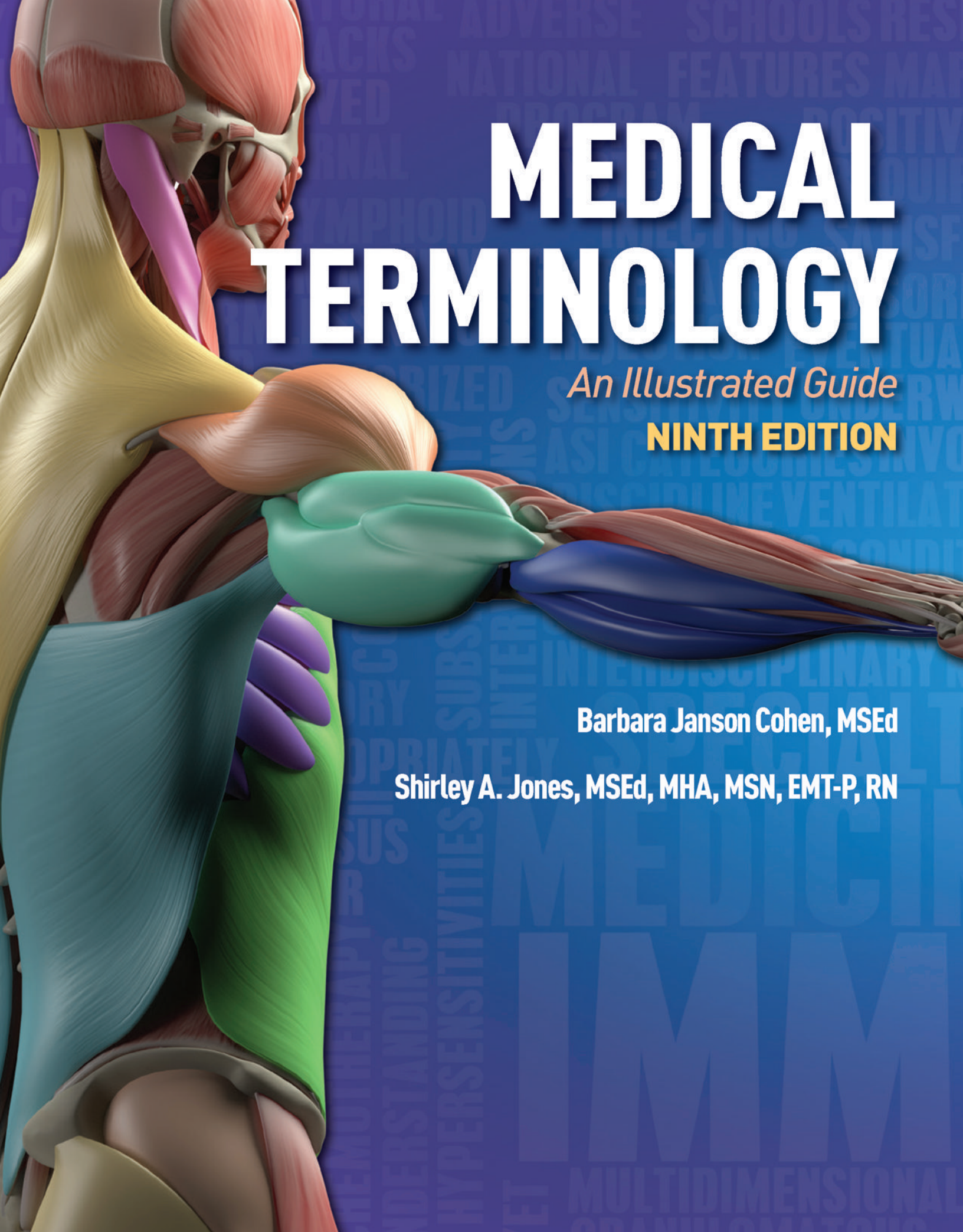


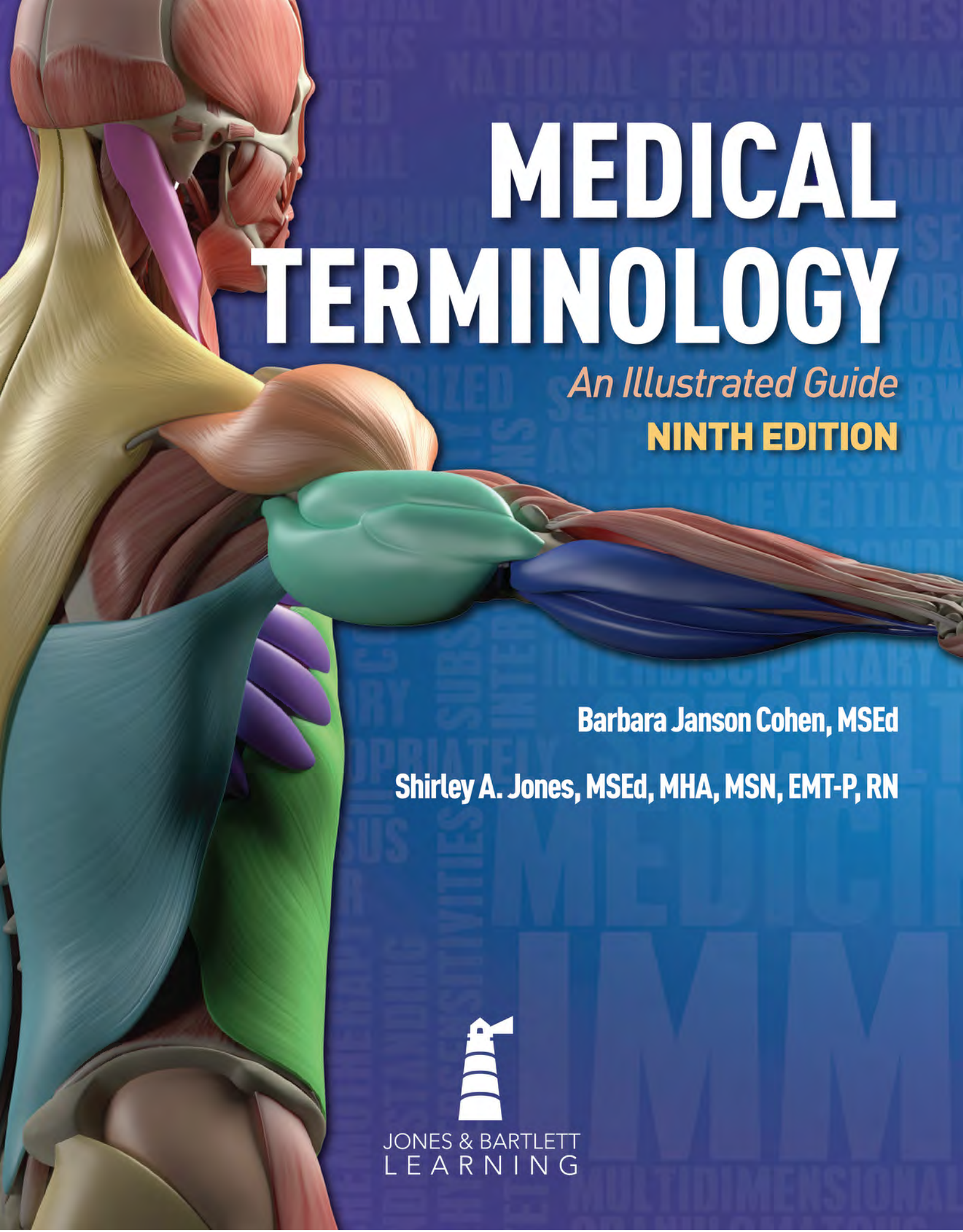
MEDICAL TERMINOLOGY

An Illustrated Guide

NINTH EDITION

Barbara Janson Cohen, MSEd

Shirley A. Jones, MSEd, MHA, MSN, EMT-P, RN



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For their ongoing, wholehearted love and support, I dedicate this ninth edition of *Medical Terminology: An Illustrated Guide* to my children, Jocelyn Hooven and Saul Janson.

—Barbara Janson Cohen

I dedicate this book to my parents Vivian and George Jones, to my sister Virginia E. Kelleher, and to Francis, who are all heroes in my life.

—Shirley A. Jones

Brief Contents

Contents

Appendices:

Preface

Knowledge of medical terminology is fundamental to a wide variety of healthcare fields. This text is designed to satisfy the basic learning requirements needed to practice in any health career setting. In the course of your training and future careers, you will need to learn thousands of new terms. The job might be overwhelming if not for learning the skills of dividing the words into their component parts. These roots, suffixes, and prefixes appear over and over in different terms but retain the same meanings. Knowing these meanings will help you define and remember a host of words. This process is like using a set of building blocks to assemble different structures. Using a more scientific example, it is like using the four bases in DNA to code for all the amino acids needed to make proteins.

The text opens with a general introduction to word parts and the human body as a whole, followed by an overview of diseases and treatments. Each subsequent chapter on the individual body systems begins with an illustrated overview of the system with definitions of key terms relevant to that system. Tables of word parts and exercises on using them follow. Turning to the abnormal, a section on diseases and treatments is included, followed by definitions of related key terms. The section of enrichment terms includes words and phrases that are "good to know" if time allows or if someone is particularly interested in that specialty. The sequence of the systems chapters follows the same order as that found in traditional anatomy and physiology books. Thus this text easily can be used simultaneously with study of A & P. We have tried to make this text easy to use and full of reinforcing drills. We have also included many phonetic pronunciations so you can recognize technical terms when they are spoken and can comfortably use them yourself. Each chapter is enlivened with a short opening case study. These may have some words and abbreviations that are unfamiliar to you, especially at the start of the text. They are included to spark your interest in the chapter material, and give you a sense of medical situations and language. Don't be concerned if you don't understand them completely. Return to them after you study the chapter, or even later chapters, and see if they are more understandable.

You are probably at the beginning of a long journey to gain accomplishment in your chosen field. We hope that this text will aid you in that endeavor and provide a basis on which to build your career.

—Barbara Janson Cohen
and Shirley A. Jones

Acknowledgments

In our constant quest to improve the quality of *Medical Terminology: An Illustrated Guide*, we rely on the advice and talents of many people. First, we want to acknowledge the observant instructors and students who take the time to suggest improvements in the text. Also we thank the reviewers, who make many valuable suggestions for revisions. As always, we are grateful to the dedicated publishing staff; especially for this edition, Jonathan Joyce, Michael Kerns, Julie Vitale, Jeremiah Kiely, Cody Adams, Leo Gray, and Jennifer Clements.

—Barbara Janson Cohen
and Shirley A. Jones

Reviewers

Cynthia Bowers, MS
Adjunct Instructor
Department of Allied Health
City College of Montana State University-Billings
Billings, Montana

Gerard Cronin, MS
Associate Professor
Department of Health Sciences
Salem Community College
Salem County, New Jersey

Dr. Abbey Dondanville, EdD, LAT
Associate Dean
Department of Health Sciences
Piedmont College
Demorest, Georgia

Robin Gardenhire, MSEd
Clinical Instructor
Department of Respiratory Therapy
Georgia State University
Atlanta, Georgia

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Department of Medical Laboratory Sciences
Andrews University
Berrien Springs, Michigan

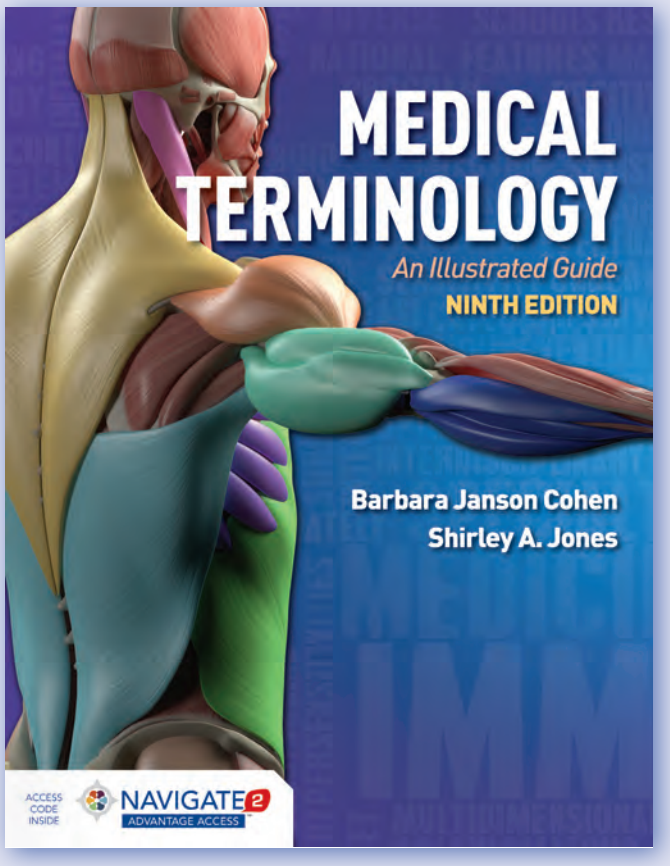
Melissa Reed, PhD
Associate Professor
Assistant Chair
Exercise Science Division
West Chester University
West Chester, Pennsylvania

Tasha Simpson
Assistant Professor
Department of Medical Laboratory Sciences
Andrews University
Berrien Springs, Michigan

Dr. Chanadra Young Whiting, EdD, MPH/HSA
Clinical Assistant Professor
Health Services Administration
Florida International University
Miami, Florida

User's Guide

Medical Terminology: An Illustrated Guide, Ninth Edition was created and developed to help you master the language of medicine. The tools and features in the text will help you work through the material presented. Please take a few moments to look through this User's Guide, which will introduce you to the features that will enhance your learning experience.



Learning Objectives

After careful study of this chapter, you should be able to:

1. Compare the location and function of smooth, cardiac, and skeletal muscles. *P190*
2. Describe the typical structure of a skeletal muscle. *P190*
3. Briefly describe the mechanism of muscle contraction. *P190*
4. Explain how muscles work together to produce movement. *P191*
5. Describe the main types of movements produced by muscles. *P192*
6. List some of the criteria for naming muscles, and give examples of each. *P192*
7. Identify and use the roots pertaining to the muscular system. *P197*
8. Describe at least seven disorders that affect muscles. *P198*
9. Interpret abbreviations pertaining to muscles. *P204*
10. Analyze several case studies involving muscles. *PP189, 212*

Case Study: Thomas s Brachial Plexus Injury

Chief Complaint
Thomas, a 16 y/o high school student, had a severe lacrosse accident that resulted in a flail arm. He had sustained right brachial plexus injury and had no recovery. He has continued to take medication for neurologic pain. He was scheduled to see his orthopedic surgeon for a possible brachial plexus exploration.

Examination
The orthopedic surgeon examined Thomas and noted that there had not been any change in his condition since the previous visit. Thomas still had no feeling or motion in his right shoulder or arm. He had atrophy over the supraspinatus and infraspinatus muscles and also subluxation of his shoulder and deltoid atrophy. He had no active motion of the right upper extremity and no sensation. The rest of his orthopedic exam showed full ROM of his hips, knees, and ankles with intact sensation and palpable distal pulses as well as normal motor function. He was diagnosed with a possible middle trunk brachial plexus injury from C7.

Clinical Course
Thomas and his parents had previous discussions with the surgeon and were aware of the prognosis and treatment plan. With middle trunk brachial plexus injury, damage to the subscapular nerve will interrupt conduction to the subscapularis and teres major muscles. Damage to the long thoracic nerve prevents conduction to the serratus anterior muscles. Injury to the pectoral nerves affects the pectoralis major and minor muscles.

Thomas was scheduled for an EMG, nerve conduction studies, and somatosensory evoked potentials (SSEPs). His diaphragm was examined under fluo oscopy to R/O phrenic nerve injury. The results of the diagnostic studies indicated that Thomas had most likely sustained a middle trunk brachial plexus injury. Thomas was scheduled for a brachial plexus exploration with possible bilateral sural (calf) nerve graft, nerve transfer, or gracilis muscle graft from his right thigh.

Case Study Revisited: Once you complete this chapter, please review the case follow-up on p. 205.

Ancillaries *At-A-Glance*

Visit the web resource to access the following resources.

Learning Resources

- eBook
- A&P Module with Heart & Lung Sounds
- Image bank
- TestPrep
- Animations
- Audio Pronunciation Glossary

Chapter Contents, Objectives, and Pretests

Chapter Opening Case Studies and Objectives help you identify learning goals and familiarize yourself with the materials covered in the chapter. Chapter Pretests quiz students on previous knowledge at the beginning of each chapter. Students should take each Chapter Pretest before starting the chapter and again after completing the chapter in order to measure progress.

Detailed Illustrations

Detailed, full-color drawings and photographs illuminate the chapters. These include clinical photographs and tissue micrographs. The many figures amplify and clarify the text and are particularly helpful for visual learners.

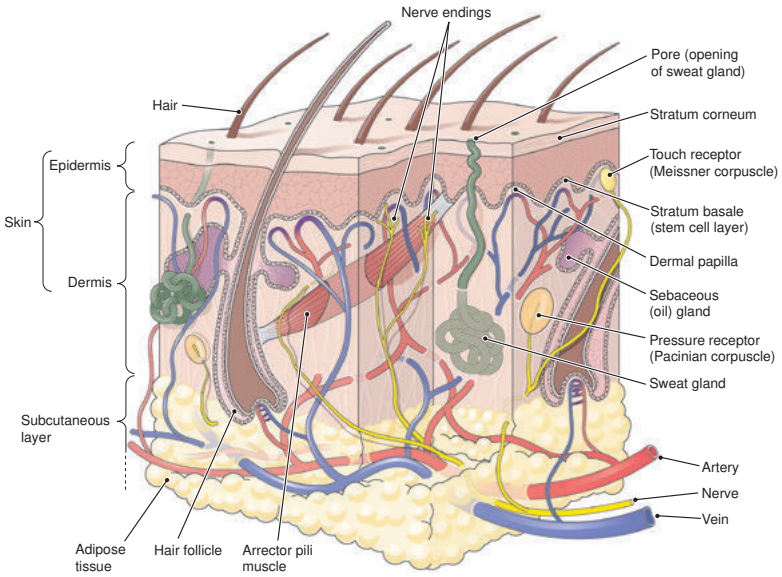


FIGURE 4-1 Cross-section of the skin. The skin layers and associated structures are shown.

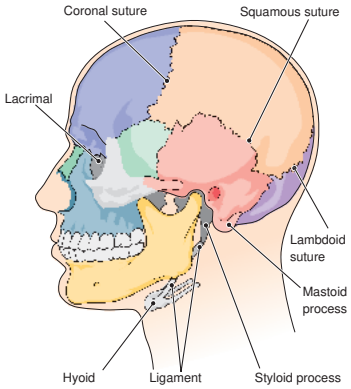


FIGURE 5-2 The skull from the left. An additional cranial bone, the ethmoid (*ETH-moyd*), is visible mainly from the interior of the skull. The hyoid is considered part of the axial skeleton but is not attached to any other bones. The tongue and other muscles are attached to the hyoid.

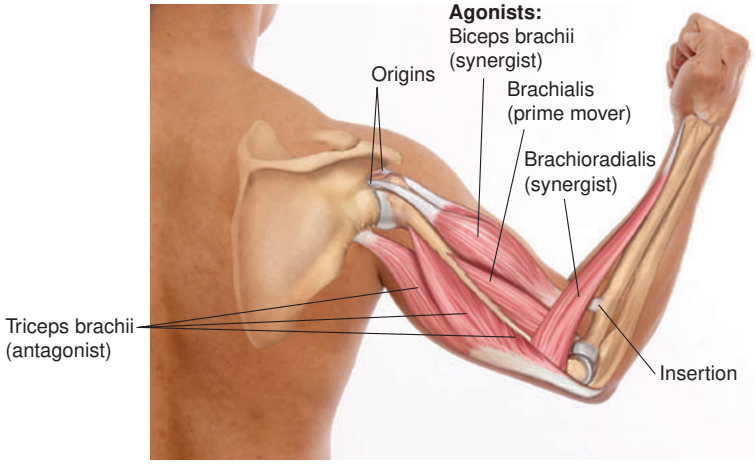


FIGURE 6-4 Muscles work together. When the brachialis, the agonistic prime mover, flexes the arm, the triceps brachii, the antagonist, must relax. Synergists, the biceps brachii and the brachioradialis, assist in this action. When the arm is extended, these muscle actions are reversed. This figure also shows three attachments of the biceps brachii, two origins and one insertion.

Focus on Words boxes

provide historical or other interesting information on select terms within a chapter.

FOCUS ON WORDS

BOX 1-3

Meaningful Suffixes

Suffixes sometimes take on a color of their own as they are added to different words. The suffix *-thon* is taken from the name of the Greek town Marathon, from which news of a battle victory was carried by a long-distance runner. It has been attached to various words to mean a contest of great endurance. We have bike-a-thons, dance-a-thons, telethons, and even major charity fundraisers called thon-a-thons.

The adjective ending *-ish* is used, as in *boyish* or *childish*, to suggest traces of certain characteristics. People tack it onto words to indicate that they are estimates, not right on target, as in *forty-ish* or *blue-ish*. A vague time for a lunch appointment could be *noon-ish*.

In science and medicine, the ending *-tech* is used to imply high technology, as in the company name Genentech, and *-pure* may be added to inspire confidence, as in the naming of the Multi-Pure water filter. The ending *-mate* suggests helping, as in *helpmate*, defined in the dictionary as a helpful companion, more specifically, a wife, or sometimes, a husband. The medical device HeartMate is a pump used to assist a damaged heart. In current terminology, the ending *-ome* refers to the objects in a comprehensive topic of study such as microbiome (total microbiologic population associated with an individual), genome (study of all the genes in an individual), and proteome (the entire protein makeup of an individual).

CLINICAL PERSPECTIVES

BOX 4-1

Medication Patches: No Bitter Pill to Swallow

For most people, pills are a convenient way to take medication, but for some, they have drawbacks. Pills must be taken at regular intervals to ensure consistent dosing, and they must be digested and absorbed into the bloodstream before they can begin to work. For those who have difficulty swallowing or digesting pills, transdermal (TD) patches offer an effective alternative to oral medications.

TD patches deliver a consistent dose of medication that diffuses at a constant rate through the skin into the bloodstream. There is no daily schedule to follow, nothing to swallow, and no stomach upset. TD patches can also deliver medication to unconscious patients, who would otherwise require intravenous drug delivery. TD patches are used in hormone replacement therapy, to treat heart disease, to manage pain, and to suppress motion sickness. Nicotine patches are also used as part of programs to quit smoking.

TD patches must be used carefully. Drug diffusion through the skin takes time, so it is important to know how long the patch must be in place before it is effective. It is also important to know when the medication's effects disappear after the patch is removed. Because the body continues to absorb what has already diffused into the skin, removing the patch does not entirely remove the medicine. There is also a danger that patches may become unsafe when heated, as by exercise, high fever, or a hot environment, such as a hot tub, heating pad, or sauna. When heat dilates the capillaries in the skin, a dangerous increase in dosage may result as more medication enters the blood.

A recent advance in TD drug delivery is iontophoresis. Based on the principle that like charges repel each other, this method uses a mild electrical current to move ionic drugs through the skin. A small electrical device attached to the patch uses positive current to "push" positively charged drug molecules through the skin and a negative current to push negatively charged ones. Even though very low levels of electricity are used, people with pacemakers should not use iontophoretic patches. Another disadvantage of these patches is that they can move only ionic drugs through the skin.

Clinical Perspectives boxes focus on body processing, as well as techniques used in clinical settings.

HEALTH PROFESSIONS

BOX 13-2

Dental Hygienist

Dental hygienists focus primarily on dental health maintenance and preventive dental care. They examine patients' dentition and periodontium (supporting structures of the teeth); take radiographic images; and perform oral prophylaxis using hand and ultrasonic instruments to remove deposits, such as calculus, stains, and plaque. They may also apply fluorides to prevent caries. They work independently or along with a dentist to administer local anesthesia and nitrous oxide sedation and to do oral screenings, polish restorations, remove sutures, apply dental sealants, and perform periodontal procedures. Dental hygienists must be knowledgeable about safety concerning x-ray equipment, anesthesia, and infectious diseases. They wear safety glasses, surgical masks, and gloves to protect themselves and their patients. A major component of the dental hygienist's work is patient education for maintenance of good oral health. They may give instruction on nutrition and proper oral care, such as brushing, flossing, and the use of antimicrobial rinses.

Most dental hygiene programs award an associate degree; some offer bachelor's or master's degrees. The higher degrees are required for research, teaching, or practice in public or school health facilities. The professional program requires 1 year of college-level prerequisite courses. The curriculum includes courses in radiography, dental anatomy, pharmacology, head and neck anatomy, and other health- and dental-related sciences. Additional material on the legal and ethical aspects of dental hygiene practice and extensive clinical training are included in the program. After graduation, dental hygienists must be licensed in their states by passing clinical and written examinations administered by the American Dental Association's (ADA) Joint Commission on National Dental Examinations.

Almost all hygienists work in dental offices. One advantage of this field is scheduling flexibility and the opportunity for part-time work. Job prospects are good; dental hygiene is among the fastest growing occupations. Benefits vary with place of employment. For additional information, contact the American Dental Hygienists' Association at adha.org.

Health Professions boxes focus on a variety of health careers, showing how the knowledge of medical terminology is applied in future careers.

FOR YOUR REFERENCE

BOX 1-2

Silent Letters and Unusual Pronunciations

Letter(s)	Pronunciation	Example	Definition of Example
ch	k	chemical *KEM-ih-kal*	pertaining to the elements and their interactions (root *chem/o* means "chemical")
dys	dis	dysfunction *dis-FUNK-shun*	difficult or abnormal (dys-) function
eu	u	euphoria *u-FOR-e-ah*	exaggerated feeling of well-being (*eu-* means "true" or "good")
gn	n	gnathic *NATH-ik*	pertaining to the jaw (gnath/o)
ph	f	phantom *FAN-tom*	illusion or imaginary image
pn	n	pneumonia *nu-MO-ne-ah*	inflammation of the lungs (pneumon/o)
ps	s	pseudonym *SU-do-nim*	false name (-nym)
pt	t	ptosis *TO-sis*	dropping, downward displacement
rh	r	rhinoplasty *RI-no-plas-te*	plastic repair of the nose (rhin/o)
x	z	xiphoid *ZI-foyd*	pertaining to cartilage attached to the sternum (from Greek *xiphos*, meaning "sword")

For Your Reference boxes provide supplemental information for terms within a chapter.

Table 2-1 Roots for Cells and Tissues

Root	Meaning	Example	Definition of Example
morph/o	form	polymorphous *pol-e-MOR-fus*	having many forms
cyt/o, -cyte	cell	cytologist *si-TOL-o-jist*	one who studies cells
nucle/o	nucleus	nuclear *NU-kle-ar*	pertaining to a nucleus
kary/o	nucleus	karyotype *KAR-e-o-tipe*	picture of a cell's chromosomes organized according to size (FIG. 2-10)
hist/o, histi/o	tissue	histocompatibility *his-to-kom-pat-ih-BIL-ih-te*	tissue similarity that permits transplantation
fibr/o	fiber	fibrosis *fi-BRO-sis*	abnormal formation of fibrous tissue
reticul/o	network	reticulum *reh-TIK-u-lum*	a network
aden/o	gland	adenoma *ad-eh-NO-mah*	tumor (-oma) of a gland
papill/o	nipple	papilla *pah-PIL-ah*	projection that resembles a nipple
myx/o	mucus	myxadenitis *miks-ad-eh-NI-tis*	inflammation (-itis) of a mucus-secreting gland
muc/o	mucus, mucous membrane	mucorrhea *mu-ko-RE-ah*	increased flow (-rhea) of mucus
somat/o, -some	body, small body	chromosome *KRO-mo-some*	small body that takes up color (dye) (chrom/o)

Word Part Tables present roots, prefixes, and suffixes covered in each chapter in an easy-to-reference format (with examples of their use in medical terminology). Word Part Knowledge aids in the learning and understanding of common terminology.

Exercises are designed to test your knowledge before you move to the next learning topic that follows each table.

Exercise 13-3

Complete the exercise. To check your answers go to Appendix 11.

Use the suffix *-ic* to write a word for the following definitions.

1. pertaining to the liver _____
2. pertaining to the gallbladder _____
3. pertaining to the pancreas _____

Use the suffix *-graphy* to write a word for the following definitions.

4. radiographic study of the liver _____
5. radiographic study of the gallbladder _____
6. radiographic study of the bile ducts _____
7. radiographic study of the pancreas _____

Use the suffix *-lithiasis* to write a word for the following definitions.

8. condition of having a stone in the common bile duct _____
9. condition of having a stone in the pancreas _____

Fill in the blanks.

10. Inflammation of the liver is called _____.
11. The word biligenesis (*bil-ih-JEN-eh-sis*) means the formation of _____.
12. A cholelith (*KO-le-lith*) is a(n) _____.
13. Choledochotomy (*ko-led-o-KOT-o-me*) is incision of the _____.
14. Cholecystectomy (*ko-le-sis-TEK-to-me*) is removal of the _____.
15. Hepatomegaly (*hep-ah-to-MEG-ah-le*) is enlargement of the _____.
16. Cholangitis (*ko-lan-JI-tis*) is inflammation of a(n) _____.
17. Pancreatolysis (*pan-kre-ah-TOL-ih-sis*) is dissolving of the _____.

Terminology *Key Terms*

The terms listed below are emphasized in this chapter. Knowing them will help you organize and prioritize your learning. These boldface terms are also found, collectively, with all chapter key terms in the Glossary.

Disease

acute *ah-KUTE*	Sudden, severe; having a short course
benign *be-NINE*	Not recurrent or malignant, favorable for recovery, describing a tumor that does not spread (metastasize) to other tissues
carcinoma *kar-sih-NO-mah*	A malignant neoplasm composed of epithelial cells (from Greek root carcino, meaning "crab") (adjective: carcinomatous)
chronic *KRON-ik*	Of long duration, progressing slowly
cyst *sist*	An abnormal filled sac or pouch; used as a root meaning a normal bladder or sac, such as the urinary bladder or gallbladder (root: cyst/o)
edema *eh-DE-mah*	Accumulation of fluid in the tissues, swelling; adjective: edematous (eh-DE-mah-tus) (see FIG. 3-2)
etiology *e-te-OL-o-je*	The cause of a disease
Gram stain	A laboratory staining procedure that divides bacteria into two groups: gram positive, which stains purple, and gram negative, which stains red
hernia *HER-ne-ah*	Protrusion of an organ through an abnormal opening; commonly called a rupture (FIG. 3-4)
immunity *ih-MU-nih-te*	All our defenses against infectious disease
inflammation *in-flah-MA-shun*	A localized response to tissue injury characterized by heat, pain, redness, and swelling
lesion *LE-zhun*	A distinct area of damaged tissue, an injury or wound

Terminology Tables-Key Terms outline the key terms emphasized in the chapter and can be used as a learning and study tool.

Terminology — *Enrichment Terms*

The terms listed below expand on the key terms to increase your knowledge of this chapter topic.

amino acids *ah-ME-no*	The nitrogen-containing compounds that make up proteins
anabolism *ah-NAB-o-lizm*	The type of metabolism in which body substances are made; the building phase of metabolism
catabolism *kah-TAB-o-lizm*	The type of metabolism in which substances are broken down for energy and simple compounds
collagen *KOL-ah-jen*	A fibrous protein found in connective tissue
cortex *KOR-tex*	The outer region of an organ
glycogen *GLI-ko-jen*	A complex sugar compound stored in liver and muscles and broken down into glucose when needed for energy
interstitial *in-ter-STISH-al*	Between parts, such as the spaces between cells in a tissue
medulla *meh-DUL-lah*	The inner region of an organ, marrow (root: medull/o)
parenchyma *par-EN-kih-mah*	The functional tissue of an organ
parietal *pah-RI-eh-tal*	Pertaining to a wall, describes a membrane that lines a body cavity
soma *SO-mah*	The body
stem cell	An immature cell that has the capacity to develop into any of a variety of different cell types, a precursor cell

Terminology Tables-Enrichment Terms provide you with more challenging terms to expand your knowledge.

Terminology — *Abbreviations*

The abbreviations listed below are emphasized in this chapter. These are also found, collectively, with all chapter abbreviations in Appendix 2.

ACE	Angiotensin-converting enzyme	**GFR**	Glomerular filtration rate
ADH	Antidiuretic hormone	**GU**	Genitourinary
ARF	Acute renal failure	**IVP**	Intravenous pyelography
ATN	Acute tubular necrosis	**IVU**	Intravenous urography
BUN	Blood urea nitrogen	**K**	Potassium
CAPD	Continuous ambulatory peritoneal dialysis	**KUB**	Kidney–ureter–bladder (radiography)
CCPD	Continuous cyclic peritoneal dialysis	**Na**	Sodium
CMG	Cystometrography; cystometrogram	**PEP**	Protein electrophoresis
CRF	Chronic renal failure	**SG**	Specific gravity
EPO	Erythropoietin	**Tm**	Maximal transport capacity
ESRD	End-stage renal disease	**UA**	Urinalysis
ESWL	Extracorporeal shock-wave lithotripsy	**UTI**	Urinary tract infection

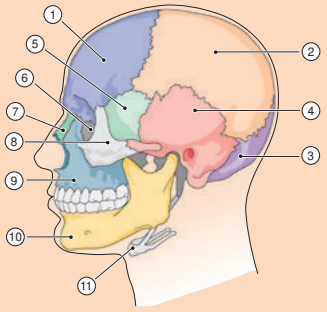
Terminology Tables-Abbreviations are listed for common terms.

SKULL FROM THE LEFT

Write the name of each numbered part on the corresponding line.

Frontal
Hyoid
Lacrimal
Mandible
Maxilla
Nasal
Occipital
Parietal
Sphenoid
Temporal
Zygomatic

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

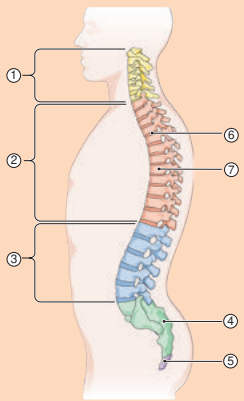


VERTEBRAL COLUMN

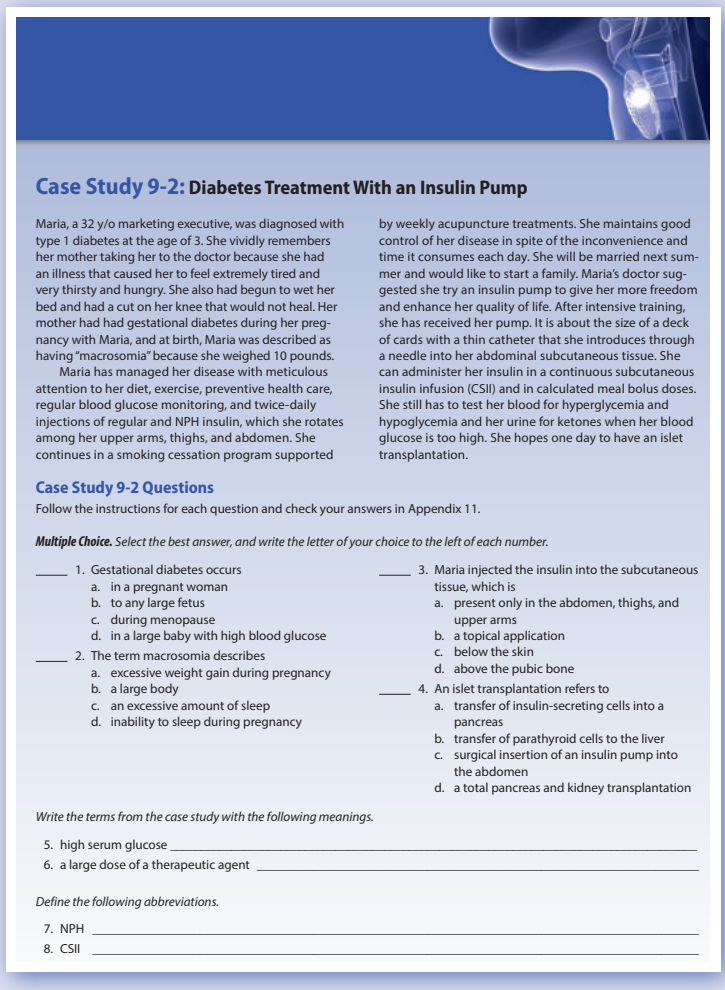
Write the name of each numbered part on the corresponding line.

Body of vertebra
Cervical vertebrae
Coccyx
Intervertebral disk
Lumbar vertebrae
Sacrum
Thoracic vertebrae

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



Chapter Review Exercises are designed to test your knowledge of the chapter material and appear at the end of each chapter.



Case Study 9-2: Diabetes Treatment With an Insulin Pump

Maria, a 32 y/o marketing executive, was diagnosed with type 1 diabetes at the age of 3. She vividly remembers her mother taking her to the doctor because she had an illness that caused her to feel extremely tired and very thirsty and hungry. She also had begun to wet her bed and had a cut on her knee that would not heal. Her mother had had gestational diabetes during her pregnancy with Maria, and at birth, Maria was described as having "macrosomia" because she weighed 10 pounds.

Maria has managed her disease with meticulous attention to her diet, exercise, preventive health care, regular blood glucose monitoring, and twice-daily injections of regular and NPH insulin, which she rotates among her upper arms, thighs, and abdomen. She continues in a smoking cessation program supported by weekly acupuncture treatments. She maintains good control of her disease in spite of the inconvenience and time it consumes each day. She will be married next summer and would like to start a family. Maria's doctor suggested she try an insulin pump to give her more freedom and enhance her quality of life. After intensive training, she has received her pump. It is about the size of a deck of cards with a thin catheter that she introduces through a needle into her abdominal subcutaneous tissue. She can administer her insulin in a continuous subcutaneous insulin infusion (CSII) and in calculated meal bolus doses. She still has to test her blood for hyperglycemia and hypoglycemia and her urine for ketones when her blood glucose is too high. She hopes one day to have an islet transplantation.

Case Study 9-2 Questions

Follow the instructions for each question and check your answers in Appendix 11.

Multiple Choice. *Select the best answer, and write the letter of your choice to the left of each number.*

____ 1. Gestational diabetes occurs
   a. in a pregnant woman
   b. to any large fetus
   c. during menopause
   d. in a large baby with high blood glucose

____ 2. The term macrosomia describes
   a. excessive weight gain during pregnancy
   b. a large body
   c. an excessive amount of sleep
   d. inability to sleep during pregnancy

____ 3. Maria injected the insulin into the subcutaneous tissue, which is
   a. present only in the abdomen, thighs, and upper arms
   b. a topical application
   c. below the skin
   d. above the pubic bone

____ 4. An islet transplantation refers to
   a. transfer of insulin-secreting cells into a pancreas
   b. transfer of parathyroid cells to the liver
   c. surgical insertion of an insulin pump into the abdomen
   d. a total pancreas and kidney transplantation

Write the terms from the case study with the following meanings.

5. high serum glucose _____
6. a large dose of a therapeutic agent _____

Define the following abbreviations.

7. NPH _____
8. CSII _____

Case Studies and Case Study Questions at the end of every chapter present terminology in the context of a medical report. These are an excellent review tool because they test your cumulative knowledge of medical terminology and put terminology into a real-world context.

Instructor, Student and Learning Resources

For the Instructor

Qualified instructors will receive a full suite of instructor resources, including the following:

- Slides in PowerPoint format
- Testbank in LMS compatible format
- Lesson Plans

For the Student

- eBook
- Anatomy & Physiology Review Module with Heart & Lung Sounds
- Animations
- TestPrep

Learning Resources

- eBook
- A&P Module with Heart & Lung Sounds
- Image Bank
- TestPrep
- Animations
- Audio Pronunciation Glossary

PART I

Introduction to Medical Terminology

CHAPTER 1

Concepts, Suffixes, and Prefixes of Medical Terminology

Pretest

Multiple Choice. **Select the best answer, and write the letter of your choice to the left of each number. To check your answers go to Appendix 11.**

_____ 1. The main part of a word is called the
   a. origin
   b. prefix
   c. root
   d. extension

_____ 2. A word part at the end of a word is the
   a. prefix
   b. adjective
   c. insertion
   d. suffix

_____ 3. The *ch* in the word *chemical* is pronounced like the letter
   a. s
   b. h
   c. k
   d. f

_____ 4. The word below that has a hard *g* is
   a. grip
   b. page
   c. gem
   d. judge

_____ 5. The suffixes *-ic, -ous, -al*, and *-oid* are found in
   a. adjectives
   b. nouns
   c. verbs
   d. roots

_____ 6. The singular of *ova* (eggs) is
   a. ovi
   b. ovae
   c. ovum
   d. ovas

_____ 7. The prefix in the word *microscopic* is
   a. mic-
   b. scop-
   c. micro-
   d. pic-

_____ 8. The opposite of hypoglycemia (low blood sugar) is
   a. hypoglucemia
   b. hyperglycemia
   c. hypocalcemia
   d. hypoglycemic

Learning Objectives

After careful study of this chapter, you should be able to:

1. Explain the purpose of medical terminology. ***P4***
2. Name the languages from which most medical word parts are derived. ***P4***
3. Define the terms *root, suffix*, and *prefix*. ***P4***
4. Explain what combining forms are and why they are used. ***P5***
5. List three features of medical dictionaries. ***P8***
6. Recognize and apply some general noun, adjective, and plural suffixes used in medical terminology. ***P9***
7. Recognize and define prefixes used in medical terminology. ***P18***
8. Analyze the suffixes and prefixes used in chapter case studies. ***PP3, 34***

Case Study: David's Digestive Problems

Chief Complaint

David, a 22 y/o college student, visited the university health clinic and stated he had a 4-month history of a burning pain in the middle of his chest (heartburn). He notices it more at night and has difficulty sleeping because of the pain. He said he is under stress due to the intensity of his college courses and has gained 20 pounds over the last 6 months. He also said that the pain seems to occur more frequently following late-night college gatherings where pizza, spicy chicken wings, and beer are served.

Examination

A well-nourished 22 y/o male complaining of (c/o) epigastric (upper abdominal) pain no longer relieved by antacids; orthopnea—currently sleeping with three pillows to aid in breathing; occasional swallowing problems, or dysphagia; ETOH (alcohol) consumption is six to eight beers per week; nonsmoker; no neurologic, musculoskeletal, genitourinary, or respiratory deficits. David was referred to a gastroenterologist for ↑ acid production and possible gastroesophageal reflux disease (GERD).

Clinical Course

The gastroenterologist saw David and ordered a special x-ray procedure, a barium swallow radiograph, to rule out any structural problems with the esophagus. The barium provides contrast to enable the radiologist to take x-rays of the esophagus. Since the results of this test proved to be inconclusive for GERD, David was scheduled for an esophageal gastroduodenoscopy (EGD). An EGD allows the gastroenterologist to visually examine the upper GI tract, showing the esophagus, stomach, and duodenum (the upper part of the small intestine). Results of the EGD showed no evidence of bleeding, ulcerations, or strictures. Since David still complained of mild heartburn he was sent home with a prescription of Prevacid and given educational material on GERD, including dietary, exercise, and stress reduction recommendations. He was told he needed to be reevaluated in 3 months.

Case Study Revisited: Once you complete this chapter, please review the case follow-up on p. 27.

Ancillaries *At-A-Glance*

Visit the web resource to access the following resources.

Learning Resources

- eBook
- A&P Module with Heart & Lung Sounds
- Image Bank
- TestPrep
- Animations
- Audio Pronunciation Glossary

Introduction

Medical terminology is a special vocabulary used by healthcare professionals for effective and accurate communication. Every health-related field requires an understanding of medical terminology, and this book highlights selected healthcare occupations in special boxes (**BOX 1-1**). While studying this chapter, you will learn about the general concepts of medical terminology and explore the specific role of suffixes and prefixes in words.

Concepts of Medical Terminology

Because it is based mainly on Greek and Latin words, medical terminology is consistent and uniform throughout the world. It is also efficient; although some of the terms are long, they often reduce an entire phrase to a single word. The one word *gastroduodenostomy*, for example, means "a communication between the stomach and the first part of the small intestine" **(FIG. 1-1)**. The part *gastr* means stomach; *duoden* represents the duodenum, the first part of the small intestine; and *ostomy* means a communication.

The medical vocabulary is vast, and learning it may seem like learning the entire vocabulary of a foreign language. Moreover, like the jargon that arises in all changing fields, it is always expanding. Think of the terms that have been added to our vocabulary in relation to computers, such as *software*, *search engine*, *flash drive*, *app*, and *blog*. The task may seem overwhelming, but there are methods to aid in learning and remembering words and even to help make informed guesses about unfamiliar words. Most medical terms can be divided into component parts—roots, prefixes, and suffixes—that maintain the same meaning whenever they appear. By learning these meanings, you can analyze and remember many words.

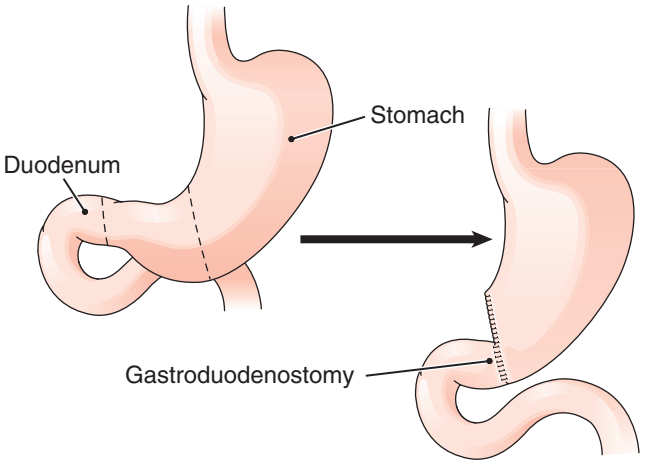


FIGURE 1-1 Gastroduodenostomy. A communication (-stomy) between the stomach (gastr) and the first part of the small intestine, or duodenum (duoden).

Word Parts

Word components fall into three categories:

1. The **root** is the fundamental unit of each medical word. It establishes the basic meaning of the word and is the part to which modifying word parts are added.
2. A **suffix** is a short word part or series of parts added at the end of a root to modify its meaning. This book indicates suffixes by a dash before the suffix, such as *-itis* (inflammation).

HEALTH PROFESSIONS
Health Information Technicians

BOX 1-1

Patient medical records are used as the basis for all medical care delivered. Every time a patient receives medical treatment, information is added to the patient's medical record, which includes the medical history, data about symptoms, test results, diagnoses, treatments, and follow-up care. Health information technicians (HITs) organize and manage these records and work closely with physicians, nurses, and other health professionals to ensure that they provide a complete and accurate basis for quality patient care.

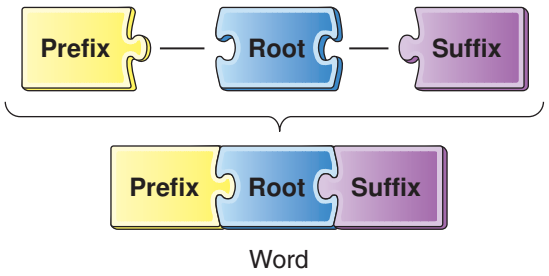
Accurate medical records are essential for administrative purposes, third-party payers, and researchers. HITs assign a code to each diagnosis and procedure a patient receives, and this information is used for accurate patient billing. In addition, HITs analyze medical records to reveal trends in health and disease. This research can be used to improve patient care, manage costs, and help establish new medical treatments.

To read and interpret medical records, HITs need a thorough background in medical terminology. Students planning to pursue this career may obtain a certificate in health information technology or complete an associate's degree in health information technology at a community college. Those wanting to move into an administrative role may complete advanced studies and a bachelor's degree in health informatics at a university. A certification examination is required to become certified as a registered health information technician (RHIT). Many institutions prefer to hire individuals who are professionally certified.

Most HITs work in hospitals and long-term care facilities. Others may work in medical clinics, government agencies, insurance companies, and consulting firms. Because of the growing need for medical care, health information technology is projected to be one of the fastest growing careers in the United States.

For more information about this profession, contact the American Health Information Management Association at ahima.org.

3. A **prefix** is a short word part added before a root to modify its meaning. This book indicates prefixes by a dash after the prefix, such as *pre-* (before).



Words are formed from roots, suffixes, and prefixes.

The simple word *learn* can be used as a root to illustrate. If we add the suffix *-er* to form *learner*, we have "one who learns." If we add the prefix *re-* to form *relearn*, we have "to learn again."

Not all roots are complete words. In fact, most medical roots are derived from other languages and are meant to be used in combinations. The Greek word *kardia*, for example, meaning "heart," gives us the root *cardi*. The Latin word *pulmo*, meaning "lung," gives us the root *pulm*. In a few instances, both the Greek and Latin roots are used for the same structure. We find both the Greek root *nephr* and the Latin root *ren* used in words pertaining to the kidney **(FIG. 1-2)**.

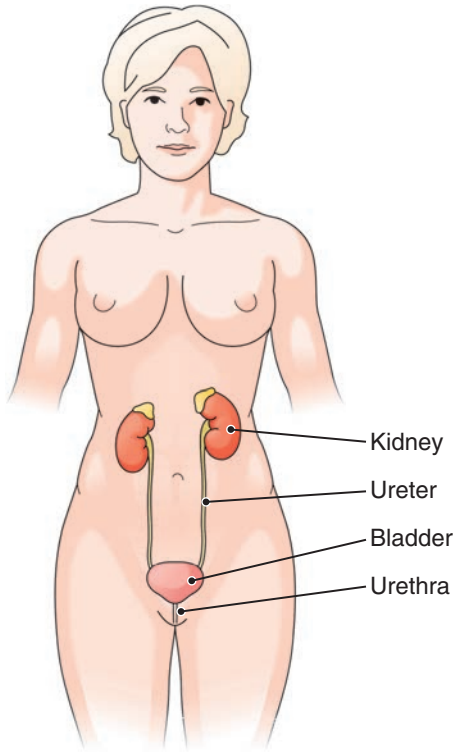


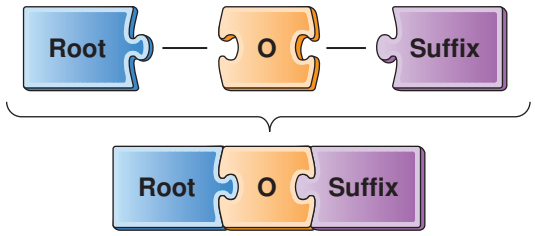
FIGURE 1-2 Structures named with more than one word root. Medical terminology uses both the Greek root *nephr* and the Latin root *ren* for the kidney, an organ of the urinary system.

Note that the same root may have different meanings in different fields of study, just as the words *web, spam, cloud, cookie,* and *tweet* have different meanings in common vocabulary than they do in "computerese." The root *myel* means "marrow" and may apply to either the bone marrow or the spinal cord. The root *scler* means "hard" but may also apply to the white of the eye. *Cyst* means "a filled sac or pouch" but also refers specifically to the urinary bladder. You will sometimes have to consider the context of a word before assigning its meaning.

A **compound word** contains more than one root. The words *eyeball*, *bedpan*, *frostbite*, and *wheelchair* are examples. Some examples of compound medical words are *cardiovascular* (pertaining to the heart and blood vessels), *urogenital* (pertaining to the urinary and reproductive systems), and *lymphocyte* (a white blood cell found in the lymphatic system).

COMBINING FORMS

When a suffix or another root beginning with a consonant is added to a root, a vowel is inserted between the root and the next word part to aid in pronunciation. This combining vowel is usually an *o*, as seen in the previous example of gastroduodenostomy, but may occasionally be *a*, *e*, or *i*.

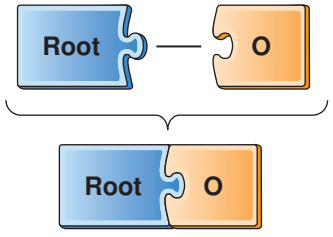


A combining vowel may be added between a root and a word part that follows.

Thus, when the suffix *-logy*, meaning "study of," is added to the root *neur*, meaning "nerve or nervous system," a combining vowel is added:

neur + o + logy = neurology (study of the nervous system)

Roots shown with a combining vowel are called **combining forms.**



A root with a combining vowel is called a combining form.

This text gives roots with their most common combining vowels added after a slash and refers to them simply as roots, as in *neur/o*. A combining vowel is usually not used if

the ending begins with a vowel. For example, the root *neur* is combined with the suffix *-itis*, meaning "inflammation of," in this way:

neur + itis = neuritis (inflammation of a nerve)

This rule has some exceptions, particularly when they affect pronunciation or meaning, and you will observe these as you work.

Word Derivations

As mentioned, most medical word parts come from Greek (G.) and Latin (L.). The original words and their meanings are included in this text only occasionally. However, they are interesting and may aid in learning. For example, *muscle* comes from a Latin word that means "mouse" because the movement of a muscle under the skin was thought to resemble the scampering of a mouse. The coccyx, the tail end of the spine, is named for the cuckoo because it was thought to resemble the cuckoo's bill **(FIG. 1-3)**. For those interested in the derivations of medical words, a good medical dictionary will provide this information.

WORDS ENDING IN *x*

When you add a suffix to a word ending in *x*, the *x* is changed to a *g* or a *c*. If there is a consonant before the *x*, such as *yx* or *nx*, the *x* is changed to a *g*. For example, *pharynx* (throat) becomes *pharyngeal* (*fah-RIN-je-al*), to mean "pertaining to the throat"; *coccyx* (terminal portion of the spine) becomes *coccygeal* (*kok-SIJ-e-al*), to mean "pertaining to the coccyx."

If a vowel comes before the *x*, such as *ax* or *ix*, you change the *x* to a *c*. Thus, *thorax* (chest) becomes *thoracic* (*tho-RAS-ik*), to mean "pertaining to the chest"; and *cervix* (neck) becomes *cervical* (*SER-vih-kal*), to mean "pertaining to a neck."

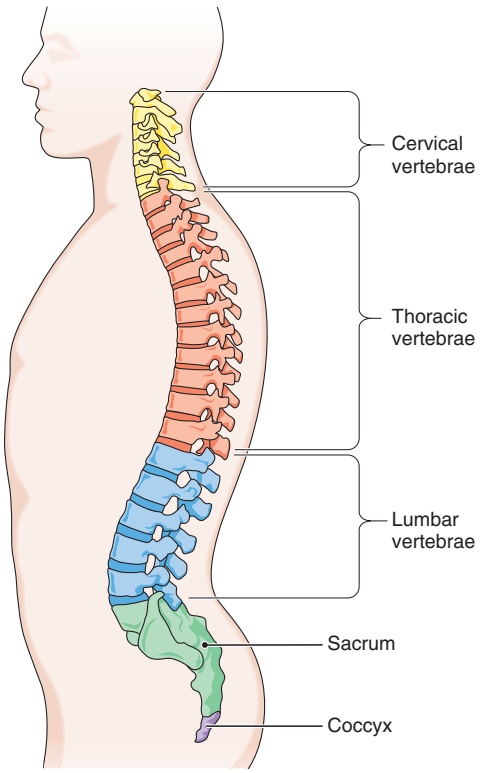


FIGURE 1-3 Word derivations. The coccyx of the spine is named by its resemblance to a cuckoo's bill.

SUFFIXES BEGINNING WITH *rh*

When you add a suffix beginning with *rh* to a root, the *r* is doubled. For example:

hem/o (blood) + **r**hage (bursting forth) = hemo**rr**hage (a bursting forth of blood)

men/o (menses) + **r**hea (flow, discharge) = meno**rr**hea (menstrual flow)

Pronunciation

This text provides phonetic pronunciations at every opportunity, even in the answer keys. The web resource has a large audio pronunciation dictionary. Take advantage of these aids. Repeat each word aloud as you learn to recognize it in print or hear it on the web resource.

The following definitions apply to pronunciation:

Vowel: There are five English vowels; a, e, i, o, u. Each has a specific sound when pronounced.

Syllable: A unit of pronunciation having one vowel sound, forming the whole or part of a word. The number of times you hear a vowel (a, e, i, o, u) in a word is equal to the number of syllables contained in the word.

No special marks are needed to follow the pronunciation if you keep a few simple rules in mind.

Rule 1

Any vowel that appears alone or at the end of a syllable gets a long pronunciation. The alphabet sounds (when the vowel "says its name") are called long vowels. They are called "long" because we hold them longer than the short sounds.

Vowel	Long Pronunciation
a	as in s*a*y, *a*te, t*a*pe
e	as in t*e*a, *e*at, s*e*at
i	as in l*i*e, m*i*te, m*i*ght
o	as in h*o*se, *o*at, m*o*at
u	as in s*u*e, m*u*te, c*u*be

Rule 2

Any vowel that appears within a syllable gets a short pronunciation:

Vowel	Short Pronunciation
a	as in h*a*t, p*a*n, m*a*t
e	as in m*e*t, p*e*n, b*e*d
i	as in b*i*n, p*i*n, m*i*tt
o	as in n*o*t, c*o*t, r*o*t
u	as in r*u*n, m*u*tt, h*u*g

Rule 3
If a vowel is at the end of a syllable but needs a short pronunciation, an *h* is added, as in *vah-nil-ah* for vanilla.

Rule 4
If a vowel within a syllable needs a long pronunciation, an *e* is added, as in *re-pete* for repeat.

Rule 5
The accented syllable in each word is shown with capital letters, as in *AK-sent*.

Be aware that word parts may change in pronunciation when they are combined in different ways. Note also that accepted pronunciations may vary from place to place. Only one pronunciation for each word is given here, but be prepared for differences.

SOFT AND HARD *c* AND *g*

- A soft *c*, as in *racer*, will be written in pronunciations as *s* (*RA-ser*).
- A hard *c*, as in *candy*, will be written as *k* (*KAN-de*).
- A soft *g*, as in *page*, will be written as *j* (*paje*).
- A hard *g*, as in *grow*, will be written as *g* (*gro*).

SILENT LETTERS AND UNUSUAL PRONUNCIATIONS

A silent letter or an unusual pronunciation can be a problem, especially if it appears at the start of a word that you are trying to look up in the dictionary. See **BOX 1-2** for some examples.

The combinations in **BOX 1-2** may be pronounced differently when they appear within a word, as in dia**gn**osis (*di-ag-NO-sis*), meaning determination of the cause of disease, in which the *g* is pronounced; a**pn**ea (*AP-ne-ah*), meaning cessation of breathing, in which the *p* is pronounced; nephro**pt**osis (*nef-rop-TO-sis*), meaning dropping of the kidney, in which the *p* is pronounced.

FOR YOUR REFERENCE

BOX 1-2

Silent Letters and Unusual Pronunciations

Letter(s)	Pronunciation	Example	Definition of Example
ch	k	chemical *KEM-ih-kal*	pertaining to the elements and their interactions (root *chem/o* means "chemical")
dys	dis	dysfunction *dis-FUNK-shun*	difficult or abnormal (dys-) function
eu	u	euphoria *u-FOR-e-ah*	exaggerated feeling of well-being (*eu-* means "true" or "good")
gn	n	gnathic *NATH-ik*	pertaining to the jaw (gnath/o)
ph	f	phantom *FAN-tom*	illusion or imaginary image
pn	n	pneumonia *nu-MO-ne-ah*	inflammation of the lungs (pneumon/o)
ps	s	pseudonym *SU-do-nim*	false name (-nym)
pt	t	ptosis *TO-sis*	dropping, downward displacement
rh	r	rhinoplasty *RI-no-plas-te*	plastic repair of the nose (rhin/o)
x	z	xiphoid *ZI-foyd*	pertaining to cartilage attached to the sternum (from Greek *xiphos*, meaning "sword")

Abbreviations

Shortened words or initials can save time in writing medical reports and case histories. We commonly use TV for television, Jr. for junior, F for Fahrenheit temperature readings, UV for ultraviolet, and Dr. for doctor. A few of the many medical abbreviations are mL for the metric measurement milliliter; dB for decibels, units of sound intensity; CA for cancer; hgb for hemoglobin; and ECG for electrocardiogram.

PHRASE ABBREVIATIONS

An **acronym** is an abbreviation formed from the first letter of each word in a phrase. Some everyday acronyms are ASAP (as soon as possible), ATM (automated teller machine), and a computer's RAM (random access memory). Acronyms have become popular for saving time and space in naming objects, organizations, and procedures. They abound in the names of government agencies: FDA (Food and Drug Administration), USDA (United States Department of Agriculture), and NIH (National Institutes of Health). Some medical acronyms are BP for blood pressure, MRI for magnetic resonance imaging, AIDS for acquired immunodeficiency syndrome, CNS for the central nervous system, and RN for registered nurse. Acronyms and abbreviations that appear in a chapter are listed and defined at the end of that chapter. Appendix 2 is a more complete list of commonly used abbreviations and acronyms with their meanings. An abbreviation dictionary is also helpful.

SYMBOLS

Symbols are commonly used as shorthand in case histories. Some examples are Ⓛ and Ⓡ for left and right and ↑ and ↓ for increase and decrease. A list of common symbols appears in Chapter 3 and in Appendix 1.

Symbols and abbreviations can save time, but they can also cause confusion if they are not universally understood. Usage varies in different institutions, and the same abbreviation may have different meanings in different fields. For example, the acronym CRF can mean chronic renal failure or case report form, and MS can represent mitral stenosis or multiple sclerosis. Again, as with roots having multiple meanings, if the acronym is not defined, its interpretation depends on its context.

Some abbreviations and symbols are subject to error and should never be used. These appear in "Do Not Use" lists published by organizations that promote patient safety, such as the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and the Institute for Safe Medical Practices (ISMP). Most institutions have a policy manual that details the accepted abbreviations for that facility. Only the most commonly used symbols and abbreviations are given here.

Medical Dictionaries

With few exceptions, you can do all the exercises in this book without the aid of a dictionary, but medical dictionaries are valuable references for everyone in health-related

Terminology *Key Terms*

The terms listed below are emphasized in this chapter. Knowing them will help you organize and prioritize your learning. These boldface terms are also found, collectively, with all chapter key terms in the Glossary.

acronym *AK-ro-nim*	An abbreviation formed from the first letter of each word in a phrase
combining forms *kom-BI-ning*	A word root combined with a vowel that links the root with another word part, such as a suffix or another root; combining forms are shown with a slash between the root and the vowel, as in *neur/o*
compound word *KOM-pownd*	A word that contains more than one root
prefix *PRE-fix*	A word part added before a root to modify its meaning
root *rute*	The fundamental unit of a word
suffix *SUH-fix*	A word part added to the end of a root to modify its meaning

fields. These include not only complete, unabridged versions, but also easy-to-carry short versions and dictionaries of medical acronyms and abbreviations. Many of these dictionaries are also available on the internet, and as applications for smartphones and tablets. Dictionaries give information on meanings, synonyms, derivations, and related terms. Those dictionaries intended for nursing and allied health professions include more complete clinical information, with notes on patient care.

Dictionaries vary in organization; in some, almost all terms are entered as nouns, such as disease, syndrome, procedure, or test. Those with a more clinical approach enter some terms according to their first word, which may be an adjective or proper name, for example, biomedical engineering, Cushing disease, and wind chill factor. This format makes it easier to look up some terms. All dictionaries have directions on how to use the book and interpret the entries, as shown in Appendix 9, taken from *Stedman's Medical Dictionary*, 28th ed.

In addition to information on individual terms and phrases, medical dictionaries have useful appendices on measurements, clinical tests, drugs, diagnosis, body structure, information resources, and other topics.

Suffixes

A suffix is a word ending that modifies a root. A suffix may indicate that the word is a noun or an adjective and often determines how the definition of the word will begin (**BOX 1-3**). For example, using the root *myel/o*, meaning "bone marrow," the adjective ending *-oid* forms the word *myeloid*, which means "like or pertaining to bone marrow." The ending *-oma* forms *myeloma*, which is a tumor of the bone marrow. Adding another root, *gen*, which represents genesis or origin, and the adjective ending *-ous* forms the word *myelogenous*, meaning "originating in bone marrow."

The suffixes given in this chapter are general ones that are used throughout medical terminology. They include endings that form:

- Nouns: a person, place, or thing
- Adjectives: words that modify nouns
- Plurals: endings that convert single nouns to multiples

Additional suffixes will be presented in later chapters as they pertain to disease states, medical treatments, or specific body systems.

NOUN SUFFIXES

The following general suffixes convert roots into nouns. **TABLE 1-1** lists suffixes that represent different conditions. Note that the ending *-sis* may appear with different combining vowels as *-osis*, *-iasis*, *-esis*, or *-asis*. The first two of these denote an abnormal condition.

TABLE 1-2 lists endings that convert roots into medical specialties or specialists. The suffix *-logy* applies to many fields other than medicine. It contains the root *log/o* taken from the Greek word *logos*, which means "word," and generally means a field of study. Some examples are biology, archeology, terminology, and technology. Terms with this ending are also used to identify an institutional department or a specialty, as in cardiology, dermatology, radiology, and others. The two endings *-iatrics* and *-iatry* contain the root *-iatr/o*, based on a Greek word for healing and meaning "physician" or "medical treatment."

FOCUS ON WORDS
Meaningful Suffixes

BOX 1-3

Suffixes sometimes take on a color of their own as they are added to different words. The suffix *-thon* is taken from the name of the Greek town Marathon, from which news of a battle victory was carried by a long-distance runner. It has been attached to various words to mean a contest of great endurance. We have bike-a-thons, dance-a-thons, telethons, and even major charity fundraisers called thon-a-thons.

The adjective ending *-ish* is used, as in *boyish* or *childish*, to suggest traces of certain characteristics. People tack it onto words to indicate that they are estimates, not right on target, as in *forty-ish* or *blue-ish*. A vague time for a lunch appointment could be *noon-ish*.

In science and medicine, the ending *-tech* is used to imply high technology, as in the company name Genentech, and *-pure* may be added to inspire confidence, as in the naming of the Multi-Pure water filter. The ending *-mate* suggests helping, as in *helpmate*, defined in the dictionary as a helpful companion, more specifically, a wife, or sometimes, a husband. The medical device HeartMate is a pump used to assist a damaged heart. In current terminology, the ending *-ome* refers to the objects in a comprehensive topic of study such as microbiome (total microbiologic population associated with an individual), genome (study of all the genes in an individual), and proteome (the entire protein makeup of an individual).

Table 1-1 Suffixes That Mean "Condition of"

Suffix	Example	Definition of Example
-ia	dementia *de-MEN-she-ah*	loss of (de-) intellectual function (from L. *mentis*: mind)
-ism	racism *RA-sizm*	discrimination based on race
-sis	thrombosis *throm-BO-sis*	having a blood clot (thrombus) in a vessel **(FIG. 1-4)**
-y	atony *AT-o-ne*	lack (a-) of muscle tone

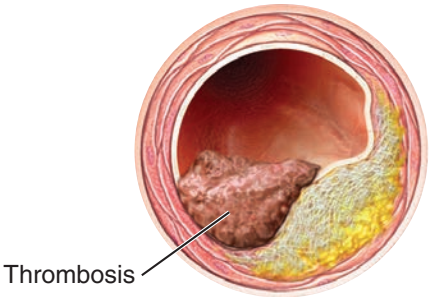


FIGURE 1-4 Thrombosis. This term refers to having a blood clot (thrombus) in a vessel. The word *thrombosis* has the noun suffix *-sis*, meaning "condition of."

Exercise 1-1

Complete the exercise. To check your answers go to Appendix 11.

Write the suffix that means "condition of" in the following words. Remember to use the phonetics to pronounce each word as you work through the exercises.

1. phobia (unfounded fear; from G. *phobos*: fear)
   FO-be-ah — ia
2. psoriasis (skin disease)
   so-RI-ah-sis — _____
3. egotism (exaggerated self-importance; from *ego*: self)
   E-go-tizm — _____
4. dystrophy (changes due to lack of nourishment; root: troph/o)
   DIS-tro-fe — _____
5. anesthesia (loss of sensation; root: esthesi/o) **(FIG. 1-5)**
   an-es-THE-ze-ah — _____
6. parasitism (infection with parasites or behaving as a parasite)
   PAR-ah-sit-izm — _____
7. stenosis (narrowing of a canal)
   steh-NO-sis — _____
8. tetany (sustained muscle contraction)
   TET-ah-ne — _____
9. diuresis (increased urination; root: ur/o)
   di-u-RE-sis — _____

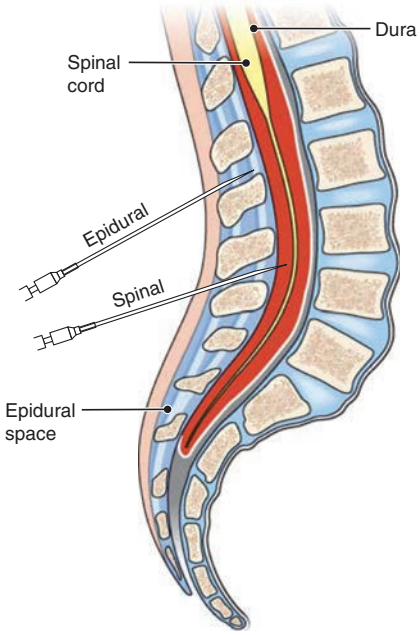


FIGURE 1-5 Injection sites for anesthesia. The word *anesthesia* uses the noun suffix *-ia*, meaning "condition of." The dura is a layer of the meninges, the membranes that cover the brain and spinal cord. One who administers anesthesia is an anesthetist or anesthesiologist.

FIGURE 1-6 Pediatrics is the care and treatment of children. The ending *-ics* indicates a medical specialty. In this photo, a pediatrician, one who practices pediatrics, is testing an infant's reflexes. The root *ped/o* means "child."

Table 1-2 Suffixes for Medical Specialties

Suffix	Meaning	Example	Definition of Example
-ian	specialist in a field of study	physician *fih-ZISH-un*	practitioner of medicine (from root *physi/o*, meaning "nature")
-iatrics	medical specialty	pediatrics *pe-de-AT-riks*	care and treatment of children (ped/o) **(FIG. 1-6)**
-iatry	medical specialty	psychiatry *si-KI-ah-tre*	study and treatment of mental (psych/o) disorders
-ics	medical specialty	orthopedics *or-tho-PE-diks*	study and treatment of the skeleton and joints (from root *ped/o*, meaning "child," and prefix *ortho*, meaning "straight")
-ist	specialist in a field of study	podiatrist *po-DI-ah-trist*	one who studies and treats the foot (pod/o)
-logy	study of	physiology *fiz-e-OL-o-je*	study of function in a living organism (from root *physi/o*, meaning "nature")

Exercise 1-2

Complete the exercise. To check your answers go to Appendix 11.

Write the suffix in the following words that means "study of," "medical specialty," or "specialist in a field of study."

1. cardiologist (specialist in the study and treatment of the heart; root: cardi/o) ist
   kar-de-OL-o-jist
2. neurology (the study of the nervous system; root: neur/o) _____
   nu-ROL-o-je

(continued)

Exercise 1-2 *(Continued)*

3. geriatrics (study and treatment of the aged; root: ger/e) **(FIG. 1-7)**
   jer-e-AT-riks _____

4. dermatology (study and treatment of the skin, or derma)
   der-mah-TOL-o-je _____

5. optician (one who makes and fits corrective lenses for the eyes; root: opt/o)
   op-TISH-an _____

6. anesthetist (one who administers anesthesia) (see **FIG. 1-5**)
   ah-NES-theh-tist _____

Write a word for a specialist in the following fields.

7. anatomy (study of body structure)
   ah-NAT-o-me anatomist

8. pediatrics (care and treatment of children; root: ped/o) (see **FIG. 1-6**)
   pe-de-AT-riks _____

9. radiology (use of radiation in diagnosis and treatment)
   ra-de-OL-o-je _____

10. psychology (study of the mind; root: psych/o)
    si-KOL-o-je _____

11. technology (practical application of science)
    tek-NOL-o-je _____

12. obstetrics (medical specialty concerning pregnancy and birth)
    ob-STET-riks _____

FIGURE 1-7 Geriatrics is the care and treatment of the aged.
A specialist in this field, a geriatrician, is shown.

ADJECTIVE SUFFIXES

The suffixes below are all adjective endings that mean "pertaining to," "like," or "resembling" **(TABLE 1-3)**. There are no rules for which ending to use for a given noun. Familiarity comes with practice. When necessary, tips on proper usage are given in the text.

Note that for words ending with the suffix *-sis*, the first *s* is changed to a *t* before adding *-ic* to form the adjective, as in genetic, pertaining to genesis (origin); psychotic, pertaining to psychosis (a mental disorder); or diuretic, pertaining to diuresis (increased urination).

Table 1-3 Suffixes That Mean "Pertaining to," "Like," or "Resembling"

Suffix	Example	Definition of Example
-ac	cardiac *KAR-de-ak*	pertaining to the heart
-al	vocal *VO-kal*	pertaining to the voice
-ar	nuclear *NU-kle-ar*	pertaining to a nucleus
-ary	salivary *SAL-ih-var-e*	pertaining to saliva
-form	muciform *MU-sih-form*	like or resembling mucus
-ic	anatomic *an-ah-TOM-ik*	pertaining to anatomy **(FIG. 1-8)**
-ical (ic + al)	electrical *e-LEK-trih-kal*	pertaining to electricity
-ile	virile *VIR-il*	pertaining to the male, masculine
-oid	lymphoid *LIM-foyd*	pertaining to the lymphatic system
-ory	circulatory *SIR-ku-lah-tor-e*	pertaining to circulation
-ous	cutaneous *ku-TA-ne-us*	pertaining to the skin (from L. *cutis*: skin)

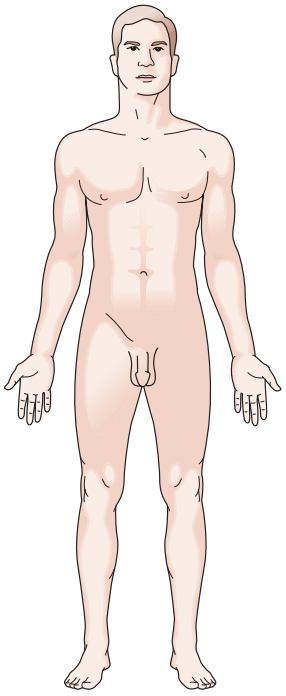


FIGURE 1-8 The anatomic position. This posture is standard in the study of anatomy. A person in this position is facing forward with arms at the side and palms forward (anterior). The adjective suffix *-ic* means "pertaining to."

Exercise 1-3

Complete the exercise. To check your answers go to Appendix 11.

Identify the suffix meaning "pertaining to," "like," or "resembling" in the following words. Remember to use the phonetics to pronounce each word as you work through the exercises.

1. dietary (pertaining to the diet) _____ ary
   DI-eh-tar-e
2. neuronal (pertaining to a nerve cell, or neuron) **(FIG. 1-9)** _____
   NU-ro-nal
3. metric (pertaining to a meter or measurement; root metr/o means "measure") _____
   MEH-trik
4. venous (pertaining to a vein; root: ven/o) _____
   VE-nus
5. epileptiform (like or resembling epilepsy) _____
   ep-ih-LEP-tih-form
6. toxoid (like or resembling a toxin, or poison) _____
   TOK-soyd
7. topical (pertaining to a surface) _____
   TOP-ih-kal
8. febrile (pertaining to fever) _____
   FEB-rile
9. neurotic (pertaining to neurosis, a mental disorder) _____
   nu-ROT-ik
10. surgical (pertaining to surgery) _____
    SUR-jih-kal
11. muscular (pertaining to a muscle) _____
    MUS-ku-lar
12. urinary (pertaining to urine; root: ur/o) _____
    U-rih-nar-e
13. respiratory (pertaining to respiration) _____
    RES-pih-rah-tor-e
14. pelvic (pertaining to the pelvis) **(FIG. 1-10)** _____
    PEL-vik
15. saccular (pouch-like, resembling a small sac) _____
    SAK-u-lar

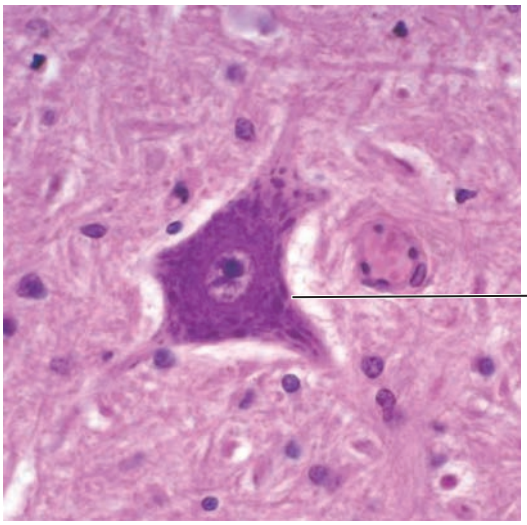


FIGURE 1-9 A neuron is a nerve cell. The adjective form of *neuron* is *neuronal*.

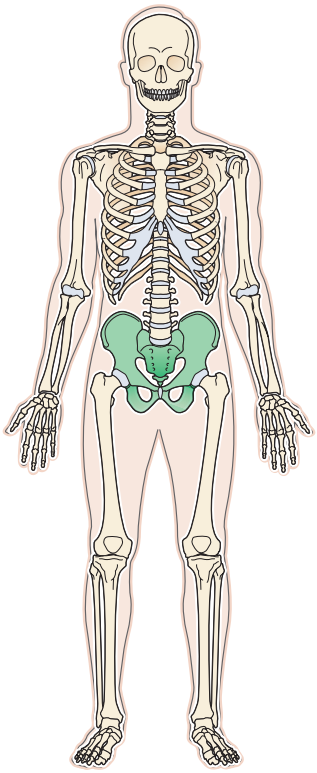


FIGURE 1-10 The pelvis is the bony hip girdle. The adjective form of pelvis is *pelvic*.

Forming Plurals

Many medical words have special plural forms based on the ending of the word. **TABLE 1-4** gives some general rules for the formation of plurals along with examples. The plural endings listed in the second column are substituted for the word endings in the first column. Note that both singular endings *-on* and *-um* change to *-a* for the plural. You have to learn which singular ending to use for specific words when converting a plural word ending in *-a* to the singular.

Table 1-4 Plural Endings

Word Ending	Plural Ending	Singular Example	Plural Example
a	ae	vertebra (bone of the spine) *VER-teh-brah*	vertebrae **(FIG. 1-11)** *VER-teh-bre*
en	ina	lumen (central opening) *LU-men*	lumina **(FIG. 1-12)** *LU-min-ah*
ex, ix, yx	ices	matrix (background substance; mold) *MA-triks*	matrices *MA-trih-seze*
is	es	diagnosis (determination of a disease or defect) *di-ag-NO-sis*	diagnoses *di-ag-NO-seze*
ma	mata	stigma (mark or scar) *STIG-mah*	stigmata *stig-MAT-ah*
nx (anx, inx, ynx)	nges	phalanx (bone of finger or toe) *fah-LANKS*	phalanges **(FIG. 1-13)** *fah-LAN-jeze*
on	a	ganglion (mass of nervous tissue) *GANG-le-on*	ganglia *GANG-le-ah*
um	a	serum (thin fluid) *SE-rum*	sera *SE-rah*
us	i	thrombus (see **FIG. 1-4**) *THROM-bus*	thrombi *THROM-bi*

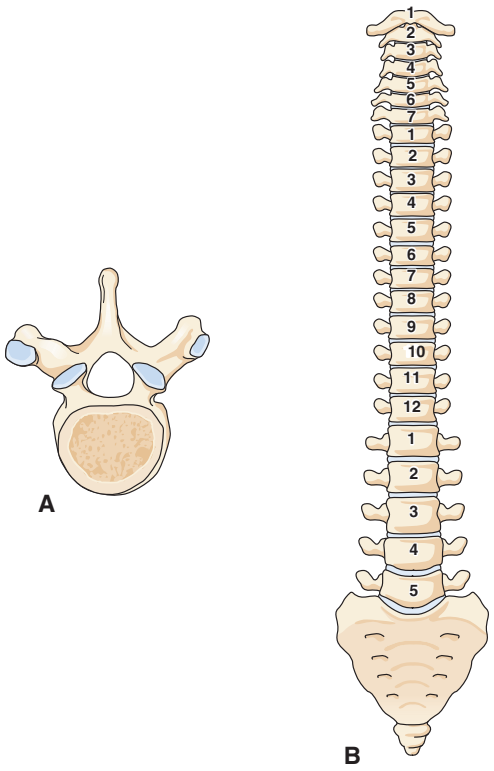


FIGURE 1-11 Bones of the spine. A. Each bone of the spine is a vertebra. **B.** The spinal column is made of 26 vertebrae.

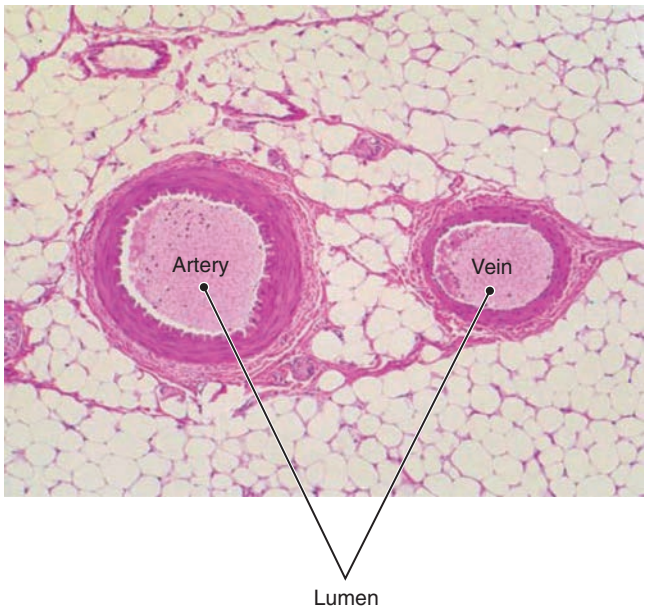


FIGURE 1-12 A lumen is the central opening of an organ or vessel. Two blood vessels are shown, an artery and a vein. The plural of lumen is *lumina*.

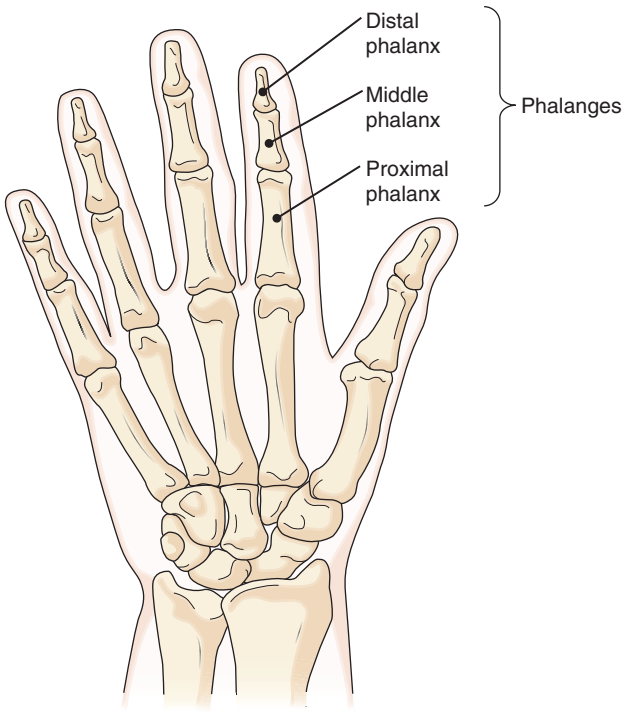


FIGURE 1-13 Bones of the right hand (anterior view). Each bone of a finger or toe is a phalanx. Each hand has 15 phalanges.

Exercise 1-4

Complete the exercise. To check your answers go to Appendix 11.

Write the plural form of the following words. The word ending is underlined in each. Remember to use the phonetics to pronounce each word as you work through the exercises.

1. patell<u>a</u> (kneecap) *pah-TEL-ah* — patellae
2. phenomen<u>on</u> (occurrence or perception) *feh-NOM-eh-non* — _____
3. oment<u>um</u> (abdominal membrane) *o-MEN-tum* — _____
4. prognos<u>is</u> (prediction of disease outcome) *prog-NO-sis* — _____
5. ap<u>ex</u> (tip or peak) *A-peks* — _____
6. ov<u>um</u> (female reproductive cell; egg) *O-vum* — _____
7. spermatozo<u>on</u> (male reproductive cell; sperm cell) *sper-mah-to-ZO-on* — _____
8. menin<u>x</u> (membrane around the brain and spinal cord) *MEH-ninks* — _____
9. embol<u>us</u> (blockage in a vessel) *EM-bo-lus* — _____

Write the singular form of the following words. The word ending is underlined in each.

10. protozo<u>a</u> (single-celled animals) *pro-to-ZO-ah* — protozoon
11. append<u>ices</u> (things added) *ah-PEN-dih-seze* — _____
12. adenom<u>ata</u> (tumors of glands) *ad-eh-NO-mah-tah* — _____
13. fung<u>i</u> (simple, nongreen plants) *FUN-ji* — _____
14. pelv<u>es</u> (cup-shaped cavities) *PEL-veze* — _____
15. foramin<u>a</u> (openings, passageways) *fo-RAM-ih-na* — _____
16. curricul<u>a</u> (series of courses) *kur-RIK-u-lah* — _____
17. ind<u>ices</u> (directories, lists) *IN-dih-seze* — _____
18. alveol<u>i</u> (small sacs) *al-VE-o-li* — _____

SOME EXCEPTIONS TO THE RULES

There are exceptions to the rules given for forming plurals, some of which will appear in later chapters. For example, the plural of *sinus* (space) is *sinuses*, the plural of *virus* is *viruses*, and *serums* (thin fluids) is sometimes used instead of *sera*. An *-es* ending may be added to words ending in *-ex* or *-ix* to form a plural, as in *appendixes*, *apexes*, and *indexes*.

Some incorrect plural forms are in common usage, for example, *stigmas* instead of *stigmata*, *referendums* instead of *referenda*, *stadiums* instead of *stadia*. Often people use *phalange* instead of *phalanx* as the singular of *phalanges*. Words ending in *-oma*, meaning "tumor," should be changed to *-omata*, but most people just add an *s* to form the plural. For example, the plural of *carcinoma* (a type of cancer) should be *carcinomata*, but *carcinomas* is commonly used.

Prefixes

A prefix is a short word part added before a word or word root to modify its meaning. For example, the word *lateral* means "side." Adding the prefix *uni-*, meaning "one," forms *unilateral*, which means "affecting or involving one side." Adding the prefix *contra-*, meaning "against or opposite," forms *contralateral*, which refers to an opposite side. The term *equilateral* means "having equal sides." Prefixes in this book are followed by dashes to show that word parts are added to the prefix to form a word.

Most of the prefixes used in medical terminology are shown in **TABLES 1-5** to **1-12**. Although the list is long, almost all of the prefixes you will need to work through this book are presented here. Some additional prefixes, including those related to disease, are given in several later chapters. The meanings of many of the prefixes in this chapter are familiar to you from words that are already in your vocabulary. You may not know all the words in the exercises, but make your best guess. The words in the tables are given as examples of usage. Almost all of them reappear in other chapters. If you forget a prefix as you work, you may refer to this chapter or to the alphabetical lists of word parts and their meanings in Appendices 3 and 4. Appendix 7 lists prefixes only.

Table 1-5 Prefixes for Numbers[a]

Prefix	Meaning	Example	Definition of Example
prim/i-	first	primary *PRI-mar-e*	first
mon/o-	one	monocular *mon-OK-u-lar*	having one eyepiece or affecting one eye
uni-	one	unite *u-NITE*	form into one part
hemi-	half, one side	hemisphere *HEM-ih-sfere*	one-half of a rounded structure **(FIG. 1-14)**
semi-	half, partial	semipermeable *sem-e-PER-me-ah-bl*	partially permeable (capable of being penetrated)
bi-	two, twice	binary *BI-nar-e*	made up of two parts
di-	two, twice	diatomic *di-ah-TOM-ik*	having two atoms
dipl/o-	double	diplococci *dip-lo-KOK-si*	round bacteria (cocci) that grow in groups of two
tri-	three	tricuspid *tri-KUS-pid*	having three points or cusps **(FIG. 1-15)**
quadr/i-	four	quadruplet *kwah-DRUPE-let*	one of four babies born together
tetra-	four	tetralogy *tet-RAL-o-je*	a group of four
multi-	many	multicellular *mul-ti-SEL-u-lar*	consisting of many cells **(FIG. 1-16)**
poly-	many, much	polymorphous *pol-e-MOR-fus*	having many forms (morph/o)

[a]Prefixes pertaining to the metric system are in Appendix 8-2.

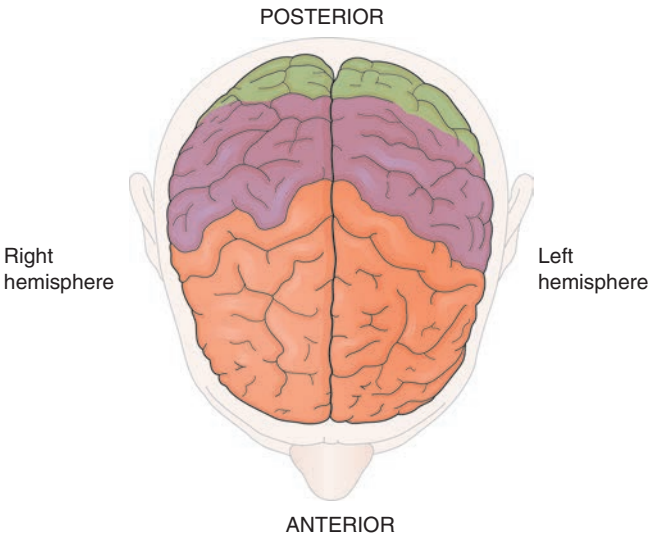


FIGURE 1-14 Brain hemispheres. Each half of the brain is a hemisphere. The prefix *hemi-* means half or one side.

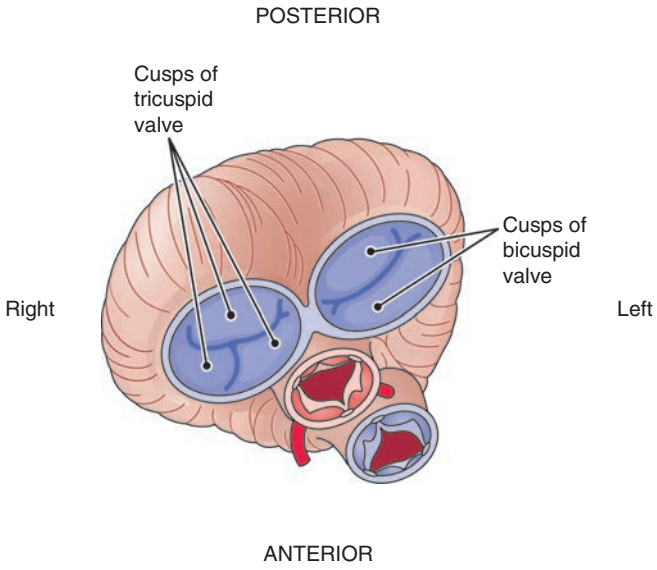


FIGURE 1-15 Heart valves. The valve on the heart's right side, the tricuspid, has three cusps (flaps); the valve on the heart's left side, the bicuspid, has two cusps. The prefixes *bi-* and *tri-* indicate number.

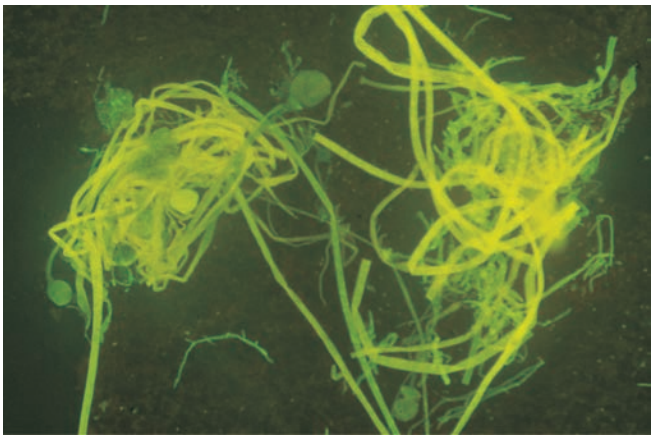


FIGURE 1-16 A multicellular organism. This fungus has more than one cell. It is a simple multicellular organism.

Exercise 1-5

Complete the exercise. To check your answers go to Appendix 11.

Fill in the blanks. Use the phonetics to pronounce each word as you work through the exercises.

1. Place the following prefixes in order of increasing numbers: tri, uni-, tetra-, bi- _____
2. A binocular (*bi-NOK-u-lar*) microscope has _____ eyepieces.
3. A quadruped (*KWAD-ru-ped*) animal walks on _____ feet (ped/o).
4. The term unilateral (*u-nih-LAT-eh-ral*) refers to _____ side (later/o).
5. The term semilunar (*sem-e-LU-nar*) means shaped like a _____ moon.
6. A diploid (*DIP-loyd*) organism has _____ sets of chromosomes (-ploid).

(continued)

Exercise 1-5 *(Continued)*

7. A tetrad (*TET-rad*) has _____ components.
8. A tripod (*TRI-pod*) has _____ legs.
9. Monophonic (*mon-o-FON-ik*) sound has _____ channel.

Give a prefix that is similar in meaning to each of the following.

10. di- _____
11. poly- _____
12. hemi- _____
13. mon/o- _____

Table 1-6 Prefixes for Colors

Prefix	Meaning	Example	Definition of Example
cyan/o-	blue	cyanosis *si-ah-NO-sis*	bluish discoloration of the skin due to lack of oxygen **(FIG. 1-17)**
erythr/o-	red	erythrocyte *eh-RITH-ro-site*	red blood cell (-cyte)
leuk/o-	white, colorless	leukemia *lu-KE-me-ah*	cancer of white blood cells
melan/o-	black, dark	melanin *MEL-ah-nin*	the dark pigment that colors the hair and skin
xanth/o-	yellow	xanthoma *zan-THO-mah*	yellow growth (-oma) on the skin

FIGURE 1-17 Cyanosis, a bluish discoloration. This abnormal coloration is seen in the toenails and toes, as compared to the normal coloration of the fingertips. The prefix *cyan/o-* means "blue."

Exercise 1-6

Complete the exercise. To check your answers go to Appendix 11.

Match the following terms, and write the appropriate letter to the left of each number.

____ 1. melanocyte (*MEL-ah-no-site*)	a. pertaining to bluish discoloration
____ 2. xanthoderma (*zan-tho-DER-mah*)	b. redness of the skin
____ 3. cyanotic (*si-ah-NOT-ik*)	c. yellow coloration of the skin
____ 4. erythema (*eh-RIH-the-mah*)	d. cell that produces dark pigment
____ 5. leukocyte (*LU-ko-site*)	e. white blood cell

Table 1-7 Negative Prefixes

Prefix	Meaning	Example	Definition of Example
a-, an-	not, without, lack of, absence	anhydrous *an-HI-drus*	lacking water (hydr/o)
anti-	against	antiseptic *an-tih-SEP-tik*	agent used to prevent infection (sepsis)
contra-	against, opposite, opposed	contraindicated *kon-trah-IN-dih-ka-ted*	against recommendations, not advisable
de-	down, without, removal, loss	decalcify *de-KAL-sih-fi*	remove calcium (calc/i) from
dis-	absence, removal, separation	dissect *dih-SEKT*	to separate tissues for anatomic study
in-[a], im- (used before b, m, p)	not	incontinent *in-KON-tih-nent*	not able to contain or control discharge of excretions
non-	not	noncontributory *non-kon-TRIB-u-tor-e*	not significant, not adding information to a medical diagnosis
un-	not	uncoordinated *un-ko-OR-dih-na-ted*	not working together, not coordinated

[a]May also mean "in" or "into" as in inject, inhale.

Exercise 1-7

Complete the exercise. To check your answers go to Appendix 11.

Identify and define the prefix in the following words.

	Prefix	Meaning of Prefix
1. aseptic	a	not, without, lack of, absence
2. antidote	_____	_____
3. amnesia	_____	_____
4. disintegrate	_____	_____
5. contraception	_____	_____
6. inadequate	_____	_____

(continued)

Exercise 1-7 *(Continued)*

7. depilatory _____ _____
8. nonconductor _____ _____

Add a prefix to form the negative of the following words.

9. conscious
10. significant unconscious
11. infect _____
12. usual _____
13. specific _____
14. congestant _____
15. compatible _____

Table 1-8 Prefixes for Direction

Prefix	Meaning	Example	Definition of Example
ab-	away from	abduct *ab-DUKT*	to move away from the midline **(FIG. 1-18)**
ad-	toward, near	adduct *ad-DUKT*	to move toward the midline (see **FIG. 1-18**)
dia-	through	diarrhea *di-ah-RE-ah*	frequent discharge of fluid fecal matter
per-	through	percutaneous *per-ku-TA-ne-us*	through the skin
trans-	through	transected *tran-SEKT-ed*	cut (sectioned) through or across

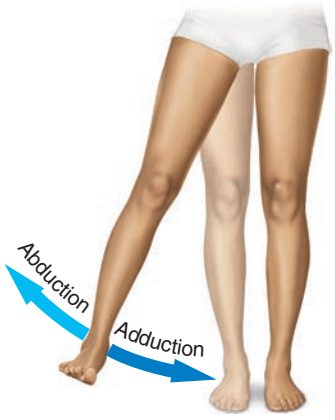


FIGURE 1-18 Abduction and adduction. The prefix *ab-* means "away from"; the leg is moved away from the body in abduction. The prefix *ad-* means "toward"; the leg is moved toward the body in adduction.

Exercise 1-8

Complete the exercise. To check your answers go to Appendix 11.

Identify and define the prefix in the following words.

	Prefix	Meaning of Prefix
1. dialysis	dia	through
2. percolate	_____	_____
3. adjacent	_____	_____
4. absent	_____	_____
5. diameter	_____	_____
6. transport	_____	_____

Table 1-9 Prefixes for Degree

Prefix	Meaning	Example	Definition of Example
hyper-	over, excess, abnormally high, increased	hyperthermia *hi-per-THER-me-ah*	high body temperature
hypo-[a]	under, below, abnormally low, decreased	hyposecretion *hi-po-se-KRE-shun*	underproduction of a substance
olig/o-	few, scanty	oligospermia *ol-ih-go-SPER-me-ah*	abnormally low number of sperm cells in semen
pan-	all	pandemic *pan-DEM-ik*	disease affecting an entire population
super-[a]	above, excess	supernumerary *su-per-NU-mer-ar-e*	in excess number

[a]May also indicate position, as in hypodermic, superficial.

Exercise 1-9

Complete the exercise. To check your answers go to Appendix 11.

Match the following terms, and write the appropriate letter to the left of each number.

____ 1. hypotensive (*hi-po-TEN-siv*)	a. excess breathing
____ 2. oligodontia (*ol-ih-go-DON-she-ah*)	b. something written above
____ 3. panplegia (*pan-PLE-je-ah*)	c. having low blood pressure
____ 4. superscript (*SU-per-skript*)	d. total paralysis
____ 5. hyperventilation (*hi-per-ven-tih-LA-shun*)	e. less than the normal number of teeth

Table 1-10 Prefixes for Size and Comparison

Prefix	Meaning	Example	Definition of Example
equi-	equal, same	equilibrium *e-kwih-LIB-re-um*	a state of balance, state in which conditions remain the same
eu-	true, good, easy, normal	euthanasia *u-thah-NA-ze-ah*	easy or painless death (thanat/o)
hetero-	other, different, unequal	heterogeneous *het-er-o-JE-ne-us*	composed of different materials, not uniform
homo-, homeo-	same, unchanging	homograft *HO-mo-graft*	tissue transplanted to another of the same species
iso-	equal, same	isocellular *i-so-SEL-u-lar*	composed of similar cells
macro-	large, abnormally large	macroscopic *mak-ro-SKOP-ik*	large enough to be seen without a microscope
mega-[a], megal/o	large, abnormally large	megacolon *meg-ah-KO-lon*	enlargement of the colon
micro-[a]	small	microcyte *MI-kro-site*	very small cell (-cyte)
neo-	new	neonate *NE-o-nate*	a newborn infant **(FIG. 1-19)**
normo-	normal	normovolemia *nor-mo-vol-E-me-ah*	normal blood volume
ortho-	straight, correct, upright	orthodontics *or-tho-DON-tiks*	branch of dentistry concerned with correction and straightening of the teeth (odont/o)
poikilo-	varied, irregular	poikilothermic *poy-kih-lo-THER-mik*	having variable body temperature (therm/o)
pseudo-	false	pseudoplegia *su-do-PLE-je-ah*	false paralysis (-plegia)
re-	again, back	reflux *RE-flux*	backward flow

[a]Mega- also means 1 million, as in megahertz. Micro- also means 1 millionth, as in microsecond.

FIGURE 1-19 A neonate or newborn. The prefix *neo-* means "new."

Exercise 1-10

Complete the exercise. To check your answers go to Appendix 11.

Match the following terms, and write the appropriate letter to the left of each number.

____ 1. isograft (*I-so-graft*)	a. having a constant body temperature
____ 2. orthotic (or-*THOT-ik*)	b. irregular, mottled condition of the skin
____ 3. pseudoreaction (*su-do-re-AK-shun*)	c. false response
____ 4. poikiloderma (*poy-kil-o-DER-mah*)	d. tissue transplanted between identical individuals
____ 5. homothermic (*ho-mo-THER-mik*)	e. straightening or correcting deformity

Identify and define the prefix in the following words.

	Prefix	Meaning of Prefix
6. homeostasis	homeo	same, unchanging
7. equivalent	_____	_____
8. orthopedics	_____	_____
9. rehabilitation	_____	_____
10. euthyroidism	_____	_____
11. neocortex	_____	_____
12. megabladder	_____	_____
13. isometric	_____	_____
14. normothermic	_____	_____

Write the opposite of the following words.

15. homogeneous (of uniform composition) *ho-mo-JE-ne-us* _____

16. macroscopic (large enough to see with the naked eye) *mah-kro-SKOP-ik* _____

Table 1-11 Prefixes for Time and/or Position

Prefix	Meaning	Example	Definition of Example
ante-	before	antenatal *an-te-NA-tal*	before birth (nat/i)
pre-	before, in front of	premature *pre-mah-CHUR*	occurring before the proper time
pro-	before, in front of	prodrome *PRO-drome*	symptom that precedes a disease
post-	after, behind	postnasal *post-NA-sal*	behind the nose (nas/o)

Exercise 1-11

Complete the exercise. To check your answers go to Appendix 11.

Match the following terms, and write the appropriate letter to the left of each number.

____ 1. postmortem (*post-MOR-tem*)	a. to occur before another event
____ 2. antedate (*AN-te-date*)	b. ancestor, one who comes before
____ 3. progenitor (*pro-JEN-ih-tor*)	c. before birth (parturition)
____ 4. prepartum (*pre-PAR-tum*)	d. throwing or extending forward
____ 5. projectile (*pro-JEK-tile*)	e. occurring after death

Identify and define the prefix in the following words.

	Prefix	Meaning of Prefix
6. prediction (*pre-DIK-shun*)	pre	before, in front of
7. postmenopausal (*post-men-o-PAW-zal*)		
8. procedure (*pro-SE-jur*)		
9. predisposing (*pre-dis-PO-zing*)		
10. antepartum (*an-te-PAR-tum*)		

Table 1-12 Prefixes for Position

Prefix	Meaning	Example	Definition of Example
dextr/o-	right	dextrogastria *deks-tro-GAS-tre-ah*	displacement of the stomach (gastr/o) to the right
sinistr/o-	left	sinistromanual *sin-is-tro-MAN-u-al*	left-handed
ec-, ecto-	out, outside	ectopic *ek-TOP-ik*	out of normal position
ex/o-	away from, outside	excise *ek-SIZE*	to cut out
end/o-	in, within	endoderm *EN-do-derm*	inner layer of a developing embryo
mes/o-	middle	mesencephalon *mes-en-SEF-ah-lon*	middle portion of the brain (encephalon), midbrain
syn-, sym- (used before b, m, p)	together	synapse *SIN-aps*	a junction between two nerve cells (**FIG. 1-20**)
tel/e-, tel/o-	end, far, at a distance	teletherapy *tel-eh-THER-ah-pe*	radiation therapy delivered at a distance from the body

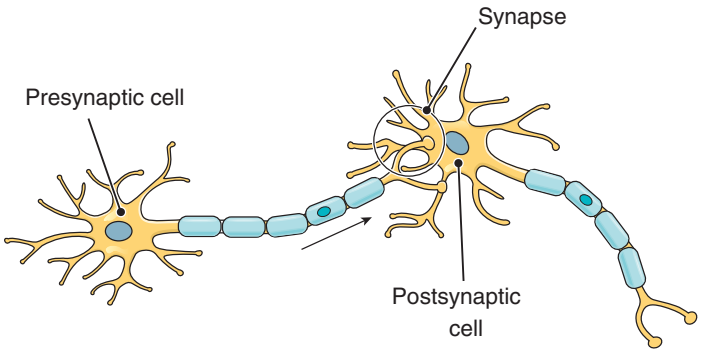


FIGURE 1-20 A synapse. Nerve cells come together at a synapse, as shown by the prefix *syn-*. The presynaptic cell is located before (prefix *pre-*) the synapse; the postsynaptic cell is located after (prefix *post-*) the synapse.

Exercise 1-12

Complete the exercise. To check your answers go to Appendix 11.

Match the following terms, and write the appropriate letter to the left of each number.

____ 1. mesoderm (*MES-o-derm*)	a. displacement of the heart to the left
____ 2. symbiosis (*sim-bi-O-sis*)	b. device for viewing the inside of a structure
____ 3. sinistrocardia (*sin-is-tro-KAR-de-ah*)	c. two organisms living together
____ 4. endoscope (*EN-do-skope*)	d. last stage of cell division (mitosis)
____ 5. telephase (*TEL-eh-faze*)	e. middle layer of a developing embryo

Identify and define the prefix in the following words.

	Prefix	Meaning of Prefix
6. sympathetic (*sim-pah-THET-ik*)	sym	together
7. extract (*EKS-tract*)	_____	_____
8. ectoparasite (*ek-to-PAR-ah-site*)	_____	_____
9. syndrome (*SIN-drome*)	_____	_____
10. endotoxin (*en-do-TOX-in*)	_____	_____

Write the opposite of the following words.

11. exogenous (outside the organism) *eks-OJ-eh-nus*	_____	_____
12. dextromanual (right-handed) *deks-tro-MAN-u-al*	_____	_____
13. ectoderm (outermost layer of the embryo) *EK-to-derm*	_____	_____

Case Study Revisited

David's Follow-up

David took the recommendations and instructions from the gastroenterologist seriously. He was aware of the consequences of GERD since his father had undergone a surgical procedure for it 2 years ago. David's father had allowed his symptoms to go untreated which caused damage to his esophagus requiring surgery. Even after surgery, David's father continues to have ongoing issues due to his noncompliance with meds and obesity. David saw first-hand what he could be facing if he did not take care of his health.

David knew he had a lot to accomplish prior to his 3-month follow-up with his physician. He followed the dosage instructions on his Prevacid and made sure he stopped by the student health center to have his monthly prescriptions filled. David also joined the local health club where he received a student discount. The club allowed free sessions with a personal trainer who helped David develop an exercise routine along with some diet tips. Soon David developed friendships with others at the club and began playing racquetball.

At his 3-month follow-up appointment, David reported no repeat episodes of epigastric pain. He completed his prescription of Prevacid, lost 10 pounds, changed his diet, and with the advice of his educational counselor cut back on some of his classes for the new semester. The gastroenterologist concluded that David's initial experience with epigastric pain was most likely due to gastroesophageal reflux (GER) and had been relieved by Prevacid and through David's lifestyle changes.

CHAPTER 1

Review

This review tests your understanding of the content introduced in this chapter. Follow the instructions for each exercise and check your answers in Appendix 11.

MULTIPLE CHOICE

Select the best answer and write the letter of your choice to the left of each number.

_____ 1. *Epi-* in the term *epigastric* is a
   a. word root
   b. prefix
   c. suffix
   d. combining form

_____ 2. The *-oid* in the term *xiphoid* is a
   a. root
   b. prefix
   c. derivation
   d. suffix

_____ 3. The term *musculoskeletal* is a(n)
   a. abbreviation
   b. word root
   c. combining form
   d. compound word

_____ 4. The adjective for *larynx* is
   a. larynxic
   b. laryngeal
   c. larynal
   d. largeal

_____ 5. The combining form for *thorax* (chest) is
   a. thorax/o
   b. thor/o
   c. thorac/o
   d. thori/o

_____ 6. In David's case study, the term GERD represents a(n)
   a. combining form
   b. acronym
   c. prefix
   d. suffix

_____ 7. In David's case study, the *ph* in dysphagia is pronounced as
   a. f
   b. p
   c. h
   d. s

FILL IN THE BLANKS

Complete the sentence with the correct term(s).

8. A root with a vowel added to aid in pronunciation is called a(n) _____.
9. Combine the word parts *dia-*, meaning "through," and *-rhea*, meaning "flow," to form a word meaning "passage of fluid stool" _____.
10. The abbreviation ETOH means (refer to Appendix 2) _____.
11. Use Appendix 3 to find that the suffix in *gastroduodenoscopy*, seen in David's opening case study, means _____.
12. Combine the root *cardi*, meaning "heart," with the suffix *-logy*, meaning "study of," to form a word meaning "study of the heart" _____.
13. The suffix *-al*, as in *esophageal*, seen in David's case study follow-up means _____.
14. Appendix 1 shows that the symbol ↑ means _____.
15. A monocle has _____ lens(es).
16. A triplet is one of _____ babies born together.
17. Sinistrad means toward the _____.
18. A disaccharide is a sugar composed of _____ subunits.
19. A contralateral structure is located on the side _____ to a given point.
20. A tetralogy is composed of _____ part(s).

Identify the suffix that means "condition of" in the following words. Remember to use the phonetics in the following exercises to pronounce each word as you work.

21. alcoholism (*AL-ko-hol-izm*) (alcohol dependence) _____
22. insomnia (*in-SOM-ne-ah*) (inability to sleep; root: somn/o) _____
23. acidosis (*as-ih-DO-sis*) (acid body condition) _____
24. dysentery (*DIS-en-ter-e*) (intestinal disorder; root: enter/o) _____
25. psychosis (*si-KO-sis*) (disorder of the mind) _____
26. anemia (*ah-NE-me-ah*) (lack of blood or hemoglobin; root: hem/o) _____

Give the suffix in the following words that means "specialty" or "specialist."

27. psychiatry (*si-KI-ah-tre*) _____
28. orthopedics (*or-tho-PE-diks*) _____
29. anesthesiologist (*an-es-the-ze-OL-o-jist*) _____
30. technician (*tek-NISH-un*) _____
31. obstetrician (*ob-steh-TRISH-un*) _____

Give the name of a specialist in the following fields.

32. dermatology (*der-mah-TOL-o-je*) _____
33. pediatrics (*pe-de-AH-triks*) _____
34. physiology (*fiz-e-OL-o-je*) _____
35. gynecology (*gi-neh-KOL-o-je*) _____

Identify the adjective suffix in the following words that means "pertaining to," "like," or "resembling."

36. anxious (*ANG-shus*) _____
37. fibroid (*FI-broyd*) _____
38. arterial (*ar-TE-re-al*) _____
39. pelvic (*PEL-vik*) _____
40. binary (*BI-nar-e*) _____
41. skeletal (*SKEL-eh-tal*) _____
42. rheumatoid (*RU-mah-toyd*) _____
43. febrile (*FEB-rile*) _____
44. vascular (*VAS-ku-lar*) _____
45. exploratory (*ek-SPLOR-ah-tor-e*) _____

PLURALS

Write the plural for the following words. Each word ending is underlined.

46. gingiva (*JIN-jih-vah*) (gum) _____
47. testis (*TEST-is*) (male reproductive organ) _____
48. criterion (*kri-TIR-e-on*) (standard) _____
49. lumen (*LU-men*) (central opening) _____
50. locus (*LO-kus*) (place) _____
51. ganglion (*GANG-le-on*) (mass of nervous tissue) _____
52. larynx (*LAR-inks*) (voice box) _____
53. nucleus (*NU-kle-us*) (center; core) _____

SINGULARS

Write the singular form for the following words. Each word ending is underlined.

54. thrombi (*THROM-bi*) (blood clots) _____
55. vertebrae (*VER-teh-bre*) (bones of the spine) _____
56. bacteria (*bak-TE-re-ah*) (type of microorganism) _____
57. alveoli (*al-VE-oli*) (air sacs) _____
58. apices (*A-pih-seze*) (high points, tips) _____
59. foramina (*fo-RAM-ih-nah*) (openings) _____
60. diagnoses (*di-ag-NO-seze*) (identifications of disease) _____
61. carcinomata (*kar-sih-NO-mah-tah*) (cancers) _____

DEFINITIONS

Identify and define the prefix in the following words.

	Prefix	Meaning of Prefix
62. hyperactive	_____	_____
63. transfer	_____	_____
64. posttraumatic	_____	_____
65. regurgitate	_____	_____
66. extend	_____	_____

67. adhere _____ _____
68. unusual _____ _____
69. detoxify _____ _____
70. semisolid _____ _____
71. premenstrual _____ _____
72. perforate _____ _____
73. dialysis (*di-AL-ih-sis*) _____ _____
74. antibody _____ _____
75. microsurgery _____ _____
76. disease _____ _____
77. endoparasite _____ _____
78. symbiotic (*sim-bi-OT-ik*) _____ _____
79. prognosis (*prog-NO-sis*) _____ _____
80. insignificant _____ _____

OPPOSITES

Write a word that means the opposite of each of the following.

81. humidify _____
82. permeable _____
83. heterogeneous _____
84. exotoxin _____
85. microscopic _____
86. hyperventilation _____
87. postsynaptic _____
88. septic _____

SYNONYMS

Write a synonym (a word having the same or nearly the same meaning as another word) in each of the following blanks.

89. supersensitivity _____
90. megalocyte (extremely large red blood cell) _____
91. antenatal _____
92. isolateral (having equal sides) _____

TRUE–FALSE

Examine the following statements. If the statement is true, write T in the first blank. If the statement is false, write F in the first blank, and correct the statement by replacing the underlined word in the second blank.

	True or False	Correct Answer
93. Immune cells are primed by their <u>first</u> exposure to a disease organism.	T	_____
94. Unicellular organisms are composed of <u>10 cells</u>.	F	one cell
95. To bisect is to cut into <u>two</u> parts.	_____	_____
96. A tetrad has <u>five</u> parts	_____	_____

97. In Latin, the oculus dexter is the left eye. _____ _____

98. A triceps muscle has six parts. _____ _____

99. A polygraph measures many physiologic responses. _____ _____

PRONUNCIATION

Pronounce the following words.

100. dyslexia

101. rheumatism

102. pneumatic

103. chemist

104. pharmacy

Pronounce the following phonetic forms and write the words they represent.

105. *KAR-de-ak* _____

106. *HI-dro-jen* _____

107. *OK-u-lar* _____

108. *ru-MAT-ik* _____

MATCHING

Match the following terms, and write the appropriate letter to the left of each number.

_____ 109.	primitive	a. one-half or one side of the chest
_____ 110.	biceps	b. having two forms
_____ 111.	unify	c. combine into one part
_____ 112.	dimorphous	d. a muscle with two parts
_____ 113.	hemithorax	e. occurring first in time

_____ 114.	erythematous	a. cell with yellow color
_____ 115.	melanoma	b. having a bluish discoloration
_____ 116.	xanthocyte	c. darkly pigmented tumor
_____ 117.	cyanotic	d. red in color
_____ 118.	leukocyte	e. white blood cell

Match each of the following prefixes with its meaning.

_____ 119.	poikilo-	a. good, true, easy
_____ 120.	eu-	b. straight, correct
_____ 121.	ortho-	c. false
_____ 122.	pseudo-	d. few, scanty
_____ 123.	oligo-	e. varied, irregular

WORD BUILDING

Write words for the following definitions using the word parts provided. A combining vowel is included. Each word part can be used more than once.

-itis	-logy	-ptosis	nephr	-o	gastr	cardi	neur-

124. Inflammation of the stomach _____ gastritis _____

125. Study of the nervous system _____

126. Dropping of the kidney _____

127. Study of the kidney _____

128. Inflammation of a nerve _____

129. Downward displacement of the heart _____

Write words for the following definitions using the word parts provided. Each word part may be used more than once.

mon/o	-al	dextr/o	end/o	macro	cardi	cyt	-ic	ecto	micro	-ia

130. Pertaining to a very small cell _____

131. A condition in which the heart is outside its normal position _____

132. Pertaining to a cell with a single nucleus _____

133. Condition in which the heart is displaced to the right _____

134. Pertaining to the innermost layer of the heart _____

135. Pertaining to a very large cell _____

136. Condition in which the heart is extremely small _____

WORD ANALYSIS

Define each of the following words, and give the meaning of the word parts in each. Use a dictionary if necessary. Remember to use the phonetics to pronounce each word as you work through the exercise.

137. renogastric (*re-no-GAS-trik*)

a. ren/o _____

b. gastr/o _____

c. -ic _____

138. geriatrician (*jer-e-ah-TRIH-shun*)

a. ger/e _____

b. iatr/o _____

c. -ic _____

d. -ian _____

139. isometric (*i-so-MET-rik*)

a. iso- _____

b. metr/o _____

c. -ic _____

140. symbiosis (*sim-be-O-sis*)

a. sym- _____

b. bio _____

c. -sis _____

Additional Case Studies

Case Study 1-1: Greg's Arthritic Knees

Chief Complaint

Greg, a 68 y/o male, presents to his family doctor c/o bilateral knee discomfort that worsens prior to a heavy rainstorm. He states that his "arthritis" is not getting any better. He has been taking NSAIDs but is not obtaining relief at this point. His family physician referred him to an orthopedic surgeon for further evaluation.

Past Medical History

Greg was active in sports in high school and college. He tore his ACL while playing soccer during his junior year in college, at which time he retired from intercollegiate athletics. His only other physical complaint involves stiffness in his right shoulder, which he attributes to pitching while playing baseball in high school.

Current Medications

NSAIDs prn for arthritic pain; Lipitor 10 mg for mild hyperlipidemia.

X-Rays

Bilateral knee x-rays revealed moderate degenerative changes with joint space narrowing in the left knee; severe degenerative changes and joint space narrowing in the right knee.

Case Study 1-1 Questions

Multiple Choice. *Select the best answer, and write the letter of your choice to the left of each number. To check your answers go to Appendix 11.*

_____ 1. The *bi-* in the word *bilateral* is a
   a. suffix
   b. root
   c. prefix
   d. combining form

_____ 2. The *-itis* in the word *arthritis* is a
   a. root
   b. prefix
   c. derivation
   d. suffix

_____ 3. *Arthr/o* is a(n)
   a. combining form
   b. acronym
   c. prefix
   d. suffix

_____ 4. The AI in the abbreviation NSAID means (see Appendix 2)
   a. antacid
   b. anti-inflammatory
   c. anti-infectious
   d. after incident

Fill in the blank with the correct answer.

5. Use Appendix 2 to find what the abbreviation *ACL* means.

   _____

6. Use Appendix 2 to find what the abbreviation *c/o* means.

   _____

7. Use Appendix 7 to find what the prefix *hyper-* means.

   _____

8. Use Appendix 2 to find what the abbreviation *prn* means.

   _____

9. Use Appendices 5, 6, and 7 to find what the word parts in *hyperlipidemia* mean.

   a. hyper- _____
   b. lip/o _____
   c. -emia _____

10. Use Appendix 3 to find what the word parts in *ortho-pedic* mean.

    a. orth/o _____

    b. ped/o _____

11. Use Appendix 7 to find what the prefix *inter-* means.

    _____

Case Study 1-2: Sally's Job-Related Breathing Problems

Chief Complaint

Sally, a 54 y/o woman, has been having difficulty breathing (dyspnea) that was originally attributed to a left upper lobe (LUL) pneumonia. She was treated with an antibiotic, and after no improvement was noted in her breathing, Sally had a follow-up chest x-ray that revealed a small LUL pneumothorax. She was referred to the respiratory clinic and saw Dr. Williams, a pulmonologist.

Past Medical History

Sally has a history of smoking a pack of cigarettes a day for 30 years but stopped smoking 2 years ago. She noticed an improvement in her breathing and tired less easily after she quit. About 1 month ago, she complained of general malaise, dyspnea, and a productive cough; she was expectorating pus-containing (purulent) sputum and was febrile. The chest radiograph and sputum cultures indicate that her symptoms had progressed into a bronchopneumonia with pulmonary edema complicated by a small pneumothorax in the LUL. A pea-size mass was identified in the left lobe. Also noted, Sally is a hairstylist as well as a manicurist and recently went back to work in a beauty salon. She has complained that the fumes from the hair chemicals and nail products affect her breathing.

Clinical Course

Dr. Williams performed a bronchoscopic examination. During the examination, she took a biopsy of the mass, and the results were negative. Sputum cultures were also taken to determine the spectrum of action of an appropriate antibiotic. A respiratory therapist measured Sally's respiratory volumes and recorded any changes. Sally was told to drink plenty of liquids, get proper rest, and refrain from working for 1 week. She was told to wear a mask when she returned to work, avoid unventilated areas in the salon, and avoid the chemical fumes as much as possible. She was given an appointment to return to the clinic in 1 month for follow-up.

Case Study 1-2 Questions

Multiple Choice. *Select the best answer, and write the letter of your choice to the left of each number. To check your answers go to Appendix 11.*

_____ 1. The *gh* in the terms cough and radiograph is pronounced as
   a. g
   b. h
   c. f
   d. s

_____ 2. The *pn* in the term bronchopneumonia is pronounced as
   a. p
   b. n
   c. f
   d. s

_____ 3. Which of the following is a compound word?
a. pulmonary
b. pneumothorax
c. respiratory
d. antibiotic

_____ 4. The suffix that means "condition of" in *pneumonia* is
a. -nia
b. -monia
c. -ia
d. -onia

_____ 5. The plural of *spectrum* is
a. spectra
b. spectria
c. spectrina
d. spectrums

Fill in the blank with the correct answer.

6. Find four words in the case study with a suffix that means "specialist in a field."
1. _____
2. _____
3. _____
4. _____

7. Find five words in the case study with suffixes that mean "pertaining to, like, or resembling," and write both the suffix and the word that contains it.

	Suffix	Word
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____

Case Study 1-3: Displaced Fracture of the Femoral Neck

While walking home from the train station, Esther, a 72 y/o woman with pre-existing osteoporosis, tripped over a raised curb and fell. In the emergency department, she was assessed for severe pain, and swelling and bruising of her right thigh. A radiograph (x-ray) showed a fracture at the neck of the right femur (thigh bone) **(FIG. 1-21)**. Esther was prepared for surgery and given a preoperative injection of an analgesic to relieve her pain. During surgery, she was given spinal anesthesia and positioned on an operating room table, with her right hip elevated on a small pillow. Intravenous antibiotics were given before the incision was made. Her right hip was repaired with a bipolar hemiarthroplasty (joint reconstruction). Postoperative care included maintaining the right hip in abduction, fluid replacement, physical therapy, and attention to signs of tissue degeneration and possible dislocation.

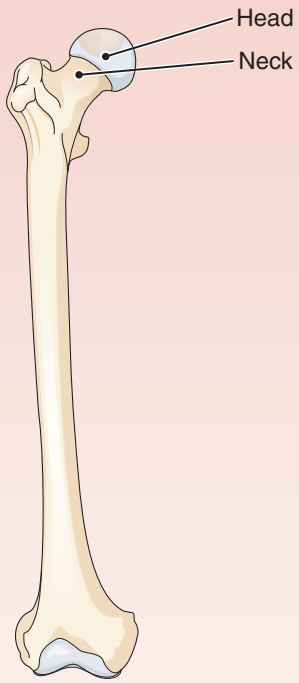


FIGURE 1-21 The right femur (thigh bone). The femoral neck is the fracture site in Case Study 1-3.