | | |
|------------------------------|---|
| 1. _____
cerebrum | a. accumulation of fluid on the brain |
| 2. _____
cerebral cortex | b. nerve pain |
| 3. _____
brainstem | c. contains the mesencephalon (midbrain), pons, and medulla oblongata |
| 4. _____
somatic nerves | d. dizziness |
| 5. _____
pons | e. hernia of the meninges and the spinal cord |
| 6. _____
autonomic nerves | f. outer layer of the cerebrum |
| 7. _____
meningomyelocele | g. fainting |
| 8. _____
neuralgia | h. smallest part of brain |
| 9. _____
convulsion | i. contact point between two nerves |
| 10. _____
syncope | j. involuntary nerves |

11. _____
vertigo

k. largest part of the brain

12. _____
hydrocephalus

l. inflammation of a nerve

13. _____
neuritis

m. seizure

14. _____
synapse

n. voluntary nerves

EXERCISE 7-5



MULTIPLE CHOICE

Choose the correct answer for the following multiple choice questions.

- Which term means paralysis on **one side** of the body?
 - diplegia
 - paraplegia
 - monoplegia
 - hemiplegia
- Which of the following terms means a disease of the CNS characterized by the formation of plaques in the brain and spinal cord?
 - amyotrophic lateral sclerosis
 - PD
 - MS
 - poliomyelitis
- To what does the term *cerebrocranial* refer?
 - brain and cranium
 - cerebellum and cranium
 - cerebrum and brain
 - cerebrum and cerebellum
- The axon is a process that extends from a neuron cell body. What is another one?
 - effector

- b. dendrite
 - c. neurotransmitter
 - d. ganglia
5. Which of the following means *accumulation of blood under the outermost meningeal layer*?
- a. epidural hematoma
 - b. intracerebral hematoma
 - c. subdural hematoma
 - d. cerebral concussion
6. Which of the following means *hardening of the brain*?
- a. MS
 - b. encephalosclerosis
 - c. encephalomyelopathy
 - d. depilepsy
7. What is cerebral meningitis?
- a. inflammation of the cerebellum
 - b. inflammation of the medulla
 - c. inflammation of the meninges of the brain
 - d. inflammation of the meninges of the spinal cord
8. Which part of the nervous system conducts impulses to skeletal muscle and is under *conscious* control?
- a. autonomic
 - b. central
 - c. somatic
 - d. afferent
9. PD is a disease of the nerves in the brain due to an imbalance of what?
- a. glucose
 - b. serotonin
 - c. oxygen

- d. DA
10. A craniectomy is an _____.
 - a. incision into a lobe
 - b. incision into the skull
 - c. excision of part of the skull
 - d. surgery to repair a nerve
 11. This is given to reduce seizure activity.
 - a. antianxiety agent
 - b. anticonvulsant agent
 - c. antipsychotic agent
 - d. sedative
 12. Of the following choices, which is the best place to perform an LP?
 - a. between T2 and T3
 - b. between T12 and L1
 - c. between L5 and S1
 - d. between L3 and L4
 13. What is another name for an absence seizure?
 - a. grand mal seizure
 - b. petit mal seizure
 - c. somnambulism
 - d. syncope
 14. A TIA involves primarily the nervous system and which other body system?
 - a. respiratory
 - b. cardiovascular
 - c. muscular
 - d. digestive
 15. Delirium is _____.
 - a. a false belief or wrong judgment despite evidence to the contrary

- b. a subjective perception of an object or voice when no such stimulus exists
- c. impaired intellectual function
- d. altered state of consciousness

EXERCISE 7-6



FILL IN THE BLANK

Fill in the blank with the correct answer.

1. Abnormal sensitivity to touch is called _____.
2. The name for “inflamed” gray matter of the spinal cord is _____.
3. Impaired intellectual function is called _____.
4. The demyelination of the spinal cord nerves is called _____.
5. The protrusion of the meninges and spinal cord tissue through a spina bifida is called a/an _____.
6. The term for a blood clot in the brain is _____.
7. _____ is characterized by a lack of muscular coordination.
8. CNS disorder often characterized by seizures is termed _____.
9. _____ is synonymous with fainting.
10. Pain in a nerve is _____.

EXERCISE 7-7



ABBREVIATIONS

Write out the term for the following abbreviations.

1. _____ ICP
2. _____ CSF
3. _____ LP
4. _____ EEG
5. _____ MS
6. _____ OCD

7. _____ PD
8. _____ PNS
9. _____ CVA
10. _____ DA

Write the abbreviation for the following terms.

11. _____ posttraumatic stress disorder
12. _____ peripheral nervous system
13. _____ cerebrovascular accident
14. _____ magnetic resonance imaging
15. _____ transient ischemic attack

EXERCISE 7-8



SPELLING

Select the correct spelling of the medical term.

1. _____ is the loss, due to brain damage, of the ability to speak or write or to comprehend the written or spoken word.
- a. Aphasia
 - b. Afasia
 - c. Aphazia
 - d. Aphesia
2. _____ is a type of psychosis that may manifest itself as paranoia, withdrawal, or psychotic symptoms.
- a. Skitzophrenia
 - b. Schizofrenia
 - c. Schizophrenia
 - d. Skizophrenia
3. _____ are the potent chemicals in the synapse between neurons.
- a. Nuerotransmitters
 - b. Neurotransmitters
 - c. Neurotransmitters

- d. Neuritransmitters
4. _____ is a collection of blood in the subdural space.
- a. Subdaral hemitoma
 - b. Subdural hemitonia
 - c. Subdural henitoma
 - d. Subdural hematoma
5. A _____ is a protrusion of the membranes of the brain or spinal cord through a defect in the cranium or vertebral column.
- a. myelomeningocele
 - b. myelomenengocele
 - c. myelomenegocell
 - d. meylomeningocele
6. The membranes that surround the brain and spinal cord are called _____.
- a. menenges
 - b. meninges
 - c. meninnges
 - d. meningis
7. The plural of nucleus is _____.
- a. nuclie
 - b. neuclei
 - c. nuclius
 - d. nuclei
8. TIA stands for transient _____ attack.
- a. ichemic
 - b. ischemic
 - c. ischimid
 - d. ischeimid

9. A sudden disturbance in brain function which sometimes produces a convulsion is called a _____.
- seisure
 - siezure
 - seizure
 - seizur
10. An _____ is a localized dilation of an artery due to vessel wall weakness.
- aneurysm
 - aneurism
 - anurism
 - anurysm

EXERCISE 7-9



CASE STUDY

Read the following excerpt from an emergency room record and answer the questions.

CHIEF COMPLAINT: Mental status changes and aphasia.

BRIEF HISTORY: J.D. is an 85-year-old female who presents to the emergency department with difficulty talking. Her daughter states that J.D. has had garbled speech for the past few days, repeatedly says, “How do you do?” and answers the same to any questions asked. This has happened in the past, but the daughter says her mother has always “gotten better.” This morning J.D. woke up and has weakness on the right side of her body. There are no other modifying factors or associated signs or symptoms.

ASSESSMENT: Probable history of TIA; now CVA with resulting dysphasia and right hemiparesis.

- What is a TIA? _____
- What does the acronym CVA represent? _____
- Break up the medical term *dysphasia* and define its word parts.

- What does the root word *paresis* mean? _____
- What is the difference between *hemiparesis* and *hemiplegia*?

6. Break up the term *hemiplegia* and define the word parts.



The Special Senses of Sight and Hearing

LEARNING OUTCOMES

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

- Name the structures of the eyes and ears.
- Label diagrams showing major components of the eyes and ears.
- Pronounce, spell, and define medical terms related to the eyes and ears and its disorders
- Interpret abbreviations associated with the eyes and ears.

INTRODUCTION

We get the English word *sense* from the Latin verb *sentire*, which means “to feel.” The phrase *special senses* comes from this word and refers to the five senses related to the organs of sight, hearing, smell, taste, and touch. Sight and hearing are treated in a single chapter because unlike smell, taste, and touch, which rely on chemical responses, sight and hearing include terminology associated with bodily organs that process electromagnetic energy (sight) and mechanical energy (hearing). Sight and hearing will be discussed in two separate sections within this chapter.

WORD PARTS RELATED TO THE EYE

The word root *ocul/o* comes from the Latin word *oculus* (eye). The word root *ophthalm/o* comes from the Greek word *ophthalmos*, which also means eye.

The Latin word *opticus* means “of sight or seeing” and from this comes words like *optic*. The suffixes -opia and -opsia both mean “vision.” Most of the remaining word parts refer to specific structures within the eye. **Table 8-1** lists word parts related to the eyes.

TABLE 8-1  **WORD PARTS RELATED TO THE EYE**

Word Part	Meaning
blephar/o	eyelid
conjunctiv/o	conjunctiva (<i>conjunctivae</i> , plural)
corne/o	horny
dacry/o	tears, lacrimal sac or lacrimal duct
dipl/o	two, double
irid/o	iris
kerat/o	hard, cornea
lacrim/o	tear, lacrimal apparatus
ocul/o	eye
ophthalm/o	eye
-opia	vision
opt/o	light, eye, vision
phac/o	lens
presby/o	old age

pupil/o	pupil
retin/o	retina
scler/o	relating to the sclera, hard
uve/o	denoting the pigmented middle eye layer

Word Parts Exercise

After studying Table 8-1, write the meaning of each of the word parts.

WORD PART	MEANING
1. retin/o	1. _____
2. kerat/o	2. _____
3. lacrim/o	3. _____
4. opt/o	4. _____
5. ocul/o	5. _____
6. uve/o	6. _____
7. dipl/o	7. _____
8. dacry/o	8. _____
9. irid/o	9. _____
10. ophthalm/o	10. _____
11. phac/o	11. _____

12. presby/o	12. _____
13. blephar/o	13. _____
14. conjunctiv/o	14. _____
15. pupil/o	15. _____
16. corne/o	16. _____
17. scler/o	17. _____

Structure and Function of the Eye

Light waves are part of the electromagnetic spectrum, and our eyes work like a motion picture camera, taking continuous pictures and transmitting them instantaneously to the brain, which converts them to images in motion. Although light energy and brain waves are both part of the electromagnetic spectrum, brain waves have much lower frequencies and, therefore, much longer wavelengths than those of light. Thus, our eyes must also convert detected light frequencies, so that the brain can enable us to “see” objects and their motions.

The eye is the organ of vision that is found within the **orbit**, a bony cavity (socket) formed by seven bones of the skull. Accessory structures of the eyes include the *extraocular muscles*, *eyebrows*, *eyelids*, *eyelashes*, *conjunctiva*, and *lacrimal apparatus*. **Extraocular muscles** are those muscles within the orbit but outside the eyeball that move the eyes. They are not visible from the exterior. **Eyebrows** are the crescent-shaped line of hairs on the superior edge of the orbit. The movable upper and lower folds that cover the surface of the eyeballs when they close are called **eyelids** (*palpebrae*), and the stiff hairs projecting from the eyelid margins are the **eyelashes**. The angle formed by the junction of the lateral parts of the upper and lower eyelids is known as the *lateral angle of eye* (*lateral canthus*), and the medial angle formed by their union is the *medial angle of eye* (*medial canthus*) (see **Figure 8-1**). The **conjunctiva** is the mucous membrane that lines the anterior surface of the eyeball and the underside of the eyelid. This membrane covers and protects the exposed surface of the eyeball (see **Figure 8-3**).

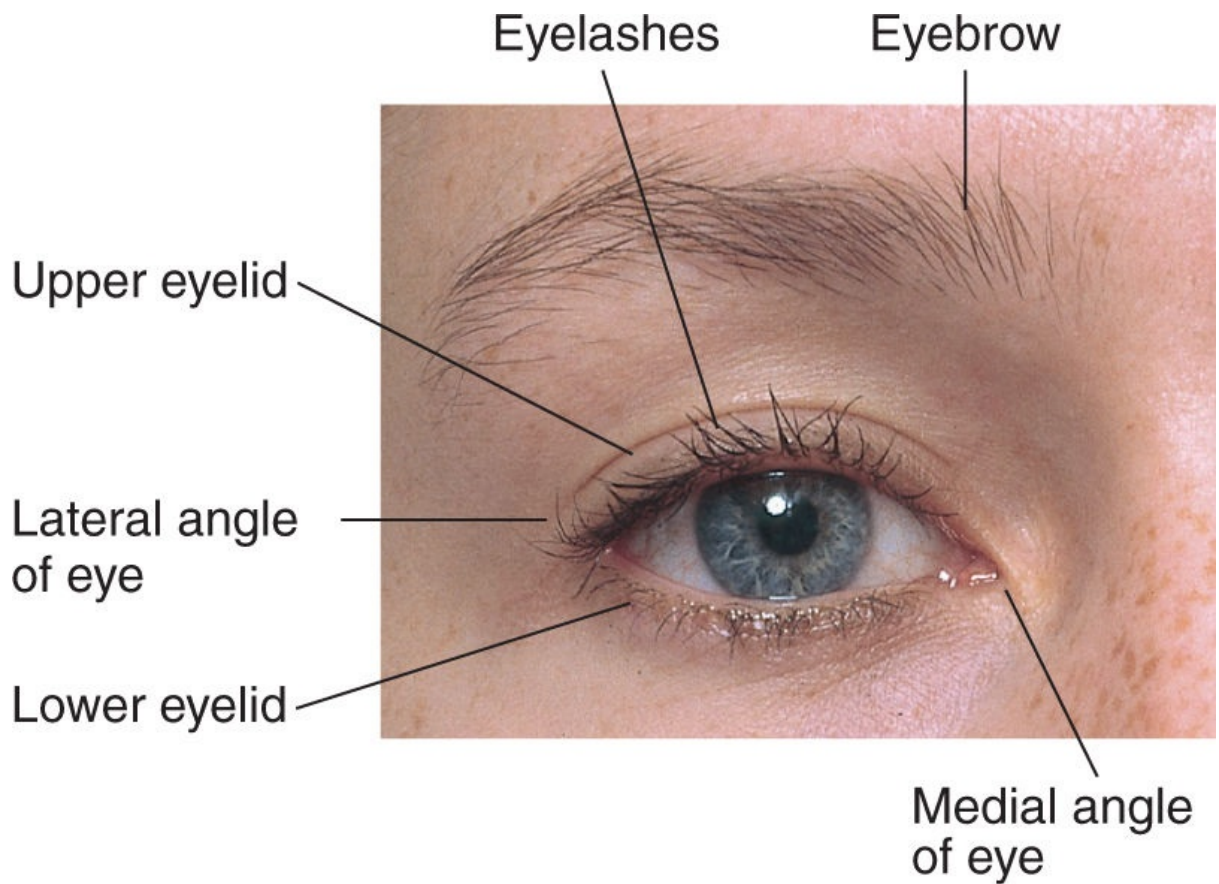


FIGURE 8-1 Protective structures of the eye.

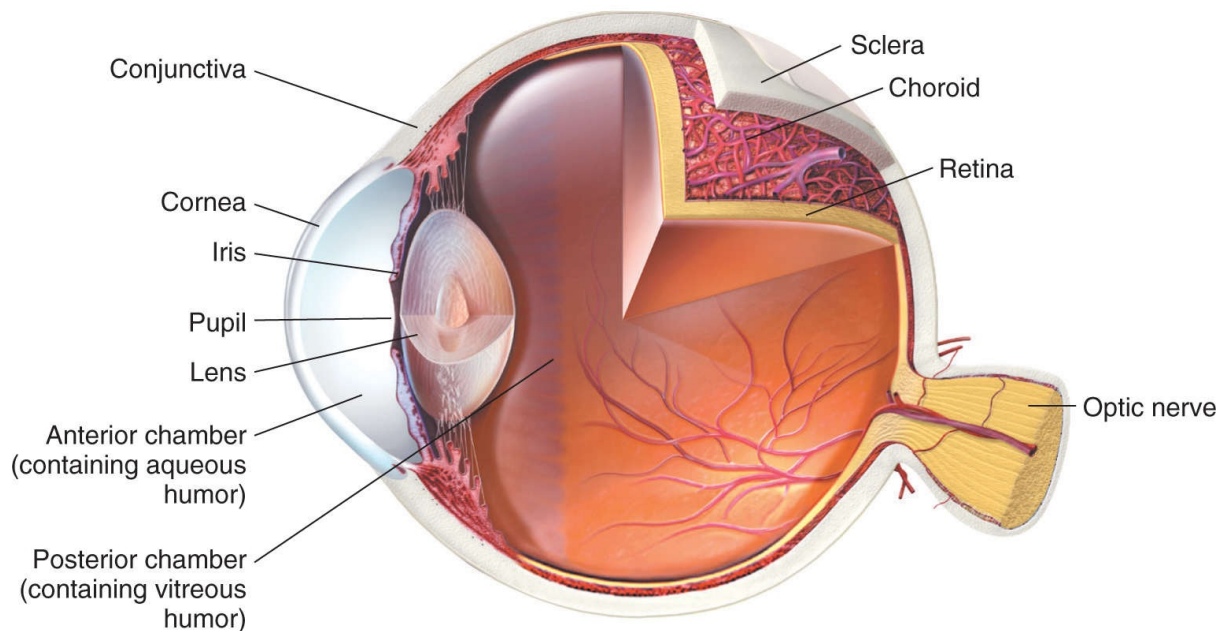


FIGURE 8-3 Structures of the eyeball.

Several structures associated with tear production and flow make up the **lacrimal apparatus**. Located superior to the outer corner of each eye are the **lacrimal glands**, which secrete tears to cleanse and moisten the eyeball surface. The **lacrimal sac** stores tears. **Lacrimal ducts** are channels that carry

tears to the eyes, whereas the **nasolacrimal ducts** carry tears from the lacrimal glands to the nose (see **Figure 8-2**).

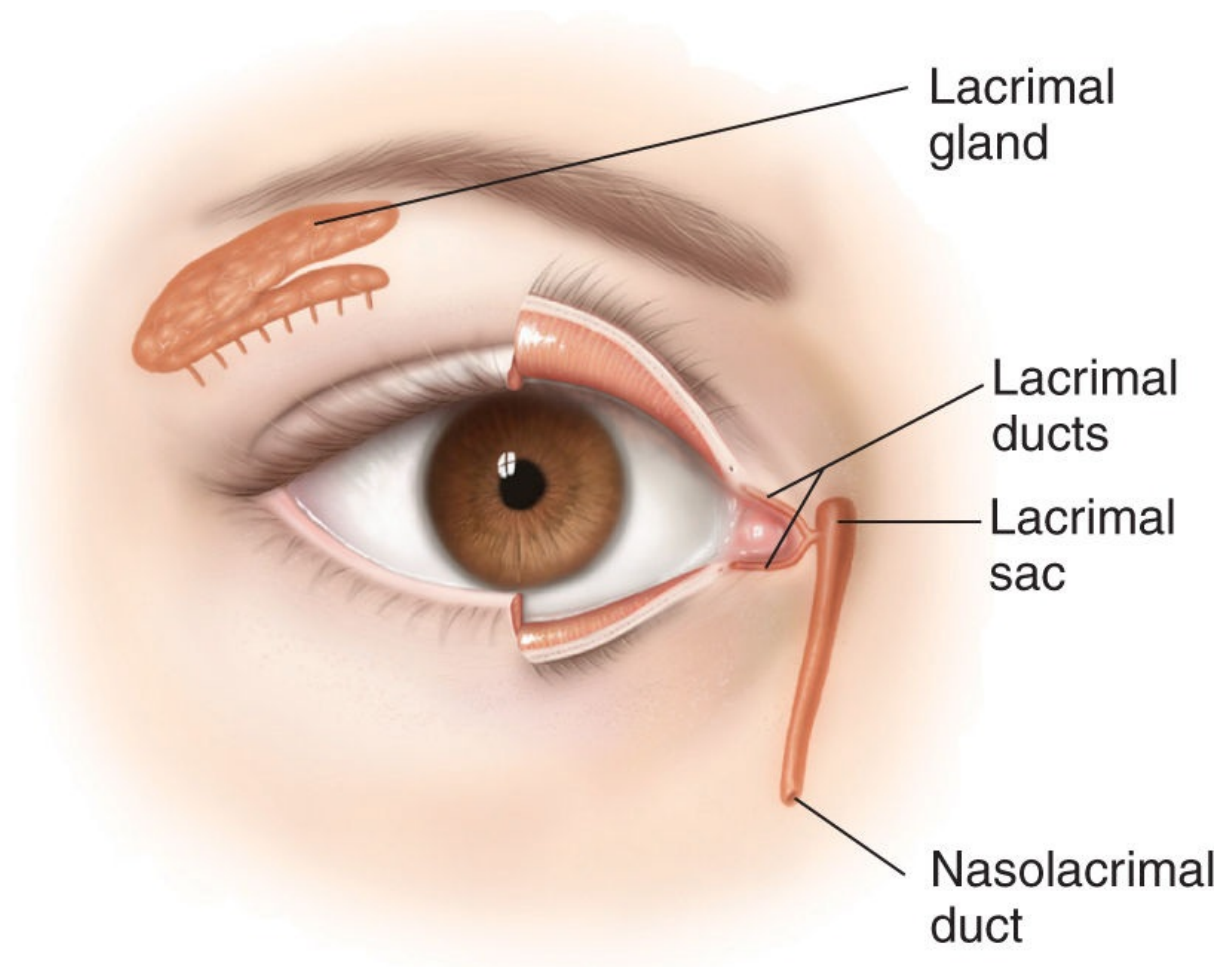


FIGURE 8-2 Structures of the right lacrimal apparatus.

The eyeball is made up of three layers, listed from the outermost to the innermost layer: *fibrous layer*, *vascular layer*, and *inner layer*. The fibrous layer consists of the *sclera* and *cornea*; the vascular layer (also called the *uvea*) is made up of the *choroid*, *ciliary body*, and *iris*; and the inner layer has the *retina* and *optic nerve*. The **sclera**, also known as the white of the eye, helps maintain the shape of eyeball and extends from the cornea to the optic nerve. The **cornea** is the transparent portion that provides most of the optical power of the eye through its ability to bend light rays to focus on the surface of the retina (see **Figure 8-3**).

The **choroid** is the opaque layer of the eyeball that contains vessels that supply blood to the eye. The **ciliary body** is a thickened portion between the choroid and iris. Its group of muscles suspends the lens and adjusts it to direct the light entering the eye. The **lens** is a transparent structure posterior to the pupil that bends and focuses light rays on the retina. It is held in place by the

ligaments of the ciliary body. The *ciliary muscles* control the shape of the lens to allow for far and near vision. The **iris** is the pigmented muscular ring that surrounds and controls the size of the **pupil**, the opening in the middle of the iris through which light enters the eye (see [Figure 8-3](#)).

The innermost layer of the eye that contains visual receptors (rod and cones) is the **retina**. The first cranial nerve, called the **optic nerve**, carries nerve impulses from the retina to the brain to give us the sense of sight. It exits the eyeball through the optic foramen (opening) in the orbit (see [Figure 8-3](#)).

The interior spaces (chambers) of the eyeball contain fluid. The *anterior chamber* is the space between the cornea and the lens, and it is filled with a watery fluid called the **aqueous humor**. The *posterior chamber* is the large open space between the lens and retina that contains a semi-gelatinous liquid, the **vitreous humor** (see [Figure 8-3](#)).



Quick Check #1

Fill in the blanks.

1. The three layers of the eyeball are the _____ layer, the _____ layer, and the _____ layer.
2. The _____ contains vessels for supplying blood to the eye.
3. The opening in the middle of the iris is the _____.

Photoreceptors are the specialized visual receptor cells in the retina. There are two types of photoreceptors: rods and cones. **Rods** are black and white receptors that respond to dim light, and **cones** are color receptors that provide color vision and sharp vision (visual acuity). These photosensitive cells receive the light waves that come in through the cornea and convert them into nerve impulses. These nerve impulses are carried to the brain through the optic nerve. An oval area of the retina is called the **macula** and at its center is a pit called the **fovea centralis**, which is saturated with cones and thus permits the best possible color vision. The **optic disc** is the location where nerve fibers from the retina converge to form the optic nerve. Because it has no photoreceptors, it is referred to as the *blind spot* (see [Figure 8-4](#)).

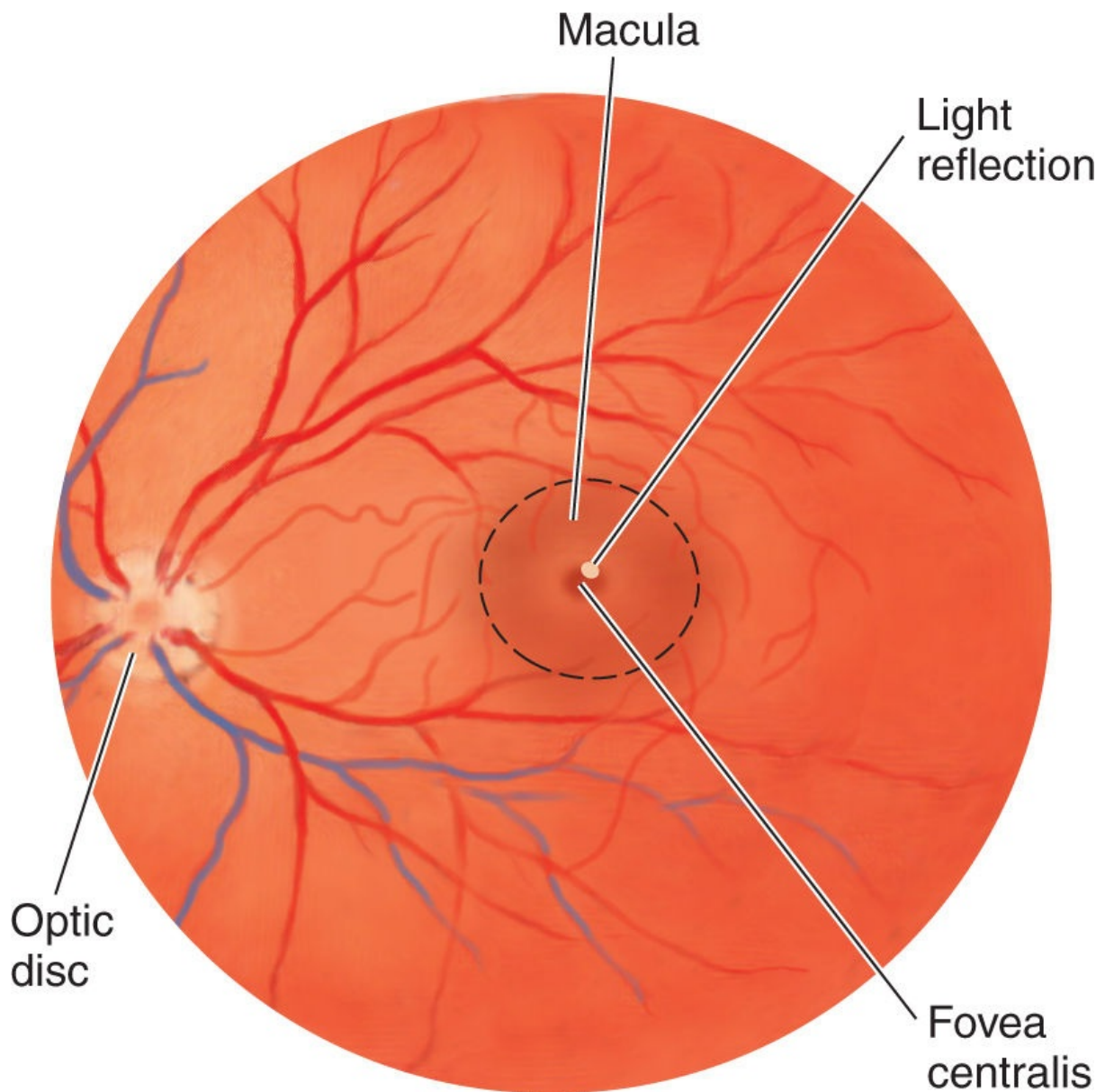


FIGURE 8-4 Structures of the internal right eye.

Refraction, the bending of light rays, is the ability of the eye to change the direction of light in order to focus it on the retina. Light rays are refracted by the cornea and lens to focus an image on the retina. We are able to see because of **accommodation**, the automatic adjustment of focusing the eye by flattening or thickening the lens (see **Figure 8-5**).

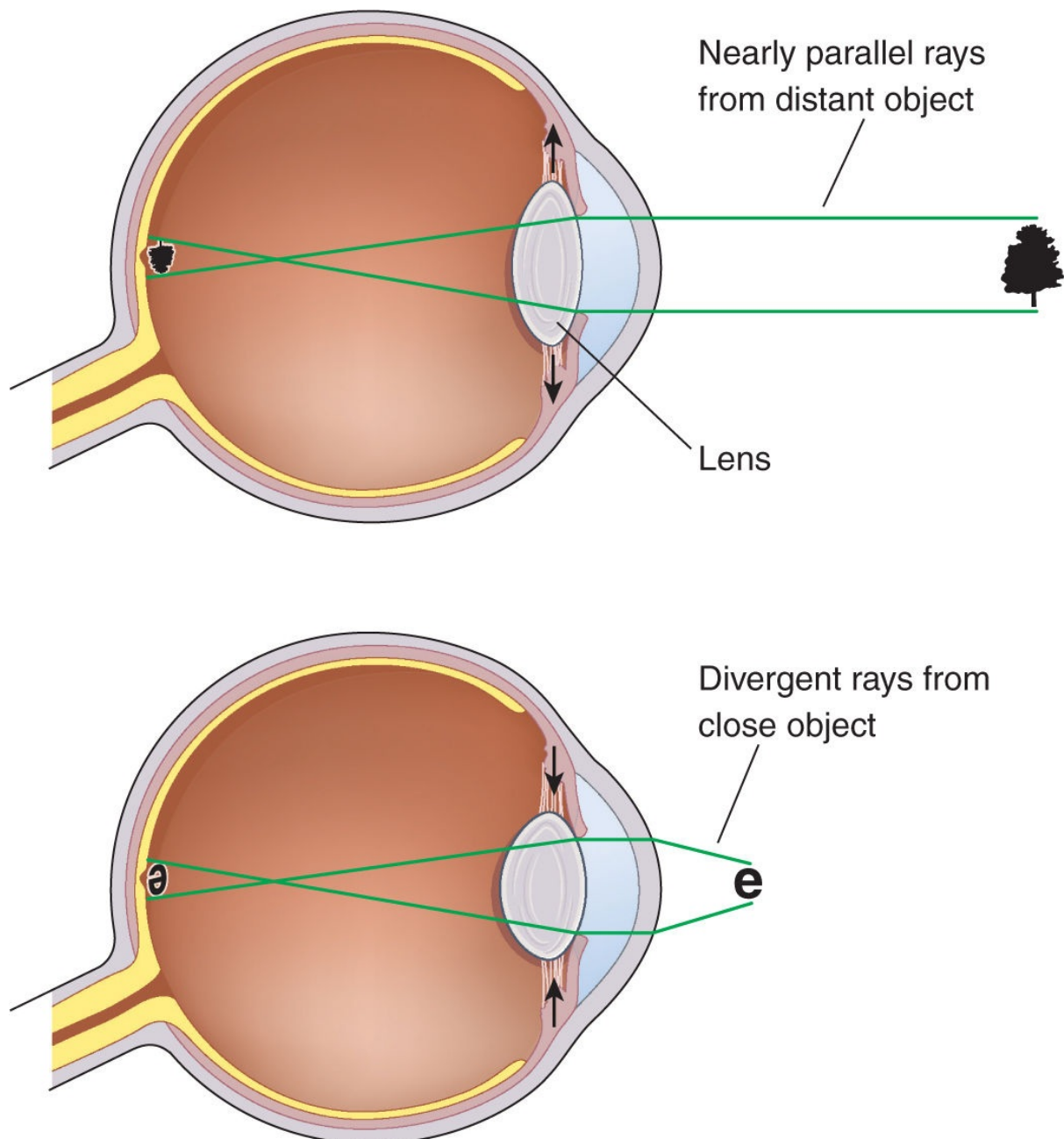


FIGURE 8-5 Accommodation. The ciliary muscles control the shape of the lens to allow for far and near vision. The top figure has an elongated lens allowing the eye to focus on distant objects. The bottom figure has a shortened lens, allowing the eye to focus on close objects.

Disorders Related to the Eye

Refractive errors, infections, and disorders of the eyelids are common. Refractive errors can be corrected with glasses, contact lenses, or operations that include the reshaping of the cornea. Other eye conditions can be treated with medications or surgery.

Refractive Errors

Hyperopia is the medical term for *farsightedness*, a condition in which the image falls behind the retina. With hyperopia, people cannot see things clearly if they are close to the eyes but can see distant objects. **Myopia** is the medical term for *nearsightedness*, a condition in which the image falls in front of the retina. People with myopia cannot see things clearly unless they are close to the eyes (see [Figure 8-6](#)). **Presbyopia** is farsightedness caused by aging. Another refractive error is called **astigmatism**, which means the light coming into the eye does not focus on a single point; this condition is caused by an irregularity of the curve of the cornea or lens that distorts light entering the eye. Corrective lenses can usually compensate for any refractive error.

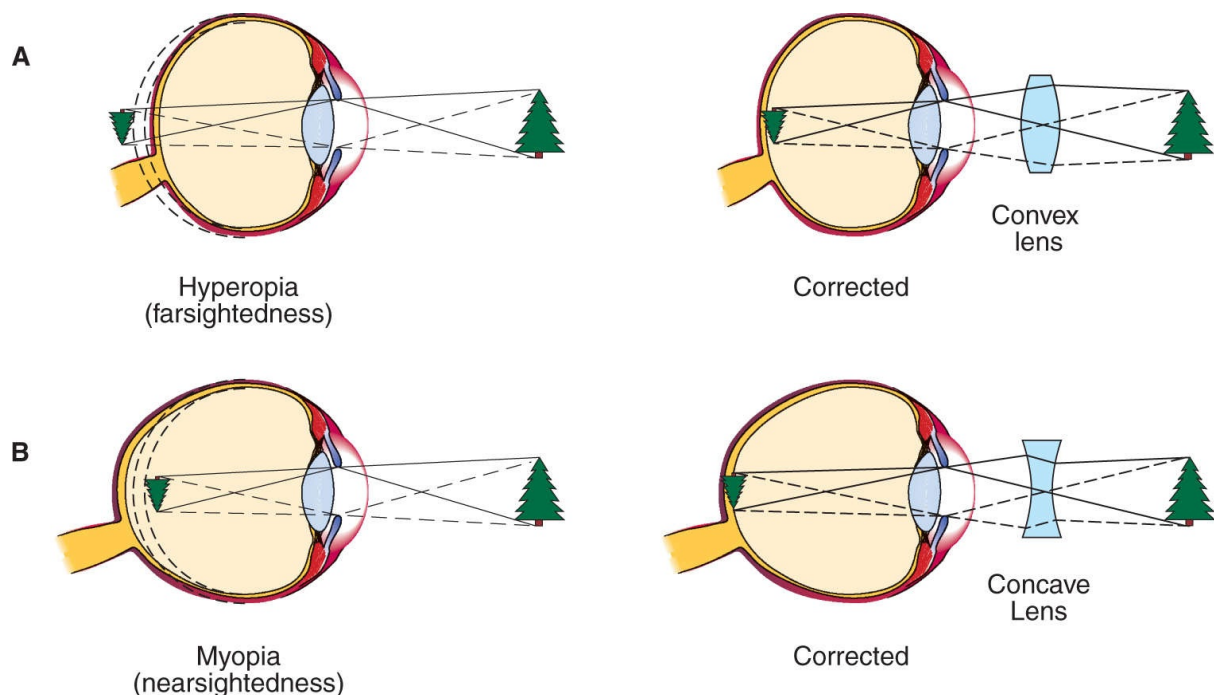


FIGURE 8-6 Refractive errors. **A.** Hyperopia or farsightedness. The image falls behind the retina, making it difficult to see up close. The corrective lens places the image properly on the retina. **B.** Myopia or nearsightedness. The image falls in front of the retina, making it difficult to see far. The corrective lens places the image properly on the retina.

Infections

Conjunctivitis, commonly known as *pinkeye*, is an inflammation of the conjunctiva. The inflammation causes small blood vessels in the conjunctiva to become more prominent, giving the sclera a pink or red color. **Keratitis** is an inflammation of the cornea that occurs when the cornea has been scratched or otherwise damaged. An inflamed lacrimal sac is called **dacryocystitis**.

Disorders of the Eyelids

Blepharoptosis is drooping of the upper eyelid. **Ectropion** is a condition in which the eyelid is turned outward away from the eyeball. **Entropion** is a condition that causes the eyelid to roll inward against the eyeball. A **hordeolum**, commonly called a **sty**, is an infection of the oil gland of an eyelash.

Other Disorders of the Eye

Xerophthalmia, also known as dry eyes, occurs when the surface of the eye becomes dry, often from wearing contact lenses or from a diminished flow of tears.

Glaucoma is a disease characterized by an increase in intraocular pressure (IOP) that causes damage to the optic nerve. If left untreated, it can result in permanent blindness. Symptoms frequently go unnoticed by the patient until the optic nerve has been damaged.

A cloudiness or opacity of the lens is called a **cataract** (see [Figure 8-7](#)). Disease, injury, chemicals, or exposure to various physical elements may cause cataracts. Surgery to replace the clouded lens with an artificial intraocular lens is a common treatment for cataracts.

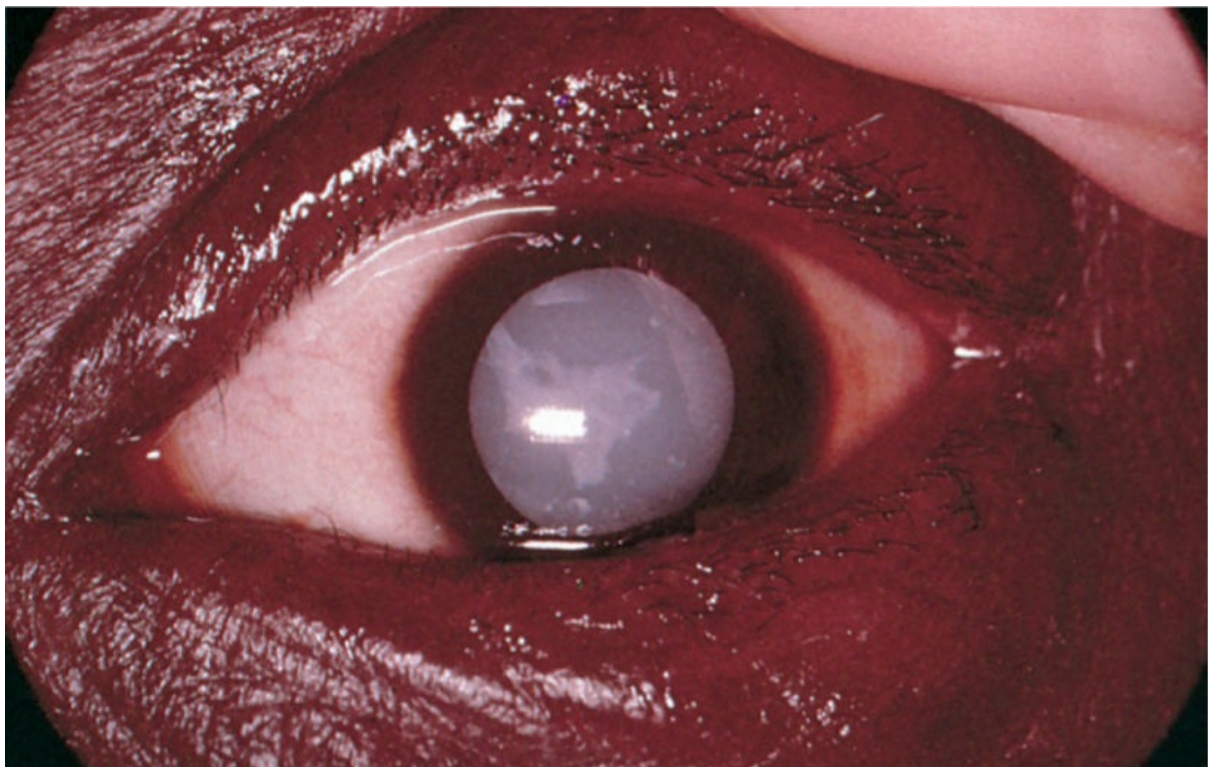


FIGURE 8-7 Cataract.

Diagnostic Tests, Treatments, and Surgical Procedures of the Eye

An **ophthalmoscope** is the instrument by which practitioners can examine the interior of the eye by looking through the pupil.

A popular procedure to correct vision problems, such as myopia, hyperopia, and astigmatism, is **laser-assisted in situ keratomileusis (LASIK)**. This procedure uses a laser to create a corneal flap and reshape the cornea. Treatment for a detached retina or retinal tear may include scleral buckling. A **scleral buckle** is a permanent silicone band that attaches to the scleral peripheral behind the eye, pulling the retina together (see **Figure 8-8**).

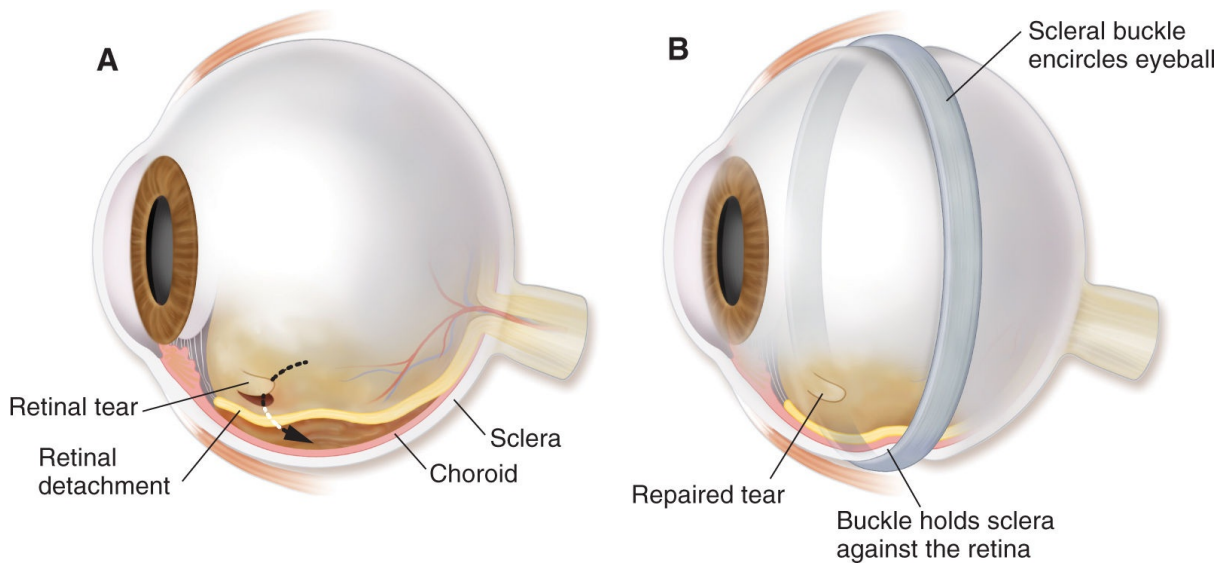


FIGURE 8-8 Scleral buckle. **A.** Detached retina. The arrow shows the movement of fluid. **B.** Repair of retinal tear by attached a band (buckle) around the sclera to keep the retina from pulling away.

Practice and Practitioners of the Eye

An **ophthalmologist** provides eye care ranging from examining eyes and prescribing corrective lenses to performing surgery. Such a wide range of activities and responsibilities requires ophthalmologists to have completed an undergraduate college degree, a doctorate in medicine, a 1-year internship, and 3 or more additional years of specialized clinical training in the field of **ophthalmology** (medical specialty concerned with the eye). **Optometry** is the profession concerned with examination of the eyes and related structures. An **optometrist** is a doctor of optometry (O.D.) who examines eyes and prescribes corrective lenses. In the United States, optometrists have completed a preprofessional undergraduate education plus 4 years of professional education at an accredited college of optometry. The technicians who fill eyeglass prescriptions and dispense eyewear are called **opticians**. This occupation requires a high school diploma and successful completion of an accredited optician program, which consists about 1 year of study.

WORD PARTS RELATED TO THE EAR

The three root words that mean ear are *aur/o*, *auricul/o*, and *ot/o*. These refer to the structure of the ear, but more commonly you will see words related to the function of the ear. *Acous/o*, *acus/o*, and *acoust/o* all mean hearing, from the Greek *akoustikos* (pertaining to hearing). The Latin word for “pertaining to hearing” is *auditorius*, which gives us the word part *audi/o* and makes up words like *auditory* and *audible*. **Table 8-2** list word parts related to the ear.

TABLE 8-2  WORD PARTS RELATED TO THE EAR

Word Part	Meaning
<i>acous/o</i> , <i>acus/o</i> , <i>acoust/o</i>	hearing
<i>audi/o</i>	sound
<i>aur/o</i>	ear
<i>auricul/o</i>	ear
<i>myring/o</i>	tympanic membrane (eardrum)
<i>ot/o</i>	ear
<i>staped/o</i>	stapes (smallest ear bone)
<i>tympan/o</i>	eardrum

Word Parts Exercise

After studying Table 8-2, write the meaning of each of the word parts.

WORD PART

MEANING

1. audi/o	1. _____
2. ot/o	2. _____
3. acous/o, acus/o, acoust/o	3. _____
4. myring/o	4. _____
5. tympan/o	5. _____
6. aur/o	6. _____
7. staped/o	7. _____
8. auricul/o	8. _____

Structure and Function of the Ear

The ear is an organ of hearing and equilibrium (balance). The ear is divided into three sections: the external ear, middle ear, and internal ear. The **external ear** consists of the auricle (outer ear), external acoustic meatus (passageway), and tympanic membrane (eardrum). It directs sound waves into the ear. Numerous ceruminous glands line the external acoustic meatus and secrete **cerumen**, better known as *earwax*. Cerumen protects the ear by preventing dust, insects, and some bacteria from entering the middle ear. The **middle ear** consists of the tympanic cavity with its auditory ossicles (bones), associated muscles, and the auditory tube. The **internal ear** contains the vestibule, which includes the bony labyrinth of semicircular canals and the cochlea (see **Figure 8-9**).

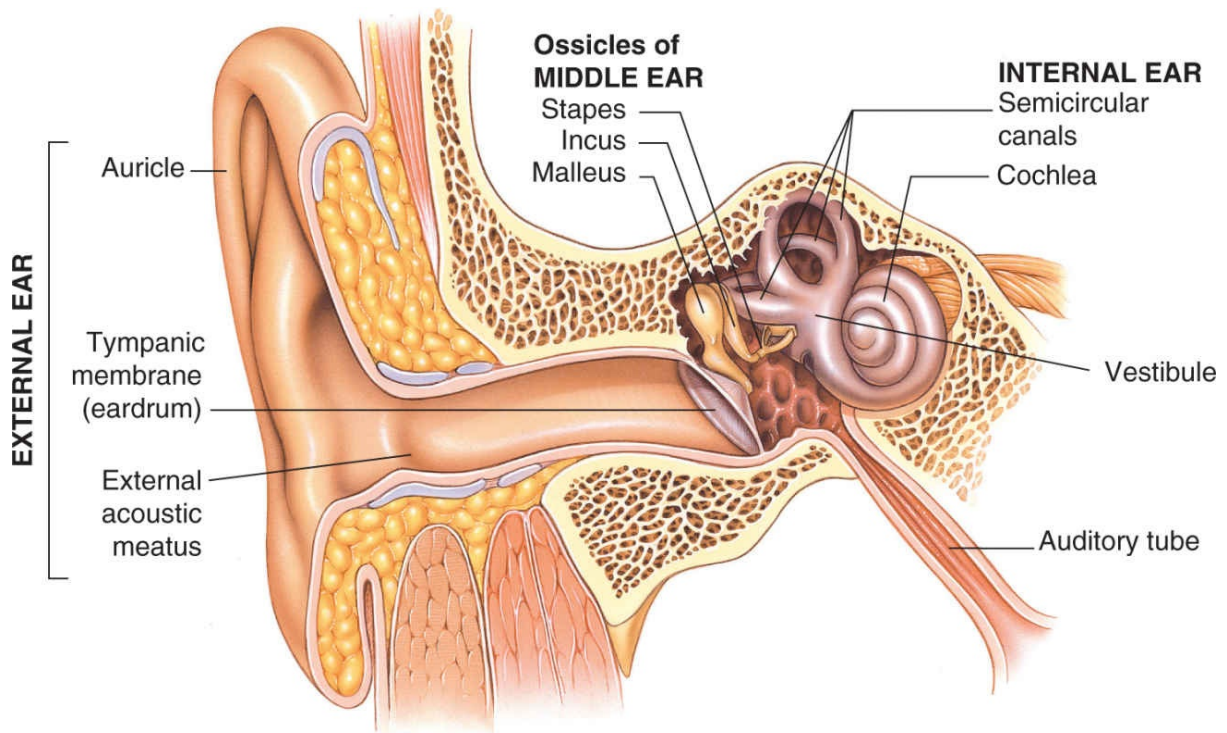


FIGURE 8-9 Structures of the external, middle, and internal ear.

Sound waves entering the ear vibrate the **tympanic membrane** (eardrum). Just beyond the tympanic membrane is the middle ear. A tiny *tympanic cavity* in the skull houses the **auditory ossicles**, three small bones called the **malleus**, **incus**, and **stapes** (see [Figure 8-10](#)). These are also sometimes referred to as the hammer, anvil, and stirrup because of their shapes. Sound waves affect these tiny bones and cause them to transmit sound vibrations to the internal ear. Also found inside the middle ear is the **auditory tube**, which reaches from the tympanic cavity to the nasopharynx to help equalize pressure in the ear with outside atmospheric pressure (see [Figure 8-9](#)).

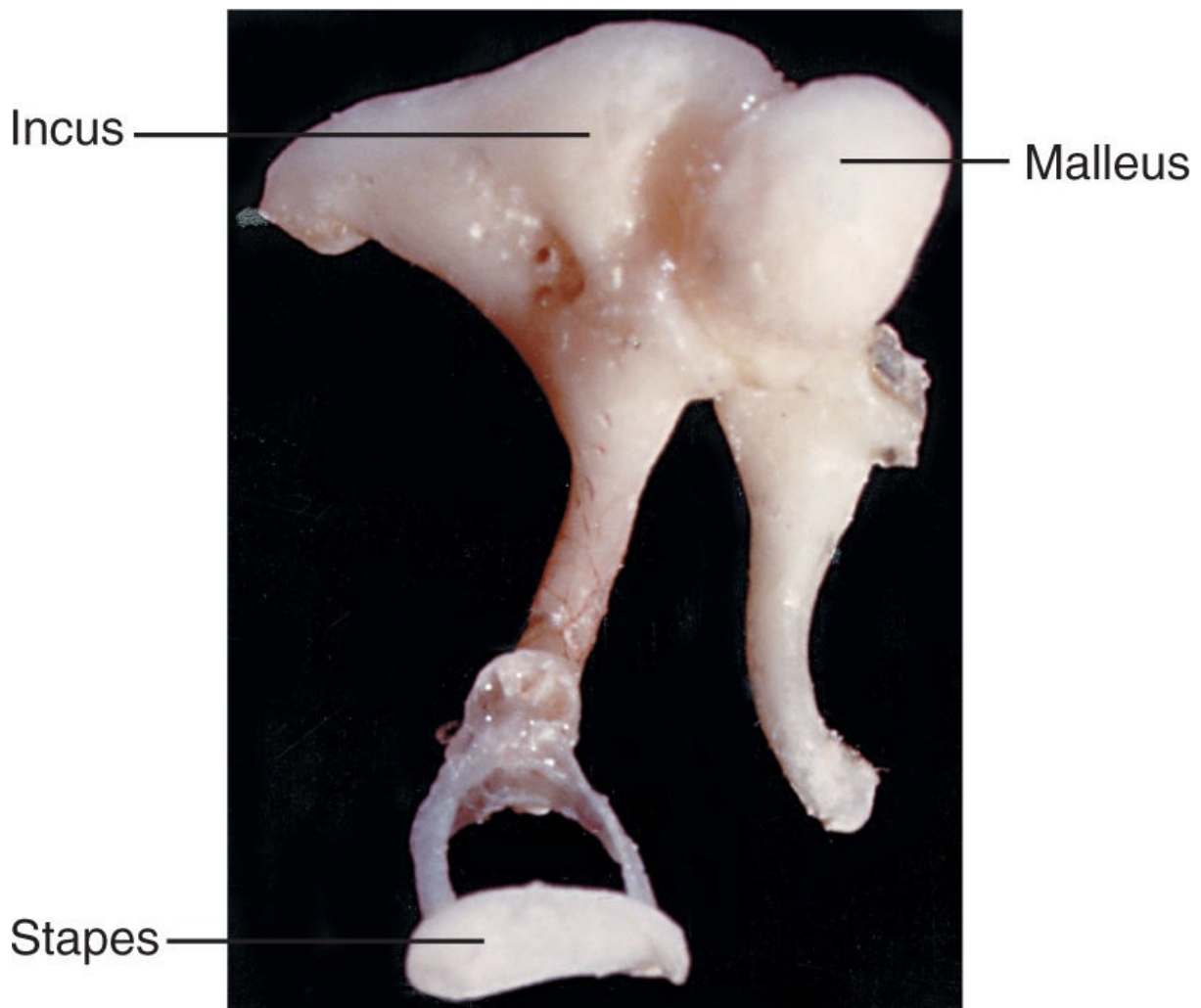


FIGURE 8-10 The auditory ossicles.

The internal ear has a **bony labyrinth** (maze) that contains the sensory receptors for hearing and balance. Major structures of the bony labyrinth include the **semicircular canals** (organ of balance) and **cochlea** (organ of hearing). Receptors in the cochlea change sound waves into nerve impulses that the brain can process.

Disorders Related to the Ear

Ear disorders can occur in any part of the ear. **Impacted cerumen**, an accumulation of earwax in the external acoustic meatus, may cause hearing loss. An earache, termed **otalgia** or **otodynia**, may be caused by trauma or infection. **Otitis** is any inflammation of the ear but can be divided into otitis externa (inflammation of the outer ear), otitis media (OM) (inflammation of the middle ear), or otitis interna (inflammation of the inner ear), with otitis media being the most common type.

Hearing loss may range from a partial loss of hearing that includes only a

certain range of frequencies to leaving a person completely **deaf** (unable to hear). **Conductive hearing loss** occurs when sound waves are not conducted through the external ear to the ossicles of the middle ear. **Sensorineural hearing loss** occurs when there is damage to the cochlea of the internal ear or to the nerve pathways to the brain. **Presbycusis** is a progressive hearing loss that occurs with aging. **Anacusis** is total deafness.



Quick Check #2

Fill in the blanks.

1. What are the medical terms for the ossicles, sometimes referred to as the hammer, anvil, and stirrup? _____
2. Identify the types of hearing loss. _____
3. Identify the structure in the labyrinth that changes sound waves into nerve impulses. _____

Other inflammatory ear conditions are **myringitis**, inflammation of the tympanic membrane; **mastoiditis**, inflammation of the mastoid air cells, which are intercommunicating cavities in the mastoid process of the temporal bone; and **labyrinthitis**, an inflammation of the labyrinth.

Two other disorders of the ear include **otosclerosis** (hardening of the stapes, resulting in sound being unable to travel from the outer ear to the internal ear) and **Ménière's syndrome, a chronic disease of the internal ear characterized by vertigo, tinnitus, and periodic hearing loss**. **Vertigo** is dizziness and/or a loss of balance. **Tinnitus** is a ringing, buzzing, or roaring sound in the ears.

Diagnostic Tests, Treatments, and Surgical Procedures of the Ear

Some disorders of the ear are treated by surgical intervention. Some of these procedures include the following:

- **Otoplasty:** surgical repair of the auricle of the ear
- **Mastoidectomy:** surgical removal of the mastoid process of the temporal bone
- **Myringectomy or tympanectomy:** surgical removal of all or part of the tympanic membrane

- **Myringotomy:** surgical incision of the eardrum to create an opening for placement of drainage tubes
- **Tympanoplasty:** surgical correction of a damaged tympanic membrane
- **Stapedectomy:** surgical removal of the stapes
- **Labyrinthotomy:** a surgical incision into the labyrinth

Practice and Practitioners of the Ear

Audiology is the specialty dealing with hearing and hearing disorders. An **audiologist** is the specialist who measures hearing and treats hearing impairments. An **otoscope** is an instrument with light and lenses used to visually examine the external ear and eardrum. **Otology** is the study of the ear and its related structures. An **otologist** is the specialist who diagnoses and treats diseases of the ear and its related structures. An **otorhinolaryngologist** is a physician who specializes in the diagnosis and treatment of diseases that involve not only the ear but also nose and throat.

ABBREVIATIONS

The following table lists common abbreviations relating to the eyes and ears. The Latin words *dexter* and *sinister* mean, respectively, “right” and “left.” These two Latin words give us many English words, such as ambidextrous (able to use either hand equally well), dextrous (good with one’s hands), and sinister (odd or spooky—probably because 83% of the population is right-handed). The first letter of each of these two words, namely, D and S, have also found their way into abbreviations for the eyes and ears. AD means right ear because *A* refers to audi/o “the ear,” and *D* refers to *dexter* “the right side.” Likewise, AS refers to the left ear. The root ocul/o refers to the eye, and thus OD is the right eye, and OS is the left eye. The abbreviation OU means both eyes and is derived from the Latin term *oculus uterque*, meaning “both eyes.”

Are abbreviations good or bad? The good thing about abbreviations is that they save time. The bad thing about them is that time saved seldom equals accuracy lost. Looking up the abbreviation AU will get you many answers, one of which is “both ears” and another of which is “aortic stenosis.” Heart surgery is not going to help someone who is suffering hearing loss in both ears. By the way, neither of those meanings has a connection with Australia, which is also among the many meanings given for the AU abbreviation.

ABBREVIATION	MEANING
AD	right ear
AS	left ear
AU	both ears
EOM	extraocular movement
IOP	intraocular pressure
LASIK	laser-assisted in situ keratomileusis
OD	right eye
O.D.	doctor of optometry
OM	otitis media
OS	left eye
OU	both eyes

Study Table SIGHT AND HEARING

TERM AND PRONUNCIATION	ANALYSIS	MEANING
Structure and Function: Eye		
accommodation (ah-KOM-moh-DAY-shun)	common English word	the process that allows the shape of the lens to change for near and far vision
aqueous humor (A-kwee-us HUE-mor)	from the Latin word <i>aqua</i> (water) + humor, from the Latin word <i>umor</i> (body fluid)	watery substance filling the space between the lens and the cornea
canthus (KAN-thus)	from the Greek word <i>kanthus</i> (corner of the eye)	angle where the upper and lower eyelids meet
choroid (KOH-royd)	derived from the Greek words <i>chorion</i> (skin, leather; a spot or plot of ground) and <i>eidos</i> (form, likeness, appearance, resemblance)	opaque middle layer of the eyeball
ciliary body (SIL-ee-her-ee)	from the Latin word <i>ciliaris</i> (pertaining to eyelashes) + body	set of muscles and suspensory ligaments that adjust the shape of lens

cones	from the Greek word <i>konos</i> (cone)	color receptors on the retina that have high visual acuity
conjunctiva (kon-JUNK-tih-vuh); plural: conjunctivae (kon-JUNK-tih-vay)	from the Latin words <i>con</i> (with) and <i>jungere</i> (to join)	the mucous membrane covering the anterior of the eyeball and inner eyelid
cornea (KOR-nee-uh)	from the Latin word <i>cornus</i> (horn)	transparent shield of tissue forming the outer wall of the eyeball
dacryocyst (DACK-ree-oh-sist)	from the Greek words <i>dakryon</i> (tear) and <i>kytis</i> (bag)	dilated upper portion of nasolacrimal duct; tear sac, lacrimal sac
extraocular muscles (EX-trah-AWK-yu-lahr MUS-ulz)	<i>extra-</i> (outside); <i>ocul/o</i> (eye); <i>-ar</i> (adjective suffix)	muscles within the orbit but outside the eyeball
eyebrows (EYE-browz)	common English word	arched line of hairs on the superior edge of the orbit
eyelashes	common English word	stiff hairs projecting from the margins of the eyelids
eyelids	common English word	movable folds that cover the front of the eyes when they close; also called <i>palpebrae</i>
fovea centralis (FOH-avee-ah sen-TRAH-lis)	<i>fovea</i> , a Latin word meaning “small pit” + <i>centralis</i> , a Latin word meaning “central”	a depression in the middle of the retina that is the area of sharpest vision
iris (EYE-rihs); plural: irides (IHR-ih-deez)	a Greek word meaning “lily,” “iris of the eye,” originally “messenger of the gods,” personified as the rainbow	the anterior part of the vascular tunic; it is the colored part of the eye
lacrimal apparatus (LAK-rih-mul app-ah-RAT-uhs)	from the Latin words <i>lacrima</i> (tear) + <i>ad</i> (toward) and <i>parare</i> (to make ready)	collectively: the lacrimal gland, lacrimal lake, lacrimal canaliculi (small canals), and lacrimal sac, along with the nasolacrimal duct
lacrimal ducts (LAK-rih-mul DUKTZ)	from the Latin words <i>lacrima</i> (tear)	channels that carry tears to the eyes
lacrimal glands (LAK-rih-mul GLANDZ)	from the Latin words <i>lacrima</i> (tear)	glands that secrete tears
lacrimal fluid (LAK-rih-mahl FLOO-id)	from the Latin words <i>lacrima</i> (tear) and <i>fluidus</i> (fluid)	a watery, physiologic saline; <i>tears</i>
lacrimal sac (LAK-rih-mul SAK)	from the Latin words <i>lacrima</i> (tear)	dilated upper part of the nasolacrimal duct
lateral angle of eye	common English words	angle formed by the union of the lateral parts of the upper eyelid and lower eyelid; also called <i>lateral canthus</i>

lens (lenz)	common English word	the refractive structure of the eye, lying between the iris and the vitreous humor
medial angle of eye	common English words	angle formed by the union of the upper eyelid and lower eyelid; also called <i>medial canthus</i>
nasolacrimal ducts	naso- (nose); from the Latin word <i>lacrima</i> (tear)	ducts that carry tears from the lacrimal glands to the nose
ocular (OK-yoo-lahr)	<i>ocul/o</i> (eye); <i>-ar</i> (adjective suffix)	adjective referring to the eye
optic disc (OP-tik DISK)	<i>opt/o</i> (light, eye, vision); <i>-ic</i> (adjective suffix)	oval area in eye without light receptors; <i>blind spot</i>
optic nerve (OP-tik nuhrv)	<i>opt/o</i> (light, eye, vision); <i>-ic</i> (adjective suffix) + nerve	the cranial nerve responsible for vision
orbit (OR-biht)	from the Latin word <i>orbita</i> (wheel track, course, orbit)	bony depression in the skull that houses the eyeball
palpebra (pal-PEE-brah)	a Latin word meaning “eyelid”	eyelid
photoreceptors (FOH-toh-ree-SEPP-tohrs)	from the Greek word <i>phos</i> (light) and the Latin word <i>recipere</i> (to receive)	retinal cones and rods
pupil (PYOO-pihl)	from the Latin word <i>pupilla</i> (little girl-doll) so called from the tiny image one sees of oneself reflected in the eye of another	the dark part in the center of the iris through which light enters the eye
retina (RETT-ih-nah)	from Medieval Latin <i>retina</i> probably from the Latin word <i>rete</i> (net)	light-sensitive membrane forming the innermost layer of the eyeball
rods	a common English word	black and white receptors on the retina that respond to dim light
sclera (SKLER-ah); plural: sclerae (SKLER-ay)	from the Greek word <i>skleros</i> (hard)	the outer surface of the eye; part of the fibrous tunic; white part of eye
uvea (YOO-vee-ah)	from the Latin word <i>uva</i> (grape)	vascular layer of the eye
vitreous body (VIH-tree-uhs BOD-ee)	from the Latin word <i>vitreus</i> (of glass, glassy) + body	a transparent jellylike substance filling the interior of the eyeball
vitreous humor (VIH-tree-uhs HYU-mohr)	from the Latin word <i>umor</i> (body fluid)	the fluid component of the vitreous body
Disorders: Eye		
amblyopia (am-blee-OH-pee-ah)	from the Greek word <i>ambly</i> (dim); <i>-opia</i> (eye, vision)	condition that occurs when visual acuity is not the same in both eyes; also called <i>lazy eye</i>

astigmatism (ah-STIG-mah-tizm)	<i>a-</i> (without) + from the Greek word <i>stigmatos</i> gen. of <i>stigma</i> (a mark, spot, puncture)	fuzzy vision caused by the irregular shape of one or both eyeballs
blepharitis (bleff-ah-RY-tiss)	<i>blephar/o</i> (eyelid); <i>-itis</i> (inflammation)	inflammation of the eyelid
blepharoconjunctivitis (BLEFF-ah-roh-kon-junk-tih-VY-tiss)	<i>blephar/o</i> (eyelid); <i>conjunctiv/o</i> (mucous membrane covering the anterior surface of the eyeball and inner eyelid); <i>-itis</i> (inflammation)	inflammation of the palpebral conjunctiva, the inner lining of the eyelids
blepharoplegia (BLEFF-ah-roh-plee-ee-uh)	<i>blephar/o</i> (eyelid); <i>-plegia</i> (paralysis)	paralysis of an eyelid
blepharoptosis (BLEFF-ahr-opp-TOH-sis)	<i>blephar/o</i> (eyelid); <i>-ptosis</i> (falling, downward placement, prolapse)	drooping eyelid
blepharospasm (BLEFF-ahr-oh-SPAZ-um)	<i>blephar/o</i> (eyelid); from the Greek <i>spasmos</i> (spasm, convulsion)	involuntary contraction of the eyelid
cataract (KAT-ah-rakt)	from the Latin word <i>cataracta</i> (waterfall)	complete or partial opacity of the ocular lens
conjunctivitis (kon-junk-tih-VY-tiss)	<i>conjunctiv/o</i> (mucous membrane covering the anterior surface of the eyeball); <i>-itis</i> (inflammation)	inflammation of the conjunctiva; pinkeye
dacryocoele (DAKK-ree-oh-seel)	<i>dacry/o</i> (tears); <i>-cele</i> (hernia)	enlargement of the lacrimal sac with fluid
dacryocystitis (DAKK-ree-oh-SIST-it is)	<i>dacryocyst/o</i> (tear sac); <i>-itis</i> (inflammation)	inflammation of the tear sac
dacryolith (DAKK-ree-oh-lith)	<i>dacry/o</i> (tears); <i>-lith</i> (stone)	a “stone” in the lacrimal apparatus
dacryorrhea (DAK-ree-uh-REE-yuh)	<i>dacry/o</i> (tears); <i>-rrhea</i> (discharge)	excessive discharge of tears
diplopia (dih-PLOH-pee-uh)	<i>diplo-</i> (from the Greek <i>diploos</i> meaning “double”); <i>-opia</i> (eye, vision)	condition in which a single object is perceived as two objects; double vision
ectropion	<i>ex-</i> (out); <i>trope</i> (Greek “that which turns”)	eversion (turning out) of the eyelid
entropion	<i>en-</i> (in); <i>trope</i> (Greek “that which turns”)	inversion (turning in) of the eyelid
glaucoma (glaw-KOH-mah)	from the Greek word <i>glaucoma</i> (cataract, opacity of the lens) (note: cataracts and glaucoma not distinguished until around 1705)	disease of the eye characterized by increased intraocular pressure and atrophy of the optic nerve

hordeolum (hor-DEE-oh-lum)	from the Latin word <i>hordeum</i> (barley)	an infection of a gland in the eye; also called <i>sty</i>
hyperopia (hy-pur-OH-pee-ya) or presbyopia (pres-be-OH-pee-ah)	<i>hyper-</i> (above normal); <i>-opia</i> (eye, vision)	Farsightedness
iridomalacia (IHR-ih-doh-muh-LAY-shee-uh)	<i>irid/o</i> (iris); <i>-malacia</i> (softening)	softening of the iris
iritis (eye-RY-tiss)	<i>ir/o</i> (iris); <i>-itis</i> (inflammation)	inflammation of the iris
keratitis (ker-ah-TYE-tis)	<i>kerat/o</i> (hard, cornea); <i>-itis</i> (inflammation)	inflammation of the cornea
lacrimal (LAK-rih-muhl)	<i>lacrim/o</i> (tear, lacrimal apparatus); <i>-al</i> (adjective suffix)	referring to or related to tears or the tear ducts and glands
lacrimation (LAK-rih-MAY-shun)	<i>lacrim/o</i> (tear, lacrimal apparatus); <i>-ation</i> (noun suffix)	secretion of tears, especially in excess
myopia (my-OHP-ee-ah)	from the Greek word <i>myops</i> (nearsighted)	Nearsightedness
oculodynia (AWK-yu-loh-DIN-ee-ah)	<i>ocul/o</i> (eye); <i>-dynia</i> (pain)	pain in the eyeball; also called <i>ophthalmalgia</i>
oculopathy (AWK-yu-loh-path-ee)	<i>ocul/o</i> (eye); <i>-pathy</i> (disease)	any disease of the eyes; also called <i>ophthalmopathy</i>
ophthalmolith (off-THAL-moh-lith)	<i>ophthalm/o</i> (eye); <i>-lith</i> (stone)	a stone in the lacrimal apparatus; also called <i>dacryolith</i>
ophthalmomalacia (off-THAL-moh-muh-LAY-shee-uh)	<i>ophthalm/o</i> (eye); <i>-malacia</i> (softening)	softening of the eyeball
ophthalmopathy (off-THAL-moh-path-ee)	<i>ophthalm/o</i> (eye); <i>-pathy</i> (disease)	any disease of the eyes; also called <i>oculopathy</i>
presbyopia (prez-bee-OH-pee-ah)	from the Greek word <i>presbys</i> (old man); <i>-opia</i> (eye, vision)	farsightedness resulting from loss of elasticity of the lens due to aging
retinitis (rett-ih-NY-tiss)	<i>retin/o</i> (retina); <i>-itis</i> (inflammation)	inflammation of the retina
retinopathy (rett-ihn-AWP-uh-thee)	<i>retin/o</i> (retina); <i>-pathy</i> (disease)	disease of the retina
scleroiditis (skler-oh-EYE-RY-tiss)	<i>sclera/o</i> (sclera); <i>ir/o</i> (iris); <i>-itis</i> (inflammation)	inflammation of the sclera and iris
strabismus (stra-BIZ-	from the Greek word <i>strabismos</i> , from	lack of parallelism in the visual axes; also

muhs)	<i>strabos</i> (squinting, squint-eyed)	called <i>crossed eyes</i>
xerophthalmia (zee-roh-OFF-thal-mee-ah)	from the Greek word <i>xeros</i> (dry); <i>ophthalm/o</i> (eye); <i>-ia</i> (condition)	dry eyes
Diagnostic Tests, Treatments, and Surgical Procedures: Eye		
blepharectomy (bleff-ah-REK-tuh-mee)	<i>blephar/o</i> (eyelid); <i>-ectomy</i> (excision)	surgical removal of part or all of an eyelid
blepharoplasty (BLEFF-ah-roh-plass-tee)	<i>blephar/o</i> (eyelid); <i>-plasty</i> (surgical repair)	surgery to correct a defective eyelid
blepharotomy (BLEFF-uh-rot-uh-mee)	<i>blephar/o</i> (eyelid); <i>-tomy</i> (incision into)	surgical incision of an eyelid
conjunctivoplasty (kon-JUNK-tih-voh-plass-tee)	<i>conjunctiv/o</i> (conjunctiva); <i>-plasty</i> (surgical repair)	surgery on the conjunctiva
dacryocystectomy (dakk-ree-oh-sist-EKK-toh-mee)	<i>dacryocyst/o</i> (tear sac); <i>-ectomy</i> (excision)	surgical removal of the lacrimal sac
dacryocystotomy (dakk-ree-oh-sist-AW-toh-mee)	<i>dacryocyst/o</i> (tear sac); <i>-tomy</i> (incision into)	incision into the lacrimal sac
lacrimotomy (lakk-rih-MAW-toh-mee) (uncommon)	<i>lacrim/o</i> (tear, lacrimal apparatus); <i>-tomy</i> (incision into)	incision into the lacrimal sac or lacrimal duct
ophthalmoscope (OFF-THAL-moh-skope)	<i>ophthalm/o</i> (eye); <i>-scope</i> (instrument for viewing)	device for examining the interior of the eyeball by looking through the pupil
ophthalmoscopy (OFF-thal-MAW-skuh-pee)	<i>ophthalm/o</i> (eye); <i>-scopy</i> (use of instrument for viewing)	examination of the eye with an ophthalmoscope
phacolysis (fah-KAWL-ih-sis)	<i>phac/o</i> (lens); <i>-lysis</i> (destruction)	operative removal of the lens in pieces
refraction (re-FRAK-shun)	from late Latin <i>refractio</i> , from <i>refringere</i> (to break up)	deflection of a ray of light into the eye for accommodation or correction of vision as it passes from one medium to another of different densities
retinectomy (ret-ihn-EK-tuh-mee)	<i>retin/o</i> (retina); <i>-ectomy</i> (excision)	surgical removal of part of the retina
retinopexy (RETT-ihn-oh-pexx-ee)	<i>retin/o</i> (retina); <i>-pexy</i> (surgical fixation)	surgical fixation of a detached retina
retinotomy (rett-ihn-		

AW-tuh-mee)	<i>retin/o</i> (retina); <i>-tomy</i> (incision into)	incision through the retina
scleral buckle (SKLEER-ul BUCK-ul)	<i>scler/o</i> (hard)	an operation to place a silicone band on the scleral periphery to tighten the retina
Practice and Practitioners: Eye		
ophthalmologist (off-thul-MAWL-uh-jist)	<i>ophthalm/o</i> (eye); <i>-logist</i> (one who studies a specific field)	physician whose specialty is the diagnosis and treatment of eye disorders
ophthalmology (off-thul-MAWL-uh-jee)	<i>ophthalm/o</i> (eye); <i>-logy</i> (study of)	medical specialty dealing with the eye
optician (opp-TISH-ihn)	<i>opt/o</i> (light, eye, vision)	person who fills prescriptions for ophthalmic lenses, dispenses glasses, and makes and fits contact lenses
optometrist (opp-TOM-uh-trist)	<i>opt/o</i> (light, eye, vision); <i>-metrist</i> (one who measures)	one trained in examining the eyes and prescribing corrective lenses
optometry (opp-TOM-uh-tree)	<i>opt/o</i> (light, eye, vision); <i>-metry</i> (measurement)	science of examining eyes for impaired vision and other disorders
Structure and Function: Ear		
auditory tube (AW-dih-uh-tor-ee TOOB)	from the Latin word <i>auditorius</i> (pertaining to hearing)	Canal that connects the middle ear to the pharynx (throat); also called <i>pharyngotympanic tube</i> and <i>eustachian tube</i>
auricle (AW-rik-uhl)	<i>auri-</i> (ear)	external portion of the ear that directs sound waves; also called <i>pinna</i>
cerumen (she-ROO-men)	from the Latin word <i>cera</i> (wax)	waxy substance produced by glands of the external acoustic meatus
external acoustic meatus (EKS-tur-nul uh-KOOS-tick mee-AY-tus)	from the Latin, <i>externus</i> (outside) + from the Greek, <i>akoustikos</i> (pertaining to sound) + from the Latin, <i>meatus</i> (passage)	Passage leading inward from the auricle to the tympanic membrane (eardrum); also called <i>external auditory canal</i>
eustachian tube (yu-STAY-shun)	named after Bartolomeo Eustachi (died 1574), who discovered the passages from the ears to the throat	canal that connects the middle ear to the pharynx (throat); also called the <i>auditory tube</i> and <i>pharyngotympanic tube</i>
incus (INK-uhs)	a Latin word meaning “anvil”	one of the auditory ossicles (the anvil)
labyrinth (LAB-uh-rinth)	from the Greek word <i>labyrinthos</i> (maze, large building with intricate passages)	canals of the inner ear
malleus (MAL-ee-uhs)	a Latin word meaning “hammer”	one of the auditory ossicles (the hammer)
		three small bones in the middle ear: the malleus

ossicles (OSS-ih-kulz)	from the Latin word <i>ossiculum</i> (a small bone)	(hammer), the incus (anvil), and the stapes (stirrup)
pinna (PIN-ah)	a Latin word meaning “feather,” “wing,” “fin,” “lobe”	external portion of the ear that directs sound waves; also called <i>auricle</i>
stapes (STAY-pee-z)	a Modern Latin word meaning “stirrup”	one of the auditory ossicles (the stirrup)
tympanic cavity (tim-PAN-ik)	<i>tympan/o</i> (eardrum); <i>-ic</i> (adjective suffix) + <i>cavity</i>	air chamber between the external acoustic meatus and the internal ear that contains the ossicles
tympanic membrane (tim-PAN-ik MEM-brayn)	<i>tympan/o</i> (eardrum); <i>-ic</i> (adjective suffix)	eardrum
Disorders: Ear		
anacusis (ann-ah-KU-sis)	<i>a-</i> (without); <i>cusis</i> , from the Greek word <i>akousis</i> (hearing)	total deafness
conductive hearing loss (kon-DUK-tihv)	common English words	hearing loss caused by interference with sound transmission in the external acoustic meatus, middle ear, or ossicles
deaf (def)	common English word	unable to hear
labyrinthitis (lab-ih-rin-THIGH-tis)	<i>labyrinth/o</i> (internal ear); <i>-itis</i> (inflammation)	inflammation of the labyrinth
mastoiditis (mas-toy-DYE-tis)	mastoid (mastoid process); <i>-itis</i> (inflammation)	inflammation of any part of the mastoid air cells of the mastoid process of the temporal bone
Ménière’s (men-YEHRs) syndrome	named for Prosper Ménière, the French physician who first described the illness in 1861	chronic disease of the internal ear characterized by vertigo, tinnitus, and periodic hearing loss
myringitis (mir-in-JIGH-tis)	<i>myring/o</i> (tympanic membrane); <i>-itis</i> (inflammation)	inflammation of the tympanic membrane
otalgia (oh-TAHL-jee-ah)	<i>ot/o</i> (ear); <i>-algia</i> (pain)	pain in the ear
otitis (oh-TY-tih-s)	<i>ot/o</i> (ear); <i>-itis</i> (inflammation)	inflammation of the ear (otitis externa = the outer ear; otitis media = the middle ear; otitis interna = the inner ear)
otodynia (oh-toh-DIN-ee-uh)	<i>ot/o</i> (ear); <i>-dynia</i> (pain)	earache
otopathy (oh-TOP-ahth-ee)	<i>ot/o</i> (ear); <i>-pathy</i> (disease)	any disease of the ear

otoplasty (oh-toh-PLAS-tee)	<i>ot/o</i> (ear); <i>-plasty</i> (surgical repair)	surgical repair of the auricle of the ear
otorrhea (oh-toh-REE-uh)	<i>ot/o</i> (ear); <i>-rrhea</i> (discharge)	fluid discharge from the ear
otosclerosis (OH-toh-skler-OH-sihs)	<i>ot/o</i> (ear); <i>scler/o</i> (hardening); <i>-osis</i> (abnormal condition)	formation of spongy bone in the internal ear producing hearing loss
presbycusis (PREZ-be-KOO-sihs)	<i>presby-</i> (old); <i>cusis</i> , from the Greek word <i>akousis</i> (hearing)	hearing loss that occurs with aging
sensorineural hearing loss (SENTZ-oh-rih-NOO-rah)	<i>sensor-</i> (sensory); <i>neur/o</i> (nervous system); <i>-al</i> (adjective suffix)	hearing loss caused by a neural condition
tinnitus (TIN-nih-tuhs)	from the Latin word <i>tinnire</i> (to ring)	sensation of noises (such as ringing) in the ears
vertigo (VUR-tih-go)	a Latin word meaning “dizziness”	sensation of spinning or whirling; dizziness; can be caused by infection or other disorder in the inner ear
Diagnostic Tests, Treatments, and Surgical Procedures: Ear		
audiogram (AW-dee-oh-gram)	<i>audi/o</i> (sound, hearing); <i>-gram</i> (record or picture)	a graphic record produced by the results of hearing tests with an audiometer
audiometer (aw-dee-AWM-ih-tehr)	<i>audi/o</i> (sound, hearing); <i>-meter</i> (measurement)	electrical device for measuring hearing
audiometry (aw-dee-AWM-ih-tree)	<i>audi/o</i> (sound, hearing); <i>-metry</i> (process of measuring)	measuring hearing with an audiometer
cochlear implant (KOK-lee-ahr IM-plant)	from the Latin word <i>cochlea</i> (snail shell); <i>-ar</i> (adjective suffix) + <i>implant</i>	surgically implanted hearing aid in the cochlea
labyrinthotomy (lab-ih-rin-THAH-toh-mee)	<i>labyrinth/o</i> (internal ear); <i>-tomy</i> (incision into)	a surgical incision into the labyrinth
mastoidectomy (mas-toy-DECK-toh-mee)	mastoid (mastoid process) + <i>-ectomy</i> (excision)	surgical removal of the mastoid process
myringectomy (mir-ini-JECK-toh-mee)	<i>myring/o</i> (tympanic membrane); <i>-ectomy</i> (excision)	surgical removal of all or part of the tympanic membrane; also called <i>tympanectomy</i>
myringoplasty (mih-RIN-go-PLASS-tee)	<i>myring/o</i> (tympanic membrane); <i>-plasty</i> (surgical repair)	surgical repair of the tympanic membrane (eardrum)
myringotomy (mih-rin-GOT-uh-mee)	<i>myring/o</i> (tympanic membrane); <i>-tomy</i> (incision into)	incision or surgical puncture of the eardrum; also called <i>tympanotomy</i>
otoplasty (OH-toh-plass-tee)	<i>ot/o</i> (ear); <i>-plasty</i> (surgical repair)	surgical repair of the auricle of the ear

otoscope (OH-toh-skope)	<i>ot/o</i> (ear); <i>-scope</i> (instrument for viewing)	device for looking into the ear
otoscopy (oh-TOSS-kuh-pee)	<i>ot/o</i> (ear); <i>-scopy</i> (use of an instrument for viewing)	looking into the ear with an otoscope
Rinne test (rihn-eh)	named after Heinrich A. Rinne, German otologist (1819–1868)	hearing test using a tuning fork; checks for differences in bone conduction and air conduction
stapedectomy (stay-peh-DECK-toh-mee)	<i>staped/o</i> (stapes); <i>-ectomy</i> (excision)	surgical removal of the stapes
tuning fork (TOO-ning)	common English words	an instrument that vibrates when struck and is used to test hearing and vibratory sensations
tympanectomy (TIM-puh-NEK-tuh-mee)	<i>tympan/o</i> (eardrum); <i>-tomy</i> (incision into)	surgical removal of the eardrum; also called <i>myringectomy</i>
tympanocentesis (TIM-puh-noh-senn-TEE-sihs)	<i>tympan/o</i> (eardrum); <i>-centesis</i> (surgical puncture for aspiration)	puncture of the tympanic membrane with a needle to aspirate middle ear fluid
tympanoplasty (TIM-puh-no-plass-tee)	<i>tympan/o</i> (eardrum); <i>-plasty</i> (surgical repair)	surgery performed on the eardrum
tympanotomy (TIM-puh-NOT-oh-mee);	<i>tympan/o</i> (eardrum); <i>-tomy</i> (incision)	incision or surgical puncture of the eardrum; also called <i>myringotomy</i>
Weber test (VAY-behr)	named after Wilhelm Edward Weber, German physicist (1804–1891)	hearing test using a tuning fork; distinguishes between conductive and sensorineural hearing loss
Practice and Practitioners: Ear		
audiologist (awd-ee-AWL-oh-jist)	<i>audi/o</i> (sound, hearing); <i>-logist</i> (one who studies a certain field)	specialist who measures hearing efficiency and treats hearing impairment
audiology (awd-ee-AWL-oh-jee)	<i>audi/o</i> (sound, hearing); <i>-logy</i> (the study of a certain field)	specialty dealing with hearing and hearing disorders
otologist (oh-TOL-oh-jist)	<i>ot/o</i> (ear); <i>-logist</i> (one who studies a certain field)	specialist in otology, the branch of medical science concerned with the study, diagnosis, and treatment of diseases of the ear and its related structures
otology (oh-TOL-oh-jee)	<i>ot/o</i> (ear); <i>-logy</i> (the study of a certain field)	branch of medical science concerned with the study, diagnosis, and treatment of diseases of the ear and its related structures
otorhinolaryngologist (oh-TOH-REYE-no-	<i>ot/o</i> (ear); <i>rhin/o</i> (nose); <i>g/o</i> (throat); <i>-logist</i> (one who studies a certain field)	physician who specializes in the diagnosis and treatment of ear, nose, and throat disorders

END-OF-CHAPTER EXERCISES

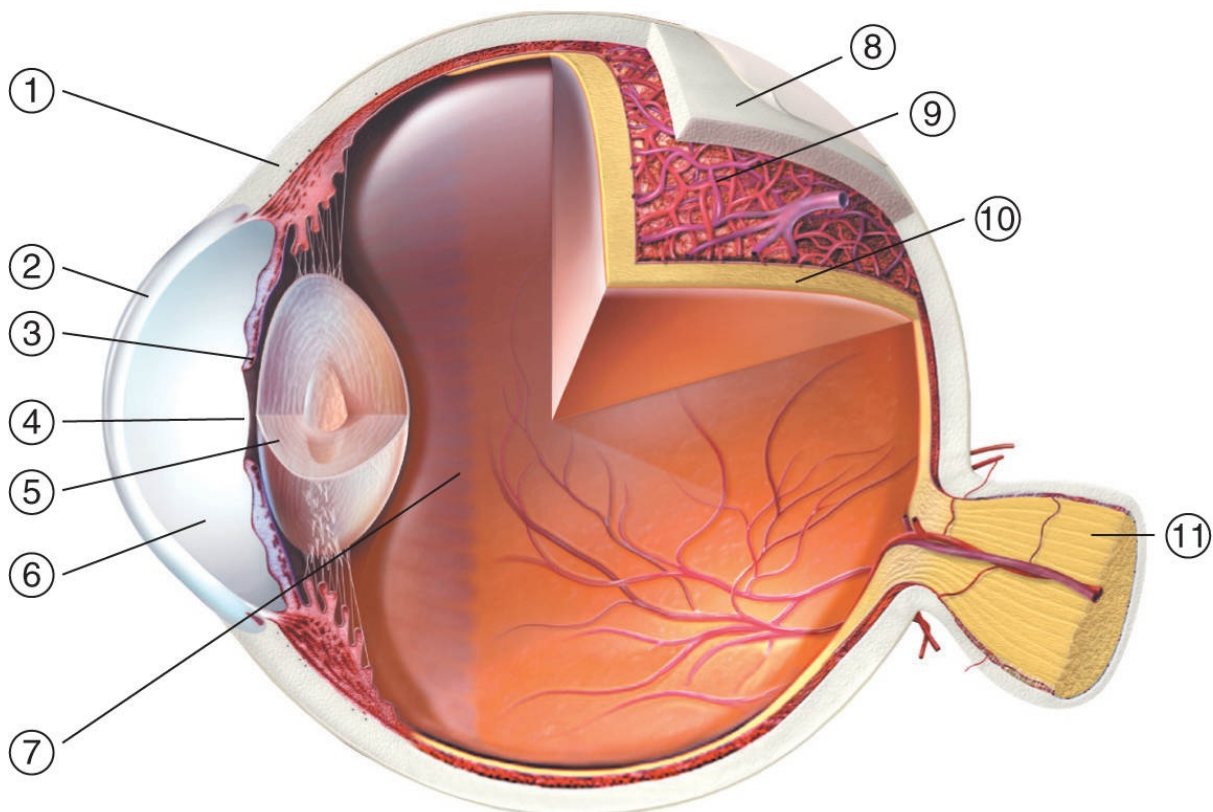
EXERCISE 8-1



LABELING: THE EYE

Using the following list, choose the correct terms to label the diagram correctly.

- anterior chamber (containing aqueous humor) choroid conjunctiva
- cornea fovea centralis iris
- lens optic nerve posterior chamber (containing vitreous humor)
- pupil retina sclera



1. _____

2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____

EXERCISE 8-2



WORD PARTS

Break each of the following terms into its word parts: prefix, root, or suffix. Give the meaning of each word part and then define the term.

1. *extraocular*

prefix: _____

root: _____

suffix: _____

definition: _____

2. *xerophthalmia*

root: _____

root: _____

suffix: _____

definition: _____

3. *scleroiditis*

root: _____

root: _____

suffix: _____

definition: _____

4. *blepharconjunctivitis*

root: _____

root: _____

suffix: _____

definition: _____

5. *audiometry*

root: _____

suffix: _____

definition: _____

6. *otosclerosis*

root: _____

root: _____

suffix: _____

definition: _____

7. *mastoidectomy*

root: _____

suffix: _____

definition: _____

8. *otorhinolaryngologist*

root: _____

root: _____

root: _____

suffix: _____

definition: _____

EXERCISE 8-3



WORD BUILDING

Use the word parts listed to build the terms defined.

-lith -centesis irid/o -rrhea -malacia

tympano myringo -pexy -tomy -lysis

phac/o ot/o -dynia retin/o -itis

cyst/o dacryo

1. _____ a “stone” in the lacrimal apparatus
2. _____ operative removal of the lens in pieces
3. _____ surgical removal of the lacrimal sac
4. _____ surgical fixation of a detached retina
5. _____ softening of the iris
6. _____ puncture of the tympanic membrane with a needle to aspirate middle ear fluid
7. _____ earache
8. _____ incision or surgical puncture of the eardrum
9. _____ fluid discharge from the ear
10. _____ inflammation of the ear

EXERCISE 8-4

MATCHING: THE EYE

Match the term with its definition.

- | | |
|----------------------------|---|
| 1. _____
ophthalmology | a. transparent shield of tissue covering the iris |
| 2. _____
vitreous humor | b. adjective associated with tears |
| 3. _____
pupil | c. sensitive inner nerve layer of the eye that contains the rods and cones |
| 4. _____
iris | d. the “colored” part of the eye |
| 5. _____
sclera | e. the dark part in the very center of the eye |
| 6. _____
cornea | f. mucous membrane that covers the anterior surface of the eyeball and lines the underside of |

each eyelid

7. _____
conjunctiva
8. _____
ophthalmoscope
9. _____
retina
10. _____
lacrimal
- g. gelatinous liquid between the lens and retina
- h. part of the outermost layer of the eye, which is white in color
- i. a device for examining the interior of the eyeball by looking through the pupil
- j. name of the medical specialty dealing with the eye

EXERCISE 8-5



MATCHING: THE EAR

Match the term with its definition.

1. _____
audiologist
2. _____
cerumen
3. _____
otoscope
4. _____
tympanoplasty
5. _____
labyrinth
6. _____
auditory ossicles
7. _____ otitis
media
8. _____
tympanic membrane
9. _____
auditory tube
- a. the eardrum
- b. maze-like portion of the inner ear
- c. specialist treating abnormal hearing
- d. device for looking into the ear
- e. inflammation of the middle ear
- f. part of the bony labyrinth (internal ear)
- g. wax-like secretion in the external auditory canal
- h. passageway that connects the middle ear to the nasopharynx
- i. surgical repair on the tympanic membrane

10. _____ cochlea j. three small bones in the middle ear: the malleus, incus, and stapes

EXERCISE 8-6



MULTIPLE CHOICE

Choose the correct answer for the following multiple choice questions.

1. The medical specialist who treats ear disorders is called a(n) _____.
 - a. ophthalmologist
 - b. otologist
 - c. audiologist
 - d. optometrist
2. A term for eardrum is _____.
 - a. tympanic membrane
 - b. malleus
 - c. oval window
 - d. none of the above
3. The function(s) of the ear include _____.
 - a. equilibrium
 - b. hearing
 - c. sound vibrations
 - d. both A and B
4. The ability of the eye to adjust to variations in distance is _____.
 - a. eversion
 - b. strabismus
 - c. accommodation
 - d. presbycusis
5. An inflammation of the tear sac is called _____.
 - a. dacryocystitis

- b. scleritis
 - c. blepharitis
 - d. keratitis
6. The layer of the eye that contains the rods and cones is the _____.
- a. sclera
 - b. choroid
 - c. uvea
 - d. retina
7. Hearing loss that is due to nerve damage is _____.
- a. conductive hearing loss
 - b. sensorineural hearing loss
 - c. tympanitis
 - d. tinnitus
8. The cornea is the transparent part of the eye and is an extension of the _____.
- a. choroid
 - b. iris
 - c. sclera
 - d. both a and c
9. The ciliary body is _____.
- a. a group of muscles that suspends the lens
 - b. the curved portion of the eye that refracts light
 - c. the area between the lens and retina
 - d. the protective layer of the eye
10. Farsightedness is called _____.
- a. myopia
 - b. hyperopia
 - c. presbyopia

d. both b and c

EXERCISE 8-7



FILL IN THE BLANK

Fill in the blank with the correct answer.

1. A cloudiness or opacity of the lens is called a _____.
2. Difficulty hearing due to the aging process is termed _____.
3. The medical term for double vision is _____.
4. Another name for dizziness due to an internal ear disturbance is _____.
5. _____ is a ringing or buzzing of the ears.
6. The external ear component is called the pinna or _____.
7. Another name for a sty is _____.
8. _____ means pain in the ear or an earache.
9. An irregularity of the curve of the cornea that distorts the light entering the eye is called _____.
10. An inflammation of the cornea is called _____.
11. The _____ contains the sensory receptors for hearing.
12. The internal ear contains the _____ canals and cochlea.
13. The passageway that goes from the middle ear to the nasopharynx is the _____.
14. _____ is the medical term for a drooping eyelid.
15. A _____ hearing loss is one in which the external or middle ear cannot conduct the sound vibrations to the internal ear.

EXERCISE 8-8



ABBREVIATIONS

Write out the term for the following abbreviations.

1. _____ AD
2. _____ OM

3. _____ OD
4. _____ AS
5. _____ OU
6. _____ OS
7. _____ LASIK

Write the abbreviation for the following terms.

8. _____ both ears
9. _____ extraocular movement
10. _____ right ear
11. _____ intraocular pressure
12. _____ left eye
13. _____ doctor of optometry

EXERCISE 8-9



SPELLING

Select the correct spelling of the medical term.

1. _____ is the medical condition known as double vision.
 - a. Diplopia
 - b. Diplopla
 - c. Dioplia
 - d. Diplopea
2. The mucous membrane covering the anterior of the eyeball and the inner eyelid is the _____.
 - a. conjuctivah
 - b. conjunktiva
 - c. conjunctiva
 - d. conjuncteva
3. The adjective _____ is used to describe tears.
 - a. lacrimul

- b. lacrimal
 - c. lacrimle
 - d. lacramal
4. An eye disease characterized by an increase in intraocular pressure is _____.
- a. glacoma
 - b. glaucoma
 - c. gluacoma
 - d. glocoma
5. An _____ is a health care professional who examines eyes and prescribes corrective lenses.
- a. optomatrist
 - b. optomotrist
 - c. optomitrist
 - d. optometrist
6. The purpose of the _____ is to funnel sound waves into the auditory canal.
- a. aricle
 - b. oricle
 - c. auricel
 - d. auricle
7. A synonym for otodynia is _____.
- a. otalgia
 - b. otoalgia
 - c. otalga
 - d. otoalga
8. The three auditory ossicles are the incus, the stapes, and the _____.
- a. maleus
 - b. malleus

- c. mallius
 - d. malleous
9. A _____ is a puncture of the tympanic membrane with a needle to aspirate middle ear fluid.
- a. timpanacentesis
 - b. timpanocentesis
 - c. tympanocentesis
 - d. tympanocentisis
10. An _____ is a specialist who measures hearing efficiency and treats hearing impairments.
- a. audiologist
 - b. adiologist
 - c. audilogist
 - d. auddiologist

EXERCISE 8-10



CASE STUDY

Read the following report and define the italicized medical terms.

PREOPERATIVE DIAGNOSIS: Chronic (1) *otitis media*

OPERATIVE PROCEDURE: Bilateral (2) *myringotomy* and placement of tubes

INDICATIONS: Recurrent ear infections with persistent fluid buildup despite prolonged medical treatment

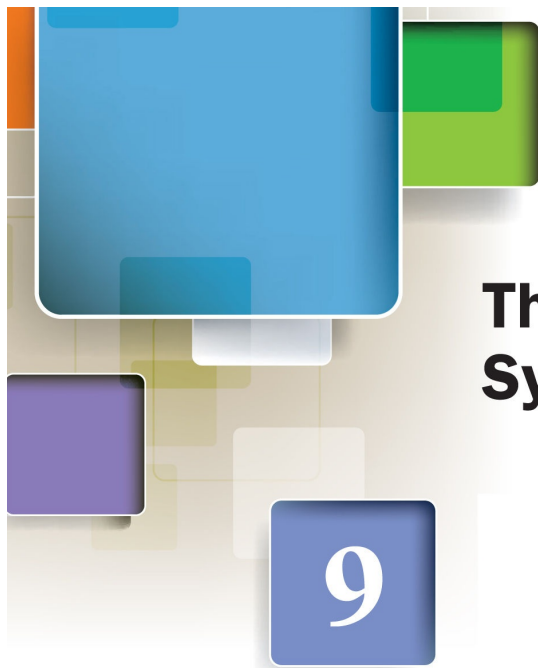
PROCEDURE: The patient was brought to the operating suite and placed under general mask anesthesia. The ear canals were cleaned of dry (3) *cerumen* and crust. Myringotomies were done bilaterally. Cultures were taken of the fluid present in the middle ear spaces. Ear tubes were placed in the myringotomy sites bilaterally. Antibiotic drops and cotton balls were placed in (4) the *external acoustic meatus*.

The patient tolerated the procedure well and was taken to the recovery room.

- 1. _____
- 2. _____

3. _____

4. _____



The Endocrine System

9

LEARNING OUTCOMES

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

- Name the major endocrine glands and the hormones each gland secretes.
- Pronounce, spell, and define medical terms related to the endocrine system and its disorders.
- Interpret abbreviations associated with the endocrine system.

INTRODUCTION

The **endocrine system** consists of ductless *glands* and organs that secrete *hormones* directly into the bloodstream. **Glands** are cell groupings that function as a secretory organ. In the case of the endocrine system, the secretion is called a **hormone**. Hormones are transported in the bloodstream to stimulate specific cells or tissues. Working together with the nervous system, the endocrine system helps to maintain **homeostasis** (chemical balance) throughout the body. The nervous system also contributes to this process by either stimulating or delaying hormone release according to feedback mechanisms.

WORD PARTS RELATED TO THE ENDOCRINE SYSTEM

Endocrine comes from *endo-* (within) and the Greek *krinein* (to separate) and refers to secreting internally. This can be contrasted to **exocrine glands**, which secrete hormones through ducts instead of directly into the

bloodstream, as endocrine glands do. An example of an exocrine gland is a sweat gland, which secretes onto the skin surface. *Aden/o* is the root for gland and comes from the Greek word for gland, *aden*. Be careful not to confuse *aden/o* with *adren/o*. *Adren/o* refers specifically to the adrenal glands, found by the kidneys and comes from the Latin *ad-* (near) and *ren/o* (kidney). **Table 9-1** lists word parts that make up endocrine system terms.

TABLE 9-1  WORD PARTS RELATED TO THE ENDOCRINE SYSTEM

Word Part	Meaning
acr/o	extremities
aden/o	gland
adren/o	adrenal glands
adrenal/o	adrenal glands
calc/i	calcium
crin/o	to separate or secrete
endocrin/o	secreting internally
gluc/o	sugar, glucose, glycogen
glyc/o	sugar, glucose, glycogen
hypophys/o	pituitary gland
-ine	suffix used in the formation of names of chemical substances
-megaly	enlargement
-oma	tumor

pancreat/o	pancreas
parathyr/o	parathyroid gland
parathyroid/o	parathyroid gland
thyr/o	thyroid gland
thyroid/o	thyroid gland
-trophin	suffix meaning nourishment or stimulation

Word Parts Exercise

After studying Table 9-1, write the meaning of each of the word parts.

WORD PART	MEANING
1. endocrin/o	1. _____
2. hypophys/o	2. _____
3. adren/o, adrenal/o	3. _____
4. -ine	4. _____
5. -trophin	5. _____
6. -oma	6. _____
7. pancreat/o	7. _____
8. acr/o	8. _____
9. aden/o	9. _____

10. thyr/o, thyroid/o	10. _____
11. -megaly	11. _____
12. gluc/o, glyc/o	12. _____
13. crin/o	13. _____
14. parathyr/o, parathyroid/o	14. _____
15. calc/i	15. _____

STRUCTURE AND FUNCTION

Several glands make up the endocrine system. These include the **pineal**, **pituitary** (anterior lobe, intermediate, and posterior lobes), **thyroid**, **parathyroid** (two paired glands, superior and inferior), **thymus**, **adrenal** (cortex and medulla), **pancreas** (pancreatic islets), **testes** (in males), and **ovaries** (in females) (see **Figure 9-1**). The hormones and primary functions of each of these glands are noted in **Table 9-2**.

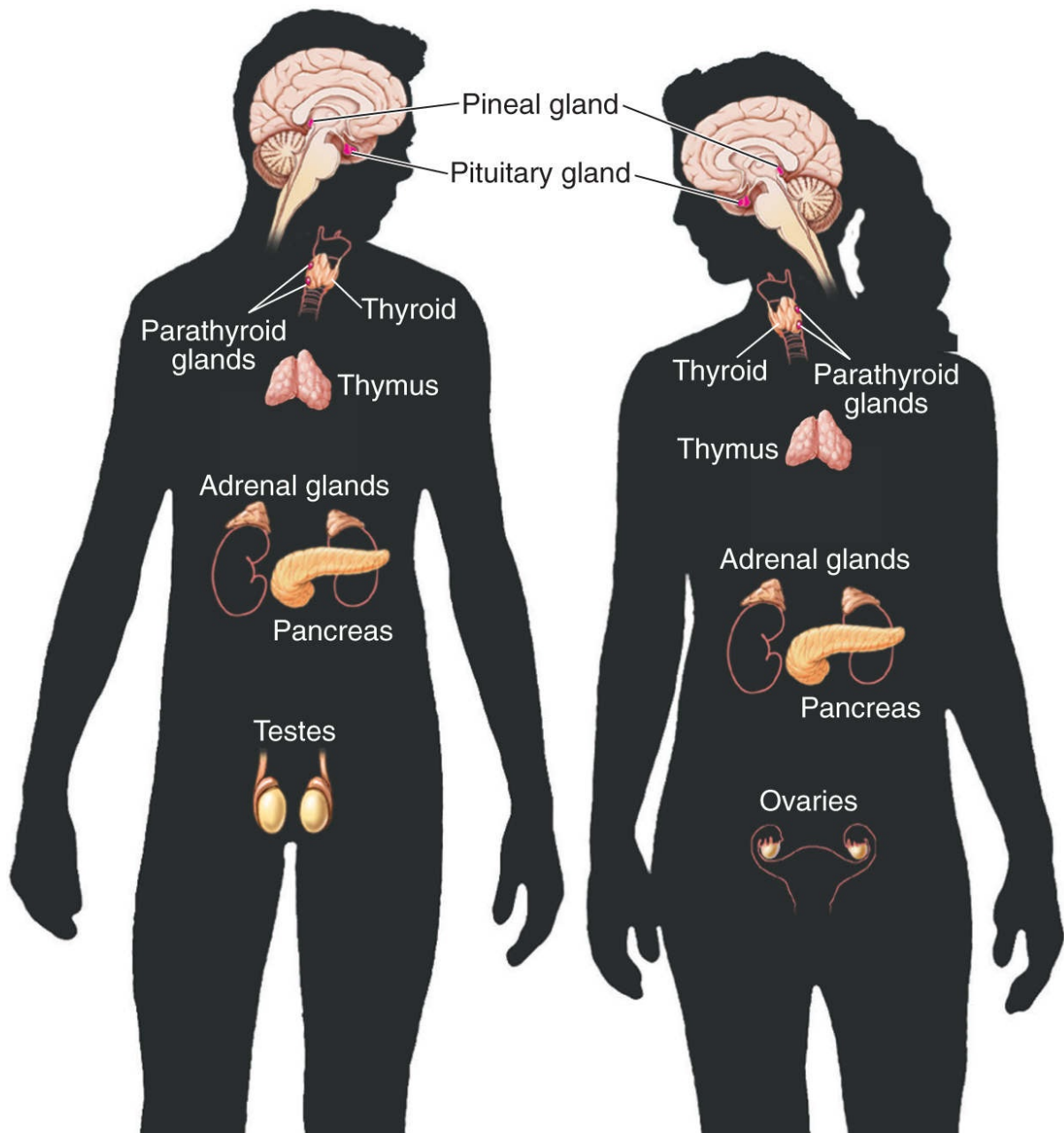


FIGURE 9-1 The endocrine system.

TABLE 9-2 SUMMARY OF THE ENDOCRINE GLANDS, HORMONES, AND HORMONE FUNCTIONS

Gland	Hormone	Hormone Function
pineal gland	melatonin	affects sleep–wake cycles and reproduction
pituitary gland		regulates activities of other glands;

		referred to as the “master gland”
anterior lobe	growth hormone (GH)	growth and development of bones, muscles, and other organs
	thyroid-stimulating hormone (TSH)	growth and development of thyroid gland
	adrenocorticotrophic hormone (ACTH)	growth and development of adrenal cortex
	follicle-stimulating hormone (FSH)	stimulates production of sperm in males and growth of ovarian follicles in females
	luteinizing hormone (LH)	stimulates the production of testosterone in males and secretion of estrogen and progesterone in females
	prolactin hormone (PRL)	stimulates milk secretion in the mammary glands
intermediate lobe	melanocyte-stimulating hormone (MSH)	regulates skin pigmentation
posterior lobe	antidiuretic hormone (ADH)	stimulates the reabsorption of water by the kidneys
	oxytocin	stimulates the uterus to contract during labor and delivery
thyroid gland	thyroxine (T ₄); also called tetraiodothyronine (T ₄)	influences growth and development, both physical and mental
	triiodothyronine (T ₃)	maintenance and regulation of metabolism

	calcitonin (CT)	decreases the blood level of calcium
parathyroid gland	parathyroid hormone (PTH)	increases the blood level of calcium
thymus	thymosin	aids T-cell development; T cells play a role in immunity
adrenal gland		consists of outer region (cortex) and inner region (medulla)
cortex	cortisol	regulates carbohydrates, proteins, fat metabolism; anti-inflammatory effect; helps the body cope during stress
	aldosterone	regulates water and electrolyte balance
	androgen (sex hormone)	develops male secondary sex characteristics
medulla	epinephrine (adrenaline)	acts as a vasoconstrictor, cardiac stimulant (increases heart rate and cardiac output), and antispasmodic; releases glucose into the bloodstream (giving the body a spurt of energy)
	norepinephrine (noradrenaline)	acts as a vasoconstrictor; elevates blood pressure and heart rate
pancreas (islets of Langerhans)	insulin	transports glucose into the cells; decreases blood glucose levels
	glucagon	promotes release of glucose by liver; increases blood glucose levels
		promotes growth, development, and

ovaries	estrogen	maintenance of female sex organs
ovaries	progesterone	prepares uterus for pregnancy; promotes development of mammary glands
testes	testosterone	promotes growth, development, and maintenance of male sex organs

What do the words *endocrine* and *hormone* actually mean? Endocrine glands are so-called because they secrete hormones directly into the bodily fluids that surround them and eventually find their way into the bloodstream. In other words, endocrine gland secretions do not travel through ducts. Glands that direct their secretions through ducts are called exocrine glands. The word *hormone* comes from Greek and means “to urge on or set in motion.” So, a hormone is a chemical “messenger” transported through blood to other parts of the body. When the hormone reaches its target destination, the “message” has been delivered and can be acted upon.

Pituitary Gland

Located in the brain, the **pituitary gland**, or *hypophysis*, is suspended from the base of the hypothalamus. (The *hypothalamus* coordinates the autonomic nervous system and the activities of the pituitary gland.) The pituitary gland controls the activities of other endocrine glands by releasing special hormones that regulate glandular functions. The pituitary gland is divided into an **anterior lobe**, or *adenohypophysis*, and a **posterior lobe**, or *neurohypophysis*.

The anterior lobe secretes several hormones essential for the development of sex glands, muscles, bones, thyroid gland, and other organs. The posterior lobe secretes two hormones that are produced in the hypothalamus, **antidiuretic hormone (ADH)** and **oxytocin (OXT)**. ADH helps the body regulate fluid balance by reducing urination. OXT enhances labor contractions during childbirth and promotes milk release during lactation (milk secretion). During ejaculation in males, a spurt of OXT stimulates reproductive tract contractions to aid sperm release. In both sexes, it also appears to play a role in social bonding.

Thyroid Gland and Parathyroid Gland

The **thyroid gland** is a butterfly-shaped gland lying in front and to the sides of the upper part of the trachea (windpipe) and lower part of the larynx (voicebox) (see **Figure 9-2**). It secretes hormones needed for cell growth, metabolism, and calcium regulation. Thyroid hormones include *triiodothyronine* (T_3), *thyroxine* (T_4), and *calcitonin* (CT). **Triiodothyronine**

(**T₃**) and **thyroxine (T₄)** play roles in many body functions including growth and development, metabolic rate, body temperature, and heart rate. **CT** helps control calcium levels in the blood by decreasing the blood level of calcium.

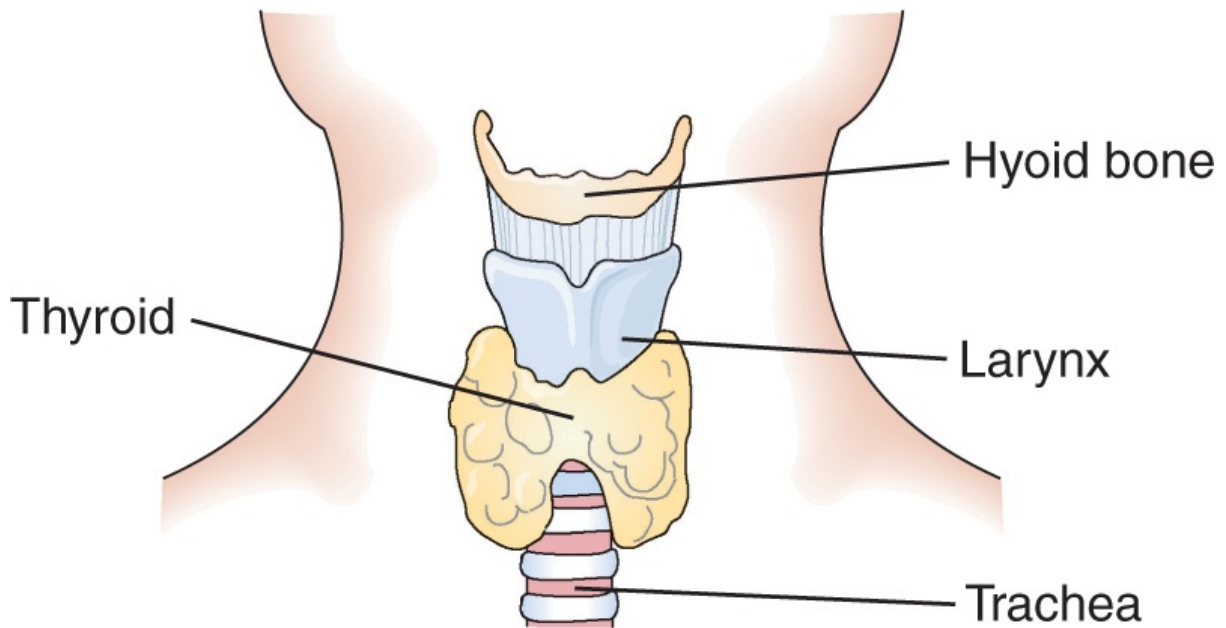


FIGURE 9-2 The thyroid gland and adjacent structures.

There are four **parathyroid glands** consisting of a superior and inferior pair, which are located on the posterior surface of the thyroid gland (see **Figure 9-3**). The hormone **parathyroid hormone (PTH)**, also called *parathyrin* or *parathormone*, helps maintain correct calcium levels in the blood by increasing the blood level of calcium.

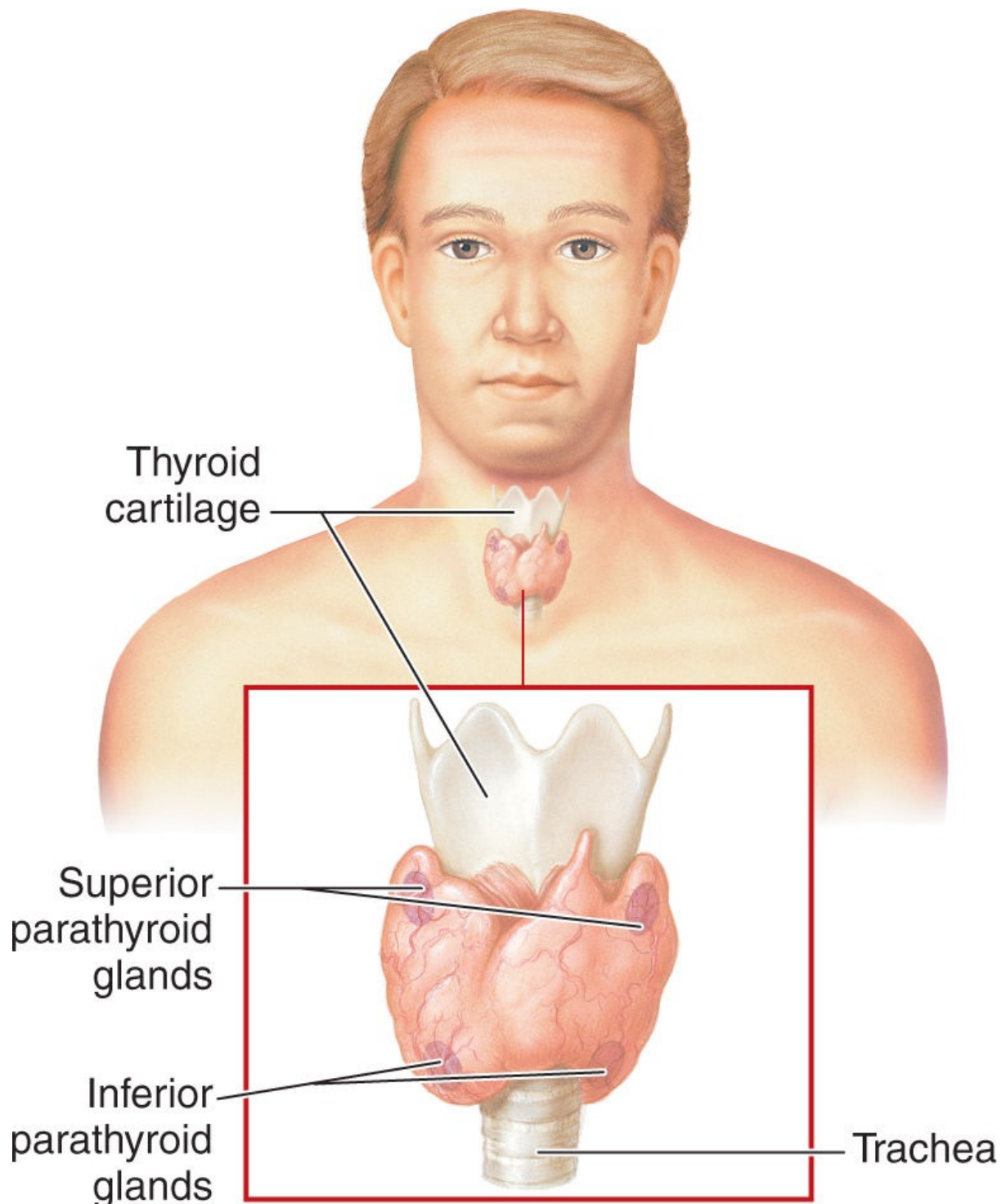


FIGURE 9-3 The parathyroid glands consist of four glands, a superior and inferior pair. They are found on the posterior surface of the thyroid gland but are highlighted in this anterior view.

Adrenal Glands

The **adrenal glands**, or *suprarenal glands*, consist of two triangular-shaped glands, each located on the superior border the kidneys. Each adrenal gland is divided into an outer part called the **adrenal cortex** and an inner part called

the **adrenal medulla** (see [Figure 9-4](#)). The adrenal cortex secretes the steroid hormones, **cortisol**, which helps the body cope with stress, and **aldosterone**, which helps with sodium regulation. It also produces **androgens**, which contribute to the development of male sex characteristics.

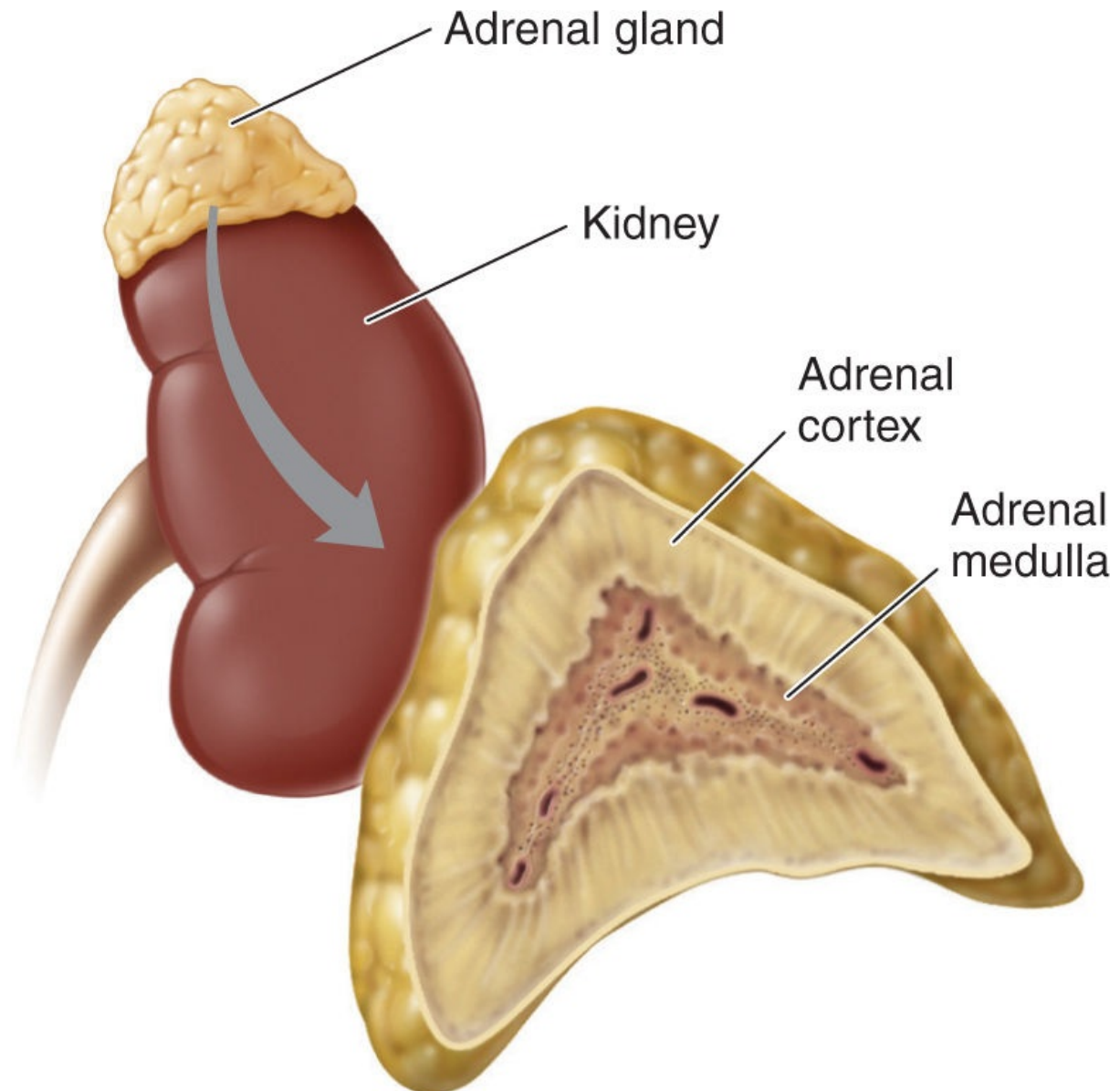


FIGURE 9-4 The adrenal glands are positioned above each kidney and have an outer adrenal cortex and an inner adrenal medulla.

The adrenal medulla secretes **epinephrine** (*adrenaline*), which stimulates the sympathetic nervous system. It also secretes **norepinephrine** (*noradrenaline*), a hormone structurally similar to epinephrine that also stimulates the sympathetic nervous system.

Pancreas

The pancreas is a feather-shaped organ located posterior to the stomach. It

contains clusters of specialized cells called the **pancreatic islet** (*islets of Langerhans*), which produce *insulin* and *glucagon*. These chemicals control blood glucose (sugar) levels and glucose metabolism throughout the body. **Insulin**, produced by the β cells of the pancreas, decreases blood glucose. **Glucagon**, produced by the α cells of the pancreas, increases blood glucose.

Gonads

Reproductive organs that produce sex cells are called **gonads**. The female gonads are the **ovaries**, and the male gonads are the **testes**. The ovaries secrete estrogen and progesterone. **Estrogen** affects the development of female organs, regulates the menstrual cycle, and plays a role in pregnancy. **Progesterone** stimulates the uterus in preparation for and maintenance of pregnancy. The testes secrete **testosterone**, a hormone that affects development of sexual organs in males and secondary sexual characteristics. We discuss the reproductive system and these hormones in Chapter 15.



Quick Check

Fill in the blanks.

1. Another name for the pituitary gland is the _____.
2. Another name for the adrenal gland is the _____ because it is located on the superior border of the kidney.
3. _____ glands secrete hormones directly into the bloodstream.

DISORDERS RELATED TO THE ENDOCRINE SYSTEM

Disorders of the endocrine system are almost always the result of an excess or a deficit in hormone production. In other words, either too much or too little of a hormone causes a problem. If there is too much, surgery or radiation may be needed. If there is too little, replacement therapy is the usual treatment.

Disorders of the Pituitary Gland

One cause of pituitary disorders can be an **adenoma**, a benign tumor that causes excessive hormone secretion. This condition may also destroy pituitary cells and cause too little hormone secretion.

Diabetes insipidus is a disorder in which the posterior lobe of the pituitary gland no longer releases sufficient amounts of ADH or because the response to ADH is impaired. This results in **polydipsia** (excessive thirst) and **polyuria** (excessive urination).

Gigantism, or *giantism*, is a disorder caused by excessive secretion of growth hormone (GH) before puberty, resulting in abnormally long bones (see [Figure 9-5](#)). When excessive GH secretion occurs in adulthood, this results in **acromegaly**, which is characterized by abnormally thick bones in the extremities, especially the hands and feet.



FIGURE 9-5 A 22-year old man with gigantism is shown next to his identical twin, who does not have the condition.

Disorders of the Thyroid Gland

As with other endocrine disorders, an excess or deficiency of thyroid hormone production results in homeostatic imbalance. **Hypothyroidism**, deficient hormone production by the thyroid gland, is characterized by decreased metabolic rate, weight gain, and tiredness. Excessive thyroid hormone production leads to **hyperthyroidism**, characterized by increased metabolic rate, weight loss, and rapid heartbeat. A form of hyperthyroidism is **Graves disease**, which is an autoimmune disorder (condition in which the body's antibodies are directed against itself) resulting in **goiter** (neck swelling) and **exophthalmos** (eye protrusion) (see **Figure 9-6**).

What causes thyroid enlargement? Enlargement of the thyroid gland (goiter) is caused by a deficiency of iodine in the diet. Iodine is necessary to make thyroid hormones. Recall that these hormones have the word part *iodo* in their names. Although this condition is no longer common in the United States, it still affects people in less developed parts of the world. The reason for its rarity in the United States is that in 1924, members of the Michigan State Medical Society championed the fight against goiter by convincing salt producers to include small amounts of iodine in their product. The discovery that goiter was a result of too little iodine in the diet had previously been noted by French physician J. B. Boussingault nearly a century earlier.



FIGURE 9-6 A young woman exhibiting the signs of Graves disease, including goiter and exophthalmos.

Disorders of the Adrenal Gland

Inflammatory conditions and viral infections involving the adrenal glands can cause a decrease in hormone production. Benign tumors are often the cause of

increased hormone production from the adrenal glands.

Addison disease is a progressive disorder caused by an insufficient amount of cortisol and aldosterone production in the adrenal gland or a failure of the pituitary gland to produce a stimulating hormone targeting the adrenal gland. It is characterized by skin darkening, weakness, and loss of appetite (see [Figure 9-7](#)).



FIGURE 9-7 Darkening of the skin caused by Addison's disease.

Cushing's syndrome is caused by an excessive amount of cortisol production by the adrenal glands. It is characterized by fat pads in the chest and abdomen and a “moon face” appearance.

The naming of disorders for persons who first identified them is a well-established practice. Recently, using the possessive form of the founder's name in the names of the disorders has been questioned, and one may, therefore, see and hear both *Addison's disease* and *Addison disease*. The problem is one of tradition versus logic. Those who eschew tradition in favor of logic say that Addison's disease is not something that 19th century British physician Thomas Addison contracted but rather a disorder he identified. Likewise, Harvey Cushing identified and did not contract Cushing's syndrome. In this book, the traditional naming was used because when you search these terms on the Internet, the apostrophe appears more often. Medical dictionaries, however, often do not include the apostrophe.

There is an exception: Graves disease, although a traditional spelling, is not a true possessive. The rule for forming possessives specifies that this should be Graves' disease. Robert Graves was an Irish physician who described exophthalmic goiter in 1835. In this one case, therefore, tradition defies not only logic but also the rules of grammar and punctuation.

Disorders of the Pancreas

Diabetes mellitus (DM) is a disorder caused by insulin deficiency and/or insulin resistance. This results in poor carbohydrate metabolism and high blood glucose level. There are two main types: **Type 1 DM** is a metabolic disorder caused by insufficient production of insulin and usually develops in childhood. Symptoms in the early stages include **glycosuria** (excess glucose in the urine) and **hyperglycemia** (excess glucose in the blood). **Type 2 DM** is caused by either a lack of insulin or the body's inability to use insulin efficiently. It usually develops in middle-aged or older adults.

DIAGNOSTIC TESTS, TREATMENTS, AND SURGICAL PROCEDURES

Hormone replacement therapy is often used to correct endocrine disorders, where the problem is a low hormone level. Examples of disorders treatable by hormone replacement are hypothyroidism and DM. In hypothyroidism, patients are given a medication called levothyroxine to replace low thyroxine levels. In diabetes, patients are given medications to treat high glucose levels. Most commonly, Type I patients are given insulin. In Type II, diet and exercise may be enough to control glucose levels. If they do need medications, these patients are more likely to receive oral medications to help decrease blood glucose. In Addison's disease, where the hormone lacking is cortisol, **corticosteroids** may also be administered for their immunosuppressant and anti-inflammatory properties.

PRACTICE AND PRACTITIONERS

Endocrinology is the medical practice of treating endocrine and hormonal disorders. The practitioner, an **endocrinologist**, specializes in caring for patients with endocrine diseases and hormonal dysfunctions that may involve sexual development, body growth, or other bodily functions.

Abbreviation Table THE ENDOCRINE SYSTEM

ABBREVIATION	MEANING
ACTH	adrenocorticotrophic hormone
ADH	antidiuretic hormone
CT	calcitonin
DM	diabetes mellitus
FBS	fasting blood sugar
FSH	follicle-stimulating hormone
GH	growth hormone
GTT	glucose tolerance test
HbA _{1c}	hemoglobin A1c (glycosylated hemoglobin)
LH	luteinizing hormone
MSH	melanocyte-stimulating hormone
PRL	prolactin
PTH	parathyroid hormone
TSH	thyroid-stimulating hormone
T ₃	triiodothyronine
T ₄	thyroxine, tetraiodothyronine

Study Table THE ENDOCRINE SYSTEM

TERM AND PRONUNCIATION	ANALYSIS	MEANING
Structure and Function		
adenogenous (ad-eh-NAW-jeh-nuhs)	<i>aden/o</i> (gland); <i>-genous</i> (originating)	originating in a gland
adenohypophysis (AD-eh-noh-hy-POFF-ih-sihs)	<i>aden/o</i> (gland); <i>hypophys/o</i> (pituitary gland)	the anterior lobe of the pituitary gland
adrenal cortex (ah-DREE-nahl kor-teks)	<i>adren/o</i> (adrenal glands); <i>cortex</i> (a Latin word meaning “bark”);	the outer region of the adrenal gland
adrenal glands (ah-DREE-nahl glands)	<i>adren/o</i> (adrenal glands)	triangular-shaped glands located above each kidney that secrete hormones that aid in metabolism, electrolyte balance, and stress reactions; each has an outer cortex and an inner medulla; <i>suprarenal glands</i>
adrenal medulla (ah-DREE-nahl med-OOL-uh)	<i>adren/o</i> (adrenal glands); <i>medulla</i> (a Latin word meaning “marrow, innermost part”)	the inner region of the adrenal gland
adrenaline (ah-DREN-ah-lihn)	<i>adren/o</i> (adrenal glands); <i>-ine</i> (a suffix used to form names of chemical substances)	chemical secreted by the adrenal medulla that increases blood circulation, breathing rate, and carbohydrate metabolism; <i>epinephrine</i>
adrenocorticotrophic hormone (ah-DREE-oh-KOR-tih-ko-TROH-pik HOR-mohn) (ACTH)	<i>cortic/o</i> (from <i>cortex</i> [bark]); from the Greek word <i>trophe</i> (nourishment); <i>-in</i> (a suffix used to form names of biochemical substances)	pituitary secretion that stimulates the adrenal glands
androgen (AN-droh-jen)	<i>andro-</i> (masculine); <i>-gen</i> (suffix meaning “source of”)	male hormone secreted by the adrenal cortex
aldosterone (al-DOSS-teh-rone)	ald (ehyd) + ster(ol) + <i>-one</i> (chemical suffix)	one of the corticosteroids, hormones produced by the adrenal glands
antidiuretic hormone (AN-tee-dy-uh-RET-ik HOHR-mohn) (ADH)	<i>anti-</i> (against); from the Greek <i>dia</i> (through); <i>-uresis</i> (urination); from the Greek word <i>hormon</i> (to set in motion)	hormone secreted by the posterior pituitary gland to prevent the kidneys from expelling too much water
calcitonin (kal-sih-TOH-nihn) (CT)	<i>calci-</i> (calcium); from the Greek <i>tonos</i> (to stretch); <i>-in</i> (suffix used to form names of biochemical substances)	hormone secreted by the thyroid that lowers blood calcium level
corticosteroids (KOR-tih-ko-STEHR-oyds)	<i>cortic/o</i> (from Latin word <i>cortex</i> [bark]); from Steros (solid); <i>-oid</i> (resemblance to)	steroids produced by the cortices of the adrenal glands; <i>cortisol</i>
		main glucocorticoid produced in the adrenal

cortisol (KOR-tih-suhl)	from the Latin word <i>corticus</i> (cortex)	cortex; inhibits inflammation and immune response
endocrine (EN-doh-krin)	<i>endo-</i> (within, inner); from the Greek word <i>krino</i> (to separate)	adjective describing a gland that delivers its secretions directly into bloodstream
epinephrine (EP-ih-NEFF-rihn)	<i>epi-</i> (upon); <i>nephr/o</i> (kidney); <i>-ine</i> (suffix used to form the names of chemical substances)	chemical secreted by the adrenal medulla that increases blood circulation, breathing rate, and carbohydrate metabolism; <i>adrenaline</i>
estrogen (EHS-troh-jen)	from the Greek word <i>oistrus</i> (estrus); <i>-gen</i> (producing)	hormone secreted by the female ovaries
exocrine gland (EX-oh-krihn GLAND)	<i>exo-</i> (outside of); from the Greek word <i>krino</i> (to separate)	gland that delivers its secretions through a duct onto the skin or other epithelial surface
follicle stimulating hormone (FOL-i-kuhl STIM-yuh-leyt-ing HOR-mohn) (FSH)	from the Latin words <i>folliculus</i> (little bag) and <i>stimulatus</i> (rouse to action); from the Greek word <i>hormon</i> (to set in motion)	hormone promoting gonadal growth
glands (GLANDZ)	From the Latin, <i>glans</i> (acorn)	organized group of cells that function as a secretory or excretory organ
glucagon (GLOO-ka-guhn)	<i>gluc/o</i> (glucose); from the Greek word <i>ago</i> (to lead)	hormone secreted by the pancreas that increases blood glucose level
homeostasis (hoh-mee-uh-STEY-sis)	from two Greek words <i>homos</i> (same) and <i>stasis</i> (existence)	tendency toward equilibrium; remaining normal
hormone (HOHR-mohn)	from the Greek word <i>hormon</i> (to set in motion)	chemical messenger that is secreted by an endocrine gland directly into the bloodstream
hydrocortisone (hy-droh-KOR-tih-sone)	<i>hydro-</i> (water); <i>cortic/o</i> (from the Greek word <i>cortex</i> meaning “bark”); <i>-one</i> (chemical suffix)	an adrenal gland hormone secretion
hypophysis (hy-POFF-ih-sihs)	<i>hypophys/o</i> (pituitary gland)	major endocrine gland in the brain that controls growth, development, and functioning of other endocrine glands; <i>pituitary gland</i>
hypothalamus (high-poh-THAL-uh-mus)	<i>hypo-</i> (below); from the Greek word, <i>thalamus</i> (bed, bedroom)	part of the brain located near the pituitary gland that secretes releasing hormones that control the release of other hormones by the pituitary gland
insulin (IN-soo-lihn)	from the Latin word <i>insula</i> (island)	hormone produced in the pancreas that decreases blood glucose level
islets of Langerhans (EYE-lets LAN-gehr-hans)	after German pathologist Paul Langerhans, who described it in 1869; islets are the regions of the pancreas that contain its hormone-producing cells	clusters of specialized cells in the pancreas that secrete insulin (β cells) and glucagon (α cells)
luteinizing hormone	from the Latin word <i>luteus</i> (yellow);	hormone that stimulates the final ripening of

(LOO-tee-uh-nahyz-ing HOHR-mohn) (LH)	from the Greek word <i>hormon</i> (to set in motion)	follicles, oocyte release, and conversion of the ruptured follicle into the corpus luteum
melanocyte-stimulating hormone (MEL-an-oh-syte STIM-yuh-leyt-ing HOHR-mohn) (MSH)	<i>melan/o</i> (black); <i>-cyte</i> (cell); from the Latin word <i>stimulatus</i> (rouse to action); from the Greek word <i>hormon</i> (to set in motion)	hormone secreted from the anterior lobe of the pituitary gland that is involved with pigmentation changes
melatonin (mel-ah-TONE-ihn)	melanophore + Greek <i>tonos</i> (to stretch); <i>-in</i> (suffix used to form names of biochemical substances)	hormone secreted by the pineal gland that is involved with sleep–wake cycles and reproduction
neurohypophysis (NUHR-oh-hy-POFF-ih-sihs)	<i>neur/o</i> (nerve); <i>hypophys/o</i> (pituitary gland)	posterior lobe of the pituitary gland that stores and releases OXT and ADH, which are produced in the hypothalamus
noradrenaline (nor-ah-DREN-ah-lihn)	<i>nor-</i> (chemical prefix); <i>adrenal/o</i> (adrenal glands); <i>-ine</i> (a suffix used to denote chemical substances)	chemical secreted by the adrenal medulla that aids the body during stress and increases blood pressure; <i>norepinephrine</i>
norepinephrine (NOR-ehp-ih-NEFF-rihn)	<i>nor-</i> (chemical prefix); <i>epi-</i> (upon); from the Greek word <i>nephros</i> (kidney); <i>-ine</i> (a suffix used to denote chemical substances)	chemical secreted by the adrenal medulla that aids the body during stress and increases blood pressure; <i>noradrenaline</i>
ovaries (OH-vayr-ees)	from the Latin word <i>ovum</i> (egg)	female gonads; two oval-shaped glands that are located in the pelvic cavity and secrete the hormones estrogen and progesterone
oxytocin (ox-ih-TOH-sihn) (OXT)	from the Greek word <i>oxytokos</i> (swift birth); <i>-in</i> (suffix used to form names of biochemical substances)	hormone secreted by the posterior pituitary gland that stimulates uterine contractions and milk ejection from mammary glands
pancreas (PAN-kree-uhs)	from the Greek word <i>pancreas</i> (sweet bread)	feather-shaped organ that lies posterior to the stomach that contains islets of Langerhans (α cells and β cells that secrete glucagon and insulin respectively)
parathyroid gland (pah-ah-THY-royd gland)	<i>para-</i> (prefix denoting involvement of two like parts; also denoting adjacent, alongside, near); <i>thyr/o</i> (thyroid gland)	secretes PTH
parathyroid hormone (pah-ah-THY-royd HOHR-mohn), parathormone (pah-ah-THOR-mohn) (PTH)	<i>para-</i> (prefix denoting involvement of two like parts; also denoting adjacent, alongside, near); <i>thyr/o</i> (thyroid gland); from the Greek word <i>hormon</i> (to set in motion)	a hormone secreted by the parathyroid gland that regulates calcium and phosphorus levels in the blood and bones
pineal gland (PIHN-ee-ahl gland)	from the Latin word <i>pinus</i> (pine); <i>-al</i> (adjective ending)	small, cone-shaped gland that secretes melatonin, which affects sleep–wake cycles and reproduction
pituitary gland (pih-TOO-ih-tahr-ee gland)	from the Latin word <i>pituita</i> (phlegm)	major endocrine gland in the brain that controls growth, development, and functioning of other endocrine glands; <i>hypophysis</i>
	from the Latin <i>pro</i> (for); from the Latin	female hormone secreted by the ovary that

progesterone (proh-JES-ter-ohn)	<i>gestare</i> (to carry about); <i>-one</i> (chemical suffix)	stimulates uterus in preparation for and maintenance of pregnancy
prolactin (pro-LAK-tih) (PRL)	from the Latin <i>pro</i> (for); from the Latin <i>lacteus</i> (milky)	a secretion of the anterior lobe of the pituitary gland that stimulates milk production
suprarenal glands (SOO-prah-REEN-ahl glands)	<i>supra-</i> (above); <i>ren-</i> (kidney); <i>-al</i> (pertaining to)	triangular-shaped glands located above each kidney that secrete hormones that aid in metabolism, electrolyte balance, and stress reactions; each has an outer cortex and an inner medulla; <i>adrenal glands</i>
testes (TES-tees)	from the plural form of the Latin <i>testis</i> (testicle)	male gonads; two oval organs that lie in the scrotum that secrete testosterone
testosterone (teh-STAH-steh-rone)	from the Latin <i>testis</i> (testicle); <i>ster(ol)</i> ; <i>-one</i> (chemical suffix)	male hormone secreted by the testes that affects development of sexual organs in males and secondary sexual characteristics
thymus (thigh-MUS)	from the Greek word <i>thymos</i> (a warty excrescence)	gland located in the neck whose function is immunologic
thyroid gland (THIGH-royd gland)	<i>thyr/o</i> (thyroid gland)	bilobed gland located in the neck that secretes thyroid hormone that is needed for cell growth and metabolism
thyroid-stimulating hormone (THIGH-royd STIM-yoo-late-ing HOR-mohn) (TSH)	<i>thyr/o</i> (thyroid gland)	hormone produced in the anterior lobe of the pituitary that stimulates the growth and function of the thyroid gland; <i>thyrotropin</i>
thyrotropin (thigh-ROT-roh-pih) (TSH)	<i>thyr/o</i> (thyroid gland); from the Greek <i>trophe</i> (nourishment); <i>-in</i> (suffix used to form names of biochemical substances)	hormone produced in the anterior lobe of the pituitary that stimulates the growth and function of the thyroid gland; <i>thyroid-stimulating hormone</i>
thyroxine (thy-ROK-sih) (T ₄)	<i>thyr/o</i> (thyroid gland); <i>-ine</i> (suffix used to form names of biochemical substances)	a secretion of the thyroid gland
triiodothyronine (try-EYE-oh-doh-THY-roh-noon) (T ₃)	<i>tri-</i> (three); <i>iodo</i> (iodine); <i>thyr/o</i> (thyroid gland); <i>-ine</i> (a suffix used to form names of chemical substances)	another secretion of the thyroid gland that is often synthesized from thyroxine (T ₄) by bodily organs
Disorders		
acromegaly (AK-roh-mehg-alee)	from the Greek <i>akron</i> (extremity); <i>-megaly</i> (enlargement)	enlargement of the extremities (mostly hands and feet) caused by excessive secretion of Addison's GH <i>after</i> puberty
Addison's disease (AD-uh-suhns dih-ZEEZ)	after the British physician, Thomas Addison, who first described the condition in 1855	disorder in which the adrenal glands do not produce sufficient cortisol; characterized by skin darkening, weakness, and loss of appetite
adenitis (ad-eh-NY-tih)	<i>aden/o</i> (gland); <i>-itis</i> (inflammation)	inflammation of a gland

adenohypophysitis (AD-eh-noh-hy-poff-ih-SY-tihz)	<i>aden/o</i> (gland); <i>hypophys/o</i> (pituitary gland); <i>-itis</i> (inflammation)	inflammation of the anterior pituitary, often related to pregnancy
adenoma (ad-en-OH-muh)	<i>benignus</i> (Latin for <i>aden/o</i> (gland)– <i>oma</i> (tumor))	benign (nonmalignant) neoplasm in which the tumor cells form glands or gland-like structures
adrenatitis (ah-dree-nah-LY-tiss)	<i>adrenal/o</i> (adrenal glands); <i>-itis</i> (inflammation)	inflammation of an adrenal gland
adrenopathy (ah-dree-nah-LOP-ah-thee);	<i>adrenal/o</i> (adrenal glands); <i>-pathy</i> (disease)	any disease of the adrenal glands; <i>adrenopathy</i>
adrenomegaly (ah-dree-noh-MEG-ah-lee)	<i>adren/o</i> (adrenal gland); <i>-megaly</i> (enlargement)	enlargement of the adrenal glands
adrenopathy (ah-dree-NOP-ah-thee)	<i>adrenal-</i> (adrenal glands); <i>-pathy</i> (disease)	any disease of the adrenal glands; <i>adrenopathy</i>
Cushing’s syndrome (KOOSH-ingz SINDruhm)	named after Harvey Cushing, American physician, who described the disorder in 1932	a hormonal disorder caused by too much cortisol; characterized by fat pads in the chest and abdomen and a “moon face” appearance
diabetes insipidus (DY-ah-BEET-ehs ihn-SIP-ih-duhs)	<i>diabetes</i> , a Greek word meaning “a compass,” “a siphon”; <i>insipidus</i> (lacking flavor or zest)	condition brought about by the posterior pituitary’s failure to produce enough ADH
diabetes mellitus (DY-ah-BEET-ehs meh-LY-tuhs) (DM)	<i>diabetes</i> , a Greek word meaning “a compass, a siphon”; <i>mellitus</i> , a Latin word meaning “sweetened with honey” or “honey-sweet”	condition brought about by insufficient production of insulin in the pancreas or the failure of the body’s cells to absorb glucose
exophthalmos (ek-sof-THAL-mos)	<i>ex</i> (out) + <i>ophthalmos</i> (eye)	protruding or bulging eyes from their sockets
gigantism (JEYE-gan-tizm)	<i>giant</i> (common English word); <i>-ism</i> (condition)	abnormal overgrowth of the body due to excessive secretion of the GH <i>before</i> puberty; <i>giantism</i>
glycosuria (GLY-koh-SYUR-ee-ah)	<i>glyc/o/s</i> (sugar); <i>-uria</i> (urine)	sugar (glucose) in the urine
goiter (GOY-tuhr)	from the Latin word <i>gutter</i> (throat)	chronic enlargement of the thyroid gland
Graves disease (grahvz dih-ZEEZ)	named after Robert James Graves (1796–1853), an Irish physician who first described exophthalmic goiter in 1835	a common form of hyperthyroidism resulting from overproduction of thyroxine caused by a false immune system response
Hashimoto’s thyroiditis (Hah-shee-moh-tohz thahy-roi-DAHY-tis)	Hashimoto (Japanese surgeon, 1881–1934); <i>thyr/o</i> (thyroid gland); <i>-itis</i> (inflammation)	an autoimmune disorder that attacks the thyroid gland causing hypothyroidism

hyperglycemia (hy-puhr-gly-SEEM-ee-ah)	<i>hyper-</i> (above normal); <i>glyc/o</i> (sugar); <i>-ia</i> (condition)	excessive sugar (glucose) in the blood
hyperpituitarism (HY-puhr-pih-TOO-ih-tahr-izm)	<i>hyper-</i> (above normal); from the Latin word <i>pituita</i> (phlegm)	excessive hormone secretion by the pituitary gland
hyperthyroidism (HY-puhr-THY-royd-izm)	<i>hyper-</i> (above normal); <i>thyr/o</i> (thyroid); <i>-ism</i> (condition)	excessive production of thyroid hormone by the thyroid gland; overactive thyroid
hypophysitis (hy-poh-fih-SY-tih-s)	<i>hypophys/o</i> (pituitary gland); <i>-itis</i> (inflammation)	inflammation of the pituitary gland
hypopituitarism (hy-poh-pih-TOO-ih-tahr-izm)	<i>hypo-</i> (below normal); from the Latin word <i>pituita</i> (phlegm); <i>-ism</i> (condition)	condition of diminished hormone secretion from the anterior pituitary gland
hypothyroidism (hahy-puh-THAHY-roi-diz-uhm)	<i>hypo-</i> (below normal); thyroid refers to the thyroid gland; <i>-ism</i> (state of)	decrease in thyroid hormone production
pituitarism (pih-TOO-ih-tahr-izm)	from the Latin word <i>pituita</i> (phlegm); <i>-ism</i> (condition)	pituitary dysfunction
polydipsia (pol-ee-DIP-see-uh)	<i>poly-</i> (much) + the Greek word <i>dipsa</i> (thirst)	excessive thirst that is usually indicative of diabetes
polyuria (pol-ee-YOO-ree-uh)	<i>poly-</i> (much) + the Greek word <i>ouron</i> (urine)	excessive urination
thyroaplasia (THY-roh-a-PLAY-zee-ah)	<i>thyr/o</i> (thyroid gland); aplasia from the Greek <i>a plassein</i> (not to form)	congenital condition characterized by low thyroid output
thyroiditis (thy-roy-DY-tih-s)	<i>thyr/o</i> (thyroid gland); <i>-itis</i> (inflammation)	inflammation of the thyroid gland
thyromegaly (thy-roh-MEG-ah lee)	<i>thyr/o</i> (thyroid gland); <i>-megaly</i> (enlargement)	enlargement of the thyroid gland
toxic goiter (TOK-sik GOI-ter)	from two Latin words <i>toxicus</i> (poisoned); <i>gutter</i> (throat)	a goiter that forms excessive secretions causing signs and symptoms of hyperthyroidism
Type 1 diabetes mellitus (DY-ah-BEET-ehs meh-LY-tuhs)	<i>diabetes</i> , a Greek word meaning “a compass, a siphon”; <i>mellitus</i> , a Latin word meaning “sweetened with honey” or “honey-sweet”	condition brought about by insufficient production of insulin in the pancreas and generally appearing in childhood
Type 2 diabetes mellitus (DY-ah-BEET-ehs meh-LY-tuhs)	<i>diabetes</i> , a Greek word meaning “a compass, a siphon”; <i>mellitus</i> , a Latin word meaning “sweetened with honey” or “honey-sweet”	condition brought about by insufficient production of insulin in the pancreas or the failure of the body’s cells to absorb glucose

Diagnostic Tests, Treatments, and Surgical Procedures

adenectomy (ad-eh-NEK-toh-mee)	<i>aden/o</i> (gland); <i>-ectomy</i> (excision)	excision of a gland
adenotomy (ad-eh-NOT-oh-mee)	<i>aden/o</i> (gland); <i>-tomy</i> (cutting operation)	incision of a gland
adrenalectomy (ah-dree-nah-LEK-toh-mee)	<i>adrenal/o</i> (adrenal glands); <i>-ectomy</i> (excision)	surgical removal of one adrenal gland or both adrenal glands
fasting blood sugar (FSB)	<i>fasting</i> (to not eat)	test for diabetes; after drinking glucose, the patient fasts and then their blood is tested for glucose; <i>glucose tolerance test</i> (GTT)
glycosylated hemoglobin (glye-KOS-ih-late-ed HE-muh-gloh-bin) (HbA _{1c})	<i>glyco-</i> (glucose, sugar); <i>hem-</i> (blood)	blood test that indicates the amount of glucose in the blood over the previous few (no more than 3) months; used to indicate how well DM is being controlled
hypoglycemic (HY-poh-gly-SEE-mik)	<i>hypo-</i> (below normal); <i>glyc/o</i> (sugar); <i>-ic</i> (pertaining to)	drug used to lower blood glucose
hypophysectomy (HY-poh-fih-SEK-toh-mee)	<i>hypophys/o</i> (pituitary gland); <i>-ectomy</i> (excision)	surgical removal of the hypophysis (pituitary gland)
parathyroidectomy (PAHR-ahthy-royd-EK-toh-mee)	<i>parathyr/o</i> (parathyroid gland); <i>-ectomy</i> (excision)	surgical excision of the parathyroid gland
thyroidectomy (THY-royd-EK-toh-mee)	<i>thyr/o</i> (thyroid gland); <i>-ectomy</i> (excision)	removal of the thyroid gland
thyroparathyroidectomy (THY-roh-pehr-ah-THY-roy-DEK-toh-mee)	<i>thyr/o</i> (thyroid gland); <i>parathyr/o</i> (parathyroid gland); <i>-ectomy</i> (excision)	removal of the thyroid and parathyroid glands
thyrotomy (thy-ROT-oh-mee)	<i>thyr/o</i> (thyroid gland); <i>-tomy</i> (cutting operation)	surgery performed on the thyroid gland
Practice and Practitioners		
endocrinologist (en-dokrih-NOL-oh-jist)	<i>endocrin/o</i> (endocrine); <i>-logist</i> (one who specializes)	medical specialist in endocrinology
endocrinology(en-dokrih-NOL-oh-jee)	<i>endocrin/o</i> (endocrine); <i>-logy</i> (study of)	medical specialty of the endocrine system

END-OF-CHAPTER EXERCISES

EXERCISE 9-1



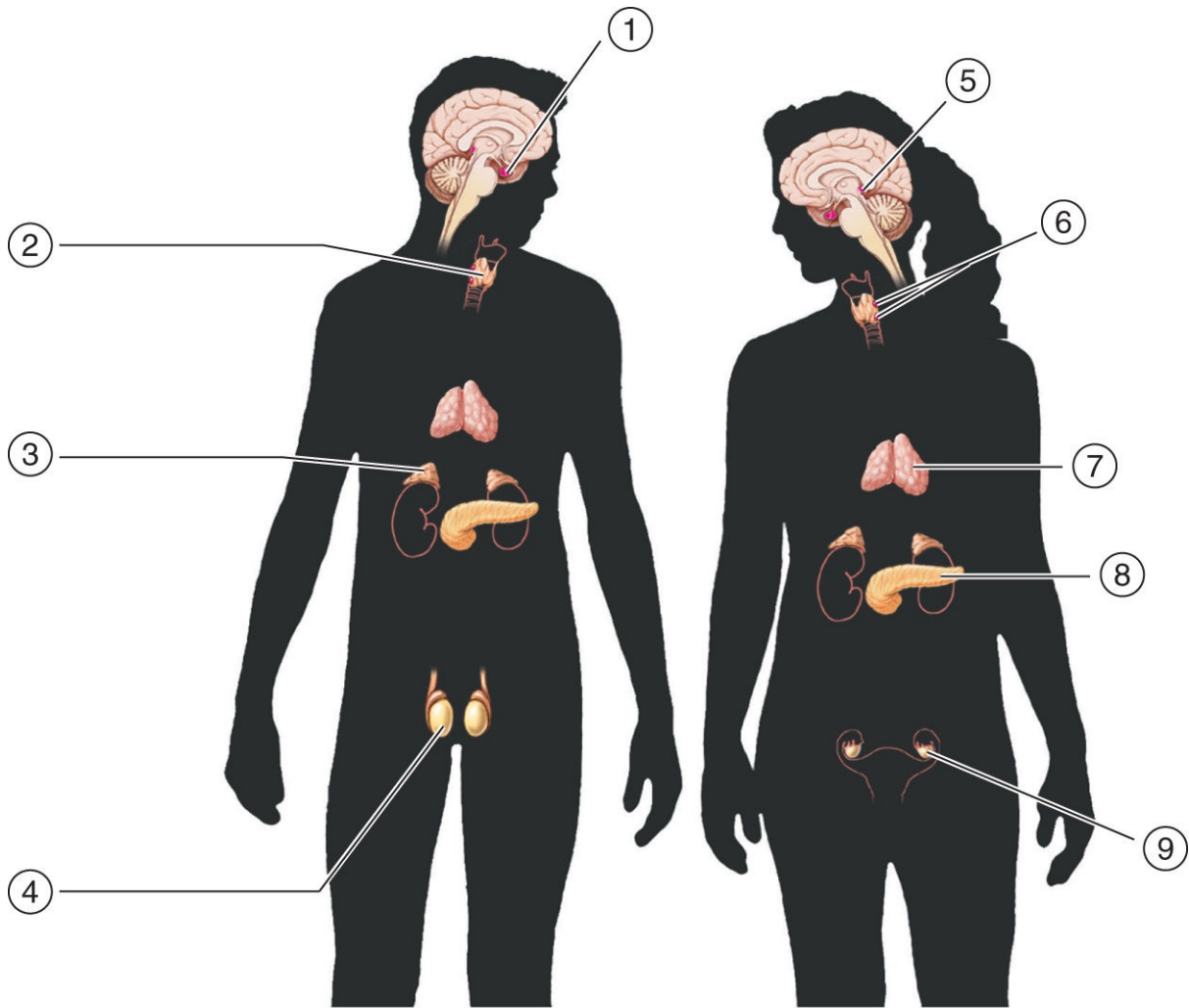
LABELING

Using the following list, choose the correct terms to label the diagram correctly.

adrenal glands parathyroid glands testes

ovaries pineal gland thymus

pancreas pituitary gland thyroid



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

EXERCISE 9-2



WORD PARTS

Break each of the following terms into its word parts: prefix, root, or suffix. Give the meaning of each word part and then define the term.

1. adenogenous

root: _____

suffix: _____

definition: _____

2. epinephrine

prefix: _____

root: _____

suffix: _____

definition: _____

3. suprarenal

prefix: _____

root: _____

suffix: _____

definition: _____

4. adrenomegaly

root: _____

suffix: _____

definition: _____

5. hyperglycemia

prefix: _____

root: _____

suffix: _____

definition: _____

6. adenotomy

root: _____

suffix: _____

definition: _____

7. thyroparathyroidectomy

root: _____

root: _____

suffix:

definition: _____

8. endocrinology

root: _____

suffix: _____

definition: _____

EXERCISE 9-3



WORD BUILDING

Use **adren/o** to build the medical words meaning:

1. enlargement of the adrenal gland _____
2. surgical removal of an adrenal gland _____
3. disease of the adrenal glands _____

Use **thyr/o** or **thyroid/o** to build the medical words meaning:

4. condition of minimal functioning of the thyroid gland _____
5. inflammation of the thyroid gland _____
6. incision of the thyroid gland _____
7. enlargement of the thyroid gland _____

Use **pancreat/o** to build the medical words meaning:

8. tumor of the pancreas _____
9. inflammation of the pancreas _____
10. originating in the pancreas _____

EXERCISE 9-4



MATCHING

Match the term with its definition.

- | | |
|-------------------------------------|--|
| 1. _____
adrenalopathy | a. synonym for epinephrine |
| 2. _____
hyperpituitarism | b. thyroid-stimulating hormone, secreted by the anterior lobe of the pituitary gland |
| 3. _____
adenogenous | c. enlargement of the thyroid gland |
| 4. _____
antidiuretic hormone | d. disease of the adrenal glands |
| 5. _____
adrenaline | e. synonym for pituitary gland |
| 6. _____ master gland, hypophysis | f. hormone secreted by the thyroid to decrease blood calcium level |
| 7. _____
calcitonin | g. originating in a gland |
| 8. _____ goiter | h. removal of the thyroid and parathyroid glands |
| 9. _____
parathyroid gland | i. hormone released by the posterior lobe of the pituitary gland |
| 10. _____
thyrotropin | j. secretes PTH (parathyroid hormone) |
| 11. _____
thyromegaly | k. excessive pituitary secretion |
| 12. _____
adenohypophysitis | l. inflammation of the anterior pituitary gland |
| 13. _____
thyroparathyroidectomy | m. chronic enlargement of the thyroid |

EXERCISE 9-5



MULTIPLE CHOICE

Choose the correct answer for the following multiple choice questions.

- The master gland is known as the _____.

- a. pituitary gland
 - b. thymus gland
 - c. thyroid gland
 - d. pineal gland
2. The ovaries produce which two hormones?
- a. insulin and glucagon
 - b. estrogen and progesterone
 - c. testosterone and thymosin
 - d. T_3 and T_4
3. Endocrine means _____.
- a. to cringe from within
 - b. to secrete within
 - c. to cry inside
 - d. disease of the gland
4. Over-secretion of GH in an adult produces a condition called _____.
- a. hyperthyroidism
 - b. adenitis
 - c. acromegaly
 - d. tetany
5. _____ is an enlargement of the thyroid gland.
- a. Hypothyroidism
 - b. Goiter
 - c. Thyroidectomy
 - d. Addison's disease
6. A chemical secreted from an endocrine gland is called a/an _____.
- a. hormone
 - b. lymph

- c. neurotransmitter
 - d. insulin
7. Hypersecretion of GH may cause _____.
- a. insulin
 - b. diabetes
 - c. hypothyroidism
 - d. gigantism
8. _____ is associated with excessive hormone secretion from the adrenal cortex.
- a. Cushing's syndrome
 - b. Exophthalmos
 - c. Goiter
 - d. Gigantism
9. The two-lobed gland in the neck is called the _____.
- a. Adam's apple
 - b. thymus
 - c. pituitary gland
 - d. thyroid gland

EXERCISE 9-6



FILL IN THE BLANK

Fill in the blank with the correct answer.

1. Another term for enlargement of the thyroid gland besides goiter is _____.
2. Insufficient insulin production or insulin resistance results in the condition called _____.
3. An abnormally high level of glucose in the blood is termed _____.
4. Excessive urination is called _____.
5. The term _____ means sugar (glucose) in the urine.
6. The hormone _____ increases blood glucose level.

7. The enlargement of extremities caused by the overproduction of GH in adults is _____.
8. _____ is the tendency toward equilibrium.

EXERCISE 9-7

ABBREVIATIONS

Write out the term for the following abbreviations.

1. _____ GTT
2. _____ PTH
3. _____ T₄
4. _____ FBS
5. _____ ADH
6. _____ HbA_{1c}
7. _____ GH
8. _____ PTH

Write the abbreviation for the following terms.

9. _____ adrenocorticotrophic hormone
10. _____ follicle-stimulating hormone
11. _____ diabetes mellitus
12. _____ calcitonin
13. _____ melanocyte-stimulating hormone
14. _____ triiodothyronine
15. _____ prolactin
16. _____ thyroid-stimulating hormone
17. _____ luteinizing hormone

EXERCISE 9-8

SPELLING

Select the correct spelling of the medical term.

1. An _____ is a physician who specializes in caring for patients with endocrine diseases and hormonal dysfunctions.
 - a. enocreenologist

- b. endokrineologist
 - c. endocrineologist
 - d. endocrinologist
2. A medication that can be taken orally to lower the circulating level of blood glucose is called a _____.
- a. hypogysemic
 - b. hyperglycemic
 - c. hypoglycemic
 - d. hyperglysemik
3. _____ is one of the hormones produced in the pancreas that regulates blood sugar.
- a. Insullin
 - b. Insulin
 - c. Insalin
 - d. Insulen
4. One of the main disorders of the pancreas is called _____.
- a. diabetes mellitus
 - b. diabetis mellitus
 - c. diabetis melletes
 - d. diabetes mellitus
5. The _____ is located posterior to the stomach.
- a. pancreas
 - b. pancrease
 - c. pankreas
 - d. pankrease
6. In addition to insulin, the pancreas also produces _____, which increases blood sugar.
- a. glukagon
 - b. glucagun

- c. glucagon
 - d. glucagone
7. The _____ gland controls the activities of the other endocrine glands.
- a. pituatary
 - b. pitooatary
 - c. patuitary
 - d. pituitary
8. A _____ is a chronic enlargement of the thyroid gland.
- a. goyter
 - b. goiter
 - c. goitar
 - d. goytar
9. Enlargement of the extremities, especially the hands and feet, that is caused by excessive GH after puberty is called _____.
- a. acromeguly
 - b. acromegaly
 - c. acrohmegaly
 - d. akromegaly
10. The male sex hormone secreted by the adrenal cortex is _____.
- a. andragen
 - b. androhgen
 - c. androjen
 - d. androgen

EXERCISE 9-9



CASE STUDY

ENDOCRINOLOGY OFFICE CONSULTATION

After reading the case study, answer the following questions.

OFFICE NOTE: This 59-year-old woman has previously been in good health. On a routine physical examination, she was noted to have a thyroid nodule on the right lobe of the thyroid gland. She complained of hoarseness, dysphasia, local tenderness, and a slight enlargement on the right side of her neck. She also stated that she feels anxious and cannot sleep throughout the night.

On physical examination, the right side of the neck was visibly enlarged, and a nodule was felt; it was noted that the patient's eyes were bulging outward. A blood test to check her thyroid hormone levels indicated a high value of TSH. No other modifying factors or associated signs or symptoms were present.

1. What does dysphasia mean?

2. What is a medical term for an "enlargement of the thyroid gland"?

3. What does TSH stand for?



The Cardiovascular System

10

LEARNING OUTCOMES

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

- Understand blood flow through the heart and through the body.
- Name the elements that form blood.
- Pronounce, spell, and define medical terms related to the cardiovascular system and its disorders.
- Interpret abbreviations associated with the muscular system.

INTRODUCTION

The **cardiovascular system** is made up of the heart and blood vessels, which transport blood. The blood vessels include all the **arteries** (carrying blood *away* from the heart), **veins** (carrying blood *toward* the heart), and **capillaries** (vessels between the arteries and veins). Together they form a transportation system that delivers oxygen and nutrients to the body's cells, returns carbon dioxide and wastes to be eliminated, and helps regulate body temperature. The heart pumps the blood within the blood vessels to all parts of the body. When we discuss the cardiovascular system, we can divide it into the *pulmonary circuit* and the *systemic circuit*. The **pulmonary circuit** is the passage of blood from the heart's right ventricle, through the lung's pulmonary arteries, and then back through the pulmonary veins to the heart's left atrium. The **systemic circuit** is the circulation of blood through the arteries, capillaries, and veins of the general system (see **Figure 10-1**).

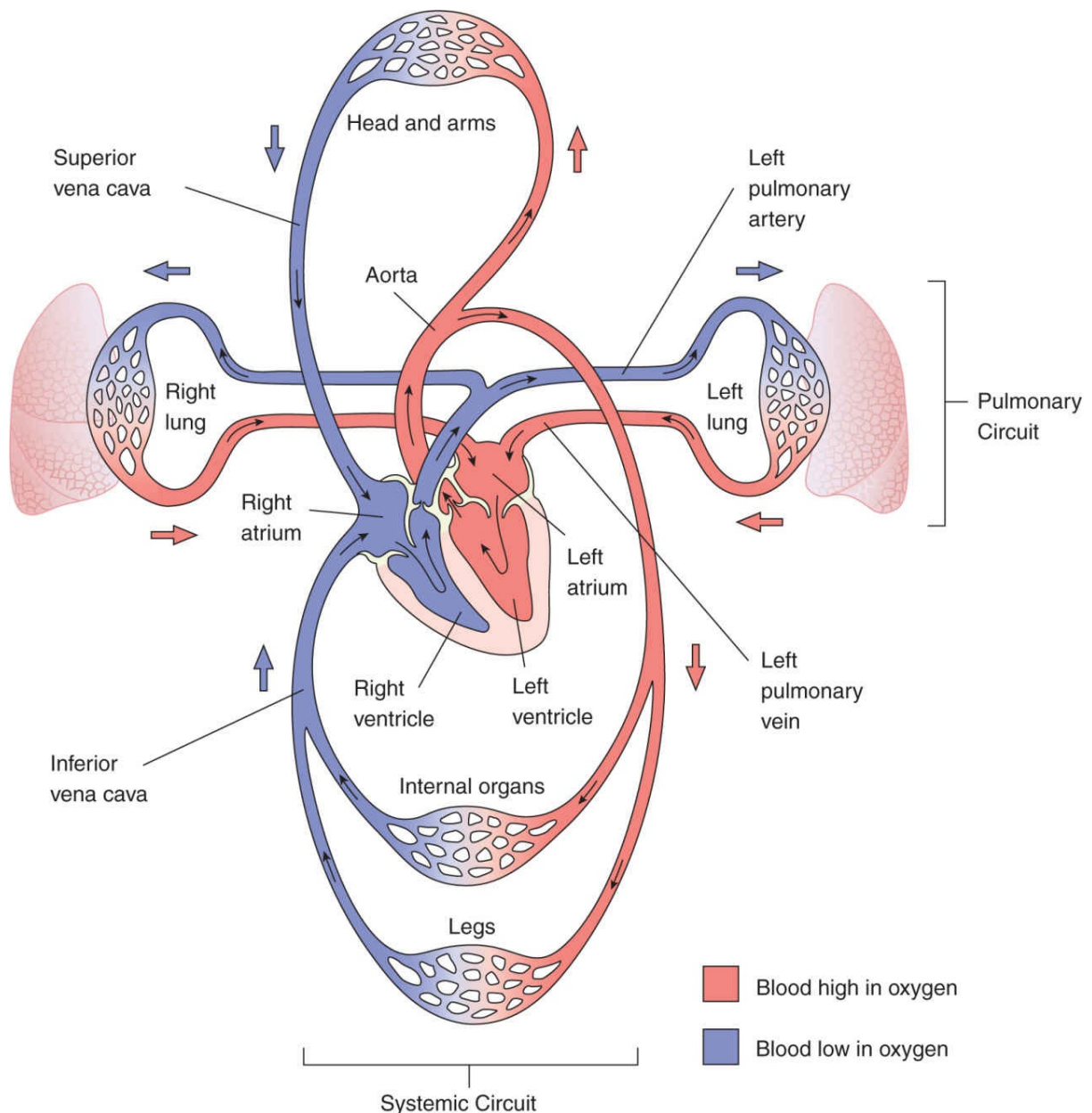


FIGURE 10-1 The cardiovascular system. The cardiovascular system consists of blood flow in a closed system of vessels. The pulmonary circuit carries blood to and from the lungs, and the systemic circuit carries blood to and from all other parts of the body. Blood that is low in oxygen leaves the right side of the heart and enters the lungs, whereas blood that is rich in oxygen leaves the lungs and is returned to the left side of the heart to be pumped out to the systemic circuit. The vessels depicted in *red* signify blood that is high in oxygen; the vessels depicted in *blue* signify blood that is low in oxygen.

WORD PARTS RELATED TO THE CARDIOVASCULAR SYSTEM

The term *cardiovascular* introduces two word parts: *cardi/o*, which comes from the Greek *kardia* (heart), and *vas/o*, which comes from the Latin *vas* (vessel). The third component to this system besides the heart and vessels is blood. The root words *hem/o* and *hemat/o* both mean blood, as does the suffix–*emia*. **Table 10-1** lists word parts related to the cardiovascular system terms.

TABLE 10-1  WORD PARTS RELATED TO THE CARDIOVASCULAR SYSTEM

Word Part	Meaning
angi/o	vessel
aort/o	aorta
arteri/o	artery
ather/o	fatty
atri/o	atrium
brady-	slow
cardi/o	heart
coron/o	crown; encircling, such as in the coronary blood vessels encircling the heart
-ectasis	dilation, expansion
electr/o	electricity
-emia	blood
endo-	within, inner

-gram	written record
hem/o	blood
hemat/o	blood
isch	restricting, thinning
my/o	muscle
peri-	around, surrounding
phleb/o	vein
-stenosis	a narrowing
tachy-	fast
thromb/o	clot
valv/o	valve
valvul/o	valve
varic/o	dilated
vas/o	vessel
ven/o	vein
ventricul/o	ventricle

Word Parts Exercise

After studying Table 10-1, write the meaning of each of the word parts.

WORD PART	MEANING
1. root meaning vein	1. _____
2. root meaning heart	2. _____
3. root meaning vessel	3. _____
4. root meaning within, inner	4. _____
5. prefix meaning fast	5. _____
6. root meaning clot	6. _____
7. prefix meaning around, surrounding	7. _____
8. root meaning fatty	8. _____
9. root meaning atrium	9. _____
10. suffix meaning written record	10. _____
11. suffix meaning blood	11. _____
12. root meaning muscle	12. _____
13. suffix meaning a narrowing	13. _____
14. root meaning blood	14. _____
15. root meaning artery	15. _____
16. root meaning vein	16. _____
17. root meaning valve	17. _____

18. root meaning aorta	18. _____
19. prefix meaning slow	19. _____
20. root meaning dilated	20. _____
21. root meaning crown	21. _____
22. suffix meaning dilation or expansion	22. _____
23. root meaning vessel	23. _____
24. root meaning electricity	24. _____
25. root meaning ventricle	25. _____
26. root meaning restricting, thinning	26. _____

STRUCTURE AND FUNCTION

The Heart

The heart is a four-chambered hollow organ with three layers. Its lowermost tip is called the **apex**. The innermost layer is called the **endocardium**. The middle layer, which is the actual heart muscle and the thickest of the three layers, is called the **myocardium**. The outer layer of the heart is called the **epicardium**, which is surrounded by the **pericardium**, a sac that surrounds the heart (see **Figure 10-2**).

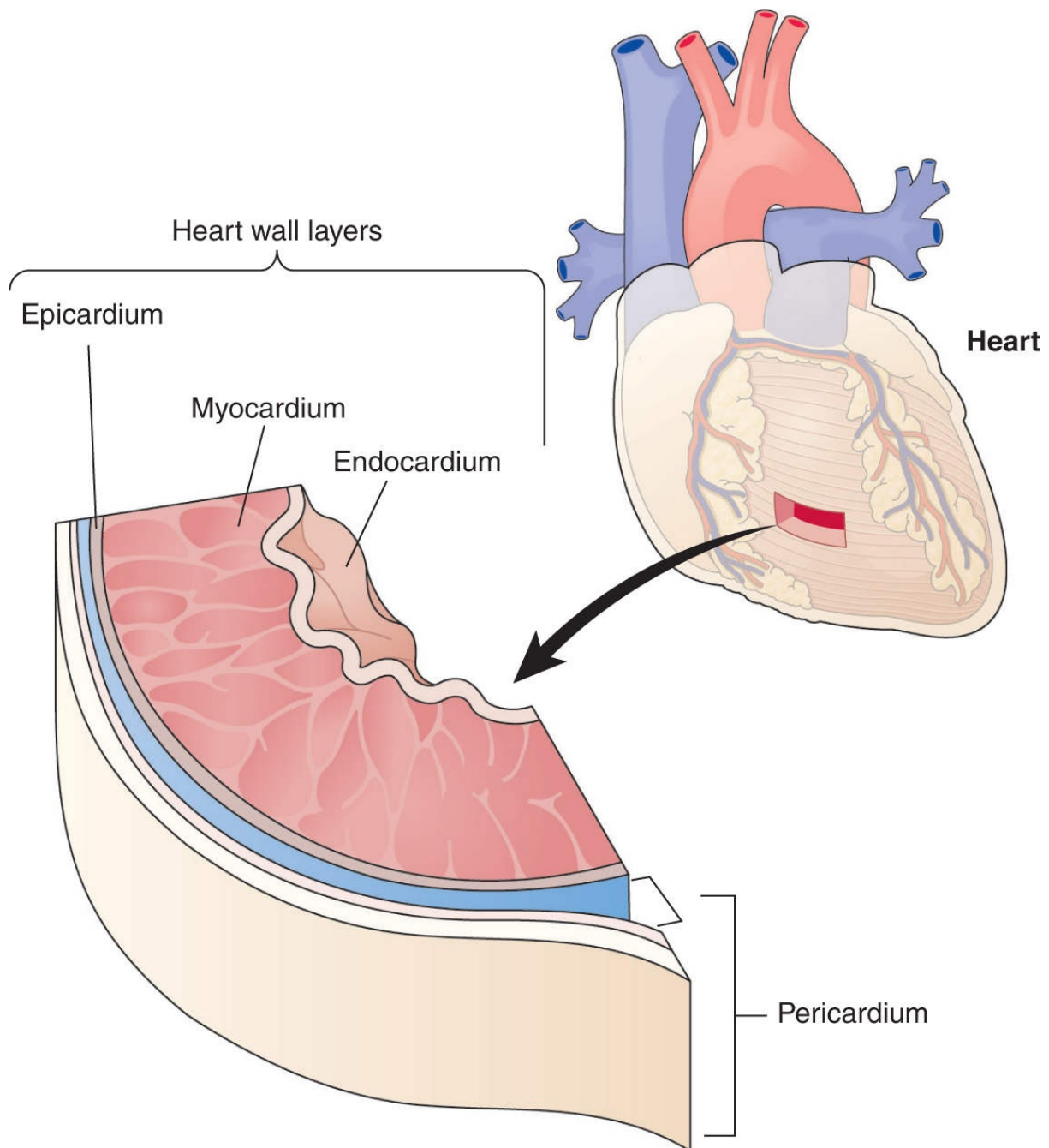


FIGURE 10-2 Layers of the heart and pericardium. The heart wall is composed of three layers: the epicardium, myocardium, and endocardium. Note the thickness of the myocardium or “muscle” layer. The pericardium is composed of two layers and has fluid in the space between the layers. This fluid helps to reduce friction when the heart beats.

The heart acts as a double pump whose chambers are separated by a wall called the **septum**. Remember anatomic position when thinking about blood flow and how it relates to the figures. The right side of the heart is the right side of the patient and will be shown on the left in figures on the book pages, just as anatomic position states it should be. The right side of the heart pumps

deoxygenated blood to the **lungs** where the blood picks up oxygen. Because the right side is pumping a shorter distance, the muscle in this side of the heart is thinner. The left side of the heart receives blood that has been oxygenated in the lungs, and it pumps the oxygenated blood through the entire body. In the heart, blood travels through four distinct chambers. The atria are the superior (top) chambers and the ventricles are the inferior (bottom) chambers. The four chambers are as follows:

- **Right atrium:** upper right chamber that receives blood from all body parts except the lungs; the **interatrial septum** separates the right and left **atria** (plural of *atrium*).
- **Right ventricle:** lower right chamber that receives blood from the right atrium and pumps it to the lungs; the **interventricular septum** separates the right and left ventricles.
- **Left atrium:** upper left chamber that receives oxygen-rich blood as it returns from the lungs.
- **Left ventricle:** lower left chamber that pumps blood out the aorta (large artery) to all parts of the body.

Blood Flow Through the Heart

Blood first enters the heart from either the **superior vena cava** or **inferior vena cava**. Both of these veins drain into the right atrium. Blood leaves the heart at the left ventricle by way of a large artery called the **aorta**. Blood flow through the heart is directed by one-way valves located at the entrance and exit to each of the ventricles. The **atrioventricular (AV) valves** are found at the entrance to the ventricles and are so named because they come between the atria and ventricles. The **right AV valve** is also known as the **tricuspid valve** because it has three cusps (flaps) that open and close. It controls the opening between the right atrium and right ventricle. The **left AV valve** is located between the left atrium and left ventricle and is called the **bicuspid valve** or **mitral valve**. It has two cusps that control blood flow.

Why is the left AV valve also called the mitral valve? This name comes from the valve's similarity to a miter, which is a tall ceremonial hat that is tapered to a point and worn by some clergymen as a symbol of their office.

The exit valves separate the ventricles from the lungs on the right side and the rest of the body on the left side. These valves are named **semilunar** because the flaps resemble half moons. The exit point at the right ventricle is called the **pulmonary valve** (*pulmonary semilunar valve*), and it is located between the right ventricle and the **pulmonary arteries**, the vessels that lead

to the lungs. The **aortic valve** (*aortic semilunar valve*) is located between the left ventricle and the aorta, the vessel that leads to the rest of the body. The pathway of blood through the heart is illustrated in **Figure 10-3**.

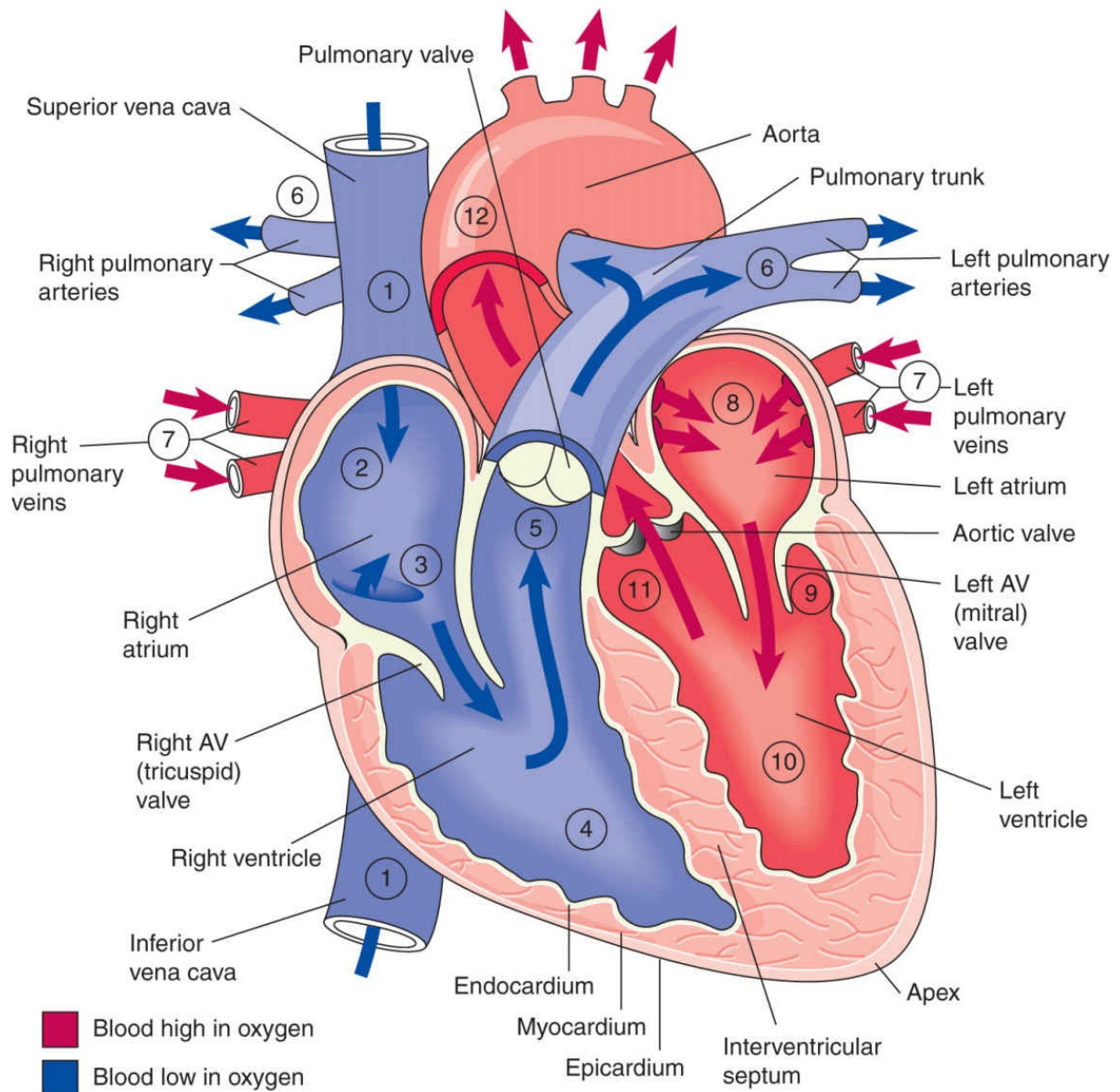


FIGURE 10-3 The heart and pathway of blood flow. Deoxygenated blood returns from the body into the heart through the superior and inferior venae cavae. The pathway of the blood through the heart begins when blood is returned to the vena cava (#1) and exits the heart through the aorta (#12) to the rest of the body. Note: The right side of the heart is colored in *blue*, signifying deoxygenated blood. The left side of the heart is colored in *red* because it carries oxygenated blood.

Use the adjective “ventricular” only when you are absolutely sure of the meaning of the phrase you are uttering. The reason for caution is that the brain, as well as the heart, contains ventricles.

The Heartbeat

To pump blood effectively throughout the body, the heart must contract and relax in a rhythmic cycle known as a **heartbeat**. The **conducting system of the heart** generates and transmits signals that stimulate the myocardium of

the heart to contract and relax in sequence. The conducting system of the heart includes the following (see [Figure 10-4](#)):

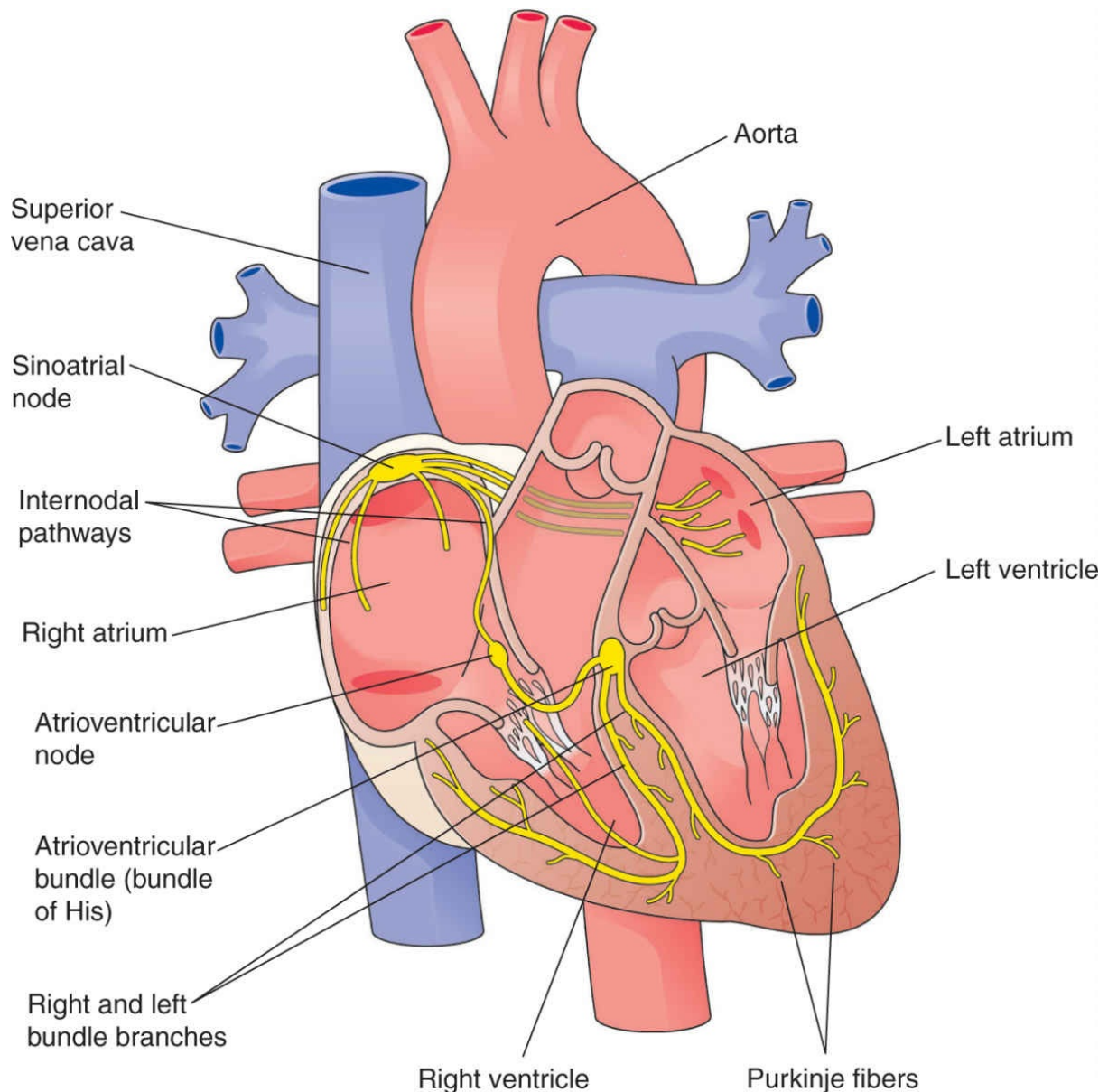


FIGURE 10-4 Conducting system of the heart. The electrical stimulus begins in the sinoatrial node. The electrical stimulus moves from the sinoatrial node, through the internodal pathways, to the atrioventricular node, through the atrioventricular bundle, through the right and left bundle branches, and terminates in the Purkinje fibers where excitation of the ventricles occurs.

- **Sinoatrial node (SA node):** located in the upper posterior wall of the right atrium; action potential is generated here and distributed to other cells of the conducting system; conducting cells form **internodal pathways** that distribute the impulse across the atria as it travels toward the ventricles; also called the pacemaker of the heart.
- **Atrioventricular node (AV node):** located at the junction between the atria and ventricles; continues to generate impulses toward the atrioventricular bundle.

- **Atrioventricular bundle (AV bundle or bundle of His) and right and left bundle branches:** AV bundle is located at the top of the interventricular septum; right and left bundle branches travel down each side of the septum toward the apex; transmit impulses to the Purkinje fibers.
- **Purkinje fibers:** peripheral fibers extending from the bundle branches that end in the right and left ventricles; stimulation from the AV bundle causes excitation of the ventricular muscles, resulting in contraction.

The electrical activity of the heart can be recorded on an **electrocardiogram (ECG, EKG)**. The machine that does the recording is called an **electrocardiograph**.

Why bundle of His? Why not “bundle of His or Hers”? In 1893, German physician, Wilhelm His, figured out that a heartbeat starts in a particular group of AV fibers, which were, subsequently, named for him. A Czech anatomist/physiologist, Jan Evangelista Purkyně, likewise discovered the Purkinje (or Purkyne) fibers. Born in 1787, Purkyně contributed many other scientific discoveries to the world. For example, he was the first to show that fingerprints could be used to establish identity, and his studies of the human eye foreshadowed motion pictures.

Each heart contraction, called **systole**, is followed by a relaxation called **diastole**. These complete rounds of cardiac systole and diastole make up the **cardiac cycle** and are illustrated in **Figure 10-5**.

Heart rate (HR) is the number of times the heart beats per minute. The blood that is forced through the vessels by contraction creates an increase in arterial pressure that can be felt as a pulse. The radial artery on the thumb side of the anterior wrist is a common location for feeling an arterial pulse.

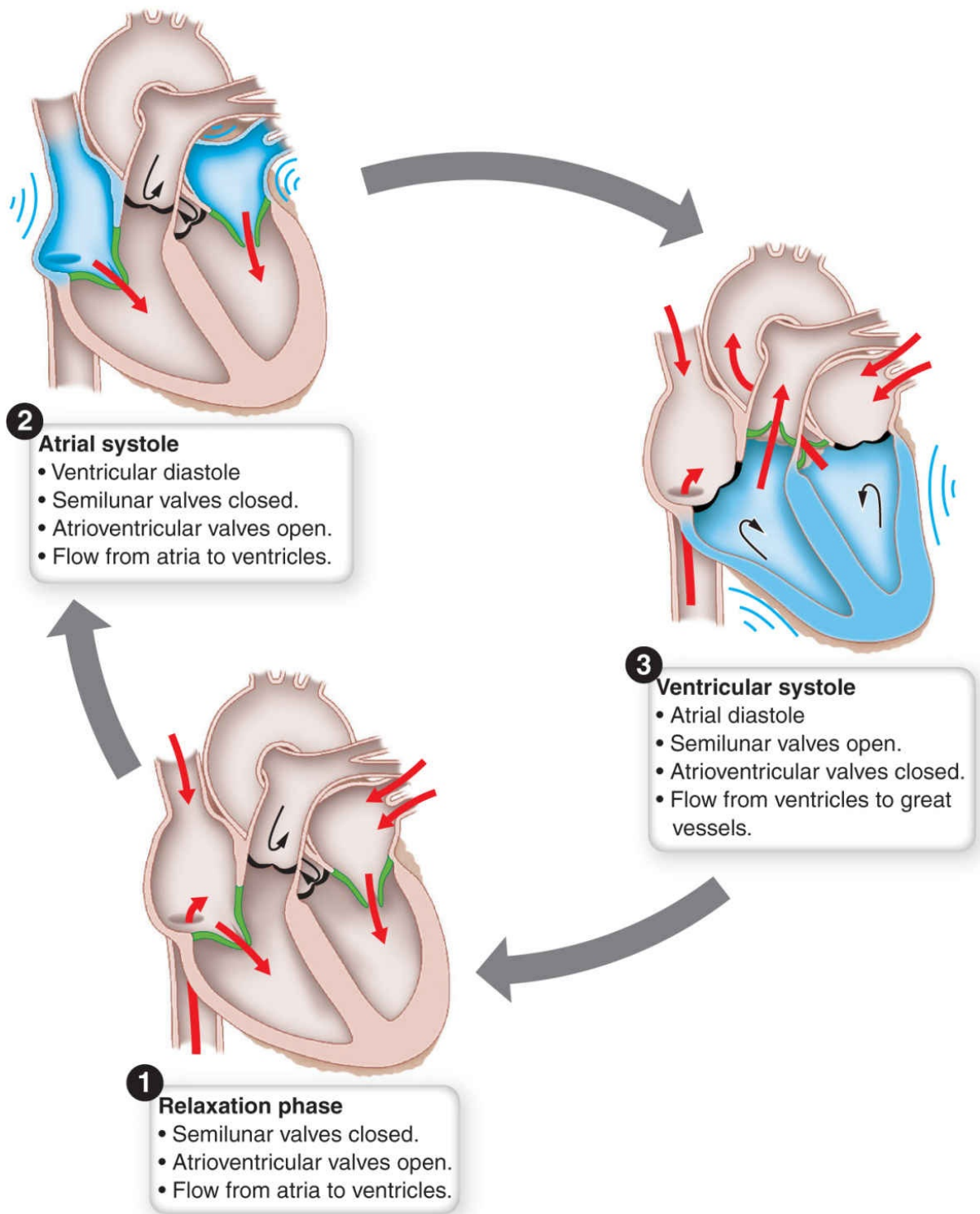


FIGURE 10-5 The three phases of the cardiac cycle.

Blood Vessels

Blood vessels are tubular structures that convey blood. The types of blood vessels include arteries, arterioles, capillaries, venules, and veins (see [Figure 10-6](#)).

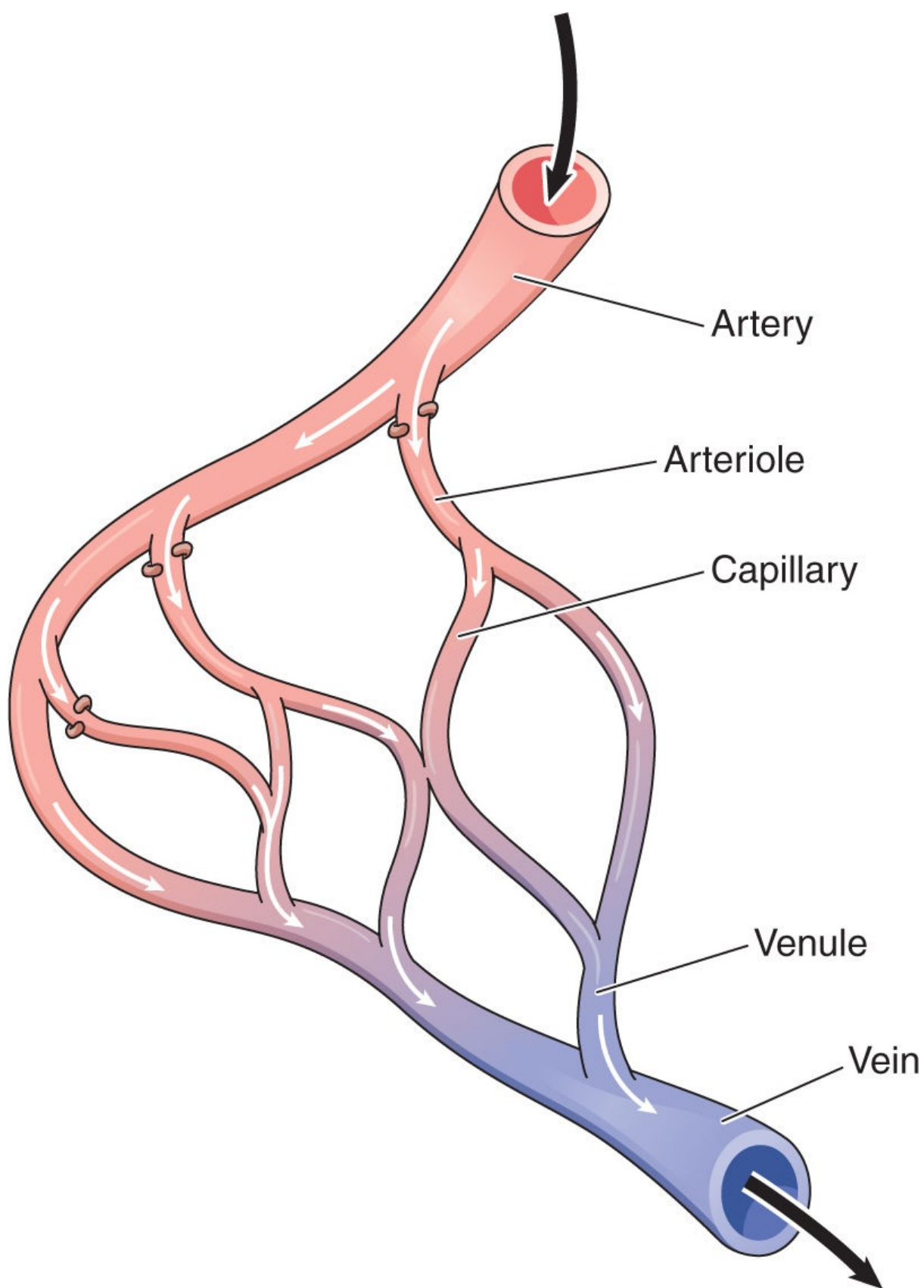


FIGURE 10-6 The five types of blood vessels.

- **Arteries:** thick-walled, muscular, elastic blood vessels that carry blood

away from the heart. With the exception of pulmonary and umbilical arteries, arteries contain oxygenated blood.

- **Arterioles:** branches of the arteries that carry blood to the capillaries.
- **Capillaries:** blood vessels that connect the arterial and venous systems; they are only one cell thick and allow for the exchange of nutrients, gases, and wastes.
- **Venules:** vessels that are continuous with capillaries and transport blood to the veins.
- **Veins:** blood vessels that carry blood toward the heart. With the exception of pulmonary and umbilical veins, veins contain deoxygenated blood.

The **lumen** of a blood vessel is the tubular space through which blood flows. The nervous system can stimulate the lumen to be opened, known as **vasodilation**, or closed, which is called **vasoconstriction**. Vasodilation and vasoconstriction each can have an effect on blood pressure (BP).

BP is a measurement of the amount of pressure exerted against the walls of blood vessels. BP is recorded as a fractional number, **systolic** over **diastolic**. For example, 120/80 means the systolic pressure is 120 and the diastolic pressure is 80. Systolic pressure occurs when the highest pressure is exerted against the vessel walls, and diastolic pressure occurs when the lowest pressure is exerted against the vessel walls. BP can be measured by several methods, but the most common is with an instrument called a **sphygmomanometer**, commonly called a BP cuff.

Blood

Blood is a fluid connective tissue made up of plasma (55%) and formed elements (45%). **Plasma** is a clear, straw-colored fluid that is composed mostly of water (91%), along with proteins and other nutrients in solution. The formed elements in blood consist of **red blood cells (RBCs)**, also called **erythrocytes**; **white blood cells (WBCs)**, also called **leukocytes**, and **platelets**, also called **thrombocytes**. Each element has an important role, ranging from the transportation of oxygen (erythrocytes), to defense of the body against harmful organisms (leukocytes), to blood clotting (platelets). The following list identifies the structure and function of each element:

- **RBCs:** The main function of RBCs is to transport oxygen. The oxygen binds to **hemoglobin (Hb)**, a protein.
- **WBCs:** WBCs are the body's main defense against harmful

organisms; there are five types of leukocytes: **neutrophils**, **eosinophils**, **basophils**, **lymphocytes**, and **monocytes**. Owing to the role leukocytes play in the body's defense, they will be discussed again in Chapter 11, which covers the lymphatic system and immunity.

- **Platelets:** These cell fragments play an important role in the blood-clotting process. They are the smallest of the formed elements, roughly half the size of erythrocytes.

Blood Groups

The four major blood groups (types) are **A**, **B**, **AB**, and **O**. Blood type compatibility is an important consideration when blood is transfused from one person to another. **Table 10-2** lists the blood type compatibilities for donors and recipients.

TABLE 10-2 BLOOD TYPES AS DONORS AND RECIPIENTS

Blood Type	Can Donate to	Can Receive from
A	A or AB only	A or O only
B	B or AB only	B or O only
AB (universal recipient)	AB only	A, B, AB, O
O (universal donor)	A, B, AB, O	O only

The presence or absence of a protein on the surface of an RBC is responsible for what is known as the **Rh factor**. The Rh factor is named for the first two letters in the word *rhesus*, a reference to the rhesus macaque, the blood of which was used in early experiments. A person whose blood contains the Rh factor is **Rh positive (Rh⁺)**. People with blood that does not contain the Rh factor are **Rh negative (Rh)**.



Quick Check

Fill in the blanks.

1. Arteries transfer blood to _____.
2. _____ are blood vessels that return blood to the heart.
3. Erythrocyte is another term for _____.

DISORDERS RELATED TO THE CARDIOVASCULAR SYSTEM

Heart disease includes numerous problems and is a leading cause of death. This section discusses disorders related to the cardiovascular system.

Coronary Artery Disease

Coronary artery disease (CAD) is narrowing of the lumen of one or more of the coronary arteries, usually due to atherosclerosis. Normal blood vessels have a smooth lumen. When there is a progressive buildup of plaque or fatty deposits on inner arterial walls, the lumen narrows, creating **atherosclerosis**. One cause of plaque buildup in the coronary arteries is a condition of increased blood fat (lipid) called **hyperlipidemia**. Common types of lipids are high-density lipoproteins (HDLs) and low-density lipoproteins (LDLs). When there is a hardening and loss of elasticity in the artery, impeding blood flow to the heart muscle, the condition is called **arteriosclerosis** (see [Figure 10-7](#)). An inadequate supply of blood and oxygen to tissues is called **ischemia**. In the heart, the myocardium is the tissue that suffers from a lack of blood flow and oxygen.

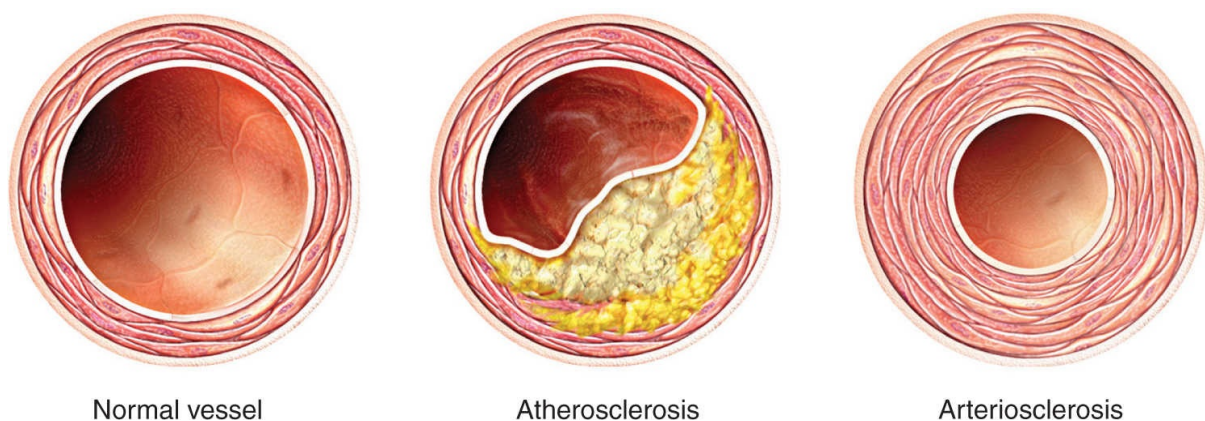


FIGURE 10-7 A comparison between atherosclerosis and arteriosclerosis.

Blood Clots

A **thrombus** is a blood clot in a blood vessel, which can impede blood flow to the myocardium and cause ischemia. **Thrombosis** is the formation of a thrombus. An **embolus** is a blood clot that moves throughout the bloodstream.

Myocardial Infarction and Congestive Heart Failure

A **myocardial infarction (MI)**, commonly called a *heart attack*, results from a lack of oxygen supply to the myocardium. Various diagnostic tests are used to identify abnormal cardiac function. Among these are an ECG; **echocardiography** (ultrasonic examination of the heart); **cardiac catheterization** (insertion of a catheter and contrast dye into the coronary arteries to detect blockage); and a stress test.

A simple blood test to discover the presence of *troponin* may confirm a diagnosis of MI. **Troponin** is a muscle protein released into the bloodstream when an MI occurs.

Congestive heart failure (CHF) occurs when the heart cannot pump enough blood to meet the body's needs for oxygen and nutrients. This leads to edema (swelling) in the legs and fluid buildup in the lungs.

The acronym MONA is sometimes used to refer to standard emergency treatment for a suspected heart attack. M stands for morphine, O for oxygen, N for nitroglycerin, and A for aspirin.

Arrhythmias

A normal heart rhythm is called **sinus rhythm**. An **arrhythmia** is any irregularity of the heart's rhythm, such as a slow or fast rate or extra beats. **Bradycardia** (less than 50 beats/minute) is a slower than normal HR, and **tachycardia** (more than 90 beats/minute) is a faster than normal rate. **Fibrillation** describes rapid, random, and ineffective contractions of the heart. Some arrhythmias are more serious than others. **Atrial fibrillation**, commonly shortened to "A-fib," occurs when the atria beat faster than the ventricles. This condition causes a quivering motion of the atria, which is usually not life threatening, although it can predispose the atria to thrombi formation. It affects many people and can often be controlled with drugs. Sustained **ventricular fibrillation**, a condition in which the ventricles ineffectively pump blood, can be fatal.

Hypertension

The term for high BP is **hypertension (HTN)**. It occurs when the systolic reading exceeds 140 mm Hg or the diastolic is >90 mm Hg. Over time, HTN may lead to arteriosclerosis (hardening of the arteries) and/or **left ventricular hypertrophy** (oversized left ventricle). When HTN is related to another medical problem, such as a kidney disorder, it is called **secondary hypertension**.

Are atherosclerosis and arteriosclerosis the same ailment? Not exactly. Both conditions exhibit

similar symptoms; however, these symptoms occur for different reasons. A patient who has arteriosclerosis has hardening of the arteries caused by continuous high BP. A patient with atherosclerosis has similar symptoms because his or her arteries have been narrowed by plaque buildup. So, a patient can have arteriosclerosis and not have atherosclerosis and vice versa. Both have the same symptoms, however, and some patients have both conditions.

Blood Disorders

Any abnormality of the blood may be called a **dyscrasia**. There are three major types: **anemia**, **leukemia**, and **clotting disorders**:

- **Anemia** is a condition marked by a deficiency of RBCs or a low level of Hb.
- **Leukemia** is characterized by an increased number of WBCs.
- **Clotting disorders** include **hemophilia** (hereditary bleeding disorder), **thrombocytopenia** (an insufficient number of thrombocytes), and **disseminated intravascular coagulation (DIC)** (extreme clotting caused by trauma or disease).

DIAGNOSTIC TESTS, TREATMENTS, AND SURGICAL PROCEDURES

Medications and surgical procedures are used to treat arrhythmias. **Antiarrhythmic** medications, such as amiodarone, affect calcium channels in the heart to regulate rhythm. Other medications that are used in patients with atrial fibrillation may include blood thinners, such as Coumadin, Xarelto, and Eliquis, because these patients are at a higher risk of developing a blood clot due to blood pooling in the heart and not continuously flowing as it should. **Cardioversion**, a treatment for fibrillation, involves applying an electric current to restore a normal heart rhythm. **Ablation therapy**, applying radiofrequency waves to the heart, is used to cure a variety of cardiac arrhythmias, such as some tachycardias and atrial fibrillation.

Surgical procedures for treating blockages in blood vessels include the following:

- **Percutaneous transluminal coronary angioplasty (PTCA)** involves the insertion of a balloon-tipped catheter to open a blocked coronary artery (see [Figure 10-8](#)).

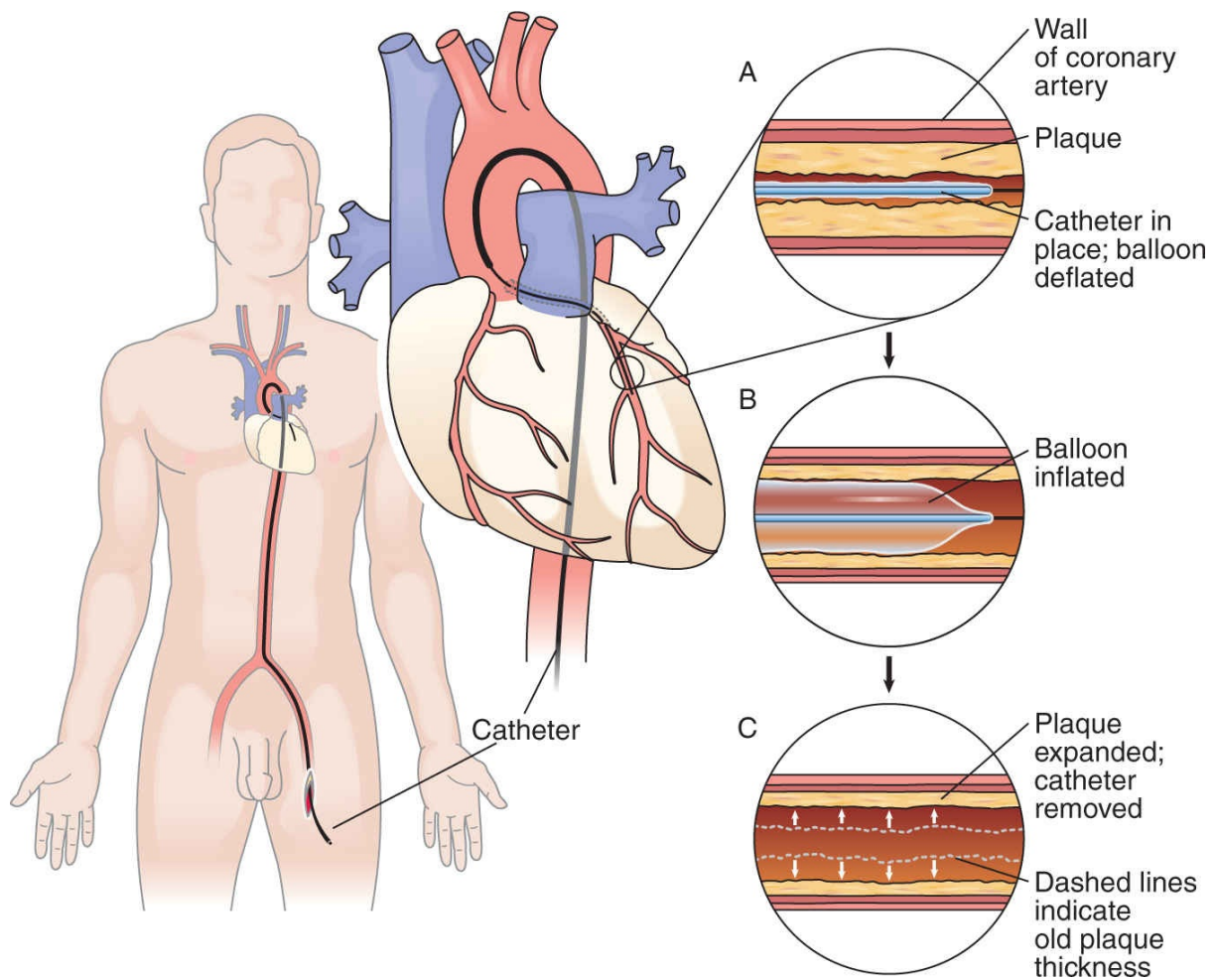


FIGURE 10-8 Percutaneous transluminal coronary angioplasty (PTCA). **A.** Plaque deposits in the artery. **B.** Plaque buildup narrows the coronary vessel, impeding blood flow to the myocardium. **C.** The rough interior edges encourage clot formation in the artery.

- **Arterial stent** includes the implantation of a stent, which is a mesh tube that is implanted into an artery to provide support (see [Figure 10-9](#)).

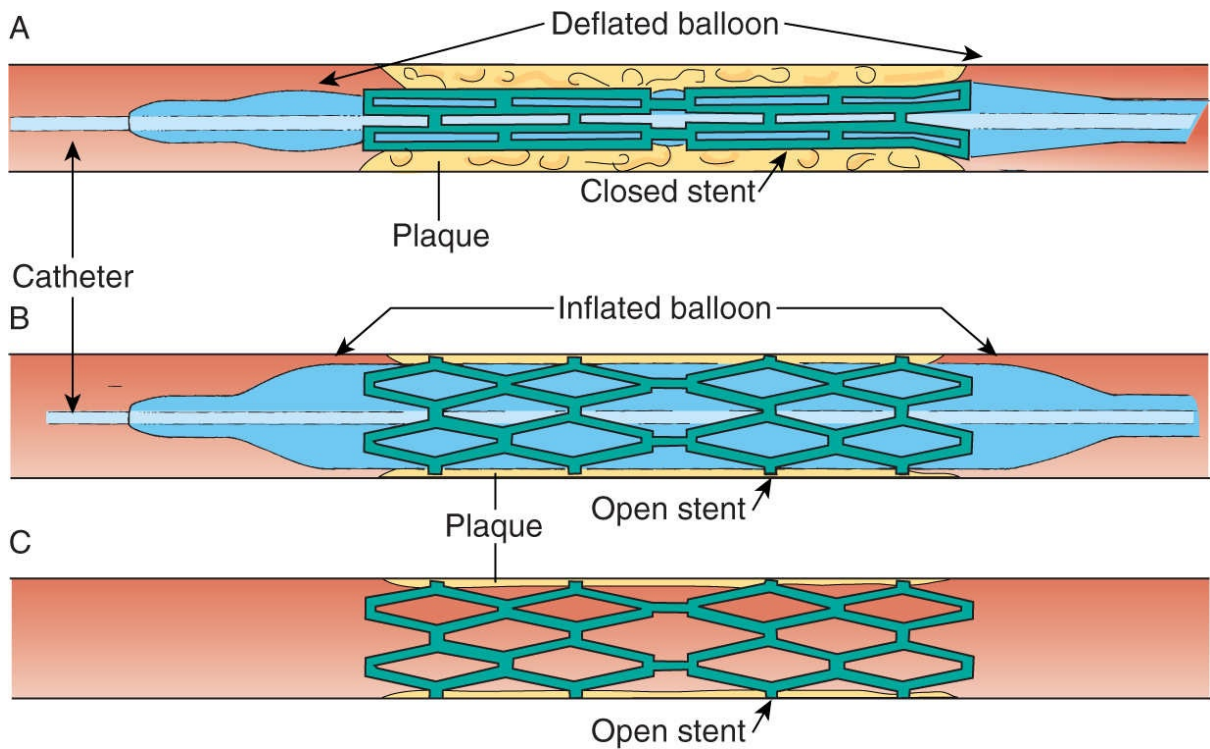


FIGURE 10-9 Arterial stent. **A.** A balloon-tipped catheter is placed into the artery with the balloon deflated and the stent closed. **B.** When the stent is in the proper position of the narrowed artery, the balloon is inflated, causing the stent to open. **C.** The catheter is removed, and the stent remains in place.

- **Coronary artery bypass graft (CABG)** is a surgical procedure in which a damaged section of a coronary artery is replaced or bypassed with a graft vessel (see **Figure 10-10**).

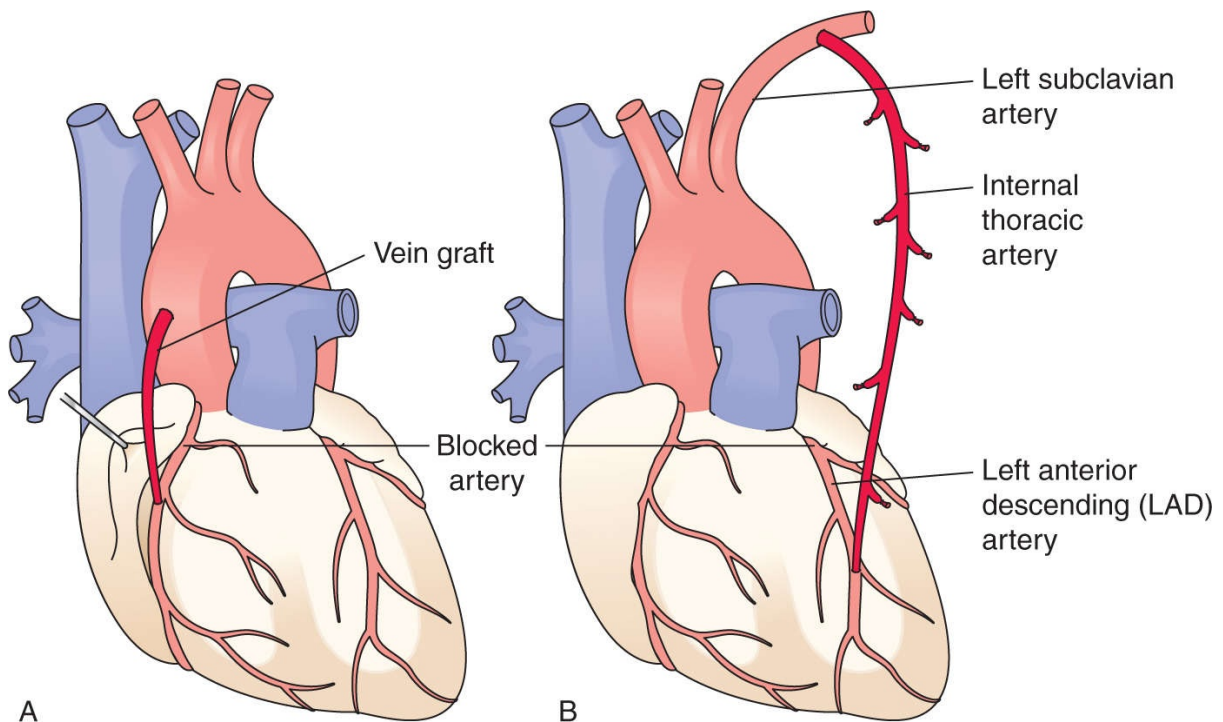


FIGURE 10-10 Coronary artery bypass graft (CABG). **A.** A segment of the saphenous vein extracted from the leg is used to carry blood from the aorta to a part of the right coronary artery that is distal to the occlusion. **B.** The internal thoracic artery from the chest is used to bypass an obstruction in the left anterior descending artery. The graft redirects the blood flow or “bypasses” the blocked artery.

- **Endarterectomy** is the removal of the inner lining of a blocked artery.

PRACTICE AND PRACTITIONERS

The specialists who treat disorders of the cardiovascular system include cardiologists, cardiovascular surgeons, and hematologists. **Cardiologists** diagnose and treat heart disorders. **Cardiovascular surgeons** surgically correct disorders of the cardiovascular system. **Hematologists** treat disorders of the blood.

Abbreviation Table THE CARDIOVASCULAR SYSTEM

ABBREVIATION	MEANING
A-fib	atrial fibrillation
AV	atrioventricular
BP	blood pressure
CABG	coronary artery bypass graft
CAD	coronary artery disease
CCU	cardiac care unit
CHF	congestive heart failure
DIC	disseminated intravascular coagulation
EKG or ECG	electrocardiogram, electrocardiograph, electrocardiography, cardiogram
Hb	hemoglobin (protein in the blood that carries oxygen)
HDL	high-density lipoprotein
HR	heart rate
HTN	hypertension

LDL	low-density lipoprotein
MI	myocardial infarction
PTCA	percutaneous transluminal coronary angioplasty
RBC	red blood cell
Rh ⁺ , Rh ⁻	symbol for Rh blood group; Rh positive, Rh negative
SA	sinoatrial
SOB	shortness of breath
TIA	transient ischemic attack
WBC	white blood cell

Study Table THE CARDIOVASCULAR SYSTEM

TERM AND PRONUNCIATION	ANALYSIS	MEANING
Structure and Function		
aorta (ay-OR-tah)	from the Greek word <i>aeirein</i> (to lift up or to be hung)	the main trunk of the systemic arterial system
aortic valve (ay-ORT-ikvalv)	from the Greek word <i>aeirein</i> (to lift up or to be hung); from the Latin word <i>valva</i> (that which turns)	valve between the left ventricle to the aorta; also called <i>aortic semilunar valve</i>
apex (A-peks)	from the Latin for summit or tip	the pointed inferior portion of the heart
arteries (AR-tuh-rees)	from the Greek word <i>arteria</i> (windpipe)	the largest of the blood vessels that carry blood away from the heart
arterioles (ar-TEER-ee-oles)	from the Greek word <i>arteria</i> (windpipe)	the smallest arteries that connect with the capillaries
atria (singular: atrium) (AY-tree-ah; AY-tree-uhm)	a Latin word meaning “entry hall”	upper two of the four heart chambers, composed of the right atrium and left atrium
atrioventricular node (AY-tree-oh-ven-TRIK-u-lahr); AV node	from the Latin word meaning “entry hall”; from the Latin <i>venter</i> (belly)	fibers located at the base of the right atrium near the ventricle that carry electrical stimulation to the AV bundle

atrioventricular valve (ay-tree-oh-ven-TRIK-yoo-ler valv)	from the Greek word <i>arteria</i> (windpipe); from the Latin word <i>venter</i> (belly)	a valve between an atria and a ventricle; there are two AV valves, a right and a left
basophil (BAY-soh-fil)	from the Greek <i>basis</i> and <i>philein</i> (to love)	a WBC with granules that stain with basic dyes
bicuspid valve (by-KUSS-pidvalv)	<i>bi</i> -(two); from the Latin <i>cuspidem</i> (cusp or point); from the Latin word <i>valva</i> (that which turns)	flap (valve) between the left atrium and left ventricle; also called <i>mitral valve</i>
bundle of His (BUHN-dl ov-hiz)	named for Swiss cardiologist Wilhelm His, Jr., who discovered the function of these cells in 1893	located at the top of the interventricular septum; carries electrical impulses from the AV node to Purkinje fibers
capillaries (KAP-ih-layr-ees)	from the Latin word <i>capillus</i> (hair)	the smallest of the blood vessels where gas and nutrient exchange occurs
cardiac cycle (KAR-dee-ak SIGH-kuhl)	<i>cardi/o</i> (heart); <i>-ac</i> (adjective ending)	a complete round of systole and diastole
conducting system of the heart	common English words	The system of muscle fibers comprising the SA node, internodal pathways, AV node and bundle, right and left bundle branches, and Purkinje fibers
diastole (dye-AS-toh-lee)	from the Greek word <i>diastole</i> (dilation)	relaxation phase of the heart
endocardium (en-doh-KAR-dee-uhm)	<i>endo-</i> (within); <i>cardi/o</i> (heart)	the inner lining of the heart
eosinophil (ee-oh-SIHN-oh-fil)	from the Greek words <i>eos</i> (dawn); <i>philein</i> (to love)	a WBC that stains with certain dyes
epicardium (ep-ih-KAR-dee-uhm)	<i>epi-</i> (on, upon); <i>cardi/o</i> (heart)	the outer covering of the heart
erythrocytes (er-RITH-ro-sites)	<i>erythr/o</i> (red); <i>-cyte</i> (cell)	RBCs that carry oxygen
heartbeat (HART-beet)	common English word	a complete cycle of heart contraction and relaxation
heart rate (HART REYT)	common English words	the number of times per minute the heart contracts
hemoglobin (Hb) (hee-mo-GLO-bihn)	<i>hem-</i> (blood); from the Latin <i>globus</i> (globe)	the protein that gives blood its red color
inferior vena cava (in-FEER-ee-er VEE-nah KAV-ah)	<i>inferior</i> , a Latin word meaning “lower”; from the Latin words <i>vena</i> (vein); <i>cava</i> (hollow)	large vein that collects blood from the smaller veins of the lower body
left atrium (left AY-tree-uhm)	a Latin word meaning “entry hall”	upper left heart chamber

left ventricle (left VEN-tri-kul)	from the Latin word <i>venter</i> (belly)	lower left heart chamber
leukocytes (LUKE-o-sytes)	<i>leuk/o</i> (white); <i>-cyte</i> (cell)	WBCs that play a role in immunity
lumen (LOO-muhn)	Latin for “light”; in anatomy used to describe an opening or passageway	the space in the interior of a hollow tubular structure like an artery
lymphocyte (LIM-foh-site)	from the Latin <i>lympho-</i> (lymph); <i>-cyte</i> (cell)	one of five types of WBC; distributed throughout lymphatic tissue
mitral valve (MY-trahlvalv)	from the Latin word <i>mitra</i> (turban); from the Latin word <i>valva</i> (that which turns)	flap (valve) between the left atrium and the left ventricle; also called <i>bicuspid valve</i>
monocyte (MON-oh-site)	<i>mon/o</i> (single); <i>-cyte</i> (cell)	a relatively large WBC
myocardium (my-oh-KAR-dee-uhm)	<i>my/o</i> (muscle); <i>cardi/o</i> (heart)	the heart muscle, which includes nerves and blood vessels
neutrophil (NU-troh-fil)	from the Latin word <i>neuter</i> (neither); from the Greek word <i>philein</i> (to love)	a mature WBC normally constituting more than half of the total number of leukocytes
pericardium (pehr-ih-KAR-dee-uhm)	<i>peri-</i> (surrounding); <i>cardi/o</i> (heart)	sac that surrounds the heart
plasma (PLAZ-muh)	a Greek word meaning “something molded” or “created”	the fluid portion of blood consisting mainly of water
platelets (PLATE-lets)	from the English word plate and the diminutive suffix <i>-let</i>	smallest of the formed elements; important in the clotting process; also called <i>thrombocytes</i>
pulmonary artery (PULL-moh-nahr-ee AHR-tuh-ree)	<i>pulmon/o</i> (lung); from the Greek word <i>arteria</i> (windpipe)	vessel that carries deoxygenated blood from the right ventricle to the lungs
pulmonary circuit (PULL-moh-nahr-ee SER-kit)	<i>pulmon/o</i> (lung); from the Latin word <i>circuitus</i> (going around)	passage of blood from the right ventricle through the pulmonary arteries to the lungs and back through the pulmonary veins to the left atrium
pulmonary valve (PULL-moh-nahr-eevalv)	<i>pulmon/o</i> (lung); from the Latin word <i>valva</i> (that which turns)	valve between the right ventricle and lungs; also called <i>pulmonary semilunar valve</i>
pulmonary veins (PULL-moh-nahr-eevayns)	<i>pulmon/o</i> (lung); from the Latin word <i>vena</i> (blood vessel)	vessels that carry oxygenated blood from the lungs to the left atrium
pulse (puhls)	from the Latin word <i>pulsum</i> (push, knock, drive)	rhythmic expansion and contraction of an artery produced by pressure of the blood moving through the artery
Purkinje fibers (per-KIN-jee FIGH-berz)	named after Jan Evangelista Purkinje, who discovered them in 1839	fibers that carry stimulation throughout the ventricles

red blood cells (red blud selz)	common English words	erythrocytes that contain Hb for carrying blood
Rh factor (AR-h FAK-ter)	from rh(esus), so-called because the blood group was discovered in rhesus monkeys	an antigen, first discovered in the rhesus monkey; a person is either Rh positive or Rh negative
right atrium (rite AY-tree-uhm)	a Latin word meaning “entry hall”	upper right heart chamber
right ventricle (rite VEN-trik-al)	from the Latin word <i>venter</i> (belly)	lower right heart chamber
semilunar valve (sem-ee-LOO-ner valv)	<i>semi-</i> (half); from the Latin word <i>luna</i> (moon)	a heart valve at the exit of a ventricle; pulmonary semilunar valve and aortic semilunar valve
septa (singular: septum) (SEPP-tah; SEPP-tuhm)	from the Latin word <i>saeptum</i> (a fence)	thin wall that separates cavities or masses; in the heart, septa separate the right atrium from the left atrium and the right ventricle from the left ventricle
sinoatrial node (SA node) (SYE-noh-AY-tree-ahl nohd)	from the Latin words <i>sinus</i> (bend, fold, curve) and <i>atrium</i> (entry hall)	known as the pacemaker of the heart; electrical impulse originates here
sinus rhythm (SYE-nus RITH-uhm)	<i>sinus</i> , a Latin word meaning “bend,” “fold,” “curve”; from the Greek word <i>rhythmos</i> (measured flow or movement)	normal rhythm of the heartbeat
superior vena cava (suh-PEER-ee-er VEE-nah KAV-ah)	<i>superior</i> , a Latin word meaning “higher”; from the Latin words <i>vena</i> (vein) and <i>cava</i> (hollow)	large vein that collects blood from the smaller veins of the upper body
systemic circuit (sis-TEM-ik SER-kit)	from the Greek word <i>systema</i> (an organized whole); from the Latin word <i>circuitus</i> (going around)	circulation of blood through the arteries, capillaries, and veins of the general system, from the left ventricle to the right atrium
systole (SIS-toh-lee)	a Greek word meaning “contraction”	contraction phase of the heart
thrombocyte (THROM-boh-site) (also called platelet)	from the Greek word <i>thrombos</i> (clot of blood); <i>-cyte</i> (cell)	smallest of the formed elements; important in the coagulation process
tricuspid valve (try-KUSS-pidvalv)	<i>tri-</i> (three); from the Latin <i>cuspidem</i> (cusp or point)	valve between the right atrium and the right ventricle; also called <i>right AV valve</i>
troponin (TROH-poh-nihn)	from the Greek word <i>trepein</i> (to turn)	a muscle protein that is released into the bloodstream when a heart attack occurs
vascular (VASS-cue-lahr)	<i>vascul/o</i> (blood vessel); <i>-ar</i> (adjective suffix)	adjectival form of <i>vessel</i>
veins (VAYNS)	from the Latin word <i>vena</i> (vein)	the blood vessels that return blood from the tissues to the heart

venous (VEE-nuhs)	from the Latin word <i>vena</i> (vein)	adjectival form of <i>vein</i>
venules (VEEN-yuhlz)	from the Latin <i>venula</i> (diminutive form of <i>vena</i> [vein])	small veins
ventricle (VEN-tri-kul)	from the Latin word <i>venter</i> (belly)	lower two of the four heart chambers, composed of the right ventricle and left ventricle
white blood cells (wite blud selz)	common English words	formed element in the blood that protects the body against harmful bacteria
Disorders		
anemia (ah-NEE-mee-a)	from the Greek word <i>anaimia</i> (without blood)	abnormally low RBC count
aneurysm (AN-yur-iz-um)	from the Greek word <i>aneurysmos</i> (to dilate)	a localized dilation of an artery, cardiac chamber, or other vessel
angina pectoris (an-JY-nuh PEK-tor-is)	from the Greek word <i>agkhone</i> (a strangling); also <i>angere</i> (anguish); <i>pectoris</i> , a Latin word meaning “chest”	pain in the chest due to ischemia
angiospasm (AN-jee-o-spaz-uhm)	<i>angi/o</i> (blood vessel); from the Greek word <i>spasmos</i> (spasm)	spasm in blood vessels
angiostenosis (AN-jee-o-steh-NO-siss)	<i>angi/o</i> (blood vessel); <i>-stenosis</i> (a narrowing)	narrowing of a blood vessel
arrhythmia (ah-RITH-mee-ah)	<i>a-</i> (without); from the Greek word <i>rhythmos</i> (measured flow or movement); <i>-ia</i> (condition)	abnormal rhythm; irregular heartbeat
arteriosclerosis (ar-TEER-ee-o-sklu-RO-sis)	from the Greek word <i>arteria</i> (windpipe); <i>scler/o</i> (hardness); <i>-osis</i> (abnormal condition of)	hardening of the arteries
arteriospasm (ar-TEER-ee-o-spaz-uhm)	from the Greek word <i>arteria</i> (windpipe); from the Greek word <i>spasmos</i> (a spasm or convulsion)	spasm of an artery
arteriostenosis (ar-TEER-ee-oh-steh-NO-sihs)	from the Greek word <i>arteria</i> (windpipe); <i>-steno</i> (narrow); <i>-osis</i> (abnormal condition)	narrowing of an artery
atheroma (ath-er-OH-mah)	from the Greek word <i>ather</i> (groats, porridge); <i>-oma</i> (tumor)	fatty deposit or plaque within the arterial wall
atherosclerosis (ath-er-oh-skleh-ROH-sis)	<i>ather/o</i> (fatty); <i>scler/o</i> (hardening); <i>-osis</i> (abnormal condition of)	hardening and narrowing of the arteries
atrial fibrillation (A-fib) (fih-	from the Latin word <i>atrium</i> (entry hall) -	rapid, random, ineffective contractions

brih-LAY-shun)	<i>al</i> (adjective suffix); from the Latin word <i>fibra</i> (fiber, string, thread)	of the atrium
atriomegaly (AY-tree-oh-MEG-ah-lee)	from the Latin word <i>atrium</i> (hall); <i>-megaly</i> (enlargement)	enlargement of an atrium
bradycardia (bray-dee-KAR-dee-ah)	<i>brady-</i> (slow); <i>cardi/o</i> (heart); <i>-ia</i> (condition)	abnormally slow heartbeat
cardiac arrest (KAR-dee-ak)	<i>cardi/o</i> (heart); from the Latin words <i>ad</i> and <i>restare</i> (to stop, remain behind)	cessation of heart activity
cardiomegaly (kar-dee-oh-MEG-ah-lee)	<i>cardi/o</i> (heart); <i>-megaly</i> (enlargement)	enlargement of the heart
cardiomyopathy (kar-dee-oh-my-AWP-uh-thee)	<i>cardi/o</i> (heart); <i>my/o</i> (muscle); <i>-pathy</i> (disease)	disease of the heart muscle (myocardium)
cardiopathy (kar-dee-AWP-uh-thee)	<i>cardi/o</i> (heart); <i>-pathy</i> (disease)	any heart disease
cardiorrhexis (kar-dee-oh-REX-ihs)	<i>cardi/o</i> (heart); <i>-rrhexis</i> (rupture)	rupture in the heart wall
carditis (kar-DY-tiss)	<i>cardi/o</i> (heart); <i>-itis</i> (inflammation)	inflammation of the heart
congestive heart failure (CHF) (kuhn-JEST-iv hart FEYL-yer)	from the Latin word <i>congerere</i> (to bring together, pile up)	syndrome where the heart is unable to pump enough blood to meet the body's needs for oxygen and nutrients; as a result, fluid is retained and accumulates in the ankles and legs
coronary artery disease (CAD) (KAWR-u-ner-ee AHR-tuh-ree dih-ZEEZ)	from the Latin <i>coronarius</i> (of a crown); from the Greek word <i>arteria</i> (windpipe)	narrowing of the lumen of one or more coronary arteries, usually due to atherosclerosis
disseminated intravascular coagulation (DIC) (dih-SEMM-ihn-ay-ted ihn-tra-VASS-kyu-lahr koh-AG-yu-LAY-shun)	from the Latin <i>dis-</i> (in every direction); <i>seminare</i> (to plant, propagate); <i>intra-</i> (within); <i>vascul/o</i> (vessel); <i>-ar</i> (adjective suffix); coagulation (from the Latin verb <i>coagulo</i> [curdle])	widespread clotting and obstruction of blood flow to the tissues
dyscrasia (dys-KRAY-sha)	<i>dys-</i> (bad, difficult); from the Greek word <i>krasis</i> (mingling)	general term for a blood disorder
embolus (EM-bow-lus)	from the Greek word <i>embolus</i> (plug or stopper)	a blood clot that is carried in the bloodstream
endocarditis (en-doh-kar-DY-tiss)	<i>endo-</i> (within); <i>cardi/o</i> (heart); <i>-itis</i> (inflammation)	inflammation of the endocardium
fibrillation (fib-ruh-LEY-shun)	from the Latin word <i>fibrilla</i> (little fiber)	exceedingly rapid contractions or twitching of muscle fibers
hemolysis (hee-MAWL-ih-sihs)	<i>hem/o</i> (blood); <i>-lysis</i> (destruction)	change or destruction of RBCs

hemophilia (hee-mo-FEEL-ee-ya)	<i>hem/o</i> (blood); <i>-phil(ia)</i> (attraction)	congenital disorder impeding the coagulation process
hemorrhage (HEM-o-rij)	<i>hem/o</i> (blood); <i>-rrhage</i> (burst forth)	discharge of blood; bleeding
hyperlipidemia (high-per-LIP-ih-DEE-mee-ah)	<i>hyper-</i> (above normal); <i>lip/o</i> (fat); <i>-demia</i> (from hema [blood])	elevated cholesterol, triglycerides, and lipoproteins in the blood
hypertension (high-per-TEN-shun)	<i>hyper-</i> (above normal); from the Latin word <i>tendere</i> (to stretch)	elevated BP (>140/90 mm Hg)
hypertrophy (high-PUR-troh-fee)	<i>hyper-</i> (above normal); <i>-trophy</i> (nourishment)	increase in size of a part or organ
ischemia (is-KEE-mee-ah)	from the Greek word <i>iskhaimos</i> (a stopping of the blood); <i>-ia</i> (condition)	deficiency in blood supply and oxygen to the tissues
leukemia (loo-KEE-mee-uh)	leukos (Greek word for “white”); <i>-emia</i> (blood)	progressive proliferation of abnormal leukocytes
myocardial infarction (MI) (my-oh-KAR-dee-ahl in-FARK-shun)	<i>my/o</i> (muscle); <i>cardi/o</i> (heart); <i>-al</i> (adjective suffix); from the Latin word <i>infractioem</i> (a breaking)	heart attack
myocarditis (my-oh-kar-DY-tiss)	<i>my/o</i> (muscle); <i>cardi/o</i> (heart); <i>-itis</i> (inflammation)	inflammation of the heart muscle
pericarditis (pehr-ih-kar-DY-tiss)	<i>peri-</i> (surrounding); <i>cardi/o</i> (heart); <i>-itis</i> (inflammation)	inflammation of the pericardium
secondary hypertension (SEK-uhn-der-ee high-per-TEN-shun)	<i>hyper-</i> (above normal); from the Latin word <i>tendere</i> (to stretch)	hypertension due to a known cause
tachycardia (tak-ih-KAR-dee-ah)	<i>tachy-</i> (fast); <i>cardi/o</i> (heart); <i>-ia</i> (condition)	abnormally rapid heartbeat
thrombocytopenia (THROM-boh-sigh-toh-PEE-nee-ah)	<i>thromb/o</i> (blood clot); <i>cyt/o</i> (cell); <i>-penia</i> (deficiency)	abnormal decrease in the number of thrombocytes (platelets)
transient ischemic attack (TIA) (TRAN-see-ent is-KEE-mik uh-TAK)	isch: root from the Greek word for restricting or thinning; <i>-emia</i> , suffix referring to blood	sudden loss of neurologic function with complete recovery usually within 24 h; mini-stroke
thrombus (THROM-bus)	<i>thromb/o</i> (blood clot)	blood clot attached to an interior wall of a vein or artery
thrombosis (throm-BOH-sis)	Greek word for “a clumping or curdling”	formation or presence of a thrombus (blood clot)
valvulitis (valv-yu-LY-tiss)	from the Latin word <i>valva</i> (that which turns); <i>-itis</i> (inflammation)	inflammation of a heart valve

vasculitis (also angiitis)(VAS-kyu-ligh-tis)	<i>vascul/o</i> (blood vessel); <i>-itis</i> (inflammation)	inflammation of a vessel
vasoconstriction (VAZE-oh-kon-STRIK-shun)	<i>vas/o</i> (duct, blood vessel); from the Latin word <i>constringere</i> (to draw tight)	narrowing of blood vessels
vasodilation (VAZE-oh-dy-LAY-shun)	<i>vas/o</i> (vessel); from the Latin word <i>dilatere</i> (to make wider)	widening of blood vessels
ventricular fibrillation (ven-TRIK-yoo-ler fib-ruh-LAY-shun)	from the Latin word <i>venter</i> (belly); from the Latin word <i>fibrilla</i> (little fiber)	exceedingly rapid contractions or twitching of ventricular heart muscle that replaces normal contraction
Diagnostic Tests, Treatments, and Surgical Procedures		
ablation (ah-BLAY-shun)	from the Latin words <i>ab-</i> (away); and <i>latus</i> (brought)	partial destruction of the pathway of the electrical conducting system of the heart to treat irregular heart rhythms
angiogram (AN-jee-oh-gram)	<i>angi/o</i> (blood vessel); <i>-gram</i> (record or picture)	printed record obtained through angiography
angiography (an-jee-AWG-ruff-ee)	<i>angi/o</i> (blood vessel); <i>-graphy</i> (process of recording)	radiography of a blood vessel after injection of a contrast dye
angioplasty (AN-jee-oh-plass-tee)	<i>angi/o</i> (blood vessel); <i>-plasty</i> (surgical repair)	surgical repair of a blood vessel
antianginals (an-tee-AN-jih-nulz)	<i>anti-</i> (against); from the Greek <i>ankhone</i> (strangling); <i>-al</i> (adjective suffix)	drugs used to treat chest pain
antiarrhythmics (an-tee-uh-RITH-micks)	<i>anti-</i> (against); <i>a-</i> (without); from the Greek word <i>rhythmos</i> (measured flow or movement)	drug used to treat rhythm abnormalities
arterial stent (ar-TEER-ee-ul stent)	English word <i>stenting</i> refers to the process of stiffening	a device implanted into an artery to open and provide support to the arterial wall
atrioseptoplasty (AY-tree-oh-SEP-toh-plass-tee)	from the Latin words <i>atrium</i> (entry hall) and <i>saeptum</i> (fence); <i>-plasty</i> (surgical repair)	surgical repair of an atrial septum
cardiac catheterization (KAR-dee-ak KATH-eh-ter-eye-zay-shun)	<i>cardi/o</i> (heart); <i>-ac</i> (pertaining to); from the Greek word <i>kathienai</i> (to let down, thrust in)	procedure where a catheter is inserted into an artery and guided into the heart; may be used for diagnosis of blockages or for treatment
cardiac glycosides (KAR-dee-ak GLYE-koh-sides)	<i>cardi/o</i> (heart); <i>-ac</i> (pertaining to); <i>glyc/o</i> (sugar) + <i>-ide</i>	drugs used to improve heart output by increasing the muscular contraction
cardiogram (KAR-dee-oh-gram)	<i>cardi/o</i> (heart); <i>-gram</i> (record or picture)	a graphic trace of electrical activity in the heart

cardiotomy (kar-dee-AW-tuh-mee)	<i>cardi/o</i> (heart); <i>-tomy</i> (cutting operation)	incision into the heart or incision into the cardia of the stomach
cardioversion (KAR-dee-oh-VER-zhun)	<i>cardi/o</i> (heart); from the Latin word <i>vertere</i> (to turn)	use of electrical shock to restore the heart's normal rhythm
coronary artery bypass graft (CABG) (KAWR-uh-ner-ee AHR-tuh-ree BYE-pas graft)	from the Latin <i>cor</i> (heart); from the Greek word <i>arteria</i> (windpipe); common English words	through an open chest, a graft (piece of vein or other heart artery) is implanted on the heart to bypass a blockage
diuretic (DYE-ur-eh-tik)	from the Greek word <i>diouretikos</i> (prompting urine)	a drug used to increase urination and thereby decrease water content in blood to decrease BP
echocardiography (EK-oh-KAR-dee-AH-grah-fee)	from the Greek word <i>ekhe</i> (sound); <i>cardi/o</i> (heart); <i>-graphy</i> (process of recording)	ultrasonic procedure used to evaluate the structure and motion of the heart
electrocardiogram (ee-LEK-troh-KAR-dee-oh-gram)	<i>electro-</i> (electricity); Greek <i>kardia</i> (heart); <i>gramma</i> (drawing)	graphic record of the heart's action currents
electrocardiograph (ee-LEK-troh-KAR-dee-oh-graf)	<i>electro-</i> (electricity); <i>kardia</i> (heart); <i>graph</i> (instrument for recording)	an instrument for recording the electrical currents that traverse the heart
endarterectomy (end-art-er-ECK-toh-mee)	<i>endo-</i> (within); <i>arteri/o</i> (artery); <i>-ectomy</i> (excision)	surgical removal of the lining of an artery
nuclear stress test (NOO-klee-er-stres test)	common English words	assessment of blood flow through the heart through the use of a nuclear element injection while the patient exercises
percutaneous transluminal coronary angioplasty (PTCA) (pur-kyoo-TEY-nee-uhs trans-LOO-min-uhl KAWR-uh-ner-ee AN-jee-uh-plas-tee)	<i>per-</i> (through); <i>cutane/o</i> (skin); <i>trans-</i> (across, through); <i>lumen</i> (passage); <i>coron/o</i> (crown); <i>angi/o</i> (blood vessel); <i>-plasty</i> (surgical repair)	an operation for enlarging the narrowed lumen of a coronary artery by inflating and withdrawing a balloon on the tip of an angiographic catheter
pericardiotomy (PEHR-ih-car-dee-AW-toh-mee)	<i>peri-</i> (surrounding); <i>cardi/o</i> (heart); <i>-tomy</i> (cutting operation)	incision into the pericardium
sphygmomanometer (SFIG-moh-mah-NOM-eh-ter)	from the Greek words <i>sphygmos</i> (pulse), <i>manos</i> (thin), <i>metros</i> (measure)	instrument used to measure BP
statins (STAT-inz)	from lovastatin, from <i>lo</i> + <i>vastatin</i> (stuff)	a class of cholesterol-lowering drug
valvoplasty (VALV-oh-plass-tee); also valvuloplasty (VALV-yu-loh-plass-tee)	from the Latin word <i>valva</i> (that which turns); <i>-plasty</i> (surgical repair)	surgical repair of a heart valve
valvotomy (valv-AW-toh-mee)	from the Latin word <i>valva</i> (that which turns); <i>-tomy</i> (cutting operation)	surgical removal of a blocked heart valve (stenosis of a heart valve) by cutting into it; also called <i>valvulotomy</i>

Practice and Practitioners

cardiologist (kar-dee-AWL-oh-jist)	<i>cardi/o</i> (heart); <i>-logist</i> (one who specializes)	heart specialist
cardiology (kar-dee-AWL-oh-jee)	<i>cardi/o</i> (heart); <i>-logy</i> (study of)	medical specialty dealing with the heart
cardiovascular surgeon (kar-dee-oh-VAS-kyoo-ler SUR-jun)	<i>cardi/o</i> (heart); <i>vas/o</i> (vessel)	a medical practitioner who surgically corrects disorders of the cardiovascular system
hematologist (HEE-mah-tah-logist)	<i>hemat/o</i> (blood); <i>-logist</i> (one who specializes)	blood specialist
hematology (HEE-mah-TAH-lo-jee)	<i>hemat/o</i> (blood); <i>-logy</i> (study of)	medical specialty dealing with blood

END-OF-CHAPTER EXERCISES

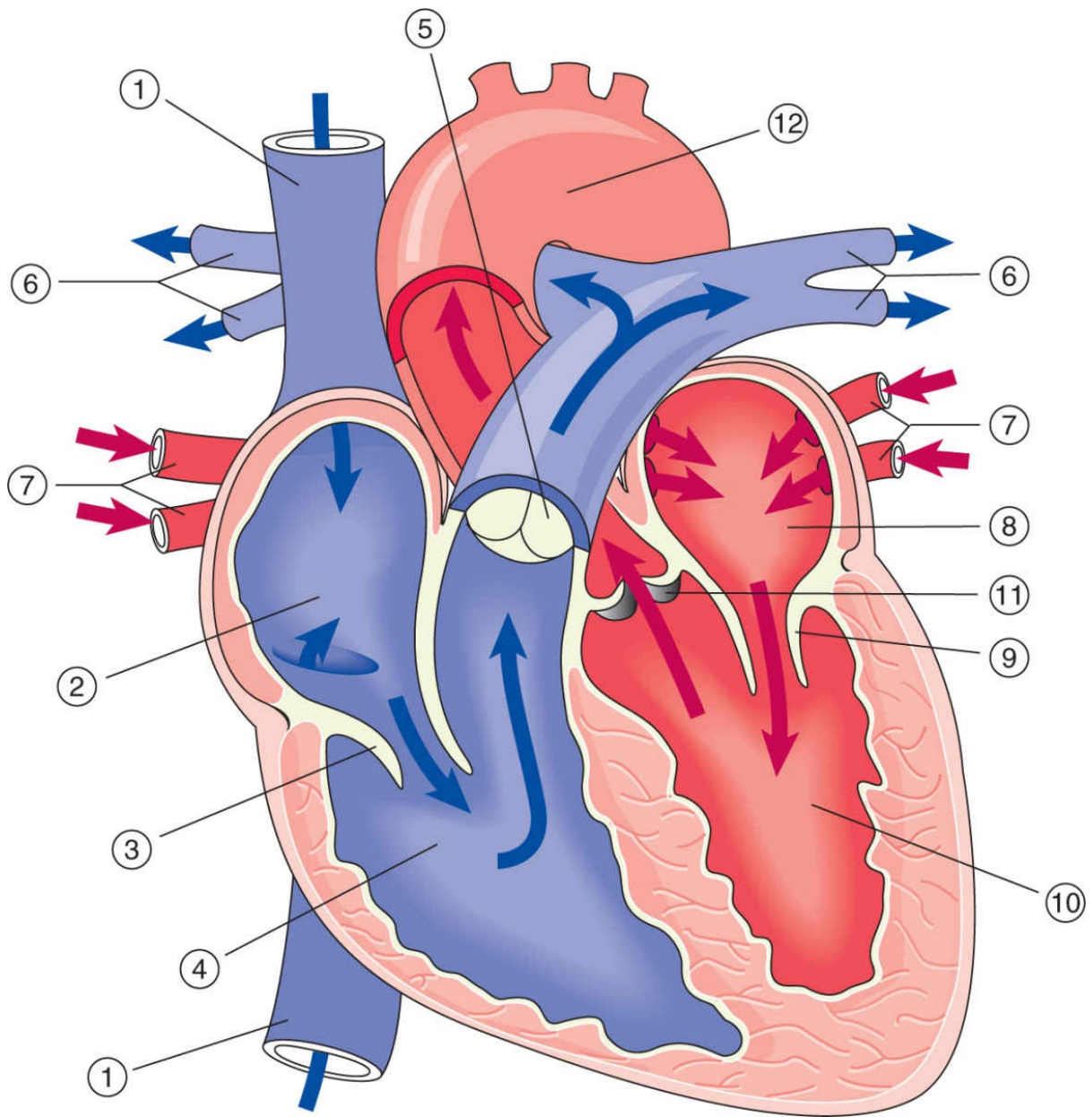
EXERCISE 10-1



LABELING

Using the following list, choose the correct terms to label the diagram correctly.

- | | | |
|----------------|------------------------|---------------------------------|
| aorta | left AV (mitral) valve | right atrium |
| aortic valve | pulmonary arteries | right ventricle |
| left atrium | pulmonary valve | superior and inferior vena cava |
| left ventricle | pulmonary veins | right AV (tricuspid) valv |



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

10. _____

11. _____

12. _____

EXERCISE 10-2



WORD PARTS

Break each of the following terms into its word parts: prefix, root, or suffix. Give the meaning of each word part and then define the term.

1. erythrocyte

root: _____

suffix: _____

definition: _____

2. atherosclerosis

root: _____

root: _____

suffix: _____

definition: _____

3. cardiomyopathy

root: _____

root: _____

suffix: _____

definition: _____

4. endocarditis

prefix: _____

root: _____

suffix: _____

definition: _____

5. thrombocytopenia

root: _____

root: _____

suffix: _____

definition: _____

6. angiogram

root: _____

suffix: _____

definition: _____

7. hematology

root: _____

suffix:

definition: _____

8. pericardiotomy

prefix: _____

root: _____

suffix:

definition: _____

EXERCISE 10-3



WORD BUILDING

Use the word parts listed to build the terms defined.

a-, an- -dilation

inter-

peri-

valv/o

angio/o -ectomy

leuk/o

-philia

vas/o

arteri/o -emia

-lysis

-rhythm

ven/o

ather/o erythr/o

-megaly

-spasm

ventricul/o

atri/o -genic

my/o

-stenosis

cardi/o hem/o; hemat/o

-oma

thromb/o

-cyte -ic, -ia, -ac, -al, -ar, -ary -ous, -um -penia

-tomy

1. originating in the heart _____
2. an incision into the atrium _____
3. an RBC _____
4. hereditary bleeding disorder caused by a deficiency of a clotting factor _____
5. spasm of a vein _____
6. removal of a blood clot _____
7. dilation of a vessel _____
8. enlargement of the heart _____
9. narrowing of an artery _____
10. fatty plaque _____
11. a WBC _____
12. the surgical removal of a valve _____
13. pertaining to the heart _____
14. destruction of RBCs _____
15. between the ventricles _____
16. an abnormally low level of Hb _____
17. heart muscle _____
18. removal of a fatty plaque _____
19. abnormal heart rhythm _____

EXERCISE 10-4



MATCHING

Match the term with its definition.

- | | |
|------------------------|---|
| 1. _____ ischemia | a. pacemaker of the heart |
| 2. _____ anemia | b. electric current used to restore normal sinus rhythm |
| 3. _____ cardioversion | c. surgical removal of the inner lining of an artery |

- | | |
|--|---|
| 4. _____ SA node | d. abnormality of the blood |
| 5. _____ Hb | e. thrombocytes |
| 6. _____
vasoconstriction | f. a protein in the RBC |
| 7. _____ tricuspid
valve | g. deficiency of blood flow to an organ |
| 8. _____
endarterectomy | h. vessels are narrowed |
| 9. _____ platelets | i. low level of Hb in the blood |
| 10. _____ dyscrasia | j. between the right atrium and right ventricle |

EXERCISE 10-5



MULTIPLE CHOICE

Choose the correct answer for the following multiple choice questions.

- Which of the following is a type of WBC?
 - thrombocyte
 - eosinophil
 - erythrocyte
 - platelet
- What is the term that describes the destruction of bacteria by special WBCs?
 - phagocytosis
 - leukocytosis
 - erythrocytosis
 - neutrophilosis
- Platelets are also referred to as _____.
 - erythrocytes
 - thrombocytes
 - basophils

- d. neutrophils
4. Oxygen-carrying pigment of RBCs is called _____.
- a. hematocrit
 - b. Hb
 - c. leukemia
 - d. gamma globulin
5. Which of the following is a malignant disease of the blood?
- a. leukemia
 - b. leukopenia
 - c. erythropenia
 - d. thrombosis
6. Which of the following terms describes hardened tissue?
- a. sclerotic
 - b. thrombotic
 - c. occluded
 - d. fibrillated
7. The heart muscle is supplied with blood vessels called _____.
- a. capillaries
 - b. coronary arteries
 - c. corpuscles
 - d. carpals
8. What is the function of a leukocyte?
- a. transports O₂
 - b. manufactures Hgb
 - c. initiates coagulation
 - d. defends against disease
9. Which is the smallest blood vessel?

- a. artery
 - b. arteriole
 - c. vein
 - d. capillary
10. Which of the following is characteristic of the artery in arteriostenosis?
- a. hardened
 - b. soft
 - c. dilated
 - d. narrowed

EXERCISE 10-6



FILL IN THE BLANK

Fill in the blank with the correct answer.

1. The term for low BP is _____.
2. The term for a rapid pulse rate is _____.
3. A _____ is medical specialist who deals with blood.
4. The artery that carries blood out of the heart to the lung is the _____ artery.
5. The “universal donor” is the blood type _____ while the “universal recipient” is the blood type _____.
6. The study of the heart and heart conditions is _____.
7. An incision into a vein is a _____.
8. Elevated blood fat is called _____.
9. The mitral valve is also called the left AV valve and the _____ valve.
10. The two veins that carry blood into the right atrium are the _____ and the _____.

EXERCISE 10-7



ABBREVIATIONS

Write out the term for the following abbreviations.

1. _____ BP
2. _____ A-fib
3. _____ LDL
4. _____ SOB
5. _____ WBC
6. _____ AV
7. _____ CAD
8. _____ CHF
9. _____ HR
10. _____ Hb
11. _____ MI
12. _____ TIA

Write the abbreviation for the following terms.

13. _____ hemoglobin
14. _____ atrial fibrillation
15. _____ red blood cell
16. _____ sinoatrial
17. _____ congestive heart failure
18. _____ electrocardiogram
19. _____ coronary artery bypass graft
20. _____ hypertension
21. _____ disseminated intravascular coagulation
22. _____ high-density lipoprotein
23. _____ percutaneous transluminal coronary
angioplasty

EXERCISE 10-8



SPELLING

Select the correct spelling of the medical term.

1. The _____ BP reflects the arterial pressure during relaxation of a cardiac chamber.
 - a. distolic
 - b. diastolic
 - c. diatolic
 - d. diastollic
2. An adjective meaning “related to the myocardium” is _____.
 - a. myocardial
 - b. mycardial
 - c. myocardal
 - d. miocardial
3. A deficiency in blood supply to the tissues is _____.
 - a. ichemia
 - b. iscemia
 - c. ischemia
 - d. ishemia
4. The condition that exhibits both hardening and narrowing of the arteries is called _____.
 - a. athrosclersis
 - b. atheroclerosis
 - c. atheroscleris
 - d. atherosclerosis
5. A _____ is a WBC.
 - a. leukocyte
 - b. lukocyte
 - c. luekocyte
 - d. leukosite
6. An abnormal decrease in the number of thrombocytes or platelets is

- called _____.
- thrombocytopenia
 - thrombocytopenia
 - throbcytopenia
 - thombecytpenia
7. The smallest blood vessel that connects the arterial and venous systems is known as a _____.
- capillary
 - cappillary
 - capillarie
 - capillary
8. An abnormally rapid heartbeat is called _____.
- tachicardia
 - tachycardia
 - tacycardia
 - tachycarda
9. A blood disorder characterized by an excessive increase in the number of WBCs is _____.
- lukemia
 - lukimia
 - leukemia
 - luekemia
10. A drug used to treat heart rhythm abnormalities is called an _____.
- antiarrhythmic
 - antarhythmic
 - antiarhythmic
 - antiarythmic



Read the case and answer the questions that follow.

BRIEF HISTORY: The patient is a 56-year-old male who had been complaining of recurrent chest pain when performing mild activities at home. The chest pain subsides when he lies down. He also has experienced shortness of breath (SOB) when carrying in the groceries and climbing up one set of stairs. He has a history of high BP.

EMERGENCY ROOM VISIT: The patient arrives at the emergency room with angina pectoris that is relieved by rest, a BP of 180/110 mm Hg, and SOB. An EKG is performed, which indicates that the patient is having atrial arrhythmias and an MI. He is given aspirin and started on antiarrhythmics, diuretics, vasodilators, and oxygen. He is admitted to the CCU for observation and treatment.

DIAGNOSIS: Hypertension, an MI, and atrial fibrillation.

1. Define angina pectoris.

2. What does the acronym SOB stand for?

3. What is hypertension?

4. What is an EKG?

5. What type of pharmacologic intervention is used with this patient? Define each drug classification.

6. What is an MI? What are the two roots in myocardial, and what do they mean?

7. Define atrial fibrillation.



The Lymphatic System and Immunity

11

LEARNING OUTCOMES

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

- Name the organs that make up the lymphatic system.
- Understand the relationship between the cardiovascular system and the lymphatic system.
- Name the types of immunity.
- Pronounce, spell, and define medical terms related to the lymphatic system and its disorders.
- Pronounce, spell, and define medical terms related to immunity and immune disorders.
- Interpret abbreviations associated with the lymphatic system.

INTRODUCTION

The lymphatic system and immunity are considered together because each supports the other. The **lymphatic system** is a network of tissues, organs, nodes, and lymphatic vessels (*lymphatics*) spread throughout the body. Fluid called **lymph** is found within lymphatic vessels, and this lymph empties from the *right lymphatic duct* and the *thoracic duct* into specific veins in the thorax to reenter the bloodstream. These veins are the *left subclavian vein* and the *right subclavian vein* (see **Figure 11-1**). Lymph contains a type of white blood cells called **lymphocytes**, which are groups of B cells (*B lymphocytes*) and T cells (*T lymphocytes*) important to immune function. Medically

speaking, **immunity** refers to the body's ability to resist disease, and we gain immunity either actively (through contact with a disease or by vaccinations) or passively (from our mothers while in utero, from breast milk, or through injection of antibodies). **Vaccines** are substances used to stimulate the production of antibodies and to provide immunity against disease without inducing the disease.

Drained by right lymphatic duct

- Parotid nodes
- Right lymphatic duct
- Right subclavian vein
- Axillary lymph nodes
- Thymus
- Lymphatics of breasts
- Superficial lymphatics of upper limb
- Deep inguinal lymph nodes
- Superficial lymphatics of lower limb

Drained by thoracic duct

- Cervical lymph nodes
- Left subclavian vein
- Thoracic duct
- Mediastinal lymph nodes
- Spleen

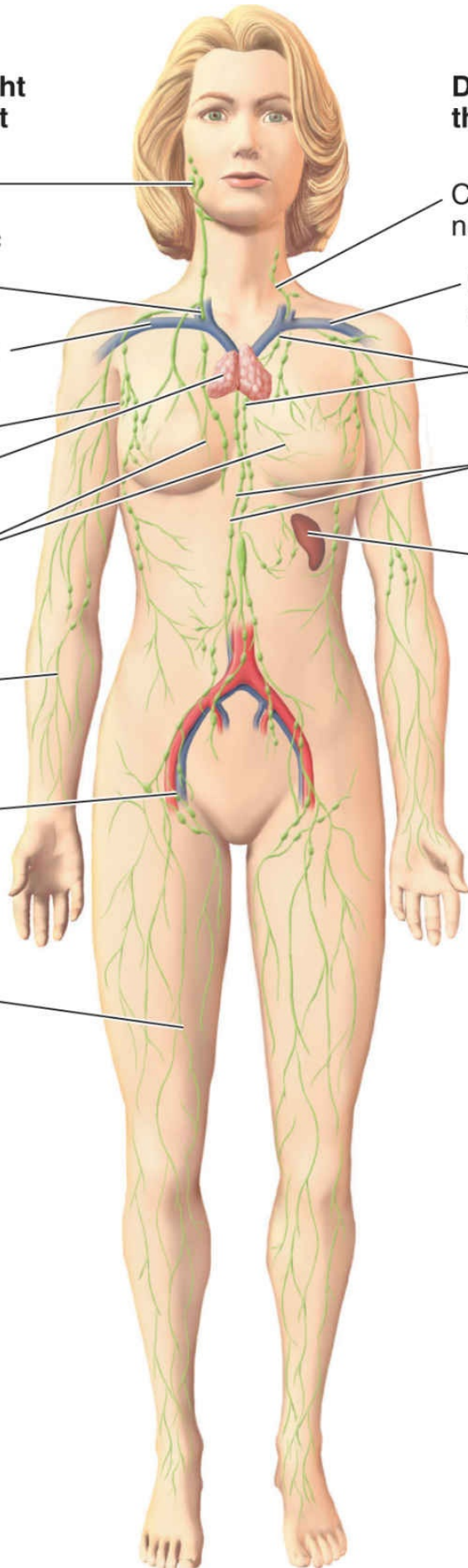


FIGURE 11-1 An overview of the lymphatic system.

What is lymph? Like plasma, which is the fluid part of blood, lymph is a fluid that consists mostly of water. It also contains a low concentration of proteins in solution and, of course, lymphocytes. The word lymph is also used as an adjective in naming lymph vessels and lymph nodes. A second adjective, lymphatic, is most often used when referring either to the whole system or to some specific part of the system, such as the “right lymphatic duct.” Either adjective, however, is acceptable.

The lymphatic system works closely with the immune response to ensure defense against **pathogens** (disease-causing agents). In addition to protecting the body from infection, the lymphatic system also maintains fluid balance and absorbs recently digested fats that are broken down in the digestive tract.

WORD PARTS RELATED TO THE LYMPHATIC SYSTEM AND IMMUNITY

Lymph is actually a Latin word meaning “water” or “clear water.” The roots that come from this word are lymph/o and lymphat/o. The root word immun/o comes from the Latin word *immunis*, which means exempt from. In the medical sense, immun/o means the body is “exempt” from illness. **Table 11-1** lists word parts that make up lymphatic system and immunity terms.

TABLE 11-1  WORD PARTS RELATED TO THE LYMPHATIC SYSTEM AND IMMUNITY

Word Part	Meaning
an-	without
immun/o	immune system
lymph/o	lymph or lymphatic system
lymphaden/o	lymph nodes
lymphangi/o	lymph vessels
lymphat/o	lymph or lymphatic system
-megaly	enlargement

-oid	resembling
path/o	disease
phag/o	ingest or engulf
-phylaxis	protection
splen/o	spleen
thym/o	thymus
tonsill/o	tonsil

Word Parts Exercise

After studying Table 11-1, write the meaning of each of the word parts.

WORD PART	MEANING
1. immun/o	1. _____
2. phag/o	2. _____
3. -phylaxis	3. _____
4. -megaly	4. _____
5. tonsill/o	5. _____
6. splen/o	6. _____
7. an-	7. _____

8. lymphaden/o	8. _____
9. lymphangi/o	9. _____
10. lymph/o, lymphat/o	10. _____
11. thym/o	11. _____
12. -oid	12. _____
13. path/o	13. _____

STRUCTURE AND FUNCTION

Lymphatic tissues include *tonsils*, the *thymus*, *spleen*, *lymph nodes*, *lymphoid nodules of the small intestine* (Peyer’s patches), and the *appendix*. **Tonsils** are masses of lymphatic tissue in the pharynx that filter bacteria. The **thymus** is a lymphatic organ located in the chest deep to the sternum. The **spleen** is a large mass of lymphatic tissue in the upper left quadrant of the abdomen involved with destroying bacteria by **phagocytosis** (ingestion by lymphocytes) and removing old blood cells by **hemolysis** (red blood cell rupture). Cells able to complete phagocytosis are called **phagocytes** and include **macrophages**, **microphages**, **neutrophils**, and **monocytes**.

Bean-shaped masses of lymphatic tissue distributed along lymphatic vessels are called **lymph nodes**. Collections of closely packed lymphoid nodules in the wall of the small intestine, known as **Peyer’s patches**, are involved with intestinal immunity. The **appendix**, a worm-like structure that extends from the intestine, contains immune system cells that protect the “good bacteria” living in the gut (see [Figure 11-1](#)).

Whereas the cardiovascular system circulates blood within a closed system, the lymphatic system distributes lymph on a one-way path via lymphatic vessels. Lymphatic vessels, which run alongside blood vessels, begin where lymphatic capillaries interlace with the blood capillaries of the cardiovascular system, forming networks. Recall that lymph is similar to blood in that it contains special cells called *lymphocytes*, which are a type of white blood cell that fights disease and infection.

How does blood become lymph? Fluid travels from the arterioles to the venules. Some of the fluid that leaks out of the blood capillaries is left in the tissues (interstitial fluid). This fluid is picked up by the open-ended lymph capillaries and circulates in the lymphatic system as lymph. Lymph continues to flow in the lymphatic system until it is returned to the bloodstream at the (see [Figure 11-2](#)).

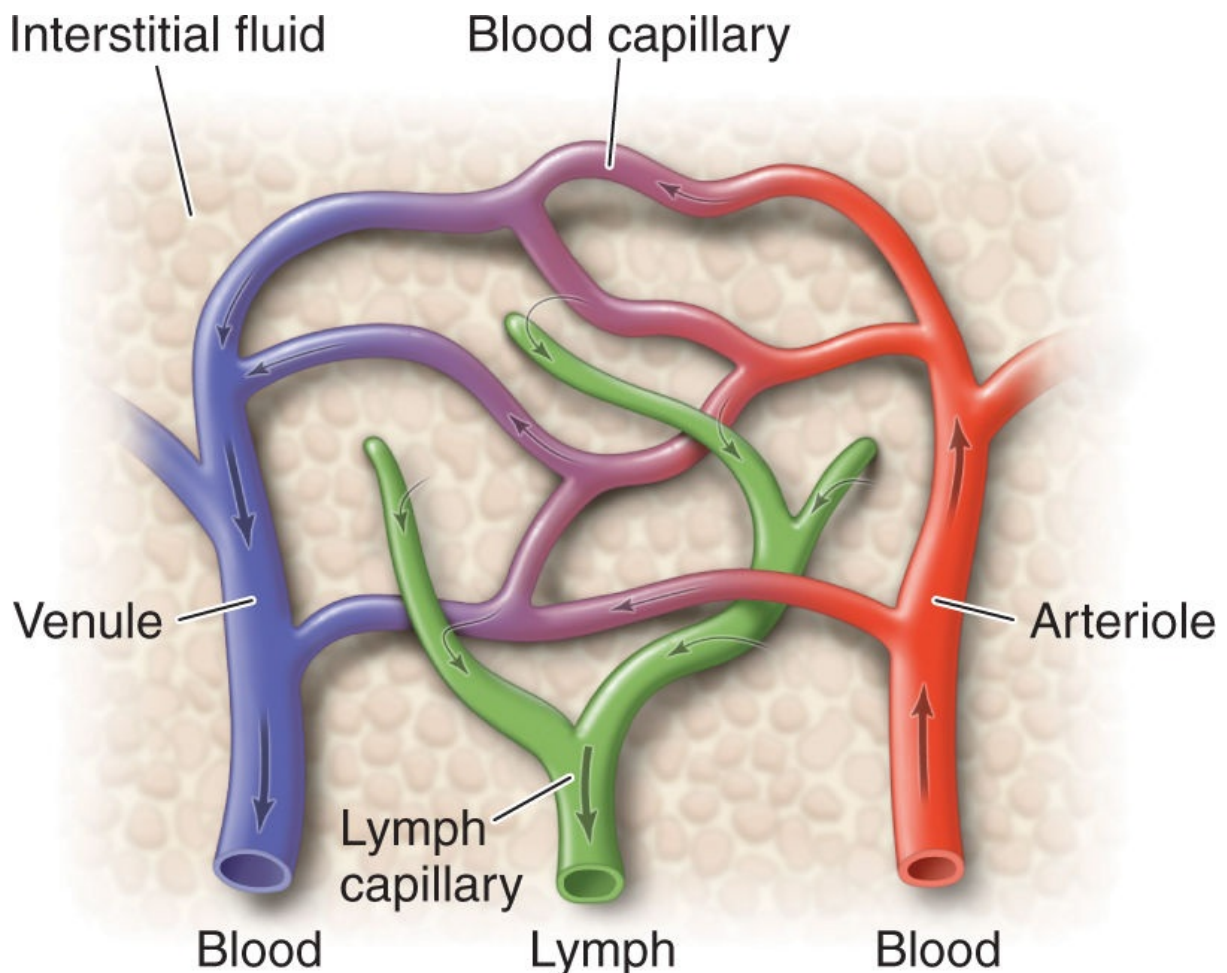


FIGURE 11-2 Lymph flow. This figure shows the structural relationship between the blood capillaries and the lymph capillaries.

How does lymph return to the bloodstream? Lymph is picked up by the lymph vessels, filtered by the lymph nodes, propelled back into the venules, and then into the veins. The lymphatic vessels from bigger structures called lymphatic trunks, which merge into the thoracic duct on the left side of the body or the right lymphatic duct on the right sides of the body. These ducts then empty into the left or right subclavian vein (see [Figure 11-1](#)).

All of these structures play an important role in the body's immune responses. An immune response is the body's reaction to an **antigen** (a substance that induces an immune response in the body). An **antibody** is a

soldier-like protein that protects the body and inactivates antigens.

Immunity is classified as innate immunity or adaptive immunity. **Innate immunity** (natural immunity) is genetically determined resistance that a person is born with. **Adaptive immunity** is a type of resistance that is acquired only after a person has been exposed to a particular antigen. Adaptive immunity is then broken down into two categories, each with two subcategories. The two types of adaptive immunity are *active* (resistance that results from previous exposure to an antigen) and *passive* (resistance that results from the transfer of antibodies). The two types of active immunity are *naturally acquired* (results from contact with the disease) and *artificially acquired* (results from vaccination). The two types of passive immunity are *naturally acquired* (resistance that results through the placenta or from breast milk) and *artificially acquired* (resistance that results from injection of antibodies) (see **Figure 11-3**).

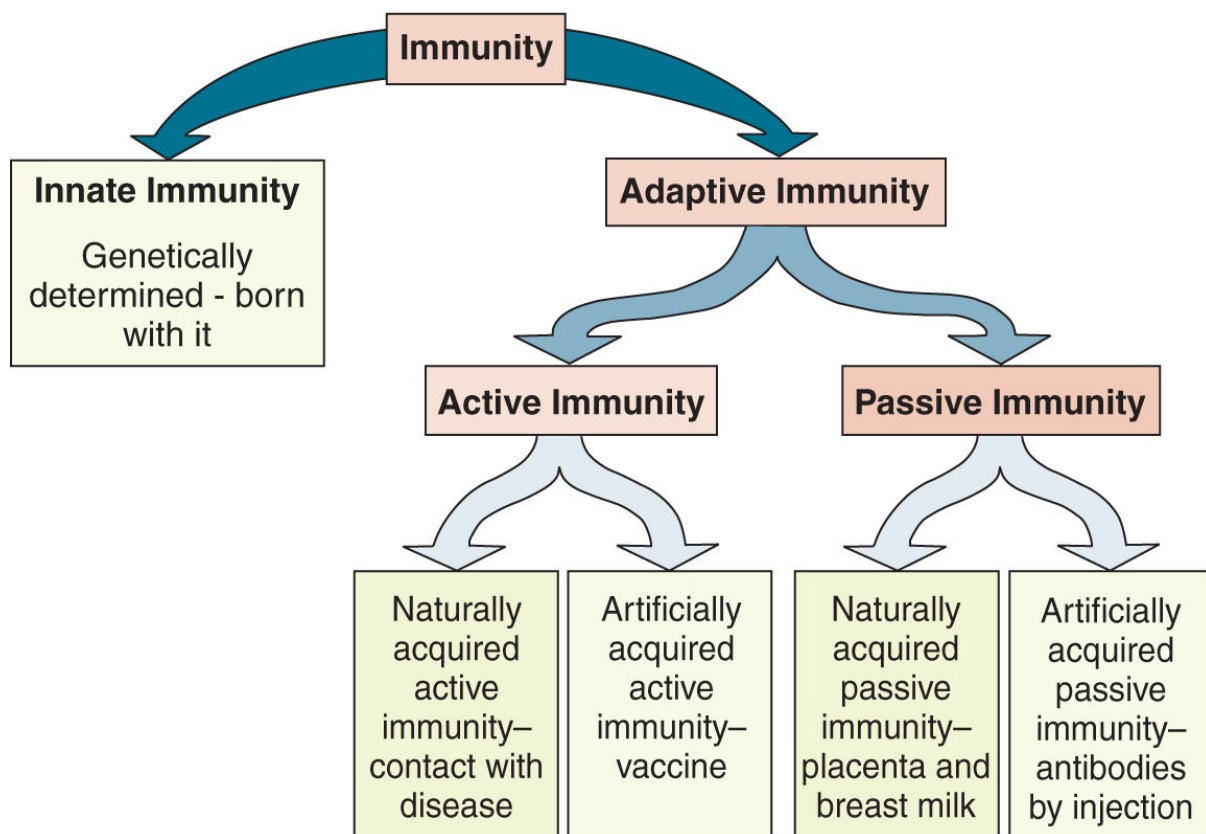


FIGURE 11-3 The types of immunity.



Quick Check

Fill in the blanks.

1. Besides fighting infection, the lymphatic system maintains

_____ balance and absorbs recently digested
_____.

2. Name the tissues and organs of the lymphatic system.

3. An _____ is a substance that induces an immune response.

DISORDERS RELATED TO THE LYMPHATIC SYSTEM AND IMMUNITY

A primary function of the lymphatic system is to filter out harmful organisms. When bacteria spread into the lymphatic system or when an injury to the body is not treated effectively, an infection can result causing **lymphadenitis**, which is swelling of a lymph node. Swelling of lymph tissue is called **lymphedema** (see **Figure 11-4**). Lymphedema is the result of infection or obstruction of the lymph vessels. **Lymphadenopathy**, any disease process affecting lymph nodes, is an indicator of possible infection. **Autoimmune diseases** are any disorders in which normal body tissues are destroyed by the immune response being directed against the body's own tissue. An **allergy** is a hypersensitivity reaction to a particular antigen (allergen), such as pollen, a particular food, or dust. Lymph and immune disorders include the following:



FIGURE 11-4 Lymphedema of the right lower extremity in a patient with

elephantiasis. Elephantiasis is a parasitic infection that causes lymphatic vessel obstruction.

- **Acquired immunodeficiency syndrome (AIDS)** is caused by the human immunodeficiency virus (HIV) and is an infectious process characterized by swollen lymph glands or lymphadenopathy.
- **Infectious mononucleosis** is an acute infection caused by the Epstein-Barr virus (EBV) and is characterized by fever, enlarged cervical lymph nodes, and fatigue.
- **Splenomegaly**, enlargement of the spleen, is indicative of infectious disease.
- **Anaphylaxis** is a systemic, life-threatening reaction to a foreign substance.
- **Hodgkin's lymphoma** is a malignant disease of the lymph nodes.
- **Rheumatoid arthritis (RA)** is an autoimmune disorder that affects joints.
- **Systemic lupus erythematosus (SLE)** is a chronic inflammatory disorder that affects connective tissue throughout the body and is marked by fever, weakness, joint pain, and lymphadenopathy.

DIAGNOSTIC TESTS, TREATMENTS, AND SURGICAL PROCEDURES

A range of treatments exists for treating lymphatic and immune system disorders. They include **corticosteroids** for relief of inflammation, **immunosuppressants** to dampen the immune response, **antiviral** agents to thwart virus infections, and **vaccination** (*immunization*) to offer artificially acquired immunity.

Surgical procedures can be necessary. The spleen is especially fragile, making it susceptible to rupturing. This makes it difficult to repair and instead a **splenectomy** (excision of the spleen) occurs. Other removal procedures may include a **lymphadenectomy** (removal of a lymph node), **lymphangiectomy** (removal of a lymph vessel), **thymectomy** (removal of the thymus), or **tonsillectomy** (removal of a tonsil).

PRACTICE AND PRACTITIONERS

Allergists specialize in diagnosing and treating altered immunologic and allergic conditions, and **hematologists** provide diagnosis and treatment of

blood and blood-forming tissue disorders. **Immunology** is the study of the immune system. An **immunologist** is a specialist who studies, diagnoses, and treats problems associated with immunity. **Oncologists** may become involved in the care of patients with tumors.

Abbreviation Table THE LYMPHATIC SYSTEM AND IMMUNITY

ABBREVIATION	MEANING
AIDS	acquired immunodeficiency syndrome
EBV	Epstein-Barr virus
HIV	human immunodeficiency virus
RA	rheumatoid arthritis
SLE	systemic lupus erythematosus

Study Table THE LYMPHATIC SYSTEM AND IMMUNITY

TERM AND PRONUNCIATION	ANALYSIS	MEANING
Structure and Function		
acquired immunity (uh-KWIRE-duh ih-MYOO-ni-tee)	common English words	resistance resulting from previous exposure to an infectious agent
allergen (AL-ur-jehn)	from the Greek word <i>allos</i> (other); <i>-gen</i> (producing)	an antigen that induces an allergic or hypersensitive response
antibody (AN-ti-bod-ee)	<i>anti-</i> (against) + <i>body</i>	a molecule generated in specific opposition to an antigen
antigen (AN-tuh-jehn)	<i>anti-</i> (against); <i>-gen</i> (producing)	agent or substance that provokes an immune response
appendix (ah-PEN-dicks)	from the Latin verb <i>appendum</i> (attach)	tube-shaped sac attached to an opening into the large intestine that plays a role in immunity
artificial immunity (ahr-tuh-FISH-uhlih-MYOO-ni-tee)	common English words	immunization; immunity acquired from a vaccination

autoimmunity (aw-toh-ih-MYOO-ni-tee)	<i>auto-</i> (self) + immunity	antibodies or lymphocytes produced against antigens normally present in the body; literally, immune to oneself
B cell (BEE sell)	B refers to the fact that these cells are derived from bone marrow	nonthymus dependent, short-lived lymphocyte; <i>B lymphocyte</i>
B lymphocyte (BEE LIHM-foh-site)	B refers to the fact that these cells are derived from bone marrow; <i>lymph/o</i> (lymph); <i>-cyte</i> (cell)	nonthymus dependent, short-lived lymphocyte; <i>B cell</i>
immunity (ih-MYOO-ni-tee)	from the Latin word <i>immunis</i> (exempt)	protection against disease
inflammation (in-flah-MAY-shun)	common English word	redness and swelling caused by injury or abnormal stimulation by a physical, chemical, or biologic agent
leukocyte (LUKE-oh-site)	<i>leuk/o</i> (white); <i>-cyte</i> (cell)	white blood cell
lymph (LIMF)	<i>lymph/o</i> (lymph)	a fluid collected from tissues throughout the body that contains mostly white blood cells and flows through the lymphatic vessels
lymph node (LIMF NODE)	<i>lymph/o</i> (lymph); from the Latin word, <i>nodus</i> (knot)	small, bean-shaped mass of lymphatic tissue that filters bacteria and foreign material from the lymph; located on larger lymph vessels in the cervical, mediastinal, axillary, and inguinal regions
lymphatic system (lihM-FAT-tik SIS-tuhm)	<i>lymph/o</i> (lymph); <i>-atic</i> (adjective suffix)	collectively, the vessels, nodes, and capillaries that carry the lymph and its disease-fighting cells to the areas in which they are needed
lymphocyte (LIHM-foh-syte)	<i>lymph/o</i> (lymph); <i>-cyte</i> (cell)	white blood cell in the lymphatic system
lymphoid nodules of the small intestine (LIMF-oid NOD-yulz)	common English words	collections of spherical masses of lymphoid cells closely packed together; <i>Peyer's patches</i>
macrophage (MAK-roh-fayj)	<i>macro-</i> (large); <i>phag/o</i> (ingest or engulf)	large phagocyte
microphage (MIKE-roh-fayj)	<i>micro-</i> (small); <i>phag/o</i> (ingest or engulf)	small phagocyte
monocyte (MON-oh-site)	<i>mono-</i> (single); <i>-cyte</i> (cell)	a type of white blood cell that is also a phagocyte
natural immunity (NACH-er-uhl ih-MYOO-ni-tee)	common English words	resistance manifested by an individual who has not been immunized; immunity passed on from mother to fetus or from mother to baby in breast milk

neutrophil (NU-troh-fil)	<i>neutr/o</i> (neutral); <i>-phil</i> (love)	a type of white blood cell that is also a phagocyte
pathogen (PATH-oh-jehn)	<i>path/o</i> (disease); <i>-gen</i> (produce)	substance that produces disease
Peyer's patches (PEY-erz PACH-ez)	named after Swiss anatomist Johann Peyer	collections of spherical masses of lymphoid cells closely packed together; <i>lymphoid nodules of the small intestine</i>
phagocyte (FAG-oh-syte)	<i>phag/o</i> (ingest or engulf); <i>-cyte</i> (cell)	white blood cell that clears away pathogens and debris
phagocytosis (FAG-oh-sy-toh-sis)	<i>phag/o</i> (ingest or engulf); <i>cyt/o</i> (cell); <i>-osis</i> (condition of)	process of ingestion and digestion carried out by white blood cells
reaction (ree-AK-shun)	common English word	an action of an antibody on a specific antigen; also, in reference to immune responses, an abnormal or unwanted reaction
spleen (SPLEEN)	<i>splen/o</i> (spleen)	immune system organ that gets rid of damaged red blood cells and reclaims and stores iron
T cell (TEE SELL)	T (stands for thymus);	thymus dependent, long-lived lymphocyte; <i>T lymphocyte</i>
T lymphocyte (TEE LIHM-foh-syte)	T (stands for thymus); <i>lymph/o</i> (lymph); <i>-cyte</i> (cell)	thymus dependent, long-lived lymphocyte; <i>T cell</i>
thymus (THYE-muhs)	<i>thym/o</i> (thymus)	immune system gland located behind (deep to) the sternum
tonsil (TON-sihl)	<i>tonsill/o</i> (tonsil)	collection of lymph tissue; in common understanding, the lingual, pharyngeal, and (especially) palatine tonsils
Disorders		
allergy (AL-er-jee)	From the Greek word, <i>allos</i> (other) + <i>ergon</i> (work)	extreme sensitivity reaction to a normally harmless substance
anaphylaxis (an-ah-FIL-ax-ihs)	<i>ana-</i> (without); from the Greek word <i>phylaxis</i> (protection)	life-threatening reaction to a foreign substance; symptoms include blockage of air passages, decreased blood pressure, generalized edema
acquired immunodeficiency syndrome (uh-KWAHY-erd im-yoo-no-di-FISH-uhn-see SIN-droh-m)	from the Latin word <i>acquirere</i> (gain); <i>immunis</i> (exempt); <i>deficere</i> (to desert, fail)	a deficiency of cellular immunity induced by infection with the HIV
autoimmune disease (aw-toh-ih-MEWN di-ZEEZ)	<i>auto-</i> (self) + <i>immunis</i> (exempt from) and from Old French <i>desaise</i> (lack of each)	disorder in which the immune response is directed against the body's own tissues

elephantiasis (el-eh-fan-TYE-uh-sis)	from the Greek word, <i>elephas</i> (elephant) and <i>-iasis</i> (suffix forming the name of the disease)	lymphatic disease caused by filaria (parasitic roundworm) that is characterized by swelling of the legs and male scrotum
hemolysis (hee-MAWL-ih-sihs)	<i>hem/o</i> (blood); <i>-lysis</i> (destruction)	change or destruction of red blood cells
Hodgkin's lymphoma (HODJ-kinz lim-FOH-mah)	named after English physician Thomas Hodgkin (1798–1866) who first described it; <i>lymph/o</i> (lymph or lymphatic system); <i>-oma</i> (tumor)	chronic malignant disease of the lymph nodes; <i>Hodgkin disease</i>
immunodeficiency (IM-yoo-noh-dee-FISH-ehn-see)	<i>immun/o</i> (immune system) + <i>deficiency</i>	impairment of the immune system
infectious mononucleosis (in-FEK-shus mon-uh-noo-kee-OH-sis)	from the Latin word <i>infectionem</i> (infection); <i>mono-</i> (one); Latin <i>nucleus</i> (kernel); <i>-osis</i> (abnormal condition)	an acute illness of young adults caused by the EBV; spread by saliva transfer; characterized by fever, sore throat, enlargement of lymph nodes and spleen
lymphadenitis (lim-FAD-eh-NYE-tiss)	<i>lymph/o</i> (lymph or lymphatic system); <i>aden/o</i> (gland); <i>-itis</i> (inflammation)	inflammation of a lymph node or lymph nodes
lymphadenopathy (lim-fah-deh-NOP-ah-thee)	<i>lymph/o</i> (lymph or lymphatic system); <i>aden/o</i> (gland); <i>-pathy</i> (disease)	chronic or excessively swollen lymph nodes; any disease of the lymph nodes
lymphangiitis (lim-FAN-jee-EYE-tiss)	<i>lymphangi/o</i> (lymph vessel); <i>-itis</i> (inflammation)	inflammation of lymph vessels; <i>lymphangitis</i> ; <i>lymphatitis</i>
lymphangitis (lim-fan-JY-tiss)	<i>lymphangi/o</i> (lymph vessel); <i>-itis</i> (inflammation)	inflammation of lymph vessels; <i>lymphangiitis</i> ; <i>lymphatitis</i>
lymphatitis (lim-fah-TY-tiss)	<i>lymph/o</i> (lymph or lymphatic system); <i>-itis</i> (inflammation)	inflammation of the lymph vessels or nodes; <i>lymphangiitis</i> ; <i>lymphangitis</i>
lymphedema (lim-feh-DEE-mah)	<i>lymph/o</i> (lymph or lymphatic system); from the Greek word <i>oidema</i> (a swelling tumor)	swelling of the subcutaneous tissues due to obstruction of lymph vessels or nodes
lymphoma (lim-FOH-mah)	<i>lymph/o</i> (lymph or lymphatic system); <i>-oma</i> (tumor)	tumor of lymph tissue
lymphopathy (lim-FOP-ah-thee)	<i>lymph/o</i> (lymph or lymph gland); <i>-pathy</i> (disease)	disease of the lymph vessels or nodes
rheumatoid arthritis (ROO-mah-toid ar-THRY-tuhs) (RA)	from the Greek word <i>rheuma</i> (flux); <i>-oid</i> (resemblance of)	systemic disease that affects the connective tissue; involves many joints, especially those of the hands and feet
splenitis (splee-NY-tiss)	<i>splen/o</i> (spleen); <i>-itis</i> (inflammation)	inflammation of the spleen

splenomegaly (splee-noh-MEG-ah-lee)	<i>splen/o</i> (spleen); <i>-megaly</i> (enlargement)	enlargement of the spleen
splenopathy (splee-NOP-ah-thee)	<i>splen/o</i> (spleen); <i>-pathy</i> (disease)	any disease of the spleen
systemic lupus erythematosus (sis-TEM-ik LOO-pus er-ih-THEEM-uh-toh-sis) (SLE)	adjective form of the English word <i>system</i> ; <i>lupus</i> (a Latin word meaning “wolf”); <i>erythematosus</i> (from the Greek word <i>erythema</i> meaning “flush”)	an inflammatory, autoimmune connective tissue disorder with variable features; diffuse erythematous (red) butterfly rash on face
thymitis (thye-MY-tihs)	<i>thym/o</i> (thymus); <i>-itis</i> (inflammation)	inflammation of the thymus
tonsillitis (TAWN-sih-LY-tihs)	<i>tonsill/o</i> (tonsils); <i>-itis</i> (inflammation)	inflammation of a tonsil (commonly, the palatine tonsil)
Diagnostic Tests, Treatments, and Surgical Procedures		
antiviral (an-tee-VAHY-ruhl)	<i>anti-</i> (against); from the Latin word <i>virus</i> (poison, sap of plants, slimy liquid)	drug used to treat various viral infections or conditions
chemotherapy (KEE-moh-ther-ah-pee)	<i>chem/o</i> (chemical) + therapy, a common English word	treatment of malignancies using chemical agents and drugs (usually reserved for treatment of cancer)
corticosteroids (kor-tih-ko-STER-oyds)	from the Latin word <i>cortex</i> (bark); from the Greek <i>steros</i> (solid, stable)	hormone-like preparations used as anti-inflammatory agents; topical agents used for their immunosuppressive and anti-inflammatory properties
immunization (IM-yoo-nuh-zay-shun)	<i>immun/o</i> (immune system); <i>-ization</i> (noun suffix)	protection from communicable diseases by administration of a weakened or killed pathogen, or a protein of a pathogen, to cause the immune system to create antibodies for future protection; <i>vaccination</i>
immunosuppressant (IM-yoo-no-suh-PRESS-ant)	<i>immun/o</i> (immune system) + suppressant	something that interferes with the immune system
lymphangiography (lim-FAN-jee-OG-rah-fee)	<i>lymphangi/o</i> (lymph vessel); <i>-graphy</i> (process of recording)	radiography of the lymph vessels
lymphadenectomy (lim-fad-eh-NEK-tah-mee)	<i>lymphaden/o</i> (lymph gland); <i>-ectomy</i> (excision)	removal of lymph nodes
lymphangiectomy (lim-FAN-jee-EK-tah-mee)	<i>lymphangi/o</i> (lymph vessel); <i>-ectomy</i> (excision)	removal of a lymph vessel
lymphangiectomy (lim-FAN-jee-OT-oh-mee)	<i>lymphangi/o</i> (lymph vessel); <i>-tomy</i> (cutting operation)	incision of a lymph vessel

lymphography (lim-FOG-ruh-fee)	<i>lympho-</i> (lymph) + <i>grapho</i> (to write)	visualization of lymphatics (lymphangiography) and lymph nodes (lymphadenography) by radiography after injecting a contrast dye (usually iodized oil) into a lymphatic vessel
splenectomy (splee-NEK-toh-mee)	<i>splen/o</i> (spleen); <i>-ectomy</i> (excision)	removal of the spleen
splenorrhaphy (splee-NOR-ah-fee)	<i>splen/o</i> (spleen); <i>-rraphy</i> (rupture)	suture of a ruptured spleen
splenotomy (splee-NOT-oh-mee)	<i>splen/o</i> (spleen); <i>-tomy</i> (cutting operation)	incision of the spleen
thymectomy (thye-MEK-toh-me)	<i>thym/o</i> (thymus); <i>-ectomy</i> (excision)	removal of the thymus
tonsillectomy (TAWN-sih-LEK-toh-mee)	<i>tonsill/o</i> (tonsil); <i>-ectomy</i> (excision)	removal of a tonsil
vaccination (vak-sih-NAY-shun)	from the Latin word <i>vaccinus</i> (relating to a cow). So named because of its early use of the cowpox virus against smallpox	protection from communicable diseases by administration of a weakened or killed pathogen, or a protein of a pathogen, to cause the immune system to create antibodies for future protection; <i>immunization</i>
vaccine (VAK-seen)	from the Latin word <i>vaccinus</i> , from <i>vacca</i> (cow). So named because of its early use of the cowpox virus against smallpox	substance used to stimulate antibody production and to provide immunity against a disease without causing the disease
Practice and Practitioners		
allergist (AL-er-jist)	from the Greek words <i>allos</i> (other, different, strange) and <i>ergon</i> (activity); <i>-ist</i> (one who specializes)	a medical practitioner who specializes in the diagnosis and treatment of allergies
hematologist (hee-mah-TAHL-oh-jist)	<i>hemat/o</i> (blood); <i>-logist</i> (one who specializes)	a medical practitioner who specializes in the diagnosis and treatment of blood disorders
immunologist (im-yoo-NOL-oh-jist)	<i>immun/o</i> (immune system); <i>-logist</i> (one who specializes)	a medical practitioner specializing in the immune system
immunology (IM-yoo-NOL-oh-jee)	<i>immun/o</i> (immune system); <i>-logy</i> (study of)	the medical specialty dealing with the immune system
oncologist (on-KOL-oh-jist)	from the Greek word <i>onkos</i> (mass, bulk); <i>-logist</i> (one who specializes)	a medical practitioner who specializes in the diagnosis and treatment of malignant tumors (cancer)

END-OF-CHAPTER EXERCISES

EXERCISE 11-1



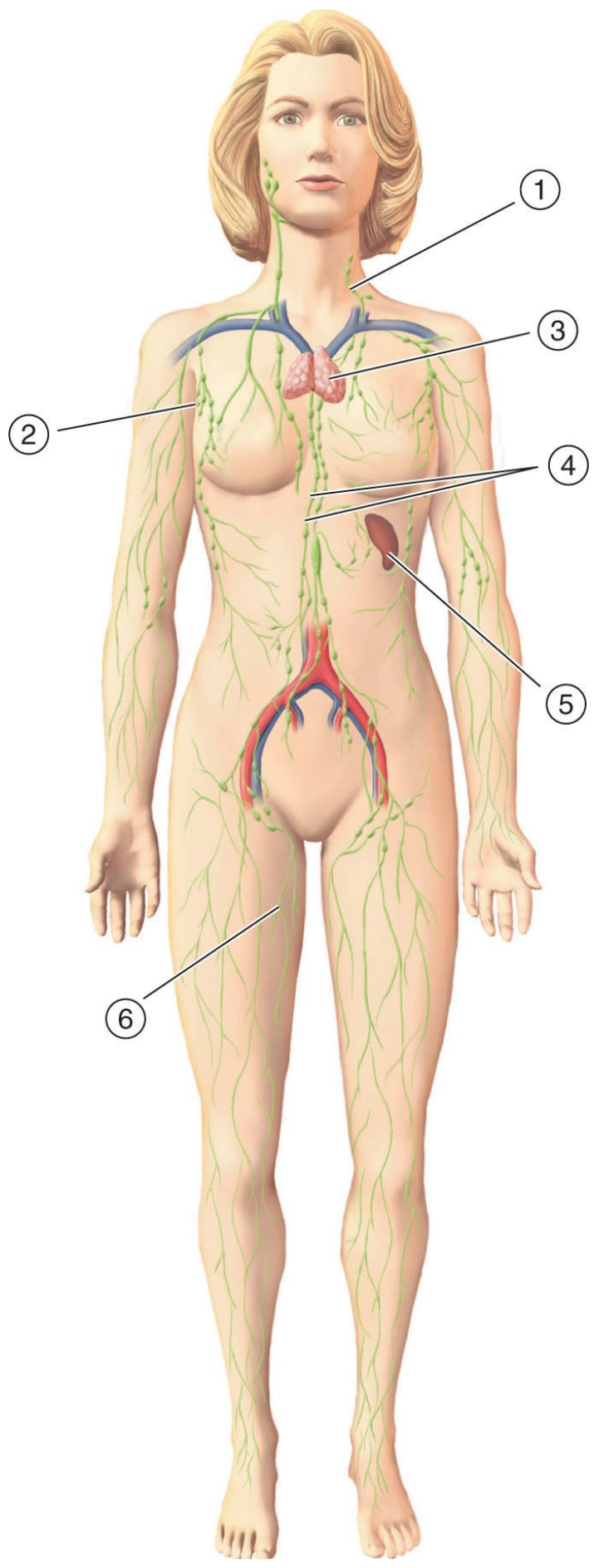
LABELING

Using the following list, choose the correct terms to label the diagram correctly.

axillary lymph nodes mediastinal lymph nodes superficial lymphatics of lower limb

cervical lymph nodes spleen

thymus



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

EXERCISE 11-2



WORD PARTS

Break each of the following terms into its word parts: prefix, root, or suffix. Give the meaning of each word part and then define the term.

1. lymphocyte

root: _____

suffix: _____

definition: _____

2. phagocytosis

root: _____

root: _____

suffix: _____

definition: _____

3. anaphylaxis

prefix: _____

root: _____

definition: _____

4. hemolysis

root: _____

suffix: _____

definition: _____

5. lymphoma

root: _____

suffix: _____

definition: _____

6. splenectomy

root: _____

suffix: _____

definition: _____

7. thymectomy

root: _____

suffix: _____

definition: _____

8. immunology

root: _____

suffix: _____

definition: _____

EXERCISE 11-3



WORD BUILDING

Use the word parts listed to build the terms defined.

aden/o immun/o lymph/o -pathy

angi/o -itis -megaly phag/o

-cytosis -logist -oma thym/o

-graphy

1. inflammation of a lymph gland _____

2. tumor of a lymph gland _____

3. enlargement of the thymus _____

4. inflammation of a lymph vessel _____

5. disease of a lymph gland _____

6. specialist who studies and treats the immune system

7. radiographic procedure of the lymphatic system

8. process of a WBC engulfing a harmful organism

EXERCISE 11-4



MATCHING

Match the term with its definition.

- | | |
|-----------------------------|---|
| 1. _____
lymphadenopathy | a. enlarged spleen |
| 2. _____
lymphedema | b. specialty that deals with immune disorders |
| 3. _____
phagocytosis | c. artificially acquired immunity |
| 4. _____
autoimmune | d. life-threatening allergic reaction to a foreign substance |
| 5. _____
splenomegaly | e. disease of the lymph glands |
| 6. _____
lymphocyte | f. accumulation of fluid in the intercellular tissues |
| 7. _____
immunology | g. the process of engulfing foreign materials |
| 8. _____
anaphylaxis | h. protective lymph organ that is attached to the proximal end of the large intestine |
| 9. _____
appendix | i. the body reacts to its own tissues |
| 10. _____
immunization | j. specialized WBC of the immune system |

EXERCISE 11-5



MULTIPLE CHOICE

Choose the correct answer for the following multiple choice questions.

1. The lymphatic organ that removes old blood cells by means of

- hemolysis is the _____.
- tonsils
 - spleen
 - thymus
 - appendix
2. Peyer's patches are found in the _____.
- respiratory system
 - cardiovascular system
 - digestive system
 - muscular system
3. Immunizations are a type of _____.
- naturally acquired immunity
 - naturally acquired passive immunity
 - artificially acquired immunity
 - innate immunity
4. Lymphocytes are a type of _____.
- white blood cell
 - red blood cell
 - platelet
 - thrombocyte
5. The tonsils are located in the _____.
- larynx
 - abdomen
 - lungs
 - pharynx
6. A practitioner who specializes in blood disorders is a(n) _____.
- allergist
 - hematologist

- c. immunologist
 - d. oncologist
7. A treatment used to treat inflammation is a(n) _____.
- a. antiviral
 - b. chemotherapy
 - c. corticosteroid
 - d. immunosuppressant
8. A molecule that is generated in specific opposition to an antigen is a(n) _____.
- a. allergen
 - b. antibody
 - c. pathogen
 - d. leukocyte
9. The type of immunity passed down from mother to child is called _____.
- a. naturally acquired active immunity
 - b. artificially acquired active immunity
 - c. naturally acquired passive immunity
 - d. autoimmunity
10. The root lymphaden/o means _____.
- a. lymph
 - b. immune
 - c. lymph vessel
 - d. lymph node

EXERCISE 11-6



FILL IN THE BLANK

Fill in the blank with the correct answer.

1. Lymph contains white blood cells, called _____, that fight infection.

2. The functions of the immune system are to protect the body from infection, absorb fats that are broken down in the digestive tract, and _____.
3. After lymph is picked up by the lymph vessels and filtered by the _____, it is propelled into venules and then into veins.
4. _____ immunity is genetically determined.
5. The _____ are masses of lymphatic tissue located in the pharynx to filter out bacteria.
6. Swelling caused by obstruction of lymphatic vessels is called _____.
7. Surgical removal of the spleen is called a _____.
8. The medical professional who specializes in diagnosing and treating altered immunologic and allergic conditions is known as a(n) _____.
9. The “T” in T cell stands for _____.
10. Failure of the immune system to adequately protect the body from infection is known as _____.

EXERCISE 11-7



ABBREVIATIONS

Write out the term for the following abbreviations.

1. _____ SLE
2. _____ RA
3. _____ EBV

Write the abbreviation for the following terms.

4. _____ acquired immunodeficiency syndrome
5. _____ human immunodeficiency virus

EXERCISE 11-8



SPELLING

Select the correct spelling of the medical term.

1. A _____ is a type of white blood cell that is distributed throughout lymphatic tissue.

- a. lymphocyte
 - b. limphocyte
 - c. lymfocyte
 - d. lymphosite
2. A _____ is a type of mature, phagocytic white blood cell.
- a. nuetrophil
 - b. nutrophil
 - c. neutrophil
 - d. neutraphil
3. _____ is the process of ingestion and digestion by white blood cells.
- a. Pagocytosis
 - b. Phagecytosis
 - c. Phagocytosis
 - d. Phageocytosis
4. Protection against infectious disease is called _____.
- a. immunity
 - b. imunity
 - c. imunnity
 - d. ammunty
5. Some signs of the life-threatening reaction to a foreign substance called _____ are blockage of air passages, decreased blood pressure, and generalized edema.
- a. anephylaxis
 - b. anaphilaxis
 - c. aniphylaxis
 - d. anaphylaxis
6. An impairment of the immune system is called an _____.

- a. imunodeficiency
 - b. immunodeficiency
 - c. immunedeficiency
 - d. immunodeficiency
7. _____ is the process by which resistance to an infectious disease is induced.
- a. Imunization
 - b. Immunisation
 - c. Immunizasion
 - d. Immunization
8. Treatment of malignancies using chemical agents and drugs is called _____.
- a. kemotherapy
 - b. cemotherapy
 - c. chemotherapy
 - d. chematherapy
9. A _____ is a medical practitioner who specializes in the diagnosis and treatment of blood disorders.
- a. hemtologist
 - b. hematologist
 - c. hemetologist
 - d. hemitologist
10. An _____ is a substance that induces sensitivity or an immune response in the form of antibodies.
- a. antigen
 - b. antugen
 - c. antegin
 - d. antegen



Read the case and answer the questions below.

BRIEF HISTORY: A 16-year-old male complained to his parents of being extremely fatigued. He was not able to keep up with his school schedule or after school sports. His throat was sore and he noticed “lumps” in his neck and groin. He had a fever and loss of appetite. He recently began to complain of pain in his upper left belly.

OFFICE VISIT: A physician examined the patient and ordered blood tests. He noted lymphadenopathy in the cervical, axillary, and inguinal areas. He also observed an erythematous throat and determined that the spleen was enlarged.

DIAGNOSIS AND TREATMENT PLAN: The diagnosis was mononucleosis, an infectious disease caused by a virus. The prescribed treatment consisted of over-the-counter analgesics to reduce the abdominal pain, along with fluids and rest. Throat lozenges were prescribed to ease sore throat discomfort.

1. What does “lymphadenopathy” mean?

2. What is the medical term for an “enlarged spleen”?

3. What is mononucleosis?



The Respiratory System

12

LEARNING OUTCOMES

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

- Name the structures that make up the respiratory system.
- Pronounce, spell, and define medical terms related to the respiratory system and its disorders.
- Interpret abbreviations associated with the respiratory system.

INTRODUCTION

The respiratory system is all the air passages from the nose to the pulmonary alveoli in the lungs. It is divided into an *upper respiratory tract* and a *lower respiratory tract*. The upper respiratory tract is made up of the **paranasal sinuses, nasal cavity, nose, and pharynx**. The lower respiratory tract is made up of the **larynx, lungs, trachea, bronchi, bronchioles, and alveoli** (see **Figure 12-1**). The respiratory system allows us to inhale oxygen (O₂) and exhale carbon dioxide (CO₂). Oxygen is a gas needed by our cells, and carbon dioxide is a gaseous metabolic waste that needs to be eliminated. **Figure 12-2** shows the process of this gas exchange, which is accomplished through external and internal respiration. **External respiration** is the process in which air is brought into the lungs, and oxygen and carbon dioxide are exchanged in the bloodstream at the capillaries surrounding the alveoli. **Internal respiration** is the process where oxygen and carbon dioxide move between the bloodstream and the body's cells.

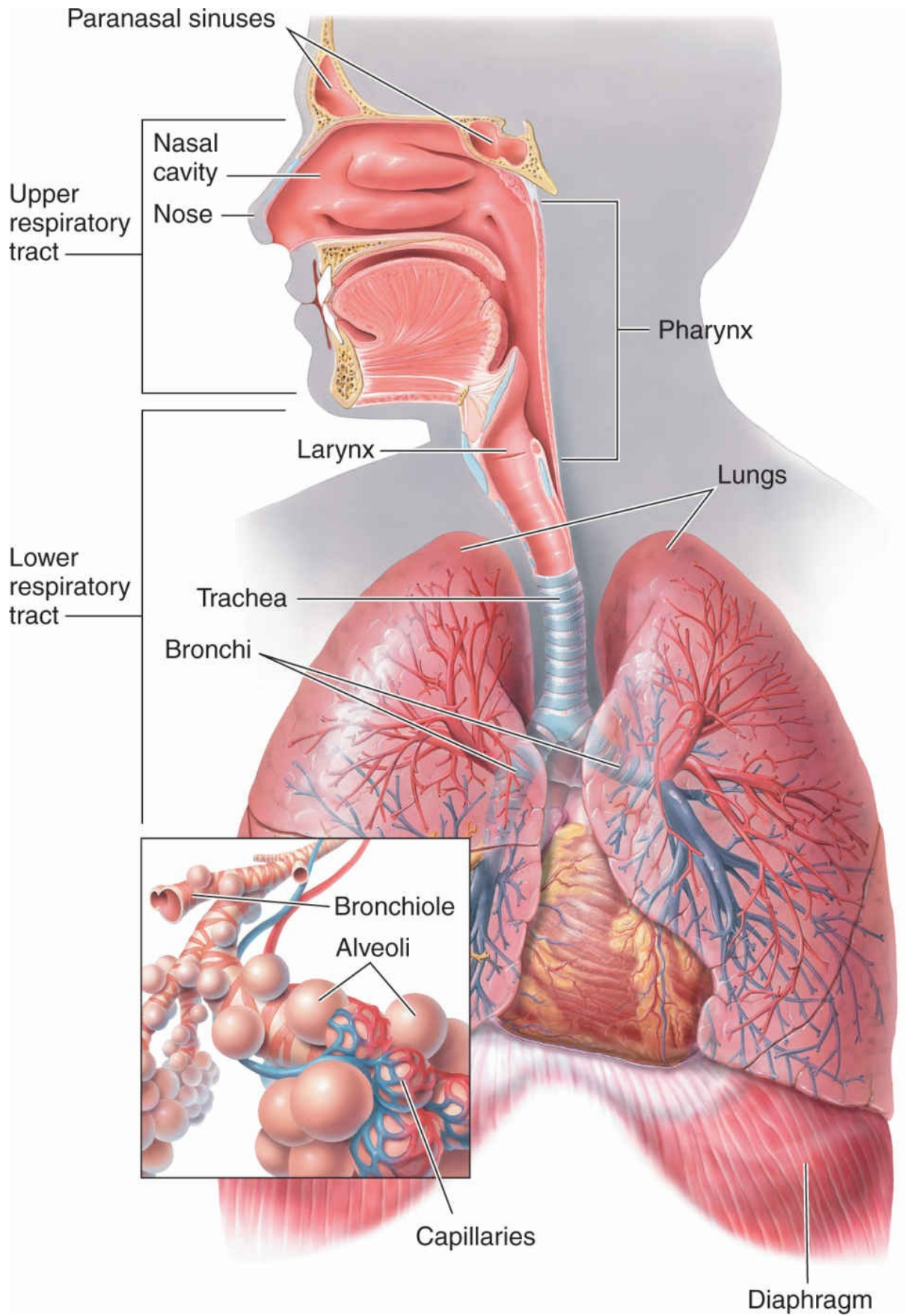


FIGURE 12-1 The structures of the upper and lower respiratory system.

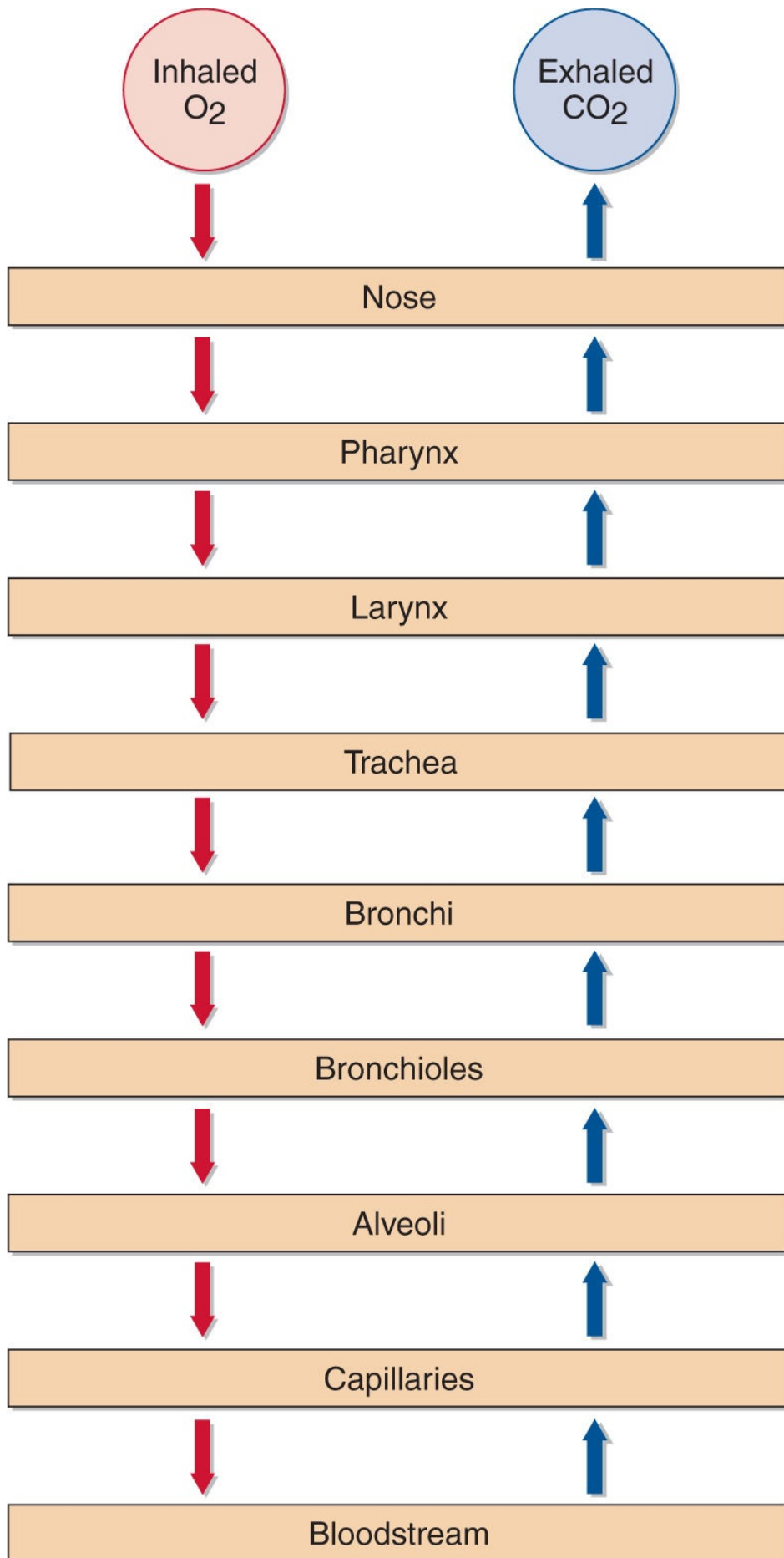


FIGURE 12-2 Pathway of inhaled/exhaled air. *Red arrows* indicate oxygenated air and *blue arrows* represent deoxygenated air. Oxygen (O₂) enters the respiratory system through the nose and travels down through the pharynx and larynx and into the bronchi, bronchioles, and alveoli of the lungs where a gas exchange takes place. Oxygen moves into the bloodstream where it is carried to the cells and is exchanged with carbon dioxide (CO₂). The carbon dioxide passes back up through the respiratory structures and is exhaled.

WORD PARTS RELATED TO THE RESPIRATORY SYSTEM

The word part *spir/o* (which is a root) and the suffix *-pnea* are both used to describe breathing. *Pulmon/o* means lung, and is the root of the word **pulmonary** (an adjective used to describe the lungs). Similarly, *nas/o* means nose and provides the root for **nasal** (an adjective used to describe the nose). Another root meaning nose is *rhin/o*. *Nasal* comes from the Latin word for nose, *nasus*, while *rhin/o* comes from the Greek word for nose, *rhis*. *Pneum/o* comes from the Greek word *pneumon* (lung) and can refer to the lungs or air. *Pneum/o* is the root for the well known infection pneumonia. **Table 12-1** shows common word parts related to the respiratory system.

TABLE 12-1  COMMON WORD PARTS RELATED TO THE RESPIRATORY SYSTEM

Word Part	Meaning
adeno-	glandlike
spir/o	breathing
bronch/o, bronchi/o	bronchus
laryng/o	larynx
lob/o	lobe
nas/o	nose

or/o	mouth, opening
-oxia	oxygen
pharyng/o	pharynx
-phonia	voice
phren/o	diaphragm
pleur/o	rib, side, pleura
-pnea	breathing
pneumo-, pneumon/o	lungs, air
pulmon/o	lung
rhin/o	nose
sinus/o	sinus cavity
spir/o	breathing
thorac/o, thorac/i, thoracic/o	thorax, chest
tonsill/o	tonsil
trache/o	trachea

Word Parts Exercise

After studying Table 12-1, write the meaning of each of the word parts.

WORD PART	MEANING
1. -phonia	1. _____
2. trache/o	2. _____
3. thorac/o, thorac/i, thoracic/o	3. _____
4. bronch/o, bronchi/o	4. _____
5. -pnea	5. _____
6. laryng/o	6. _____
7. sinus/o	7. _____
8. pleur/o	8. _____
9. pneumo-, pneumon/o	9. _____
10. nas/o	10. _____
11. -oxia	11. _____
12. pharyng/o	12. _____
13. phren/o	13. _____
14. pulmon/o	14. _____
15. or/o	15. _____

STRUCTURE AND FUNCTION

The respiratory system begins with the paranasal sinuses, nasal cavity, and nose and then descends to the pharynx, larynx, and trachea. Inferior to the trachea, the system splits into the right and left side. This inferior portion

consists of the bronchi and bronchioles that branch in the lungs, and the tiny air sacs called alveoli. A dome-shaped muscle important for breathing, called the **diaphragm**, is located at the base of the lungs.

The Nose, Nasal Cavity, and Paranasal Sinuses

Air enters the nose through openings called **nostrils**. The **nose** is lined with small hairs that trap particles and prevent them from entering the respiratory tract. Air then passes into the **nasal cavity**, a space on either side of a wall called the **nasal septum** that divides the nose into left and right halves. Here, the air is warmed and moistened. **Mucus**, a clear sticky secretion, coats the lining of the nasal cavity to filter out particles. The **paranasal sinuses** are air-filled cavities in the bones of the face that are connected to the nasal cavity. These sinuses include the frontal, ethmoidal, maxillary, and sphenoidal (see **Figure 12-3**).

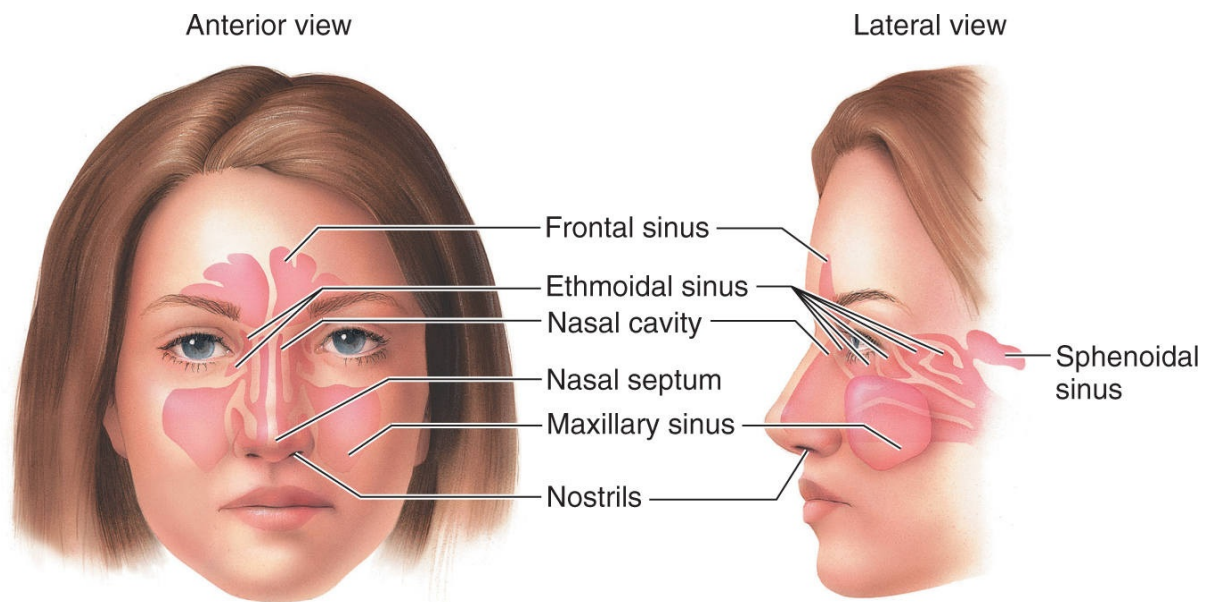


FIGURE 12-3 The nasal cavity and paranasal sinuses.

The Pharynx and Tonsils

The **pharynx**, also known as the throat, has three divisions: the *nasopharynx*, *oropharynx*, and *laryngopharynx*. The **nasopharynx** is posterior to the nasal cavity, the **oropharynx** is the middle portion located posterior to the oral cavity (mouth), and the **laryngopharynx** is the lower portion posterior to the larynx (see **Figure 12-4**). Lymphatic tissue called **tonsils** that aid in filtering bacteria are associated with the pharynx. The **pharyngeal tonsil**, also known as the **adenoids**, is located in the nasopharynx; the **palatine tonsil** is in the oropharynx; and the **lingual tonsil** is at the base of the posterior portion of the tongue (see **Figure 12-5**). Removal of the tonsils and adenoids is referred to

as a *tonsillectomy* and *adenoidectomy*; this is abbreviated as T and A.

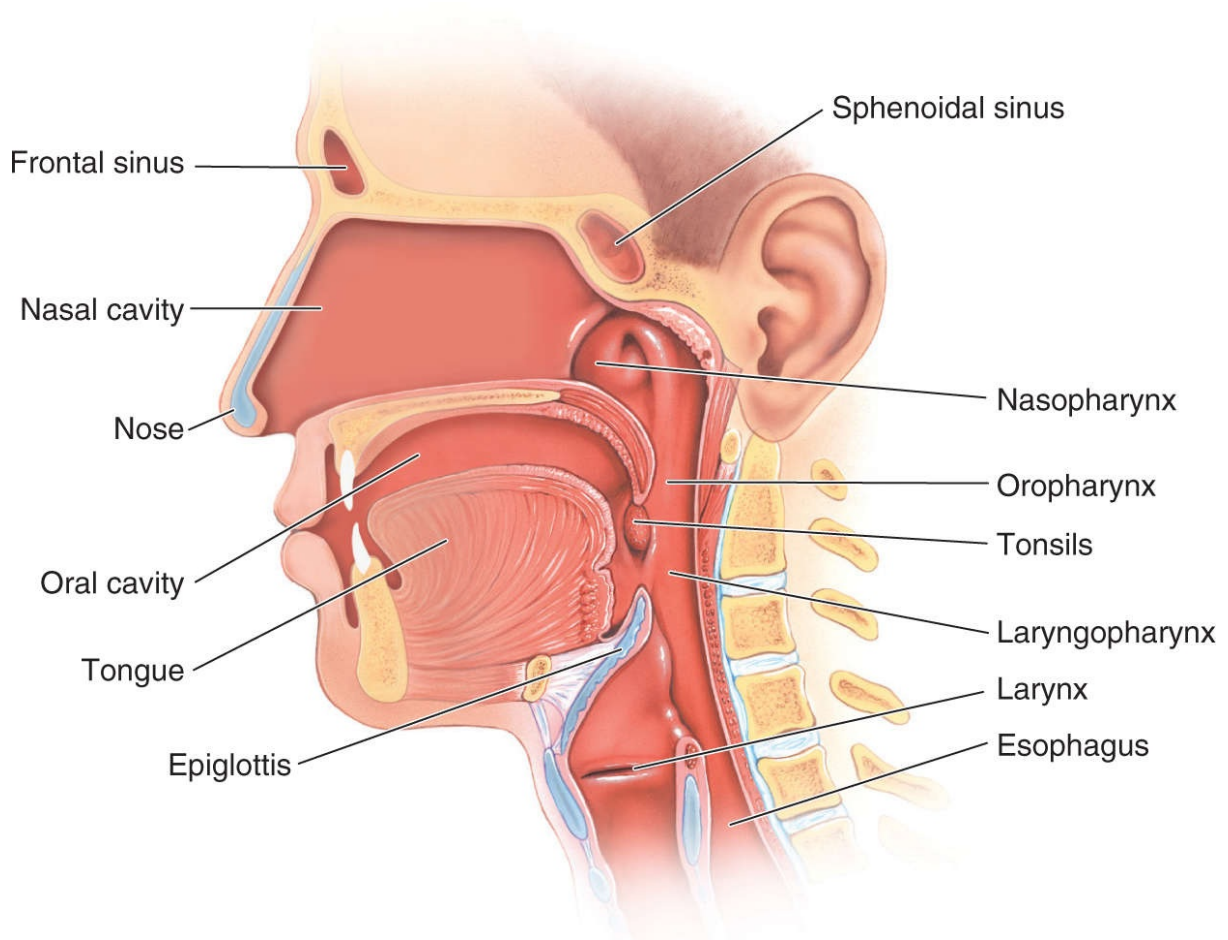


FIGURE 12-4 The regions of the pharynx.

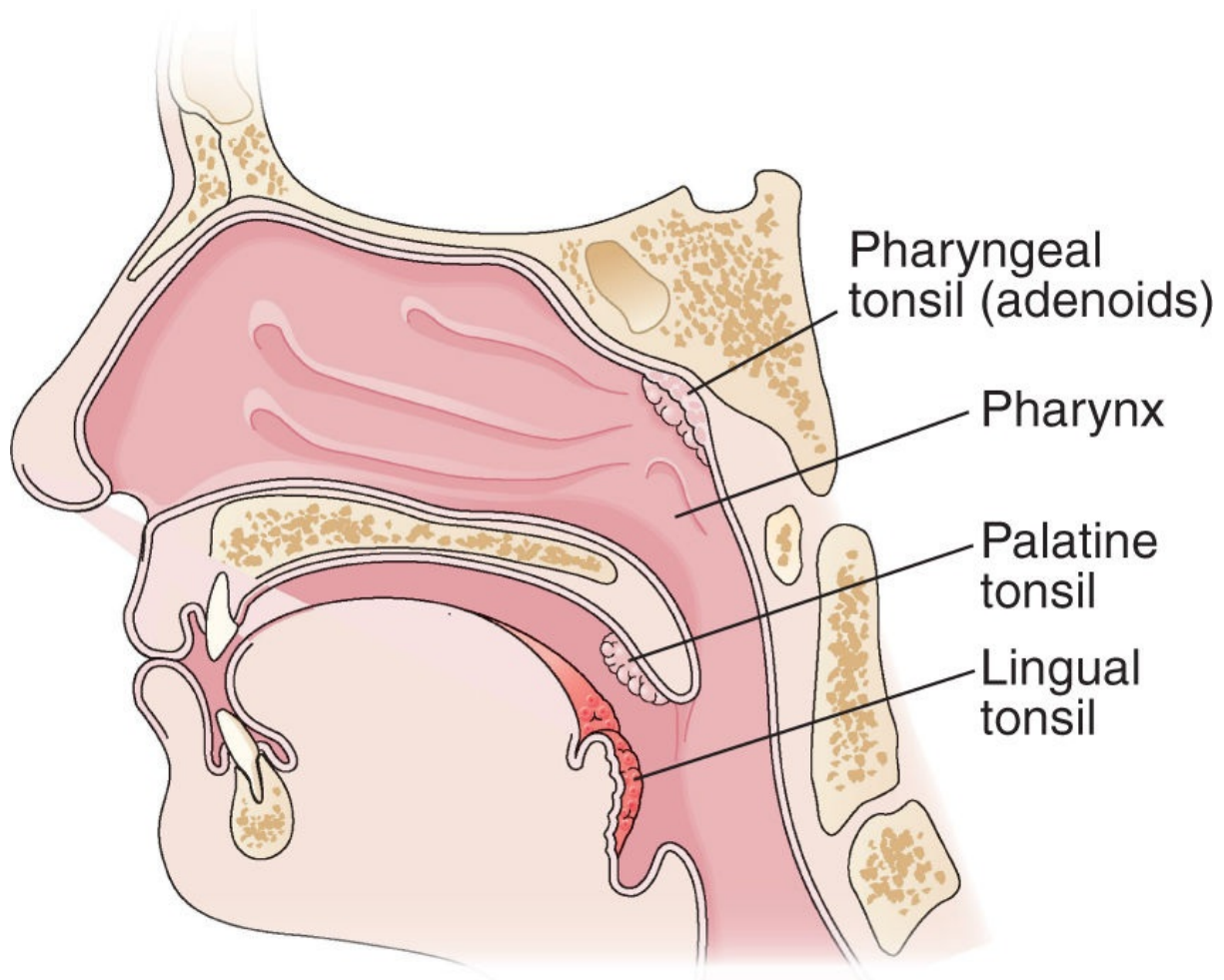


FIGURE 12-5 The pharynx and tonsils.

The Larynx and Trachea

The **larynx**, or *voice box*, is the organ that produces sound. Located between the pharynx and trachea, it is made up of cartilages and elastic membranes that house the vocal cords (vocal folds) and the muscles that control them (see [Figure 12-4](#) and [12-6](#)). Air enters the larynx through a slit-like opening called the **glottis**. A flap of cartilage known as the **epiglottis** protects the glottis during swallowing to prevent food or liquids from entering the respiratory tract. As air flows over the **vocal cords**, they vibrate to produce sound (see [Figure 12-6](#)).

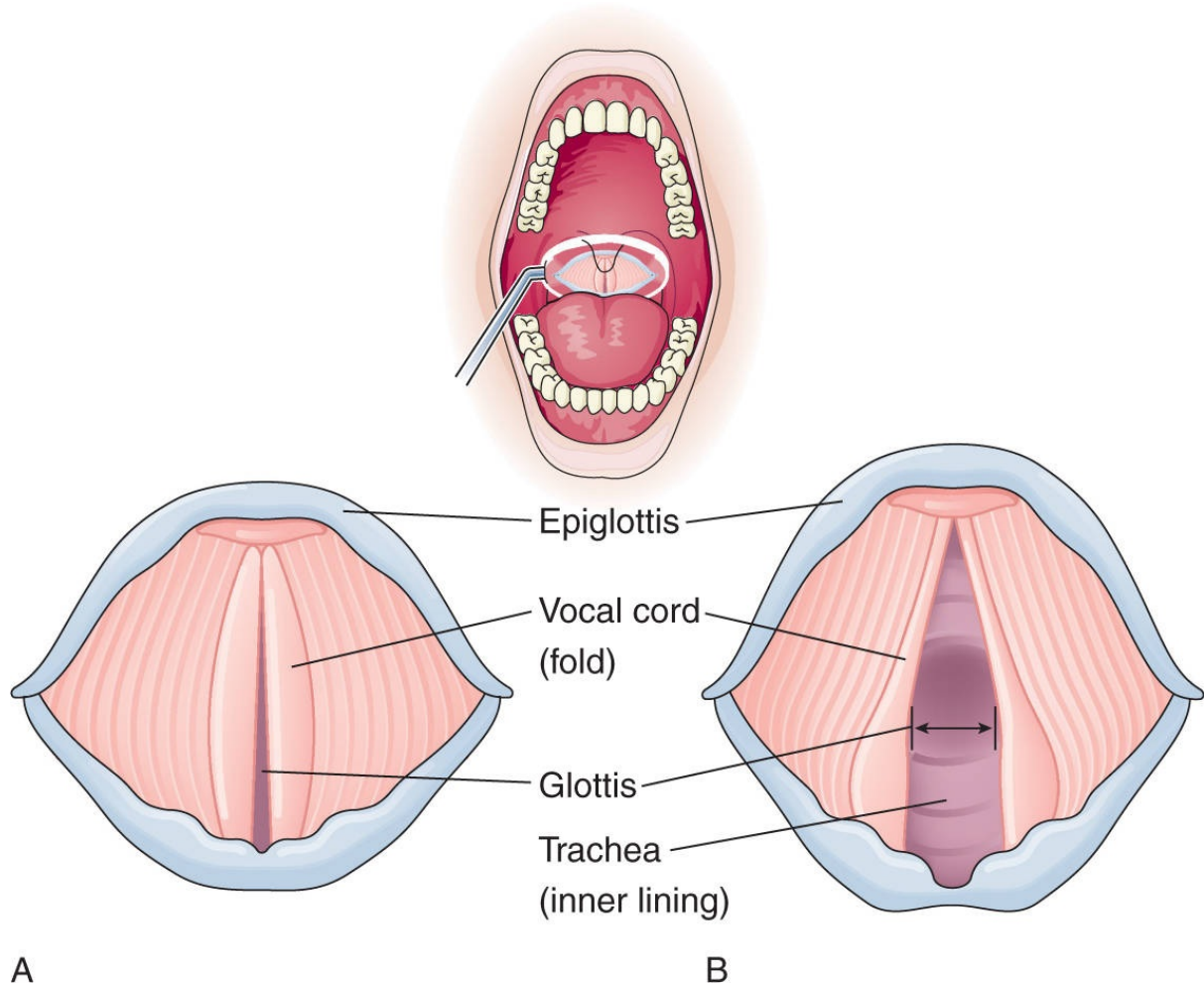


FIGURE 12-6 The vocal cords with **(A)** glottis closed and **(B)** glottis open.

The Trachea, Bronchi, Bronchioles, and Alveoli

The **trachea** (windpipe) is a cartilaginous tube that conducts air from the larynx to the bronchial tree. The **bronchial tree** consists of air-passage tubes that lead from the trachea to the lungs. It begins with two major airways called the **left bronchus** and **right bronchus**. The plural form of *bronchus* is *bronchi*. Air passes through the bronchi, which subdivide into increasingly smaller branches called **bronchioles**. The flow of air terminates in the bronchial tree in tiny air sacs called **alveoli**. Alveoli are structures where gas exchange of oxygen and carbon dioxide occurs (see **Figure 12-1** and **12-7**).

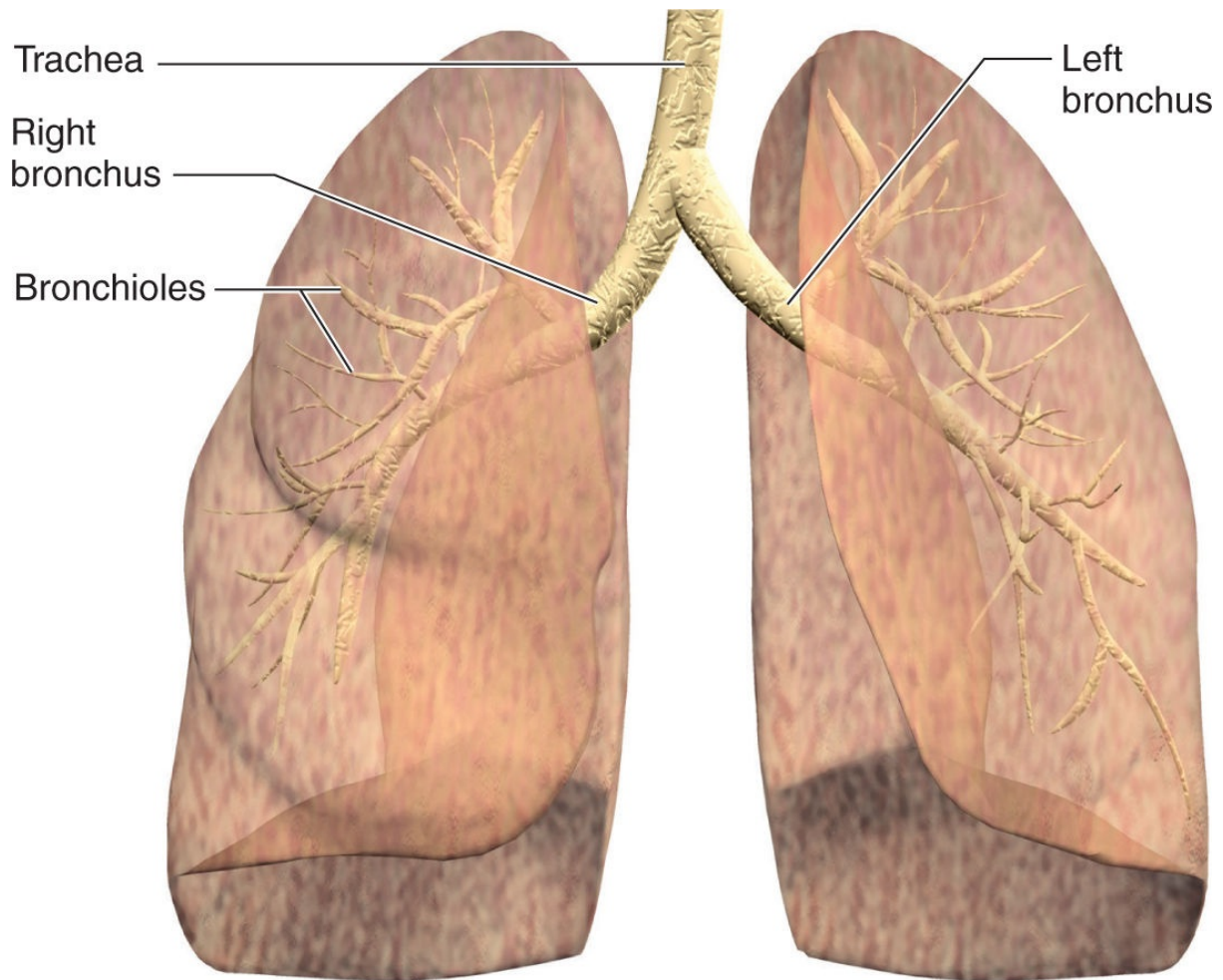


FIGURE 12-7 The trachea and bronchial tree.

The Lungs

The **lungs** are paired, spongy organs of breathing located in the thoracic (chest) cavity. They are enclosed in the **pleura**, which is a membrane composed of two layers called the **parietal pleura** and the **visceral pleura** (see [Figure 12-8](#)). The parietal (outer) pleura line the thoracic cavity and form the sac containing each lung. The visceral (inner) pleura closely surround each lung. The right lung is slightly larger than the left and has three lobes called the **superior lobe**, **middle lobe**, and **lower lobe**. The left lung has only two lobes, the **superior lobe** and **inferior lobe**. The left lung also has a medial indentation called the **cardiac notch**, which provides room for the heart. Each cone-shaped lung has an upper **apex** and a lower **base**, which rests on the diaphragm. The lungs and airways bring in fresh, oxygen-enriched air and get rid of waste carbon dioxide made by the cells in the body.

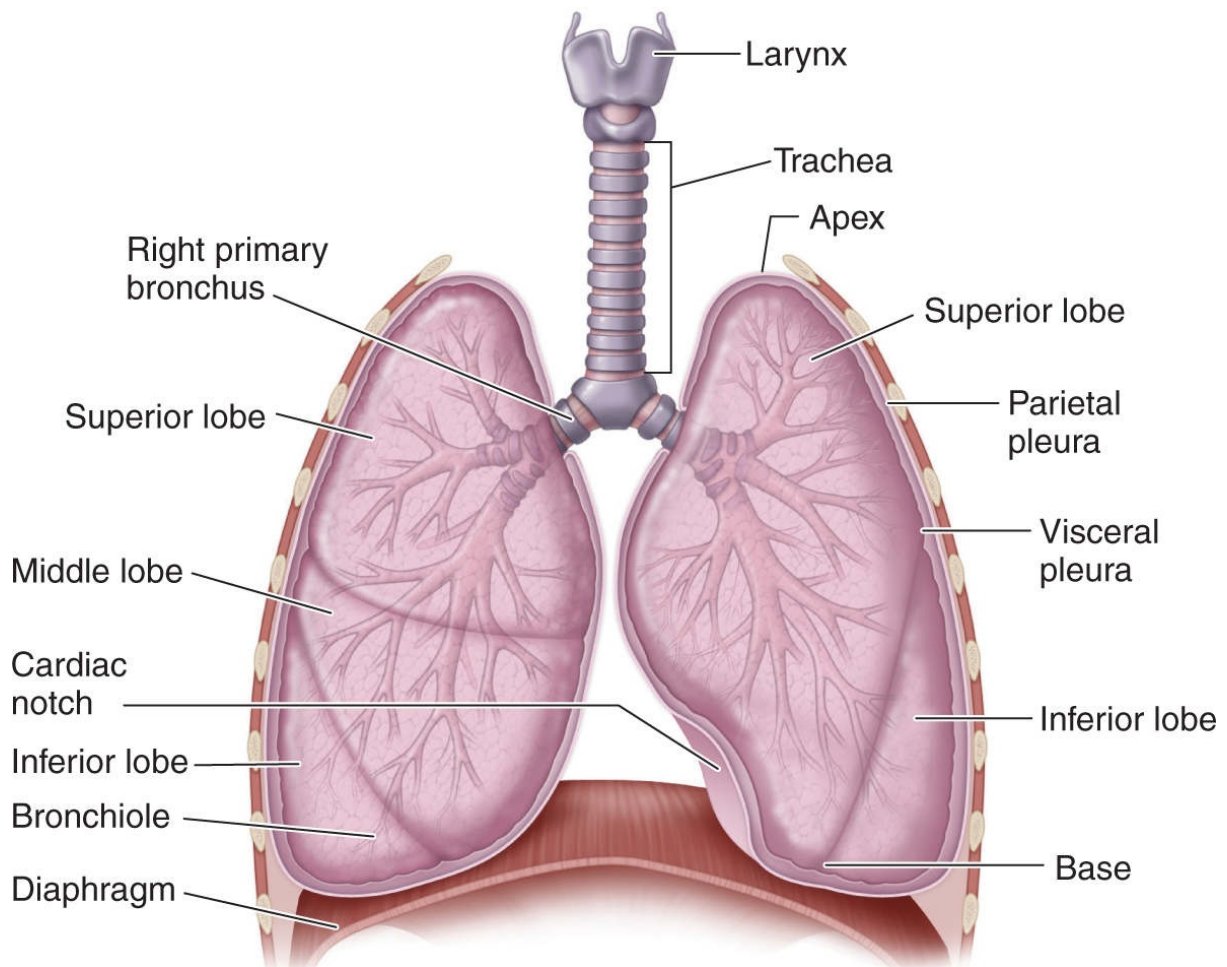


FIGURE 12-8 The lungs are paired organs of breathing located in the thoracic cavity. They are enclosed by an outer parietal pleura and an inner visceral pleura.

The Diaphragm

The **diaphragm** is a sheet of muscle that separates the thoracic cavity (which houses the lungs) from the lower abdominal cavity. The diaphragm is a major muscle used in breathing. When the diaphragm contracts, it moves inferiorly, the chest expands, and inhalation (inspiration or breathing in) occurs. When the diaphragm relaxes, it moves superiorly, the chest contracts, and exhalation (expiration or breathing out) occurs (see **Figure 12-9**). Two adjectives that mean the same thing and are used to describe the *diaphragm*, are *diaphragmatic* and *phrenic*.

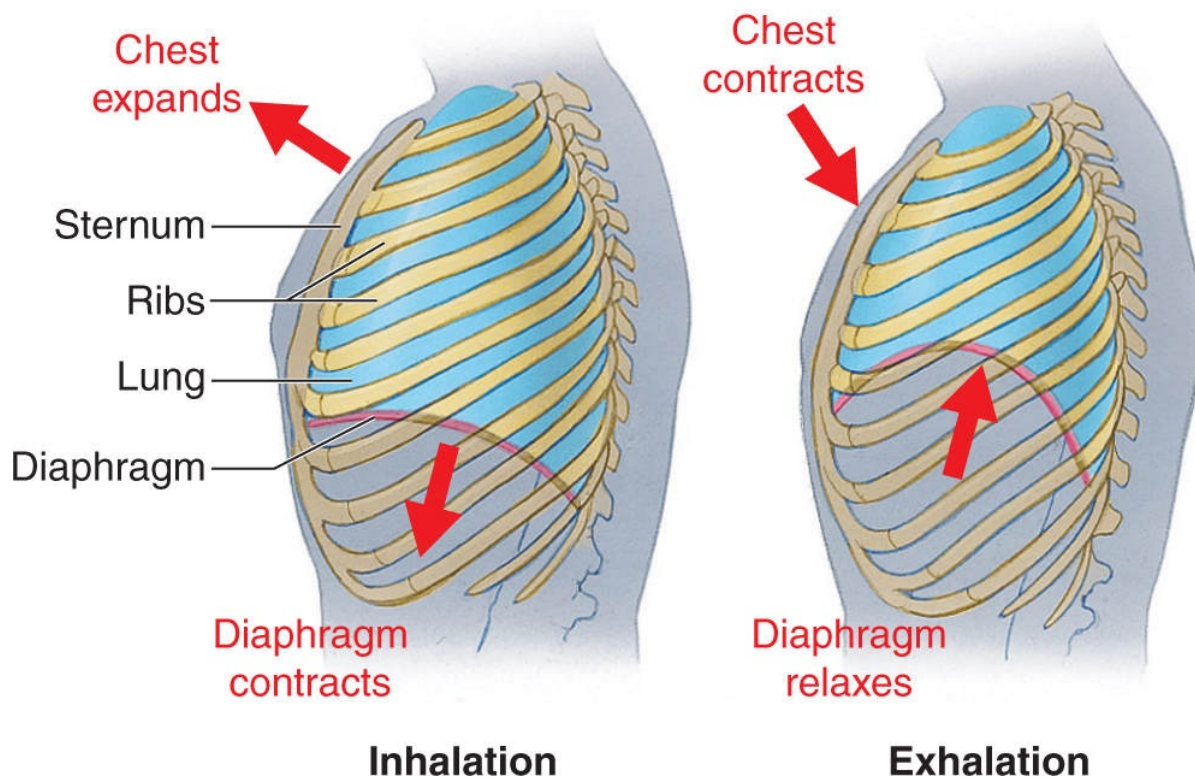


FIGURE 12-9 The process of breathing.



Quick Check

1. Another name for the voice box is the _____.
2. Another name for the windpipe is the _____.
3. Another name for the throat is the _____.

DISORDERS RELATED TO THE RESPIRATORY SYSTEM

The pathway through which air moves in and out of the lungs needs to remain **patent** (a common English word that when used as a medical term means “physically open”) in order for proper oxygen and carbon dioxide exchange to take place. When this pathway becomes partially blocked, the body’s normal response is a sneeze or cough, which may produce **sputum** (mucus from the lower respiratory system); **hemoptysis**, which is spitting or coughing up blood; or other secretions that need to be removed for optimal airway **patency** (state of being freely open).

Abnormal breath sounds are another indication of respiratory disease. **Rales**, also known as crackles, are high-pitched popping sounds usually originating in the smaller airways. **Rhonchi** (singular, *rhonchus*) are low-pitched sounds that come from the larger airways. **Wheezing** or whistling

sounds may indicate excessive secretions or partially obstructed airways. **Stridor** is a high-pitched squeaking sound that occurs when one breathes in, which is a sign of respiratory obstruction, especially in the trachea or larynx. Respiratory diseases may also alter breathing patterns and rates. Normal breathing, **eupnea**, should be regular and effortless. The following is a list of abnormalities in breathing:

Tachypnea: rapid breathing rate (it is normal to have tachypnea during exercise)

Bradypnea: abnormally slow breathing rate

Apnea: cessation of breathing; short periods of apnea may occur during sleep

Dyspnea: difficult or labored breathing

Orthopnea: discomfort or difficulty in breathing while lying flat; difficulty is relieved by sitting up

Cheyne Stokes: a cyclical breathing pattern in which breathing gradually decreases to a complete stop and then returns to normal

Kussmaul breathing: rapid, deep breathing; characteristic of diabetic acidosis or other causes of acidosis

A number of disorders affect the respiratory system. Some result in **rhinitis**, inflammation of the nasal mucous membrane, or **dysphonia**, altered voice production, which is usually painful or difficult (seen commonly in laryngitis). Disorders are discussed under the following broad categories: infectious disorders, obstructive lung diseases, and expansion disorders.

Infectious Disorders

Infectious disorders are diseases that are capable of being transmitted from person to person without actual contact. An upper respiratory infection is commonly called a URI. Here are some common respiratory system infectious disorders:

Common cold virus: any virus strain associated with the common cold, chiefly rhinoviruses

Sinusitis: inflammation of any sinus mucous membrane

Although rhinoviruses most frequently cause the common cold, there are over 200 other viruses, including the human coronavirus and the respiratory syncytial virus, that can also cause the common cold. Coronaviruses also cause bird bronchitis, mouse hepatitis, and newborn calf diarrhea.

Croup: acute obstruction of the upper respiratory tract (upper airway) in infants and children resulting in a barking cough with difficult and noisy breathing; also called **laryngotracheobronchitis**

Epiglottitis: inflammation of the epiglottis, which may cause respiratory obstruction

Influenza (flu): acute infectious respiratory disease caused by influenza viruses

Pneumonia: inflammation of the lung parenchyma (lung tissue of bronchioles, bronchi, blood vessels, and alveoli); may be caused by infection of a bacteria or a virus

Laryngitis: inflammation of the larynx mucous membrane

Pertussis (whooping cough): acute inflammation of the larynx, trachea, and bronchi caused by *Bordetella pertussis*

Tuberculosis (TB): infection caused by *Mycobacterium tuberculosis*; symptoms include fatigue, anorexia, weight loss, fever, chronic cough, and hemoptysis

Obstructive Lung Diseases

Obstructive disease impairs airflow through the bronchial tree. The obstruction may be caused by an increased production of secretions or actual destruction of the lung tissues. Well-known disorders that fall into this category include:

Asthma: lung disease characterized by reversible inflammation and constriction

Cystic fibrosis (CF): genetic disorder in which the lungs become clogged with excessive amounts of abnormally thick mucus

Chronic obstructive pulmonary disease (COPD): an umbrella term that includes both emphysema and chronic bronchitis (described next)

Emphysema: condition in which the alveoli are enlarged and inefficient, leading to shortness of breath (SOB)

Chronic bronchitis: inflammation of the mucous membrane of the bronchi

Expansion Disorders

Adequate lung expansion is necessary for proper gas exchange to take place.

Some disease conditions cause restrictions on the lung's capacity, thereby causing inadequate exchange between the atmosphere and the lungs. **Atelectasis** (collapsed lung) and **pneumothorax** (accumulation of air in the pleural cavity) are two such disorders.

DIAGNOSTIC TESTS, TREATMENTS, AND SURGICAL PROCEDURES

Both noninvasive and invasive procedures are used to diagnose respiratory system disorders. The noninvasive procedures include chest X-rays (CXR), lung scans, pulse oximetry, arterial blood gases (ABGs), and computed tomography scans. **Pulse oximetry** measures the oxygen saturation of arterial blood, whereas an **ABG** measures the amount of oxygen and carbon dioxide dissolved in arterial blood. Invasive procedures may include thoracentesis and bronchoscopy. A **thoracentesis** (*pleural tap*) is an insertion of a needle into the pleural cavity to withdraw fluid. A **bronchoscopy** is an examination of the trachea and bronchial tree through a viewing instrument called a bronchoscope (see **Figure 12-10**). Respiratory therapists perform **pulmonary function tests (PFTs)** on patients to assess breathing. A **spirometer** is an instrument used for measuring the air capacity of the lungs. Examples of air volumes and lung capacities measured by spirometry are presented in **Table 12-2**.

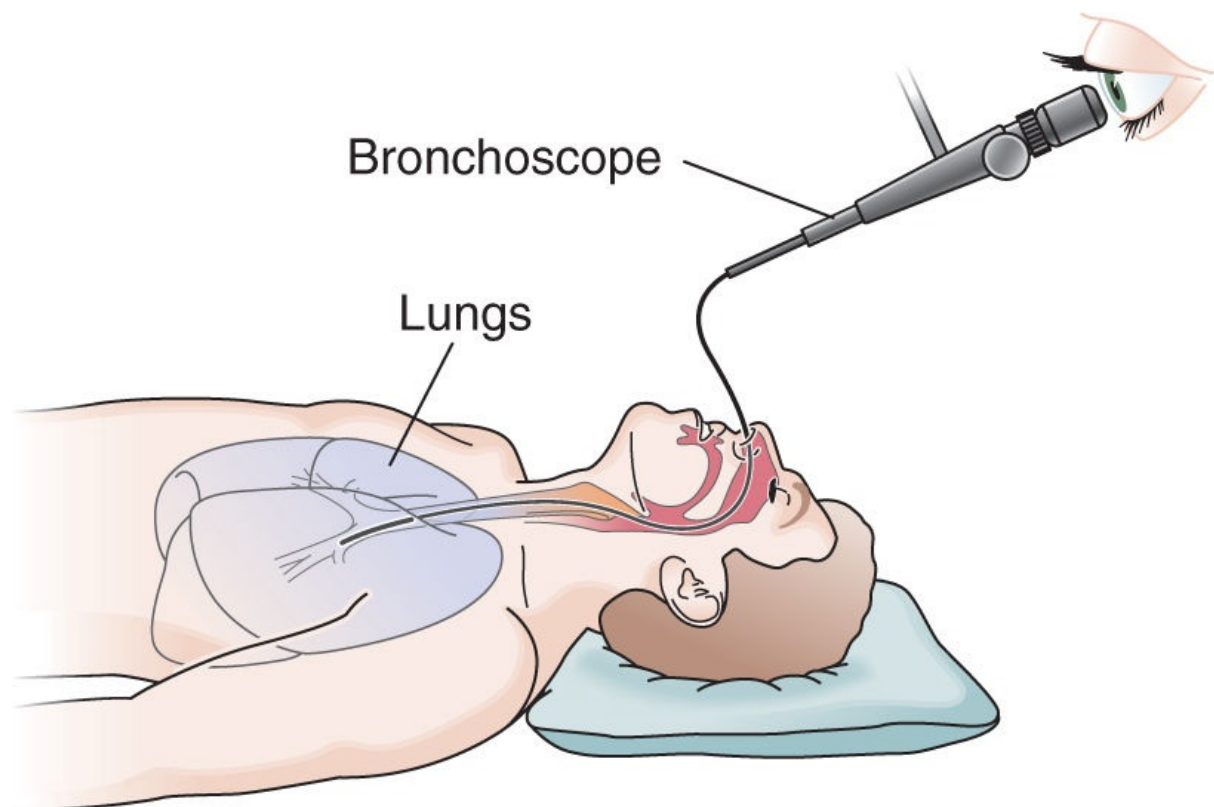


FIGURE 12-10 Bronchoscopy. Introduction of a bronchoscope through the nose that is then guided down into the bronchi. Visual examination (suffix -scopy means “visual examination”) can be made of the bronchial tree, biopsies may be taken from the bronchi, and secretions may be removed for analysis or to reduce respiratory distress.

TABLE 12-2  PULMONARY VOLUMES AND CAPACITIES

Volume	Description	Average Value
tidal volume (TV)	volume of air entering or exiting the lungs during normal breathing	500 mL
inspiratory reserve volume (IRV)	volume of air entering the lungs plus the tidal volume during forced inhalation	300 mL
expiratory reserve volume (ERV)	volume of air exiting the lungs plus the tidal volume during forced exhalation	1000 mL
vital capacity (VC)	maximum volume of air that can be exhaled after taking the deepest possible breath	4500 mL
residual volume (RV)	volume of air in the lungs at all times	1500 mL
total lung capacity (TLC)	volume of air that the lungs can hold	6000 mL

Treatment of lung conditions commonly includes medication. **Antihistamines** are drugs used to treat acute allergic reactions, like the symptoms seen in common pollen allergies. **Decongestants** are used to treat congestion. There are multiple types of drugs that one inhales. For example, a **bronchodilator** is used to expand the bronchi. Another example is an inhaled corticosteroid, which is used to reduce inflammation in the respiratory system.

PRACTICE AND PRACTITIONERS

Several different health care professionals diagnose and treat respiratory system disorders. A **pulmonologist** is a physician who specializes in **pulmonology**, which is the study of the lungs and their related structures. Both **otolaryngologists** and **otorhinolaryngologists** diagnose and treat disorders of the ears, nose, and throat. **Respiratory therapists** are allied health care professionals who specialize in airway management, mechanical ventilation (breathing), and blood acid–base balance.

Abbreviation Table THE RESPIRATORY SYSTEM

ABBREVIATION	MEANING
ABG	arterial blood gas
BP	blood pressure
CF	cystic fibrosis
c/o	complains of
CO ₂	carbon dioxide
COPD	chronic obstructive pulmonary disease
CXR	chest X-ray
ERV	expiratory reserve volume
F	fahrenheit
ICU	intensive care unit
IRV	inspiratory reserve volume
O ₂	oxygen
P	pulse
PFT	pulmonary function test
R	respiration
RV	residual volume (as measured with test equipment)
SOB	shortness of breath

T	temperature
T and A	tonsillectomy and adenoidectomy
TB	tuberculosis
TLC	total lung capacity
TV	tidal volume
URI	upper respiratory infection
VC	vital capacity
WBC	white blood cell

Study Table THE RESPIRATORY SYSTEM

TERM AND PRONUNCIATION	ANALYSIS	MEANING
Structure and Function		
adenoids (AD-en-oidz)	from the Greek word <i>adenoeides</i> (gland)	epithelial and lymphatic structure located on the posterior wall of the nasopharynx; also called pharyngeal tonsil
alveoli (al-VEE-oh-lye); singular: alveolus (al-VEE-oh-luss)	diminutive of the Latin word <i>alveus</i> (cavity, hollow)	tiny air sacs in the lungs where the exchange of oxygen and carbon dioxide occurs between the lungs and blood
apex (AY-pex)	a Latin word meaning “summit,” “peak,” “tip”	upper tip of each lung
base (beys)	common English word	word used to describe the bottom of each lung
bronchi (BRON-kye); singular: bronchus (BRON-kuss)	<i>bronch/o-</i> , <i>bronch/i-</i> (bronchus)	tubes (right and left) branching off from the trachea and into the lungs
bronchiole (BRON-kee-ole)	<i>bronch/o-</i> , <i>bronch/i-</i> (bronchus)	very small branches of bronchi that extend into the lungs
cilia (SIHL-ee-ah)	plural of the Latin word <i>cilium</i> (eyelash, eyelid)	small hairs in the upper respiratory tract that sweep foreign matter and mucus out of the respiratory tract
diaphragm (DY-uh-fram)	from the Greek word <i>diaphragma</i> (partition, barrier)	the dome-shaped major muscle of breathing located at the base of the thoracic cavity

epiglottis (ep-ih-GLOT-ih)	<i>epi-</i> (upon) + the Greek <i>glottis</i> (tongue, mouth of the windpipe)	a mucous membrane-covered, leaf-shaped piece of cartilage at the root of the tongue
external respiration (eks-TUR-nuhl res-puh-REY-shun)	from the Latin words <i>externus</i> (outside) and <i>respirationem</i> (breathing)	process in which air is brought into the lungs and oxygen and carbon dioxide are exchanged in the bloodstream at the capillaries surrounding the alveoli
glottis (GLOT-is)	a Greek word meaning “tongue,” “mouth of the windpipe”	part of the larynx consisting of the vocal folds (vocal cords) and the slit-like opening between the folds
internal respiration (in-TUR-nuhl res-puh-REY-shun)	from the Latin words <i>internus</i> (internal) and <i>respirationem</i> (breathing)	process where oxygen and carbon dioxide move between the bloodstream and the body’s cells
laryngopharynx (LAYN-in-go-FAYR-inx)	<i>laryng/o</i> (larynx); <i>-al</i> (adjective suffix); <i>pharyng/o</i> (pharynx)	lower portion of the pharynx
larynx (LAYR-inx)	<i>laryng/o</i> (larynx)	air passageway between the pharynx and the trachea that holds the vocal cords; commonly called the voice box
lingual tonsils (LING-gwuhl TON-suhlz)	from the Latin words <i>lingua</i> (tongue) and <i>tonsillae</i> (tonsil)	collection of lymphatic tissue on the under surface of the tongue
lobe (lohb)	from the Latin word <i>lobus</i> (lobe)	a subdivision of the lung; the left lung has a <i>superior lobe</i> , <i>middle lobe</i> , and <i>lower lobe</i> ; the right lung has a <i>superior lobe</i> and <i>inferior lobe</i>
lungs (luhngz)	from the German word <i>lunge</i> (lung)	organs of breathing located in the pulmonary cavities of the thorax
mediastinum (MEE-dee-ahs-TYN-um)	from the Latin word <i>mediastinus</i> (midway)	area between the lungs that houses the heart, aorta, trachea, esophagus, and bronchi
mucus (MYU-kus)	a Latin word meaning “slime,” “mold”	clear secretion produced by the mucous membranes of the respiratory tract
nasal (NAY-zuhl)	<i>nas/o</i> (nose); <i>-al</i> (adjective suffix)	adjective referring to the nose
nasal cavity (NAY-zuhl KAV-ih-tee)	from the Latin words <i>nasus</i> (nose) and <i>cavus</i> (hollow)	the space on either side of the nasal septum that extends from the nostril to the pharynx
nasal septum (NAY-zuhl SEP-tum)	<i>nas/o</i> (nose); <i>-al</i> (adjective); from the Latin word <i>saeptum</i> (partition)	the wall dividing the nasal cavity into halves
nasopharynx (NAY-zoh-FAYR-inx)	<i>nas/o</i> (nose); <i>pharyng/o</i> (pharynx)	upper portion of the pharynx
nose (nohz)	from the Latin word <i>nasus</i> (nose)	specialized organ at the entrance of the respiratory system
oropharynx (awr-oh-FAR-	from the Latin word <i>oris</i> (mouth);	middle portion of the pharynx

ingks)	<i>pharyng/o</i> (pharynx)	
palatine tonsils (PAL-uh-tahyn TON-suhlz)	from the Latin word <i>tonsillae</i> (tonsil)	a mass of lymphatic tissue embedded in the lateral wall of the oral pharynx
paranasal sinuses (pair-uh-NAY-zul SIGH-nuh-sez)	<i>para-</i> (alongside); <i>nas/o</i> (nose); <i>-al</i> (adjective); from the Latin word <i>sinus</i> (cavity)	paired air-filled cavities in the bones of the face that are connected to the nasal cavity; these include the frontal, sphenoidal, maxillary, and ethmoidal sinuses
patency (PAY-tehn-see)	from the Latin word <i>patere</i> (lie open, be open)	the state of being open
patent (PAH-tehnt or PAY-tehnt)	from the Latin word <i>patere</i> (lie open, be open)	open; adjective form of patency
pharyngeal tonsils (fuh-RIN-jee-uhl TON-suhlz)	from the Latin words <i>pharyngeus</i> (pharynx) and <i>tonsillae</i> (tonsil)	epithelial and lymphatic structure located on the posterior wall of the nasopharynx; also called adenoids
pharynx (FAYR-inx)	a Greek word meaning “throat”	passageway just inferior to the nasal cavity and mouth
phrenic (FREN-ik)	from the Greek word <i>phren</i> (midriff, heart, mind)	adjective referring to the diaphragm; synonymous with diaphragmatic
pleura (PLU-rah)	a Greek word meaning “side of the body,” “rib”	serous membrane that surrounds the lung; <i>parietal pleura</i> is the outer layer; <i>visceral pleura</i> is the inner layer
pulmonary (PULL-muhn-ayr-ee)	<i>pulmon/o</i> (lung); <i>-ary</i> (adjective suffix)	adjective meaning relating to the lungs
sputum (SPYOU-tum)	from the Latin word <i>spuere</i> (to spit)	thick mucus ejected through the mouth
tonsils (TON-silz)	from the Latin word <i>tonsillar</i> (a stake)	lymphatic structures including the pharyngeal tonsil (adenoids), palatine tonsil, and lingual tonsil
trachea (TRAY-kee-uh)	from the Greek word <i>trakheia</i> (windpipe)	air passage extending from the larynx into the thorax; <i>windpipe</i>
ventilation (ven-ti-LAY-shun)	from the Latin word <i>ventilo</i> (the wind)	movement of gases into and out of the lungs
vocal cords (VO-kuhl kords)	from the Latin words <i>vocalis</i> (speaking) and <i>chorda</i> (string)	folds of mucus membranes that are used in speech production
Disorders		
apnea (APP-nee-uh)	<i>a-</i> (without); <i>-pnea</i> (breathing)	absence of breathing
asthma (AZ-mah)	a Greek word meaning “a panting”	a lung disease characterized by reversible inflammation and constriction

atelectasis (at-eh-LEK-tah-sihs)	from the Greek word <i>ateles</i> (incomplete); <i>ectasis</i> (expansion)	collapse of a lung or part of a lung, leading to decreased gas exchange
bradypnea (BRAH-dip-NEE-ah)	<i>brady-</i> (slow); <i>-pnea</i> (breathing)	abnormally slow breathing
bronchial pneumonia (BRAWN-kee-uhl nu-MO-nee-ah); also called <i>bronchopneumonia</i>	<i>bronchi/o</i> (bronchus); <i>-al</i> (adjective suffix); <i>pneumon/o</i> (air, lung)	inflammation of the smaller bronchial tubes
bronchiectasis (BRON-kee-EK-tay-sis)	<i>bronchi/o</i> (bronchus); <i>-ectasis</i> (expansion)	chronic dilation of the bronchi
bronchiolitis (bron-kee-oh-LYE-tihs)	<i>bronchi/o</i> (bronchus); <i>-itis</i> (inflammation)	inflammation of the bronchioles
bronchiostenosis (BRON-kee-oh-steh-NOH-sis)	<i>bronchi/o</i> (bronchus); <i>sten/o</i> (narrowing); <i>-osis</i> (abnormal condition of)	narrowing of the bronchial tubes
bronchitis (bron-KYE-tihs)	<i>bronchi/o</i> (bronchus); <i>-itis</i> (inflammation)	inflammation of the mucous membrane of the bronchial tubes
bronchoconstriction (BRON-koh-kon-STRIK-shun)	<i>bronch/o</i> (bronchus); from the Latin word <i>constrictus</i> (compress)	the bronchi become narrowed or constricted
bronchodilation (BRON-koh-DYE-lay-shun)	<i>bronch/o</i> (bronchus); from the Latin word <i>dilatate</i> (make wider, dilate)	the bronchi become more open or dilated
bronchopneumonia (BRON-koh-nu-MO-nee-uh); also called <i>bronchial pneumonia</i>	<i>bronch/o</i> (bronchus); <i>pneumon/o</i> (air, lung); <i>-ia</i> (condition)	inflammation of the smaller bronchial tubes
bronchospasm (BRON-koh-spaz-uhm)	<i>bronch/o</i> (bronchus); from the Latin word <i>spasmus</i> (a spasm)	abnormal contraction of bronchi
Cheyne-Stokes (SHAYN-STOHKS)	named after John Cheyne, British physician, and William Stokes, Irish physician, who first described the disorder in the 19th century	a rhythmic respiratory pattern where there is a variation in depth of respirations alternating with periods of apnea
common cold virus (KOM-uhn kohld VYE-ruhs)	<i>virus</i> is the Latin word for poison	any virus associated with the common cold, chiefly rhinoviruses
croup (krupe)	obsolete English verb (to croak)	a viral infection that causes swelling of the larynx and epiglottis; a barking noise is characteristic; <i>laryngotracheobronchitis</i>
cyanosis (sigh-uh-NOH-)	from the Greek, <i>kyanos</i> (dark blue)	dark bluish discoloration of the skin and

sis)	color)	mucous membranes due to deficient oxygenation of the blood
cystic fibrosis (SIS-tik FYE-broh-sis)	from the Greek word <i>kystis</i> (bladder, pouch); from the Latin word <i>fibra</i> (fiber); <i>-osis</i> (abnormal condition)	genetic disorder in which the lungs become clogged with excessive amounts of abnormally thick mucus
dysphonia (DIS-fohn-ya)	<i>dys-</i> (difficult); <i>phon/o</i> (sound); <i>-ia</i> (condition)	difficult or painful speech
dyspnea (DISP-nee-uh)	<i>dys-</i> (difficult); <i>-pnea</i> (breathing)	difficulty breathing
emphysema (ehm-fih-SEE-mah)	a Greek word meaning “swelling”	condition in which the alveoli are inefficient because of distension
epiglottitis (ep-i-GLOT-eye-tis)	<i>epiglottis</i> (Latin for epiglottis); <i>-itis</i> (inflammation)	inflammation of the epiglottis
eupnea (yoop-NEE-uh)	<i>eu-</i> (good, normal); <i>-pnea</i> (breathing)	normal breathing while resting
hemoptysis (HEE-mop-ti-sis)	<i>hem/o</i> (blood); <i>-ptysis</i> (spitting)	spitting or coughing up blood
influenza (IN-flew-EN-zah); flu (floo)	an Italian word meaning “influence” (of planets or stars)	highly contagious viral infection of the upper respiratory tract that is spread by droplets
Kussmaul (KUHS-mowl)	named after 19th century German physician who first noted it among patients with advanced diabetes mellitus	rapid deep respirations that are characteristic of an acid–base imbalance (frequently seen in uncontrolled diabetes)
laryngitis (LAYR-ihn-jye-tis)	<i>laryng/o</i> (larynx); <i>-itis</i> (inflammation)	inflammation of the larynx
laryngospasm (lah-RIHN-go-spaz-uhm)	<i>laryng/o</i> (larynx); from the Latin word <i>spasmus</i> (a spasm)	involuntary contraction of the larynx
laryngostenosis (lah-RIHN-go-steh-NO-sihs)	<i>laryng/o</i> (larynx); <i>sten/o</i> (narrowing); <i>-osis</i> (abnormal condition)	a narrowing of the larynx
laryngotracheobronchitis (LAHYR-ing-go-TRAY-kee-oh-brahn-KYE-tis)	<i>laryng/o</i> (larynx); <i>trache/o</i> (trachea); <i>bronchi/o</i> (bronchus)	a viral infection that causes swelling of the larynx and epiglottis; a barking noise is characteristic; <i>croup</i>
orthopnea (or-THOP-NEE-ah)	<i>ortho-</i> (straight, correct); <i>-pnea</i> (breathing)	discomfort or difficulty in breathing while lying flat; difficulty is relieved by sitting up
pertussis (per-TUSS-ihs)	from the Latin <i>per-</i> (through); <i>tussis</i> (cough)	an acute infectious inflammation of the larynx, trachea, and bronchi caused by <i>Bordetella pertussis</i>
pharyngitis (fair-in-JYE-	<i>pharyng/o</i> (pharynx); <i>-itis</i>	inflammation of the pharynx

tihs)	(inflammation)	
pharyngospasm (fah-RIN-goh-spas-uhm)	<i>pharyng/o</i> (pharynx); from the Latin word <i>spasmus</i> (a spasm)	involuntary contraction of the pharynx
phrenoplegia (fren-oh-PLÉE-jee-ah)	<i>phren/o</i> (diaphragm); <i>-plegia</i> (paralysis)	paralysis of the diaphragm
pleurisy (PLUR-ih-see)	from the Latin word <i>pleurisy</i> (side of the body)	inflammation of the pleura (membrane that surrounds the lungs and lines the walls of the thoracic cavity)
pneumolith (NOO-mo-lith)	<i>pneum/o</i> (air, lung); from the Greek word <i>lithos</i> (stone)	calculus (stone) in a lung
pneumonia (noo-MONE-yah)	<i>pneumon/o</i> (air, lung); <i>-ia</i> (condition)	inflammation of a lung caused by infection, chemical inhalation, or trauma; <i>pneumonitis</i>
pneumonitis (noo-mo-NYE-tihs)	<i>pneumon/o</i> (air, lung); <i>-itis</i> (inflammation)	inflammation of a lung caused by infection, chemical inhalation, or trauma; <i>pneumonia</i>
pneumothorax (NOO-moh-thoh-rax)	<i>pneumon/o</i> (air, lung); from the Greek word <i>thorakos</i> (breastplate, chest)	accumulation of air in the pleural cavity
rales (RAHLZ)	from the French word <i>raler</i> (to make a rattling sound in the throat)	abnormal breath sound; crackles
rhinitis (rye-NYE-tiss)	<i>rhin/o</i> (nose); <i>-itis</i> (inflammation)	inflammation of the inner lining of the nasal cavity
rhinopathy (rye-NOH-path-ee)	<i>rhin/o</i> (nose); <i>-pathy</i> (disease)	any disease of the nose
rhinorrhea (rye-noh-REE-ah)	<i>rhin/o</i> (nose); <i>-rrhea</i> (discharge)	discharge from the nose
rhonchi (RON-kye)	from the Greek <i>rhonchos</i> (snore)	abnormal breath sound; low-pitched sonorous sounds
sinusitis (sy-nuh-SYE-tihs)	<i>sinus/o</i> (sinus); <i>-itis</i> (inflammation)	inflammation of the respiratory sinuses
stridor (STRYE-dohr)	a Latin word meaning “harsh, high pitched”	high-pitched squeaking sound frequently associated with croup
tachypnea (TAK-ip-NE-ah)	<i>tachy-</i> (rapid); <i>-pnea</i> (breathing)	abnormal rapid respiration
tracheitis (tray-kee-EYE-tiss)	<i>trache/o</i> (trachea); <i>-itis</i> (inflammation)	inflammation of the trachea
tracheostenosis (TRAY-kee-oh-sten-OH-siss)	<i>trache/o</i> (trachea); <i>sten/o</i> (narrowing); <i>-sis</i> (condition)	abnormal narrowing of the trachea

tuberculosis (tu-BURK-yu-loh-sihs)	from the Latin word- <i>tuberculum</i> (small swelling, pimple); <i>-osis</i> (abnormal condition)	disease caused by presence of <i>Mycobacterium tuberculosis</i> , most commonly affecting the lungs
wheezing (WEE-zing)	common English word; from Old Norse <i>hvaesa</i> (to hiss)	abnormal breath sounds; whistling sounds heard with upper airway obstruction
Diagnostic Tests, Treatments, and Surgical Procedures		
antihistamine (an-tee-HISS-tah-MEEN)	<i>anti-</i> (against); from the Greek word <i>histos</i> (tissue); from the Latin <i>amine</i> (ammonia, compound)	drug used to treat acute allergic reactions
antipyretic (an-tee-PYE-reh-tik)	<i>anti-</i> (against); from the Greek <i>pyretos</i> (fever); <i>-ic</i> (adjective suffix)	drug used to reduce fever
arterial blood gas (ahr-TEER-ee-uhl BLUD GAS)	<i>arteri/o</i> (artery) + blood + gas, common English words	measures the partial pressures of oxygen and carbon dioxide in the arterial blood
bronchodilator (bron-koh-DYE-lay-tor)	<i>bronch/o</i> (bronchus); from the Latin word <i>dilatate</i> (make wider)	drug used to expand the bronchi
bronchoplasty (BRON-koh-plass-tee)	<i>bronch/o</i> (bronchus); <i>-plasty</i> (surgical repair)	surgical repair of a bronchus
bronchoscope (BRON-koh-skope)	<i>bronch/o</i> (bronchus); <i>-scope</i> (instrument for viewing)	a device for visually inspecting the interior of a bronchus
bronchoscopy (bron-KOSS-ko-pee)	<i>bronch/o</i> (bronchus); <i>-scopy</i> (use of instrument for viewing)	inspection of the bronchial tree using a bronchoscope
decongestant (DEE-kon-jes-tant)	<i>de-</i> (away from, cessation); from the Latin word <i>congerere</i> (to bring together)	drug used to reduce congestion
laryngectomy (LAYR-ehn-JEK-toh-mee)	<i>laryng/o</i> (larynx); <i>-ectomy</i> (excision)	excision of the larynx
laryngoscope (lah-RIHN-go-skope)	<i>laryng/o</i> (larynx); <i>-scope</i> (instrument for viewing)	instrument with a light at the tip to aid in visual inspection of the larynx
laryngoplasty (lah-RIHN-go-plass-tee)	<i>laryng/o</i> (larynx); <i>-plasty</i> (surgical repair)	surgical repair of the larynx
laryngoscopy (LAYR-ihn-GOSS-koh-pee)	<i>laryng/o</i> (larynx); <i>-scopy</i> (use of instrument for viewing)	visual inspection of the larynx with the aid of a laryngoscope
laryngotomy (layr-ihn-GOT-oh-mee)	<i>laryng/o</i> (larynx); <i>-tomy</i> (cutting operation)	incision into the larynx
pharyngoplasty (fah-	<i>pharyng/o</i> (pharynx); <i>-plasty</i> (surgical	surgical repair of the pharynx

RIHN-go-plass-tee)	repair)	
pharyngoscope (fah-RIN-goh-skope)	<i>pharyng/o</i> (pharynx); <i>-scope</i> (instrument for viewing)	instrument with a light at the tip to aid in the visual inspection of the pharynx
pharyngoscopy (FAH-rihn-GAW-skoh-pee)	<i>pharyng/o</i> (pharynx); <i>-scopy</i> (use of instrument for viewing)	visual inspection of the pharynx with aid of a pharyngoscope
pharyngotomy (FAYR-ihh-GOT-oh-mee)	<i>pharyng/o</i> (pharynx); <i>-tomy</i> (cutting operation)	surgical incision into the pharynx
pneumonectomy (NOO-mo-NEK-toh-mee)	<i>pneumon/o</i> (air, lung); <i>-ectomy</i> (excision)	removal of pulmonary lobes from a lung
pneumonorrhaphy (noo-mo-NOR-ah-fee)	<i>pneumon/o</i> (air, lung); <i>-rrhaphy</i> (surgical suturing)	suturing of a lung
pneumotomy (noo-mo-NOT-ah-mee)	<i>pneumon/o</i> (air, lung); <i>-tomy</i> (cutting operation)	incision into a lung
postural drainage (PAHS-chu-ral DRAIN-ej)	common English words	a physical therapy technique where the patient lies on his or her side on a decline to help drain the lungs
pulmonary function test (PULL-muhn-ayr-ee FUHNGK-shuhn test)	<i>pulmon/o</i> (lung); <i>-ary</i> (adjective suffix); function tests, common English words	measurement of lung volumes to assess breathing and ventilation; instrument used is a spirometer
pulse oximeter (puhls ahk-SIM-eh-tuhr)	from the Latin word <i>pellere</i> (to push, drive); from the Greek words <i>oxys</i> (sharp) and <i>metron</i> (measure)	a device that measures the oxygen saturation of arterial blood by reference to light wave lengths
pulse oximetry (puhls ahk-SIM-eh-tree)	from the Latin word <i>pellere</i> (to push, drive); from the Greek words <i>oxys</i> (sharp) and <i>metron</i> (measure)	a small instrument is placed on a finger or thin body part that measures the oxygen saturation of arterial blood
rhinoplasty (RYE-noh-plass-tee)	<i>rhin/o</i> (nose); <i>-plasty</i> (surgical repair)	surgery performed on the nose
rhinoscope (RYE-noh-skope)	<i>rhin/o</i> (nose); <i>-scope</i> (instrument for viewing)	a small mirror with a thin handle; used in rhinoscopy
rhinoscopy (rye-NAW-skoh-pee)	<i>rhin/o</i> (nose); <i>-scopy</i> (use of instrument for viewing)	visual inspection of the nasal areas
rhinotomy (rye-NAW-toh-mee)	<i>rhin/o</i> (nose); <i>-tomy</i> (cutting operation)	surgical incision into the nose
sinusotomy (sy-nus-OT-oh-mee)	<i>sinus/o</i> (sinus); <i>-tomy</i> (cutting operation)	incision into a sinus
spirometer (spy-ROM-eh-ter)	from the Latin word <i>spirare</i> (breath, blow, live); from the Greek word <i>metron</i> (measure)	a device used to measure respiratory gases

thoracentesis (THOH-rah-sen-TEE-sihs)	<i>thorac/o</i> (thorax); <i>-centesis</i> (surgical puncture)	insertion of a needle into the pleural cavity to withdraw fluid for diagnostic purposes, to drain excess fluid, or to re-expand a collapsed lung
tracheoplasty (TRAY-kee-oh-plass-tee)	<i>trache/o</i> (trachea); <i>-plasty</i> (surgical repair)	surgical repair of the trachea
tracheostomy (tray-kee-OS-toh-mee)	<i>trache/o</i> (trachea); from the Greek <i>stoma</i> (mouth)	surgical creation of an opening into the trachea to form an airway or to prepare for the insertion of a tube for ventilation
tracheotomy (tray-kee-AH-toh-mee)	<i>trache/o</i> (trachea); <i>-tomy</i> (cutting operation)	incision into the trachea for purpose of restoring airflow to the lungs
Practice and Practitioners		
otolaryngologist (oh-toh-LAYR-ihn-GAW-loh-jist)	<i>ot/o</i> (ear); <i>laryng/o</i> (larynx); <i>-logist</i> (one who specializes)	physician who specializes in diagnosis and treatment of ear, nose, and throat diseases
otolaryngology (oh-toh-LAYR-ihn-GAW-loh-jee)	<i>ot/o</i> (ear); <i>laryng/o</i> (larynx); <i>-logy</i> (study of)	branch of medical study concerned with the ear, nose, and throat and diagnosis and treatment of its diseases
otorhinolaryngologist (oh-toh-RYE-no-layr-ihn-GAW-loh-jist)	<i>ot/o</i> (ear); <i>rhin/o</i> (nose); <i>laryng/o</i> (larynx); <i>-logist</i> (one who specializes)	physician who specializes in diagnosis and treatment of ear, nose, and throat diseases
pulmonologist (PULL-muhn-AWL-oh-jist)	<i>pulmon/o</i> (lung); <i>-logist</i> (one who specializes)	physician who specializes in diagnosing and treating respiratory disorders
pulmonology (PULL-muhn-AW-loh-jee)	<i>pulmon/o</i> (lung); <i>-logy</i> (study of)	medical specialty of diagnosing and treating respiratory disorders
respiratory therapist (RES-per-uh-tawr-ee THER-uh-pist)	from the Latin word <i>respirare</i> (breathe, blow back, blow again); therapist	allied health care professional who specializes in airway management, mechanical ventilation, and blood acid–base balance

END-OF-CHAPTER EXERCISES

EXERCISE 12-1



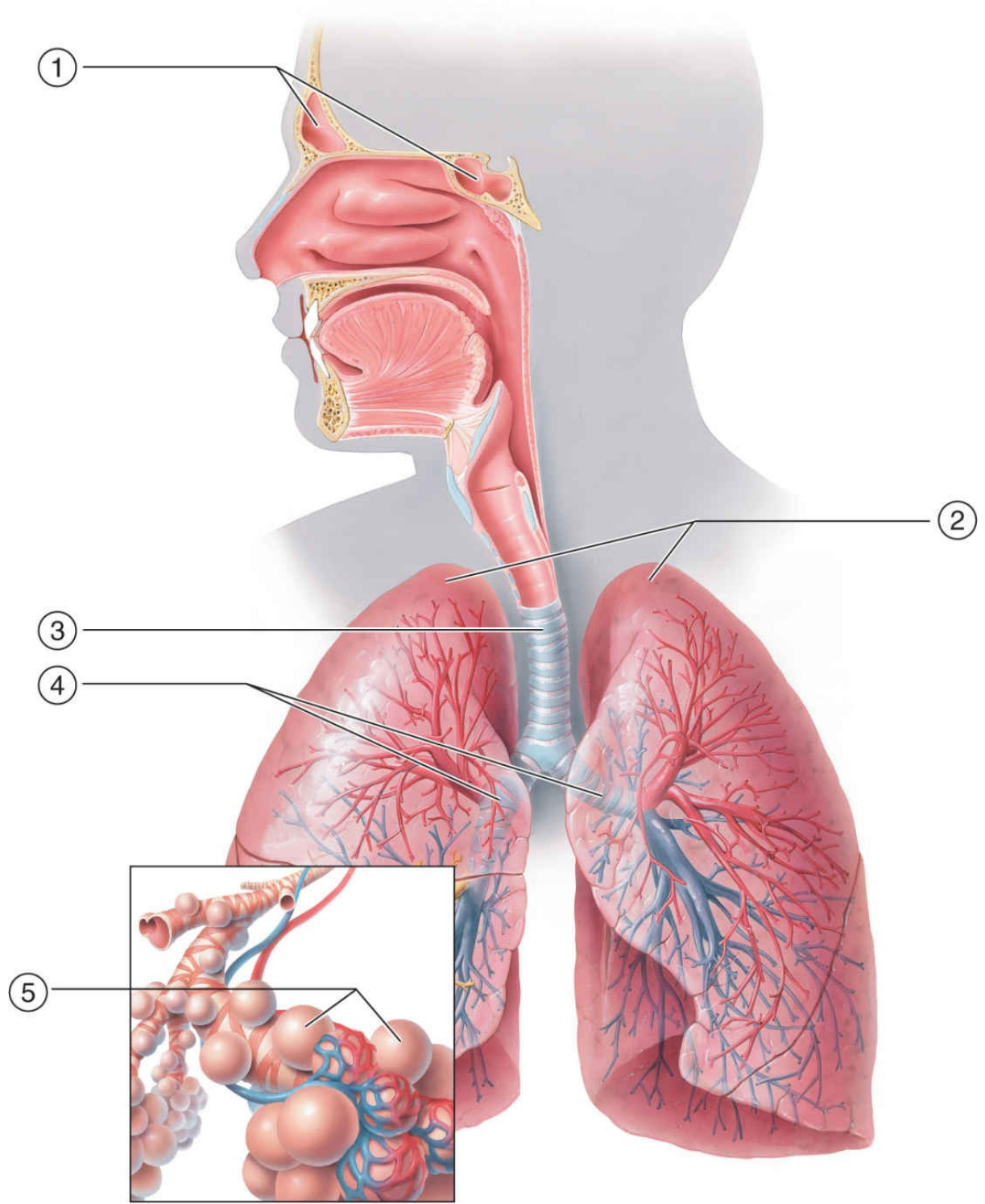
LABELING

Using the following list, choose the correct terms to label the diagram correctly.

alveoli lungs

trachea

bronchi paranasal sinuses



1. _____
2. _____
3. _____
4. _____
5. _____

EXERCISE 12-2**WORD PARTS**

Break each of the following terms into its word parts: prefix, root, or suffix. Give the meaning of each word part and then define the term.

1. *nasopharynx*

root: _____

root: _____

definition: _____

2. *pulmonary*

root: _____

suffix: _____

definition: _____

3. *dysphonia*

prefix: _____

root: _____

suffix: _____

definition: _____

4. *hemoptysis*

root: _____

suffix: _____

definition: _____

5. *laryngostenosis*

root: _____

root: _____

suffix: _____

definition: _____

6. *antipyretic*

prefix: _____

root: _____

suffix: _____

definition: _____

7. *rhinoplasty*

root: _____

suffix: _____

definition: _____

8. *otolaryngologist*

root: _____

root: _____

suffix: _____

definition: _____

EXERCISE 12-3



WORD BUILDING

Use *branch/o* or *bronchi/o* to build the medical words meaning:

1. inflammation of the bronchi _____
2. chronic dilation of the bronchioles _____

Use the suffix *-itis* to build the medical words meaning:

3. inflammation of the larynx _____
4. inflammation of a sinus _____
5. inflammation of the epiglottis _____

Use the suffix *-pnea* to build the medical words meaning:

6. rapid breathing _____
7. slow breathing _____
8. painful or difficulty breathing _____
9. difficulty breathing while lying down _____

EXERCISE 12-4



MATCHING

Match the term with its definition.

1. _____ a. the lid or flap that helps prevent food and drink

- alveoli from entering the trachea
2. _____
diaphragm
 3. _____
pulmonary
 4. _____
trachea
 5. _____
epiglottis
 6. _____
pneumonia,
pneumonitis
 7. _____
larynx
 8. _____
bronchioles
 9. _____
asthma
 10. _____
pharynx
 11. _____
emphysema
 12. _____
bronchitis
 13. _____
dyspnea
 14. _____
tracheotomy
 15. _____
bronchiostenosis
- b. the “voice box”
 - c. indicating something in or associated with the lungs
 - d. the major muscle of the respiratory system
 - e. tiny “sacs” in the lungs that receive oxygen from the bronchioles and transfer it to the capillaries
 - f. the “windpipe”; air flows through it to the bronchi
 - g. inflammation of a lung, caused by infection, chemical inhalation, or trauma
 - h. incision into the trachea
 - i. inner lining of the lung
 - j. the smallest extensions of the bronchi, which pass air directly to the alveoli
 - k. a lung disease characterized by reversible inflammation and constriction
 - l. throat
 - m. narrowing of a bronchial tube
 - n. inflammation of the mucous membrane of the bronchial tubes
 - o. difficulty breathing

16. _____ p. inspection using a bronchoscope
apnea
17. _____ q. absence of breathing
visceral pleura
18. _____ r. condition in which the alveoli are inefficient due
bronchoscopy to distension

EXERCISE 12-5



MULTIPLE CHOICE

Choose the correct answer for the following multiple choice questions.

- Pertussis is the medical term for _____.
 - strep throat
 - diphtheria
 - whooping cough
 - Lyme disease
- What is the uppermost part of the pharynx?
 - oropharynx
 - laryngopharynx
 - nasopharynx
 - hypopharynx
- What is the serous membrane that lines the walls of the pulmonary cavity?
 - visceral pleura
 - parietal pleura
 - visceral peritoneum
 - parietal peritoneum
- Which procedure involves making an opening in the trachea to facilitate breathing?
 - intubation
 - tracheocentesis
 - tracheoplasty

- d. tracheostomy
5. Which of the following would probably cause dysphonia?
 - a. rhinitis
 - b. laryngitis
 - c. otitis
 - d. ophthalmodynia
 6. Which of the following is the same as pharyngitis?
 - a. sore lung
 - b. inflammation of the pharynx
 - c. examination of the throat
 - d. a fungal condition of the pharynx
 7. Which term means the drawing of air into the lungs?
 - a. respiration
 - b. orthopnea
 - c. inhalation
 - d. hypoxia
 8. What is another term for *pneumonia*?
 - a. pleuropneumonia
 - b. pneumonitis
 - c. pulmonary edema
 - d. pulmonary insufficiency
 9. What is a collapse of part of a lung called?
 - a. asthma
 - b. atelectasis
 - c. SIDS
 - d. CF
 10. What is a lobectomy?
 - a. incision of the lung

- b. excision of a lung
- c. excision of a lobe of a lung
- d. bilateral incision of the skull

EXERCISE 12-6



FILL IN THE BLANK

Fill in the blank with the correct answer.

1. Expectoration of blood is called _____.
2. The term for slow breathing is _____.
3. A surgical puncture of the lung is called a _____.
4. Pleurisy is _____.
5. The membrane that surrounds the lung is the _____.
6. The term for difficulty breathing while lying down is _____.
7. Chronic dilation of the bronchi is called _____.
8. Discharge from the nose is known as _____.
9. The abnormal breathing condition that describes alternating periods of apnea and dyspnea is _____.

EXERCISE 12-7



ABBREVIATIONS

Write out the term for the following abbreviations.

1. _____ COPD
2. _____ ABG
3. _____ TLC
4. _____ CF
5. _____ T and A
6. _____ URI

Write the abbreviation for the following terms.

7. _____ tuberculosis
8. _____ oxygen
9. _____ carbon dioxide

10. _____ pulmonary function test
11. _____ residual volume
12. _____ shortness of breath

EXERCISE 13-8



SPELLING

Select the correct spelling of the medical term.

1. The _____ is the major muscle responsible for breathing, located at the base of the thoracic cavity.
 - a. diafram
 - b. diaphram
 - c. diagphram
 - d. diaphragm
2. The _____ is more commonly known as the throat.
 - a. pharinx
 - b. pharynx
 - c. pherinx
 - d. pherynx
3. The _____, which is also called the windpipe, is the tube that connects the larynx to the bronchi.
 - a. tracea
 - b. trachia
 - c. trachea
 - d. traychea
4. Abnormally rapid breathing is called _____.
 - a. tachypnea
 - b. tachynea
 - c. tachypnia
 - d. tacypnia
5. Inflammation of a lung commonly caused by infection is called _____.

- a. pneumonia
 - b. pnuemonia
 - c. neumonia
 - d. numonia
6. Discharge from the nasal mucous membrane is called _____.
- a. rinorea
 - b. rhinorrhea
 - c. rinoria
 - d. rhinorhea
7. A _____ is a drug used to expand the bronchi.
- a. broncodilator
 - b. bronchodilater
 - c. bronkodilator
 - d. bronchodilator
8. Inserting a needle into the pleural cavity to withdraw fluid, drain fluid, or re-expand a collapsed lung is called _____.
- a. thorcentesis
 - b. thoracensis
 - c. thoracentesis
 - d. thoracenteesys
9. An _____ is a physician who specializes in the diagnosis and treatment of ear, nose, and throat diseases.
- a. otolaringologist
 - b. otolaryngologist
 - c. otolaryngolist
 - d. otalaringologist
10. _____ is a Greek word that means “short breath” or “a panting.”
- a. Asthma

- b. Asma
- c. Azma
- d. Azthma

EXERCISE 12-9



CASE STUDY

Analyze the following medical record and answer the questions below.

MEDICAL RECORD

HISTORY: A 30-year-old female who c/o a nonproductive cough, dyspnea, and a fever of 3 days; patient has a negative history for smoking and has otherwise been in good health.

PHYSICAL EXAM: T 102°F, BP 104/65, R 26, P 108

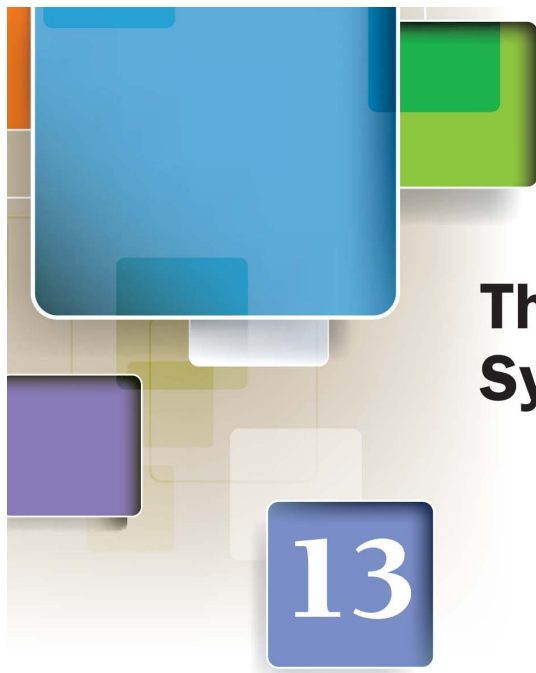
Tachypnea is accompanied by mild cyanosis, and inspiratory rales are noted during a stethoscope exam. WBC is elevated, CXR shows diffuse infiltrates at the bases of both lungs. An ABG taken while the patient was breathing room air was abnormal and showed the patient had low oxygen content in the blood. A sputum specimen contained WBCs.

DIAGNOSIS: Pneumonia of unknown etiology.

TREATMENT PLAN: Admit patient to the ICU. Administer antibiotics and oxygen by face mask and monitor patient's status.

1. What are the findings on physical examination?
 - a. Fast breathing, blue skin, and crackles heard in the lungs as the patient inhales
 - b. Slow breathing, blue skin, and rales heard in the lungs as the patient holds her breath
 - c. Slow breathing, blue skin, and rhonchi heard in the lungs as the patient exhales
 - d. Fast heart rate, blue skin, and rales heard in the lungs as the patient inhales
 - e. Fast breathing, blue skin, and wheezing heard in the lungs as the patient inhales
2. What is the patient's chief complaint? Circle the answer.
 - a. Cannot breathe, fever, and coughing up material from lungs

- b. Dry cough and difficulty breathing
- c. Fever, coughing up sputum, and breathing fast
- d. Hoarse throat, dry cough, and fever
- e. Fever with a dry cough and difficulty breathing



The Digestive System

13

LEARNING OUTCOMES

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

- Name the major organs and accessory organs that make up the digestive system.
- Pronounce, spell, and define medical terms related to the digestive system and its disorders.
- Interpret abbreviations associated with the digestive system.

INTRODUCTION

The digestive system is composed of organs whose job is to ingest food, change that food into a usable form, and then eliminate wastes. The **digestive tract** is a continuous tube beginning with the mouth and ending at the anus. This tract is also called the **gastrointestinal (GI) tract** or **alimentary canal**. Organs of the digestive system include the mouth, pharynx, esophagus, stomach, small intestine, and large intestine. Accessory organs of the digestive system include salivary glands, the liver, gallbladder, and pancreas (see **Figure 13-1**). The three main functions of the digestive system are digestion, absorption, and elimination. **Digestion** is the mechanical, chemical, and enzymatic processes in which ingested food is converted into substances the body can use. **Absorption** is taking in these substances by the body's cells. The removal of wastes from the body is called **elimination**.

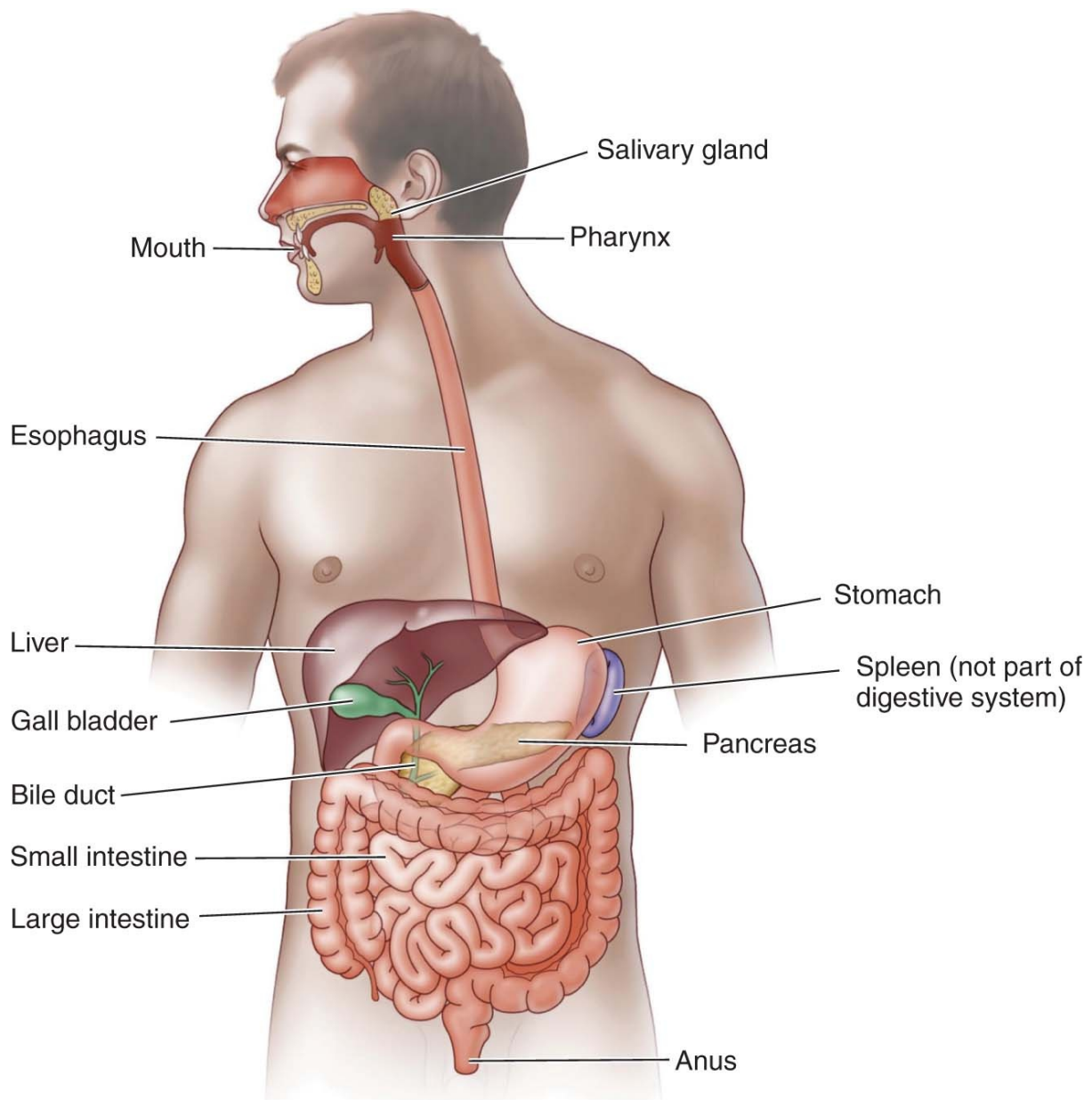


FIGURE 13-1 Structures of the digestive system.

The GI tract can be divided into an upper gastrointestinal (UGI) tract and a lower GI tract. The UGI consists of the mouth, esophagus, and the stomach. The pyloric sphincter at the distal end of the stomach marks the end of the upper GI tract. Past this point, the GI tract is called the lower GI tract. The lower GI tract consists of the small intestine and the large intestine. The small intestine is subdivided into three different parts. The large intestine is also divided into three different parts.

WORD PARTS RELATED TO THE GASTROINTESTINAL SYSTEM

The term GI is made up of two words from two different languages. “Gastr/o”

is the root word for stomach and comes from the Greek language, whereas *intestinum* is the Latin word for gut. The other name this tract is known by is alimentary canal. The root word “aliment/o” means nutrition. Eating or swallowing can be designated by either the root phag/o or the suffix–phagia, which both refer to eating. Many of the word parts related to the digestive system are listed in **Table 13-1**.

TABLE 13-1  WORD PARTS RELATED TO THE DIGESTIVE SYSTEM

Word Part	Meaning
abdomin/o	abdomen
aliment/o	nutrition
bucc/o	cheek
cheil/o	lip
chol/e, chol/o	bile, gall
cholangi/o	bile duct
cholecyst/o	gallbladder
choledoch/o	common bile duct
col/o, colon/o	colon
dent/i, dent/o	teeth
diverticul/o	diverticulum
duoden/o	duodenum
-emesis	vomiting

enter/o	intestine
esophag/o	esophagus
gastr/o	stomach
gingiv/o	gums
gloss/o	tongue
hepat/o	liver
ile/o	ileum
jejun/o	jejunum
lapar/o	abdomen
-lith	stone
pancreat/o	pancreas
-pepsia	digestion
phag/o	eating, swallowing
-phagia	eat or swallow
proct/o	anus and rectum
pylor/o	pylorus
rect/o	rectum
-scope	instrument used for viewing

-scopy	visual examination
sial/o	salivary glands
sigmoid/o	sigmoid colon
stomat/o	mouth

Word Parts Exercise

After studying Table 13-1, write the meaning of each of the word parts.

WORD PART	MEANING
1. -phagia	1. _____
2. choledoch/o	2. _____
3. stomat/o	3. _____
4. sigmoid/o	4. _____
5. abdomin/o	5. _____
6. enter/o	6. _____
7. lapar/o	7. _____
8. rect/o	8. _____
9. -lith	9. _____
10. sial/o	10. _____
11. hepat/o	11. _____

12. pylor/o 12. _____

13. chol/e, chol/o 13. _____

14. cholangi/o 14. _____

15. esophag/o 15. _____

16. -emesis 16. _____

17. -scope 17. _____

18. gloss/o 18. _____

19. jejun/o 19. _____

20. gastr/o 20. _____

21. cheil/o 21. _____

22. ile/o 22. _____

23. pancreat/o 23. _____

24. bucc/o 24. _____

25. cholecyst/o 25. _____

26. -pepsia 26. _____

27. col/o, colon/o 27. _____

28. dent/i, dent/o 28. _____

29. phag/o 29. _____

30. duoden/o	30. _____
31. proct/o	31. _____
32. gingiv/o	32. _____
33. -scopy	33. _____
34. aliment/o	34. _____

STRUCTURE AND FUNCTION

The food we eat needs to be converted into a form our bodies can use. The digestive tract and associated organs are responsible for that conversion.

Major Organs of the Digestive Tract

The major organs of the digestive tract are those that make up the one-way tube. These structures include mouth, pharynx, esophagus, stomach, small intestine, and large intestine.

The Mouth (Oral Cavity)

Digestion begins in the mouth (oral cavity), where food is broken apart by **mastication**, which is a technical term for chewing. A slightly acidic fluid called *saliva* is produced by the salivary glands. Saliva moistens the food and forms a **bolus**, a small ball of masticated food that is pushed back and downward with the tongue.

Why *bolus* and not simply *ball* or *mass*? That is a good question, especially as the Latin word *bolus*, which means ball, has a more common medical meaning that has no direct connection to the digestive system. Bolus can simply mean “a large pill” or a dose of medication given intravenously for a special purpose. Within the GI system, it refers to a ball of chewed food.

The Pharynx and Esophagus

Next, the bolus enters the pharynx (throat), which, as you know from Chapter 12, is also part of the respiratory tract. From the pharynx, the bolus passes into the **esophagus**, a tube that connects the throat to the stomach. Here, the bolus is lubricated with mucus before being carried into the stomach by wavelike muscular contractions called **peristalsis**. The **lower esophageal sphincter (LES)**, also called the *cardiac sphincter*, is a ringlike muscle that controls the flow from the esophagus into the stomach (**Figure 13-2**).

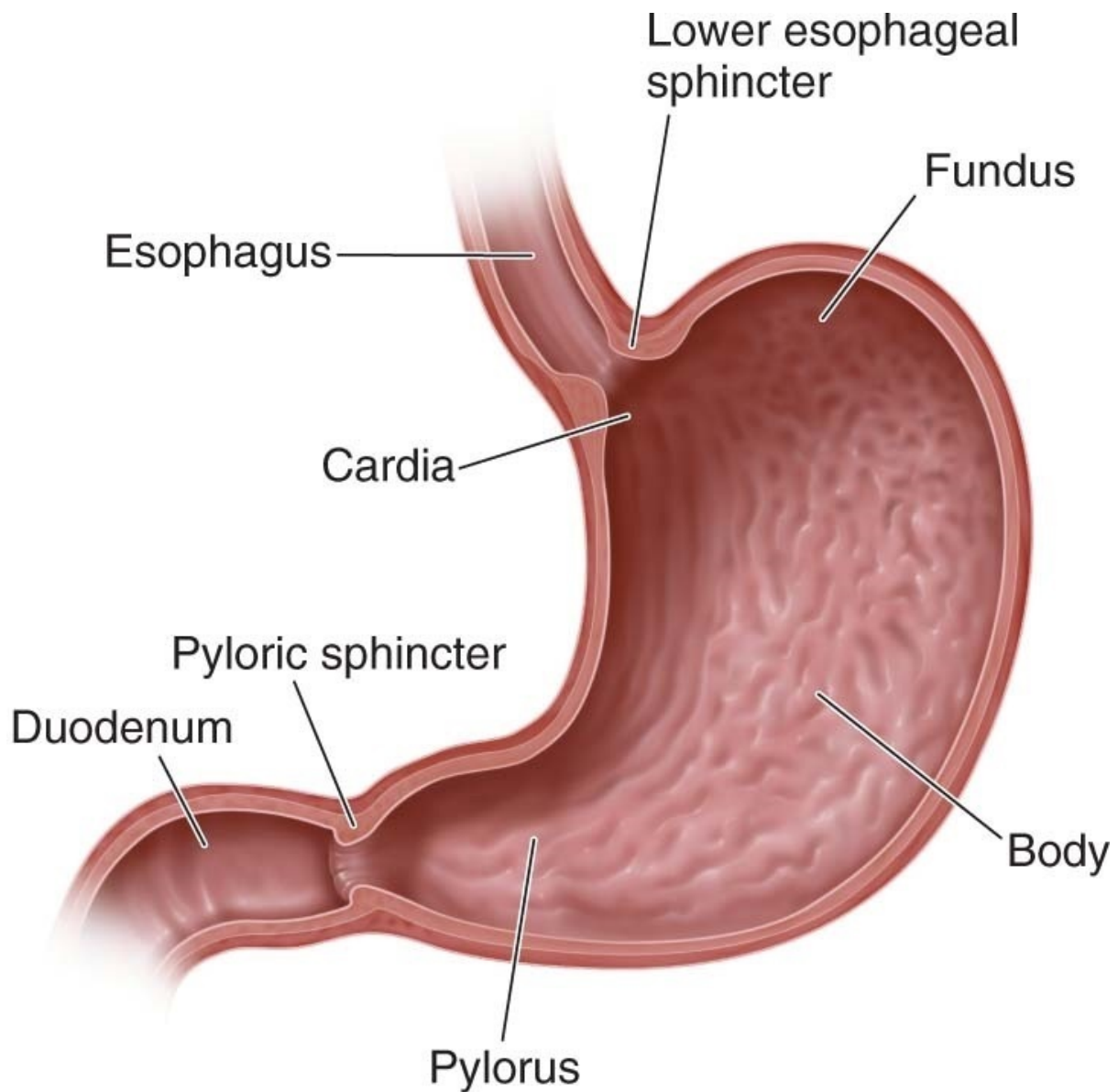


FIGURE 13-2 The esophagus, stomach, and duodenum.

The Stomach

The stomach is a J-shaped organ that physically and chemically digests food. The regions of the stomach include the *cardia*, *fundus*, *body*, and *pylorus*. Its first job is to act as a temporary storage place for the food while it does its second job: secreting hydrochloric acid and enzymes to help break down proteins, fats, and carbohydrates. Digestion includes physical changes, such as the reduction of particle size and liquefaction (converting solids to liquids), and chemical changes needed to produce fuel for the body's cells. After 3 or 4 hours, the stomach's contents, which by this stage consist of a liquid called **chyme** (pronounced kyme), begin to enter the small intestine. Chyme passes through the **pyloric sphincter**, a ring of muscle at the distal end of the stomach, and into the **duodenum**, the first part of the small intestine. At

times, a *nasogastric tube*, which is a narrow tube passed into the stomach via the nose, is used short term to supply nutrition or it can be used to aspirate the stomach. Nutrition that is maintained entirely by central venous injection or by other non-GI route is termed *total parenteral nutrition* (TPN). Shorthand for “nothing by mouth” is NPO, derived from the Latin *non per os*. **Figure 13-2** shows the esophagus, stomach, and duodenum.

The Small Intestine

The lower GI tract begins with the small intestine, which extends from the stomach’s pyloric sphincter to the first part of the large intestine. Although it is about 20 feet in length, it is known as the small intestine because it is smaller in diameter than the large intestine. The small intestine is divided into three parts: the **duodenum**, **jejunum**, and **ileum**. From the duodenum, chyme moves into the jejunum and from there into the ileum. The **ileocecal sphincter** (not shown) controls the flow from the ileum into the cecum, the first part of the large intestine (see **Figure 13-3**).

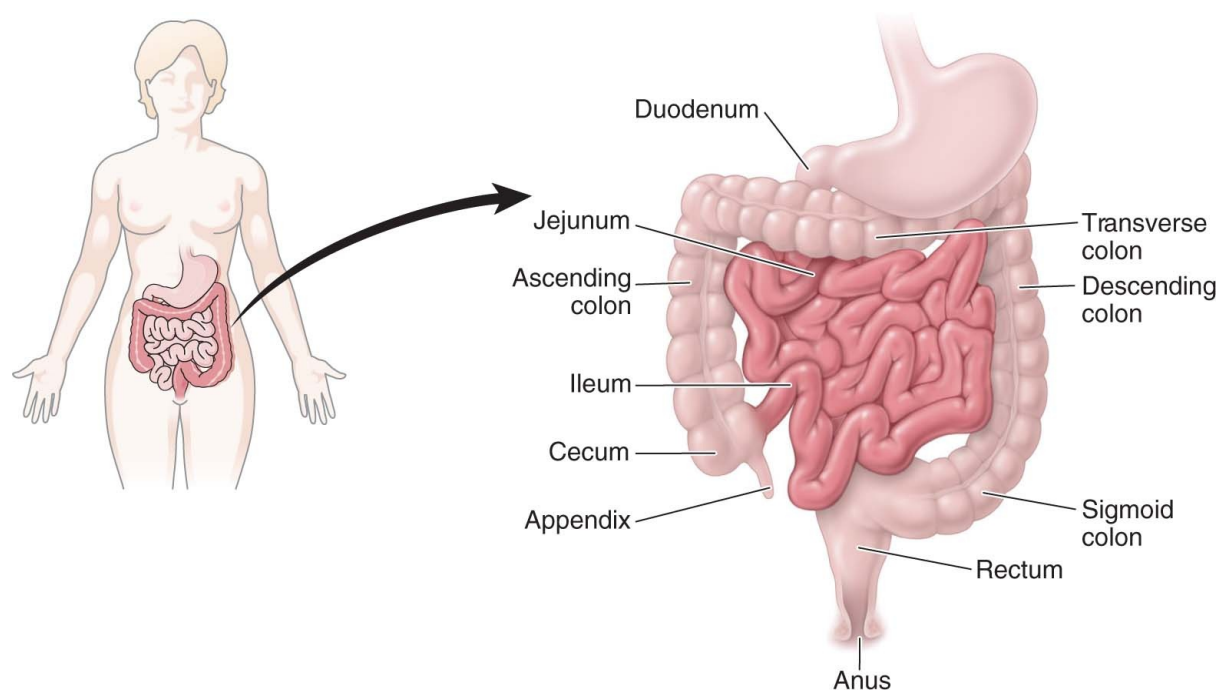


FIGURE 13-3 The small and large intestines. The small intestine, illustrated in *dark pink*, is made up of the duodenum, jejunum, and ileum. The large intestine, illustrated in *light pink*, can be divided into the ascending colon, transverse colon, and the descending colon. The intestinal tract ends at the anus.

Isn't the ileum also the name of one of the three bones making up the hip? No, that's the ilium. Although both words are pronounced the same, they have one letter that is different. If you remember that hip and ilium both have an “i” in the middle, you will be able to distinguish these two terms, which have different roots.

The Large Intestine

The large intestine extends from the ileocecal valve to the anus. It is divided into three parts: the **cecum**, **colon**, and **rectum**. The **cecum** is the beginning part of the large intestine. Attached to the cecum is a tube-shaped sac called the **appendix**. This structure is sometimes called the *vermiform appendix*. Vermiform, which means wormlike, is usually omitted, and the single word *appendix* is the preferred term. The appendix consists of lymphatic tissue and is, functionally speaking, part of the lymphatic system.

The colon is subdivided into four parts: the **ascending colon**, **transverse colon**, **descending colon**, and **sigmoid colon** (see **Figure 13-3**). The last part, the sigmoid colon, continues from the descending colon and connects to the rectum. The rectum takes up approximately the last 6 inches of the large intestine and terminates at the **anus**, through which wastes are eliminated. **Figure 13-4** illustrates the pathway of food through the GI tract.

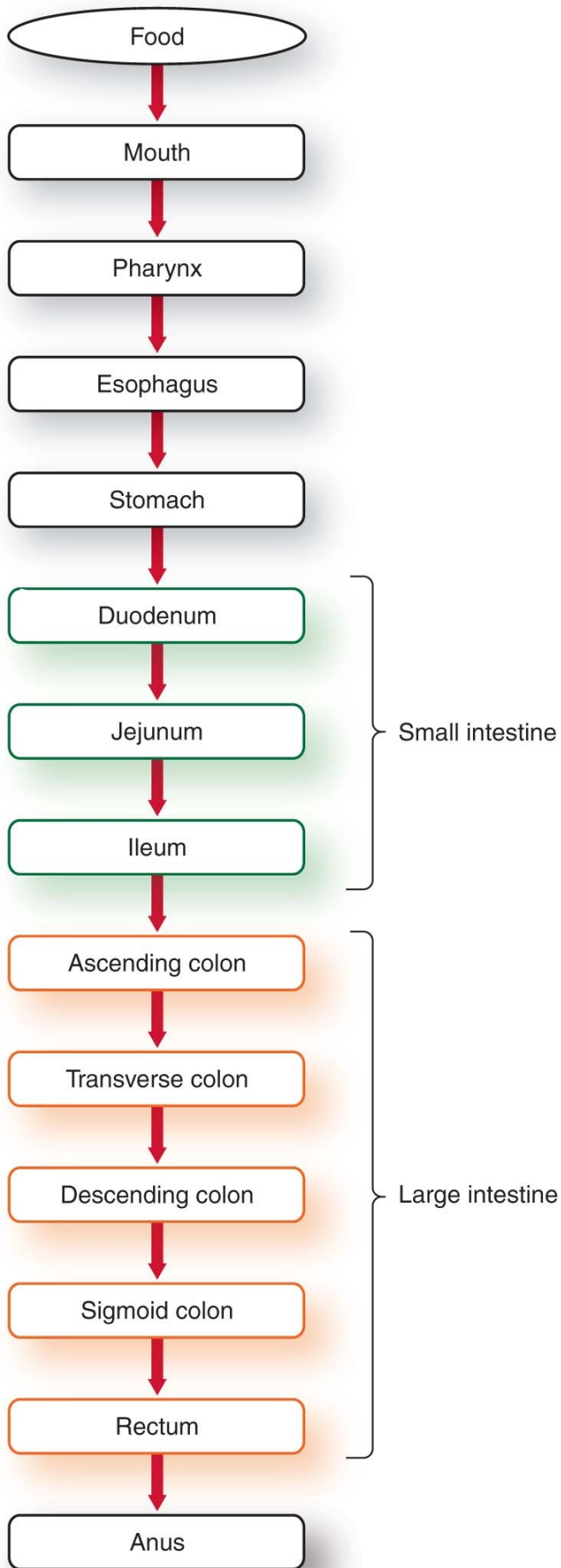


FIGURE 13-4 Pathway of food through the gastrointestinal tract.

Accessory Organs

Although the *salivary glands*, *liver*, *gallbladder*, and *pancreas* are not part of the GI tract, they play key roles in the digestive process. Because they are not part of the one-way canal, they are referred to as **accessory organs** of the digestive system (see **Figure 13-5**).

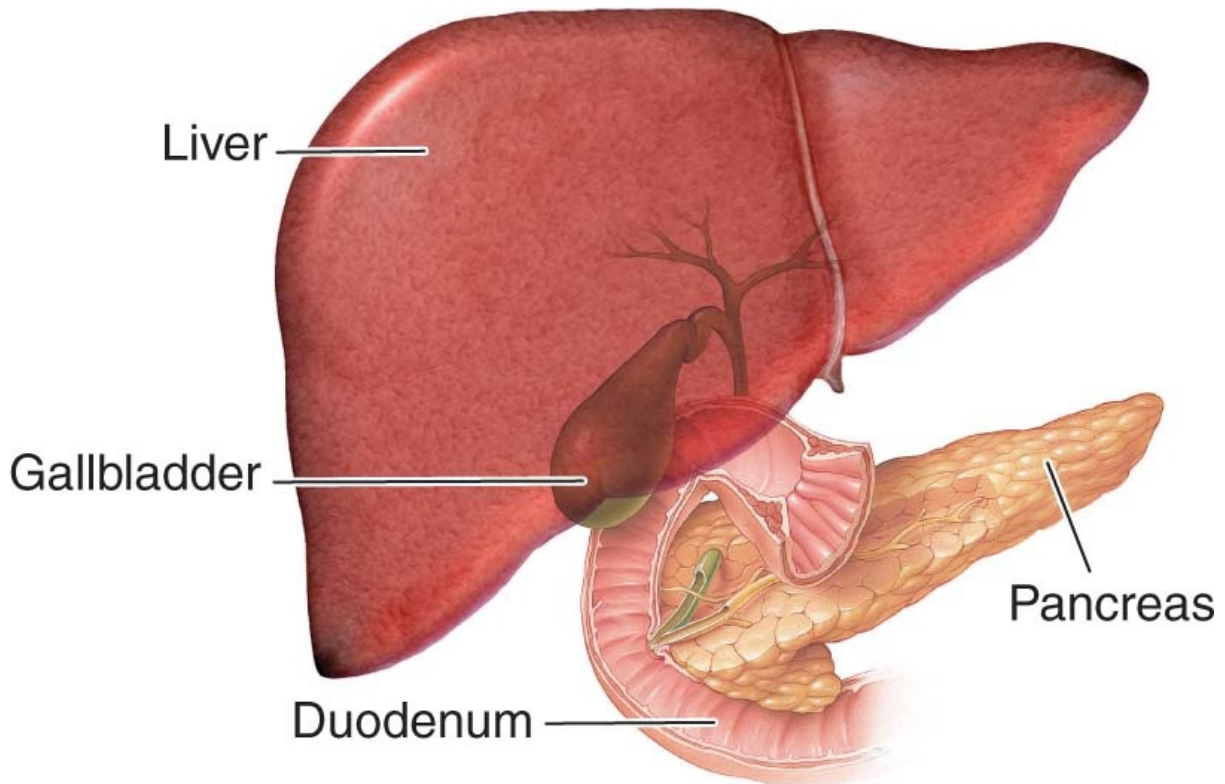


FIGURE 13-5 Accessory organs of the digestive system.

Salivary Glands

Salivary glands are any of the saliva-secreting glands (*parotid*, *submandibular*, and *sublingual*) of the oral cavity. The senses of taste and smell stimulate the salivary glands to secrete **saliva**, a watery liquid that contains enzymes that begin the digestive process. Saliva also helps flush bacteria in the mouth and keeps the teeth and tongue clean. **Figure 13-1** shows the location of the salivary glands.

Liver

The liver, located in the upper right quadrant of the abdomen deep to the diaphragm, plays many important roles in digestion, metabolism, and detoxification of harmful substances. One of its main digestive functions is to

manufacture and secrete **bile**, a liquid that breaks down fat into droplets. This breaking down process is called *emulsification*. Our bodies need bile to process fats before they are released into the bloodstream. Once bile is produced in the liver, it travels down the **bile duct** to the gallbladder for storage. The liver is an important organ whose functions are integrated into many of the body's systems.

Gallbladder

Although the liver produces and recycles bile, the **gallbladder**, which is located in a depression under the liver, stores, condenses, and delivers the bile to the small intestine, specifically the duodenum (see **Figure 13-5**).

Pancreas

The pancreas is an elongated feather-shaped organ that lies posterior to the stomach. It has both digestive and endocrine functions. It produces digestive enzymes that aid in processing carbohydrates and fats in foods as well as secreting hormones directly into the bloodstream (see **Figure 13-5**).

DISORDERS RELATED TO THE DIGESTIVE SYSTEM

Disorders of the upper GI tract may involve oral cavity infections, such as **stomatitis** (inflammation of the mucous membranes in the mouth) and **gingivitis** (inflammation of the gums). **Parotiditis** (also known as *parotitis*) is an inflammation of the parotid gland, which is the largest of the salivary glands. (See **Figure 13-1** for location of the salivary gland). Other abnormal conditions such as **dental caries** (cavities) and **bruxism** (an involuntary clenching or grinding of teeth) can occur in the mouth.

The following are a few common disorders of the upper digestive tract:

1. **Dysphagia:** difficulty in swallowing
2. **Esophagitis:** inflammation of the esophagus
3. **Hiatal hernia:** stomach protrusion through the esophageal hiatus (opening) of the diaphragm into the thoracic cavity (see **Figure 13-6**)

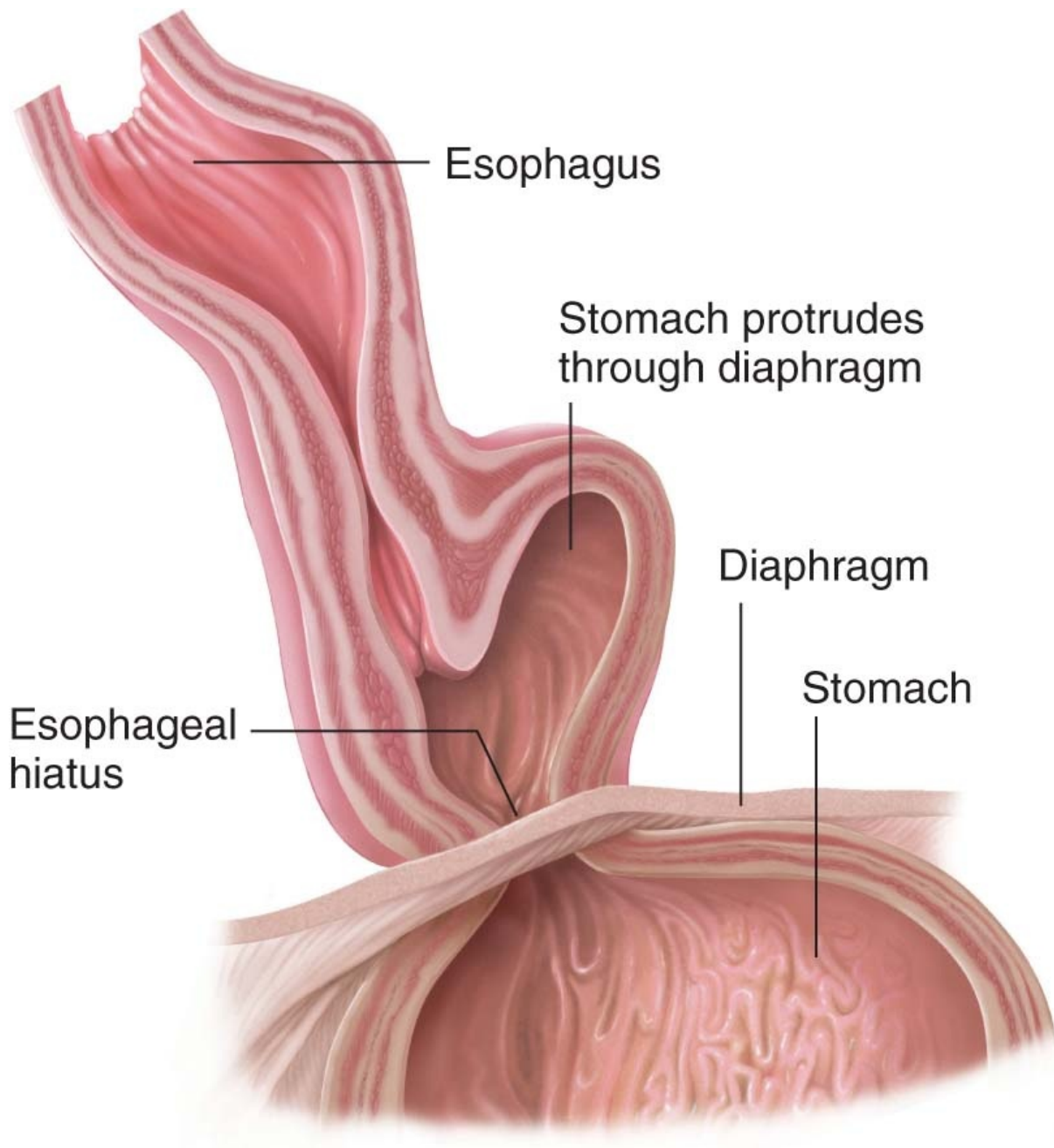


FIGURE 13-6 Hiatal hernia.

- 4. **Gastroesophageal reflux disease (GERD):** upward flow of stomach acid into the esophagus
- 5. **Gastritis:** inflammation of the stomach (gastric) mucous membranes



Quick Check

Fill in the blanks.

1. A small ball of masticated food is called a

- _____.
2. The stomach has two main jobs. The first is the temporary storage of food. What is the other one? _____
 3. The three divisions of the small intestine are the _____, _____, and _____.

Disorders of the Lower Gastrointestinal Tract

Disorders of the lower GI tract include obstructions, inflammation, or structural abnormalities. These conditions are listed later. A common procedure for studying the lower intestinal tract is a *barium enema* (BE), in which barium sulfate, a radiopaque dye, is injected into the rectum for X-ray imaging.

1. **Crohn's disease:** inflammation in the mucosal lining of the intestine (usually the ileum)
2. **Appendicitis:** inflammation of the appendix
3. **Peritonitis:** inflammation of the peritoneum, which is the sac that lines the abdominal cavity
4. **Diverticula:** pouches in the intestinal wall that form as increased pressure pushes the wall of the colon outward at weakened points
5. **Diverticulosis:** condition characterized by the presence of a number of diverticula
6. **Diverticulitis:** inflammation of diverticula, which fill with stagnant fecal matter and become inflamed
7. **Inguinal hernia:** protrusion of a small loop of intestine through a weak spot in the lower abdominal wall or groin
8. **Intestinal obstruction:** refers to a lack of movement of the intestinal contents through the intestine
9. **Intussusception:** a telescoping of a section of bowel inside an adjacent section
10. **Volvulus:** a twisting of the bowel

Disorders of the Accessory Organs of the Digestive System

Many of the conditions that affect the digestive system accessory organs are obstructions caused by stones, tumors, or inflammatory processes. A few of

these are described as follows:

1. **Cholelithiasis:** a condition in which calculi or stones reside in the gallbladder or bile ducts
2. **Cholecystitis:** inflammation of the gallbladder
3. **Cholangiolitis:** inflammation of a bile duct
4. **Choledocholithiasis:** obstruction of the biliary tract by gallstones
5. **Hepatitis:** inflammation of the liver
6. **Irritable bowel syndrome (IBS):** a condition characterized by abdominal pain, constipation (infrequent bowel movements with hardened feces), diarrhea, gas, and bloating
7. **Jaundice** (also called **icterus**): a symptom of hepatitis characterized by a yellowing of the skin and eyes as a result of bile accumulation
8. **Cirrhosis:** chronic liver disease characterized by inflammation and scar tissue formation; it typically results from alcoholism or hepatitis.

Additional conditions, signs, symptoms, and disorders of the digestive system include **anorexia** (loss of appetite), **bulimia** (binge eating followed by self-induced vomiting and misuse of laxatives), **eructation** (belching or burping gas), **hyperemesis** (excessive vomiting), **dyspepsia** (indigestion), and **hemorrhoids** (enlarged veins in or near the anus).

DIAGNOSTIC TESTS, TREATMENTS, AND SURGICAL PROCEDURES


To view different parts of the GI tract, different tools are required. An **enteroscope** is an instrument for inspecting the inside of the intestine; the procedure is called an **enteroscopy**. Visual examination of the duodenum is called **duodenoscopy**. A **gastroscope** is an instrument for viewing the stomach, and the procedure is called **gastroscopy**. A **colonoscope** is a long, flexible fiber-optic endoscope used to perform a **colonoscopy** (visual examination of the colon). Endoscopic examination of the esophagus, stomach, and duodenum performed using a fiber-optic instrument is called an **esophagogastroduodenoscopy (EGD)**, whereas a radiographic contrast study using dye is called an **upper gastrointestinal series (UGIS)**.

Sometimes, a surgical procedure is necessary. The word part “ostomy,” which is a word on its own meaning “mouth,” is an artificial **stoma** (opening) into the GI canal. Patients with a stoma have a section of their intestines removed, so instead of waste exiting through the rectum, an artificial opening

is established, and waste exits into a bag or pouch the patient wears. A **colostomy** is an opening into the colon. A **duodenostomy** is an opening into the duodenum. Notice that *-ostomy* looks very similar to *-otomy*, which is an incision (cutting), not the establishment of an opening.

PRACTICE AND PRACTITIONERS

Apart from the specialists who treat the oral cavity and other shared organs of other systems, the specialists concerned with the digestive system are **gastroenterologists** (physicians specializing in disorders of the stomach and intestines) and **proctologists** (physicians specializing in disorders of the anus and rectum). The specialties are **gastroenterology** and **proctology**, respectively. In the hospital setting, many GI disorders are diagnosed and treated by an **internist**, a nonsurgical specialist in internal medicine.

Abbreviation Table  THE DIGESTIVE SYSTEM	
ABBREVIATION	MEANING
BE	barium enema
BM	bowel movement
EGD	esophagogastroduodenoscopy
GERD	gastroesophageal reflux disease
GI	gastrointestinal
HCl	hydrochloric acid
IBS	irritable bowel syndrome
LES	lower esophageal sphincter
NG	nasogastric
NPO	non per os (Latin for “nothing by mouth”)
PO	per os (Latin for “by mouth”)
TPN	total parenteral nutrition
UGIS	upper gastrointestinal series

Study Table



THE DIGESTIVE SYSTEM

TERM AND PRONUNCIATION	ANALYSIS	MEANING
Structure and Function		
accessory organs (ak-SES-uh-ree OR-gunz)	from the Latin word <i>accessorius</i> (that which is subordinate to something else)	in the GI system: the salivary glands, liver, gallbladder, and pancreas
alimentary canal (al-ih-MEN-tah-ree)	from the Latin word <i>alimentarius</i> (pertaining to food) + canal	passage leading from the mouth to the anus through the pharynx, esophagus, stomach, and intestines; <i>digestive tract</i> or <i>GI tract</i>
appendix (uh-PEN-diks)	Latin word for “something attached”	tube-shaped sac attached into the cecum of the large intestine; <i>vermiform appendix</i>
bile (BILE)	from the Latin word <i>bilis</i> (fluid secreted from the liver)	yellow-brown or green liquid secreted by the liver into the duodenum to emulsify fats
bile duct (BILE DUKT)	from the Latin words <i>bilis</i> (fluid secreted from the liver) and <i>ductus</i> (a leading)	tube that transports bile from the liver to the gallbladder
bilirubin (BIHL-ee-ROO-bin)	from the Latin <i>bilus</i> (bile) and <i>ruber</i> (red)	waste produced by worn out red blood cells breaking down
bowel movement (BM) (BOWEL MOOV-ment)	from the Latin <i>botellus</i> , a diminutive of <i>botulus</i> (sausage)	defecation
cardiac sphincter (KAR-dee-ak SFINGK-ter)	<i>cardi/o</i> (heart); <i>-ac</i> (adjective suffix); from the Greek word <i>sphingein</i> (to bind tight)	the ringlike muscle between the esophagus and stomach that controls food flow; LES
cecum (SEE-kuhm)	from the Latin word <i>caecus</i> (hidden)	a pouch connected to the junction of the small and large intestines, forming the first part of the large intestine
chyme (KYME)	from the Latin word <i>chymus</i> (juice produced by digestion)	the semifluid mass of partly digested food passed from the stomach into the duodenum
colon (KOH-luhn); also called the <i>large intestine</i>	from the Greek word <i>kolon</i> (large intestine)	the large intestine, divisible into the ascending, transverse, descending, and sigmoid colons
deglutition (dee-gloo-TISH-uhn)	from the Latin word <i>deglutire</i> (to swallow, overwhelm, abolish)	swallowing
digestive tract (dye-JES-tiv TRAKT)	from the Latin word <i>digero</i> + <i>-gestus</i> (to force apart, divide, dissolve)	passage leading from the mouth to the anus through the pharynx, esophagus, stomach, and intestines; <i>alimentary canal</i> or <i>GI tract</i>

duodenal (doo-OD-en-uhl)	from the Greek word <i>dodekadaktylon</i> (literally “12 fingers long”; named by Greek physician Herophilus) + <i>-al</i> (adjective suffix)	adjective form of duodenum used in the terms naming some digestive system disorders
duodenum (doo-OD-en-um)	from the Greek <i>dodekadaktylon</i> (12 fingers long)	segment of the small intestine connecting with the stomach
esophagus (ee-SOF-ah-guhs)	from the Greek <i>oisophagos</i> (gullet, literally “what carries and eats”)	the part of the digestive tract between the pharynx and stomach
gallbladder (GAWL-blad-er)	from Old English <i>galla</i> (to shine, yellow); from Old English <i>bledre</i> (to blast, blow up, swell up)	small pear-shaped organ that stores bile
gastric (GAS-trik)	<i>gastr/o</i> (stomach); <i>-ic</i> (adjective suffix)	adjective form of stomach
gastrointestinal (GI tract (GAS-troh-in-TES-tin-ahl TRAKT)	<i>gastr/o</i> (stomach); from Latin <i>intestina</i> , plural of <i>intestinus</i> (internal, inward, intestine) + tract	passage leading from the mouth to the anus through the pharynx, esophagus, stomach, and intestines; <i>alimentary canal</i> or <i>digestive tract</i>
ileocecal sphincter (ILL-ee-oh-see-kul SFINGK-ter)	<i>ile/o</i> (ileum); from the Latin <i>caecum</i> (blind); <i>-al</i> (adjective suffix); <i>sphincter</i> (from the Greek word <i>sphingein</i> : to bind tight)	muscular ring that separates the distal portion of the ileum (small intestine) and the beginning of the cecum (large intestine)
ileum (ILL-ee-uhm)	a Latin word meaning “flank,” “groin”	the longest segment of the small intestine, which leads into the large intestine
intestine (ihn-TESS-tin)	from Latin <i>intestina</i> , plural of <i>intestinus</i> (internal, inward, intestine)	the small intestine is divisible into the duodenum, jejunum, and ileum; the large intestine comprises the cecum, colon, rectum, and anus
jejunum (jeh-JOO-num)	from the Latin word <i>jejunus</i> (empty, fasting, abstinent, hungry)	eight-foot-long segment of the small intestine between the duodenum and the ileum
liver (LIV-er)	from the Old English word <i>lifer</i> (liver)	the largest glandular organ of the body, lying beneath the diaphragm in the upper part of the gastric region, involved in many metabolic processes
lower esophageal sphincter (LES) (LOW-ur eh-sof-uh-JEE-ul SFINGK-ter)	from the Greek word <i>sphingein</i> (to bind tight)	the ringlike muscle between the esophagus and stomach that controls food flow; <i>cardiac sphincter</i>
lower GI tract (LOH-er JEE EYE TRAKT)	<i>gastr/o</i> (stomach); from Latin <i>intestina</i> , plural of <i>intestinus</i> (internal, inward, intestine) + tract	the small intestine and large intestine
mastication (MAS-ti-kay-shun)	from the Latin verb <i>masticare</i> (to chew)	the process of chewing food
oral cavity (OR-uhl)	from the Latin words <i>os</i> (mouth) and	

KAV-i-tee)	<i>cavus</i> (hollow)	the mouth
pancreas (PAN-kree-as)	from the Greek words <i>pan</i> (all) and <i>kreas</i> (flesh, meat)	organ of the digestive system that has both exocrine and endocrine functions; secretes enzymes that aid in digestion
pancreatic (pan-kree-AT-ik)	<i>pancreat/o</i> (pancreas); <i>-ic</i> (adjective suffix)	adjective for pancreas
peristalsis (pear-ih-STAL-sis)	from the Greek word <i>peristaltiko</i> (clasping and compressing)	wavelike muscular contractions that move food along in the digestive tract
pharynx (FAYR ingks)	from the Greek word <i>pharunx</i> (throat)	passageway just below the nasal cavity and mouth
pyloric sphincter (pye-LOHR-ik SFINGK-ter)	<i>pylor/o</i> (pylorus); <i>-ic</i> (adjective suffix); sphincter (from the Greek word <i>sphingein</i> : to bind tight)	ring of muscle between the stomach and duodenum
rectum (REK-tuhm)	Latin word for “straight”	the terminal portion of the digestive tract
saliva (suh-LYE-vuh)	Latin word for “spittle”	a clear, tasteless, slightly acidic fluid secreted from the salivary glands
salivary glands (SAL-ih-vahr-ee GLANDZ)	from the Latin word <i>salivarius</i> (slimy, clammy) + gland from the Latin word <i>glans</i> (acorn)	collectively, the parotid, sublingual, and submandibular glands that secrete saliva
stoma (STOH-mah)	a Greek word meaning “mouth,” “opening”	an artificial opening
stomach (STUM-uhk)	from the Latin word <i>stomachus</i> (throat, gullet, stomach)	digestive organ composed of four regions (cardia, fundus, body, and pylorus)
upper GI tract (UP-er JEE EYE TRAKT)	<i>gastr/o</i> (stomach); from Latin <i>intestina</i> , plural of <i>intestinus</i> (internal, inward, intestine) + tract	the oral cavity, pharynx, esophagus, and stomach
Disorders		
anorexia (an-or-ECKS-ee-ah)	from the Greek <i>an</i> (without) + <i>orexis</i> (appetite, desire)	loss of appetite
appendicitis (ay-PEN-dih-SYE-tis)	from the Latin word <i>appendix</i> (something attached); <i>-itis</i> (inflammation)	inflammation of the appendix
ascites (uh-SYE-teez)	from the Greek word <i>askos</i> (bag)	abnormal accumulation of fluid in the peritoneal cavity
bruxism (BRUKS-ism)	from the Greek word <i>ebryxa</i> , root from <i>brykein</i> infinitive of the verb; <i>ebryxa</i> (to gnash the teeth) + <i>-ism</i> (condition)	involuntary grinding of the teeth that usually occurs during sleep

bulimia (bull-EE-mee-ah)	from the Greek word <i>boulemia</i> (hunger)	eating disorder characterized by episodes of binge eating followed by self-induced vomiting and misuse of laxatives
cholangiolitis (KOH-lan-jee-oh-LYE-tis)	<i>cholangi/o</i> (bile, duct); <i>-itis</i> (inflammation)	inflammation of the bile ducts
cholecystitis (KOH-lee-siss-TYE-tiss)	<i>cholecyst/o</i> (gallbladder); <i>-itis</i> (inflammation)	inflammation of the gallbladder
cholecystopathy (KOH-lee-siss-TOP-ah-thee)	<i>cholecyst/o</i> (gallbladder); <i>-pathy</i> (disease)	any disease of the gallbladder
choledocholithiasis (koh-LED-oh-koh-lith-EYE-uh-sis)	<i>choledoch/o</i> (common bile duct); <i>-lithiasis</i> (condition of having stones)	inflammation of the bile duct caused by gallstones
cholelithiasis (KOH-lee-lih-THYE-ah-sis)	<i>chol/e</i> (bile, gall); <i>-lithiasis</i> (condition of having stones)	formation or presence of stones in the gallbladder or bile duct
cirrhosis (sir-OH-sis)	from the Greek word <i>kirrhos</i> (tawny), named for the orange-yellow appearance of a diseased liver	chronic disease of the liver
colitis (koh-LYE-tis)	<i>col/o</i> (colon); <i>-itis</i> (inflammation)	inflammation of the colon
constipation (kon-stih-PAY-shun)	from the Latin word <i>constipare</i> (to press or crowd together)	decrease in the frequency of bowel movements; difficulty in passing stools; and/or hard, dry stools
Crohn's disease (KRONZ dih-ZEEZ)	named after American B.B. Crohn (1884–1983), one of the team that described it in 1932	chronic inflammation of part(s) of the intestinal tract
dental caries (DEN-tul KAYR-eez)	<i>dent/i</i> (tooth); <i>-al</i> (adjective suffix) + <i>caries</i> , a Latin word meaning “rot,” “rottenness,” “corruption”	tooth decay
diverticulum (dye-ver-TIK-yoo-luhm); pl. diverticula (dye-ver-TIK-yoo-luh)	Latin word for “a bypath”	a pouch or sac opening from a tube, such as the gut
diverticulitis (dye-ver-tik-yoo-LYE-tis)	from the Latin word <i>diverticulum</i> (a bypath, side road); <i>-itis</i> (inflammation)	inflammation of a diverticulum or sac in the intestinal tract
diverticulosis (dye-ver-tik-yoo-LOH-sis)	<i>diverticulum</i> (bypath); <i>-osis</i> (abnormal condition)	presence of a number of diverticula of the intestine; common in middle age
duodenitis (doo-odd-eh-NY-tihs)	<i>duoden/o</i> (duodenum); <i>-itis</i> (inflammation)	inflammation of the duodenum

dyspepsia (dis-PEP-see-ah)	from the Greek word <i>dyspeptos</i> (hard to digest); <i>-ia</i> (condition of)	impairment of digestion
dysphagia (dis-FAY-jee-ah)	<i>dys-</i> (difficulty); <i>phag/o</i> (eating, swallowing); <i>-ia</i> (condition of)	difficulty swallowing
enteritis (ehn-teh-RYE-tihs)	<i>enter/o</i> (intestine); <i>-itis</i> (inflammation)	inflammation of the intestine
enterohepatitis (EN-teh-roh-hep-ah-TI-tihs)	<i>enter/o</i> (intestine); <i>hepat/o</i> (liver); <i>-itis</i> (inflammation)	inflammation of the intestine and liver
enteropathy (en-tehr-OP-ah-thee)	<i>enter/o</i> (intestine); <i>-pathy</i> (disease)	any intestinal disease
eructation (ee-RUK-tay-shun)	from the Latin verb <i>eructo</i> (belch)	belching or burping gas up from the stomach
esophagitis (ih-SOF-uh-jye-tis)	<i>esophag/o</i> (esophagus); <i>-itis</i> (inflammation)	inflammation of the esophagus
gastric ulcers (GAS-trik UHL-serz)	<i>gastr/o</i> (stomach); <i>-ic</i> (adjective suffix) + ulcer, from the Latin <i>ulcus</i> , related to the Greek word <i>helkos</i> (wound, sore)	erosion of the gastric mucosa
gastritis (gas-TRY-tihs)	<i>gastr/o</i> (stomach); <i>-itis</i> (inflammation)	inflammation of the stomach
gastroduodenitis (GAS-troh-doo-oh-deh-NY-tihs)	<i>gastr/o</i> (stomach); <i>duoden/o</i> (duodenum); <i>-itis</i> (inflammation)	inflammation of the stomach and duodenum
gastroenteritis (GAS-troh-en-teh-RYE-tihs)	<i>gastr/o</i> (stomach); <i>enter/o</i> (intestine); <i>-itis</i> (inflammation)	inflammation of the stomach and intestine
gastroesophageal reflux disease (GAS-troh-ee-sof-a-JEE-al REE-flucks dih-ZEEZ) (GERD)	<i>gastr/o</i> (stomach); <i>esophag/o</i> (esophagus); <i>-al</i> (adjective suffix); + reflux disease	backward flow of stomach acid into the esophagus
gingivitis (JIN-jeh-vye-tis)	<i>gingiv/o</i> (gums); <i>-itis</i> (inflammation)	inflammation of the gums
hemorrhoids (HEM-oh-roydz)	from the Greek word <i>haimorrhoides</i> derived from <i>haima</i> (blood); and <i>rhoos</i> (a flowing)	enlarged veins in or near the anus that may cause pain or bleeding
hepatitis (hep-ah-TYE-tihs)	<i>hepat/o</i> (liver); <i>-itis</i> (inflammation)	inflammation of the liver
hepatogenic (heh-pah-toh-JEN-ik)	<i>hepat/o</i> (liver); <i>-genic</i> (originating)	originating in the liver

hepatomegaly (heh-PAH-toh-MEG-ah-lee)	<i>hepat/o</i> (liver); <i>-megaly</i> (enlargement)	enlarged liver
hiatal hernia (HYE-ay-tahl HER-nee-ah)	from the Latin word <i>hiatus</i> (gaping, opening); <i>-al</i> (adjective suffix) + the Latin word <i>hernia</i> (rupture)	protrusion of the stomach through the diaphragm into the thoracic cavity
hyperemesis (hy-per-EM-ih-sis)	<i>hyper-</i> (excessive); <i>-emesis</i> (vomit)	excessive vomiting
inguinal hernia (ING-gwi-nahl HER-nee-ah)	from the Latin word <i>inguinalis</i> (of the groin) + the Latin word <i>hernia</i> (rupture)	outpouching of intestines into the inguinal or groin region
intestinal obstruction (in-TES-tih-nul ob-STRUK-shun)	from the Latin words <i>intestinum</i> (gut); <i>-al</i> (adjective suffix); <i>obstructionem</i> (a barrier)	an obstruction in the intestine
intussusception (in-tuh-suh-SEP-shun)	from the Latin word <i>intus</i> (within); from the Latin word <i>suscipere</i> (undertake; support, accept)	one part of the intestine slipping or telescoping over another
irritable bowel syndrome (IBS) (IR-ih-tuh-bul BOWEL SIN-drome)	from the Latin <i>irritabilis</i> (irritate) + from the Latin <i>botellus</i> , diminutive of <i>botulus</i> (sausage) + from the Greek <i>sundrome</i> , from <i>sun-</i> (together) + <i>dramein</i> (to run)	condition characterized by abdominal pain, constipation, diarrhea, gas, and bloating
jaundice (JAWN-dis) or icterus (IK-tehr-us)	from Middle French word <i>jaunisse</i> (yellow)	yellowish cast to the skin, sclera (white part of the eye), and mucous membranes caused by bile deposits
jejunitis (jeh-joo-NYE-tih)	<i>jejun/o</i> (jejunum); <i>-itis</i> (inflammation)	inflammation of the jejunum
melena (muh-LEE-nuh)	from the Greek word <i>melas</i> (black)	dark-colored, tarry stools due to the presence of blood
pancreatitis (PAN-kree-ah-TYE-tih)	<i>pancreat/o</i> (pancreas); <i>-itis</i> (inflammation)	inflammation of the pancreas
pancreatopathy (PAN-kree-ah-TOP-ah-thee)	<i>pancreat/o</i> (pancreas); <i>-pathy</i> (disease)	any disease of the pancreas
parotiditis (pah-RAH-ti-DYE-tis)	parotid from the Greek words <i>para-</i> (beside) and <i>otos</i> (ear); <i>-itis</i> (inflammation)	inflammation of the parotid gland
peritonitis (PAYR-ih-toh-NYE-tis)	from the Greek words <i>peri-</i> (around) and <i>teinein</i> (to stretch); <i>-itis</i> (inflammation)	inflammation of the peritoneal cavity
polyp (PAHL-ip)	from the Latin word <i>polypus</i> (cuttlefish)	growth protruding from a stalk in the digestive

		tract
sialoadenitis (SY-ah-loh-ah-deh-NYE-tihs)	<i>sial/o</i> (saliva, salivary gland); <i>aden/o</i> (gland); <i>-itis</i> (inflammation)	inflammation of a salivary gland
sialoangiitis (SYE-ah-loh-an-jee-EYE-tihs)	<i>sial/o</i> (saliva, salivary gland); <i>angi/o</i> (vessel); <i>-itis</i> (inflammation)	inflammation of a salivary duct
sialorrhoea (SYE-ah-loh-REE-ah)	<i>sial/o</i> (saliva, salivary gland); <i>-rrhea</i> (discharge)	excessive production of saliva
sialostenosis (SYE-ah-loh-steh-NO-sihs)	<i>sial/o</i> (saliva, salivary gland); <i>-stenosis</i> (narrowed, blocked)	narrowing of a salivary duct
stomatitis (STOH-mah-tye-tis)	<i>stomat/o</i> (mouth); <i>-itis</i> (inflammation)	inflammation of the mucous membranes of the mouth
volvulus (VOL-vyuh-luhs)	from the Latin verb <i>volvere</i> “to turn, twist”	a twisting of the intestine
Diagnostic Tests, Treatments, and Surgical Procedures		
antacids (ant-AS-ids)	from <i>anti-</i> (against) + acids	medications used to reduce or neutralize acidity
antidiarrheal (an-tee-DYE-ah-REE-al)	<i>anti-</i> (against); from the Greek <i>dia-</i> (through) + <i>-rrhea</i> (discharge); <i>-al</i> (adjective suffix)	drugs that relieve diarrhea by absorbing the excess fluid or by decreasing intestinal motility
antiemetic (an-tee-EE-meh-tik)	<i>anti-</i> (against); <i>-emesis</i> (vomit); <i>-ic</i> (adjective suffix)	drugs used to relieve vomiting
antiflatulence (an-tee-FLAT-yoo-lens)	<i>anti-</i> (against); from the Latin word <i>flatus</i> (a blowing, a breaking wind)	drugs taken to relieve gas or flatus
cholecystectomy (KOH-lee-siss-TEK-toh-mee)	<i>cholecyst/o</i> (gallbladder); <i>-ectomy</i> (surgical removal)	removal of the gallbladder
cholecystotomy (KOH-lee-siss-TOT-oh-mee)	<i>cholecyst/o</i> (gallbladder); <i>-tomy</i> (incision)	incision into the gallbladder
colectomy (koh-LEK-toh-mee)	<i>col/o</i> (colon); <i>-ectomy</i> (surgical removal)	removal of all or part of the colon
colonoscope (koh-LON-oh-skope)	<i>colon/o</i> (colon); <i>-scope</i> (instrument for viewing)	long-flexible fiber-optic endoscope used in colonoscopy
colonoscopy (koh-lon-OSS-koh-pee)	<i>colon/o</i> (colon); <i>-scopy</i> (viewing)	visual examination of the colon with a colonoscope

colopexy (KOH-loh-pehk-see)	<i>col/o</i> (colon); <i>-pexy</i> (surgical fixation)	attachment of a portion of the colon to the abdominal wall
colostomy (koh-LOSS-tuh-mee)	<i>col/o</i> (colon); <i>-stomy</i> (permanent opening)	surgical establishment of an opening into the colon
colotomy (koh-LOT-uh-mee)	<i>col/o</i> (colon); <i>-tomy</i> (incision)	incision into the colon
duodenectomy (doo-oh-deh-NEK-toh-mee)	<i>duoden/o</i> (duodenum); <i>-ectomy</i> (surgical removal)	removal of the duodenum
duodenoscopy (doo-oh-deh-NOS-kuh-pee)	<i>duoden/o</i> (duodenum); <i>-scopy</i> (viewing)	visual examination of the duodenum with the aid of an endoscope
duodenostomy (doo-oh-deh-NOS-toh-mee)	<i>duoden/o</i> (duodenum); <i>-stomy</i> (permanent opening)	surgical establishment of an opening in the duodenum
emetic (ee-MET-ik)	<i>emesis</i> (vomit); <i>-ic</i> (adjective suffix)	drugs that stimulate or induce vomiting; frequently used in poisoning cases
enteroscope (en-TEHR-oh-skope)	<i>enter/o</i> (intestine); <i>-scope</i> (instrument for viewing)	lighted instrument for visually examining the intestines
enteroscopy (en-tehr-OS-koh-pee)	<i>enter/o</i> (intestine); <i>-scopy</i> (viewing)	visual examination of the intestines
gastrectomy (gas-TREK-toh-mee)	<i>gastr/o</i> (stomach); <i>-ectomy</i> (surgical removal)	removal of part of the stomach
gastroscope (GAS-troh-scope)	<i>gastr/o</i> (stomach); <i>-scope</i> (instrument for viewing)	lighted instrument (endoscope) for visually examining the stomach
gastroscopy (gas-TROS-koh-pee)	<i>gastr/o</i> (stomach); <i>-scopy</i> (viewing)	visual examination of the stomach with a lighted instrument (endoscope)
H2 blockers or H2-receptor antagonists	H2 (or histamine ₂), a common chemical in the body, signals the stomach to make acid; H2 blockers oppose histamine's action and reduce the amount of acid the stomach produces; + blocker, a common English word	drugs that block the release of gastric acid; used to treat gastroesophageal reflux disease
hepatoscopy (hep-uh-TOS-kuh-pee)	<i>hepat/o</i> (liver); <i>-scopy</i> (viewing)	visual examination of the liver
hepatopexy (HEH-pah-to-pek-see)	<i>hepat/o</i> (liver); <i>-pexy</i> (surgical fixation)	anchoring of the liver to the abdominal wall
jejunectomy (jeh-joo-NEK-toh-mee)	<i>jejun/o</i> (jejunum); <i>-ectomy</i> (surgical removal)	removal of all or part of the jejunum

jejunoplasty (jeh-JOON-oh-plass-tee)	<i>jejun/o</i> (jejunum); <i>-plasty</i> (surgical repair)	surgical repair of the jejunum
jejunotomy (jeh-joo-NOT-oh-mee)	<i>jejun/o</i> (jejunum); <i>-tomy</i> (incision)	incision into the jejunum
nasogastric (NG) tube (nay-zoh-GAS-trik TOOB)	<i>naso-</i> (nose) + <i>gastric</i> (stomach)	a flexible tube passed through the nose and into the stomach to deliver nutrition or to aspirate (suction out) contents
pancreatotomy (PAN-kree-ah-TOT-ah-mee)	<i>pancreat/o</i> (pancreas); <i>-tomy</i> (incision)	incision into the pancreas
sialoadenectomy (SYE-al-oh-ah-deh-NEK-tah-mee)	<i>sial/o</i> (saliva, salivary gland); <i>aden/o</i> (gland); <i>-ectomy</i> (surgical removal)	removal of a salivary gland
sialadenotomy (SYE-al-oh-ah-deh-NOT-ah-mee)	<i>sial/o</i> (saliva, salivary gland); <i>aden/o</i> (gland); <i>-tomy</i> (incision)	incision of a salivary gland
sialography (SYE-ah-LOG-rah-fee)	<i>sial/o</i> (saliva, salivary gland); <i>-graphy</i> (the process of recording)	radiography (X-rays) of salivary glands and ducts
total parenteral nutrition (TPN) (TOH-tul puh-REN-ter-ul noo-TRISH-un)	from the Latin <i>totalis</i> (whole, entire); <i>para-</i> (beside) + from the Greek <i>enteron</i> (intestine); from the Latin <i>nutrition</i> (to nourish)	nutrition maintained entirely by central intravenous injection or other non-GI route
upper gastrointestinal series (UGIS) (UP-er gas-troh-in-TES-tin-ul seer-EEZ)	from the Middle English <i>up</i> + <i>-er</i> ; <i>gastrointestinal</i> (relating to the stomach and intestines); from the Latin <i>sero</i> (to join together)	radiographic contrast study (X-rays with dye) of the esophagus, stomach, and duodenum
Practice and Practitioners		
gastroenterologist (GAS-troh-en-tehr-OL-oh-jist)	<i>gastr/o</i> (stomach); <i>enter/o</i> (intestine); <i>-logist</i> (one who studies a certain field)	a specialist in the diagnosis and treatment of digestive system disorders
gastroenterology (GAS-troh-en-tehr-OL-oh-jee)	<i>gastr/o</i> (stomach); <i>enter/o</i> (intestine); <i>-logy</i> (the study of)	the specialty concerned with the digestive system
internal medicine (in-TUR-nuhl MED-uh-sin)	two common English words	specialty in the diagnosis and nonsurgical treatment of serious and/or chronic illnesses; the phrase is quite commonly used in North America (but not necessarily elsewhere); it also covers subspecialties in specific organs, such as the liver, kidneys, etc.
internal (English adjective meaning)		

internist (IN-tur-nist)	“inside”); -ist (practitioner)	a specialist in internal medicine
proctologist (prok-TOL-uh-jist)	<i>proct/o</i> (anus and rectum); -logist (one who studies a certain field)	a specialist in the diagnosis and treatment of rectal and anal disorders
proctology (prok-TOL-uh-jee)	<i>proct/o</i> (anus and rectum); -logy (study of)	study of the rectum and anus

END-OF-CHAPTER EXERCISES

EXERCISE 13-1



LABELING

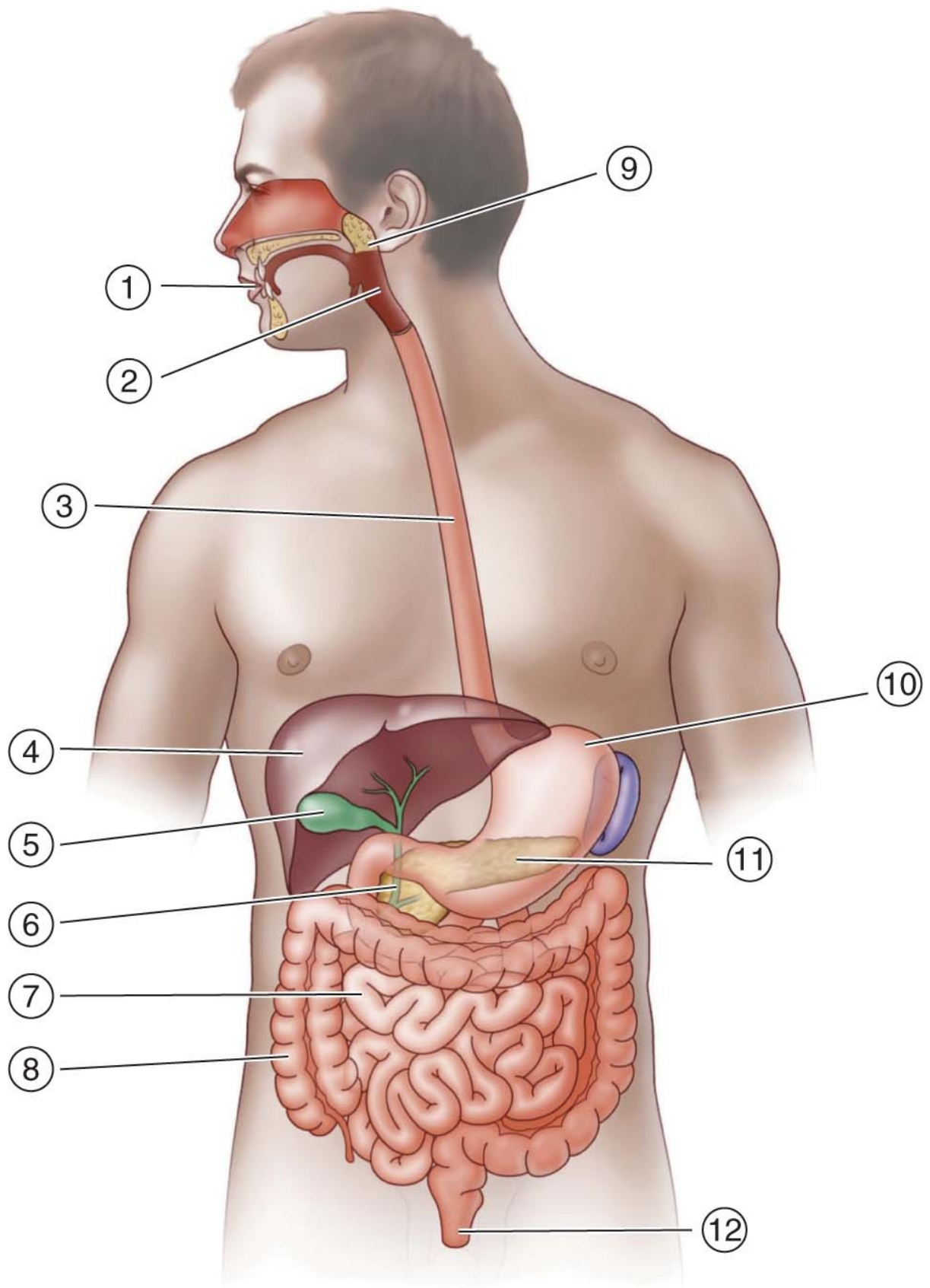
Using the following list, choose the correct terms to label the diagram correctly.

anus large intestine pharynx

bile duct liver salivary gland

esophagus mouth small intestine

gallbladder pancreas stomach



1. _____
2. _____

3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

EXERCISE 13-2



WORD PARTS

Break each of the following terms into its word parts: prefix, root, or suffix. Give the meaning of each word part and then define the term.

1. cholelithiasis

root: _____

suffix: _____

suffix: _____

definition: _____

2. enterohepatitis

root: _____

root: _____

suffix: _____

definition: _____

3. parotiditis

prefix: _____

root: _____

suffix: _____

definition: _____

4. sialorrhea
 root: _____
 suffix: _____
 definition: _____
5. colonoscopy
 root: _____
 suffix: _____
 definition: _____
6. gastroenterologist
 root: _____
 root: _____
 suffix: _____
 definition: _____
7. colectomy
 root: _____
 suffix: _____
 definition: _____
8. jejunotomy
 root: _____
 suffix: _____
 definition: _____

EXERCISE 13-3



WORD BUILDING

Use the word parts listed to build the terms defined.

- | | | | |
|-------------|----------|---------|--------|
| -al | enter/o | -ia | phag/o |
| cholecyst/o | gastr/o | -ic | -pexy |
| col/o | -genic | -itis | -scope |
| duoden/o | gingiv/o | jejun/o | sial/o |

7. _____
jaundice
8. _____
ascites
9. _____
esophagostenosis
10. _____
diarrhea
- g. first part of small intestine
- h. adjective referring to intestine(s)
- i. inflammation of esophagus
- j. watery discharge from the rectum;
liquid stools

EXERCISE 13-5



MULTIPLE CHOICE

Choose the correct answer for the following multiple choice questions.

- Dysphagia is difficulty with _____.
 - talking
 - swallowing
 - elimination
 - digestion
- Anorexia is _____.
 - difficulty in digestion
 - hyperemesis
 - loss of appetite
 - a small ulcer
- Gas in the stomach or intestines is _____.
 - gavage
 - icterus
 - flatus
 - dysentery
- Diverticulitis is an inflammation of _____.
 - small pouches in the intestine
 - the appendix

- c. the pharynx
 - d. descending colon
5. Movement of the intestines in which contents are propelled toward the anus is termed _____.
- a. pyloroplasty
 - b. volvulus
 - c. peristalsis
 - d. gastroenteric
6. The buccal mucosa is in the _____.
- a. nostril
 - b. stomach and intestines
 - c. mouth, inside the cheek
 - d. greater curvature of the stomach
7. Belching is called _____.
- a. volvulus
 - b. eructation
 - c. gastroenteric
 - d. halitosis
8. Vomiting blood is called _____.
- a. hematitis
 - b. indigestion
 - c. mastication
 - d. hematemesis
9. Telescoping of the intestines into themselves is called _____.
- a. gastrojejunostomy
 - b. intussusception
 - c. volvulus
 - d. sphincter

10. A colonoscopy is _____.
- an endoscopic study of the colon
 - an upper endoscopy with biopsy
 - a type of BE
 - an endoscopic study of the small intestine

EXERCISE 13-6



FILL IN THE BLANK

Fill in the blank with the correct answer.

- The sphincter that controls flow from the ileum to the cecum is the _____.
- The large intestine is divided into the cecum, colon, and _____.
- Saliva is secreted by the _____.
- The _____ is responsible for storing, condensing, and delivering bile to the small intestine.
- A hiatal hernia is a disorder in which the _____ protrudes through the diaphragm.
- Inflammation of the gallbladder is called _____.
- Presence of calculi or stones in the gallbladder or bile ducts is called _____.
- A drug that is used to relieve vomiting is called an _____.
- The instrument used to view the stomach in a gastroscopy is a _____.
- Removal of part of the stomach is called a _____.

EXERCISE 13-7



ABBREVIATIONS

Write out the term for the following abbreviations.

- _____ PO
- _____ UGIS

3. _____ TPN
4. _____ BM
5. _____ GI
6. _____ GERD
7. _____ IBS
8. _____ LES

Write the abbreviation for the following terms.

9. _____ hydrochloric acid
10. _____ nasogastric
11. _____ barium enema
12. _____ esophagogastroduodenoscopy
13. _____ nothing by mouth

EXERCISE 13-8



SPELLING

Select the correct spelling of the medical term.

1. The large intestine from the cecum to the rectum is also called the _____.
 - a. colon
 - b. cologne
 - c. collon
 - d. colin
2. The GI in GI tract stands for _____.
 - a. gastrointestinle
 - b. gastrointestinel
 - c. gastrointestinal
 - d. gastrarentestinal
3. A loss of appetite is called _____.
 - a. anoresia
 - b. anorexia

- c. anarexia
 - d. anorexia
4. _____ is a chronic liver disease characterized by inflammation and degeneration.
- a. Cirosis
 - b. Cirrhosis
 - c. Cirrosis
 - d. Cirhosis
5. A yellowish cast to the skin, scleras, and other mucous membranes caused by bile deposits is called _____.
- a. jandice
 - b. juandice
 - c. jaundise
 - d. jaundice
6. A _____ is a surgical establishment of an opening into the colon.
- a. colostimy
 - b. colostamy
 - c. colostomy
 - d. colostemy
7. Tarry, bloody stool is called _____.
- a. malena
 - b. milena
 - c. melena
 - d. melana
8. A growth protruding from a stalk is a _____.
- a. polyp
 - b. polip
 - c. pollup

- d. pollyp
9. _____ is an eating disorder characterized by episodes of binge eating followed by self-induced vomiting and misuse of laxatives.
- a. Bullimia
 - b. Bulleemia
 - c. Bulemia
 - d. Bulimia
10. A _____ is an enlarged vein in or near the anus that may cause pain or bleeding.
- a. hemoroid
 - b. hemorrhoid
 - c. hemroid
 - d. hemorhoid

EXERCISE 13-9



CASE STUDY

Reggie V., a middle-aged man, began feeling pain in his upper abdomen about a month ago. He described the pain as a burning sensation that at first disappeared after he took over-the-counter antacids. In the last 10 days or so, however, he has noticed that these measures have become less and less helpful.

His pain is not accompanied by SOB, nausea, or chest pains, and his appetite remains normal. His BP was slightly elevated also, and he reported that on the basis of a family history of HTN, his GP had advised him to stop smoking cigarettes and restrict caffeinated drinks to one or two a day.

This patient's WBC count was normal. Endoscopy revealed a 1-cm gastric ulcer.

1. What does the abbreviation SOB stand for?

2. What does the abbreviation BP stand for?

3. Does the abbreviation HTN have anything to do with the first two

abbreviations? Explain how each may relate to the other two.

4. What does WBC stand for?

5. What word parts make up the word “endoscopy” in the case study?
What does the term *endoscopy* mean?

6. What is a gastric ulcer?



The Urinary System

14

LEARNING OUTCOMES

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

- Name the structures that make up the urinary system.
- Pronounce, spell, and define medical terms related to the urinary system and its disorders.
- Interpret abbreviations associated with the urinary system.

INTRODUCTION

The **urinary system** is composed of the *kidneys*, *ureters*, *urinary bladder*, and *urethra* (see **Figure 14-1A**). These organs are responsible for the formation, storage, and removal of urine. These processes start with the **kidneys**, paired structures that remove wastes from the bloodstream, reclaim important electrolytes like sodium and potassium, help regulate blood pressure and fluid balance, and aid in red blood cell production. The kidneys then form **urine**, which is fluid containing water and dissolved substances. The **ureters** are tubular structures that transport urine from the kidneys to the **urinary bladder**, an organ that stores urine. The urine is then eliminated through the **urethra**, a canal leading from the urinary bladder to the exterior. This process regulates the amount of water in the body and maintains the proper balance of acids and electrolytes, which is necessary for human survival. **Figure 14-1B** shows the processes of urine formation, transport, storage, and elimination.

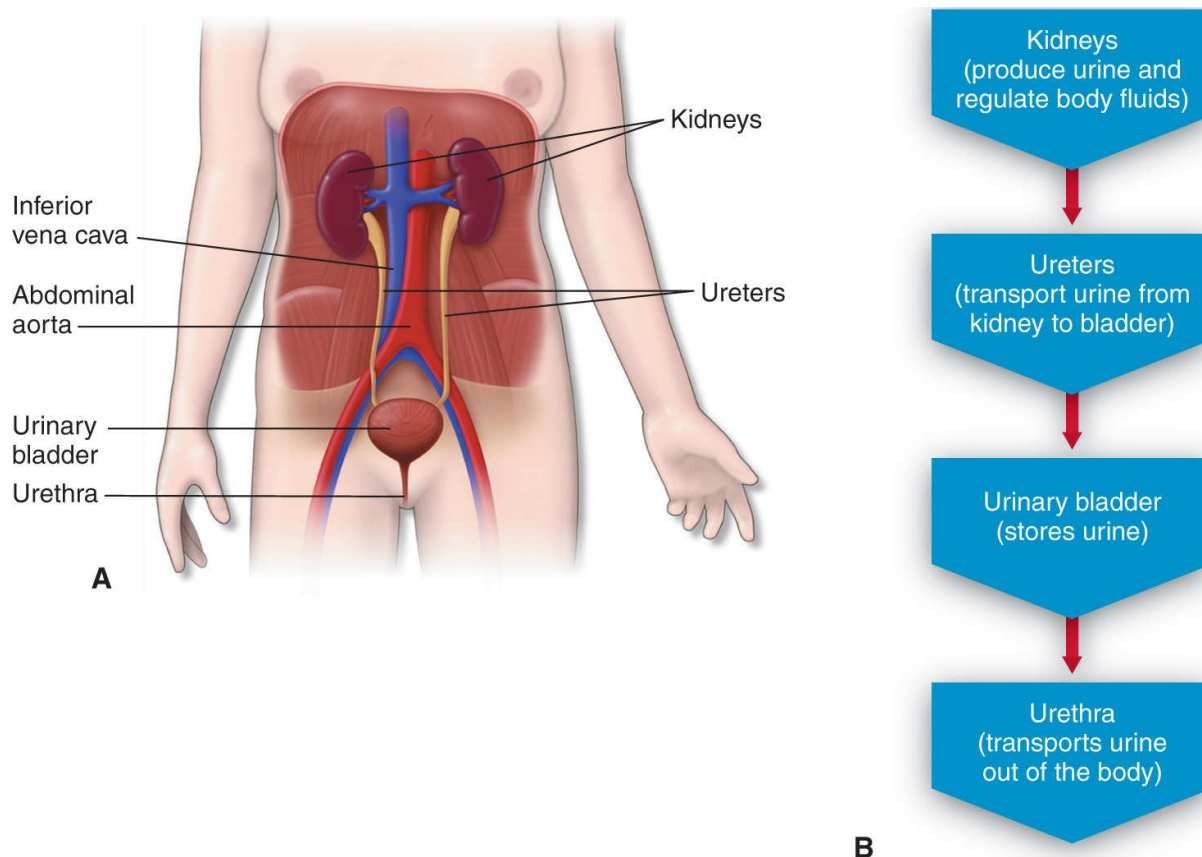


FIGURE 14-1. Primary organs of the urinary system. **A.** Anterior view of the kidneys, ureters, urinary bladder, and urethra (male). **B.** The process of urine formation, transport, storage, and elimination, beginning with the kidney and ending with the urethra.

WORD PARTS RELATED TO THE URINARY SYSTEM

Nephr/o and ren/o are both root words that mean kidney. The term *cyst* and the word part *cyst/o* mean bladder, whereas the word parts *ur/o* and *urin/o* mean urine. **Table 14-1** lists word parts used in forming urinary system terms.

TABLE 14-1  WORD PARTS RELATED TO THE URINARY SYSTEM

Word Part	Meaning
cyst/o	bladder
glomerul/o	glomerulus
-iasis	condition, state

lith/o	stone
nephr/o, ren/o	kidney
noct/o	night
olig/o	few, little
poly-	much, many
py/o	pus
pyel/o	pelvis
ur/o, urin/o	urine
ureter/o	ureter
urethr/o	urethra

Word Parts Exercise

After studying Table 14-1, write the meaning of each of the word parts.

WORD PART	MEANING
1. ur/o, urin/o	1. _____
2. noct/o	2. _____
3. olig/o	3. _____
4. -iasis	4. _____
5. glomerul/o	5. _____

6. nephro/o, ren/o	6. _____
7. urethr/o	7. _____
8. lith/o	8. _____
9. poly-	9. _____
10. py/o	10. _____
11. pyel/o	11. _____
12. ureter/o	12. _____
13. cyst/o	13. _____

What's the difference between the roots nephro/o and ren/o? Both may be used to refer to the kidneys. However, nephro/o is used in the names of most, but not all, kidney disorders and treatments. For example, nephro/o is the root in nephritis, nephralgia, nephrectomy, nephrorrhaphy, nephrotomy, and nephromegaly. In general, the term *nephrology* is also more common than renology, but the adjective renal is far more common than its counterpart, nephric. Renal is more common when naming structures, such as the renal capsule and the renal fascia.

STRUCTURE AND FUNCTION

The kidneys are bean-shaped organs (hence the source for the name of the kidney bean) and are about the size of a deck of cards. They lie retroperitoneally, which is posterior to the peritoneum in the abdominopelvic cavity, along each side of the spinal column. Each kidney is covered by a thin membrane called the *fibrous capsule*. A thicker layer of fatty tissue, called the **perinephric fat** or *pararenal fat body*, surrounds the fibrous capsule and thus provides protection for this vital organ. Finally, a thin layer of connective tissue, called the **renal fascia**, forms each kidney's outer covering. The two regions of the kidney are the outer **renal cortex** and the inner **renal medulla**. The **hilum** is the indented and narrowest part of the kidney, where blood vessels and nerves enter and leave. The flattened funnel-shaped expansion of the upper end of the ureter where urine collects in the kidney is called the **renal pelvis**. The cup-like structure that drains into the renal pelvis is the **calyx**. **Figure 14-2** shows the anatomy of a kidney.

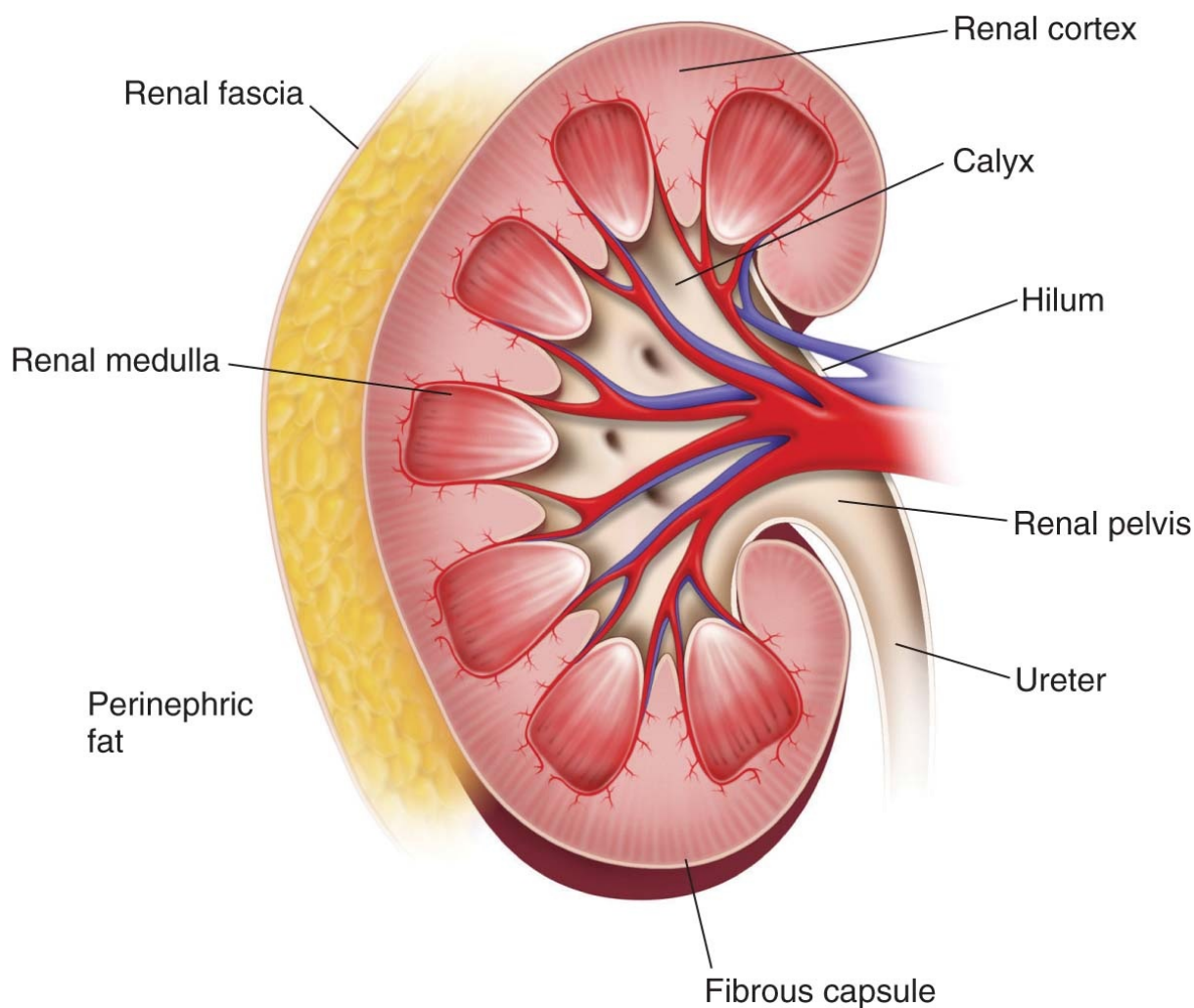


FIGURE 14-2 Sagittal view of the kidney and internal structures.

The kidneys form urine and remove two natural products of metabolism, **urea** and **uric acid**, along with other wastes from the blood. The kidneys also filter, reabsorb, and secrete nonwaste products back into the bloodstream.

Filtration and the urine production begin in the **nephrons**, which are the functional units of the kidneys. Each kidney has approximately 1 million nephrons, and each nephron consists of a *renal corpuscle* and the *renal tubule*. The **renal corpuscle** is a structure composed of the *glomerulus* and the *glomerular* (Bowman's) *capsule*. The **glomerulus** consists of a cluster of capillaries through which blood and wastes are filtered. The **renal tubule** consists of the *proximal convoluted tubule*, *nephron loop* (loop of Henle), and the *distal convoluted tubule* (see [Figure 14-3](#)). Fluid not returned to the bloodstream becomes urine, is collected in the *collecting duct*, and moves into the renal pelvis before ultimately entering the ureter. The ureters carry the urine to the urinary bladder, where it is stored.

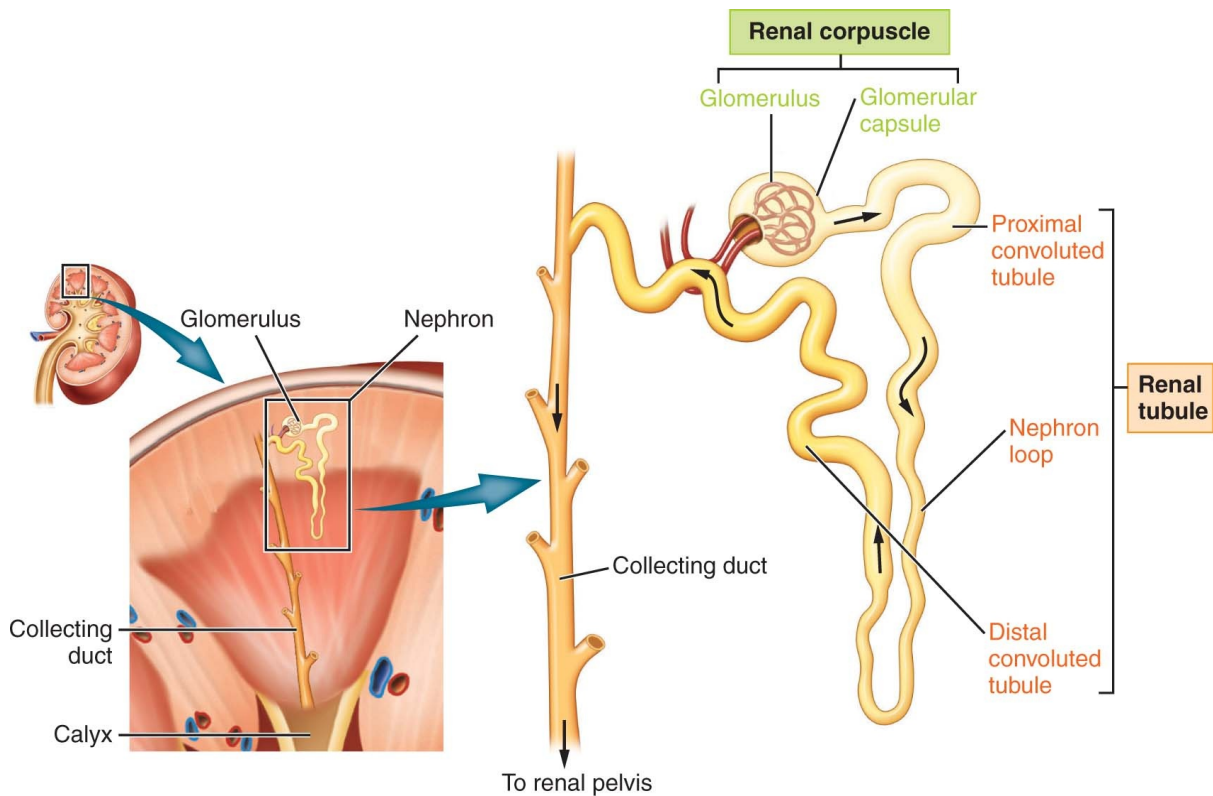


FIGURE 14-3 Section of the kidney showing a representative nephron.

The urinary bladder stores the urine until a sufficient volume causes an increase in pressure and triggers the urge to urinate via the *micturition reflex*. The **micturition reflex** is a contraction of the walls of the urinary bladder and relaxation of the urethral sphincter in response to the rise in urinary bladder pressure. Micturition is also called *urination*, *uresis*, or *voiding*. Urination is regulated by two sphincters, the circular muscles that surround the urethra. They are the *internal urethral sphincter*, which is located at the entrance to the urethra and is involuntarily controlled, and the *external urethral sphincter*, which is located at the distal end of the urethra and is under voluntary control.



Quick Check

Fill in the blanks.

1. Name the primary organs of the urinary system.

_____, _____,

2. The indented part of the kidney, where blood vessels and nerves enter or exit, is called the _____.

3. Name the two urethral sphincters.

DISORDERS RELATED TO THE URINARY SYSTEM

Disorders of the urinary system can affect any urinary structures. Some of these disorders are listed as follows:

- **Dysuria:** painful, difficult urination
- **Incontinence:** the loss of urinary control
- **Retention:** the inability to empty the bladder
- **Urinary tract infections (UTIs):** infection of the urinary tract. Examples of UTIs include the following:
 - **Cystitis:** inflammation of the urinary bladder, usually caused by infection
 - **Glomerulonephritis:** inflammation of the glomerulus, which can involve one or both kidneys, usually caused by infection
 - **Nephritis:** inflammation of the kidney(s), usually caused by infection
 - **Pyelonephritis:** inflammation of the calyces and renal pelvis, typically due to bacterial infection
 - **Urethritis:** inflammation of the urethra, usually caused by infection
- **Renal failure** or *end-stage renal disease* (ESRD) is loss of renal function that results in kidneys ceasing urine production. It can be acute renal failure (ARF) or chronic renal failure (CRF).

DIAGNOSTIC TESTS, TREATMENTS, AND SURGICAL PROCEDURES


The root *cyst/o* is used to form terms having to do with the urinary bladder. Examples include **cystalgia** (pain in the urinary bladder), **cystectomy** (excision of the urinary bladder), and **cystopexy** (surgical attachment of the urinary bladder to the abdominal wall or to other supporting structures). All of these terms come from the Greek word *kystis*, which means bladder.


A test of kidney function is the *glomerular filtration rate* (GFR). This test determines the volume of water filtered out of the blood plasma through the capillary walls into the glomerular capsule per unit of time. An X-ray or computed tomography (CT) scan of the kidneys, ureters, and bladder (KUB) after intravenous injection of a contrast dye is known as an *intravenous*

pyelogram (IVP). The contrast is injected into a vein and is excreted by the kidneys to show the urinary system. Blood urea nitrogen (BUN) is a blood test that measures kidney function by assessing the level of nitrogenous waste and urea that are in the blood.

PRACTICE AND PRACTITIONERS

A physician who specializes in the diagnosis and treatment of urinary disorders is called a **urologist**, and the specialty practice is **urology**. A physician who treats the kidney and kidney disorders is called a **nephrologist**. This area of specialty is named **nephrology**.

Abbreviation Table  THE URINARY SYSTEM	
ABBREVIATION	MEANING
ARF	acute renal failure
BUN	blood urea nitrogen
CAPD	continuous ambulatory peritoneal dialysis
CRF	chronic renal failure
CT	computed tomography
ESRD	end-stage renal disease
GFR	glomerular filtration rate
IVP	intravenous pyelogram
KUB	kidneys, ureter, and bladder
UA	urinalysis
UTI	urinary tract infection

Study Table  The Urinary System		
TERM AND PRONUNCIATION	ANALYSIS	MEANING
Structure and Function		

calyx (KAY-lik)	from the Greek <i>kalux</i> (cup of a flower)	cup-like structure that drains into the renal pelvis
electrolyte (ee-LEK-troh-lyte)	from the Greek words <i>electron</i> (able to produce static electricity by friction) and <i>lytos</i> (soluble)	an ionizable substance, such as sodium or potassium, in solution within body cells
glomerulus (gloh-MER-yu-luhs)	from the Latin word <i>glomus</i> (ball of yarn)	capillary network found inside each nephron
hilum (HY-luhm)	a Latin word meaning “a small thing,” “a trifle”	narrow part of the kidney where blood vessels and nerves enter and leave
kidney (KID-nee)	originally <i>kidenere</i> , perhaps a compound of Old English <i>cwith</i> (womb) + <i>neere</i> (kidney) in reference to the shape of the organ	organ that excretes urine, removes nitrogenous wastes of metabolism, reclaims electrolytes and water, and contributes to blood pressure and red blood cell production
micturition (mik-chuh-RISH-uhn)	from the Latin <i>micturio</i> (to desire to urinate)	urination; <i>uresis</i> ; <i>voiding</i>
micturition reflex (mik-chuh-RISH-uhn REE-fleks)	from the Latin <i>micturio</i> (to desire to urinate) and the Latin word <i>reflexus</i> (to bend back)	contraction of the bladder walls and relaxation of the bladder and urethral sphincter in response to a rise in pressure within the bladder
nephron (NEFF-ron)	from the Greek word <i>nephros</i> (kidney)	tiny structure within the kidney in which the urine-production process begins
perinephric fat (PERH-ih-NEF-rik FAT)	<i>peri-</i> (around); <i>nephr-</i> (kidney) <i>-ic</i> (adjective suffix)	fatty tissue surrounding the renal capsule; <i>pararenal fat body</i>
renal capsule (REE-nul KAP-suhl)	<i>ren/o</i> (kidney); <i>-al</i> (adjective suffix); <i>capsula</i> , a Latin word meaning “a small box”	thin membrane covering each kidney, deep to the perinephric fat and renal fascia
renal corpuscle (REE-nul KOR-pus-el)	from the Latin word <i>renalis</i> (kidneys) + the Latin word <i>corpusculum</i> (body)	the collection of glomerular capillaries and the glomerular (Bowman’s) capsule that encloses them
renal cortex (REE-nul KOR-teks)	from the Latin words <i>renalis</i> (kidneys) and <i>cortex</i> (bark)	outer region of the kidney
renal fascia (REE-nul FASH-ee-ah)	<i>ren/o</i> (kidney); <i>-al</i> (adjective suffix); <i>fascia</i> , a Latin word meaning band or sash	protective outer covering of the kidney
renal medulla (REE-nul me-DOO-luh)	from the Latin word <i>renalis</i> (kidneys); from the French word <i>medius</i> (middle)	inner region of the kidney
renal pelvis (REE-nul PEL-vis)	from the Latin words <i>renalis</i> (kidneys) and <i>pelvis</i> (basin)	a reservoir in each kidney that collects urine
renal tubule (REE-	from the Latin words <i>renalis</i> (kidneys) and	small tubes including the proximal convoluted tubule, nephron loop (loop of

nul TOO-byool)	<i>tubulus</i> (tube)	Henle), and the distal convoluted tubule that convey urine from the glomeruli to the renal pelvis
retroperitoneal (reh-troh-pehr-ih-toh-NEE-al)	<i>retro-</i> (backward, behind); from the Greek word <i>peritenein</i> (to stretch over)	external or posterior to the peritoneum, which is a serous membrane lining the abdominopelvic cavity
sphincters (SFINK-tehrs)	from the Greek word <i>sphincter</i> (band, anything that binds tight)	circular muscle that surrounds a tube such as the urethra and constricts the tube when it contracts
urea (yu-REE-ah)	from the French word <i>uree</i> (urine)	natural waste product of metabolism that is excreted in urine
ureters (yu-REE-tehrs; also YUR-eh-tehrs)	from the Greek word <i>oureter</i> , from <i>ourein</i> (to urinate)	two tubes that transfer urine from the kidneys to the urinary bladder
urethra (yu-REE-thrah)	from the Greek word <i>ourethra</i> , from <i>ourein</i> (to urinate)	tube that conducts urine away from the bladder for expulsion
uric acid (YUR-ik AS-id)	<i>ur/o</i> (urine); <i>-ic</i> (adjective suffix) + acid from the Latin word <i>acidus</i> (sour-tasting)	natural waste product of metabolism that is excreted in urine
urinary bladder (YUR-ihn-ayr-ee BLAD-dehr)	from the Greek word <i>ouron</i> (urine); Anglo-Saxon, <i>blaedre</i> (bladder)	temporary storage receptacle for urine
urinate (YUR-ihn-ayt)	<i>urin/o</i> (urine); <i>-ate</i> (verb suffix)	passing of urine
urine (YUR-ihn)	from the Greek word <i>ouron</i> (urine)	water and soluble substances excreted by the kidneys
void (voyd)	from Old French <i>voide</i> (empty, hollow, waste)	to urinate
Disorders		
albuminuria (al-byu-mihn-YUR-ee-ah)	from the Latin <i>albumen</i> (egg white); <i>ur/o</i> (urine); <i>-ia</i> (condition)	presence of the protein, albumin, in the urine, typically a sign of kidney disease
anuria (an-YUR-ee-ah)	<i>an-</i> (without); <i>ur/o</i> (urine); <i>-ia</i> (condition)	failure of the kidneys to produce urine
calculus (KAL-kyu-luhs); plural: calculi (KAL-kyu-lye)	a Latin word meaning small pebble	a kidney stone (in the context of this body system)
cystalgia (sihs-TAL-jee-ah)	<i>cyst/o</i> (bladder); <i>-algia</i> (pain)	pain in the urinary bladder
cystitis (sihs-TYE-tihs)	<i>cyst/o</i> (bladder); <i>-itis</i> (inflammation)	inflammation of the urinary bladder

cystocele (SIHS-toh-seel)	<i>cyst/o</i> (bladder); <i>-cele</i> (hernia)	hernia of the urinary bladder
cystolith (SIS-toh-lith)	<i>cyst/o</i> (bladder); <i>-lith</i> (stone)	urinary bladder stone
dysuria (dihs-YUR-ee-ah)	<i>dys-</i> (difficult); <i>ur/o</i> (urine); <i>-ia</i> (condition)	difficult or painful urination
enuresis (en-yoo-REE-sis)	from Greek <i>enourein</i> (to urinate in)	bedwetting
glomerulonephritis (gloh-mer-yoo-loh-ne-FRY-tis)	<i>glomerul/o</i> (glomerulus); <i>nephro/o</i> (kidney); <i>-itis</i> (inflammation)	inflammation of the kidney glomeruli typically caused by an immune response and not an acute response to kidney infection
glycosuria (gly-kohs-YUR-ee-ah)	<i>glycos-</i> (sugar); <i>ur/o</i> (urine); <i>-ia</i> (condition)	presence of carbohydrates (sugar) in the urine; <i>glucosuria</i>
hematuria (hee-ma-TYOO-ree-uh)	<i>hemat/o</i> (blood); <i>ur/o</i> (urine); <i>-ia</i> (adjective suffix)	presence of blood in the urine
incontinence (in-KON-tih-nents)	from the Latin word <i>incontinentia</i> (inability to retain)	inability to control urination
nephralgia (neh-FRAL-jee-ah)	<i>nephro/o</i> (kidney); <i>-algia</i> (pain)	pain in the kidneys
nephritis (neh-FRY-tih)	<i>nephro/o</i> (kidney); <i>-itis</i> (inflammation)	inflammation of the kidney
nephrolithiasis (NEFF-ro-lih-THY-ah-sihs)	<i>nephro/o</i> (kidney); <i>lith/o</i> (stone); <i>-iasis</i> (condition)	the presence of renal calculi
nephromegaly (neh-fro-MEG-ah-lee)	<i>nephro/o</i> (kidney); <i>-megaly</i> (enlargement)	enlargement of one or both kidneys; <i>renomegaly</i>
nephropathy (neh-FROP-ah-thee)	<i>nephro/o</i> (kidney); <i>-pathy</i> (disease)	any disease of the kidney
nephroptosis (neh-FROP-toh-sis)	<i>nephro/o</i> (kidney); <i>-ptosis</i> (falling downward, prolapse)	prolapse (slipping out of position) of the kidney
nocturia (noc-TUR-ee-ah)	<i>noct/o</i> (night); <i>ur/o</i> (urine); <i>-ia</i> (condition)	excessive urination at night
oliguria (oh-lih-GUR-ee-ah)	<i>oligo/o</i> (little); <i>ur/o</i> (urine); <i>-ia</i> (condition)	diminished urine production
polyuria (pol-ee-YUR-ee-ah)	<i>poly-</i> (much, many); <i>ur/o</i> (urine); <i>-ia</i> (condition)	excessive urine production

pyelonephritis (pye-eh-loh-neh-FRY-tis)	<i>pyel/o</i> (pelvis); <i>nephro</i> (kidney); <i>-itis</i> (inflammation)	inflammation of the renal calyces and renal pelvis due to local bacteria infection
pyuria (pu-YOUR-ee-ah)	<i>py/o</i> (pus); <i>ur/o</i> (urine); <i>-ia</i> (condition)	pus in the urine
renal calculus (REE-nahl KAL-ku-luhs)	<i>ren/o</i> (kidney); <i>calculus</i> , a Latin word meaning “stone”	a kidney stone
renal failure (REE-nahl FAIL-yur)	<i>ren/o</i> (kidney); <i>-al</i> (adjective suffix); failure, common English word	impairment of renal function, either acute or chronic, with retention of urea, creatinine (compound produced by the metabolism of creatine), and other waste products
renal hypoplasia (REE-nahl HY-poh-PLAYZ-ee-ah)	<i>ren/o</i> (kidney); <i>hypo-</i> (below normal); <i>-plasia</i> (formation, development)	an underdeveloped kidney
retention (ree-TEN-shun)	from the Latin word <i>retentio</i> (a retaining, a holding back)	the inability to empty the bladder
uremia (yu-REE-mee-ah) or azotemia (ays-oh-TEAM-ee-ah)	<i>ur/o</i> (urine); <i>-emia</i> (blood condition)	an excess of urea in the blood
ureteritis (yoo-ree-ter-EYE-tis)	<i>ureter/o</i> (ureter); <i>-itis</i> (inflammation)	inflammation of a ureter
urethralgia (yu-ree-THRAL-jee-ah)	<i>urethr/o</i> (urethra); <i>-algia</i> (pain)	pain in the urethra; <i>urethrodynia</i>
urethritis (yu-ree-THRY-tihs)	<i>urethr/o</i> (urethra); <i>-itis</i> (inflammation)	inflammation of the urethra
urethrostenosis (yu-REE-throh-steh-NO-sihs)	<i>urethr/o</i> (urethra); <i>sten/o</i> (narrow); <i>-sis</i> (condition)	narrowing of the urethra
urinary tract infection (yur-ih-NAIR-ee TRAKT in-FEK-shun)	<i>urin/o</i> (urine); <i>-ary</i> (adjective suffix); 1 tract 1 infection	microbial infection of any part of the urinary tract
Diagnostic Tests, Treatments, and Surgical Procedures		
antibiotic (an-tee-BYE-ot-ik)	from <i>anti-</i> (against) + the Greek word <i>biotikos</i> (fit for life)	medicine that inhibits the growth of bacteria
catheter (CATH-eh-tehr)	from the Greek word <i>kathienai</i> (to let down, thrust in)	a flexible tube that enables passage of fluid from or into a body cavity
cystectomy (sihs-TEK-toh-mee)	<i>cyst/o</i> (bladder); <i>-ectomy</i> (excision)	excision of the urinary bladder

cystopexy (SIHS-toh-pek-see)	<i>cyst/o</i> (bladder); <i>-pexy</i> (fixation)	surgical attachment (fixation) of the urinary bladder to the abdominal wall or other supporting structures
cystoscopy (sihs-TOS-ko-pee)	<i>cyst/o</i> (bladder); <i>-scopy</i> (use of an instrument for viewing)	visual inspection of the urinary bladder by means of an instrument called a cystoscope
dialysis (dy-AL-ih-sihs)	a Greek word meaning “dissolution,” “separation”	filtration to remove colloidal particles from a fluid; a method of artificial kidney function; types include continuous ambulatory peritoneal dialysis (CAPD) and extracorporeal dialysis
diuretic (dy-yu-REHT-ik)	from the Greek words <i>dia-</i> (through) and <i>ourein</i> (urine)	drug that promotes urination
hemodialysis (HEE-mo-dy-AL-ih-sihs)	<i>hemo-</i> (blood); <i>dialysis</i> , a Greek word meaning “dissolution,” “separation”	removal of unwanted substances from the blood by passage through a semipermeable membrane; <i>kidney dialysis</i>
kidney transplant (KID-nee TRANS-plant)	originally <i>kidenere</i> , perhaps a compound of Old English <i>cwith</i> (womb) + <i>neere</i> (kidney) in reference to the shape of the organ; from the late Latin <i>transplantare</i> (something moved to a new place)	operation in which a donor kidney is placed into a recipient
lithotripsy (LITH-oh-trip-see)	<i>lith/o</i> (stone); <i>-tripsy</i> (crushing)	treatment in which a stone in the kidney, urethra, or urinary bladder is broken up into small particles
nephrectomy (neh-FREK-toh-mee)	<i>nephr/o</i> (kidney); <i>-ectomy</i> (removal)	removal of a kidney
nephrolithotomy (NEH-froh-lih-THOT-oh-mee)	<i>nephr/o</i> (kidney); <i>lith/o</i> (stone); <i>-tomy</i> (incision into)	incision into the kidney to remove a kidney stone
nephropexy (NEF-roh-pek-see)	<i>nephr/o</i> (kidney) + the Greek work <i>pexis</i> (fixation)	operative fixation of a floating or mobile kidney
ureteroplasty (yu-REE-tehr-oh-plass-tee)	<i>ureter/o</i> (ureter); <i>-plasty</i> (surgical repair)	surgical repair of a ureter
ureterorrhaphy (yu-ree-ter-OR-uh-fee)	<i>ureter/o</i> (ureter); <i>-rrhaphy</i> (surgical suturing)	suture of a ureter
ureteroscope (yu-REE-tehr-oh-skohp)	<i>ureter/o</i> (ureter); <i>-scope</i> (instrument for viewing)	instrument used to visually examine the ureter
urinalysis (UA) (yur-ih-NAL-ih-sihs)	<i>urin/o</i> (urine); <i>-alysis</i> from the English word analysis	analysis of urine by physical, chemical, and microscopic means to test for the presence of substances or disease

Practice and Practitioners

nephrologist (neh-FROL-oh-jist)	<i>nephr/o</i> (kidney); <i>-logist</i> (one who studies a special field)	a medical specialist who diagnoses and treats disorders of the kidney
nephrology (neh-FROL-oh-jee)	<i>nephr/o</i> (kidney); <i>-logy</i> (study of)	medical specialty dealing with the kidneys
urologist (yu-ROL-oh-jist)	<i>ur/o</i> (urine); <i>-logist</i> (one who studies a special field)	a medical specialist who diagnoses and treats disorders of the urinary system
urology (yu-ROL-oh-jee)	<i>ur/o</i> (urine); <i>-logy</i> (study of)	the medical specialty dealing with the urinary system

END-OF-CHAPTER EXERCISES

EXERCISE 14-1

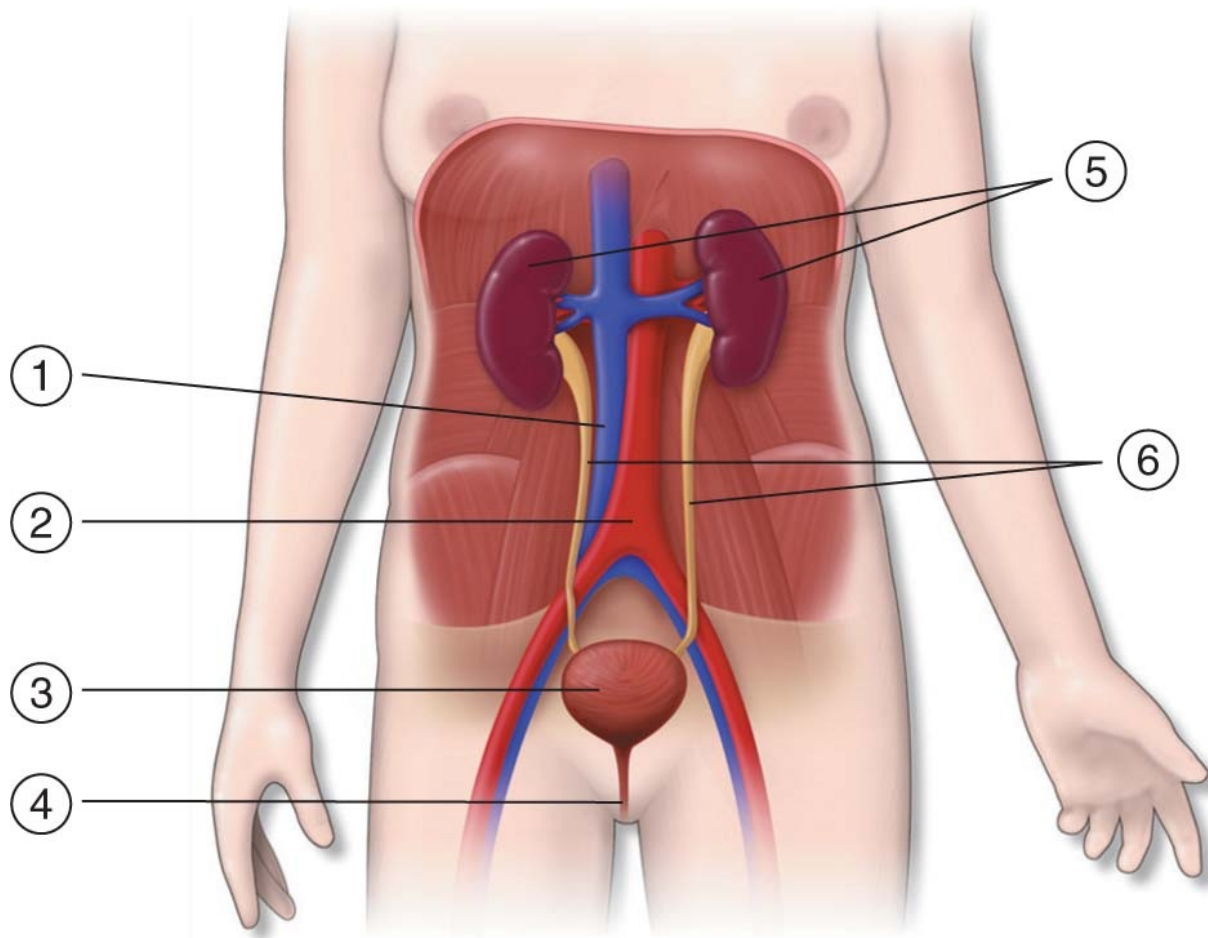


LABELING

Using the following word list, choose the correct terms to label the diagram correctly.

abdominal aorta kidneys urethra

inferior vena cava ureters urinary bladder



1. _____
2. _____
3. _____
5. _____
4. _____
6. _____

EXERCISE 14-2

WORD PARTS

Break each of the following terms into its word parts: root, prefix, or suffix. Give the meaning of each word part and then define each term.

1. *anuria*
 prefix: _____
 root: _____
 suffix: _____

definition: _____

2. *cystalgia*

root: _____

suffix: _____

definition: _____

3. *nephrolithiasis*

root: _____

root: _____

suffix: _____

definition: _____

4. *hematuria*

root: _____

root: _____

suffix: _____

definition: _____

5. *glomerulonephritis*

root: _____

root: _____

suffix: _____

definition: _____

6. *nephrologist*

root: _____

suffix: _____

definition: _____

7. *urology*

root: _____

suffix: _____

definition: _____

8. *nephrectomy*

root: _____

suffix: _____

definition: _____

EXERCISE 14-3



WORD BUILDING

Use the word parts listed to build the terms defined.

albumen urethro -tripsy cyst/o

-ur/o -stenosis ur/o -ectomy

-ia ur/o -logist -scope

nephro -emia nephr/o urter/o

-aliga lith/o -logy -rrhaphy

1. presence of protein in urine _____
2. pain in the kidneys _____
3. narrowing of the urethra _____
4. an excess of urea in the blood _____
5. treatment in which a stone is broken into smaller particles

6. one who studies the urinary system _____
7. study of the kidney _____
8. excision of the bladder _____
9. instrument used to examine the bladder _____
10. suture of a ureter _____

EXERCISE 14-4



MATCHING

Match the term with its definition.

1. _____
nephron

a. capillary network found inside each
nephron

- | | |
|--------------------------------------|--|
| 2. _____
urethra | b. urination |
| 3. _____ renal
calculus | c. pain in the bladder |
| 4. _____
glomerulus | d. tube that conducts urine away from the bladder for excretion |
| 5. _____
micturition | e. an ionizable substance in solution within body cells |
| 6. _____ uric
acid | f. narrow part of the kidney where blood vessels and nerves enter and exit |
| 7. _____
ureters | g. functional unit of the kidney |
| 8. _____ hilum | h. two tubes that transfer urine from the kidneys to the urinary bladder |
| 9. _____
electrolyte | i. X-ray of the ureter |
| 10. _____ UA | j. natural waste product of metabolism excreted in the urine |
| 11. _____
nephralgia | k. a kidney stone |
| 12. _____
nephritis | l. excision of a kidney, ureter, and at least part of the urinary bladder |
| 13. _____
urethrostenosis | m. inflammation of the kidney |
| 14. _____
nephrolithotomy | n. narrowing of the urethra |
| 15. _____
nephroureterocystectomy | o. any disease of the kidney |
| 16. _____
ureterography | p. pain in the kidneys |

17. _____
cystalgia

q. incision into the kidney to remove a
calculus (kidney stone)

18. _____
nephropathy

r. urinalysis

EXERCISE 14-5



MULTIPLE CHOICE

Choose the correct answer for the following multiple choice questions.

- The _____ carry the urine from the renal pelvis to the urinary bladder.
 - urethra
 - meatus
 - cortex
 - ureters
- The inability to hold urine is called _____.
 - polyuria
 - incontinence
 - hematuria
 - enuresis
- Excretion of urine from the bladder is properly termed as _____.
 - voiding
 - micturition
 - urination
 - all of the above
- The functioning unit of the kidney is the _____.
 - nephron
 - cortex of the kidney
 - glomeruli
 - pelvis of the kidney

5. What does anuria mean?
 - a. failure to produce urine
 - b. no urine from the kidney
 - c. painful urination
 - d. pus in the urine
6. What term means destruction of kidney tissue?
 - a. nephrolithiasis
 - b. neurolysis
 - c. nephrolysis
 - d. resection
7. What is the correct plural form of the word calculus?
 - a. calcula
 - b. calculuses
 - c. calculi
 - d. calculae
8. What is the term for surgical repair of a ureter?
 - a. ureterectomy
 - b. ureteroplasty
 - c. ureterectasia
 - d. ureterolysis
9. A hernia of the urinary bladder is called a _____.
 - a. cystitis
 - b. cystocele
 - c. cystalgia
 - d. cystolith
10. Which of the following is NOT a correct match between a word part and its definition?
 - a. cyst/o; bladder
 - b. py/o; pus

- c. pyel/o; pelvis
- d. urethr/o; ureter

EXERCISE 14-6



FILL IN THE BLANK

Fill in the blank with the correct answer.

1. Tom suffered from CRF. His sister donated one of her normal kidneys to him and he had a(n) _____.
2. Cindy had a floating kidney that required surgical fixation. Her urologist performed a surgical procedure known as a(n) _____.
3. The surgeons operated on Robert to remove a kidney stone (calculus) from his kidney. The name of this surgery is _____.
4. Gabbi had to have one of her ureters repaired because of a stricture. This procedure is called _____.
5. The physician had to examine Joshua's bladder for blood. They used a special instrument. This procedure is called a(n) _____.
6. _____ are medications that promote urination.
7. The two tubes that transfer urine from the kidneys to the urinary bladder are the _____.
8. Natural waste products of metabolism that are excreted in urine include _____.
9. Filtration to remove colloidal particles from a fluid is called _____.
10. The word part *-logist* in urologist means _____.

EXERCISE 14-7



ABBREVIATIONS

Write out the term for the following abbreviations.

1. _____ UTI
2. _____ GFR
3. _____ ESRD
4. _____ BUN
5. _____ CRF

Write the abbreviation for the following terms.

6. _____ urinalysis
7. _____ kidney, ureter, and bladder
8. _____ acute renal failure
9. _____ intravenous pyelogram
10. _____ continuous ambulatory peritoneal dialysis

EXERCISE 14-8



SPELLING

Select the correct spelling of the medical term.

1. The _____ is a tiny structure within the kidney in which the urine production process begins.
 - a. nephron
 - b. nephran
 - c. nephren
 - d. nefron
2. An _____ is an ionizable substance in solution.
 - a. electrolyte
 - b. electralyte
 - c. electrolite
 - d. electrelyte
3. A circular muscle that surrounds a tube and constricts the tube when it contracts is called a _____.
 - a. spincter
 - b. sphincter
 - c. sphicter
 - d. sphinter
4. The presence of protein in the urine is _____.
 - a. albuminaria
 - b. albumineralia
 - c. albumineuria

- d. albuminuria
5. A _____ is a drug that promotes the excretion of urine.
- a. diretic
 - b. diuritic
 - c. diuretic
 - d. duiretic
6. Excessive urination at night is known as _____.
- a. nocturia
 - b. nocturnia
 - c. noacteria
 - d. nockturia
7. A _____ is a flexible tube that enables passage of fluid from or into a body cavity.
- a. cathater
 - b. cathiter
 - c. catheter
 - d. cathuter
8. Difficult or painful urination is called _____.
- a. dysurea
 - b. disuria
 - c. disurea
 - d. dysuria
9. A treatment in which a stone in the kidney, urethra, or urinary bladder is broken up into small particles is called _____.
- a. lithutripsy
 - b. lithetripsy
 - c. lithotripsy
 - d. lithotripsee
10. The purpose of a _____ is to detect and manage a wide

range of disorders, which can include diabetes, kidney disease, or UTI's.

- a. urinalasis
- b. urinealysis
- c. urinlasis
- d. urinalysis

EXERCISE 14-9



CASE STUDY

Read the following case study. There are 11 phrases that can be reworded with a medical term that was introduced in this chapter. Determine what the term is and write your answers in the space provided.

Heather is a 40-year-old female who saw a (1) specialist who treats disorders of the urinary system for complaints of urinary frequency, (2) painful urination, (3) blood in her urine, and low abdominal pain. She was also experiencing a low-grade fever and general fatigue. The doctor ordered a (4) laboratory reading of her urine and an (5) X-ray of her kidneys, ureters, and bladder. The laboratory results showed red blood cells in the urine, and the urine was cloudy with an odor. Tests indicated multiple (6) small, round, calcified objects in the (7) urine reservoir. Heather was diagnosed with a (8) condition of having bacteria in the urinary tract and also (9) stones in her bladder. The doctor ordered a(n) (10) drug used to kill bacteria, and he told Heather that she needed to have a (11) procedure in which a scope is inserted into the bladder to remove the stones. Heather's signs and symptoms improved, and she returned to have the procedure. Her recovery was uneventful.

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____
- 7. _____
- 8. _____
- 9. _____

10. _____

11. _____



The Reproductive System

15

LEARNING OUTCOMES

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

- Label diagrams of the male and female reproductive systems.
- Name the structures that make up the male and female reproductive systems.
- Understand medical terms related to pregnancy.
- Pronounce, spell, and define medical terms related to the reproductive system and its disorders.
- Interpret abbreviations associated with the reproductive system.

INTRODUCTION

The primary function of the reproductive system is to perpetuate life. The reproductive process begins with fertilization, which occurs when sex cells called **gametes** fuse. Male gametes are known as **sperm** and female gametes are known as **oocytes**. The name for the organ that produces a gamete is **gonad**. Male gonads are *testes*, whereas female gonads are *ovaries*.

The single cell formed at **fertilization** (the fusion of a sperm with an oocyte) is called a **zygote**. A zygote contains more than a trillion molecules, despite its diameter of only 0.1 mm. These trillion or so molecules all communicate and work together forming a human organism.

WORD PARTS RELATED TO THE REPRODUCTIVE

SYSTEM

The reproductive system is the one body system where both structure and function vary greatly between the sexes. For this reason, there are very different word parts to describe the male and the female reproductive systems. Word parts that refer to the testes, prostate, sperm, and penis are only applicable to the male system, whereas word parts that refer to the breasts, vagina, ovaries, uterine tubes, and uterus apply to the female system.

Anatomists and clinicians use the singular term *testis* or the plural term *testes* to refer to the male gonad(s), but *testicle* and *testicles* are also commonly used. The Latin word for “testis” is *testis*, but the Latin word for “testicle” is *testiculus*, which is a diminutive form of *testis*. The Greek word for testicle is *orkheos*, which is where the roots orch/o, orchid/o, and orchid/o originate. The roots for sperm are spermat/o and sperm/o, which comes from the Late Latin word *sperma*, meaning seed or sperm.

There are two word roots for vagina: colp/o and vagin/o. The root colp/o comes from the Greek word *kolpos* (womb) but refers to the vagina and not the uterus. *Vagina* is actually a Latin word meaning “sheath” or “covering.”

There are also three word roots for uterus: metr/o, hyster/o, and uter/o. *Uterus* is a Latin word, meaning womb. Hyster/o comes from the Greek word *hysteria*, which also translates to womb. **Table 15-1** shows common word parts related to the reproductive system.

TABLE 15-1  WORD PARTS RELATED TO THE REPRODUCTIVE SYSTEM

Word Part	Meaning
amni/o	amnion
balan/o	glans penis
cervic/o	cervix, neck
circum/o	around
colp/o	vagina

gonad/o	gonads, sex glands
gynec/o	woman, female
hyster/o	uterus
lact/o	milk
mamm/o	breast
mast/o	breast
men/o	menses, menstruation
metr/o	uterus
nat/o	birth
oophor/o	ovary, egg-bearing
orch/o, orchi/o, orchid/o	testes
ovari/o	ovary, egg-bearing
prostat/o	prostate gland
salping/o	tube, uterine tube
sperm/o, spermat/o	sperm
uter/o	uterus
vagin/o	vagina
vas/o	vessel, vas deferens

vulv/o

vulva

Word Parts Exercise

After studying Table 15-1, write the meaning of each of the word parts.

WORD PART	MEANING
1. mast/o, mamm/o	1. _____
2. spermat/o, sperm/o	2. _____
3. salping/o	3. _____
4. vas/o	4. _____
5. circum/o	5. _____
6. ovari/o	6. _____
7. colp/o	7. _____
8. prostat/o	8. _____
9. amni/o	9. _____
10. nat/o	10. _____
11. hyster/o	11. _____
12. vulv/o	12. _____
13. orchid/o	13. _____
14. cervic/o	14. _____

15. balan/o	15. _____
16. gonad/o	16. _____
17. gynec/o	17. _____
18. lact/o	18. _____
19. men/o	19. _____
20. oophor/o	20. _____

STRUCTURE AND FUNCTION

This section describes the male reproductive system and then the female reproductive system. Functions of the male reproductive system include synthesizing the hormone testosterone; producing, storing, and transporting sperm; and making and releasing fluid from glands that support the sperm. This male reproductive fluid is called **semen**. Main functions of the female reproductive system are producing the hormones estrogen and progesterone; propagating life by producing oocytes; transporting oocytes to sites where they can be fertilized by sperm; supporting and nurturing a developing human organism; and providing an infant's first source of nutrition and protective antibodies through breast milk. Note that in males, the urethra is part of both the urinary and reproductive systems. In females, the urethra does not play a role in reproduction but the opening to the exterior is enclosed by the **vulva**, the term for the female external genitalia.

The Male Reproductive System

The male reproductive system is divided into internal *genitalia* (reproductive organs) and external genitalia. Internal genitalia include the testes, epididymis, ductus deferens (vas deferens), seminal glands (seminal vesicles), prostate, and bulbo-urethral glands. **Testes** are two oval-shaped gonads, located in a sac known as the *scrotum*, that produce sperm and testosterone. The **seminal glands**, also called the **seminal vesicles**, are two glands located at the base of the urinary bladder that produce seminal fluid, which becomes a component of semen. The gland that surrounds the beginning of the urethra

(inferior to the bladder) that secretes a fluid that becomes part of the semen is the **prostate**. The **bulbo-urethral glands** (*Cowper's glands*) are two glands inferior to the prostate that secrete a sticky fluid that also becomes a component of semen. External genitalia include the penis and scrotum. The **penis** is the external male organ used in urination and sexual intercourse, whereas the **scrotum** is a pouch that is suspended on either side of and behind the penis that encloses the testes. The rounded head of the penis forms a structure called the **glans penis**. A free fold of skin covers the glans penis and is known as the **foreskin** or **prepuce**. **Figure 15-1** shows the structures of the male reproductive system.

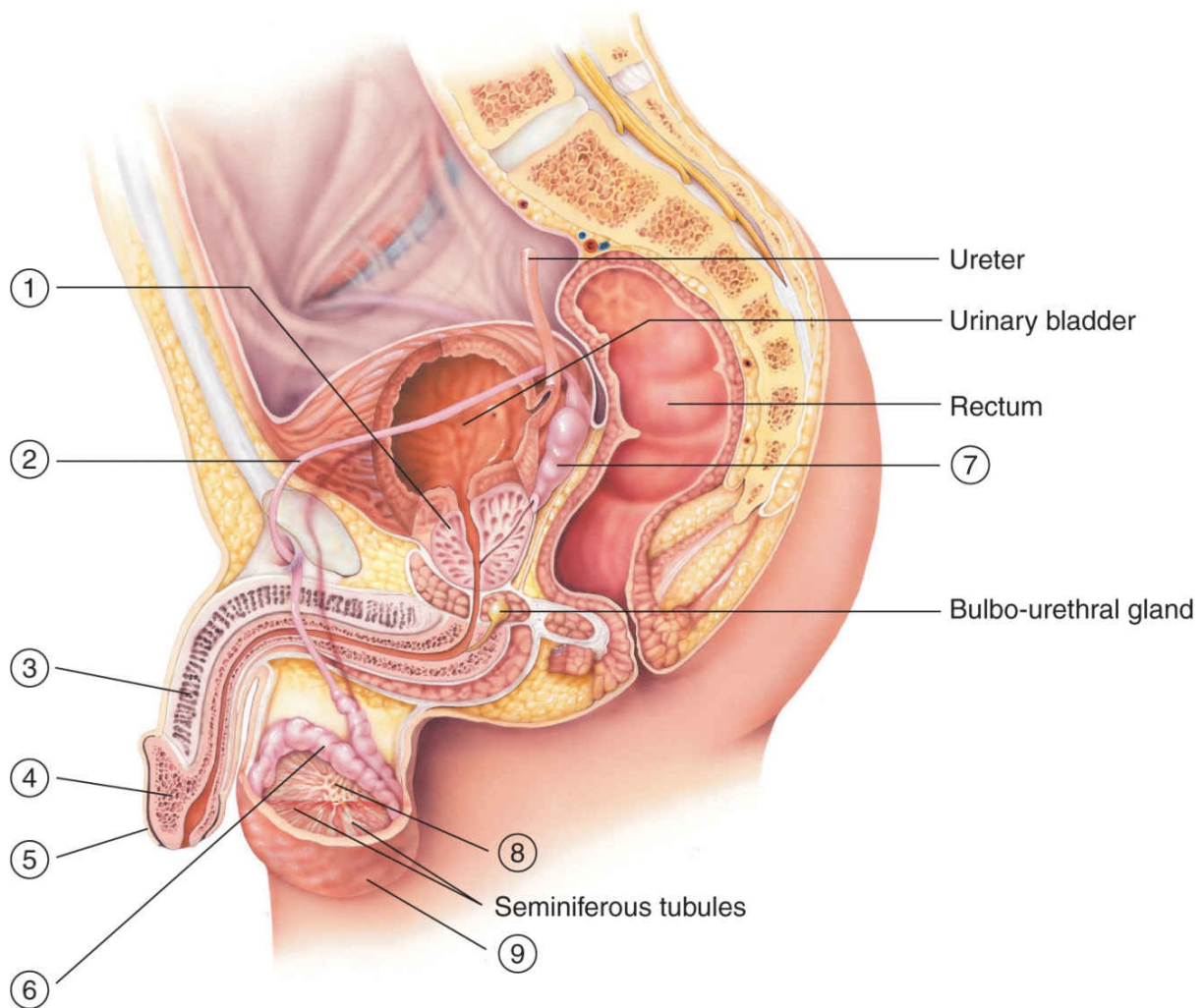


FIGURE 15-1 A sagittal view of the male reproductive system and adjacent structures.

An important function of the male reproductive system is to produce sperm. The process, called **spermatogenesis**, involves stem cells dividing and differentiating into sperm. It involves cell division known as **meiosis**, which reduces the number of chromosomes from 46 to 23.

Meiosis is a type of cell division that occurs in sex cells to reduce the number of chromosomes. Mitosis is a different type of cell division that occurs in cells to produce two daughter cells that both have the same number of chromosomes as the original cell. *Meiosis* is a Greek word meaning “a lessening.” Mitosis comes from the Greek word *mitos* meaning “thread” and reflects what the process of mitosis looks like when the chromosomes, which look thread-like when they bend and twist as they replicate.

Spermatogenesis begins in the *seminiferous tubules* of the testes and is initiated by the secretion of **androgens**, which are a group of hormones that have masculinizing effects. The most significant androgen is **testosterone**. After spermatogenesis is complete, the sperm migrate from the seminiferous tubules to the **epididymis**, a coil-shaped tube at the upper part of the testis

where the sperm mature as they are stored. Sperm are released during the process of ejaculation, which begins with erection. When stimulated, the tissues in the penis become filled with blood, causing an *erection*. During erection, mature sperm leave the epididymis and enter the muscular tube of the **ductus deferens**, which leads to the *ejaculatory duct* that passes through the prostate. Fluid from the seminal glands is secreted into the duct. This fluid nourishes the sperm and forms much of the volume of the semen. The ductus deferens and the duct of the seminal gland unite to form the **ejaculatory duct**. The sperm and the fluid are now propelled through the ejaculatory duct toward the urethra. As the urethra passes through the prostate, milky secretions are added, forming semen. During ejaculation, the semen is expelled from the urethra at the tip of the penis. **Figure 15-2** shows the pathway of sperm, beginning with production in the testes.

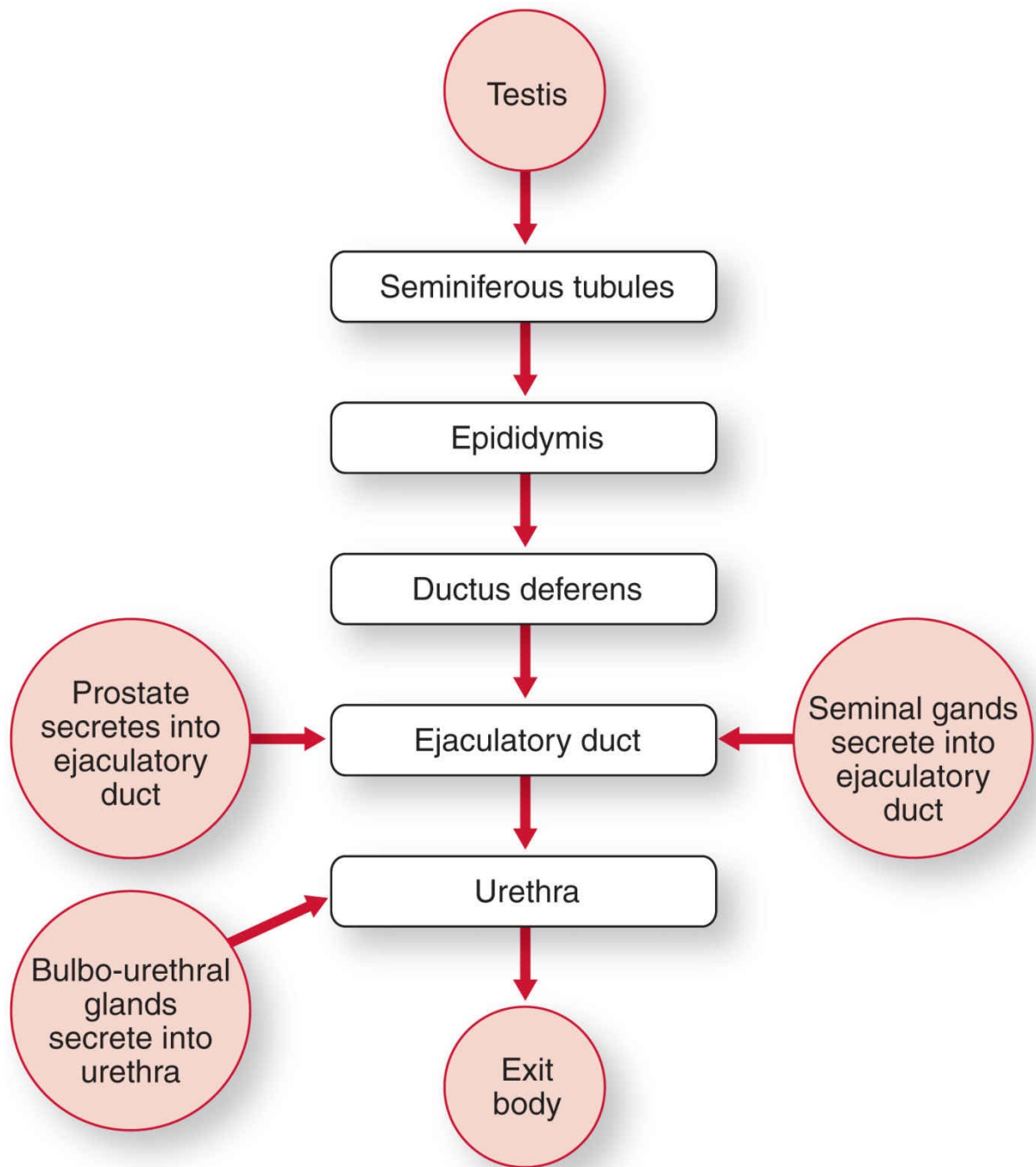


FIGURE 15-2 Pathway of sperm. The secretions from the glands that contribute to seminal fluid are shown in circles.

The Female Reproductive System

Like the male reproductive system, the female reproductive system is also divided into internal and external genitalia. The internal female reproductive organs are the *uterus*, two *ovaries*, two *uterine tubes*, and the *vagina*. Female external genitalia include the *clitoris*, *labium majus*, and *labium minus* (see [Figure 15-3](#)). Breasts are technically part of the integumentary system because their tissue contains modified sweat glands. We will discuss them

here because breasts are the female organs of milk secretion.

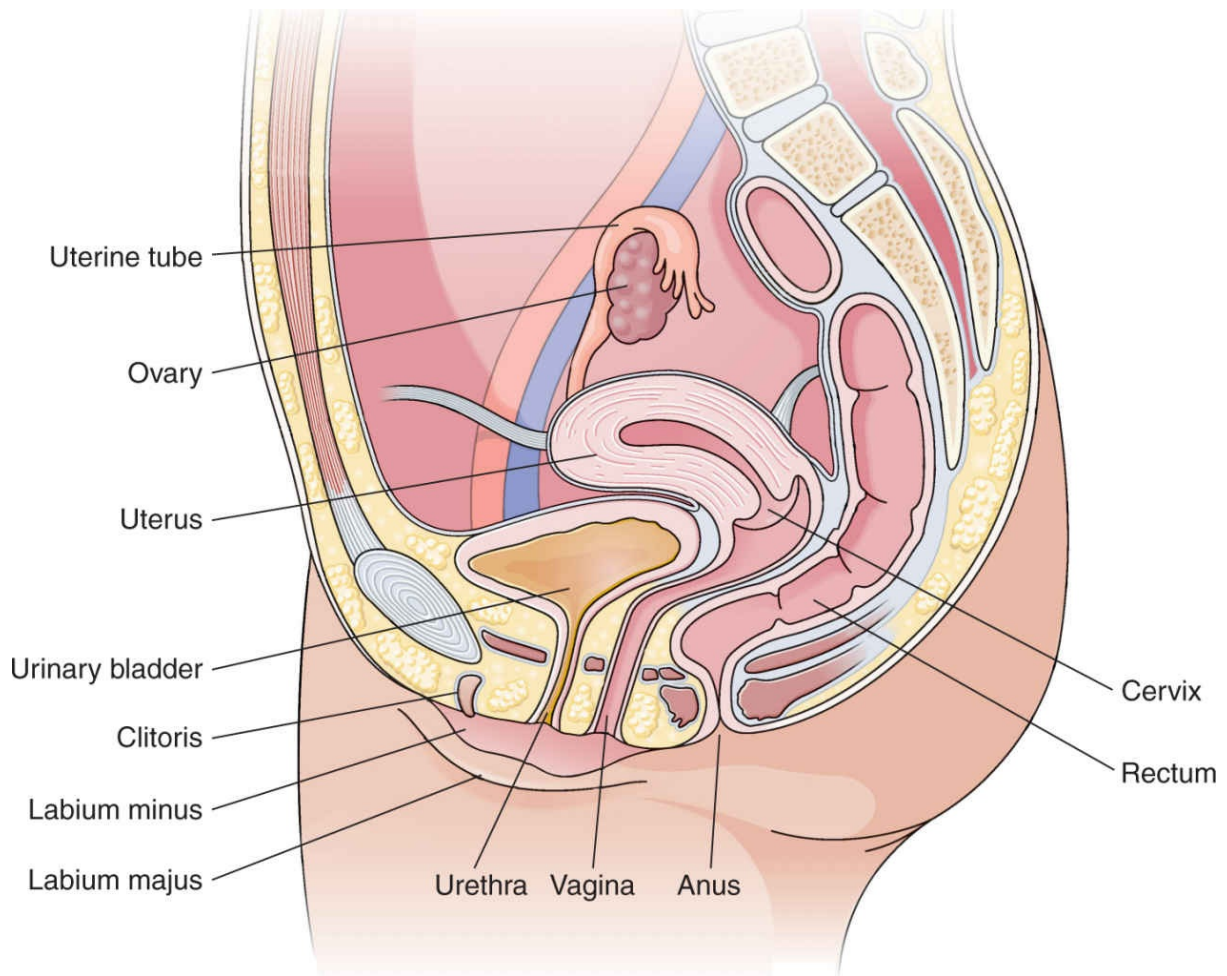


FIGURE 15-3 The sagittal view of the female reproductive system and adjacent structures.

The **uterus** is a pear-shaped organ that has a dome-shaped top portion called the **fundus** and a lower, narrow portion referred to as the **cervix**, which extends into the vagina. The uterus is composed of three layers of tissues: the **perimetrium**, which is the outer surrounding layer; the **myometrium**, which is the middle muscular layer; and the **endometrium**, which is the inner layer. The endometrium reacts to hormonal changes every month, and the result is **menstruation**, which involves a shedding of the endometrial lining.

Two **ovaries** lie on either side of the uterus in the pelvic cavity. The ovaries produce oocytes, the female gametes (sex cells). When an oocyte is fertilized by a sperm, it develops into an **ovum** (egg) and is capable of developing into a new individual.

The **uterine tubes** (*Fallopian tubes*) extend from the ovaries to the uterus. They provide the path by which an oocyte travels from the ovary to the uterus. Fertilization takes place in the uterine tube.

The vagina is a muscular tube that extends from the cervix to the outside

of the body. The vagina has the following functions:

- Allows for passage outside the body of the monthly menstrual flow of blood and tissue
- Is the organ for sexual intercourse
- Serves as the birth canal during a normal vaginal birth

The external genitalia, commonly known as the **vulva**, include organs that enable sperm to enter the body, protect the internal genital organs from infectious organisms, and provide sexual pleasure. The **clitoris** is a small mass of erectile tissue that responds to sexual stimulation. *Labia* are two sets of skin folds that cover the female external genitalia and tissues. The **labium majus** (plural, *labium majora*) is one of two rounded external folds, and the **labium minus** (plural, *labium minora*) is one of two inner folds that surround the openings to the vagina and urethra (see **Figure 15-3**).

Breasts are protruding organs that have a *nipple* and an *areola*. The **nipple** is a projection on the breast surface through which *lactiferous* (milk) *ducts* open onto the body surface. The **areola** is the dark-pigmented area around the nipple.

Each breast contains a **mammary gland**, the modified sweat gland that produces milk. The subdivisions of the mammary gland are called *lobules* (see **Figure 15-4**). Breast milk provides nourishment for the newborn. **Lactation** is the term given to the production of milk.

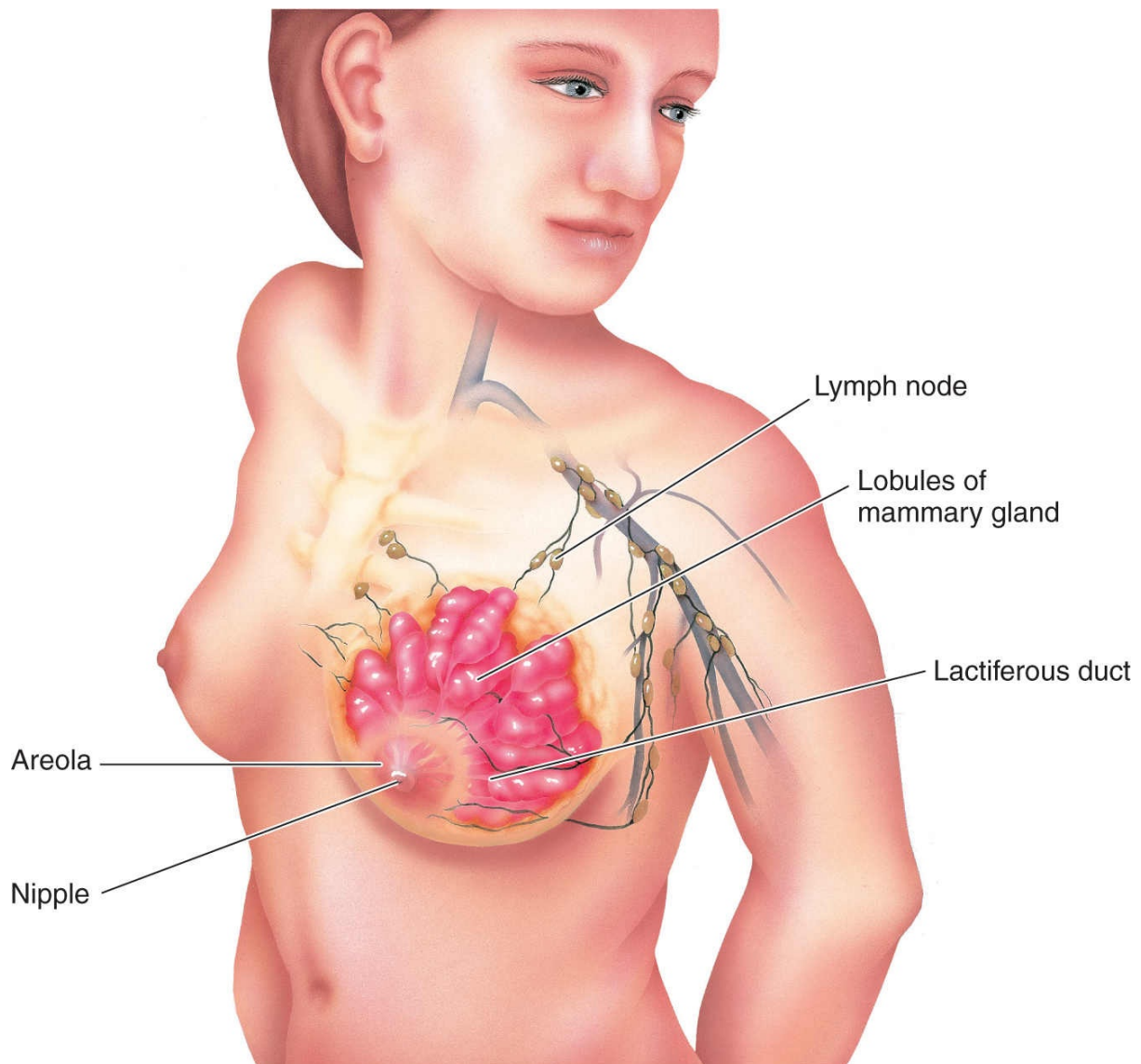


FIGURE 15-4 Frontal view of the breasts.

Like the male reproductive system, the female reproductive system provides gametes for fertilization, but its function in the process continues by providing an environment for a fertilized egg to develop into to a fully formed baby.

The preparation for the process is accommodated by the **menstrual cycle** (also called the **uterine cycle**), a recurrent periodic change in the ovaries and uterus that occurs approximately every 28 days. The first time this cycle occurs in a female, around age 11 or 12, it is called **menarche**. When this monthly cycle stops occurring for the final time, around age 45 to 55, it is called **menopause**. Hormones control the menstrual cycle, which has three phases: **menstrual phase** (days 0 to 7; destruction and shedding of the endometrium), **proliferative phase** (days 7 to 14; repair and regeneration of the endometrium and preparation of the endometrial lining for implantation if

fertilization occurs after ovulation on day 14), and the **secretory phase** (days 14 to 28; secretion of hormones). If male sperm are present during **ovulation** (the release of an oocyte), the possibility of fertilization exists.

Pregnancy

Pregnancy, or **gestation**, is the condition of having a developing embryo or fetus in the uterus. When a secondary oocyte is fertilized by the male sperm, it forms a *zygote*, which travels through the uterine tube and implants into the uterus. Once implanted, the zygote is called an **embryo** during the first 8 weeks of gestation. Between the end of the 8th week and birth, which under normal circumstances occurs between weeks 38 and 40, the term **fetus** is used. The fetus receives nourishment from the uterine wall through the *umbilical cord* and the *placenta*. The **umbilical cord** is the structure that contains blood vessels and connects the embryo or fetus to the placenta, whereas the **placenta** is a temporary organ implanted in the uterus formed during pregnancy. The **amnion** (*amniotic sac*) is the inner layer of the membrane that surrounds the fetus and contains *amniotic fluid*. **Amniotic fluid** encases the fetus and provides a cushion for the fetus as the mother moves (see [Figure 15-5](#)).

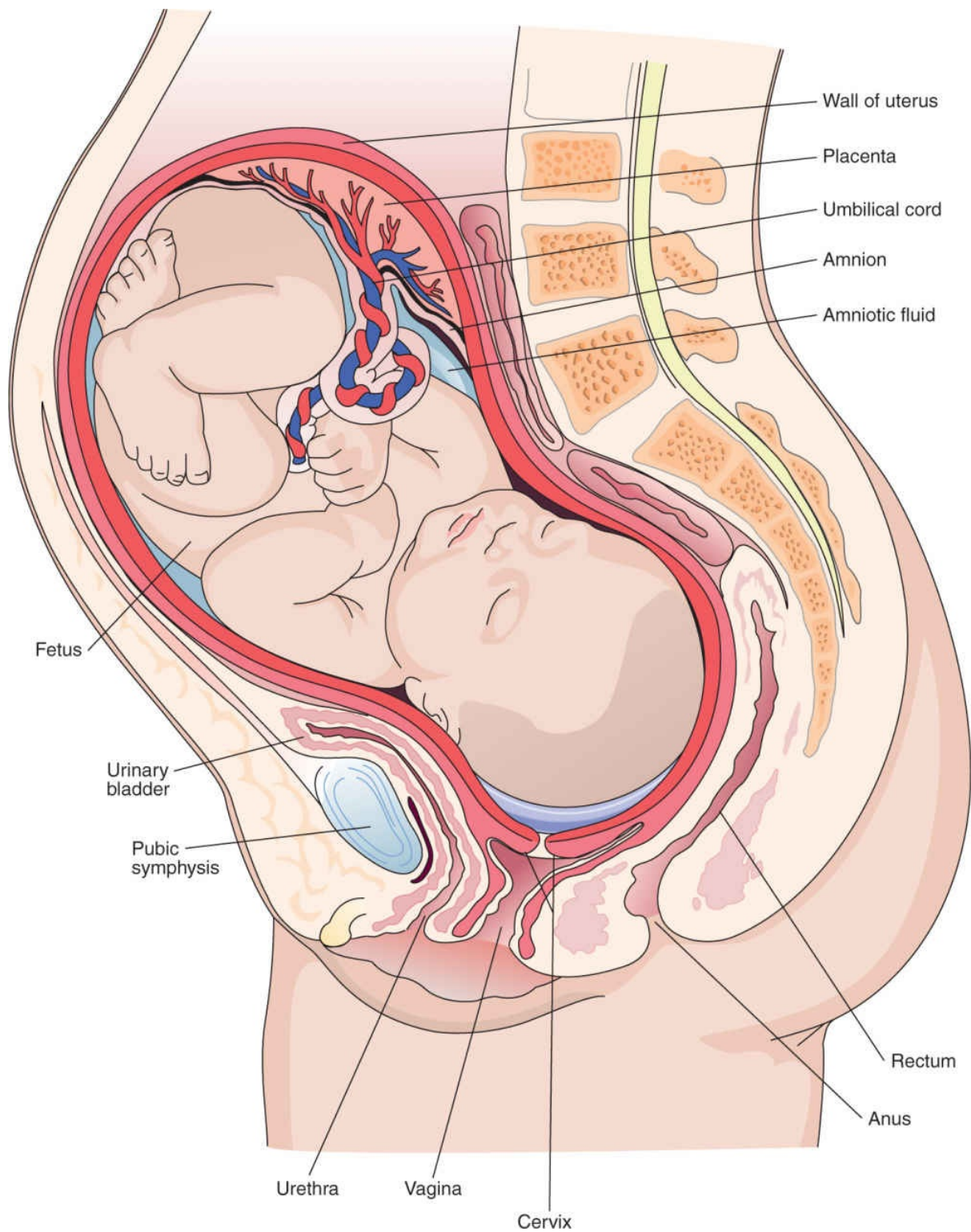


FIGURE 15-5 A pregnant uterus with fetus.

Terms Associated with Pregnancy

Gravida, para, and abortus are shorthand notations for a woman's pregnancy history. The term **gravida (G)**, derived from the Latin word *gravidus* (heavy), means a pregnant woman. Gravida is usually followed by a Roman numeral

or Arabic numeral and indicates the number of pregnancies. For example, gravida I, GI, and G1 all refer to a woman in her first pregnancy and gravida II, GII, and G2 refer to a woman in her second pregnancy. The term can also be preceded by the Latin prefix *primi-* for first and *secundi-* for second, as in *primigravida* (first pregnancy) and *secundigravida* (second pregnancy). The number following gravida indicates the number of times a patient has been pregnant regardless of whether these pregnancies were carried to term. A current pregnancy, if any, is included in this count. The term **para (P)**, derived from the Latin word *pario* (to bring forth) refers to a woman who has given birth to one or more infants. Like gravida, it is followed by a Roman numeral or Arabic numeral or preceded by a Latin prefix. For example, para I, primipara, PI, and P1 refer to a woman who has given birth for the first time, whereas para II, secundipara, PII, and P2 refer to a woman who has given birth for a second time to one or more infants. Para indicates the number of births that occurred after 20 weeks (including viable and nonviable [i.e., stillbirths]). Pregnancies consisting of multiples, such as twins or triplets, count as one birth for the purpose of this notation. **Abortus (A)** is the Latin word for “miscarriage” and indicates the number of pregnancies that were lost for any reason, including induced abortions or miscarriages. Stillbirths are not included.

In the United States, Arabic numerals are used. Therefore, the obstetric history of a woman who has had two pregnancies (both of which resulted in live births) would be noted as G2P2. The obstetrical history of a woman who has had four pregnancies, one of which was a miscarriage before 20 weeks, would be noted as G4P3A1. That of a woman who has had one pregnancy of twins with successful outcomes would be noted as G1P1.

The *estimated date of confinement* (EDC) or *estimated date of delivery* (EDD) is the date an infant is expected to be born and is calculated by counting forward 280 days (40 weeks) from the first day of the mother’s last menstrual period (LMP). It is also called the due date.



Quick Check

Fill in the blanks.

1. List functions of the male reproductive system.

2. The term for milk production is

_____.

3. A synonym for pregnancy is _____.

DISORDERS RELATED TO THE REPRODUCTIVE SYSTEM

Disorders common to both the male and female reproductive systems are briefly described under the following sections: sexually transmitted diseases (STDs), inflammation, structural abnormalities, and tumors. Additional conditions affecting males and females, respectively, are included at the end of this section.

Sexually Transmitted Diseases

STDs, also called **sexually transmitted infections (STIs)**, are contagious diseases acquired during sexual contact. Examples include human immunodeficiency virus (HIV), herpes simplex virus (HSV), gonorrhea (GC), chlamydia, pelvic inflammatory disease (PID), syphilis, and human papillomavirus (HPV) infection.

The **HIV** attacks the immune system after it is transmitted through blood or other infected body fluids. **HSV** is a variety of infections caused by herpesvirus types 1 and 2 that produce cold sores, genital inflammation, and conjunctivitis. **GC** is a highly contagious disease caused by *Neisseria gonorrhoeae* bacteria that may also be transmitted to a child from an infected mother during birth. **Chlamydia** is another common infection spread through sexual contact and is caused by a very small parasitic bacterium from the *Chlamydia* genus. **PID**, an infection of the uterus, ovaries, and uterine tubes, can prevent fertilization. If a woman has PID and an oocyte does become fertilized, the zygote may implant outside the uterus, which is known as an **ectopic** (*ektopos* is Greek for “out of place”) pregnancy. An ectopic pregnancy can be life threatening. **Syphilis** is a highly contagious disease caused by the *Treponema pallidum* bacterium. A developing fetus can contract the disease through an infected mother. **HPV** is a sexually transmitted virus that can lead to cervical cancer.

Inflammation

Infections of the female reproductive system may result from exposure to bacteria, fungi, or viruses. Many of the conditions are marked by inflammation, the terms for which are indicated by the suffix *-itis*, which you learned in earlier chapters.

Male reproductive system inflammation conditions include **epididymitis**

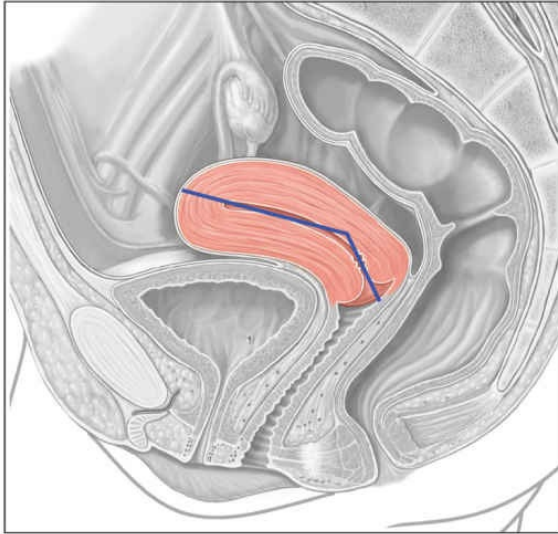
(inflammation of the epididymis), **prostatitis** (inflammation of the prostate), **balanitis** (inflammation of the glans penis), and **orchitis** (inflammation of a testis). Balanitis occurs in uncircumcised males who still have an intact glans penis.

Female reproductive system inflammation disorders include **mastitis** (breast inflammation), **oophoritis** (ovary inflammation), **salpingitis** (uterine tube inflammation), **cervicitis** (inflammation of the uterine cervix), and **vaginitis** (inflammation of the vagina). Salpingitis can lead to a closing of the uterine tubes, thereby causing infertility.

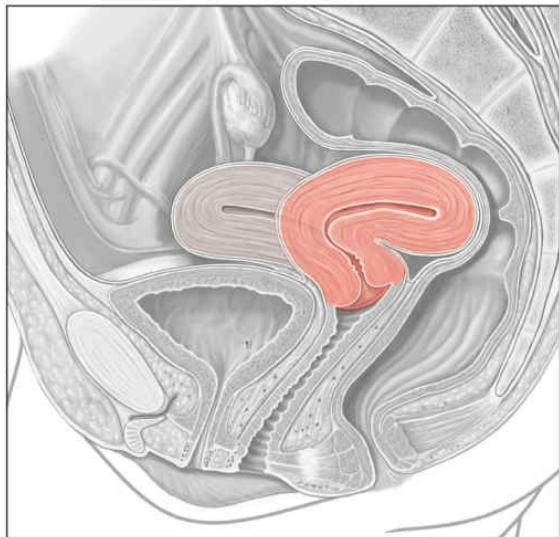
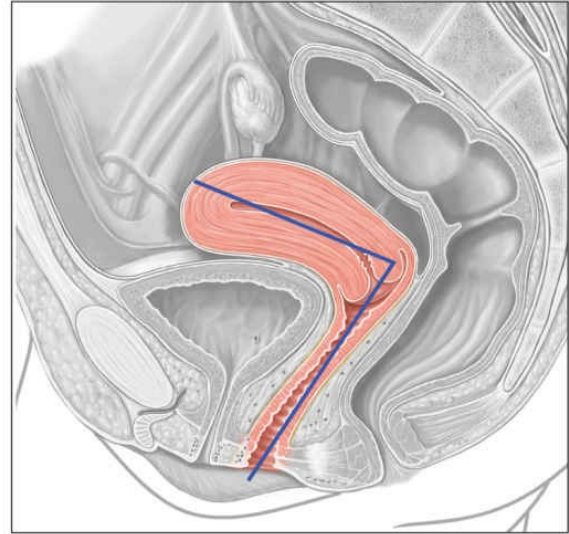
Female Structural Abnormalities

In adult women, the uterus may be out of position or actually may have a bend in its body. **Anteflexion** (forward bending) is the normal position of the uterus (see [Figure 15-6A](#)). **Anteversio**n (forward turning) is the normal position of the uterus in which it is angled anteriorly relative to the long axis of the vagina, so that it rests on the urinary bladder (see [Figure 15-6B](#)). **Retroflexion** (backward bending) is an abnormal tipping with the body of the uterus bent back on itself, forming an angle with the cervix (see [Figure 15-6C](#)). **Retroversio**n (backward turning) is an abnormal tipping of the entire uterus backward (see [Figure 15-6D](#)). A **prolapsed uterus** involves the descent of the uterus or cervix into the vaginal canal. Two other conditions involving structural abnormalities of the female reproductive system are a **cystocele**, which is a protrusion of the urinary bladder into the anterior wall of the vagina, and a **rectocele**, which is a protrusion of the rectum into the posterior wall of the vagina.

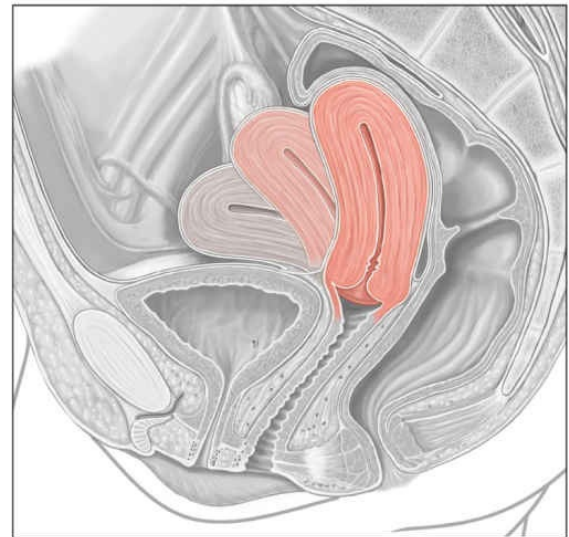
A Anteflexion



B Anteversion



C Retroflexion



D Retroversion

FIGURE 15-6 Variants of uterine position within the pelvis. The pink-shaded organ is the uterus.

Tumors

Benign tumors of the uterus are called *fibroleiomyomas* or **fibroids**. Cysts, which may also be considered a benign tumor, are usually caused by hormonal disturbances.

Cancer of the endometrium is the most common type of cancer in the female reproductive system. A **hysterectomy** (removal of the uterus) is a common treatment. **Endometriosis** is a condition in which endometrial tissue grows outside the uterus, frequently forming cysts, and causing pelvic pain.

Menstrual Cycle Disorders

Menstruation, commonly called a *period*, generally occurs once per month. However, menstrual cycle disorders are common. **Amenorrhea** is the absence of menstruation. **Dysmenorrhea** is painful menstruation. **Menorrhagia** is an increased amount and duration of blood flow. **Oligomenorrhea** is a reduced blood flow along with abnormally infrequent menstruation.

Disorders that Affect Males

Any disease that affects the testes is called **orchioopathy**. This includes **azoospermia** (absence of living sperm in the semen), **oligospermia** (low sperm count), **orchialiga** (pain in the testes), **anorchism** (absence of one or both testes; may be congenital or acquired), and **cryptorchism** (failure of one or both testes to descend into the scrotum).

Other disorders that affect the male reproductive system include the following condition listed as follows:

- **Benign prostatic hyperplasia (BPH):** an enlarged, noncancerous prostate
- **Hydrocele:** fluid accumulation in the scrotum
- **Phimosis:** narrowing of the opening of the foreskin so it cannot be retracted or pulled back to expose the glans penis
- **Varicocele:** enlargement of veins in the spermatic cord (bundle of nerves and blood vessels connecting the testes to the abdominal cavity)

DIAGNOSTIC TESTS, TREATMENTS, AND SURGICAL PROCEDURES

Some diagnostic and surgical treatments and procedures of the male reproductive system are listed as follows:

- **Circumcision:** a surgical procedure to remove the foreskin of the penis
- **Orchiectomy:** removal of one or both testes
- **Orchioplasty:** surgical repair of a testis
- **Transurethral resection of the prostate (TURP):** the removal of part or all of the prostate through the urethra
- **Varicocelectomy:** the removal of a portion of an enlarged vein to remove a varicocele
- **Vasovasostomy:** procedure to restore fertility to a vasectomized male

by reconnecting the ductus (vas) deferens

Some diagnostic and surgical treatments and procedures of the female reproductive system are listed as follows:

- **Amniocentesis:** amniotic fluid is tested for fetal abnormalities; can also help determine fetal lung maturity, age, and sex of fetus (see **Figure 15-7**).

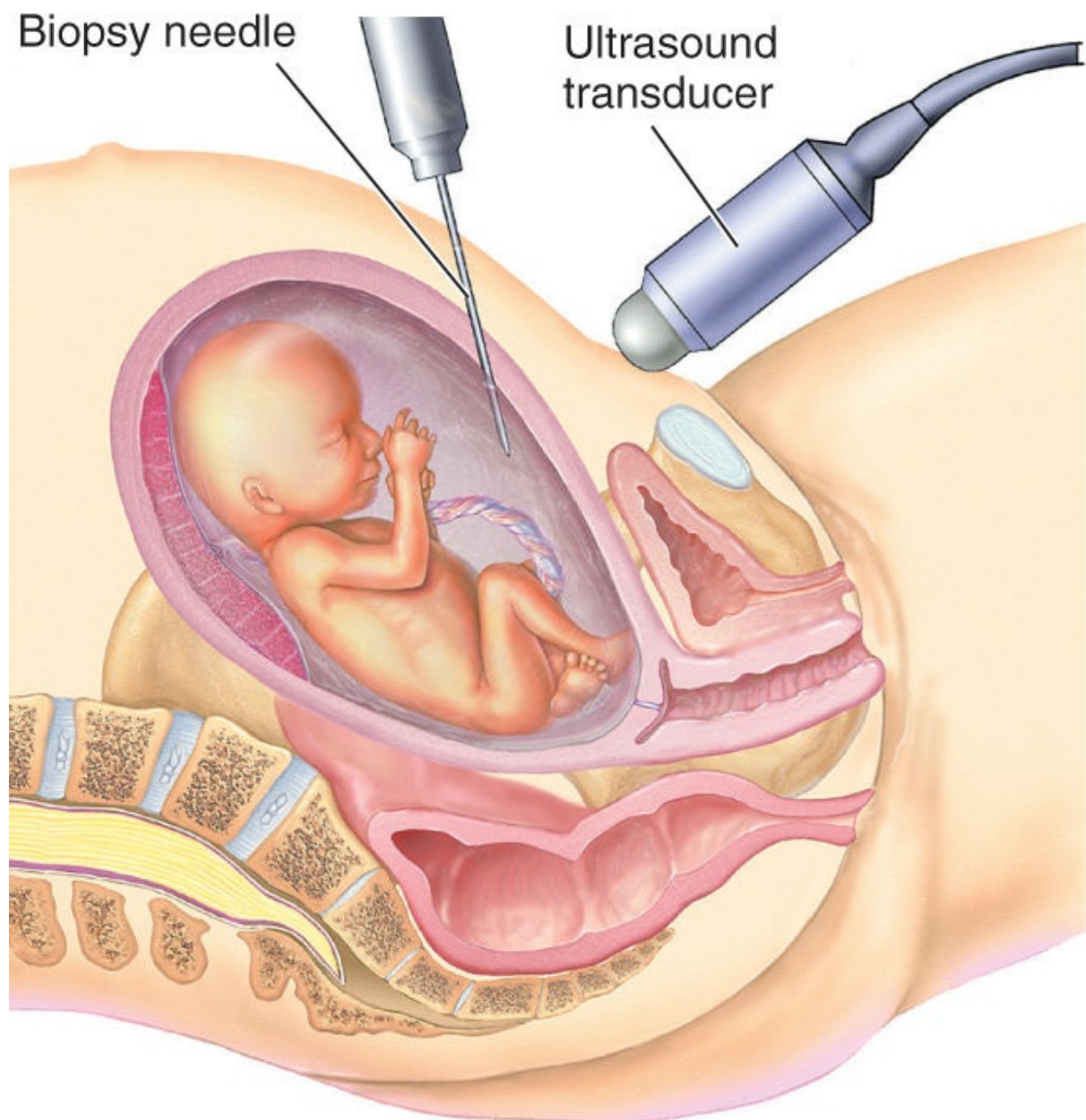


FIGURE 15-7 Amniocentesis. A biopsy needle is inserted through the abdominal wall into the uterus, and a sample of amniotic fluid is removed from the amniotic sac using guided ultrasound.

- **Colposcopy:** visual examination of the tissues of the cervix and vagina using a surgical instrument called a colposcope

- **Papanicolaou test (Pap smear):** scraping of the cervical tissues to diagnose cervical cancer or other conditions of the cervix and surrounding tissues
- **Dilation and curettage (D&C):** dilation (widening) of the cervix and scraping the lining of the uterus with a surgical instrument called a curette, which has a loop, ring, or scoop with sharpened edges attached to a handle
- **Cone biopsy:** surgical removal of a cone-shaped section of the cervix
- **Laparoscopy:** visual examination of the interior of the abdomen by means of a surgical instrument called a laparoscope
- **Oophorectomy:** removal of one ovary
- **Bilateral oophorectomy:** removal of both ovaries
- **Salpingo-oophorectomy:** removal of an ovary and uterine tube
- **Bilateral salpingo-oophorectomy:** removal of both ovaries and uterine tubes
- **Hysterosalpingography:** a radiographic examination of the uterus and uterine tubes
- **Hysterectomy:** surgical removal of the uterus
- **Mammography:** radiographic examination of the breast
- **Mastectomy:** removal of a breast
- **Tubal ligation:** surgical procedure that involves severing and tying the uterine tubes to prevent future conception

PRACTICE AND PRACTITIONERS

Obstetrics (OB) is the medical specialty concerned with the medical care of women during pregnancy and childbirth, and **obstetricians** (from *obstetrix*, the Latin word for midwife) are the specialists who provide medical care to pregnant women and deliver babies. **Gynecology (GYN)** is the study of the female reproductive system and **gynecologists** diagnose and treat disorders of the female reproductive system. **Urologists** diagnose and treat disorders of the urinary and male reproductive systems. **Neonatology** is the medical specialty dealing with newborns, and **pediatrics** is the medical specialty dealing with children. The specialists in these fields are the **neonatologist**, who specializes in newborns, and the **pediatrician**, who specializes in the diagnosis and treatment of childhood disorders.

Abbreviation Table THE REPRODUCTIVE SYSTEM

ABBREVIATION	MEANING
A	abortus
BPH	benign prostatic hyperplasia
CS	cesarean section
C-section	cesarean section
D&C	dilation and curettage
EDC	estimated date of confinement (due date)
EDD	estimated date of delivery (due date)
G	gravida
GC	gonorrhea
GYN	gynecology
HIV	human immunodeficiency virus
HPV	human papillomavirus
HSV	herpes simplex virus
LMP	last menstrual period
OB	obstetrics
P	para
Pap smear	papanicolaou smear
PID	pelvic inflammatory disease
STD	sexually transmitted disease
STI	sexually transmitted infection
TURP	transurethral resection of the prostate

Study Table THE REPRODUCTIVE SYSTEM

TERM AND PRONUNCIATION	ANALYSIS	MEANING
Structure and Function		
abortion (uh-BOR-tus)	from the Latin word <i>abortus</i> (miscarriage)	any product of a miscarriage
amniotic fluid (am-nee-OT-ik FLOO-id)	<i>amni/o</i> (amnion); <i>-ic</i> (suffix meaning pertaining to); fluid (from the Latin word for fluid, <i>fluidus</i>)	the fluid within the amnion (amniotic sac) that surrounds the embryo/fetus and helps to protect it from mechanical injury
amnion (AM-nee-on)	from the Greek word, <i>amnion</i> (membrane around the fetus) and diminutive of <i>amnos</i> (lamb)	innermost membrane enveloping the embryo/fetus in the uterus; <i>amniotic sac</i>
amniotic sac (am-nee-OT-ik SAK)	<i>amni/o</i> (amnion); <i>-ic</i> (suffix meaning pertaining to); sac (from the Latin word for bag, <i>saccus</i>)	innermost membrane enveloping the embryo/fetus in the uterus; <i>amnion</i>
androgens (AN-droh-jenz)	from the Greek words <i>andros</i> (man) and <i>genein</i> (to produce)	hormones that stimulate the activity of accessory male sex hormones; testosterone is an androgen
areola (uh-REE-oh-luh)	Latin word for “small area”	circular pigmented area surrounding the nipple
bulbo-urethral gland (buhl-boh-yoo-REE-thruhl GLAND)	from the Latin word <i>bulbus</i> (bulb); from the Greek word <i>ourethra</i> (passage for urine)	one of two small glands along the urethra; <i>Cowper’s gland</i>
cervix (SER-viks)	Latin word for “neck” (as in the neck of the uterus)	common term for the neck of the uterus that dips into the vagina
chromosome (KROH-moh-sohm)	from the Greek word <i>khroma</i> (color) and <i>soma</i> (body), so called because the structures contain a substance that stains readily with basic dyes	a gene-bearing bundle of DNA found in the nucleus of all cells
clitoris (KLIT-or-is)	from the Greek word <i>kleitoris</i> (small, sensitive, erectile part)	small (less than 2 cm) mass of erectile tissue in females that responds to sexual stimulation
embryo (EHM-bree-oh)	from the Greek word <i>embryon</i> (young animal, literally, “that which grows”)	name change from <i>zygote</i> after the first cell division until the 8th week of pregnancy
endometrium (en-doh-MEE-tree-uhm)	endo- (within); from the Greek <i>metra</i> (uterus)	membrane forming the inner layer of the uterine wall

epididymis (ehp-ih-DIHD-ih-muhs)	from the Greek words <i>epi</i> (on) + <i>didymos</i> (testicle)	organ in which the male sperm become functional
fallopian tubes (fah-LOH-pee-ahn TOOBZ)	named after Gabriello Fallopio (1523–1562), an Italian anatomist who first described them	tubular structures between the ovaries and the uterus; <i>uterine tubes</i>
fertilization (fer-til-ih-ZAY-shun)	from the Latin word <i>fertilis</i> (fruitful)	the joining of the male and female gametes (in the context of the human reproductive system)
fetus (FEE-tuhs)	Latin word meaning “the bearing,” “bringing forth,” or “hatching of young”	name change from <i>embryo</i> after the 8th week of pregnancy to birth
fundus (FUHN-duhs)	Latin word for “bottom”	the upper rounded portion of the uterus above the openings of the uterine tubes
gamete (GAH-meet)	Greek word meaning “a wife”; also <i>gametes</i> (a husband), from <i>gamein</i> (to take a wife, to marry)	term given to both the sex cells; female oocyte and male sperm
gestation (jehs-TAY-shun)	from the Latin word <i>gestare</i> (to bear, carry, gestate)	period of development that occurs between the formation of the zygote and birth of the child; <i>pregnancy</i>
gonad (GOH-nad)	from the Greek word <i>gone</i> (seed, act of generation, race, family)	gamete-generating organ (ovary or testis)
gravida (GRAV-ih-duh)	from the Latin word <i>gravis</i> (heavy, profound, important)	a pregnant woman
lactation (lak-TAY-shun)	from the Latin word <i>lactare</i> (to suckle, entice, lead on, induce); derived from the Latin word <i>lac</i> (milk)	milk production
labium majus (LAY-bee-um MAY-jus)	from the Latin words <i>labium</i> (lip) + <i>magnus</i> (great)	part of the labia that covers and protects the female external genital organs
labium minus (LAY-bee-um MYE-nus)	from the Latin words <i>labium</i> (lip) + <i>minor</i> (smaller)	Inner folds of the labia that surround the openings to the vagina and urethra
mammary gland (MAM-uh-ree GLAND)	from the Latin word <i>mamma</i> (breast)	modified sweat gland that produces milk
meiosis (migh-OH-sis)	Greek word meaning “a lessening”	cell division comprising two nuclear divisions in rapid succession that results in four gametocytes
menarche (meh-NAR-kee)	from the Greek words <i>men</i> (month) and <i>arkhe</i> (beginning)	beginning of menstruation (menses)

menopause (MEN-oh-pawz)	from the Latin words <i>mensis</i> (month) and <i>pausis</i> (a cessation, a pause)	normal stopping of the monthly menstrual cycle (periods)
menses (MEN-seez)	plural form of the Latin word <i>mensis</i> (month)	periodic bleeding occurring at intervals of about 4 weeks in which the endometrial lining is shed; <i>menstruation</i>
menstruation (men-stroo-AYE-shuhn)	from the Latin word <i>menstruus</i> (monthly); <i>-atio</i> (process)	cyclic endometrial shedding and discharge of a bloody fluid from the uterus; <i>menses</i>
menstrual (MEN-stroo-uhl)	from the Latin word <i>mensis</i> (month)	relating to the menses (menstruation)
menstrual cycle (MEN-stroo-ul SIGH-kul)	from the Latin word <i>mensis</i> (month)	part of the reproductive system process in women, comprising three phases: menstrual, proliferative, and secretory; <i>uterine cycle</i>
mitosis (my-TOH-sihs)	from the Greek word <i>mitos</i> (wrap, thread); <i>-osis</i> (process)	process of cell division by which one cell becomes two, both of which contain the maternal and paternal chromosomes
myometrium (my-oh-MEE-tree-uhm)	<i>myo-</i> (muscle); from the Greek <i>metra</i> (uterus)	the muscular wall of the uterus
ovary (OH-vah-ree)	from the Latin word <i>ovum</i> (egg)	small almond-shaped organ located on either side of the uterus that produces hormones and releases oocytes
ovulation (OV-yoo-lay-shun)	from the Latin word <i>ovum</i> (egg); <i>-atio</i> (process)	release of an oocyte from the ovary
ovum (OH-vuhm); plural, ova (OH-vah)	Latin word meaning “egg”	fertilized oocyte before implantation
para (PAR-ah)	from the Latin verb <i>pario</i> (to bring forth, produce, create)	a woman who has given birth to a viable fetus
penis (PEE-nihs)	from the Latin <i>penis</i> (tail)	external male sex organ used in urination and sexual intercourse that transports the male sperm into the female vagina
placenta (pla-SEN-tah)	Latin word meaning “cake”	a spongy organ that is attached to the fetus by the umbilical cord and that provides nourishment to the fetus
pregnancy (PREG-nan-see)	<i>pre-</i> (before); from the Latin word <i>gnascor</i> (to be born)	period of time when the fetus grows inside of the uterus; <i>gestation</i>
proliferative phase (pro-LIF-er-uh-tiv FAZE)	from the Latin words <i>proles</i> (offspring) and <i>ferre</i> (to carry, to bear)	menstrual phase (days 7–14) controlled by estrogen secreted by ovarian follicles (cell aggregation in the ovary that contains an oocyte), simultaneous with their development
prostate (PROS-tate)	from the Greek word <i>prostates</i> (one standing in front)	male gland that produces and stores prostatic fluid, a fluid medium that is part of semen; <i>prostate gland</i>

scrotum (SKROH-tum)	from the Latin word <i>scrotum</i> cognate with Old English <i>scrud</i> (garment, source of shroud)	the sac that encloses and protects the testes
secretory phase (se-KREE-toh-ree FAZE)	from the Latin verb <i>secretionem</i> (to separate)	menstrual phase (days 14–28) controlled by the hormone progesterone that coincides with the formation of the corpus luteum (a hormone-secreting structure that develops in the ovary after the oocyte has been released, but degenerates after a few days unless fertilization occurs)
semen (SEE-mehn)	a Latin word meaning “seed”	combination of sperm, their associated glandular secretions, and prostatic fluid
seminal gland (SEH-min-ahl GLAND)	from the Latin word <i>semen</i> (seed); -al (adjective suffix)	gland at the base of the urinary bladder that secretes a thick substance that nourishes sperm; <i>seminal vesicle</i>
seminal vesicle (SEH-min-ahl VES-i-kuhl)	from the Latin words <i>semen</i> (seed) and <i>vesica</i> (bladder, balloon)	gland at the base of the urinary bladder that secretes a thick substance that nourishes sperm; <i>seminal gland</i>
sperm (SPURM)	from the Greek words <i>sperma</i> (seed) and <i>zoion</i> (animal)	the male gamete; sperm is singular or plural
spermatogenesis (SPUR-mah-toh-JEHN-ih-sihs)	<i>spermat/o</i> (sperm); + <i>genesis</i> (production)	production of sperm
testes (TES-teez); singular: testis (TES-tihs)	from the Latin word <i>testiculus</i> dim. of <i>testis</i> (witness) (the organ being evidence of virility)	the organs that produce and store the male gametes
testosterone (tehs-TOSS-teh-rohn)	from the Latin word <i>testis</i> (witness); - <i>sterone</i> (steroid hormone)	the male reproductive hormone (androgen) prominent in male gamete production
umbilical cord (um-BILL-ih-kul KORD)	from the Latin words <i>umbilicus</i> (navel) + <i>chorda</i> (string)	connecting stalk between the embryo/fetus and the placenta that contains two arteries and one vein
urethra (yu-REETH-rah)	from the Greek word <i>ourethra</i> (passage for urine)	canal leading from the bladder to the exterior; male ductwork that acts as a part of both the male urinary system and male reproductive system
uterine cervix (YOO-ter-in SUR-viks)	<i>uter/o</i> (uterus); - <i>ine</i> (adjective suffix) + <i>cervix</i> , Latin word for neck	the “neck” located at the lower end of the uterus
uterine cycle (YOO-ter-in SIGH-kul)	<i>uter/o</i> (uterus); - <i>ine</i> (adjective suffix); from the Latin word <i>tubus</i> (tube)	part of the reproductive system process in women, comprising three phases: menstrual, proliferative, and secretory; <i>menstrual cycle</i>
uterine tubes (YOO-ter-in TOORZ)	<i>uter/o</i> (uterus); - <i>ine</i> (adjective suffix); from the Latin word	tubular structures between the ovaries and the uterus; <i>fallopian tubes</i>

uterus (YOO-ter-us)	Latin word meaning “womb” or “belly”	reproductive organ in which the fertilized oocyte is implanted and in which the embryo/fetus develops
vagina (vuh-JYE-nuh)	Latin word for sheath	the female genital canal extending between the cervix of the uterus and the exterior
vas deferens (vas DEHF-eh rehnhz)	from the Latin words <i>vas</i> (vessel) and <i>deferens</i> (carrying down)	duct leading out of the epididymis; <i>ductus deferens</i>
vulva (VUL-vuh)	from the Latin word <i>vulva</i> (wrapper or covering)	female external genital organs
zygote (ZY-goht)	from the Greek word <i>zygotos</i> (yoked)	single cell formed at fertilization from the union of the oocyte with the sperm
Disorders		
amenorrhea (ah-MEN-oh-REE-ah)	<i>a-</i> (without); <i>men/o</i> (menses); <i>-rrhea</i> (flowing, discharge)	absence of menstruation
anorchism (an-OR-kizm)	<i>an-</i> (without); <i>orch/o</i> (testes); <i>-ism</i> (condition)	congenital absence of one or both testes
anteflexion (an-tee-FLEX-shun)	<i>ante-</i> (something positioned in front of); from the Latin word <i>flectere</i> (to bend)	forward bend of the uterus
anteversion (an-tee-VER-shun)	<i>ante-</i> (something positioned in front of); from the Latin word <i>versio</i> (turning)	turning forward of the entire uterus
azoospermia (ay-ZOH-oh-SPER-mee-ah)	<i>a-</i> (without); from the Greek word <i>azoos</i> (lifeless); <i>sperm/o</i> (sperm)	absence of living sperm in the semen
balanitis (bal-ah-NIGH-tis)	<i>balan/o</i> (glans penis); <i>-itis</i> (inflammation)	inflammation of the glans penis
benign prostatic hyperplasia (BPH) (bee-NINE pros-TAT-ik high-per-PLAY-zhee-uh)	benign (common English word) + <i>prostat/o</i> (prostate) + <i>-ic</i> (adjective suffix); <i>hyper-</i> (above normal); <i>-plasia</i> (development, growth)	an enlarged, noncancerous prostate; <i>prostatomegaly</i>
cervicitis (sur-vih-SY-tihs); also trachelitis (trak-ih-LY-tihs)	<i>cervic/o</i> (cervix); <i>-itis</i> (inflammation)	inflammation of the uterine cervix
cryptorchidism (kript-OR-kid-iz-um)	from the Greek word <i>kryptos</i> (hidden); <i>orch/o</i> (testes); <i>-ism</i> (condition)	undescended testes or when one or both testes fail to descend into the scrotum; <i>cryptorchism</i>

cystocele (SIS-toh-seel)	<i>cyst/o</i> (bladder); <i>-cele</i> (hernia)	protrusion of the bladder into the anterior wall of the vagina
dysmenorrhea (dis-MEN-oh-REE-ah)	<i>dys-</i> (bad, difficult); <i>men/o</i> (menses); <i>-rrhea</i> (flowing, discharge)	painful menstruation
ectopic (ek-TOP-ik)	from the Greek word <i>ektopos</i> (away from a place, distant)	out of place; a pregnancy occurring elsewhere than in the uterus
endometriosis (EN-doh-MEE-tree-OH-sis)	from the Greek words <i>endon</i> (within) and <i>metra</i> (womb) + <i>-osis</i> (condition)	presence of endometrial tissue outside the uterus
epididymitis (ep-ih-did-ih-MY-tis)	from the Greek words <i>epi</i> (on) and <i>didymos</i> (testicle); <i>-itis</i> (inflammation)	inflammation of the epididymis
fibroids (FIGH-broidz)	from the Latin word <i>fibra</i> (a fiber, filament); <i>-oid</i> (resembling)	benign neoplasm derived from smooth muscle occurring in the uterus; <i>fibroleiomyoma</i>
gonorrhea (GC) (gon-oh-REE-ah)	from the Greek <i>gonos</i> (offspring); <i>-rrhea</i> (discharge, flowing)	highly contagious sexually transmitted disease caused by bacteria
herpes simplex virus (HSV) (HUR-peeZ SIM-pleks VYE-rus)	<i>herpes</i> (Latin for a spreading skin eruption); <i>simplex</i> (Latin for simple); <i>virus</i> (Latin for poison)	infections caused by herpesvirus types 1 and 2; symptoms include groups of vesicles and lesions on the genitalia
human immunodeficiency virus (HIV) (HYOO-mun IM-yoo-noh-dee-fish-en-see VYE-rus)	<i>immunis</i> (Latin for exempt); <i>deficientem</i> (Latin for deficient); <i>virus</i> (Latin for poison)	virus that attacks the immune system; can be sexually transmitted
human papillomavirus (HPV) (HYOO-mun pap-ih-LOH-muh VYE-rus)	<i>papilla</i> (Latin for nipple; <i>-oma</i> (tumor); <i>virus</i> (Latin for poison)	most common sexually transmitted disease; causes certain types of genital warts
hydrocele (HIGH-droh-seel)	<i>hydro-</i> (water); <i>-cele</i> (hernia)	hernia filled with fluid in the testes
hysteralgia (HIHS-teh-RAL-jee-ah); also hysterodinia (HIHS-teh-roh-DIHN-ee-ah)	<i>hyster/o</i> (womb, uterus); <i>-algia/-dynia</i> (pain)	pain in the uterus
hysteropathy (hiss-ter-ROP-ah-thee)	<i>hyster/o</i> (womb, uterus); <i>-pathy</i> (disease)	any disease of the uterus
mastitis (mast-EYE-tis)	<i>mast/o</i> (breast); <i>-itis</i> (inflammation)	inflammation of the breast

menorrhagia (MEN-oh-RAY-jee-ah)	<i>men/o</i> (menses); <i>-rrhagia</i> (rapid flow of blood)	increased amount and duration of menstrual flow
oligomenorrhea (oh-LIG-oh-MEN-oh-REE-ah)	<i>olig/o</i> (having little); <i>men/o</i> (menses); <i>-rrhea</i> (discharge, flowing)	markedly reduced menstrual flow along with abnormally infrequent menstruation
oligospermia (oh-LIG-oh-SPER-mee-ah)	<i>olig/o</i> (having little); <i>-sperm/o</i> (sperm); <i>-ia</i> (condition)	low sperm count
oophoritis (oh-of-or-EYE-tis)	<i>oophor/o</i> (ovary); <i>-itis</i> (inflammation)	inflammation of an ovary; <i>ovaritis</i>
orchialgia (or-kee-AL-jee-ah)	<i>orchi/o</i> (testes); <i>-algia</i> (pain)	pain in the testes
orchitis (or-KIGH-tis)	<i>orchi/o</i> (testes); <i>-itis</i> (inflammation)	inflammation of a testis
ovarialgia (oh-vahr-ee-AL-jee-ah)	<i>ovari/o</i> (ovary); <i>-algia</i> (pain)	pain in an ovary
ovaritis (ohv-ah-RY-tihs)	<i>ovari/o</i> (ovary); <i>-itis</i> (inflammation)	inflammation of an ovary; <i>oophoritis</i>
pelvic inflammatory disease (PID) (PEL-vik in-FLAM-uh-tawr-ee dih-ZEEZ)	common English words	acute or chronic suppurative inflammation of female pelvic structures (endometrium, uterine tubes, pelvic peritoneum) due to infection by <i>Neisseria gonorrhoeae</i> , <i>Chlamydia trachomatis</i> , or other organisms
phimosis (fi-MOH-sis)	from the Greek word <i>phimoo</i> (to muzzle); <i>-osis</i> (condition)	narrowing of the opening of the foreskin so it cannot be retracted or pulled back to expose the glans penis
prolapsed uterus (proh-LAPSED YOO-ter-uhs)	common English word; <i>uterus</i> is a Latin word meaning "womb"	descent of the uterus or cervix into the vagina
prostatitis (PROS-tah-TYE-tis)	<i>prostat/o</i> (prostate); <i>+itis</i> (inflammation)	inflammation of the prostate
rectocele (REK-toh-seel)	<i>rect/o</i> (rectum); <i>-cele</i> (hernia)	protrusion of the rectum into the posterior wall of the vagina
retroflexion (re-troh-FLEX-shun)	<i>retro-</i> (backward) + flexion, from the Latin word <i>flectere</i> (to bend)	abnormal tipping with the body of the uterus bent back on itself
retroversion (re-troh-VER-shun)	<i>retro-</i> (backward); from the Latin word <i>versio</i> (to turn)	an abnormal tipping of the entire uterus backward
salpingitis (sal-pin-JY-tis)	<i>salping/o</i> (tube, uterine tube); <i>-itis</i> (inflammation)	inflammation of the uterine tube

sexually transmitted disease (STD) (SEK-shoo-uh-lee trans-MIT-ted dih-ZEEZ)	common English words	diseases that are transmitted through sexual intercourse or sexual contact (HIV, syphilis, chlamydia); STI
syphilis (SIF-ih-lis)	from a poem <i>Syphilis sive Morbus Gallicus</i> by Fracastorius, <i>Syphilus</i> being a shepherd and principal character	a highly contagious STD that is caused by a bacterium
vaginitis (VAJ-ih-NIGH-tis)	<i>vagin/o</i> (vagina); <i>-itis</i> (inflammation)	inflammation of the vaginal tissues that may be infectious or due to several other causes
varicocele (VAR-ih-ko-seel)	<i>varic/o</i> (varix, varicose, varicosity); <i>-cele</i> (hernia)	a varicose vein of the testes
Diagnostic Tests, Treatments, and Surgical Procedures		
amniocentesis (am-nee-oh-sen-TEE-sihs)	<i>amni/o</i> (amnion); <i>-centesis</i> (surgical puncture for aspiration)	extraction and diagnostic examination of amniotic fluid from the amniotic sac
bilateral oophorectomy (bye-LAT-er-ul oh-of-oh-REK-tuh-mee)	<i>bi-</i> (two); <i>lateral</i> (side); <i>oophor/o</i> (ovary); <i>-ectomy</i> (excision)	removal of both ovaries
bilateral salpingo-oophorectomy (bye-LAT-er-ul sal-ping-oh-oh-of-oh-REK-tuh-mee)	<i>bi-</i> (two); <i>lateral</i> (side); <i>salping/o</i> (tube, fallopian tube); <i>oophor/o</i> (ovary); <i>+ectomy</i> (excision)	removal of both sets of ovaries and uterine tubes
cervicectomy (surv-ih-SEK-toh-mee)	<i>cervic/o</i> (cervix); <i>+ectomy</i> (excision);	excision of the uterine cervix; <i>trachelectomy</i>
cervicoplasty (SURV-ih-ko-plass-tee)	<i>cervic/o</i> (cervix); <i>+plasty</i> (surgical repair)	surgical repair of the uterine cervix
cervicotomy (surv-ih-KOT-oh-mee)	<i>cervic/o</i> (cervix); <i>+tomy</i> (incision into);	incision into the uterine cervix
cesarean section (CS or C-section) (seh-SAYR-ee-ahn SEK-shuhn); other spellings are caesarean and caesarian	etymology uncertain	surgical operation through the abdominal wall and uterus for delivery of the baby
circumcision (SER-kum SIZH-un)	<i>circum/o</i> (around); from the Latin word <i>caedo</i> (cut)	a surgical procedure to remove the foreskin of the penis
colposcope (kol-POH-skope)	<i>colp/o</i> (vagina); <i>-scope</i> (instrument used to view)	endoscopic instrument used to magnify and examine the tissues of the vagina and cervix

colposcopy (kol-POSS-koh-pee)	<i>colp/o</i> (vagina); <i>-scopy</i> (use of an instrument for viewing)	using an endoscopic instrument to examine the vagina and cervix
dilation and curettage (D&C) (dye-LAY-shun and KYOO-ruh-tahzh)	from the Latin word <i>dilatare</i> (to make wider, enlarge); from the French word <i>curette</i> (scoop)	dilation of the cervix and curettage, which involves scraping of the lining of the uterus
hysterectomy (his-ter-EK-tuh-mee)	<i>hyster/o</i> (uterus); <i>-ectomy</i> (excision)	surgical removal of the uterus
hysteropexy (his-ter-oh-PEK-see)	<i>hyster/o</i> (uterus); <i>-pexy</i> (fixation)	surgical fixation of the uterus
hysteroplasty (his-ter-oh-PLAS-tee)	<i>hyster/o</i> (uterus); <i>-plasty</i> (surgical repair)	surgical repair of the uterus
hysterosalpingography (HISS-ter-roh-sal-ping-goh-gruh-fee)	<i>hyster/o</i> (uterus); <i>salping/o</i> (tube, fallopian tube); <i>-graphy</i> (process of recording)	radiography of the uterus and uterine tubes
hysterotomy (his-ter-OT-oh-mee)	<i>hyster/o</i> (uterus); <i>-tomy</i> (incision into)	incision of the uterus
laparoscopy (lap-uh-ROS-kuh-pee)	<i>lapar/o</i> (of or pertaining to the abdominal wall, flank); <i>-scopy</i> (use of an instrument for viewing)	direct visualization of the interior of the abdomen with the use of a laparoscope
mammography (mah-MOG-ruh-fee)	<i>mamm/o</i> (breast); <i>-graphy</i> (process of recording)	examination of the breast by means of an imaging technique, such as radiography
mastectomy (mas-TEK-toh-mee)	<i>mast/o</i> (breast); <i>-ectomy</i> (excision)	removal of a breast
oophorectomy (OH-of-oh-rek-tuh-mee)	<i>oophor/o</i> (ovary); <i>-ectomy</i> (excision)	excision of an ovary; <i>ovariectomy</i>
oophoroplasty (oh-of-or-oh PLAS-tee)	<i>oophor/o</i> (ovary); <i>-plasty</i> (surgical repair)	surgical repair of an ovary
oophorotomy (oh-of-or-OT-uh-mee)	<i>oophor/o</i> (ovary); <i>-tomy</i> (incision into)	incision into an ovary
orchietomy (or-kee-EK-toh-mee)	<i>orchi/o</i> (testes); <i>-ectomy</i> (excision)	removal of one or both testes; <i>orchechtomy</i> ; <i>orchidectomy</i>
orchiopesty (OR-kee-oh-nlass-tee)	<i>orchi/o</i> (testes); <i>-plasty</i> (surgical repair)	surgical repair of a testis

orchiotomy (or-kee-OT-ah-mee)	<i>orchi/o</i> (testes); <i>-tomy</i> (incision into)	incision into a testis
ovariectomy (oh-vahr-ee-EK-toh-mee)	<i>ovari/o</i> (ovary); <i>-ectomy</i> (excision)	excision of one or both ovaries
ovariotomy (oh-vahr-ee-OT-oh-mee)	<i>ovari/o</i> (ovary); <i>-tomy</i> (incision into)	incision of an ovary
Pap smear (Papanicolaou) (pap smear)	named after George Papanicolaou, who developed the technique	exfoliative biopsy or a scraping of the cervix to diagnose conditions of the cervix and surrounding tissues
salpingo-oophorectomy (sah-ling-goh oh-uh-fuh-REK-tuh-mee)	<i>salping/o</i> (tube, uterine tube); <i>oophor/o</i> (ovary); <i>-ectomy</i> (excision)	removal of an ovary and uterine tube
transurethral resection of the prostate (TURP) (TRANS-yoo-ree-thrul ree-SEK-shun of the PROS-tate)	from the Latin <i>trans</i> (across); from the Greek word <i>ourethra</i> (urethra); re- (again) from the Latin <i>secare</i> (to cut)	the removal of part or all of the prostate through the urethra
tubal ligation (TOO-ball lie-GAY-shun)	tube; <i>-al</i> (adjective suffix); ligation, from the Latin word <i>ligare</i> (to bind)	surgical procedure performed for female sterilization where each fallopian tube is tied off or “ligated” to prevent the oocyte from reaching the uterus
uteropexy (yoo-ter-oh-PEK-see)	<i>uter/o</i> (uterus); <i>-pexy</i> (fixation)	surgical fixation of the uterus; <i>hysteropexy</i>
uteroplasty (yoo-ter-oh-PLAS-tee)	<i>uter/o</i> (uterus); <i>-plasty</i> (surgical repair)	surgical repair of the uterus; <i>hysteroplasty</i>
uterotomy (yoo-ter-OT-uh-mee)	<i>uter/o</i> (uterus); <i>-tomy</i> (incision into)	incision of the uterus; <i>hysterotomy</i>
varicocelectomy (VAIR-ih-koh-seh-LEK-tuh-mee)	<i>varic/o</i> (varix, varicose, varicosity); <i>-cele</i> (hernia); <i>-ectomy</i> (excision)	the removal of a portion of an enlarged vein to remove a varicocele
vasovasostomy (vay-soh-vay-ZOS-toh-mee)	<i>vas/o</i> (vessel, vas deferens); <i>-stomy</i> (creation of an opening)	procedure to restore fertility to a vasectomized male; reconnect the ductus (vas) deferens
Practice and Practitioners		
gynecologist (guy-neh-KOL-oh-jist)	<i>gynec/o</i> (woman, female); <i>-logist</i> (one who studies a certain field)	a specialist of the female reproductive system
gynecology (guy-neh-KOL-oh-jee)	<i>gynec/o</i> (woman, female); <i>-logy</i> (study of)	the study of the female reproductive system

neonatology (NEE-oh-nay-TOL-oh-jee)	<i>neo-</i> (new); <i>nat/o</i> (birth); <i>-logy</i> (study of)	the medical specialty dealing with newborns
neonatologist (NEE-oh-nay-TOL-oh-jist)	<i>neo-</i> (new); <i>nat/o</i> (birth); <i>-logist</i> (one who studies a certain field)	the medical specialist dealing with newborns
obstetrician (OB-steh-trish-uhn)	from the Latin word <i>obstetricis</i> (midwife), derived from the Latin word <i>obstare</i> (to stand opposite to)	a physician who specializes in the medical care of women during pregnancy and childbirth
obstetrics (OB) (ob-STET-riks)	from the Latin word <i>obstetricis</i> (midwife), derived from the Latin word <i>obstare</i> (to stand opposite to)	medical specialty concerned with the medical care of women during pregnancy and childbirth
pediatrician (pee-dee-a-TRISH-an)	from the Greek <i>paid-</i> , stem of <i>pais</i> (child); <i>-iatr/o</i> (pertaining to medicine)	medical specialist of children
pediatrics (pee-dee-AT-riks)	from the Greek <i>paid-</i> , stem of <i>pais</i> (child); <i>-iatr/o</i> (pertaining to medicine)	medical specialty dealing with children
urologist (yoo-ROL-uh-jist)	<i>uro-</i> (urinary) + <i>logos</i> (study)	medical specialists who diagnose and treat disorders of the urinary and male reproductive systems

END-OF-CHAPTER EXERCISES

EXERCISE 15-1



LABELING

Using the following list, choose the correct terms to label the diagrams correctly.

Label the figure of the male reproductive system.

ductus deferens or vas deferens glans penis scrotum

epididymis

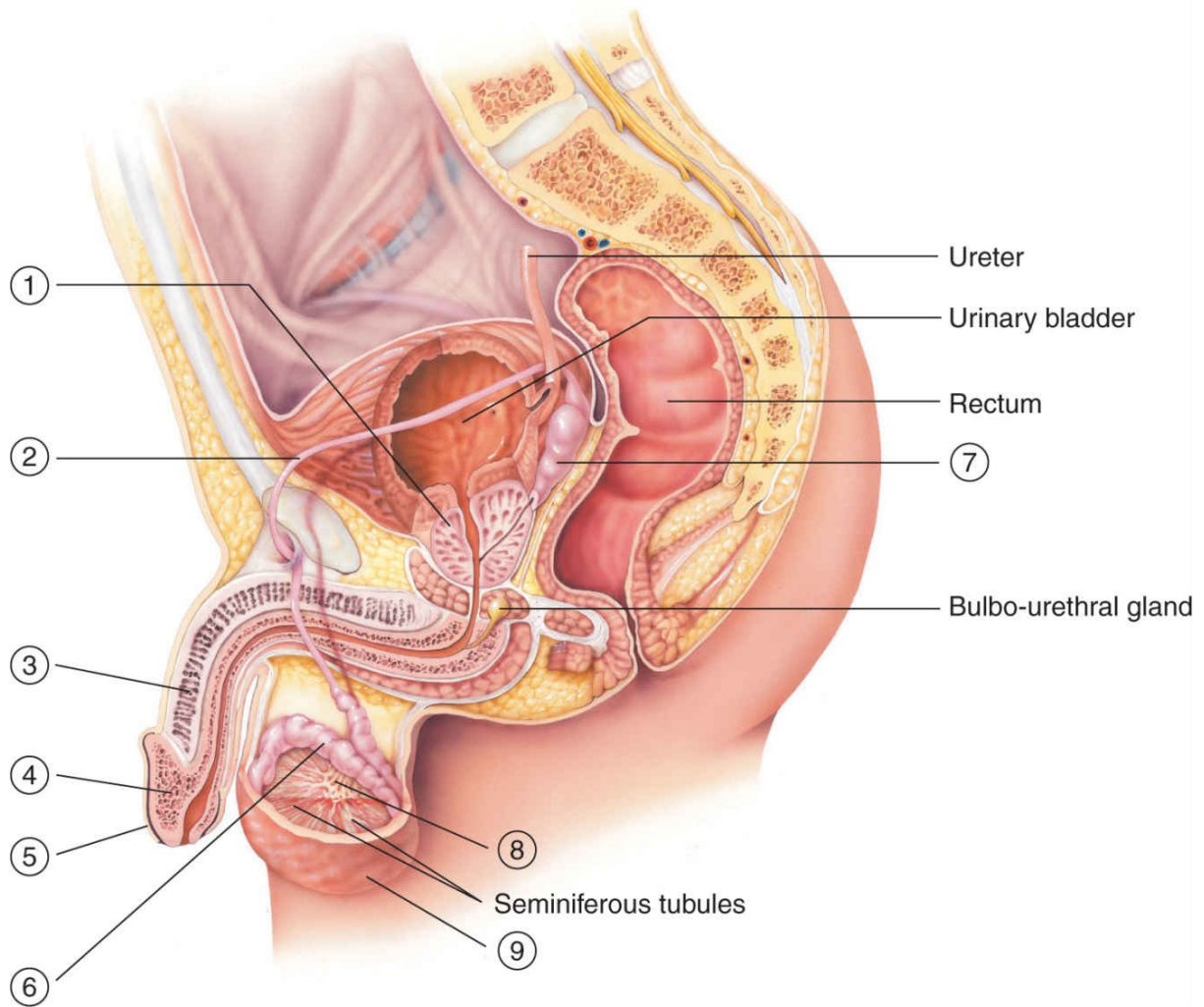
penis

seminal gland

foreskin

prostate

testis

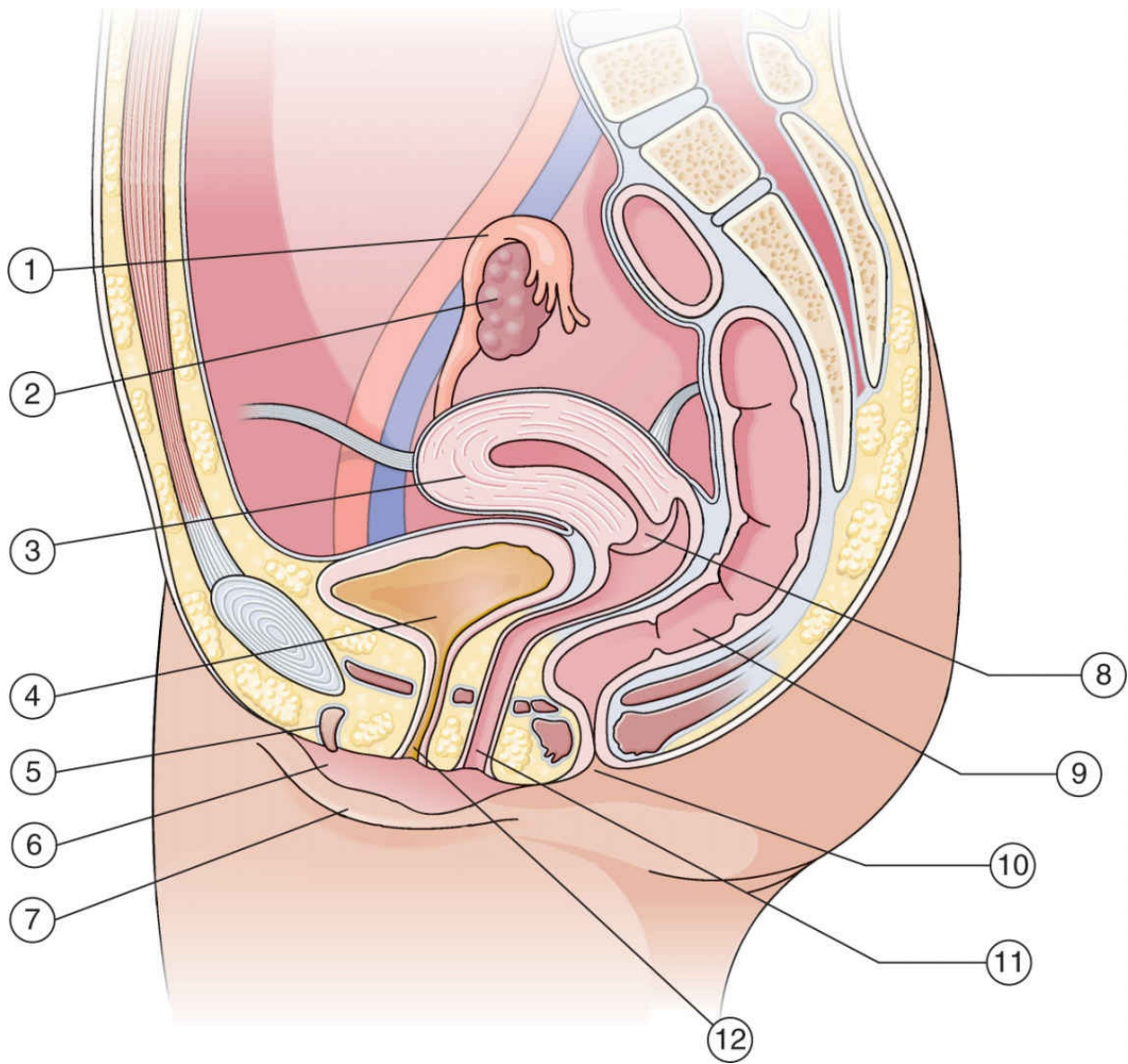


1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

Label the figure of the female reproductive system.

- | | | |
|--------|--------------|-----------------|
| anus | labium minus | urinary bladder |
| cervix | ovary | uterine tube |

clitoris rectum uterus
labium majus urethra vagina



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

12. _____

EXERCISE 15-2



WORD PARTS

Break each of the following terms into its word parts: prefix, root, or suffix. Give the meaning of each word part and then define the term.

1. *amenorrhea*

prefix: _____

root: _____

suffix: _____

definition: _____

2. *azoospermia*

prefix: _____

prefix: _____

root: _____

suffix: _____

definition: _____

3. *dysmenorrhea*

prefix: _____

root: _____

suffix: _____

definition: _____

4. *menorrhagia*

root: _____

suffix: _____

definition: _____

5. *prostatitis*

root: _____

suffix: _____

definition: _____

6. *hysterotomy*

root: _____

suffix: _____

definition: _____

7. *mastectomy*

root: _____

suffix: _____

definition: _____

8. *neonatology*

prefix: _____

root: _____

suffix: _____

definition: _____

EXERCISE 15-3



WORD BUILDING

Use the word parts listed to build the terms defined.

-algia -graphy -logist -pexy

amni/o gynec/o mamm/o -pathy

-cele hyster/o mast/o -scopy

-centesis -itis oophor/o -tomy

cyst/o lapar/o orchi/o uter/o

1. protrusion of the bladder into the anterior wall of the vagina

2. pain in the uterus _____
3. inflammation of the breast _____
4. any disease of the testes _____
5. extraction and diagnostic examination of amniotic fluid from the amniotic sac _____

6. examination of the breast by means of an imaging technique, such as radiography _____
7. direct visualization of the interior of the abdomen with the use of a laparoscope _____
8. incision into an ovary _____
9. surgical fixation of the uterus _____
10. specialist of the female reproductive system _____

EXERCISE 15-4



MATCHING

Match the term with its definition.

- | | | |
|--|-----|---|
| 1. _____
deferens | vas | a. combination of sperm and associated liquids that nourish the sperm |
| 2. _____
prostate | | b. pain in the ovary |
| 3. _____
spermatogenesis | | c. organs that produce and store male gametes |
| 4. _____
epididymis | | d. duct leading out of the epididymis |
| 5. _____
semen | | e. production of sperm |
| 6. _____
orchialgia | | f. inflammation of an ovary |
| 7. _____
testes | | g. pain in the testes |
| 8. _____
hysterectomy and bilateral
oophorectomy | | h. release of the female gamete from the ovary |
| 9. _____
ovarialgia | | i. organ in which the male sperm become functional; lies on top of the testes |
| 10. _____
hysteropexy | | j. excision of the uterine cervix |
| 11. _____
period of | | k. surgical fixation of the uterus |

gestation

12. _____
oophoritis
13. _____ ovulation
14. _____ oocyte
15. _____
cervicectomy
- l. the female gamete
- m. surgical removal of the uterus and right and left ovaries
- n. time lapse between zygote formation and birth
- o. gland that surrounds the urethra; secretes alkaline fluid that assists in sperm motility

EXERCISE 15-5



MULTIPLE CHOICE

Choose the correct answer for the following multiple choice questions.

- The surgical removal of testes is called _____.
 - orchiectomy
 - vasectomy
 - circumcision
 - cauterization
- A prolapsed uterus means that the uterus is _____.
 - bent backward on itself
 - descended down into the vagina
 - tipped forward
 - tipped backward
- Menarche is _____.
 - the beginning of menstruation
 - the end of menopause
 - part of the first trimester
 - another name for gestation
- Cryptorchidism is _____.

- a. underdeveloped testes
 - b. small ovaries
 - c. ruptured ovaries
 - d. undescended testes
5. Removal of fluid from the area around the fetus to analyze it is called _____.
- a. cervicentesis
 - b. amniocentesis
 - c. intrauterine analysis
 - d. uterocentesis
6. The surgical procedure that removes the prostate is called a _____.
- a. vasectomy
 - b. prostatectomy
 - c. vasoligation
 - d. circumcision
7. A Papanicolaou test is done to detect _____.
- a. fibroids
 - b. metritis
 - c. cancer of the cervix
 - d. ovarian cancer
8. A difficult or painful monthly blood flow is termed _____.
- a. dysmenorrhea
 - b. menorrhagia
 - c. dysmetrorrhagia
 - d. menometrorrhagia
9. A colposcope is used to visualize the _____.
- a. testis

- b. epididymis
- c. breast
- d. vagina

EXERCISE 15-6



FILL IN THE BLANK

Fill in the blank with the correct answer.

1. A male gamete is also called a _____.
2. A female gamete is also called an _____.
3. Spermatogenesis is initiated by the secretion of the androgen _____.
4. The male glands located at the base of the urinary bladder that produce a fluid that nourishes the sperm are the _____.
5. The inner layer of the uterus is the _____.
6. A fertilized egg is called an _____ during the first 8 weeks of gestation.
7. A fertilized egg that implants outside the uterus is called an _____ pregnancy.
8. A Pap smear uses tissue from the _____.
9. The plural of ovum is _____.
10. The plural of ovary is _____.

EXERCISE 15-7



ABBREVIATIONS

Write out the term for the following abbreviations.

1. BPH _____
2. G _____
3. HIV _____
4. EDD _____
5. CS _____
6. OB _____
7. EDC _____
8. STD _____

9. GYN _____
10. PID _____
11. HSV _____

Write the abbreviation for the following terms.

12. abortus _____
13. sexually transmitted infection _____
14. transurethral resection of the prostate _____
15. gonorrhea _____
16. last menstrual period _____
17. dilation and curettage _____
18. para _____
19. human papillomavirus _____

EXERCISE 15-8



SPELLING

Select the correct spelling of the medical term.

1. The Latin word for neck is _____, which is a common term for a structure found in the uterus.
 - a. cirvix
 - b. cervics
 - c. cerviks
 - d. cervix
2. The term for a female oocyte and a male sperm is _____.
 - a. gameat
 - b. gameet
 - c. gamete
 - d. gemete
3. The beginning of menses is called _____.
 - a. menarche

- b. menarch
 - c. menerch
 - d. mennarche
4. The plural of testis is _____.
- a. testeas
 - b. testes
 - c. testies
 - d. testees
5. A gene-bearing bundle of DNA found in the nucleus of all cells is a _____.
- a. cromosome
 - b. chromasome
 - c. chromosome
 - d. chromosone
6. The absence of menstruation is called _____.
- a. amenorrhea
 - b. amenorhea
 - c. amenorea
 - d. amenoria
7. A low sperm count is known as _____.
- a. oligaspermia
 - b. oligospermia
 - c. oligospermea
 - d. oliguspermiea
8. The STD caused by the bacterium *Treponema pallidum* is _____.
- a. sipilis
 - b. siphilis
 - c. siphyllis

- d. syphilis
9. A _____ is a practitioner who specializes in the female reproductive system.
 - a. gynecologist
 - b. gynecologist
 - c. gynecologist
 - d. gynocologist
 10. The extraction and diagnostic examination of amniotic fluid from the amniotic sac is called _____.
 - a. amiocentesis
 - b. aminocentesis
 - c. amniocentesis
 - d. amnoicentesis

EXERCISE 15-9



CASE STUDY

A 27-year-old gravida II, para I woman without significant medical history. Blood work was normal before delivery of a stillborn 1-pound, 11-ounce infant during week 21. Although ultrasound studies during week 14 and amniocentesis during week 15 were unremarkable, intrauterine fetal demise had occurred during week 18.

1. What does gravida II para I mean?

2. What is amniocentesis?

3. Using your knowledge of word parts, define intrauterine

APPENDIX A

Answers

CHAPTER 1

Quick Check

prefix = intra-

root = cran/i

suffix = -al

EXERCISE 1-1 DEFINING TERMS

1. cardiology
2. gerontology
3. hematology
4. dermatology
5. neurology
6. psychology

EXERCISE 1-2 ANALYZING TERMS

TERM	ROOT	SUFFIX	DEFINITION
1. neuropathy	neuro	-pathy	disease of the nerves
2. psychology	psycho	-logy	the study and science of mental processes and behavior
3. pathogen	patho	-genic	causing disease

- | | | | | |
|-----|--------------|---------------|--------|---|
| 4. | neuralgia | neur | -algia | pain in one or more nerves |
| 5. | systemic | system | -ic | relating to a body system or systems |
| 6. | psychiatrist | psych
iatr | -ist | a medical doctor who specializes in the diagnosis and treatment of mental and emotional disorders |
| 7. | pediatrician | ped
iatr | -ician | a physician who deals with the care and treatment of babies and children |
| 8. | iatrogenic | iatro | -genic | refers to ailments caused by a doctor or other medical personnel |
| 9. | cardialgia | cardi | -algia | pain in the heart (or stomach) |
| 10. | neuritis | neur | -itis | inflammation of a nerve or nerves |

EXERCISE 1-3 FILL IN THE BLANK

1. around
2. study of
3. skin
4. roots, suffix
5. logos, word
6. inflammation, tendon
7. before
8. Pain, -dynia
9. -itis
10. psychology

CHAPTER 2

Quick Check

- | | | | |
|----|--------|-------------------|---------------------|
| 1. | anti- | definition: not | refers to: negation |
| 2. | hyper- | definition: above | refers to: position |

3. tachy- definition: rapid refers to: speed

EXERCISE 2-1 ADDING PREFIXES OF TIME OR SPEED

1. anteroom; outer room that leads into another room
2. neoclassic; new classic work
3. postglacial; following the glacial period
4. predominant; important
5. tachometer; instrument used to compute speed based on travel time or distance based on speed

EXERCISE 2-2 ADDING PREFIXES OF DIRECTION

1. abnormal; adjective meaning “away from normal”
2. adjoining; adjective meaning “next to”
3. concentric; having the same center
4. contralateral; the other side
5. diagram; illustration that gives an overall view
6. sympathetic; sharing emotions with another person
7. synthesis; assembling parts into a whole

EXERCISE 2-3 ADDING PREFIXES OF POSITION

1. eccentric; outside the center; unusual
2. ectomorph; slightly built person
3. enslave; to make a slave of
4. endocardial; adjective meaning “inside the heart”
5. epidemic; great number of occurrences of a particular disease
6. exchange; give something in return for another
7. exosphere; the far reaches of the atmosphere
8. extraterrestrial; beyond the earth
9. hypersensitive; highly sensitive
10. hypothesis; a possible explanation underlying the facts
11. infrastructure; the internal framework of a system or organization

12. intercollegiate; participation involving at least two colleges
13. intramural; inside the walls; often applied to sports teams within a school
14. mesosphere; the middle part of the earth's atmosphere
15. metaphysics; beyond physics
16. panorama; a wide expansive view of everything
17. paralegal; a trained assistant to a lawyer

EXERCISE 2-4 ADDING PREFIXES OF SIZE OR NUMBER

1. biannual; occurring twice a year
2. hemisphere; half of a sphere
3. macrocosm; the universe
4. microscope; a device for viewing objects invisible to the human eye
5. monorail; a railway system on which the vehicle travels on one rail
6. oligarchy; rule by a small group of people
7. quadrilateral; having four sides
8. semiannual; twice a year
9. triangle; three-sided geometric shape
10. unicycle; a vehicle having one wheel

EXERCISE 2-5 COMBINING ROOTS AND SUFFIXES THAT DENOTE MEDICAL CONDITIONS

1. card/i/o
 - a. cardiocele; herniation of the heart
 - b. cardiodynia; heart pain
 - c. cardiectasia; dilation of the heart
 - d. carditis; inflammation of the heart
 - e. cardiomalacia; softening of the heart
 - f. cardiomegaly; enlargement of the heart
 - g. cardioptosis; drooping of the heart
 - h. cardioplegia; paralysis of the heart

- i. cardiorrhesis; rupture of the heart wall
- j. cardiospasm; spasm of the heart
- 2. dermat/o
 - a. dermatitis; inflammation of the skin
 - b. dermatoma; tumor of the skin
 - c. dermatomegaly; enlargement of the skin
 - d. dermatosis; abnormal condition of the skin
- 3. hem/o, hemat/o
 - a. hemolysis; destruction of the blood cells
 - b. hematogenesis; produced by the blood
 - c. hematoma; localized mass of blood
 - d. hematosi; abnormal condition of the blood
- 4. neur/o
 - a. neuralgia; nerve pain
 - b. neurectasis; dilation of a nerve
 - c. neuritis; inflammation of a nerve
 - d. neuroma; tumor of a nerve
- 5. oste/o
 - a. osteodynia; bone pain
 - b. osteoma; bone tumor
 - c. osteomalacia; softening of the bone
 - d. osteopenia; reduction of bone density
 - e. osteoporosis; porous bone, condition resulting in decreased bone mass
 - f. osteitis; inflammation of the bone
- 6. psych/o
 - a. psychosis; severe mental and behavioral disorder

EXERCISE 2-6 COMBINING ROOTS AND SUFFIXES THAT DENOTE DIAGNOSTIC TERMS, TEST INFORMATION, OR

SURGICAL PROCEDURES

1. card/i/o
 - a. cardiogenic; originating in the heart
 - b. cardiogram; graphic record of the heart
 - c. cardiograph; machine that produces a cardiogram
 - d. cardiography; process of electrically measuring heart function
 - e. cardiopathy; heart disease
 - f. cardiorrhaphy; suture of the wall of the heart
2. dermat/o
 - a. dermatoplasty; surgical repair of the skin
3. hemat/o
 - a. hematogenesis; originating with or in the blood
 - b. hematometry; examination of blood
4. neur/o
 - a. neurectomy; removal of a nerve or part of a nerve
 - b. neurogenic; adjectival form of *neurogenesis*; *originating in the nervous system*
 - c. neurogenesis; originating in the nervous system
5. oste/o
 - a. osteorrhaphy; suturing broken bone together
 - b. osteoplasty; surgical repair of the bone
 - c. osteogenesis; formation of bone
 - d. ostectomy; excision of bone
 - e. osteotomy; cutting of bone
6. path/o
 - a. pathogen; a disease-causing agent
 - b. pathogenic; adjectival form of *pathogen*; *disease causing*
 - c. pathogenesis; development of a disease
7. psych/o

- a. psychogenic; adjectival form of *psychogenesis*; of *mental origin*
- b. psychogenesis; mental development
- c. psychometry; mental testing
- d. psychopathy; mental illness or disorder

EXERCISE 2-7 COMBINING ROOTS AND SUFFIXES ASSOCIATED WITH A MEDICAL SPECIALIST OR SPECIALTY

1. card/i/o
 - a. cardiology; medical specialty that diagnoses and treats heart diseases
 - b. cardiologist; heart specialist
2. derm/o, dermat/o
 - a. dermatology; medical specialty that diagnoses and treats skin disorders
 - b. dermatologist; skin specialist
3. ger/o/nt/o
 - a. geriatrics; medical specialty that diagnoses and treats the aged
 - b. gerontology; the study of the process and results of aging
 - c. gerontologist; specialist in gerontology
4. hem/o, hemat/o
 - a. hematology; medical specialty that diagnoses and treats blood disorders
 - b. hematologist; a specialist who treats blood disorders
5. neur/o
 - a. neurology; medical specialty that diagnoses and treats the nervous system
 - b. neurologist; specialist who treats the nervous system
6. oste/o
 - a. osteology; medical specialty that diagnoses and treats disorders of the skeletal system
 - b. osteologist; a bone specialist
7. path/o

- a. pathology; study of disease
 - b. pathologist; a medical specialist who studies pathology
8. psych/o
- a. psychology; study of the mind
 - b. psychiatry; the medical specialty that diagnoses and treats mind disorders
 - c. psychiatrist; a medical specialist in psychiatry

EXERCISE 2-8 COMBINING ROOTS AND SUFFIXES THAT DENOTE ADJECTIVES

- 1. card/i/o
 - a. cardiac; refers to the heart
- 2. hem/o, hemat/o
 - a. hemotoxic; destructive of red blood cells
- 3. derm/o, dermat/o
 - a. dermal; adjective denoting skin
 - b. dermatic; adjective denoting skin
- 4. ger/o, geront/o
 - a. geriatric; adjective meaning “pertaining to the elderly or aging”
 - b. gerontal; adjective meaning “old-age related”
- 5. neur/o
 - a. neural; adjective meaning “related to the nervous system”
 - b. neurotic; adjective meaning “pertaining to neurosis”
- 6. spin/o
 - a. spinal; adjective referring to spinal column
 - b. spinous; adjective meaning “having spines”
- 7. oste/o
 - a. osteal; adjective meaning “bone”
 - b. osteoid; adjective meaning “resembling bone”

EXERCISE 2-9 MATCHING SUFFIXES WITH MEANINGS

1. g
2. i
3. b
4. m
5. j
6. d
7. c
8. h
9. f
10. e
11. a
12. o
13. n
14. k
15. l

EXERCISE 2-10 FILL IN THE BLANK

1. -algia, -dynia
2. angiectasis
3. adjective
4. suture of a blood vessel
5. -graphy
6. tumor of the blood vessel
7. surgical repair
8. dermatologist
9. old patients
10. gerontology is the study of old age; geriatrics is the branch of medicine dealing with the care of older people
11. ad-
12. ante-

13. abnormally slow heartbeat
14. beyond
15. hyper-
16. medicine to prevent coagulation (clotting)
17. three
18. the instrument will make objects visible that are too small to be seen with the unaided eye
19. endocarditis; inflammation of the inside of the heart
20. tachypnea is rapid breathing; dyspnea is difficulty or painful breathing

CHAPTER 3

Quick Check

1. distal: proximal
2. inferior: superior
3. anterior: posterior
4. dorsal: ventral

Word Parts Exercise

1. across
2. back
3. near
4. cartilage
5. front, anterior
6. muscle
7. superior
8. neck
9. groin
10. spinal cord

EXERCISE 3-1 MATCHING

A. Planes of the Body

1. c
2. b
3. a

B. Directional Terms

1. f
2. g
3. h
4. j
5. i
6. e
7. a
8. d
9. c
10. b

EXERCISE 3-2 FILL IN THE BLANK

1. distal
2. proximal
3. anterior, ventral
4. medial
5. superior
6. lateral
7. posterior, dorsal
8. inferior

EXERCISE 3-3 WORD BUILDING

1. hypo-, -ic; hypogastric
2. -al; dorsal
3. -itis; chondritis
4. trans-, -ic; transthoracic

5. -itis; neuritis
6. epi-, -al; epicardial

EXERCISE 3-4 SHORT ANSWER

1. lateral
2. toward the back
3. proximal
4. anterior or forward
5. ventral

EXERCISE 3-5 TRUE OR FALSE

1. False
2. True
3. False
4. True
5. True
6. False
7. True
8. False
9. False
10. True

CHAPTER 4

Quick Check

Suffix	Term
-ous	subcutaneous
-cyte	melanocyte
-aceous	sebaceous

Word Parts Exercise

1. skin
2. fungus
3. cell
4. sweat
5. red
6. dry
7. to carry
8. below
9. sebum (oil; fat)
10. upon
11. white
12. blue
13. dry, scaly (fishlike)
14. skin
15. horny tissue or cells
16. skin
17. nail
18. black
19. hair
20. hardening
21. yellow

EXERCISE 4-1 LABELING THE SKIN

1. hair
2. epidermis
3. dermis
4. hypodermis (subcutaneous) layer
5. nerve
6. artery

7. vein
8. adipose tissue
9. sudoriferous (sweat) gland
10. hair follicle
11. arrector pili muscle
12. sebaceous (oil) gland
13. pore (opening of sweat gland)

EXERCISE 4-2 WORD PARTS

1. avascular
prefix: a-, without;
root: vascular, small vessels;
definition: without blood vessels
2. epidermis
prefix: epi-, upon;
root: dermis, skin;
definition: outer layer of the skin
3. melanocyte
root: melano;
suffix: -cyte, cell;
definition: cell that produces melanin
4. scabicide
root: scabies, infection caused by mites;
suffix: -icide, destruction;
definition: agent lethal to mites
5. dermatomycosis
root: dermato, skin;
root: myc, fungus;
suffix: -osis, abnormal condition;

definition: fungal infection of the skin

6. onychectomy

root: onych, nail;

suffix: -ectomy, excision;

definition: surgical removal of a nail

7. ecchymosis

prefix: ec-, out;

root: chymos, juice;

suffix: -osis, abnormal condition;

definition: a purple patch more than 3 mm in diameter caused by blood under the skin

8. antiseptic

prefix: anti-, against;

root: septic, poison;

definition: agent that inhibits the growth of infectious agents

EXERCISE 4-3 WORD BUILDING

1. dermatoplasty
2. hemangioma
3. dermatitis
4. subcutaneous
5. onychotomy
6. dermatology
7. onychomalacia
8. paronychia
9. ichthyosis
10. hyperhidrosis

EXERCISE 4-4 MATCHING

1. d
2. e

3. i
4. f
5. b
6. c
7. g
8. j
9. h
10. a
11. l
12. k

EXERCISE 4-5 MULTIPLE CHOICE

1. b
2. b
3. b
4. d
5. b
6. c
7. b
8. b
9. d
10. d
11. d
12. b
13. b
14. a
15. c

EXERCISE 4-6 FILL IN THE BLANK

1. keloid

2. fissure
3. Cyanosis
4. scleroderma
5. alopecia
6. albinism
7. vitiligo
8. Urticaria
9. biopsy
10. polyp

EXERCISE 4-7 ABBREVIATIONS

1. body surface area
2. incision and drainage
3. SLE
4. UV

EXERCISE 4-8 SPELLING

1. d.
2. d
3. c
4. a
5. d
6. c
7. b
8. d
9. a
10. a

EXERCISE 4-9 CASE STUDY

1. antibiotic; medication used to kill bacteria or treat an infection
2. impetigo; contagious superficial skin infection that presents with vesicles

3. dermatologist; medical specialist who diagnoses and treats disorders of the skin
4. dermatitis; inflammation of the skin
5. erythematous; redness of the skin
6. pustules; small elevated areas of skin that contains pus
7. edema; swelling in the tissues
8. antipruritic medication; medication used to reduce or stop itching
9. pruritus; itching
10. One reason the dermatologist may have been asking about pets is that allergies to pets may cause some of the signs and symptoms of an allergic reaction. Another possible reason to ask about children and pets is that they can carry diseases that are uncommon in adult populations, but more common in children and animals.

CHAPTER 5

Quick Check

1. osteocytes
2. synovial
3. mandible

Word Parts Exercise

1. swayback, curve
2. joined (yoked) together
3. wrist
4. foot, child
5. bone
6. bones of fingers and toes
7. pain
8. cranium
9. joined together
10. inflammation

11. muscle
12. to visually examine
13. movement
14. correct, straight
15. femur, thighbone
16. softening
17. surgical repair
18. joint
19. pelvis
20. growth
21. arm
22. finger, toe
23. rib
24. bone marrow
25. electricity
26. thorax, chest
27. humerus, upper arm bone
28. porous
29. stiff, fused, closed
30. vertebrae
31. written record of
32. movement
33. both sides
34. calcaneus, heel bone
35. hump
36. neck
37. study of
38. cartilage

39. lower back
40. removal of, excision of
41. tumor

EXERCISE 5-1 LABELING: SKELETON

1. cranium
2. facial bones
3. mandible
4. sternum
5. costal cartilage
6. vertebral column
7. ilium
8. pubis
9. sacrum
10. calcaneus
11. metatarsals
12. phalanges
13. tarsal bones
14. tibia
15. fibula
16. patella
17. femur
18. clavicle
19. scapula
20. humerus
21. ribs
22. radius
23. ulna
24. carpal bones

25. metacarpals
26. phalanges

EXERCISE 5-2 FIGURE LABELING: LONG BONE

1. proximal epiphysis
2. diaphysis
3. distal epiphysis
4. spongy bone
5. epiphyseal plate
6. periosteum
7. compact bone
8. medullary cavity
9. endosteum

EXERCISE 5-3 WORD PARTS

1. osteorrhaphy
root: oste/o = bone
suffix: -rrhaphy = surgical suturing
definition: suturing together the fragments of a broken bone
2. arthrocentesis
root: arthr/o = joint
suffix: -centesis = surgical puncture for aspiration
definition: aspiration of fluid from a joint by needle puncture
3. brachialgia
root: brachi/o = arm
suffix: -algia (pain)
definition: pain in the arm
4. osteochondritis
root: oste/o = bone
root: chondr/o = cartilage

suffix: -itis = inflammation

definition: inflammation of bone and its overlying cartilage

5. carpectomy

root: carp/o = wrist

suffix: -ectomy = surgical removal

definition: excision of a portion or all of the wrist

6. chondrosarcoma

root: chondr/o = cartilage

root: sarc/o = flesh

suffix: -oma = tumor

definition: malignant tumor derived from cartilage

7. dactylomegaly

root: dactyl/o = finger, toe

suffix: -megaly = enlargement

definition: enlargement of one or more fingers or toes

EXERCISE 5-4 WORD BUILDING

1. osteomyelitis
2. arthroscopy
3. chondromalacia
4. arthrogram
5. arthralgia
6. kinesiology
7. chondroplasty
8. intercostal
9. osteitis
10. osteosarcoma
11. arthroplasty
12. myelogram

13. chondritis
14. osteoporosis
15. costalgia

EXERCISE 5-5 MATCHING

1. e
2. d
3. b
4. c
5. a
6. f
7. g

EXERCISE 5-6 MULTIPLE CHOICE

1. d
2. a
3. d
4. a
5. c
6. b
7. c
8. d
9. a
10. a
11. d
12. b
13. a
14. a
15. b

EXERCISE 5-7 FILL IN THE BLANK

1. arthritis
2. arthrocentesis
3. orthopedic surgeon
4. compound
5. medullary
6. ligament
7. herniated disc

EXERCISE 5-8 ABBREVIATIONS

1. anterior cruciate ligament
2. computed tomography
3. cervical vertebra 1
4. total knee arthroplasty
5. lumbar vertebra 5
6. rheumatoid arthritis
7. nonsteroidal anti-inflammatory drug
8. magnetic resonance imaging
9. THR
10. Fx
11. Tx
12. ROM
13. T12
14. TKR
15. MRI

EXERCISE 5-9 SPELLING

1. a
2. b
3. b
4. d

5. c
6. d
7. a
8. c
9. a
10. b

EXERCISE 5-10 CASE STUDY

1. a physician who treats and diagnoses skeletal disorders
2. ROM = range of motion; unable to flex or move her wrist much
3. a wrist bone was broken in several places
4. hip bone, which is formed by the fusion of the ilium, ischium, and pubis, was broken and pressed into another part of the bone
5. realignment
6. a treatment using elastics or pulley and weights

CHAPTER 6

Quick Check

Muscle Tissue Type	Location
1. skeletal	voluntary, striated muscle tissue found throughout the body attached to bones
2. smooth	involuntary muscle tissue lining blood vessels, hollow organs, and respiratory passageways
3. cardiac	involuntary, striated muscle tissue making up the heart wall

Word Parts Exercise

1. ligament
2. tendon
3. tone
4. paralysis

5. muscle
6. movement
7. partial or incomplete paralysis
8. strength
9. muscle
10. four
11. 11. fibrous membrane
12. fiber
13. half
14. alongside, near

EXERCISE 6-1 WORD PARTS

1. fibromyalgia
root: fibro, fiber;
root: my/o, muscle;
suffix: -algia, pain;
definition: a chronic disorder characterized by widespread aching and stiffness of muscles and soft tissues
2. periostitis
prefix: peri-, around;
root: osteo, bone;
suffix: -itis, inflammation;
definition: inflammation of the periosteum or the covering that surrounds the bone
3. tendinoplasty
root: tendo, tendon;
suffix: -plasty, restoring function to a part;
definition: surgical procedure to restore function to the tendon
4. myology
root: my/o, muscle;

suffix: -ology, study of;

definition: study of muscles

5. electromyography

root: electro, electricity;

root: myo, muscle;

suffix: -graphy, process of writing;

definition: diagnostic technique that records the strength of muscle contractions by means of electrical stimulation

6. epicondylitis

prefix: epi-, around;

root: condyl, rounded end surface of bone;

suffix: -itis, inflammation;

definition: inflammation of the tissues around the elbow

7. hemiplegia

prefix: hemi-, half;

root: plegia, paralysis;

definition: total paralysis of one side of the body

8. paralysis

prefix: para-, not normal;

suffix: -lysis, loosening;

definition: loss of sensation and voluntary muscle movements caused by an injury or disease

EXERCISE 6-2 WORD BUILDING

1. tenotomy

2. neurologist

3. paraplegia

4. myocele

5. hemiparesis

6. fasciitis

7. kinesiocalgia
8. fibromyalgia
9. myopathy; musculopathy
10. myositis

EXERCISE 6-3 MATCHING

1. d
2. i
3. f
4. b
5. c
6. e
7. a
8. g
9. k
10. h
11. l
12. j

EXERCISE 6-4 MULTIPLE CHOICE

1. c
2. c
3. b
4. d
5. a
6. a
7. c
8. a
9. d
10. a

EXERCISE 6-5 FILL IN THE BLANK

1. Epicondylitis
2. ligament
3. plantar flexion
4. Asthenia
5. myocele
6. Plantar fasciitis
7. electromyography (EMG)
8. tendinoplasty
9. Myology
10. myalgia

EXERCISE 6-6 ABBREVIATIONS

1. muscular dystrophy
2. rest, ice, compression, elevation
3. cumulative trauma disorder
4. myasthenia gravis
5. EMG
6. ALS
7. IM
8. Fx
9. MD

EXERCISE 6-7 SPELLING

1. c
2. a
3. b
4. d
5. d
6. c

7. c
8. b
9. a
10. a

EXERCISE 6-8 CASE STUDY

1. flexion (closing the angle of a joint); extension (opening the angle of a joint); rotation (turning a body part on its own axis); abduction (movement away from midline)
2. inflammation of a tendon
3. range of motion is the amount of movement that is possible at the joint
4. nonsteroidal anti-inflammatory drug

CHAPTER 7

Quick Check

1. brain and spinal cord
2. homeostasis
3. brainstem

Word Parts Exercise

1. slight paralysis
2. outer layer or covering
3. referring to the mind
4. paralysis
5. memory
6. physician; to treat
7. fear
8. brain
9. the cerebrum; also, the brain in general
10. water
11. a membrane
12. ganglia (*ganglion*, singular)

13. suffix meaning “morbid attraction to” or “impulse toward”
14. in connection with the nervous system, refers to the spinal cord and medulla oblongata
15. nerve, nerve tissue
16. spider
17. to split
18. head
19. mind
20. resembling
21. the cerebellum
22. spine
23. speech
24. glue

EXERCISE 7-1

1. dendrites
2. nucleus
3. cell body
4. myelin
5. axon

EXERCISE 7-2 WORD PARTS

1. psychosis
root: psycho, of or pertaining to the mind;
suffix: -sis, condition of;
definition: a serious disorder involving a marked distortion of, or sharp break from, reality
2. electroencephalography
root: electro, electric;
root: encephalo, brain;
suffix: -graphy, process of recording;

definition: record of the electrical potential of the brain

3. astrocytoma

root: astro, star;

root: cyt, cell;

suffix: -oma, tumor;

definition: star-shaped tumor that usually develops in the cerebrum

4. cerebrovascular

root: cerebro, brain;

root: vascul;

suffix: -ar, adjective suffix;

definition: of or relating to the brain and its blood vessels

5. encephalitis

root: encephal, of or pertaining to the brain;

suffix: -itis, inflammation;

definition: inflammation of the brain

6. epidural

prefix: epi-, above;

root: dura, relating to the dura mater;

suffix: -al, adjective suffix;

definition: on or around the dura mater

7. psychiatrist

root: psych, of or pertaining to the mind;

root: iatr, of or pertaining to medicine or a physician;

suffix: -ist, one who specializes in;

definition: a medical doctor who specializes in the diagnosis and treatment of psychological disorders

8. meningioma

root: mening, membrane;

suffix: -oma, tumor;

definition: benign tumor of the meninges

EXERCISE 7-3 WORD BUILDING

1. encephalitis
2. glioma
3. hemiparesis
4. lobotomy
5. neuroglia
6. parasympathetic
7. paranoia
8. neuroplasty
9. diencephalon
10. paresthesia

EXERCISE 7-4 MATCHING

1. k
2. f
3. c
4. n
5. h
6. j
7. e
8. b
9. m
10. g
11. d
12. a
13. l
14. i

EXERCISE 7-5 MULTIPLE CHOICE

1. d
2. c
3. a
4. b
5. a
6. b
7. c
8. c
9. d
10. c
11. b
12. d
13. b
14. b
15. d

EXERCISE 7-6 FILL IN THE BLANK

1. hyperesthesia
2. poliomyelitis
3. dementia
4. multiple sclerosis
5. myelomeningocele
6. cerebral thrombosis
7. Ataxia
8. epilepsy
9. Syncope
10. neuralgia

EXERCISE 7-7 ABBREVIATIONS

1. intracranial pressure

2. cerebral spinal fluid
3. lumbar puncture
4. electroencephalography
5. multiple sclerosis
6. obsessive-compulsive disorder
7. Parkinson's disease
8. peripheral nervous system
9. cerebrovascular accident
10. dopamine
11. PTSD
12. PNS
13. CVA
14. MRI
15. TIA

EXERCISE 7-8 SPELLING

1. a
2. c
3. c
4. d
5. a
6. b
7. d
8. b
9. c
10. a

EXERCISE 7-9 CASE STUDY

1. transient ischemic attack; sometimes called a ministroke
2. cerebrovascular accident

3. dys- means “difficult”; -phasia means “speak”
4. partial or incomplete paralysis
5. hemiparesis means “partially paralyzed on half the body”; hemiplegia means “complete paralysis on half the body”
6. hemi- means “half”; -plegia means “paralysis”

CHAPTER 8

Quick Check

1. fibrous, vascular, inner
2. choroid
3. pupil

Word Parts Exercise

1. retina
2. hard, cornea
3. tear, lacrimal apparatus
4. light, eye, vision
5. eye
6. denoting the pigmented middle eye layer
7. two, double
8. tears, lacrimal sac or lacrimal duct
9. iris
10. eye
11. lens
12. old age
13. eyelid
14. conjunctiva (plural: conjunctivae)
15. pupil
16. horny
17. relating to the sclera; hard

Quick Check

1. malleus, incus, and stapes
2. conductive hearing loss, sensorineural hearing loss, presbycusis, and anacusis
3. cochlea

Word Parts Exercise

1. sound
2. ear
3. hearing
4. tympanic membrane (eardrum)
5. eardrum
6. ear
7. stapes
8. ear

EXERCISE 8-1 LABELING

1. conjunctiva
2. cornea
3. iris
4. pupil
5. lens
6. anterior chamber (containing aqueous humor)
7. posterior chamber (containing vitreous humor)
8. sclera
9. choroid
10. retina
11. optic nerve

EXERCISE 8-2 WORD PARTS

1. extraocular

prefix: extra-, outside;
root: ocul, eye;
suffix: -ar, adjective suffix;
definition: situated outside the eye

2. xerophthalmia

root: xero, dry;
root: ophthalm, eye;
suffix: -ia, condition;
definition: dry eyes

3. scleroiditis

root: sclera, sclera;
root: ir/o, iris;
suffix: -itis, inflammation;
definition: inflammation of the sclera and iris

4. blepharconjunctivitis

root: blephar, eyelid;
root: conjunctiv, mucous membrane covering the anterior surface of the eyeball and inner eyelid;
suffix: -itis, inflammation;
definition: inflammation of the palpebral conjunctiva, the inner lining of the eyelids

5. audiometry

root: audio, hearing;
suffix: -metry, process of measuring;
definition: measuring hearing with an audiometer

6. otosclerosis

root: oto, ear;
root: sclero, hardening;
suffix: -osis, abnormal condition;

definition: formation of spongy bone in the inner ear producing hearing loss

7. mastoidectomy

root: mastoid, mastoid process;

suffix: -ectomy, excision;

definition: surgical removal of the mastoid process

8. otorhinolaryngologist

root: oto, ear;

root: rhino, nose;

root: laryngo, throat;

suffix: -logist, one who studies a certain field;

definition: physician who specializes in the diagnosis and treatment of ear, nose, and throat disorders

EXERCISE 8-3 WORD BUILDING

1. dacryolith
2. phacolysis
3. dacryocystotomy
4. retinopexy
5. iridomalacia
6. tympanocentesis
7. otodynia
8. myringotomy
9. otorrhea
10. otitis

EXERCISE 8-4 MATCHING: THE EYE

1. j
2. g
3. e
4. d

5. h
6. a
7. f
8. i
9. c
10. b

EXERCISE 8-5 MATCHING: THE EAR

1. c
2. g
3. d
4. i
5. b
6. j
7. e
8. a
9. h
10. f

EXERCISE 8-6 MULTIPLE CHOICE

1. b
2. a
3. d
4. c
5. a
6. d
7. b
8. c
9. a
10. d

EXERCISE 8-7 FILL IN THE BLANK

1. cataract
2. presbycusis
3. diplopia
4. vertigo
5. Tinnitus
6. auricle
7. hordeolum
8. Otagia
9. astigmatism
10. keratitis
11. cochlea
12. semicircular
13. auditory tube
14. Blepharoptosis
15. conductive

EXERCISE 8-8 ABBREVIATIONS

1. right ear
2. otitis media
3. right eye
4. left ear
5. both eyes
6. left eye
7. laser-assisted in situ keratomileusis
8. AU
9. EOM
10. AD
11. IOP

12. OS
13. O.D.

EXERCISE 8-9 SPELLING

1. a
2. c
3. b
4. b
5. d
6. d
7. a
8. b
9. c
10. a

EXERCISE 8-10 CASE STUDY

1. middle ear infection or inflammation
2. incision into the tympanic membrane
3. earwax
4. passageway leading inward from the auricle to the tympanic membrane (eardrum)

CHAPTER 9

Quick Check

1. hypophysis
2. suprarenal gland
3. Endocrine

Word Parts Exercise

1. secreting internally
2. pituitary gland
3. adrenal glands

4. suffix used in the formation of names of chemical substances
5. suffix meaning nourishment or stimulation
6. tumor
7. pancreas
8. extremities
9. gland
10. thyroid gland
11. enlargement
12. sugar, glucose, glycogen
13. to separate or secrete
14. parathyroid gland
15. calcium

EXERCISE 9-1 LABELING

1. pineal gland
2. thyroid
3. adrenal glands
4. testes
5. pituitary gland
6. parathyroid glands
7. thymus
8. pancreas
9. ovaries

EXERCISE 9-2 WORD PARTS

1. adenogenous
root: aden/o (gland)
suffix: -genous (originating)
definition: originating in a gland
2. epinephrine

prefix: epi- (upon)

root: nephr/o (kidney)

suffix: -ine (chemical substance)

definition: hormone secreted from the adrenal medulla, which is the central region of the adrenal gland located on the superior border of each kidney

3. suprarenal

prefix: supra- (above)

root: ren/o (kidney)

suffix: -al (pertaining to)

definition: above the kidney

4. adrenomegaly

root: adren/o (adrenal gland)

suffix: -megaly (enlargement)

definition: enlargement of the adrenal gland

5. hyperglycemia

prefix: hyper- (above normal)

root: glyc/o (glucose; sugar)

suffix: -ia (condition)

definition: excessive glucose (sugar) in the blood

6. adenotomy

root: aden/o (gland)

suffix: -tomy (cutting operation)

definition: incision of a gland

7. thyroparathyroidectomy

root: thyr/o (thyroid gland)

root: parathyr/o (parathyroid gland)

suffix: -ectomy (excision)

definition: excision of the thyroid and parathyroid glands

8. endocrinology

root: endocrin/o (endocrine)

suffix: -ology (study of)

definition: medical specialty of the endocrine system

EXERCISE 9-3 WORD BUILDING

1. adrenomegaly
2. adrenalectomy
3. adrenopathy
4. hypothyroidism
5. throiditis
6. throidotomy
7. thyromegaly
8. pancreatoma
9. pancreatitis
10. pancreatogenic

EXERCISE 9-4 MATCHING

1. d
2. k
3. g
4. i
5. a
6. e
7. f
8. m
9. j
10. b
11. c
12. l

13. h

EXERCISE 9-5 MULTIPLE CHOICE

1. a
2. b
3. b
4. c
5. b
6. a
7. d
8. a
9. d

EXERCISE 9-6 FILL IN THE BLANK

1. thyromegaly
2. diabetes mellitus
3. hyperglycemia
4. polyuria
5. glycosuria
6. glucagon
7. acromegaly
8. Homeostasis

EXERCISE 9-7 ABBREVIATIONS

1. glucose tolerance test
2. parathyroid hormone
3. thyroxine or tetraiodothyronine
4. fasting blood sugar
5. antidiuretic hormone
6. hemoglobin A_{1c}
7. growth hormone

8. parathyroid hormone
9. ACTH
10. FSH
11. DM
12. CT
13. MSH
14. T₃
15. PRL
16. TSH
17. LH

EXERCISE 9-8 SPELLING

1. d
2. c
3. b
4. a
5. a
6. c
7. d
8. b
9. b
10. d

EXERCISE 9-9 CASE STUDY

1. difficulty speaking
2. goiter, thyromegaly
3. thyroid stimulating hormone

CHAPTER 10

Quick Check

1. arterioles

2. Veins

3. red blood cell

Word Parts Exercise

1. ven/o or phlebo
2. cardi/o
3. angi/o or vas/o
4. endo-
5. tachy-
6. thromb/o
7. peri-
8. ather/o
9. atri/o
10. -gram
11. -emia
12. my/o
13. -stenosis
14. hem/o, hemat/o
15. arteri/o
16. phleb/o or ven/o
17. valv/o, valvul/o
18. aort/o
19. brady-
20. varic/o
21. coron/o
22. -ectasis
23. vas/o or angi/o
24. electr/o
25. ventricul/o

26. isch

EXERCISE 10-1 LABELING

1. superior and inferior vena cava
2. right atrium
3. right AV (tricuspid) valve
4. right ventricle
5. pulmonary valve
6. pulmonary arteries
7. pulmonary veins
8. left atrium
9. left AV (mitral) valve
10. left ventricle
11. aortic valve
12. aorta

EXERCISE 10-2 WORD PARTS

1. erythrocyte
root: erythr/o (red)
suffix: -cyte (cell)
definition: red blood cell
2. atherosclerosis
root: ather/o (fatty)
root: scler/o (hardening)
suffix: -osis (abnormal condition)
definition: hardening and narrowing of the arteries
3. cardiomyopathy
root: cardi/o (heart)
root: my/o (muscle)
suffix: -pathy (disease)

definition: disease of the heart muscle

4. endocarditis

prefix: endo- (within)

root: cardi/o (heart)

suffix: -itis (inflammation)

definition: inflammation of the endocardium

5. thrombocytopenia

root: thromb/o (blood clot)

root: cyt/o (cell)

suffix: -penia (deficiency)

definition: abnormal decrease in the number of thrombocytes

6. angiogram

root: angi/o (blood vessel)

suffix: -gram (record or picture)

definition: printed record of a blood vessel

7. hematology

root: hemat/o (blood)

suffix: -logy (study of)

definition: medical specialty dealing with blood

8. pericardiotomy

prefix: peri- (surrounding)

root: cardi/o (heart)

suffix: -tomy (cutting operation)

definition: incision into the pericardium

EXERCISE 10-3 WORD BUILDING

1. cardiogenic

2. atriotomy

3. erythrocyte

4. hemophilia
5. vasospasm
6. thrombectomy
7. vasodilation
8. cardiomegaly
9. arteriostenosis
10. atheroma
11. leukocyte
12. valvectomy
13. cardiac
14. hemolysis, erythrolysis
15. interventricular
16. anemia
17. myocardium
18. atherectomy
19. arrhythmia

EXERCISE 10-4 MATCHING

1. g
2. i
3. b
4. a
5. f
6. h
7. j
8. c
9. e
10. d

EXERCISE 10-5 MULTIPLE CHOICE

1. b
2. a
3. b
4. b
5. a
6. a
7. b
8. d
9. d
10. d

EXERCISE 10-6 FILL IN THE BLANK

1. hypotension
2. tachycardia
3. hematologist
4. pulmonary
5. O, AB
6. cardiology
7. phlebotomy
8. hyperlipidemia
9. bicuspid
10. superior vena cava, inferior vena cava

EXERCISE 10-7 ABBREVIATIONS

1. blood pressure
2. atrial fibrillation
3. low-density lipoprotein
4. shortness of breath
5. white blood cell
6. atrioventricular

7. coronary artery disease
8. congestive heart failure
9. heart rate
10. hemoglobin
11. myocardial infarction
12. transient ischemic attack
13. Hb
14. A-fib
15. RBC
16. SA
17. CHF
18. ECG or EKG
19. CABG
20. HTN
21. DIC
22. HDL
23. PTCA

EXERCISE 10-8 SPELLING

1. b
2. a
3. c
4. d
5. a
6. b
7. d
8. b
9. c
10. a

EXERCISE 10-9 CASE STUDY

1. pain in the chest due to ischemia
2. shortness of breath
3. high blood pressure
4. electrocardiogram; record of the heart's electrical activity
5. aspirin—anticoagulant effect; antiarrhythmics—decrease abnormal atrial heart beats; diuretics—decrease fluid volume by increasing urination; vasodilators—increase diameter of blood vessels to decrease blood pressure and increase blood flow
6. myocardial infarction or heart attack; lack of blood supply (infarction) to the heart muscle; my/o means “muscle” and cardi/o means “heart”
7. irregular atrial contractions; frequently a rapid irregular rhythm

CHAPTER 11

Quick Check

1. fluid; fats
2. tonsils, lymph nodes, thymus, spleen, appendix, lymphoid nodules of the small intestine (Peyer's patches)
3. antigen

Word Parts Exercise

1. immune system
2. ingest or engulf
3. protection
4. enlargement
5. tonsil
6. spleen
7. without
8. lymph nodes
9. lymph vessels
10. lymph or lymphatic system

11. thymus
12. resembling
13. disease

EXERCISE 11-1 LABELING

1. cervical lymph nodes
2. axillary lymph nodes
3. thymus
4. mediastinal lymph nodes
5. spleen
6. superficial lymphatics of lower limb

EXERCISE 11-2 WORD PARTS

1. lymphocyte
root: lymph/o (lymph)
suffix: -cyte (cell)
definition: white blood cell in the lymphatic system
2. phagocytosis
root: phag/o (ingest or engulf)
root: cyt/o (cell)
suffix: -osis (condition of)
definition: process carried out by white blood cells to ingest and digest solid substances
3. anaphylaxis
prefix: ana- (without)
root: phylaxis (protection)
definition: life-threatening reaction to a foreign substance
4. hemolysis
root: hem/o (blood)
suffix: -lysis (destruction)
definition: destruction of red blood cells

5. lymphoma
root: lymph/o (lymph)
suffix: -oma (tumor)
definition: tumor of lymph tissue
6. splenectomy
root: splen/o (spleen)
suffix: -ectomy (excision)
definition: excision (removal) of the spleen
7. thymectomy
root: thym/o (thymus)
suffix: -ectomy (excision)
definition: excision (removal) of the thymus
8. immunology
root: immun/o (immune system)
suffix: -logy (study of)
definition: study of the immune system

EXERCISE 11-3 WORD BUILDING

1. lymphadenitis
2. lymphoma
3. thymomegaly
4. lymphangitis
5. lymphadenopathy
6. immunologist
7. lymphography
8. phagocytosis

EXERCISE 11-4 MATCHING

1. e
2. f

3. g
4. i
5. a
6. j
7. b
8. d
9. h
10. c

EXERCISE 11-5 MULTIPLE CHOICE

1. b
2. c
3. c
4. a
5. d
6. b
7. c
8. b
9. c
10. d

EXERCISE 11-6 FILL IN THE BLANK

1. lymphocytes
2. maintain fluid balance
3. lymph nodes
4. Innate
5. tonsils
6. lymphedema
7. splenectomy
8. allergist

9. thymus
10. immunodeficiency

EXERCISE 11-7 ABBREVIATIONS

1. systemic lupus erythematosus
2. rheumatoid arthritis
3. Epstein–Barr virus
4. AIDS
5. HIV

EXERCISE 11-8 SPELLING

1. a
2. c
3. c
4. a
5. d
6. b
7. d
8. c
9. b
10. a

EXERCISE 11-9 CASE STUDY

1. disease of the lymph nodes
2. splenomegaly
3. an infectious disease caused by the Epstein–Barr virus

CHAPTER 12

Quick Check

1. larynx
2. trachea
3. pharynx

Word Parts Exercise

1. voice
2. trachea
3. thorax, chest
4. bronchus
5. breathing
6. larynx
7. sinus cavity
8. rib, side, pleura
9. lungs, air
10. nose
11. oxygen
12. pharynx
13. diaphragm
14. lung
15. mouth, opening

EXERCISE 12-1 LABELING

1. paranasal sinuses
2. lungs
3. trachea
4. bronchi
5. alveoli

EXERCISE 12-2 WORD PARTS

1. nasopharynx
root: nas/o (nose)
root: pharyng/o (pharynx)
definition: upper portion of the pharynx
2. pulmonary

root: pulmon/o (lung)

suffix: -ary (related to)

definition: adjective meaning related to the lungs

3. dysphonia

prefix: dys- (painful)

root: phon/o (sound)

suffix: -ia (condition)

definition: condition of painful speech

4. hemoptysis

root: hem/o (blood)

suffix: -ptysis (spitting)

definition: spitting or coughing up blood

5. laryngostenosis

root: laryng/o (larynx)

root: sten/o (narrowing)

suffix: -osis (abnormal condition)

definition: condition of a narrowing of the larynx

6. antipyretic

prefix: anti- (against)

root: pyretos (fever)

suffix: -ic (adjective)

definition: drug used to reduce fever

7. rhinoplasty

root: rhin/o (nose)

suffix: -plasty (surgical repair)

definition: surgical repair of the nose

8. otolaryngologist

root: ot/o (ear)

root: laryng/o (larynx)

suffix: -logist (one who studies)

definition: physician who specializes in ear, nose, and throat diseases

EXERCISE 12-3 WORD BUILDING

1. bronchitis
2. bronchiectasis
3. laryngitis
4. sinusitis
5. epiglottitis
6. tachypnea
7. bradypnea
8. dyspnea
9. orthopnea

EXERCISE 12-4 MATCHING

1. e
2. d
3. c
4. f
5. a
6. g
7. b
8. j
9. k
10. l
11. r
12. n
13. o
14. h

15. m
16. q
17. i
18. p

EXERCISE 12-5 MULTIPLE CHOICE

1. c
2. c
3. b
4. d
5. b
6. b
7. c
8. b
9. b
10. c

EXERCISE 12-6 FILL IN THE BLANK

1. hemoptysis
2. bradypnea
3. pneumocentesis
4. inflammation of the pleura (membrane that surrounds the lungs and lines the walls of the thoracic cavity)
5. pleura
6. orthopnea
7. bronchiectasis
8. rhinorrhea
9. Cheyne–Stokes respirations

EXERCISE 12-7 ABBREVIATIONS

1. chronic obstructive pulmonary disease
2. arterial blood gas

3. total lung capacity
4. cystic fibrosis
5. tonsillectomy and adenoidectomy
6. upper respiratory infection
7. TB
8. O₂
9. CO₂
10. PFT
11. RV
12. SOB

EXERCISE 12-8 SPELLING

1. d
2. b
3. c
4. a
5. a
6. b
7. d
8. c
9. b
10. a

EXERCISE 12-9 CASE STUDY

1. a
2. b

CHAPTER 13

Quick Check

1. bolus
2. The stomach also secretes acid and enzymes to help break down

proteins, fats, and carbohydrates.

3. duodenum, jejunum, ileum

Word Parts Exercise

1. eat or swallow
2. common bile duct
3. mouth
4. sigmoid colon
5. abdomen
6. intestine
7. abdomen
8. rectum
9. stone
10. salivary glands
11. liver
12. pylorus
13. bile, gall
14. bile duct
15. esophagus
16. vomit
17. instrument used for viewing
18. tongue
19. jejunum
20. stomach
21. lip
22. ileum
23. pancreas
24. cheek
25. gallbladder

26. digestion
27. colon
28. teeth
29. eating, swallowing
30. duodenum
31. anus and rectum
32. gums
33. visual examination
34. nutrition

EXERCISE 13-1 LABELING

1. mouth
2. pharynx
3. esophagus
4. liver
5. gallbladder
6. bile duct
7. small intestine
8. large intestine
9. salivary gland
10. stomach
11. pancreas
12. anus

EXERCISE 13-2 WORD PARTS

1. cholelithiasis

root: chol/e (bile, gall)

suffix: -lith (stone)

suffix: -iasis (condition of)

definition: formation or presence of stones in the gallbladder or common bile duct

2. enterohepatitis
root: enter/o (intestine)
root: hepat/o (liver)
suffix: -itis (inflammation)
definition: inflammation of the intestine and liver
3. parotiditis
prefix: para- (beside)
root: ot/o (ear)
suffix: -itis (inflammation)
definition: inflammation of the parotid salivary gland
4. sialorrhea
root: sial/o (saliva, salivary gland)
suffix: -rrhea (discharge)
definition: excessive production of saliva
5. colonoscopy
root: colon/o (colon)
suffix: -scopy (viewing)
definition: visual examination of the colon
6. gastroenterologist
root: gastr/o (stomach)
root: enter/o (intestine)
suffix: -logist (one who studies)
definition: a specialist in the diagnosis and treatment of digestive system disorders
7. colectomy
root: col/o (colon)
suffix: -ectomy (surgical removal)
definition: excision of all or part of the colon
8. jejunotomy

root: jejun/o (jejunum)

suffix: -tomy (incision)

definition: incision into the jejunum

EXERCISE 13-3 WORD BUILDING

1. gastric
2. cholecystopathy
3. gingivitis
4. sialostenosis
5. enteroscope
6. colopexy
7. jejunectomy
8. hepatogenic
9. dysphagia
10. duodenal

EXERCISE 13-4 MATCHING

1. b
2. f
3. i
4. g
5. h
6. d
7. e
8. a
9. c
10. j

EXERCISE 13-5 MULTIPLE CHOICE

1. b
2. c

3. c
4. a
5. c
6. c
7. b
8. d
9. b
10. a

EXERCISE 13-6 FILL IN THE BLANK

1. ileocecal sphincter
2. anus
3. salivary glands
4. gallbladder
5. stomach
6. cholecystitis
7. cholelithiasis
8. antiemetic
9. gastroscope
10. gastrectomy

EXERCISE 13-7 ABBREVIATIONS

1. per os or nothing by mouth
2. upper gastrointestinal series
3. total parenteral nutrition
4. bowel movement
5. gastrointestinal
6. gastroesophageal reflux disease
7. irritable bowel syndrome
8. lower esophageal sphincter

9. HCl
10. NG
11. BE
12. EGD
13. NPO

EXERCISE 13-8 SPELLING

1. a
2. c
3. b
4. b
5. d
6. c
7. c
8. a
9. d
10. b

EXERCISE 13-9 CASE STUDY

1. shortness of breath
2. blood pressure
3. HTN stands for hypertension, which is high blood pressure. Hypertension and shortness of breath may accompany each other. Smoking and excessive caffeine intake may be related to both conditions.
4. white blood cell
5. Endo- means within; -scopy means “look” or “see”. Endoscopy may be defined as looking inside, by means of an instrument called an endoscope.
6. A gastric ulcer is a sore on the lining (mucous membrane) of the stomach.

CHAPTER 14

Quick Check

1. kidneys, ureters, urinary bladder, and urethra
2. hilum
3. internal urethral sphincter and external urethral sphincter

Word Parts Exercise

1. urine
2. night
3. little, few
4. condition, state
5. glomerulus
6. kidney
7. urethra
8. stone
9. much, many
10. pus
11. pelvis
12. ureter
13. bladder

EXERCISE 14-1 LABELING

1. inferior vena cava
2. abdominal aorta
3. urinary bladder
4. urethra
5. kidneys
6. ureters

EXERCISE 14-2 WORD PARTS

1. anuria
prefix: an-, without

root: ur/o, urine
suffix: -ia, condition
definition: absence of urine formation

2. cystalgia

root: cyst/o, bladder
suffix: -algia, pain
definition: pain in the bladder

3. nephrolithiasis

root: nephr/o, kidney
root: lith/o, stone
suffix: -iasis, condition
definition: presence of a kidney stone

4. hematuria

root: hemat/o, blood
root: ur/o, urine
suffix: -ia, condition
definition: blood in the urine

5. glomerulonephritis

root: glomerul/o, glomerulus
root: nephr/o, kidney
suffix: -itis, inflammation
definition: renal disease characterized by inflammation of the glomeruli

6. nephrologist

root: nephr/o, kidney
suffix: -logist, one who studies
definition: a specialist who treats kidney disorders

7. urology

root: ur/o, urine

suffix: -logy, study of

definition: study of the urinary system

8. nephrectomy

root: nephr/o, kidney

suffix: -ectomy, removal

definition: removal of a kidney

EXERCISE 14-3 WORD BUILDING

1. albuminuria
2. nephralgia
3. urethrostenosis
4. uremia
5. lithotripsy
6. urologist
7. nephrology
8. cystectomy
9. cystoscope
10. ureterorrhaphy

EXERCISE 14-4 MATCHING

1. g
2. d
3. k
4. a
5. b
6. j
7. h
8. f
9. e
10. r

11. p
12. m
13. n
14. q
15. l
16. i
17. c
18. o

EXERCISE 14-5 MULTIPLE CHOICE

1. d
2. b
3. d
4. a
5. a
6. c
7. c
8. b
9. b
10. d

EXERCISE 14-6 FILL IN THE BLANK

1. kidney transplant
2. nephropexy
3. nephrolithotomy
4. ureteroplasty
5. cystoscopy
6. Diuretics
7. ureters
8. urea and uric acid

9. dialysis
10. one who studies

EXERCISE 14-7 ABBREVIATIONS

1. urinary tract infection
2. glomerular filtration rate
3. end-stage renal disease
4. blood urea nitrogen
5. chronic renal failure
6. UA
7. KUB
8. ARF
9. IVP
10. CAPD

EXERCISE 14-8 SPELLING

1. a
2. a
3. b
4. d
5. c
6. a
7. c
8. d
9. c
10. d

EXERCISE 14-9 CASE STUDY

1. urologist
2. dysuria
3. hematuria

4. urinalysis
5. KUB
6. calculi
7. urinary bladder
8. UTI
9. calculi
10. antibiotic
11. cystoscopy

CHAPTER 15

Quick Check

1. synthesizing testosterone, producing and storing sperm, and making and releasing fluid from glands that support the sperm
2. lactation
3. gestation

Word Parts Exercise

1. breast
2. sperm
3. uterine tube
4. vessel, vas deferens
5. around
6. ovary, egg-bearing
7. vagina
8. prostate gland
9. amnion
10. birth
11. uterus
12. vulva
13. testes

14. cervix, neck
15. glans penis
16. gonads, sex glands
17. woman, female
18. milk
19. menses, menstruation
20. ovary, egg-bearing

EXERCISE 15-1 LABELING

Male reproductive system

1. prostate
2. ductus deferens or vas deferens
3. penis
4. glans penis
5. foreskin
6. epididymis
7. seminal gland
8. testis
9. scrotum

Female reproductive system

1. uterine tube
2. ovary
3. uterus
4. urinary bladder
5. clitoris
6. labium minus
7. labium majus
8. cervix
9. rectum

10. anus
11. vagina
12. urethra

EXERCISE 15-2 WORD PARTS

1. amenorrhea
prefix: a- (without)
root: men/o (menses)
suffix: -rrhea (flowing, discharge)
definition: absence of menstruation
2. azoospermia
prefix: a- (without)
prefix: zoo- (animal, living being)
root: sperm/o (sperm)
suffix: -ia (condition of)
definition: absence of sperm in the semen
3. dysmenorrhea
prefix: dys- (bad, difficult)
root: men/o (menses)
suffix: -rrhea (flowing, discharge)
definition: painful menstruation
4. menorrhagia
root: men/o (menses)
suffix: -rrhagia (rapid flow of blood)
definition: increased amount and duration of flow
5. prostatitis
root: prostat/o (prostate)
suffix: -itis (inflammation)
definition: inflammation of the prostate

6. hysterotomy
root: hyster/o (uterus)
suffix: -tomy (incision into)
definition: incision of the uterus
7. mastectomy
root: mast/o (breast)
suffix: -ectomy (excision)
definition: removal of a breast
8. neonatology
prefix: neo- (new)
root: nat/o (birth)
suffix: -logy (study of)
definition: medical specialty dealing with newborns

EXERCISE 15-3 WORD BUILDING

1. cystocele
2. hysteralgia
3. mastitis
4. orchioopathy
5. amniocentesis
6. mammography
7. laparoscopy
8. oophorotomy
9. uteropexy
10. gynecologist

EXERCISE 15-4 MATCHING

1. d
2. o
3. e

4. i
5. a
6. g
7. c
8. m
9. b
10. k
11. n
12. f
13. h
14. l
15. j

EXERCISE 15-5 MULTIPLE CHOICE

1. a
2. b
3. a
4. d
5. b
6. b
7. c
8. a
9. d

EXERCISE 15-6 FILL IN THE BLANK

1. sperm
2. oocyte
3. testosterone
4. seminal glands or seminal vesicles
5. endometrium

6. embryo
7. ectopic
8. cervix
9. ova
10. ovaries

EXERCISE 15-7 ABBREVIATIONS

1. benign prostatic hyperplasia
2. gravida
3. human immunodeficiency virus
4. estimated date of delivery
5. cesarean section
6. obstetrics
7. estimated date of confinement
8. sexually transmitted disease
9. gynecology
10. pelvic inflammatory disease
11. herpes simplex virus
12. A
13. STI
14. TURP
15. GC
16. LMP
17. D&C
18. P
19. HPV

EXERCISE 15-8 SPELLING

1. d
2. c

3. a
4. b
5. c
6. a
7. b
8. d
9. b
10. c

EXERCISE 15-9 CASE STUDY

1. Gravida II means that she has had two pregnancies. Para I means that she has had one birth after 20 weeks.
2. An amniocentesis is a transabdominal puncture of the amniotic sac to remove amniotic fluid for testing.
3. Intrauterine means within the uterus.



APPENDIX B

Glossary of Word Parts with Meanings

Word Part	Meaning
ab-	away from, outside of, beyond
abdomin/o	abdomen
-ac	converts a root or noun to an adjective
acous/o, acus/o, acoust/o	hearing
acr/o	extremities
ad-	toward, near to
aden/o	gland
adeno-	glandlike
adren/o	adrenal glands
adrenal/o	adrenal glands
adip/o	fat
-al	adjective suffix
albin/o	white
-algia	pain
aliment/o	nutrition
amni/o	amnion
-amphi	both sides
a-, an-	not; without
-an	converts a root or noun to an adjective
-aneous	converts a root or noun to an adjective
angi/o	blood vessel

ankyl/o	stiff, fused, closed
ante-	before
anter/o	front, anterior
anti-	against, opposed
aort/o	aorta
-ar	converts a root or noun to an adjective
arachn/o	spider
arter/i/o	artery
ather/o	fatty
arthr/o	joint
aspir/o	breathe in
atri/o	atrium
-ary	converts a root or noun to an adjective
audi/o	sound
aur/o	ear
auricul/o	ear
balan/o	glans penis
bi-	two
blephar/o	eyelid
brachi/o	arm
brady-	slow
bronch/o, bronchi/o	bronchus
bucc/o	cheek
calcane/o	calcaneus, heel bone
calc/i	calcium
card/i/o	heart
carp/o	wrist
-cele	protrusion, hernia
-centesis	surgical puncture
cephal/o	head

cerebell/o	cerebellum
cerebr/o	cerebrum; brain
cerv/o, cervic/o	neck, cervix
cheil/o	lip
chol/e, chol/o	bile, gall
cholangi/o	bile duct
cholecyst/o	gallbladder
choledoch/o	common bile duct
chondr/o	cartilage
circum/o	around
cirrh/o	yellow
col/o, colon/o	colon
colp/o	vagina
con-	with
conjunctiv/o	conjunctiva (conjunctivae, plural)
contra-	against
corne/o	horny
coron/o	crown; encircling, such as in the coronary blood vessels encircling the heart
cortic/o	outer layer or covering
cost/o	rib
crani/o	cranium, skull
crin/o	to separate or secrete
cutane/o	skin
cyan/o	blue
cyst/o	bladder
-cyte, cyt/o	cell
dacry/o	tears, lacrimal sac, or lacrimal duct
dactyl/o	finger, toe
de-	without, not
dent/i, dent/o	teeth

derm/o, dermat/o	skin
-desis	surgical binding
di-, dipl-	two, twice
dipl/o	two, double
dia-	across, through
dis-	remove
diverticul/o	diverticulum
dors/o	back
duoden/o	duodenum
-dynia	pain
dys-	painful, bad, difficult
-eal	converts a root or noun to an adjective
ec-, ecto-	outside
-ectomy	surgical removal
-ectasis, -ectasia	expansion or dilation
-edema	excessive fluid
electr/o	electricity
-emesis	vomiting
-emia	blood
en-	inside
encephal/o	brain
endo-	within, inner
endocrin/o	secreting internally
enter/o	intestine
-eous	converts a root or noun to an adjective
epi-	upon, following, or subsequent to
erythr/o	red
esophag/o	esophagus
ex-, exo-	outside
extra-	beyond

fasci/o	fibrous membrane
femur/o	femur, thighbone
fer/o	to carry
fibr/o	fiber
gangli/o	ganglia (<i>ganglion</i> , singular)
ganglion/o	ganglia (<i>ganglion</i> , singular)
gastr/o	stomach
-gen, -genesis	origin, cause, formation
-gen, -genic, -genesis	origin, producing
gen/o	origin, cause, formation
ger/o/onto	old age
gingiv/o	gums
gli/o	glue
glomerul/o	glomerulus
gloss/o	tongue
gluc/o	sugar, glucose, glycogen
glyc/o	sugar, glucose, glycogen
gonad/o	gonads, sex glands
-gram	a recording, usually by an instrument
-graph	the instrument for making a recording
-graphy	act of graphic or pictorial recording
gynec/o	woman, female
hem/a/to	blood
hemi-	half
hem/o	blood
hemat/o	blood
hepat/o	liver
humer/o	humerus, upper arm bone
hydr/o	water
hyper-	above, beyond normal

hypo-	low, below, below normal
hypophys/o	pituitary gland
hyster/o	uterus
-iac	converts a root or noun to an adjective
-ian	specialist
-iasis	a condition or state
-iatic	converts a root or noun to an adjective
-iatics	medical specialty
iatr/o	physician
-iatry	medical specialty
-ic	adjective suffix denoting of: converts a root or noun to an adjective
-ical	converts a root or noun to an adjective
ichthy/o	dry, scaly
-ics	medical specialty
ile/o	ileum
immun/o	immune system
-ine	suffix used in the formation of names of chemical substances
infra-	inside or below
inguin/o	groin
inter-	between
intra-	inside, within
irid/o	iris
-ism	a condition of; a process; or a state of
-ist	specialist in a field of study
-itis	inflammation
jaund/o	yellow
jejun/o	jejunum
kerat/o	the cornea; horny tissue or cells
kine-, kinesi/o	movement
-kinesia	movement

kyph/o	hump
lacrim/o	tear, lacrimal apparatus
lact/o	milk
lapar/o	abdomen
laryng/o	larynx
ligament/o	ligament
-lith	stone, calculus, calcification
lob/o	lobe
-logy	study of
lord/o	swayback, curve
lumb/o	lower back
lymph/o	lymph or lymphatic system
lymphaden/o	lymph nodes
lymphangia/o	lymph vessels
lymphat/o	lymph or lymphatic system
-lysis	disintegration, breaking down
macro-	big
-malacia	softening
mamm/o	breast
-mania	morbid attraction or impulse toward
mast/o	breast
-megaly	enlargement
melan/o	black
meningi/o	membrane
men/o	menses, menstruation
ment/o	referring to the mind
meso-	middle
meta-	beyond
-meter	device for measuring
metr/o	uterus

-metry	act of measuring
micro-	small
-mnnesia	memory
mono-	one
muscul/o	muscle
myc/o	fungus
my/o	muscle
myel/o	spinal cord and medulla oblongata; bone marrow
myring/o	tympanic membrane (eardrum)
nas/o	nose
natal	birth; born
nat/o	birth
neo-	new
nephr/o, ren/o	kidney
neur/o	nerve, nerve tissue
noct/o	night
ocul/o	eye
-oid	resembling or like: converts a root or noun to an adjective
olig-, oligo-	little, few
-oma	tumor
onych/o	nail
oophor/o	ovary, egg-bearing
ophthalm/o	eye
-opia	vision
-opsy	examination
opt/o	light, eye, vision
orch/o, orchi/o, orchid/o	testes
or/o	mouth, opening
-orth/o	correct, straight
-osis	abnormal condition

oste/o	bone
-otic	converts a root or noun to an adjective
ot/o	ear
-ous	converts a root or noun to an adjective
ovari/o	ovary, egg-bearing
-oxia	oxygen
pan-	all or everywhere
pancreat/o	pancreas
para-	alongside, near
parathyr/o	parathyroid gland
parathyroid/o	parathyroid gland
-paresis	partial or incomplete paralysis
path/o	disease
-pathy	disease
ped/ia	child
ped/o	foot, child
pelv/o	pelvis
-penia	reduction of size or quantity
-pepsia	digestion
peri-	around, surrounding
-pexy	surgical fixation
phac/o	lens
phag/o	eating, swallowing
-phagia	eat or swallow
phalang/o	bones of fingers and toes
pharyng/o	pharynx
-phasia	speech
phleb/o	vein
-phobia	fear
-phonia	voice

phren/o	diaphragm
-phylaxis	protection
-physis	growth
pil/o	hair
-plasia	abnormal formation
-plasty	surgical repair
-plegia	paralysis
pleur/o	rib, side, pleura
-pnea	breathing
pneumo-, pneumon/o	lungs, air
-poesis	producing
poly-	many
-porosis	porous condition
post-	after
poster/o	posterior, back
pre-	before
presby/o	old age
proct/o	anus and rectum
prostat/o	prostate gland
proxim/o	near
-ptosis	downward displacement
psych/o	mind
pulmon/o	lung
pupil/o	pupil
pyel/o	pelvis
pylor/o	pylorus
py/o	pus
quadri-	four
rect/o	rectum
retin/o	retina

retro-	backward, behind
rhin/o	nose
-rrhage	flowing forth
-rrhapy	suture
-rrhea	discharge
-rrhexis	rupture
salping/o	tube, uterine tube
schiz/o	to split
scler/o	hard; relating to the sclera
-sclerosis	hardness
-scope	viewing; an instrument used for viewing
-scopy	act of viewing, to visually examine
seb/o	sebum
semi-	half, partial
sial/o	salivary glands
sigmoid/o	sigmoid colon
sinus/o	sinus cavity
skelet/o	skeleton
-spasm	muscular contraction
sperm/o, spermat/o	sperm
spin/o	spine
splen/o	spleen
spondyl/o	vertebrae
staped/o	stapes (smallest ear bone)
-stasis	level; unchanging
-stenosis	a narrowing
sthen/o	strength
stomat/o	mouth
-stomy	artificial or surgical opening
sub-	below

sudor-	sweat
super/o	superior
sym-	with
syn-	with, joined together
tachy-	rapid
tend/o, tendin/o	tendon
tetra-	four
thorac/o, thorac/i, thoracic/o	thorax, chest
thromb/o	clot
thym/o	thymus
thyr/o	thyroid gland
thyroid/o	thyroid gland
-tic	converts a root or noun to an adjective
-tome	instrument for cutting
-tomy	incision
ton/o	tone
tonsill/o	tonsil
trache/o	trachea
trans-	across
tri-	three
-tripsy	crushing
-tropin	suffix meaning nourishment or stimulation
tympan/o	eardrum
-ular	converts a root or noun to an adjective
uni-	one
ur/o, urin/o	urine
ureter/o	ureter
urethr/o	urethra
uter/o	uterus
uve/o	denoting the pigmented middle eye layer

vagin/o	vagina
valv/o	valve
varic/o	dilated
vas/o	vessel, vas deferens
ven/o	vein
ventricul/o	ventricle
vertebr/o	vertebrae
vulv/o	vulva
xanth/o	yellow
xer/o	dry
zygo-	joined (yoked) together



APPENDIX C

Glossary of Abbreviations

Abbreviation Meaning

A	abortus
ABG	arterial blood gas
ACL	anterior cruciate ligament
ACTH	adrenocorticotropic hormone
AD	Alzheimer's disease
AD	right ear
ADH	antidiuretic hormone
A-fib	atrial fibrillation
AIDS	acquired immunodeficiency syndrome
ALS	amyotrophic lateral sclerosis
ARF	acute renal failure
AS	left ear
AU	both ears
AV	atrioventricular
BE	barium enema
BM	bowel movement
BP	blood pressure
BPH	benign prostatic hyperplasia
BSA	body surface area
BUN	blood urea nitrogen
C (C1–C7)	cervical

CABG	coronary artery bypass graft
CAD	coronary artery disease
CAPD	continuous ambulatory peritoneal dialysis
CCU	cardiac care unit
CF	cystic fibrosis
CHF	congestive heart failure
CNS	central nervous system
c/o	complains of
CO₂	carbon dioxide
COPD	chronic obstructive pulmonary disease
CRF	chronic renal failure
CS	cesarean section
C-section	cesarean section
CSF	cerebrospinal fluid
CT	calcitonin
CT	computer tomography
CVA	cerebrovascular accident
CXA	chest X-ray
D&C	dilation and curettage
DIC	disseminated intravascular coagulation
DM	diabetes mellitus
EBV	Epstein–Barr virus
ECG	electrocardiogram, electrocardiograph, electrocardiography, or cardiogram
ECT	electroconvulsive therapy
EDC	estimated date of confinement (due date)
EDD	estimated date of delivery (due date)
EEG	electroencephalography
EGD	esophagogastroduode- noscopy
EKG	electrocardiogram, electrocardiograph, electrocardiography, or cardiogram
EMG	electromyography

EOM	extra-ocular movement
ERV	expiratory reserve volume
ESRD	end-stage renal disease
F	Fahrenheit
FBS	fasting blood sugar
FSH	follicle-stimulating hormone
Fx	fracture
G	gravida
GC	gonorrhea
GERD	gastroesophageal reflux disease
GFR	glomerular filtration rate
GH	growth hormone
GI	gastrointestinal
GTT	glucose tolerance test
GYN	gynecology
Hb	hemoglobin (protein in the blood that carries oxygen)
HbA_{1c}	hemoglobin A _{1c} (glycosylated hemoglobin)
HCl	hydrochloric acid
HDL	high-density lipoprotein
HIV	human immunodeficiency virus
HPV	human papillomavirus
HR	heart rate
HSV	herpes simplex virus
HTN	hypertension
IBS	irritable bowel syndrome
ICP	intracranial pressure
ICU	intensive care unit
IM	intramuscular
IOP	intra-ocular pressure
IRV	inspiratory reserve volume

IVP	intravenous pyelogram
I&D	incision and drainage
KUB	kidneys, ureter, and bladder
L (L1–L5)	lumbar
LASIK	laser-assister in situ keratomileusis
LES	lower esophageal sphincter
LDL	low-density lipoprotein
LH	luteinizing hormone
LLQ	left lower quadrant (of abdomen)
LMP	last menstrual period
LP	lumbar puncture
LUQ	left upper quadrant (of abdomen)
MD	muscular dystrophy
MG	myasthenia gravis
MI	myocardial infarction
MRI	magnetic resonance imaging
MS	multiple sclerosis
MSH	melanocyte-stimulating hormone
NG	nasogastric
NPO	nothing by mouth
NSAID	nonsteroidal anti-inflammatory drug
O₂	oxygen
OB	obstetrics
OCD	obsessive-compulsive disorder
OD	right eye
O.D.	doctor of optometry
OM	otitis media
OS	left eye
OU	both eyes
P	para

P	pulse
Pap smear	Papanicolaou smear
PID	pelvic inflammatory disease
PD	Parkinson's disease
PFT	pulmonary function test
PNS	peripheral nervous system
PO	per os or by mouth
PRL	prolactin
PT	physical therapy
PTCA	percutaneous transluminal coronary angioplasty
PTH	parathyroid hormone
PTSD	posttraumatic stress disorder
R	respiration
RA	rheumatoid arthritis
RBC	red blood cell
Rh¹, Rh²	symbol for Rh blood group; Rh positive, Rh negative
RICE	rest, ice, compression, elevation
RLQ	right lower quadrant (of abdomen)
ROM	range of motion
RUQ	right upper quadrant (of abdomen)
RV	residual volume (as measured with test equipment)
S	sacral
SA	sinoatrial
SLE	systemic lupus erythematosus
SOB	shortness of breath
STD	sexually transmitted disease
STI	sexually transmitted infection
T	temperature
T (T1–T12)	thoracic
T₃	triiodothyronine

T4	thyroxine tetraiodothyronine
T and A	tonsillectomy and adenoidectomy
TB	tuberculosis
THR	total hip replacement
TIA	transient ischemic attack
TKA	total knee arthroplasty
TKR	total knee replacement
TLC	total lung capacity
TPN	total parenteral nutrition
TURP	transurethral resection of the prostate
UA	urinalysis
UGIS	upper gastrointestinal series
URI	upper respiratory infection
UTI	urinary tract infection
UV	ultraviolet
VC	vital capacity
WBC	white blood cell



APPENDIX D

Error-Prone Abbreviations, Designations Symbols, and Dose

This list is a comprehensive list assembled from the Institute for Safe Medication Practices (ISMP), a nonprofit organization whose mission is to educate consumers and the healthcare community about safe medication practices.

The abbreviations, symbols, and dose designations found in this table have been reported to ISMP through the ISMP National Medication Errors Reporting Program (ISMP MERP) as being frequently misinterpreted and involved in harmful medication errors. They should NEVER be used when communicating medical information. This includes internal communications, telephone/verbal prescriptions, computer-generated labels, labels for drug storage bins, medication administration records, as well as pharmacy and prescriber computer order entry screens.

ABBREVIATIONS	INTENDED MEANING	MISINTERPRETATION	CORRECTION
µg	Microgram	Mistaken as “mg”	Use “mcg”
AD, AS, AU	Right ear, left ear, each ear	Mistaken as OD, OS, OU (right eye, left eye, each eye)	Use “right ear,” “left ear,” or “each ear”
OD, OS, OU	Right eye, left eye, each eye	Mistaken as AD, AS, AU (right ear, left ear, each ear)	Use “right eye,” “left eye,” or “each eye”
BT	Bedtime	Mistaken as “BID” (twice daily)	Use “bedtime”

cc	Cubic centimeters	Mistaken as “u” (units)	Use “mL”
D/C	Discharge or discontinue	Premature discontinuation of medications if D/C (intended to mean “discharge”) has been misinterpreted as “discontinued” when followed by a list of discharge medications	Use “discharge” and “discontinue”
IJ	Injection	Mistaken as “IV” or “intrajugular”	Use “injection”
IN	Intranasal	Mistaken as “IM” or “IV”	Use “intranasal” or “NAS”
HS hs	Half-strength At bedtime, hours of sleep	Mistaken as bedtime Mistaken as half-strength	Use “half-strength” or “bedtime”
IU**	International unit	Mistaken as IV (intravenous) or 10 (ten)	Use “units”
o.d. or OD	Once daily	Mistaken as “right eye” (OD-oculus dexter), leading to oral liquid medications administered in the eye	Use “daily”
OJ	Orange juice	Mistaken as OD or OS (right or left eye); drugs meant to be diluted in orange juice may be given in the eye	Use “orange juice”
Per os	By mouth, orally	The “os” can be mistaken as “left eye” (OS-oculus sinister)	Use “PO,” “by mouth,” or “orally”
q.d. or QD**	Every day	Mistaken as q.i.d., especially if the period after the “q” or the tail of the “q” is misunderstood as an “i”	Use “daily”

qhs	Nightly at bedtime	Mistaken as “qhr” or every hour	Use “nightly”
qn	Nightly or at bedtime	Mistaken as “qh” (every hour)	Use “nightly” or “at bedtime”
q.o.d. or QOD**	Every other day	Mistaken as “q.d.” (daily) or “q.i.d. (four times daily) if the “o” is poorly written	Use “every other day”
q1d	Daily	Mistaken as q.i.d. (four times daily)	Use “daily”
q6PM, etc.	Every evening at 6 PM	Mistaken as every 6 hours	Use “daily at 6 PM” or “6 PM daily”
SC, SQ, sub q	Subcutaneous	SC mistaken as SL (sublingual); SQ mistaken as “5 every;” the “q” in “sub q” has been mistaken as “every” (e.g., a heparin dose ordered “sub q 2 hours before surgery” misunderstood as every 2 hours before surgery)	Use “subcut” or “subcutaneously”
ss	Sliding scale (insulin) or ½ (apothecary)	Mistaken as “55”	Spell out “sliding scale;” use “one-half” or “½”
SSRI	Sliding scale regular insulin	Mistaken as selective-serotonin reuptake inhibitor	Spell out “sliding scale (insulin)”
SSI	Sliding scale insulin	Mistaken as Strong Solution of Iodine (Lugol’s)	
i/d	One daily	Mistaken as “tid”	Use “1 daily”
TIW or tiw	3 times a week	Mistaken as “3 times a day” or “twice in a week” Mistaken as the number 0 or 4, causing a 10-fold overdose	Use “3 times weekly”

U or u**	Unit	or greater (e.g., 4U seen as “40” or 4u seen as “44”); mistaken as “cc” so dose given in volume instead of units (e.g., 4u seen as 4cc)	Use “unit”
UD	As directed (“ut dictum”)	Mistaken as unit dose (e.g., diltiazem 125 mg IV infusion “UD” misinterpreted as meaning to give the entire infusion as a unit [bolus] dose)	Use “as directed”

Dose Designations and Other Information	Intended Meaning	Misinterpretation	Correction
---	------------------	-------------------	------------

Trailing zero after decimal point (e.g., 1.0 mg)**	1 mg	Mistaken as 10 mg if the decimal point is not seen	Do not use trailing zeros for doses expressed in whole numbers
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“Naked” decimal point (e.g., .5 mg)**	0.5 mg	Mistaken as 5 mg if the decimal point is not seen	Use zero before a decimal point when the dose is less than a whole unit
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Abbreviations such as mg. or mL. with a period following the abbreviation	mg mL	The period is unnecessary and could be mistaken as the number 1 if written poorly	Use mg, mL, etc. without a terminal period
--	----------	---	--

Dose Designations and Other Information	Intended Meaning	Misinterpretation	Correction
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Drug name and dose run together (especially problematic for drug names that end in “1”)	Inderal 40 mg Tegretol 300 mg	Mistaken as Inderal 140 mg Mistaken as	Place adequate space between the drug name,
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such as Inderal40 mg;
Tegretol300 mg)

Tegretol 1300 mg

dose, and
unit of
measure

Numerical dose and unit
of measure run
together (e.g., 10mg,
100mL)

10 mg 100 mL

The “m” is sometimes
mistaken as a zero
or two zeros,
risking a 10-to 100-
fold overdose

Place
adequate
space
between the
dose and
unit of
measure

Large doses without
properly placed
commas (e.g., 100000
units; 1000000 units)

100,000 units
1,000,000 units

100000 has been
mistaken as 10,000
or 1,000,000;
1000000 has been
mistaken as
100,000

Use commas
for dosing
units at or
above
1,000, or
use words
such as 100
thousand”
or 1
“million” to
improve
readability”

Drug Name Abbreviations	Intended Meaning	Misinterpretation	Correction
APAP	acetaminophen	Not recognized as acetaminophen	Use complete drug name
ARA A	vidarabine	Mistaken as cytarabine (ARA C)	Use complete drug name
AZT	zidovudine (Retrovir)	Mistaken as azathioprine or aztreonam	Use complete drug name
CPZ	Compazine (prochlorperazine)	Mistaken as chlorpromazine	Use complete drug name
DPT	Demerol-Phenergan-Thorazine	Mistaken as diphtheria-pertussis-tetanus (vaccine)	Use complete drug name
	Diluted tincture of		

DTO	opium, or deodorized tincture of opium (Paregoric)	Mistaken as tincture of opium	Use complete drug name
HCl	hydrochloric acid or hydrochloride	Mistaken as potassium chloride (The "H" is misinterpreted as "K")	Use complete drug name unless expressed as a salt of a drug
HCT	hydrocortisone	Mistaken as hydrochlorothiazide	Use complete drug name
HCTZ	hydrochlorothiazide	Mistaken as hydrocortisone (seen as HCT250 mg)	Use complete drug name
MgSO4**	magnesium sulfate	Mistaken as morphine sulfate	Use complete drug name
MS, MSO4**	morphine sulfate	Mistaken as magnesium sulfate	Use complete drug name
MTX	methotrexate	Mistaken as mitoxantrone	Use complete drug name
NoAC	novel/new oral anticoagulant	No anticoagulant	Use complete drug name
PCA	procainamide	Mistaken as patient controlled analgesia	Use complete drug name
PTU	propylthiouracil	Mistaken as mercaptopurine	Use complete drug name
T3	Tylenol with codeine No. 3	Mistaken as liothyronine	Use complete drug name
TAC	triamcinolone	Mistaken as tetracaine, Adrenalin, cocaine	Use complete drug name

TNK	TNKase	Mistaken as “TPA”	Use complete drug name
TPA or tPA	tissue plasminogen activator, Activase (alteplase)	Mistaken as TNKase (tenecteplase), or less often as another tissue plasminogen activator, Retavase (retaplast)	Use complete drug names
ZnSO4	zinc sulfate	Mistaken as morphine sulfate	Use complete drug name

Stemmed Drug Names	Intended Meaning	Misinterpretation	Correction
--------------------	------------------	-------------------	------------

“Nitro” drip	nitroglycerin infusion	Mistaken as sodium nitroprusside infusion	Use complete drug name
“Norflox”	norfloxacin	Mistaken as Norflex	Use complete drug name
“IV Vanc”	intravenous vancomycin	Mistaken as Invanz	Use complete drug name

Symbols	Intended Meaning	Misinterpretation	Correction
---------	------------------	-------------------	------------

3	Dram	Symbol for dram mistaken as “3”	Use the metric system
m̄	Minim	Symbol for minim mistaken as “mL”	

Symbols	Intended Meaning	Misinterpretation	Correction
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×3d	For three days	Mistaken as “3 doses”	Use “for three days”
> and <	More than and less than	Mistaken as opposite of intended; mistakenly use incorrect symbol; “< 10” mistaken as “40”	Use “more than” or “less than”
		Mistaken as the	Use “per”

/ (slash mark)	Separates two doses or indicates “per”	number 1 (e.g., “25 units/10 units” misread as “25 units and 110” units)	rather than a slash mark to separate doses
@	At	Mistaken as “2”	Use “at”
&	And	Mistaken as “2”	Use “and”
+	Plus or and	Mistaken as “4”	Use “and”
o	Hour	Mistaken as a zero (e.g., q2? seen as q 20)	Use “hr,” “h,” or “hour”
ϕ or ∅	zero, null sign	Mistaken as numerals 4, 6, 8, and 9	Use 0 or zero, or describe intent using whole words

**These abbreviations are included on The Joint Commission’s “minimum list” of dangerous abbreviations, acronyms, and symbols that must be included on an organization’s

“Do Not Use” list, effective January 1, 2004. Visit www.jointcommission.org for more information about this Joint Commission requirement.

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APPENDIX E

Top 100 Prescribed Medications

About the Top 100 Commonly Prescribed Medications. This list has been selected to be representative of the most commonly prescribed drugs for the year 2016 (see references). The list is arranged starting with the most prescribed prescription medication. It includes the brand name, generic name, and the drug's general class. Combination products have their individual ingredients listed.

	BRAND NAME	GENERIC NAME	CLASS
1	Norco	hydrocodone and acetaminophen	opioid analgesic
2	Prinivil, Zestril	lisinopril	antihypertensive
3	Synthroid	levothyroxine	thyroid hormone
4	Norvasc	amlodipine	antihypertensive
5	Lipitor	atorvastatin	antihyperlipidemic
6	Prilosec	omeprazole	proton pump inhibitor
7	Zocor	simvastatin	antihyperlipidemic
8	Glucophage	metformin	antidiabetic
9	Amoxil	amoxicillin	antibiotic
10	Zithromax	azithromycin	antibiotic
11	Xanax	alprazolam	benzodiazepine

12	Microzide	hydrochlorothiazide	antihypertensive
13	Neurontin	gabapentin	anticonvulsant
14	Flonase	fluticasone propionate	nasal corticosteroid
15	Ultram	tramadol	opioid analgesic
16	Motrin	ibuprofen	nonsteroidal anti-inflammatory
17	Zoloft	sertraline	antidepressant
18	Deltasone	prednisone	steroid
19	Lopressor	metoprolol tartrate	antihypertensive
20	Toprol XL	metoprolol succinate	antihypertensive
21	Cozaar	losartan	antihypertensive
22	Lasix	furosemide	antihypertensive
23	Ambien	zolpidem	hypnotic
24	Celexa	citalopram	antidepressant
25	Percocet	oxycodone and acetaminophen	opioid analgesic
26	Pravachol	pravastatin	antihyperlipidemic
27	Singulair	montelukast	leukotriene receptor antagonist
28	ProAir HFA, Ventolin HFA	albuterol	inhaled beta-2 agonist
29	Flexeril	cyclobenzaprine	skeletal muscle relaxant
30	Klonopin	clonazepam	benzodiazepine
31	Prozac	fluoxetine	antidepressant
32	Prinizide, Zestoretic	lisinopril and hydrochlorothiazide	antihypertensive

33	Tenormin	atenolol	antihypertensive
34	Protonix	pantoprazole	proton pump inhibitor
35	Mobic	meloxicam	nonsteroidal anti-inflammatory
36	Lexapro	escitalopram	antidepressant
37	Desyrel	trazodone	antidepressant
38	Augmentin	amoxicillin and clavulanate	antibiotic
39	Ativan	lorazepam	benzodiazepine
40	Cipro	ciprofloxacin	antibiotic
41	K-Dur, Klor-Con	potassium chloride	salt; treats hypokalemia
42	Coreg	carvedilol	antihypertensive
43	Keflex	cephalexin	antibiotic
44	Plavix	clopidogrel	anti-platelet
45	Bactrim	sulfamethoxazole and trimethoprim	antibiotic
46	Coumadin	warfarin	anticoagulant
47	Crestor	rosuvastatin	antihyperlipidemic
48	Flomax	tamsulosin	alpha-1 blocker
49	Zantac	ranitidine	H ₂ antagonist
50	Naprosyn	naproxen	nonsteroidal anti-inflammatory
51	Diflucan	fluconazole	antifungal
52	Cymbalta	duloxetine	antidepressant
53	Roxicodone	oxycodone	opioid analgesic
54	Wellbutrin XL	bupropion XL	antidepressant

55	Effexor XR	venlafaxine ER	antidepressant
56	Zyloprim	allopurinol	antigout
57	Medrol	methylprednisolone	corticosteroid
58	Adderall	amphetamine salts IR	stimulant
59	Zofran	ondansetron	antiemetic
60	Kenalog	triamcinolone	topical corticosteroid
61	Nexium	esomeprazole	proton pump inhibitor
62	Hyzaar	losartan and hydrochlorothiazide	antihypertensive
63	Valium	diazepam	benzodiazepine
64	Ergocalciferol	vitamin D ₂	vitamin
65	Elavil	amitriptyline	antidepressant
66	Paxil	paroxetine	antidepressant
67	Catapres	clonidine	antihypertensive
68	Tricor	fenofibrate	antihyperlipidemic
69	Glucophage XR	metformin XR	antidiabetic
70	Advair Diskus	fluticasone/salmeterol	inhaled beta-2 agonist/corticosteroid
71	Fluvirin, Afluria, Fluzone	influenza vaccine	vaccine
72	Vibramycin	doxycycline	antibiotic
73	Amaryl	glimepiride	antidiabetic
74	Aldactone	spironolactone	antihypertensive
75	Maxzide, Dyazide	triamterene and hydrochlorothiazide	antihypertensive

76	Levaquin	levofloxacin	antibiotic
77	Valtrex	valacyclovir	antiviral
78	Tylenol #2, #3, #4	acetaminophen and codeine	opioid analgesic
79	Lamictal	lamotrigine	anticonvulsant
80	Topamax	topiramate	anticonvulsant
81	Mevacor	lovastatin	antihyperlipidemic
82	Seroquel	quetiapine	antipsychotic
83	Flagyl	metronidazole	antibiotic
84	Vyvanse	lisdexamfetamine	stimulant
85	Phenergan	promethazine	antiemetic
86	none	folic acid	vitamin
87	Fosamax	alendronate	bisphosphonate
88	Glucotrol	glipizide	antidiabetic
89	Lantus Solostar	insulin glargine	long acting insulin
90	Cleocin	clindamycin	antibiotic
91	Xalatan	latanoprost	ophthalmic antiglaucoma
92	Concerta	methylphenidate ER	stimulant
93	Vasotec	enalapril	antihypertensive
94	Lyrica	pregabalin	anticonvulsant
95	Tessalon Perles	benzonatate	antitussive
96	Inderal	propranolol	antihypertensive
97	Omnicef	cefdinir	antibiotic
98	MS Contin	morphine	opioid analgesic
99	Adderall XR	amphetamine salts ER	stimulant

100 Imitrex

sumatriptan

antimigraine

ER: extended release

IR: immediate release

XL: extended release

XR: extended release

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