Medical Terminology

7TH EDITION

AN ILLUSTRATED GUIDE

Barbara Janson Cohen
Ann DePetris

Wolters Kluwer Health | Lippincott Williams & Wilkins

PASSport to Success

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Dedications

I am most grateful to Ann DePetris, a skilled and knowledgeable contributor to this text. Ann has shown a great commitment to the development of this revision, always willing to share the work and bringing her clinical expertise to the project. Thanks, Ann, for being a great and generous coworker. It's to you that I dedicate this edition of the book.

Barbara Cohen

To some very special people in my life—my husband Michael, son Paul, daughter Marie, and her husband Bobby. This wouldn't have been possible without all of your loving patience and unconditional support. And to Barbara Cohen—the uniqueness and high standards reflected in *Medical Terminology: An Illustrated Guide*, are the direct result of your unbelievable dedication and skills. You are a remarkable author and educator, and a true mentor. Barbara, it has been an honor and pleasure to work with you on this seventh edition. It's to all of you I dedicate my contributions to this edition.

Ann DePetris

Preface

Knowledge of medical terminology is fundamental to a wide variety of health care fields. This book 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's like using the four bases in DNA to code for all the amino acids needed to make proteins.

After the introductory sections, each chapter begins with an illustrated overview of a specific body system with definitions of the key terms related 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 relevant key terms. The section of supplementary 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 differs slightly from that found in traditional anatomy and physiology books. The organization emphasizes their clinical importance, starting with the cardiovascular, respiratory, and digestive systems and continuing with systems treated in more specialized fields, such as the urinary, reproductive, and musculoskeletal systems. The chapters can be taken out of order once the introductory units are completed.

We have tried to make this book 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. The online student learning resources offer many additional activities and an audio glossary. Each chapter opens with a short case study. Some of the words and abbreviations in these studies will be unfamiliar at the start, but return to the opening study after you have completed the chapter, and hopefully, it should make more sense.

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

Barbara Cohen and Ann DePetris

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. The clinicians who contributed current information in their respective fields include: Margaret O. Burr, BS, RVT, RDMS; Michael DePetris, R. Ph.; Paul DePetris, BS; Mary Green, PA-C; Nancy Gurzick, RDH, BS, MA; Marie Howard, PT, DPT; Robert Howard, DO; Bonnie L. Lehman BSN, MS, CNM; Christine Licari, RD; Pamela Morgan, OTR/L; Christina Olkowski, MT (ASCP); Donna Robertson, RNC, MSA; Anne Tobin, RN, MSN, ACNP; and Terese A. Trost MA, RT. The information they shared will help guide students through various career paths. Thanks to you all.

As always, we are grateful to the dedicated staff of Lippincott Williams & Wilkins; especially for this edition, Staci Wolfson, Product Manager, who worked on every aspect of the book and its ancillaries; and David Troy, Executive Editor, who oversaw this project from start to finish.

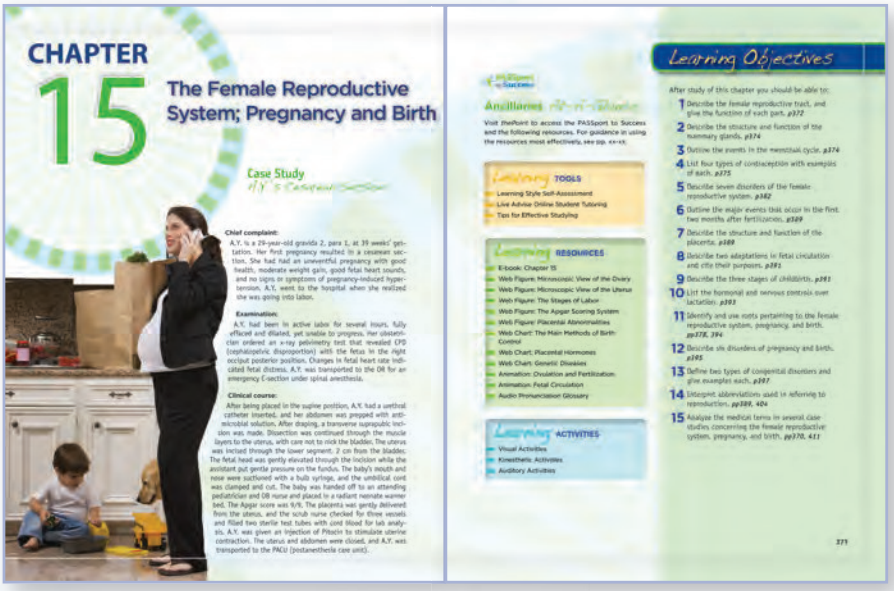
Barbara Cohen
Ann DePetris

User's Guide

Medical Terminology: An Illustrated Guide, 7th 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.

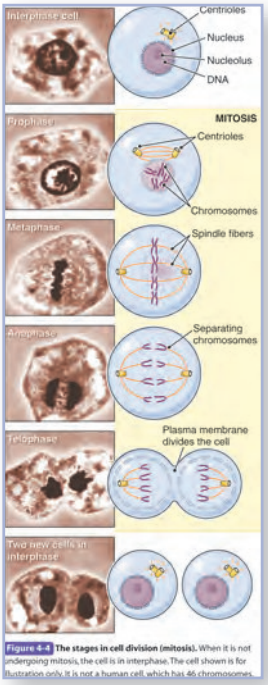
Chapter Contents, Objectives, and Pretests

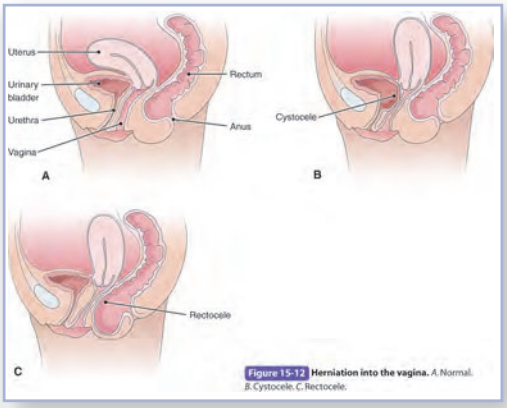
Chapter Opening Case Studies and Objectives help you identify learning goals and familiarize yourself with the materials covered in the chapter. **Chapter Pretests** quiz students on previous knowledge at the beginning of each chapter. Students should take each Chapter Pretest before starting the chapter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

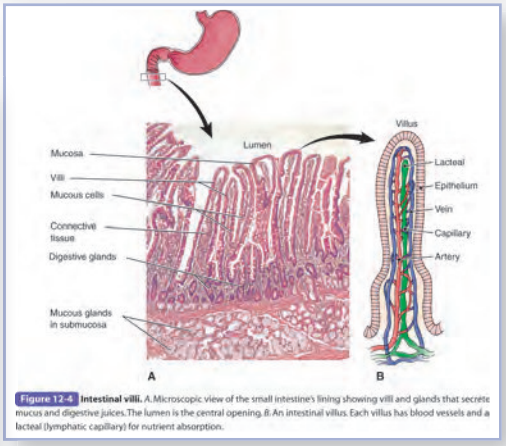


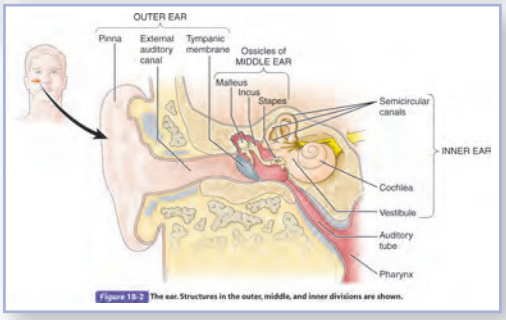
Detailed Illustrations

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.









Feature Boxes

FEATURE BOXES CALL OUT IMPORTANT INFORMATION

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

Box 2-1 Focus on Words

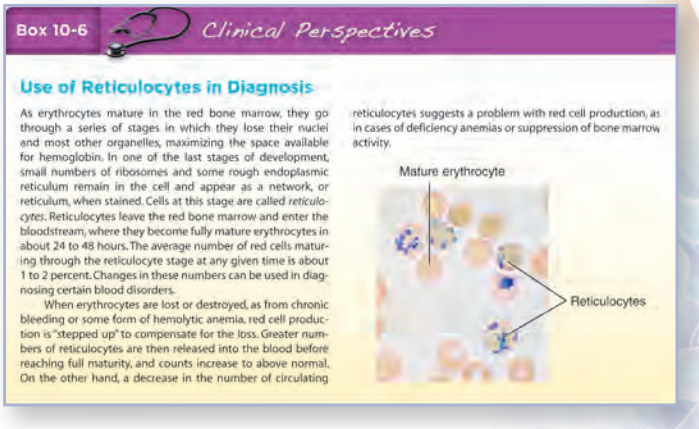
Meaningful Suffixes

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.

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



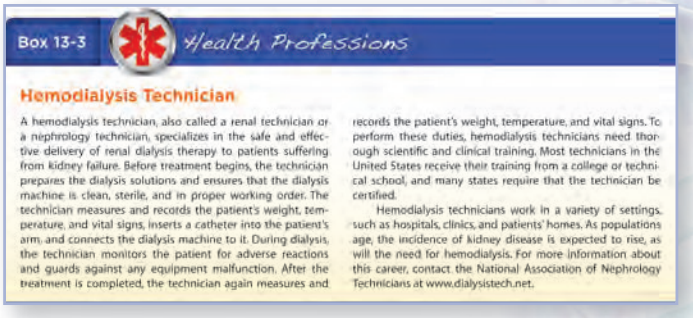
Box 10-6 Clinical Perspectives

Use of Reticulocytes in Diagnosis

As erythrocytes mature in the red bone marrow, they go through a series of stages in which they lose their nuclei and most other organelles, maximizing the space available for hemoglobin. In one of the last stages of development, small numbers of ribosomes and some rough endoplasmic reticulum remain in the cell and appear as a network, or reticulum, when stained. Cells at this stage are called *reticulocytes*. Reticulocytes leave the red bone marrow and enter the bloodstream, where they become fully mature erythrocytes in about 24 to 48 hours. The average number of red cells maturing through the reticulocyte stage at any given time is about 1 to 2 percent. Changes in these numbers can be used in diagnosing certain blood disorders.

When erythrocytes are lost or destroyed, as from chronic bleeding or some form of hemolytic anemia, red cell production is "stepped up" to compensate for the loss. Greater numbers of reticulocytes are then released into the blood before reaching full maturity, and counts increase to above normal. On the other hand, a decrease in the number of circulating reticulocytes suggests a problem with red cell production, as in cases of deficiency anemias or suppression of bone marrow activity.

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



Box 13-3 Health Professions

Hemodialysis Technician

A hemodialysis technician, also called a renal technician or a nephrology technician, specializes in the safe and effective delivery of renal dialysis therapy to patients suffering from kidney failure. Before treatment begins, the technician prepares the dialysis solutions and ensures that the dialysis machine is clean, sterile, and in proper working order. The technician measures and records the patient's weight, temperature, and vital signs, inserts a catheter into the patient's arm, and connects the dialysis machine to it. During dialysis, the technician monitors the patient for adverse reactions and guards against any equipment malfunction. After the treatment is completed, the technician again measures and records the patient's weight, temperature, and vital signs. To perform these duties, hemodialysis technicians need thorough scientific and clinical training. Most technicians in the United States receive their training from a college or technical school, and many states require that the technician be certified.

Hemodialysis technicians work in a variety of settings, such as hospitals, clinics, and patients' homes. As populations age, the incidence of kidney disease is expected to rise, as will the need for hemodialysis. For more information about this career, contact the National Association of Nephrology Technicians at www.dialysistech.net.

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

Box 21-2 For Your Reference

Types of Skin Lesions

LESION	DESCRIPTION
bulla *BUL-a*	raised, fluid-filled lesion larger than a vesicle (plural: bullae)
fissure *FISH-ur*	crack or break in the skin
macule *MAK-ul*	flat, colored spot
nodule *NOD-ul*	solid, raised lesion larger than a papule; often indicative of systemic disease
papule *PAP-ul*	small, circular, raised lesion at the surface of the skin
plaque *plak*	superficial, flat, or slightly raised differentiated patch more than 1 cm in diameter
pustule *PUS-tul*	raised lesion containing pus; often in a hair follicle or sweat pore
ulcer *UL-ser*	lesion resulting from destruction of the skin and perhaps subcutaneous tissue
vesicle *VES-i-kal*	small, fluid-filled, raised lesion; a blister or bleb
wheal *wēl*	smooth, rounded, slightly raised area often associated with itching; seen in urticaria (hives), such as that resulting from allergy

Word Part Tables

DETAILED 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.

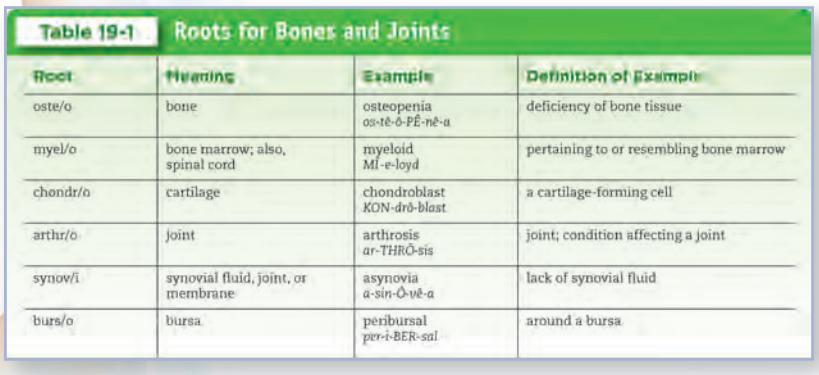
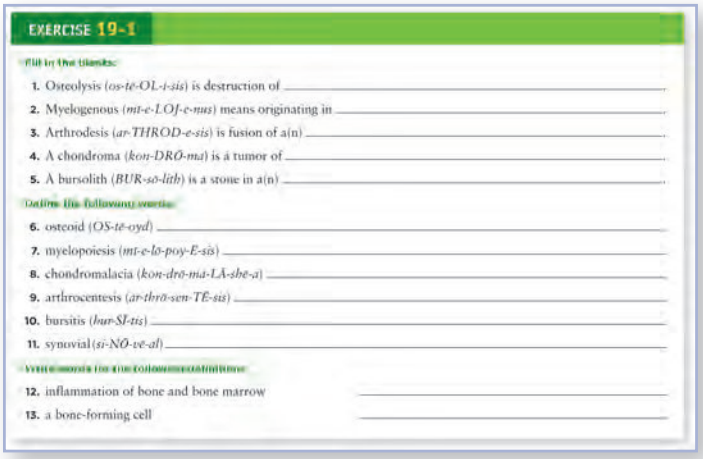


Table 19-1 Roots for Bones and Joints

Root	Meaning	Example	Definition of Example
oste/o	bone	osteopenia *os-tē-ō-PĒ-nē-a*	deficiency of bone tissue
myel/o	bone marrow; also, spinal cord	myeloid *MĪ-e-loyd*	pertaining to or resembling bone marrow
chondr/o	cartilage	chondroblast *KON-drō-blast*	a cartilage-forming cell
arthr/o	joint	arthrosis *ar-THRŌ-sis*	joint; condition affecting a joint
synov/i	synovial fluid, joint, or membrane	asynovia *a-sin-Ō-vē-a*	lack of synovial fluid
burs/o	bursa	peribursal *per-i-BER-sal*	around a bursa

Exercises

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



EXERCISE 19-1

Fill in the blanks:

1. Osteolysis (*os-tē-OL-i-sis*) is destruction of _____
2. Myelogenous (*mī-e-LOJ-e-nus*) means originating in _____
3. Arthrodesis (*ar-THROD-e-sis*) is fusion of a(n) _____
4. A chondroma (*kon-DRŌ-ma*) is a tumor of _____
5. A bursolith (*BUR-sō-lith*) is a stone in a(n) _____

Define the following words:

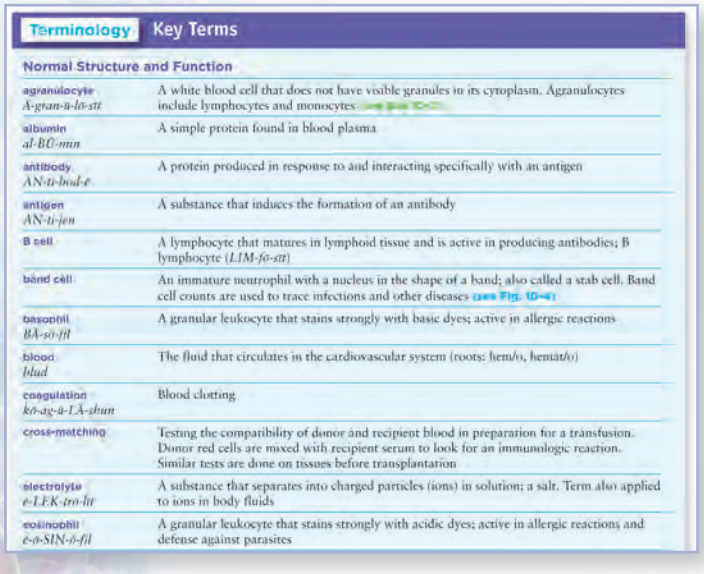
6. osteoid (*OS-tē-oyd*) _____
7. myelopoiesis (*mī-e-lō-poy-E-sis*) _____
8. chondromalacia (*kon-drō-mā-LĀ-shē-a*) _____
9. arthrocentesis (*ar-thrō-sen-TĒ-sis*) _____
10. bursitis (*bur-SĪ-tis*) _____
11. synovial (*si-NŌ-vē-al*) _____

Write words for the following definitions:

12. inflammation of bone and bone marrow _____
13. a bone-forming cell _____

Term Tables

Key Terms include the most commonly used terms.



Terminology Key Terms

Normal Structure and Function

agranulocyte *A-gran-ū-lō-sīt*	A white blood cell that does not have visible granules in its cytoplasm. Agranulocytes include lymphocytes and monocytes. see Fig. 10-4
albumin *al-BŪ-min*	A simple protein found in blood plasma
antibody *AN-ti-bod-ē*	A protein produced in response to and interacting specifically with an antigen
antigen *AN-ti-jen*	A substance that induces the formation of an antibody
B cell	A lymphocyte that matures in lymphoid tissue and is active in producing antibodies; B lymphocyte (*LIM-fō-sīt*)
band cell	An immature neutrophil with a nucleus in the shape of a band; also called a stab cell. Band cell counts are used to trace infections and other diseases. see Fig. 10-4
basophil *BĀ-sō-fil*	A granular leukocyte that stains strongly with basic dyes; active in allergic reactions
blood *blud*	The fluid that circulates in the cardiovascular system (roots: hem/o, hemāt/o)
coagulation *kō-ag-ū-LĀ-shun*	Blood clotting
cross-matching	Testing the compatibility of donor and recipient blood in preparation for a transfusion. Donor red cells are mixed with recipient serum to look for an immunologic reaction. Similar tests are done on tissues before transplantation
electrolyte *ē-LEK-trō-līt*	A substance that separates into charged particles (ions) in solution; a salt. Term also applied to ions in body fluids
eosinophil *ē-ō-SIN-ō-fil*	A granular leukocyte that stains strongly with acidic dyes; active in allergic reactions and defense against parasites

Supplementary Terms list more specialized terms.

Terminology Supplementary Terms

Normal Structure and Function	
agglutination *a-glu-ti-NA-shun*	The clumping of cells or particles in the presence of specific antibodies
bilirubin *bil-i-RU-bin*	A pigment derived from the breakdown of hemoglobin. It is eliminated by the liver in bile
complement *COM-ple-ment*	A group of plasma enzymes that interacts with antibodies
corpuscle *KOR-pus-l*	A small mass or body. A blood corpuscle is a blood cell
hemopoietic stem cell *hē-mō-poy-E-tik*	A primitive bone marrow cell that gives rise to all varieties of blood cells
heparin *HEP-a-rin*	A substance found throughout the body that inhibits blood coagulation; an anticoagulant
plasmin *PLAZ-min*	An enzyme that dissolves clots; also called *fibrinolysin*
thrombin *THROM-bin*	The enzyme derived from prothrombin that converts fibrinogen to fibrin
Symptoms and Conditions	
agranulocytosis *a-gran-u-lō-si-TŌ-sis*	A condition involving a decrease in the number of granulocytes in the blood; also called *granulocytopenia*
erythrocytosis *e-rith-rō-si-TŌ-sis*	Increase in the number of red cells in the blood; may be normal, such as to compensate for life at high altitudes, or abnormal, such as in cases of pulmonary or cardiac disease
Fanconi syndrome *fan-KŌ-ne*	Congenital aplastic anemia that appears between birth and 10 years of age; may be hereditary or caused by damage before birth, as by a virus
graft versus host reaction (GVHR)	An immunologic reaction of transplanted lymphocytes against tissues of the host; a common complication of bone marrow transplantation
hairy cell leukemia	A form of leukemia in which cells have filaments, making them look "hairy"
hematoma *hē-ma-TŌ-ma*	A localized collection of blood, usually clotted, caused by a break in a blood vessel

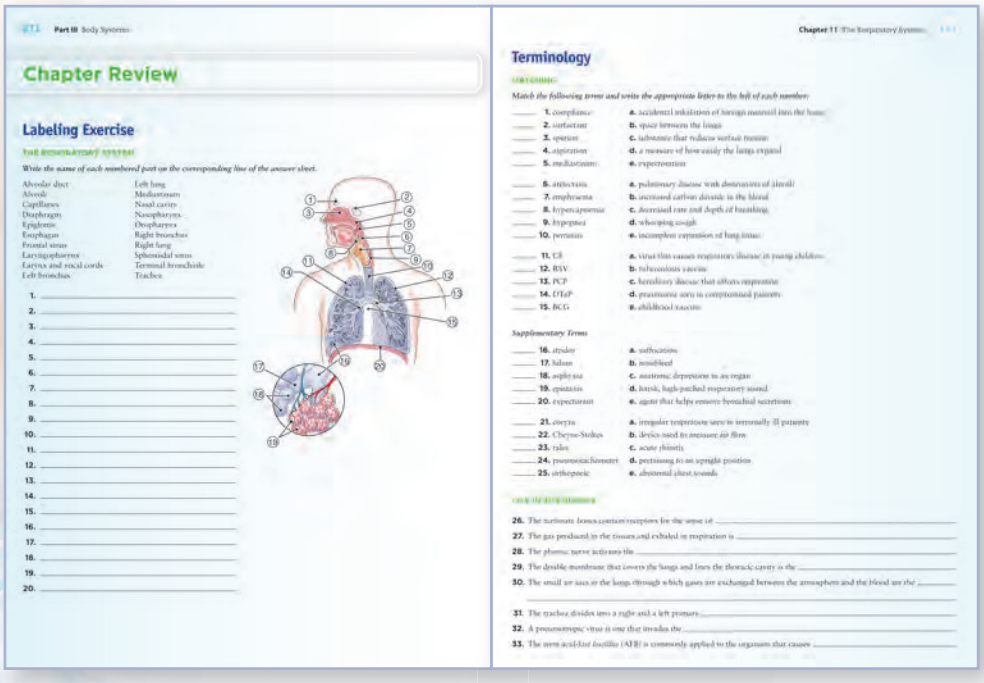
Abbreviations are listed for common terms.

Terminology Abbreviations

Ab	Antibody	ITP	Idiopathic thrombocytopenic purpura
Ag	Antigen, also silver	lytes	Electrolytes
AIDS	Acquired immunodeficiency syndrome	MCH	Mean corpuscular hemoglobin
ALL	Acute lymphoblastic (lymphocytic) leukemia	MCHC	Mean corpuscular hemoglobin concentration
AML	Acute myeloblastic (myelogenous) leukemia	mcL	Microliter
APTT	Activated partial thromboplastin time	mcm	Micrometer
BT	Bleeding time	MCV	Mean corpuscular volume
CBC	Complete blood count	MDS	Myelodysplastic syndrome
CGL	Chronic granulocytic leukemia	mEq	Milliequivalent
CLL	Chronic lymphocytic leukemia	NHL	Non-Hodgkin lymphoma
CML	Chronic myelogenous leukemia	PCV	Packed cell volume
crit	Hematocrit	pH	Scale for measuring hydrogen ion concentration (acidity or alkalinity)
DIC	Disseminated intravascular coagulation	Ph	Philadelphia chromosome
Diff	Differential count	PMN	Polymorphonuclear (neutrophil)
EBV	Epstein-Barr virus	poly	Neutrophil
ELISA	Enzyme-linked immunosorbent assay	polymorph	Neutrophil
EPO, EP	Erythropoietin	PT	Prothrombin time; pro time
ESR	Erythrocyte sedimentation rate	PTT	Partial thromboplastin time
FFP	Fresh frozen plasma	RBC	Red blood cell; red blood (cell) count
Hb, Hgb	Hemoglobin	seg	Neutrophil
Hct, Ht	Hematocrit	SLE	Systemic lupus erythematosus
HDN	Hemolytic disease of the newborn	T(C)T	Thrombin (clotting) time
HIV	Human immunodeficiency virus	TTP	Thrombotic thrombocytopenic purpura
IF	Intrinsic factor	vWF	von Willebrand factor
Ig	Immunoglobulin	WBC	White blood cell; white blood (cell) count

Chapter Review Exercises

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



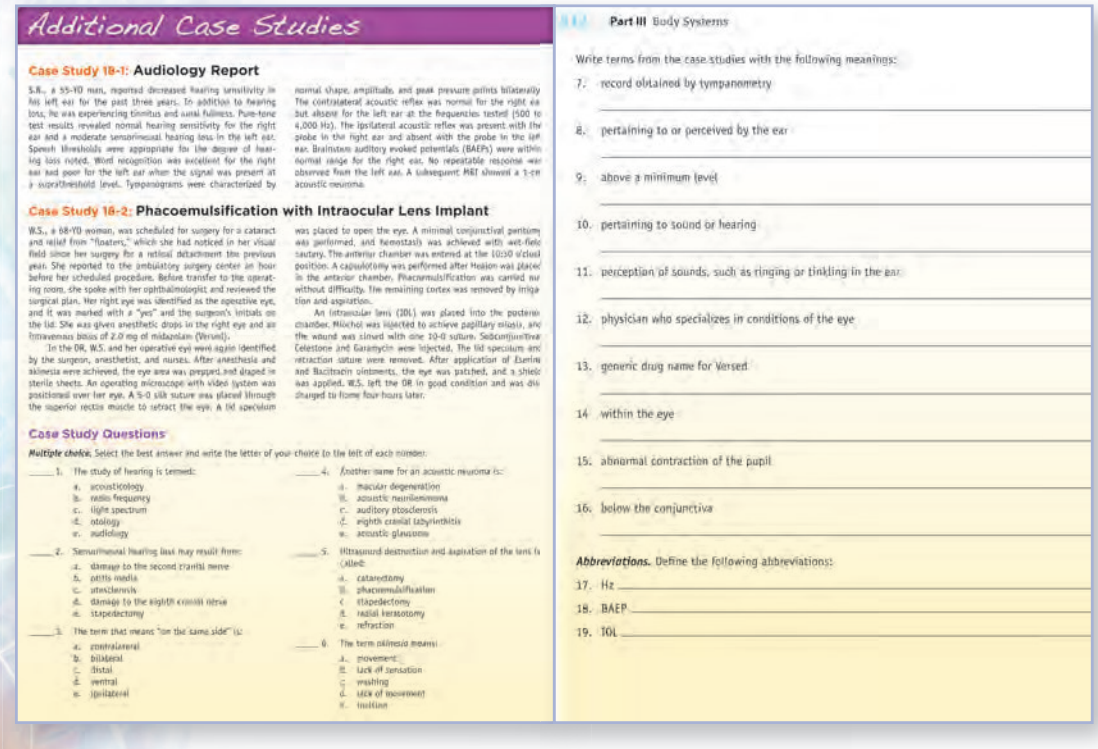
Chapter Review

Labeling Exercise

Terminology

Case Studies and Case Study Questions

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



Additional Case Studies

Case Study 18-1: Audiology Report

Case Study 18-2: Phacoemulsification with Intraocular Lens Implant

Case Study Questions

Part III Body Systems

Flashcard Starter Set

More than 100 flashcards are included at the back of the text. Add to this collection with your own cards as you work through the text (please be sure to see the Student Resources section for information on creating your own set of flashcards using the Flashcard Generator).

Student Resources and the PASSport to Success®

Different people learn in different ways. Some students learn by reading. Others take in new information by listening to their instructors. You may prefer to write down notes. A simple self-assessment can tell you whether you are a visual, auditory, or kinesthetic learner. When you understand the way that you process information most effectively, you can choose resources that fit your learning style. The PASSport to Success® is a practical system that lets you learn faster, remember more, and achieve success.

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PASSport to Success®

Go to the pronunciation glossary on the Student Resources to hear these words pronounced.

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If you like to study animations, illustrations, and diagrams, you may be a visual learner. If you like to sound out new words or discuss material with other students, you may be an auditory (hearing) learner. If you take a lot of notes during class and benefit from hands-on learning activities, you are probably a kinesthetic (touch) learner.

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2. If this is the first time you are visiting the MyPowerLearning Web site, enter your scratch-off access code from the inside cover of this book into the "Access Code" box and click "Begin!"
3. MyPowerLearning will send you an e-mail with your username and password you will use to log in to MyPowerLearning and complete your Learning Style Assessment (*Don't worry—There are no wrong answers!*).
4. Print and read your own personal learning styles report to better understand how to study most effectively and efficiently.

Once you know your own personal learning style, access thePoint.lww.com/Cohen7e on *thePoint*—the companion Web site for *Medical Terminology: An Illustrated Guide*, 7th Edition, which will allow you to search and sort PASSport to Success® activities by learning style to choose the most effective way for you to learn the material. Resources and activities available to students include the following:

- Multiple choice, true–false, and fill-in-the blank questions
- Categories
- Listen & Label and Look & Label
- Word Building
- Zooming In
- Pronounce It
- Spell It
- Sound It
- Hangman
- Crossword Puzzles
- Quiz Show
- Concentration
- Case Studies and Case Study Questions
- Dictionary and Audio Glossary application
- Flashcards and Flashcard Generator applications
- Animations
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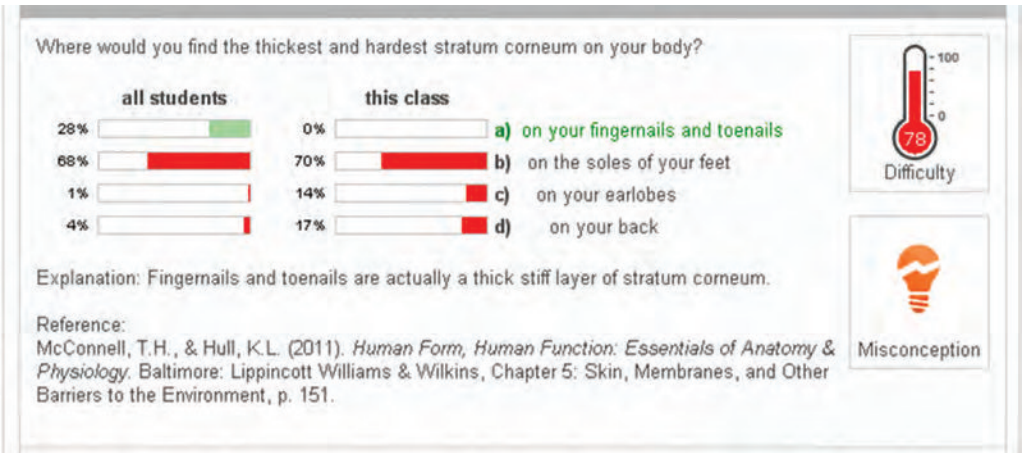
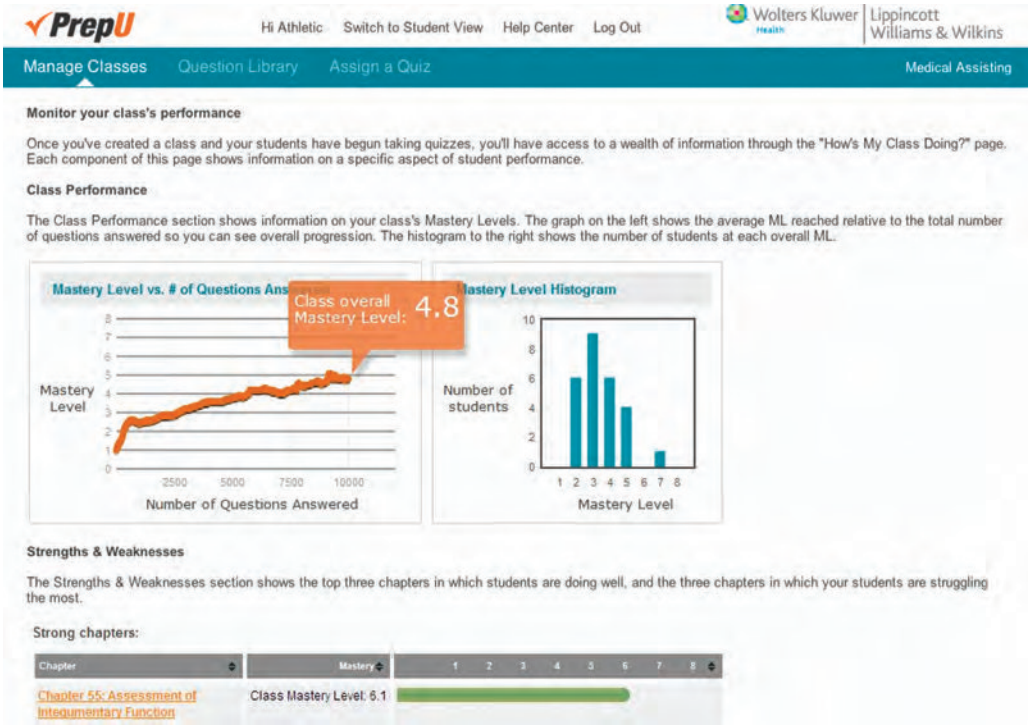


PrepU uses repetitive and adaptive quizzing to build mastery of medical terminology concepts, helping students to learn more while giving instructors the data they need to monitor each student's progress, strengths, and weaknesses. The hundreds of questions in PrepU offer students the chance to drill themselves on medical terminology and support their review and retention of the information they've learned. Each question not only provides an explanation for the correct answer, but also references the text page for the student to review the source material. PrepU for *Medical Terminology* challenges students with questions and activities that coincide with the materials they've learned in the text and gives students a proven tool to learn medical terminology more effectively. For instructors, PrepU provides tools to identify areas and topics of student misconception; instructors can use these rich course data to assess students' learning and better target their in-class activities and discussions, while collecting data that are useful for accreditation.



A learning experience individualized to each student. An adaptive learning engine, PrepU offers questions customized for each student's level of understanding, challenging students at an appropriate pace and difficulty level, while dispelling common misconceptions. As students review and master PrepU's questions, the system automatically increases the difficulty of questions, effectively driving student understanding of medical terminology to a mastery level. PrepU not only helps students to improve their knowledge, but also helps foster their test-taking confidence.

PrepU works! PrepU works, and not just because we say so. PrepU efficacy is *backed by data*:

1. In an introductory nursing course at Central Carolina Technical College, student course outcomes were positively associated with PrepU usage. The students who answered the most PrepU questions in the class also had the best overall course grades.
2. In a randomized, controlled study at UCLA, students using PrepU (for biology) achieved 62 percent higher learning gains than those who did not.

To see a video explanation of PrepU, go to http://download.lww.com/wolterskluwer_vitalstream_com/mktg/prepuvid/prepupromo01.html.

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PART I

Introduction to Medical Terminology

CHAPTER 1 Concepts of Medical Terminology

CHAPTER 2 Suffixes

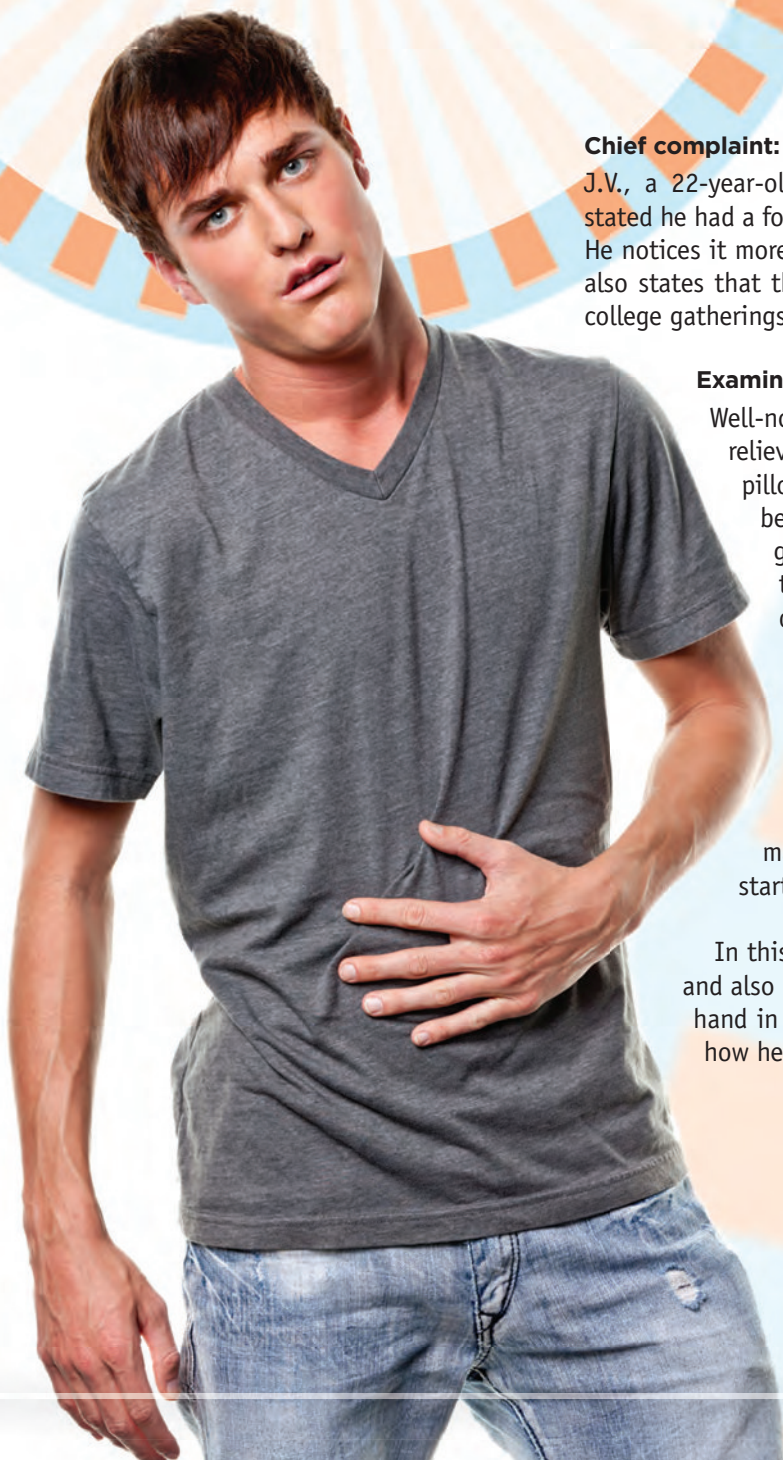
CHAPTER 3 Prefixes

CHAPTER 4 Cells, Tissues, and Organs

CHAPTER 5 Body Structure

CHAPTER 1

Concepts of Medical Terminology



Case Study
J.V.'s Digestive Problems

Chief complaint:

J.V., a 22-year-old college student, visited the university health clinic and stated he had a four-month history of a burning pain in the middle of his chest. He notices it more at night and has difficulty sleeping because of the pain. He also states that the pain seems to occur more frequently following late-night college gatherings where pizza, spicy chicken wings, and beer are served.

Examination:

Well-nourished 22-year-old male c/o epigastric pain no longer relieved by antacids; orthopnea—currently sleeping with three pillows; occasional dysphagia; ETOH consumption is six to eight beers per week; nonsmoker; no neurological, musculoskeletal, genitourinary, or respiratory deficits. Referred to a gastroenterologist for ↑ acid production and gastroesophageal reflux disease (GERD).

Clinical course:

The gastroenterologist saw J.V. and ordered an upper GI. Results demonstrated reflux disease, and J.V. underwent a gastroscopy. Results showed no evidence of bleeding, ulcerations, or strictures. The student was given educational material on GERD, including dietary recommendations. He was started on Prevacid and will be reevaluated in six months.

In this chapter, you learn about how medical words are constructed and also learn about the use of abbreviations and other types of shorthand in medical writing. Later in the chapter, we revisit J.V. and see how he is progressing under treatment.

PASSport to Success®

Ancillaries At-A-Glance

Visit *thePoint* to access the PASSport to Success and the following resources. For guidance in using the resources most effectively, see pp. viii–xvi.

Learning TOOLS

- Learning Style Self-Assessment
- Live Advise Online Student Tutoring
- Tips for Effective Studying

Learning RESOURCES

- E-Book: Chapter 1
- Web Chart: "Do Not Use" Abbreviations and Symbols
- Audio Pronunciation Glossary

Learning ACTIVITIES

- Visual Activities
- Kinesthetic Activities
- Auditory Activities

Learning Objectives

After 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. ***p6***
5. Pronounce words according to the pronunciation guide used in this text. ***p7***
6. List three features of medical dictionaries. ***p9***
7. Identify medical words and abbreviations in case studies to review concepts of medical terminology. ***pp2, 13***

Pretest

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

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

_____ **2.** A word part at the beginning of a word is a:
a. prefix
b. combining form
c. preview
d. root

_____ **3.** A word part at the end of a word is the:
a. vowel
b. adjective
c. insertion
d. suffix

_____ **4.** The adjective form of *thorax*, meaning "chest," is:
a. thoracic
b. thoraxal
c. thorous
d. thoral

_____ **5.** The *ch* in the word *chemistry* is pronounced like the letter:
a. s
b. h
c. k
d. f

_____ **6.** The *ps* in the word *psychology* is pronounced like the letter:
a. p
b. s
c. j
d. k

_____ **7.** The word below that has a hard *g* is:
a. grasp
b. gem
c. page
d. judge

_____ **8.** The symbol ↓ means:
a. start
b. turn
c. decrease
d. left

Medical terminology is a special vocabulary used by health care professionals for effective and accurate communication. Every health-related field requires an understanding of medical terminology, and this book highlights selected health care occupations in special boxes **(see Box 1-1)**. 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, stands for "a communication between the stomach and the first part of the small intestine" **(Fig. 1-1)**. The part *gastr* means stomach; *duoden* stands for 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 with the development of computers, such as software, search engines, e-mail, chatrooms, and blogs. 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.

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).
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).

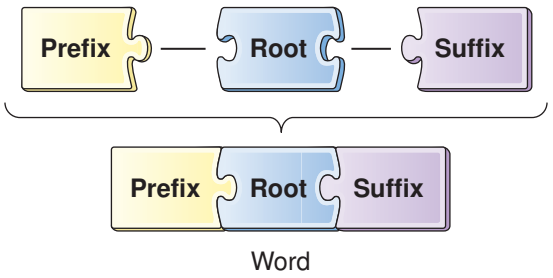
Box 1-1 Health Professions

Health Information Technicians

Every time a patient receives medical treatment, information is added to the patient's medical record, which includes data about symptoms, medical history, test results, diagnoses, and treatment. Health information technicians organize and manage these records, working 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. Health information technicians assign a code to each diagnosis and procedure a patient receives, and this information is used for accurate patient billing. In addition, health information technicians 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, health information technicians need a thorough background in medical terminology. Most of these technicians 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 www.ahima.org.



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)**.

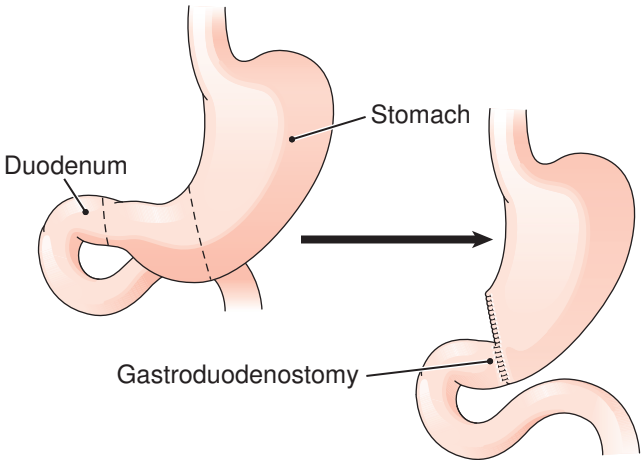


Figure 1-1 **Gastroduodenostomy.** A communication (-stomy) between the stomach (gastr) and the first part of the small intestine, or duodenum (duoden).

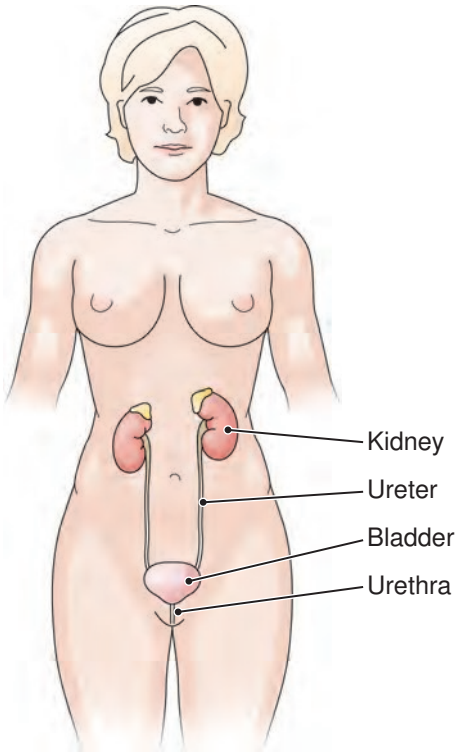


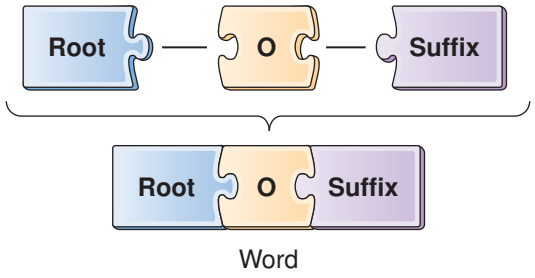
Figure 1-2 **Structures named with more than one word root.** Medical terminology uses both the Greek root *nephr* and the Latin root *ren* for the kidney, an organ of the urinary system.

Note that the same root may have different meanings in different fields of study, just as the words *spam*, *menu*, *browser*, *surfing*, and *cookie* have different meanings in common vocabulary other than 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. Health information technicians must be skilled in the use of medical language, as described in **Box 1-1**.

Compound words contain 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 gastr**o**duoden**o**stomy, but may occasionally be *a*, *e*, or *i*.

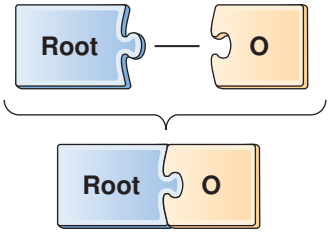


A combining vowel may be added between a root and a word part that follows.

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 usually is 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. They are interesting, however, 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, *phar**ynx*** (throat) becomes *pharyng**e**al* (*fa-RIN-jē-al*), to mean "pertaining to the throat;" *cocc**yx*** (terminal portion of the spine) becomes *coccyg**e**al* (*kok-SIJ-ē-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, *thora**x*** (chest) becomes *thora**c**ic* (*thō-RAS-ik*) to mean "pertaining to the chest" and *cervi**x*** (neck) becomes *cervi**c**al* (*SER-vi-kal*) to mean "pertaining to a neck."

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 PASSport to Success on the Web resource, *thePoint*, has a large audio pronunciation

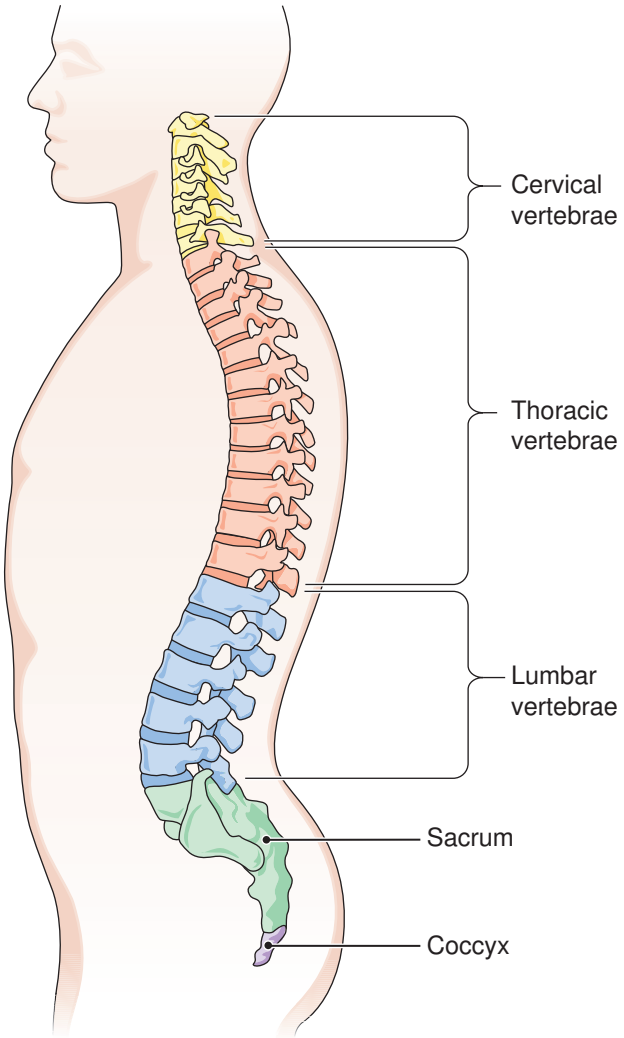


Figure 1-3 **Word derivations.** The coccyx of the spine is named by its resemblance to the bill of a cuckoo.

dictionary. Take advantage of these aids. Repeat each word aloud as you learn to recognize it in print or hear it in the Student Resources. The following pronunciation guidelines apply throughout the text.

A vowel (a, e, i, o, u) gets a short pronunciation if it has no pronunciation mark over it, such as

a as in hat
e as in met
i as in bin
o as in not
u as in run

A short line over the vowel gives it a long pronunciation:

ā as in say
ē as in tea
ī as in lie
ō as in hose
ū as in sue

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, as noted in **Box 1-2**.

SOFT AND HARD *c* AND *g*

- A soft *c*, as in *racer*, will be written in pronunciations as *s* (*RĀ-ser*).
- A hard *c*, as in *candy*, will be written as *k* (*KAN-dē*).
- A soft *g*, as in *page*, will be written as *j* (*pāj*).
- A hard *g*, as in *grow*, will be written as *g* (*grō*).

Box 1-2 Focus on Words

Pronunciations

When pronunciations are included in a text, it is sometimes difficult for authors to know which pronunciation of a term to use. Pronunciations may vary from country to country and even in different regions of the same country. Think how easy it is to distinguish a Southern accent and one from the Midwest or Northeast United States. The general rule is to use the most common pronunciation or to list that pronunciation first if more than one is given.

The word *gynecology* is usually pronounced with a hard g in the United States, but in many areas, a soft g is used, as in *jin-e-KOL-ō-jē*. Words pertaining to the cerebrum (largest part of the brain) may have an accent on different syllables. The adjective is usually pronounced with the accent on the second syllable (*se-RĒ-bral*), but in cerebrum (*SER-ē-brum*) and cerebrospinal (*ser-e-brō-SPĪ-nal*), the accented syllable differs.

The name for the first part of the small intestine (duodenum) is often pronounced *dū-ō-DĒ-num*, although the pronunciation *dū-O-de-num* is also acceptable. And the scientific term for the navel, umbilicus, is usually pronounced with the accent on the second syllable as *um-BIL-i-kus*, but *um-bi-LĪ-kus* is also used. When extreme, some alternative pronunciations can sound like a foreign language. The word we pronounce as *SKEL-e-tal* is pronounced in some other English-speaking countries as *ske-LE-tal*.

SILENT LETTERS AND UNUSUAL PRONUNCIATIONS

A silent letter or 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 1-3** for some examples.

The combinations in **Box 1-3** may be pronounced differently when they appear within a word, as in dia**gn**osis (*dī-ag-NŌ-sis*), meaning determination of the cause of disease, in which the *g* is pronounced; a**pn**ea (*AP-nē-a*), meaning cessation of breathing, in which the *p* is pronounced; nephro**pt**osis (*nef-rop-TŌ-sis*), meaning dropping of the kidney, in which the *p* is pronounced.

PASSport to Success®

Go to the Audio Pronunciation Glossary on *thePoint* to hear medical terms pronounced.

LEARNING STYLES

The term "learning styles" describes how people differ in the senses they most depend on to learn. Visual learners want to see a word in print. They like diagrams, charts, and pictures. Auditory learners need to hear words pronounced. They like to talk over what they have learned and profit from listening again to recorded lessons. Tactile learners use touch, such as writing out answers or retyping notes. They like to follow demonstrations to learn a new skill. You can evaluate your own learning style with an inventory on the Student Resources on *thePoint*. Exercises on the PASSport to Success are coded as to the learning styles they support.

Of course, we use all of our senses to some degree in learning, and the more channels we use, the more likely it is that we will absorb and remember new information. This text, in combination with the student resources, calls on multiple senses to aid learning: seeing new words in print, writing out answers, using flashcards, listening to pronunciations, and completing exercises on the computer. Unlike the fashion magazines that use perfumed ads to sell products, the olfactory sense has not yet been incorporated into textbooks. Perhaps someday student resources will have a smell feature!

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.

Box 1-3 For Your Reference

Silent Letters and Unusual Pronunciations

LETTER(S)	PRONUNCIATION	EXAMPLE	DEFINITION OF EXAMPLE
ch	**k**	**chemical** *KEM-i-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** *ū-FOR-ē-a*	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** *nū-MŌ-nē-a*	inflammation of the lungs (pneumon/o)
ps	**s**	**pseudonym** *SŪ-dō-nim*	false name (-nym)
pt	**t**	**ptosis** *TŌ-sis*	dropping, downward displacement
rh	**r**	**rhinoplasty** *RĪ-nō-plas-tē*	plastic repair of the nose (rhin/o)
x	**z**	**xiphoid** *ZĪ-foyd*	pertaining to cartilage attached to the sternum (from Greek *xiphos*, meaning "sword")

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 7 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; 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.

PASSport to Success®

See the Student Resources on *thePoint* for a chart of selected "Do Not Use" abbreviations and the Web addresses of organizations that publish these guidelines.

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 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 CD, on the internet, and also as applications for smartphones. Dictionaries give information on meanings, pronunciation, 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.

Terminology Key Terms

acronym *AK-rō-nim*	An abbreviation formed from the first letter of each word in a phrase
combining form *kom-BĪ-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 *PRĒ-fix*	A word part added before a root to modify its meaning
root *rūt*	The fundamental unit of a word
suffix *SU-fix*	A word part added to the end of a root to modify its meaning