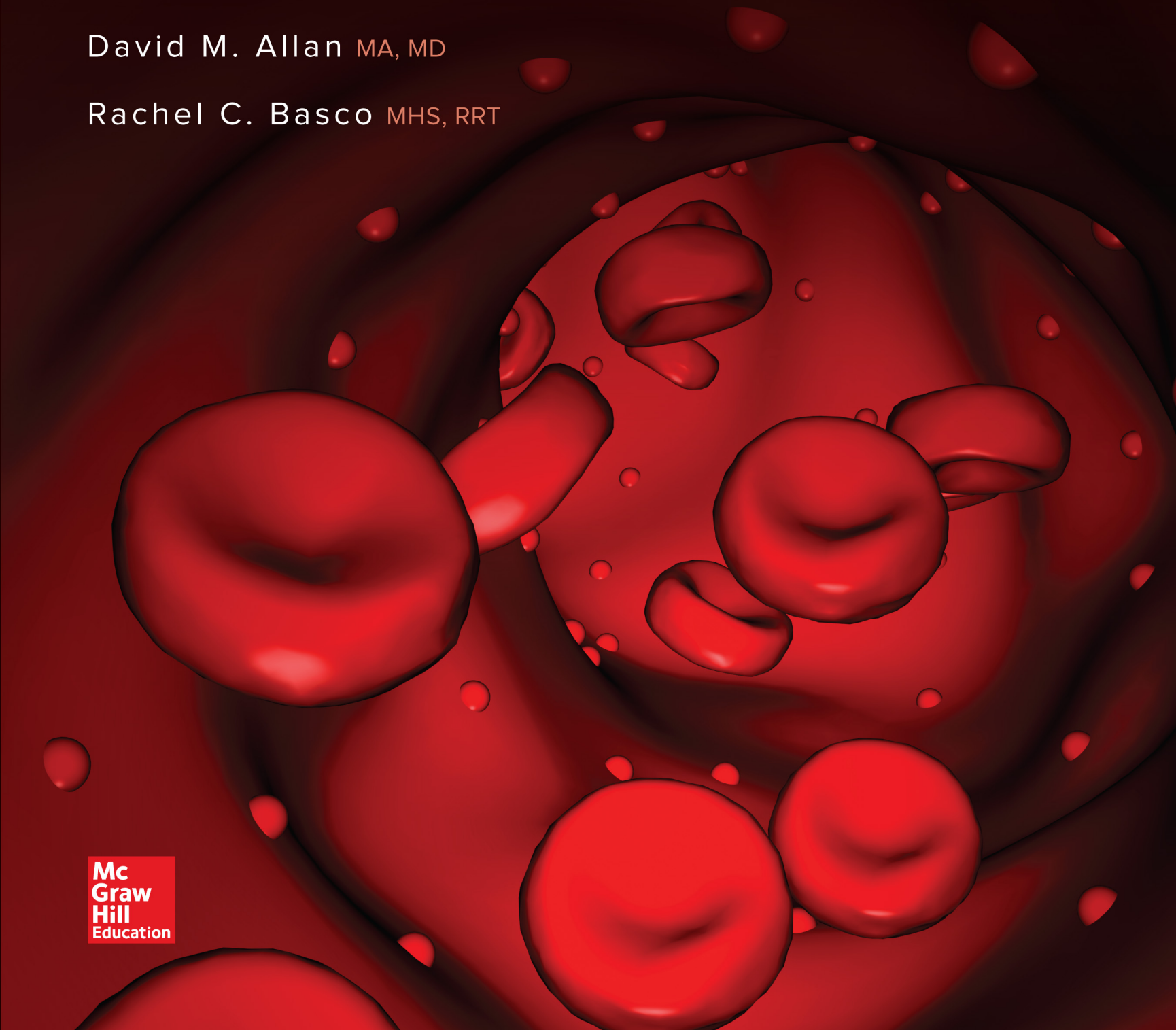
MEDICAL LANGUAGE *for* Modern Health Care

FOURTH EDITION

David M. Allan MA, MD

Rachel C. Basco MHS, RRT



Mc Graw Hill Education

Medical Language For Modern Health Care

Fourth Edition

David M. Allan, MA, MD

Rachel C. Basco, MS, RRT
Bossier Parish Community College

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MEDICAL LANGUAGE FOR MODERN HEALTH CARE, FOURTH EDITION

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Dr. Allan has worked as a family physician in England, a pediatrician in San Diego, and Associate Dean at the University of California, San Diego School of Medicine. He has designed, written, and produced more than 100 award-winning multimedia programs with virtual reality as their conceptual base. Dr. Allan resides happily in San Diego and enjoys the warmth of the people, the weather, and the beaches.

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Rachel Basco earned her BS in Cardiopulmonary Science and MS in Health Sciences from Louisiana State University Health Science Center, School of Allied Health Professions (SAHP). She worked as a registered respiratory therapist for ten years and then began her career in college instruction in respiratory therapy at LSU-SAHP in Shreveport, LA. She then found her interest to be in nonclinical education and began instructing biology courses at Bossier Parish Community College (BPCC) in Bossier City, LA.

Ms. Basco's interest in online learning developed, leading to the completion of a graduate certificate in Instructional Design from the University of Wisconsin–Stout. She is employed full-time as a project director but also as an online adjunct instructor in medical terminology at BPCC. She is in the dissertation phase for her EdD at Louisiana Tech University in Ruston, LA, with a focus on higher education policy analysis.

Ms. Basco resides in Shreveport with her husband and children. While very busy with her family, work, and studies, Rachel always finds time to visit her relatives in her home state of Wisconsin.

BRIEF CONTENTS

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TEACHING AND LEARNING SUPPLEMENTS

The **Instructor's Manual** (available online through Connect) is an invaluable resource for new and experienced medical terminology instructors. All of the components of the *Medical Language for Modern Health Care* textbook program are designed to be coherent and connected in order to create a consistent environment in which students can learn medical terminology. The Instructor's Manual shows how each component of the textbook program works to support and reinforce the content and strengths of the other components, from art and exercises to content and test bank questions.

The Instructor's Manual contains the following sections:

- **Your Medical Terminology Course—An Introduction to Teaching Medical Terminology**

  The Instructor's Manual contains:

  – A helpful introduction to teaching medical terminology.
  – Information about student learning styles and corresponding instructor strategies.
  – Innovative learning activities.
  – Assessment techniques and strategies.
  – Classroom management tips.
  – Techniques for teaching limited-English-proficiency students.

- **Lesson Planning Guide**

  In addition, the Instructor's Manual contains a Lesson Planning Guide for each of the lessons in the book. Each lesson plan contains a step-by-step teaching plan and master copies of handouts. These lessons may be used alone or combined to accommodate different class schedules. The lessons can easily be revised to reflect your preferred topic or sequence, or to add or delete topics entirely. Each of the lesson plans is designed to be used with a corresponding PowerPoint® presentation that is available on the Online Learning Center, discussed as follows.

The **Online Learning Center, Instructor Resources** also contains:

- **McGraw-Hill's Test Generator.** This flexible electronic testing program allows instructors to create tests from book-specific items. It accommodates a wide range of question types, and instructors may add their own questions. Multiple versions of a test can be created, and any test can be exported for use with course management systems such as WebCT, Blackboard, or PageOut. The program is available for Windows and Macintosh environments.
- **PowerPoint® Lecture Outlines.** PowerPoint lectures with speaking notes are available for the chapters in the textbook. The PowerPoint presentations, which combine art and lecture notes, are designed to help instructors discuss with students the important points of the lessons. The slides are customizable, allowing instructors to modify lectures to ensure that the needs of their unique students and curricula are met.
- **Image Bank.** The image bank features selected textbook images.
- **BodyAnimat3D.** Integrated 3D animations help students visualize the most difficult concepts, with pre- and post-assessment questions for every animation.

HOW TO TEACH MEDICAL TERMINOLOGY

The **Online Course for Instructors to Support** ***Medical Language for Modern Health Care*** is found in the Instructor Resources section of the Online Learning Center.

The **How to Teach Medical Terminology** course guidelines provide instructors with the introductory knowledge and resources they need to begin using the *Medical Language for Modern Health Care* textbook and related materials effectively. This course is designed to cover the "basics" of how to teach medical terminology effectively.

The How to Teach Medical Terminology online course allows instructors to choose for themselves which module they wish to take, or they may opt to take a self-assessment survey that will recommend one of the three modules.

- **Module 1** is designed for the inexperienced instructor.
- **Module 2** is designed for the instructor who has previous classroom experience but has never taught medical terminology.
- **Module 3** is designed for the experienced medical terminology instructor who has not previously used a contextualized approach to teaching the subject.

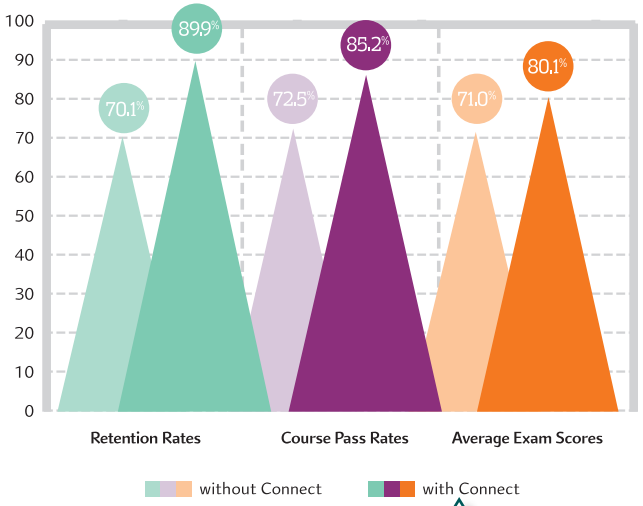
McGraw-Hill Connect® is a highly reliable, easy-to-use homework and learning management solution that utilizes learning science and award-winning adaptive tools to improve student results.

Homework and Adaptive Learning

- Connect's assignments help students contextualize what they've learned through application, so they can better understand the material and think critically.
- Connect will create a personalized study path customized to individual student needs through SmartBook®.
- SmartBook helps students study more efficiently by delivering an interactive reading experience through adaptive highlighting and review.

Over **7 billion questions** have been answered, making McGraw-Hill Education products more intelligent, reliable, and precise.

Connect's Impact on Retention Rates, Pass Rates, and Average Exam Scores



Using **Connect** improves retention rates by **19.8** percentage points, passing rates by **12.7** percentage points, and exam scores by **9.1** percentage points.

73% of instructors who use **Connect** require it; instructor satisfaction **increases** by 28% when **Connect** is required.

Quality Content and Learning Resources

- Connect content is authored by the world's best subject matter experts, and is available to your class through a simple and intuitive interface.
- The Connect eBook makes it easy for students to access their reading material on smartphones and tablets. They can study on the go and don't need internet access to use the eBook as a reference, with full functionality.
- Multimedia content such as videos, simulations, and games drive student engagement and critical thinking skills.

Robust Analytics and Reporting

- Connect Insight® generates easy-to-read reports on individual students, the class as a whole, and on specific assignments.
- The Connect Insight dashboard delivers data on performance, study behavior, and effort. Instructors can quickly identify students who struggle and focus on material that the class has yet to master.
- Connect automatically grades assignments and quizzes, providing easy-to-read reports on individual and class performance.

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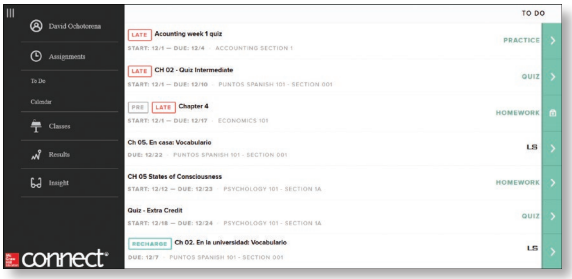
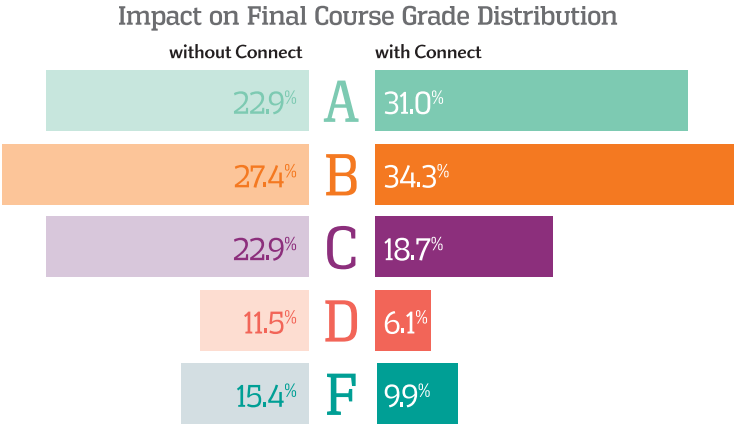


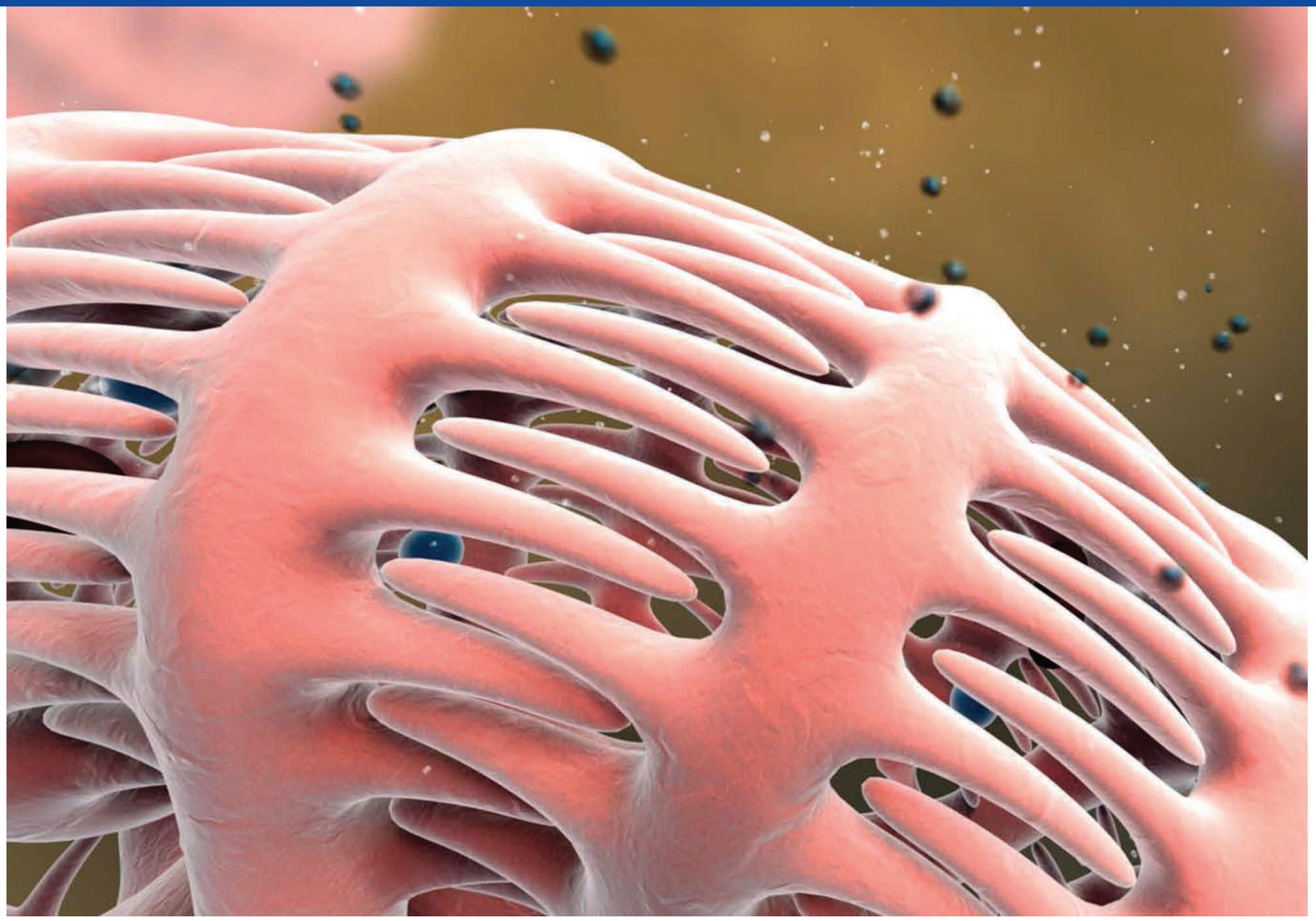


More students earn **As** and **Bs** when they use **Connect**.

Trusted Service and Support

- Connect integrates with your LMS to provide single sign-on and automatic syncing of grades. Integration with Blackboard®, D2L®, and Canvas also provides automatic syncing of the course calendar and assignment-level linking.
- Connect offers comprehensive service, support, and training throughout every phase of your implementation.
- If you're looking for some guidance on how to use Connect, or want to learn tips and tricks from super users, you can find tutorials as you work. Our Digital Faculty Consultants and Student Ambassadors offer insight into how to achieve the results you want with Connect.

Learning Medical Language



What's New in the Fourth Edition

- The content is focused on the terminology of anatomy and physiology, diseases, disorders, symptoms, diagnostic and therapeutic procedures, and pharmacology. The content is now more concise and up-to-date with new terms.
- Each content area and exercise set is tagged with its corresponding chapter learning outcome (LO).
- Over 50% of the book's artwork and photos have been replaced with more current and relevant images.
- The terms defined in this book have been reviewed for relevance against the provisional new ICD-10.
- In each of the chapters on body systems new sections detailing diagnostic procedures, therapeutic procedures and pharmacology have been added.

The abbreviation LO stands for a chapter learning outcome or goal that can be achieved by a learner during the chapter. Each LO is linked to appropriate major headings on each page of text.

Chapter Learning Outcomes

Your journey through this book, and your externship at Fulwood Medical Center, begins with getting to know the surroundings in which you will experience medical language.
In order to get the most out of your experience, you need to be able to:

LO W.1 Establish a commitment to learn medical terminology.

LO W.2 Understand how the contextual approach of this book promotes active learning.

LO W.3 Differentiate the roles of the health care team in different medical specialties.

LO W.4 Recognize the knowledge and skills you will need to be an active learner.

LO W.5 Describe the importance of effective organizational strategies and study habits.

LO W.6 Utilize the pedagogic devices used in each chapter and lesson to understand the concepts being taught.

Case Report (CR) W.1

You are

. . . a student preparing for a career as a health professional. As part of your training program, you must complete a supervised **externship.** You have just arrived at Fulwood Medical Center for your first day as an **extern.** You are glad to have this opportunity: Fulwood is a busy medical center with highly skilled, compassionate staff members. Between attending classes at night, working during the day, and raising two children, you have a full schedule. However, the knowledge and skills you are learning in your studies and at Fulwood will prepare you for a successful future.

Active Conceptual Learning

Lesson Objectives

The information in this lesson will enable you to:

- **W.1.1** Understand the reasons for learning medical terminology in order to communicate and document information effectively as a health professional.
- **W.1.2** Describe the conceptual approach used in the book and how it motivates your learning.
- **W.1.3** Understand the concept and structure of a health care team.
- **W.1.4** Determine how to be an active learner and how to actively experience medical language.

LO W.1 Why You Should Learn Medical Terminology

Medical terminology is not just another subject for which you memorize the facts and then forget them when you move on to your next course. Medical language will be used throughout your studies, as well as every day on your job. Your understanding of medical terminology will make you a successful student and health professional.

Even beyond your career goals, everyone becomes a patient at one time or another. You also may accompany an elderly parent, a friend, or a child to a doctor or emergency room. Knowing medical terminology makes it easier for you to communicate with physicians and use the Internet to research health information—and ultimately to become a proactive medical consumer.

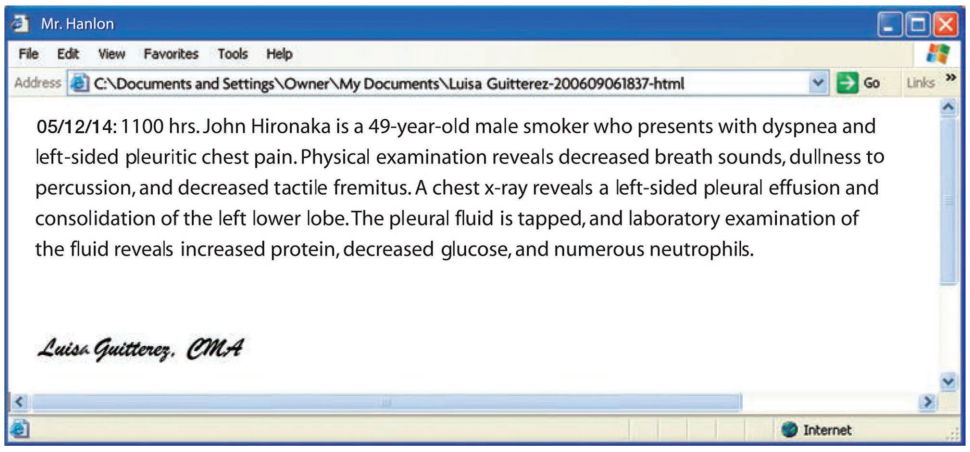
Figure W.1 shows an electronic report of a patient's condition, which is something you must be able to understand as a health professional. Terms like **dyspnea**, **pleuritic, effusion**, and **neutrophils** are used every day in medical language.

Health care professionals use specific terms to describe and talk about objects and situations they encounter each day. Like every language, medical terminology changes constantly as new knowledge is discovered. For example, in the world of genetics, the terminology used today was unheard of a decade ago. Medical terms quickly become outdated as new information makes its debut. **Consumption** is now known as **tuberculosis**, **grippe** as **influenza,** and **whooping cough** as **pertussis**.

Modern medical terminology is a language constructed over centuries, using words and elements from Greek and Latin origins as its building blocks. Some 15,000 or more words are formed from 1,200 Greek and Latin roots. It serves as an international language, enabling medical scientists from different countries and in different medical fields to communicate with a common understanding.

In your world as a health care professional, medical terminology enables you to communicate with your team leader, with other health care professionals on your team, and with other professionals in different disciplines outside your team. Understanding medical terminology also enables you to translate the medical terms into language your patients can understand, thus improving the quality of their care and demonstrating your professionalism.

In short, if you can't speak the language, you can't join the club.



▲ **Figure W.1** Electronic Report of a Patient's Condition.

LO W.2 The Contextual Approach to Learning

When medical terms are separated from their intended context, it is easy to lose sight of how important it is to use them accurately and precisely. Learning medical terminology in the context of the medical setting reinforces the importance of correct usage and precision in communication.

In every chapter and lesson in this book, the learner steps into the role of a health professional working in a situation that is relevant to the medical specialty associated with the body system being studied in that chapter. You will learn the medical terminology used in that medical specialty and body system through the context of anatomy and physiology, pathology, and therapeutic and diagnostic procedures and tests.

Patient case reports and documentation are used to illustrate the real-life application of medical terminology in modern health care, to care for and communicate with patients, and to interact with other members of the health care team.

Fulwood Medical Center is the realistic health care setting in which these interactions take place. It consists of a medical office building and an attached 250-bed hospital. The office building houses physicians practicing primary care, the major medical and surgical specialties, and some complementary medicine therapies—in all, nearly 100 physicians in 25 specialty areas. The hospital and the medical offices share pharmacy, laboratory, radiology, physical therapy, health education, and cafeteria facilities, but they have separate main entrances. A directory on the wall near the hospital lobby lists all the departments and doctors and their locations *(Figure W.2)*.

▲ **Figure W.2** **An office directory can help orient visitors within the medical office complex.** ©McGraw-Hill Education/Rick Brady, photographer

▲ **Figure W.3 A busy medical practice at Fulwood Medical Center.** ©McGraw-Hill Education/Rick Brady, photographer

▲ **Figure W.4 A primary care physician oversees the health concerns of patients and refers patients to specialists when necessary.** ©McGraw-Hill Education/Rick Brady, photographer

LO W.3 The Health Care Team

A variety of health professionals make up the teams caring for patients in each medical specialty. As a **health professional,** you are part of a team of medical and other professionals who provide health care services designed to improve patients' health and well-being in each medical specialty and setting *(Figure W.3)*.

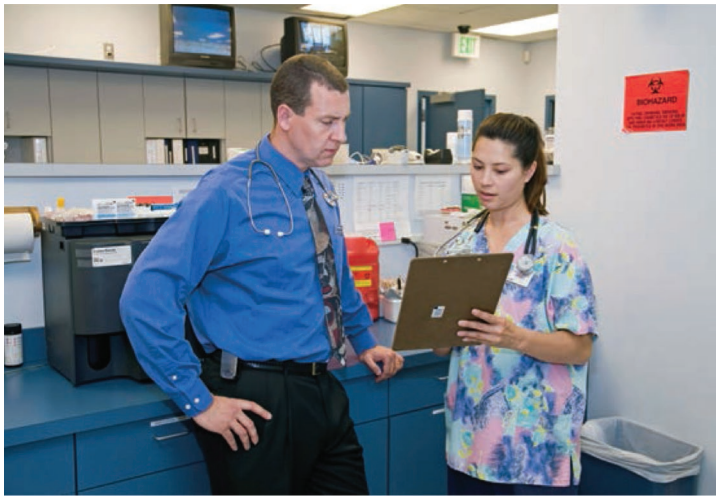
The team leader is a medical doctor, or physician, who can be an **MD** (doctor of medicine) or a **DO** (doctor of osteopathy). Most **managed care systems** require the patient to have a **primary care physician (PCP)** *(Figure W.4)*. This PCP, who may be a **family practitioner, internist,** or **pediatrician** (a doctor for children), is responsible for the overall care of the patient. In managed care delivery systems, such as Health Maintenance Organizations (HMOs) and Preferred Provider Organizations (PPOs), the PCP acts as the gatekeeper for the patient to enter the system, supervising all care the patient receives.

If needed medical care is beyond the expertise of the PCP, the patient is referred to a medical specialist *(Figure W.4)*, whose expertise is based on a specific body system or even a part of a body system. For example, a **cardiologist** has expertise in diseases of the heart and vascular system, a **dermatologist** specializes in diseases of the skin, and an **orthopedist** specializes in problems with the musculoskeletal system. A **gastroenterologist** is an expert in diseases of the whole digestive system, whereas a **colorectal surgeon** specializes only in diseases of the lower gastrointestinal tract.

Other health professionals work under the supervision of the physician and provide direct care to the patient *(Figure W.5)*. These can include a **physician assistant, nurse practitioner, medical assistant,** and, in specialty areas, different therapists, technologists, and technicians with expertise in the use of specific therapeutic and diagnostic tools.

Still other health professionals on the team provide indirect patient care *(Figure W.6)*. These include **administrative medical assistants, transcriptionists**, **health information technicians, medical insurance billers,** and **coders,** all of whom are essential to providing high-quality patient care.

As you study the language of each medical specialty at Fulwood Medical Center, you also will meet the members of each specialty's health care team and learn more about their roles in caring for the patient.



▲ **Figure W.5 Physicians, nurses, and medical assistants provide direct care to patients.** ©McGraw-Hill Education/Rick Brady, photographer

▲ **Figure W.6 Administrative medical assistants are among the health professionals who provide indirect care to patients.** ©McGraw-Hill Education/Rick Brady, photographer

LO W.4 Being an Active Learner

Medical terms provide health care professionals a way to communicate with each other and document the care they provide. To provide effective patient care, all health care professionals must be fluent in medical language. One misused or misspelled medical term on a patient record can cause errors that can result in injury or death to patients, incorrect coding or billing of medical claims, and possible fraud charges. The patient care record is a legal document as well as a clinical document.

When the medical terms are separated from their intended context, as they are in other medical terminology textbooks, it is easy to lose sight of how important it is to use these medical terms accurately and precisely. Learning medical terminology in the context of the medical setting reinforces the importance of correct usage and precision in communication.

During your time at Fulwood Medical Center, you will *experience* medical language. Just as in a real medical center, you will encounter and apply medical terminology in a variety of ways. Actively experiencing medical language will help ensure that you are truly learning, and not simply memorizing, the medical terms in each chapter. Memorizing a term allows you to use it in the same situation (for example, repeating a definition) but doesn't help you apply it in new situations. Whether you are reading chart notes in a patient's medical record or a description of the treatment prescribed by a physician, you will see medical terms being used for the purpose they were intended.

This book goes beyond simply presenting and defining new medical terms. Fulwood Medical Center, with its wide range of patient cases and health professionals and its realistic medical environment, allows you to encounter and discover terms the way they are used in real life—in different medical settings. Experiencing medical language in this context bridges the gap between what you learn in the classroom and what really happens in the clinical setting.

As you progress through this book,

- You will encounter, and be asked to interact with, patients and health care professionals.
- You will analyze medical records and documentation.
- You will be introduced to diagnostic and therapeutic methods and the pathophysiology of disease.
- You will be able to see how all of these activities depend on effective communication, accurate comprehension, and precise use of medical language.

▲ **Figure W.7 A CMA communicates with a patient.** ©Rocketclips, Inc./Shutterstock.com RF

▲ **Figure W.8** One of your responsibilities may be to read the results of diagnostic tests, such as this blood sugar reading.

LO W.4 Being an Active Learner

Below are just a few of the ways you will use medical language on your first day at Fulwood.

Listening and Speaking

You will

- Listen to patients as they describe their medical history and explain their symptoms *(Figure W.7)*. A conversation between Luisa Guitterez, a Certified Medical Assistant (CMA), and Mrs. Martha Jones, a patient, follows:

  Luisa Guitterez, CMA: "Mrs. Jones, I'm Luisa, an assistant to Dr. Lee. The receptionist noticed that you were looking pale and sweaty and notified Dr. Lee."

  Mrs. Jones: "In the rush to get here this morning, Luisa, I didn't have time to eat breakfast. I'm not feeling so well right now. . . . I'm diabetic, you know."

  Luisa Guitterez, CMA: "Dr. Lee has asked me to test your blood sugar level. As a diabetic, you've done this many times yourself, I'm sure."
- Listen to and carry out physicians' instructions and information concerning patient care.
- Speak to physicians and other health care professionals, report information, and ask questions.
- Talk with patients in the course of patient encounters and phone calls, including giving instructions and answering questions about the physician's prescribed treatment plans.
- Document your interaction with the patient.

Reading

You will

- Read physicians' comments and treatment plans in patient medical records and case reports.
- Read the results of physical examinations, procedures, and laboratory and diagnostic tests *(Figure W.8)*.

Writing

You will

- Document actions taken by yourself and other members of the health care team.
- Proofread medical documentation to ensure its accuracy.

Thinking Critically

You will

- Evaluate medical documentation for accuracy.
- Translate technical medical communication into words patients can understand.
- Analyze and understand unfamiliar medical terms using the strategies presented in this book.

Learning from Patient Cases

You will encounter realistic patient cases throughout this book. These cases ask you to step into the role of a health care professional ***(You are . . .)*** and focus on a real patient with real health care needs ***(Your patient is . . .).***

Taking full advantage of the patient cases in this book allows you to

- Experience various health care careers.
- Examine the roles you may fill to provide care for patients.
- See the types of documentation needed in these situations.
- Become acquainted with medical terminology in real-life settings.
- Recognize that every interaction with a patient is a learning experience.

Applying What You Learn

Throughout each chapter, you will be asked to apply and practice what you are learning. These application opportunities are designed to help you practice using medical terms in a variety of ways and for a variety of purposes. Specifically, the exercises will require you to perform tasks you would perform on the job, such as *listening and speaking, reading, writing,* and *thinking critically.* They are designed to help you move beyond simple memorization and become fluent in the language of modern health care.

Exercises

A. Each encounter with medical language improves your ability to (a) understand the medical terms you hear, (b) speak accurately and precisely using medical terms, (c) write accurately and precisely using the appropriate medical terms, (d) read and understand medical terms, and (e) think critically about the medical terms you experience. *These five skills are very important for all health care professionals. It is important to be able to identify experiences that build your knowledge and skill with medical language. Write the letter of the skill or skills being used in each blank below. More than one skill may be needed for each activity.* **LO W.4**

Skills: **a.** Understand spoken medical terms.

b. Speak accurately and precisely using medical terms.

c. Write accurately and precisely using medical terms

d. Read and understand medical terms.

e. Think critically about medical language.

_____ **1.** Answering a patient's questions about the physician's diagnosis and instructions.

_____ **2.** Taking a phone message when a specialist calls from another facility and has information concerning one of the patients of a physician in your facility.

_____ **3.** Proofreading an insurance claim form.

_____ **4.** Teaching a patient with special nutritional needs how to modify her diet.

_____ **5.** Using the Internet and textbooks to learn more about a disease or condition.

▲ **Figure W.12** **Being a good listener is important to success.** ©Hemera Technologies/Getty Images RF

LO W.4 Being an Active Learner (continued)

As you will find out in your externship at Fulwood Medical Center, true learning is active. You can't sit back and let someone else pour knowledge into your head. You need to play the various health care professional roles you'll assume at Fulwood and work to get as much from them as you can. Simply attending your medical terminology class is another valuable thing you can do to help yourself. However, it doesn't end there. Here are more ways you can be an active learner and get the most out of your studies.

Getting the Most Out of Lectures

1. **Prepare.** You'll be amazed at how much easier it is to understand the material when you have previewed the chapter before going to class. If you find it difficult to carve out the time, simply arrive at class 5 to 15 minutes earlier than usual and skim the chapter before the lecture begins. This will at least give you an overview of what may be discussed.
2. **Be a good listener.** Most people think they are good listeners, but few really are *(Figure W.12).* Are you?
   - You can't listen if you are talking or text messaging or looking at your cell phone.
   - You can't listen if you are daydreaming or dozing.
   - Listening and comprehending are two different things. If you don't understand something the instructor is saying, ask a question or jot a note and visit the instructor after class. Don't feel intimidated: You probably aren't the only person who "doesn't get it."
3. **Take good notes.** Here are some tips for successful note-taking:
   - Use a standard-size notebook or, better yet, a three-ring binder with loose-leaf paper. The binder will allow you to organize and integrate your notes and handouts.
   - Use a standard black or blue ink pen to take your initial notes. You can annotate later using a pencil, which can be erased if necessary.
   - Start a new page with each lecture or note-taking session.
   - Label each page of your notes with the date and a heading.
   - Focus on the main points, and try to use an outline format to take notes. This will help you capture key ideas and organize subpoints.
   - Review and edit your notes shortly after class—at least within 24 hours—to make sure they make sense. You also may want to compare your notes with those of a study partner later to make sure neither of you has missed anything.

Getting the Most Out of Reading

1. **Concentrate on what you are reading.** Survey the titles, outcomes, objectives, and headings in each chapter, and look at the visuals to identify what the chapter is all about.
2. **Use the SQ3R** (see the Study Hint) to help you read actively.
3. **Take notes on key ideas** in the reading.
4. **Write down any questions** you have.
5. **Discuss what you have read** with your study partner.

Study Hints

The SQ3R Model for Reading is a successful equation for studying:
S*urvey* what you are going to read.
Q*uestion* what you are going to learn after the preview.
R*ead*—Read the assignment.
R*ecite*—Stop every once in a while, look up from the book, and put what you've just read into your own words.
R*eview*—After you've finished, review the main points.

Performing Well on Tests

1. **Always read the directions.** If you are unsure, ask. Find out if there is a penalty for guessing. If there is not, try to answer every question on the test even if you have to guess at some.
2. **Before you begin, scan the entire test** so that you know how long it is and what types of activities and questions it contains.
3. **Answer the easy questions or sections first** so that you get as much of the exam finished as possible if difficult questions slow you down.
   - When answering multiple-choice questions, eliminate each incorrect option until you are left with the answer that seems most correct to you.
   - When answering matching questions, match all items you know first; then do your best with the ones that remain.
   - When answering essay questions, reword the question as a statement to be sure you have answered it. Give enough examples and explanation to support your points.
4. **Once you have finished the test, use any extra time to check that you have answered all questions.** If you still have time after checking for completion, reread the questions and recheck your answers.

Studying with a Partner or Group

1. **Get a study partner.** *Schedule fixed* study dates. Talk through the concepts, compare notes, and quiz each other. Studying with a partner can be fun. Think of it this way: You are multitasking, layering study time and social time. Just be sure the social time doesn't squeeze out the study time.
2. **Don't take advantage of your study partner.** If you can't make a study date or attend a class, let your partner know. You won't have a study partner—or a friend—much longer if it isn't a mutually beneficial arrangement.
3. **Establish a study group.** Choose a few students in the class, including your study partner, with whom to study on a regular basis. Having a group in addition to a study partner ensures that you will still be able to study with others if your partner has to miss a session.

Exercises

A. Budgeting your time is key to being able to take care of your priorities. *Follow these steps with the list of tasks you need to get done.* **LO W.5**

1. Rank each of the tasks in the table in order of its priority (e.g., 1 is the highest priority, 2 is next highest, and so on).
2. On a separate sheet of paper, plan a weekly schedule that will help you accomplish these tasks. Include all seven days of the week, and block off the days in hourly increments.
3. Keep in mind that while some activities have set times, others can be flexible. Also consider that activities like studying and household tasks will need to be done for a period of time *every day,* not just once a week.

   *(**Note:** There is no one "correct" answer to this exercise; however, it is beneficial to see how other students in the class chose to budget their time. Be creative but realistic. Don't forget to budget for travel time between tasks if needed.)*

Weekly Tasks

Studying for Medical Terminology _____	Errands (groceries, etc.) _____	Leisure time _____
Sleep _____	Family time _____	Household chores _____
Medical Terminology class (Tuesday and Thursday 6:30–9:30 p.m.) _____	Work (8:00–3:30 daily) _____	Meals, including preparation & cleanup _____
Church and/or hobbies _____	Exercise _____	Grooming _____

Now that you understand what it takes to be successful, you are ready to move through this textbook and engage in an externship at Fulwood Medical Center.

Learning Medical Language

Lesson Objectives

The information in this lesson will enable you to:

- **W.2.1** Identify the need for continual, lifelong learning among health professionals.
- **W.2.2** Assemble study strategies and habits to enhance your learning and test-taking capabilities.
- **W.2.3** Identify the pedagogic aids in the book.
- **W.2.4** Explain how the pedagogic aids enhance your understanding of the material.
- **W.2.5** Understand how to access and use the tools and features of McGraw-Hill Connect.

Keynote

As novelist Lillian Smith once said, ***"When you stop learning, stop listening, stop looking and asking questions, always new questions, then it is time to die."***

"I don't think much of a man who is not wiser today than he was yesterday."
—Abraham Lincoln

LO W.5 Learning Medical Language

Your current training in medical terminology is necessary for you to be able to continue your education in health care, but school is just one of the many places where you acquire knowledge. Each time you solve a problem in life, such as working through an argument with a friend or helping your child perform better in school, the knowledge you gain is *your own* answer to *your own* problem. This type of knowledge—discovered through experience—is genuine, real, and trustworthy for you. It is not determined by some distant authority, like what you learn in school. Your medical terminology instructor isn't likely to ask a test question on how to unclog your sink. Instead, this type of learning is driven by your needs and goals. The knowledge you gain from solving your own problems, whether by yourself or with the help of other people or resources, motivates you to learn even more and helps you grow as a person and as a professional.

When you are working as a health care professional, your ongoing education is an integral and inseparable part of your work activities. You'll need additional classroom training to keep your skills and professional knowledge up to date. You'll also continue to learn on your own through experience. As a health care professional, every time you interact with a patient, read a report, or talk with your team leader or peers, you are given another opportunity to learn *(Figure W.9)*.

▲ **Figure W.9** **Learning doesn't stop when you leave the classroom; every time you interact with other health care professionals and patients, you have the opportunity to learn something.** ©McGraw-Hill Education/Rick Brady, photographer

Case Report (CR) W.1 *(Continued)*

Your first day at Fulwood Medical Center went very well. The supervisor, Rosana Rice, gave you a tour of the facilities and introduced you to several health care professionals with whom you will be working. Ms. Rice discussed your duties and her expectations of you, and she asked you to review your plan for keeping up with your studies. Now it's late evening, and you have yet to feed your kids and get them into bed—not to mention pick up around the house, pay bills, and, oh yes, review a whole chapter in your medical terminology textbook to prepare for a test in class tomorrow night. How are you going to get everything done?

Keynote

A few years of committed study time now are nothing compared to the lifetime that awaits you.

LO W.5 Study Strategies and Habits

If you know you have a test every Thursday night, ask your spouse, mother, sister, or friend or someone in your support group to take care of the children on Wednesday night so you can get to a quiet place and dedicate the evening to studying. A support group of family and friends is essential to your success, so look for ways to surround yourself with people you can trust and rely on.

In addition to support, you will need to evaluate and

- Recognize the stresses you are experiencing.
- Determine what you can change because the situation, people, and events are making excessive demands on you.
- Prioritize your schedule in your head or on paper and complete each task in the proper order of importance.
- Find ways to give yourself a break from stressful situations.

The next section contains strategies that will help you get focused. It will help you learn how to manage your time and your studies to succeed—but this lesson can't do it alone. You are what you put into your studies. You have a lot of time and money invested in your education. Don't waste it by putting in half the effort. Succeeding in this class, and in life, requires the following:

- Commit your time and perseverance to learning.
- Know how to motivate yourself.
- Get organized.
- Schedule and manage your time.
- Be an active learner.

The rest of this chapter will help you learn how to be effective in these areas. As you encounter new learning situations during your externship at Fulwood, you will be prepared to handle them.

Exercises

A. Reflect on the idea of lifelong learning and how you can make it work for you to enrich your life's experience. *Think about one instance in your life when something you learned (by yourself, from another person, from research, etc.) became the foundation upon which you built further learning and information. Some examples are how to paint a room, clean a fish, use a computer, and cook a meal. Briefly describe that here.* **LO W.5**

1. What I learned, and how I learned it:

2. Now describe why you need to be committed to learning from everyday experiences on the job, and explain how that can help you in your career.

▲ **Figure W.10** **Identify your own personal preferences for learning, and seek out the resources that will best help you with your studies. Recognize your weaknesses, and try to compensate for or work to improve them.** ©Scott T. Baxter/Getty Images RF

LO W.5 Study Strategies and Habits (continued)

Committing Yourself to Learning: Your Time and Perseverance

Understanding—and mastering—what you learn in the classroom will take time and patience. Nothing worthwhile comes easily. Be committed to your studies, and you will reap the benefits in the long run. Consider this: Your training in health care is the foundation of your future career. If the foundation is poorly built, it will lead to difficulties later.

Knowing and Motivating Yourself

What type of learner are you? When are you most productive? Know yourself and your limits, and work within them *(Figure W.10)*. Think about how to motivate yourself to prioritize your studies and achieve your goals. You are the one who benefits most from your success. If you lack self-motivation and drive, you are the first person who suffers.

Know your learning style. Just as there are many types of learners, there is no right or wrong way of learning. In which of the following categories do you see yourself?

Visual learner. You respond best to seeing processes and information. Take advantage of the strengths of your learning style by doing the following:

- Focus on text illustrations and charts, as well as course handouts.
- Check to see if there are animations on the course or text website to help you.
- Consider drawing diagrams in your notes to illustrate concepts.
- Use the contextual and labeling exercises at McGraw-Hill Connect.

Auditory learner. You work best by listening to processes and information. Take advantage of the strengths of your learning style by doing the following:

- Listen carefully to—and possibly tape record (with instructor permission)—the lecture.
- Talk information through with a study partner.
- Listen to audio pronunciations of terms at McGraw-Hill Connect.

Tactile/kinesthetic learner. Hands-on learning works best for you. Take advantage of the strengths of your learning style by doing the following:

- Apply what you have learned in a role-play or realistic scenario.
- Think of ways to apply your critical thinking skills in application-based ways.
- The Online Learning Center and McGraw-Hill Connect also will help you.

In addition to these suggestions, here are a few helpful hints for students of all learning styles:

- Ask questions to make sure you understand what you hear, read, and do.
- Rephrase what you have heard in lectures and read in the text as you talk with your peers.
- Study with a partner to help you stay committed and double-check your understanding of concepts.

Getting Organized

It seems the more organized you are, the easier things come. Take time now to analyze your life and your study habits to help you get organized now, and you'll find you have a little more time—and a lot less stress as the class progresses.

Find a calendar system that works for you. The best kind is one that you can take with you everywhere. To be truly organized, you should integrate all aspects of your life into this one calendar—school, work, family, and leisure *(Figure W.11).* Some people also find it helpful to have an additional monthly calendar posted in a convenient place (for example, on the refrigerator) for "at a glance" dates and to have a visual of what is to come. If you do this, be sure you are consistently synchronizing both calendars so that you do not miss anything. (More tips for organizing your calendar can be found in the following Scheduling and Managing Your Time section.) Some sample entries follow:

▲ **Figure W.11** **Use a daily planner to help you organize school, work, family, and leisure time.** ©Vstock LLC/Tetra Images/Corbis RF

Thursday

- Work from 8:00 a.m. to 3:30 p.m.
- Doctor's appointment from 4:00 to 4:45
- Dinner from 5:15 to 6:15
- Class from 6:30 to 9:30
- Study from 10:00 to 10:30

Keep everything for your course or courses in one place—and at your fingertips. A three-ring binder works well because it allows you to add or organize handouts and notes from class in any order you prefer. Incorporating your own custom tabs helps you flip instantly to the material you need.

Find your space. Find a place that helps you be organized and focused. If it is a desk or table at home, keep it clean. Clutter adds confusion and stress, and it wastes time. If there are small children in your home, be sure your study materials are kept out of their reach. If your study space is at the library or a relative's house, keep a backpack or bag fully stocked with your text, binder or notes, pens, highlighters, sticky notes, phone numbers of study partners, and anything else you might need.

Scheduling and Managing Your Time

There is never enough time in the week to get everything done, and managing your time is one of the most difficult tasks to successfully master. Valuable time slips through your fingers so easily. Here are just a few ways time slips away unnoticed:

- **Procrastination**—putting off tasks simply because you don't feel in the mood to do them right away.
- **Distraction**—getting sidetracked by the endless variety of other things that seem easier (or more fun) to do.
- **Underestimating the value of small bits of time**—thinking it isn't worth doing any work because you have something else to do, or someplace else to be, in 20 minutes or so.

Just as you make choices about where to spend your money and how to get the best value for your dollar, you do the same with your time. In order to get the most out of your externship at Fulwood Medical Center and out of your life in general, you have to spend your time wisely. You may be able to save money for future use, but you *can't* store away time to use later. However, you *can* plan how you will spend your time in a way that maximizes the quality and the quantity of things you can get done in a day, week, month, or year. If you're like most people, you may not have a good idea of how your time is actually being used.

Keynote

We all lead busy lives, but we all make choices as to how we spend our time. Choose wisely, and make the most of every minute you have.

Exercises

A. Take time to assess your learning style, and use that to aid your study and classroom habits. *Identify the type of learner you are, and briefly describe which of the strengths in that style work best for you.* **LO W.5**

1. I am a _____ learner.

2. This works best for me:

_____

_____

_____

LO W.5 Study Strategies and Habits (continued)

Ten Steps to a Study Schedule That Works

Making a study schedule you will actually follow means knowing yourself and your limits. Implement the following tips to develop a schedule that works for you.

1. **Study when you are most productive.** When are you most productive? Are you a night owl or an early bird? Plan to study when you are most alert and can have uninterrupted segments of time. This could include a quick 5-minute review before class or a 1-hour problem-solving study session with a friend.

2. **Create a set study time for yourself daily.** Having a set schedule means making a commitment to studying. Write your study time on your calendar, and do not schedule other activities during this time.

3. **Schedule study time using shorter, focused blocks with small breaks.** Studying a little each day rather than cramming the night before a test is a much more effective use of your time. Doing this helps you learn the material and store it in your long-term memory, not just memorize it and forget it after the test. Also, you will be less fatigued and less likely to procrastinate.

4. **Plan time for family, leisure, friends, exercise, and sleep.** Studying should be your main focus, but you need to balance your time—and your life.

5. **Log your projects and homework deadlines.** Record all due dates, tests, and projects in your personal calendar so that you know what is coming. If you have a large writing project, break the assignment down into smaller targets. Set a goal for the first draft, second draft, and final copy, and record each of these deadlines in your calendar.

6. **Try to complete tasks ahead of schedule.** This will give you a chance to carefully review your work before you hand it in. You'll feel less stressed in the end.

7. **Prioritize.** In your calendar or planner, highlight or number key projects. Do them first; then cross them off when they are completed. Give yourself a pat on the back for getting them done.

8. **Review and reprioritize daily.** Check your scheduled activities each day, and adjust them if priorities have changed.

9. **Resist distractions.** Don't let unscheduled activities take you away from designated study time. The Internet is a notorious time-waster. It is easy to lose hours surfing the web or instant messaging. It's just as easy to let a 5-minute phone call with a friend turn into a 3-hour conversation. Stick to your schedule.

10. **Multitask when possible.** You may find a lot of extra time you didn't think you had. Review material or deconstruct medical terms in your head while walking to class, while doing laundry, or during "mental down time." (*Note:* Mental down time does *not* mean in the middle of a lecture.)

How to Set Yourself Up for Success

1. Don't skip class and always be on time.
2. Allow enough time to study. Schedule studying on your calendar so you won't run out of time right before a test or assignment.
3. Get a good night's sleep.
4. Ask questions and participate in class. If you have a question, someone else probably does too.
5. Take advantage of instructor office hours. If you are an online student, be sure to contact your instructor when you need additional assistance.
6. Exam preparation should be an ongoing activity. Make sure you complete your homework, and take advantage of online activities that will enhance the learning process.
7. The learning outcomes at the beginning of every chapter summarize what you must understand by the end of that chapter. Use the book and digital resources to ensure you understand the chapter material.
8. Take notes in class. Your instructor will often provide tips for remembering difficult concepts or alert you to what will be on your exams.

Good luck on your journey to mastering the language of medicine!

Study Hints

Use previous quizzes and tests as study materials. Be certain you find out the correct answer for each question you answered incorrectly. Learn from your mistakes. These questions may appear on the final exam in one form or another.

As a way to review before a test, write 10 sample questions that might appear on the test. Ask your study partner or study group to write their 10 questions. Compare questions, and try to answer every question correctly. Subject matter that you have all included in a sample question is probably important enough to be on the test.

Keynotes

Additional points to remember about your study schedule:

- Be realistic when planning—know your limits and priorities.
- Be prepared for the unexpected (child's illness, your illness, overtime at work, inclement weather), which will leave any well-planned schedule in shambles.
- Reprioritize daily on the basis of schedule disruptions and other conflicts.
- Keep the overall picture in mind, and set long- and short-term goals (what you need to get done this week, this month, before the end of the semester, and so on).
- Form a support group.

Exercises

A. Be honest with yourself and self-assess. *Are you guilty of any of the self-defeating tendencies described earlier? If so, determine to change at least one bad habit before this course begins.* **LO W.5**

1. The habit I would most like to change is

_____

2. I recognize that if I change this habit, the ***benefit*** to me will be

_____

Remember: Your instructor puts time and effort into preparing this class and marking tests. You need to devote your time and energy to the class as well.

LO W.6 Innovative Learning Aids in This Book

Each chapter is structured around a consistent and unique framework of learning devices including vivid illustrations, photographs, specific content tables, Word Analysis and Definition (WAD) tables, Case Reports, and contextual placements. No matter what the subject matter of a chapter, the structure enables you to develop a consistent learning strategy, making *Medical Language for Modern Health Care 4e* a superior learning tool.

You Are . . . Your Patient Is

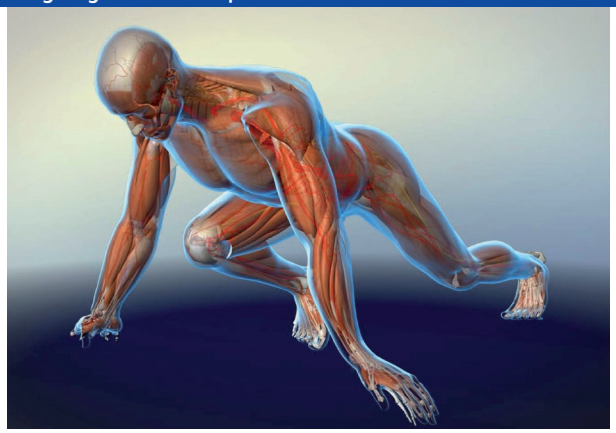
Each chapter opens by placing you in the role of a health professional related to the specialty and associated body systems and areas covered by the chapter. You also are introduced to a patient and given information about the patient's case.

Chapter Learning Outcomes

At the same time, **Chapter Learning Outcomes** let you know what you will learn in each chapter. This technique immediately engages you, motivating you to read on to learn how a particular patient's case (and the health care provider's role in the patient's care) relates to the medical terminology being introduced in the chapter.

SKELETAL SYSTEM
Language of Orthopedics

CHAPTER 14



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The health professionals involved in the diagnosis and treatment of problems of the **skeletal** system include:

- **Orthopedic surgeons (orthopedists),** medical doctors (**MDs**) who deal with the prevention, correction, disorders, and injuries of the musculoskeletal system.
- **Osteopathic physicians,** who have earned a doctorate in **osteopathy** (**DO**) and receive additional training in the musculoskeletal system and how it affects the whole body.
- **Physiatrists,** who are physicians specializing in physical medicine and rehabilitation.
- **Chiropractors (DCs),** who focus on the manual adjustments of joints—particularly the spine—to maintain and restore health.
- **Physical therapists,** who evaluate and treat pain, disease, or injury by physical therapeutic measures as opposed to medical and surgical measures.
- **Physical therapist assistants,** who work under the direction of a physical therapist to assist patients with their physical therapy.
- **Orthopedic technologists** and **technicians,** who assist orthopedic surgeons in treating patients.
- **Podiatrists,** who are practitioners in the diagnosis and treatment of disorders and injuries of the foot.
- **Orthotists,** who make and fit orthopedic appliances (**orthotics**).

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Chapter Learning Outcomes

This chapter will review the whole musculoskeletal system and will enable you to:

LO 14.1 Identify the components of the skeletal system and the functions of the bones.
LO 14.2 Discuss the growth and structure of bones.
LO 14.3 Describe diseases of bones.
LO 14.4 Explain the different types of bone fractures and their healing process.
LO 14.5 Describe the components of joints and classify joints based on the amount of movement they allow.
LO 14.6 Differentiate the movements of joints.
LO 14.7 Explain the diseases of joints.
LO 14.8 Identify the components and functions of the axial skeleton.
LO 14.9 Identify the components of the vertebral column.
LO 14.10 Describe common disorders of the vertebral column.
LO 14.11 Describe the skull and facial skeleton.
LO 14.12 Relate the structure of the shoulder girdle to its functions.
LO 14.13 Explain common disorders of the shoulder joint.
LO 14.14 Identify the components of the upper arm and elbow joint.
LO 14.15 Describe common disorders of the elbow joint.
LO 14.16 Explain the structure of the forearm and wrist.
LO 14.17 Discuss common disorders of the wrist.
LO 14.18 Relate the structure of the hand to its functions.
LO 14.19 Describe disorders of the hand.
LO 14.20 Relate the structure of the pelvic girdle to its functions.
LO 14.21 Explain disorders of the pelvic girdle.
LO 14.22 Identify the bones and joints of the hip and thigh.
LO 14.23 Describe disorders of the hip joint.
LO 14.24 Discuss the bones and joints of the knee and thigh.
LO 14.25 Understand disorders of the knee joint.
LO 14.26 Describe the bones and joints of the lower leg, ankle, and foot.
LO 14.27 Explain disorders of the ankle and foot.
LO 14.28 Discuss diagnostic procedures for disorders of the skeletal system.
LO 14.29 Explain therapeutic procedures for disorders of the skeletal system.
LO 14.30 Describe pharmacologic agents used in the treatment of disorders of the musculoskeletal system.
LO 14.A Use the medical terms of the skeletal system to communicate in writing and document accurately and precisely in any health care setting.
LO 14.B Use the medical terms of the skeletal system to communicate verbally with accuracy and precision in any health care setting.
LO 14.C Using word elements, construct medical terms associated with the skeletal system.
LO 14.D Deconstruct medical terms into their word elements (roots, combining forms, prefixes, and suffixes).
LO 14.E Identify health professionals involved in the care of patients with skeletal disorders.
LO 14.F Identify abbreviations as they relate to the words they abbreviate and use them in context to medical care.

Case Report (CR) 14.1

You are

. . . an **orthopedic technologist** working with Kevin Stannard, MD, an **orthopedist** in the Fulwood Medical Group.

Your patient is

. . . Mrs. Amy Vargas, a 70-year-old housewife, who tripped going down the front steps from her house. She has severe pain in her right hip and is unable to stand. An x-ray shows a hip fracture and marked **osteoporosis**. Dr. Stannard examined her in the Emergency Department and has admitted her for a hip replacement.

For you to work with Dr. Stannard to give optimal care to Mrs. Vargas and help her and her family understand the significance of her bone disorder and injury, you will need to be familiar with the terminology of bone structure and function and bone disorders.

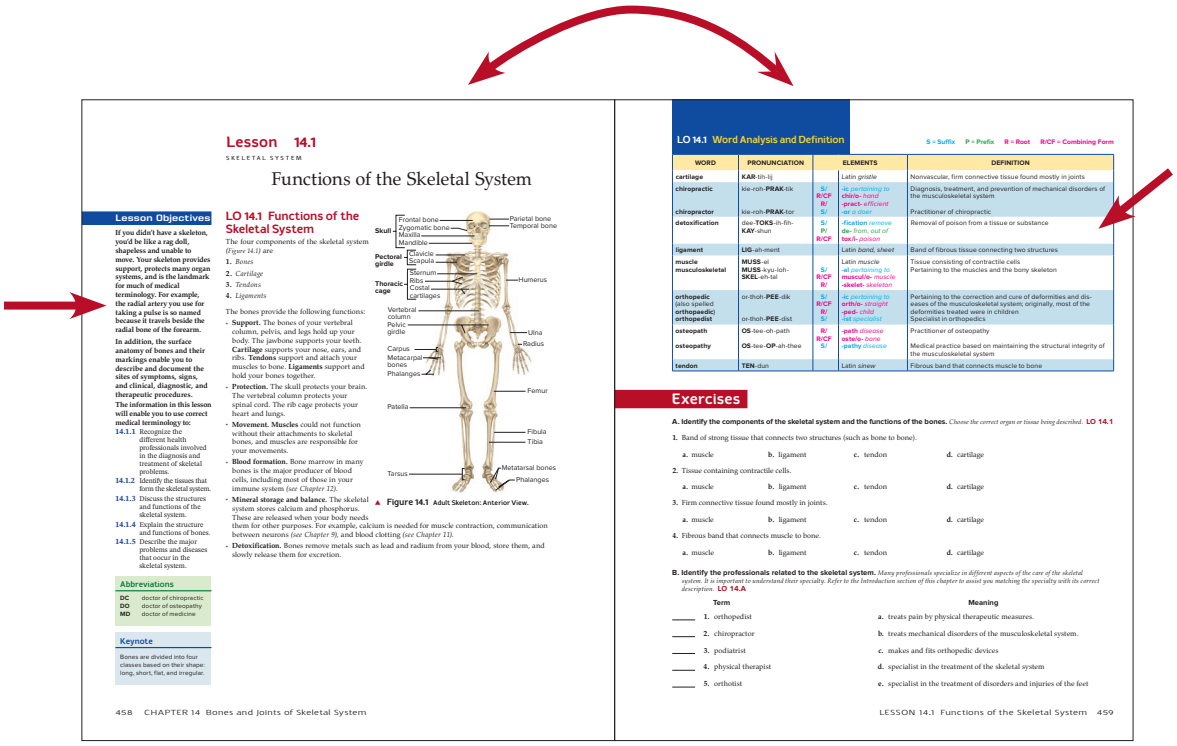
Lesson-Based Organization

The chapter content is broken down into chunks, or lessons, in order to help you digest new information and relate it to previously learned information. Rather than containing many various topics within a chapter, these lessons group the chapter material into logical, streamlined learning units designed to help you achieve the chapter outcomes. Lessons within a chapter build on one another to form a cohesive, coherent experience for the learner.

Each lesson is based on specific lesson **objectives** designed to support your achievement of the overall **chapter learning outcomes.** Each lesson in a chapter contains an introduction, lesson objectives, lesson topics, Word Analysis and Definition boxes, and lesson exercises. Within each lesson, all topics and information are presented in **self-contained two-page spreads.** This means you do not have to flip back and forth to see figures on one page that are described on another. Each section of information and every exercise are tagged with the appropriate chapter learning outcome (LO).

Word Analysis and Definition Boxes

The medical terms covered in each lesson are introduced in context, either within a patient case or in the lesson topics. To facilitate easy reference and review, the terms also are listed in boxes as a group. The **Word Analysis and Definition (WAD) boxes** list the term and its pronunciation, elements, and definition in a concise, color-coded, at-a-glance format.



Lesson 14.1
SKELETAL SYSTEM

Functions of the Skeletal System

Lesson Objectives

If you didn't have a skeleton, you'd be like a rag doll, shapeless and unable to move. Your skeleton provides support, protects many organ systems, and is the landmark for much of medical terminology. For example, the radial artery you use for taking a pulse is so named because it travels beside the radial bone of the forearm.

In addition, the surface anatomy of bones and their markings enable you to describe and document the sites of symptoms, signs, and clinical, diagnostic, and therapeutic procedures. The information in this lesson will enable you to use correct medical terminology to:

- 14.1.1 Recognize the different health professionals involved in the diagnosis and treatment of skeletal problems.
- 14.1.2 Identify the tissues that form the skeletal system.
- 14.1.3 Discuss the structures and functions of the skeletal system.
- 14.1.4 Explain the structure and functions of bones.
- 14.1.5 Describe the major problems and diseases that occur in the skeletal system.

Abbreviations

DC doctor of chiropractic
DO doctor of osteopathy
MD doctor of medicine

Keynote

Bones are divided into four classes based on their shape: long, short, flat, and irregular.

LO 14.1 Functions of the Skeletal System

The four components of the skeletal system (*figure 14.1*) are

1. *Bones*
2. *Cartilage*
3. *Tendons*
4. *Ligaments*

The bones provide the following functions:

- **Support.** The bones of your vertebral column, pelvis, and legs hold up your body. The jawbone supports your teeth. **Cartilage** supports your nose, ears, and ribs. **Tendons** support and attach your muscles to bone. **Ligaments** support and hold your bones together.
- **Protection.** The skull protects your brain. The vertebral column protects your spinal cord. The rib cage protects your heart and lungs.
- **Movement. Muscles** could not function without their attachments to skeletal bones, and muscles are responsible for your movements.
- **Blood formation.** Bone marrow in many bones is the major producer of blood cells, including most of those in your immune system (*see Chapter 12*).
- **Mineral storage and balance.** The skeletal system stores calcium and phosphorus. These are released when your body needs them for other purposes. For example, calcium is needed for muscle contraction, communication between neurons (*see Chapter 9*), and blood clotting (*see Chapter 11*).
- **Detoxification.** Bones remove metals such as lead and radium from your blood, store them, and slowly release them for excretion.

Skull: Frontal bone, Zygomatic bone, Maxilla, Mandible, Parietal bone, Temporal bone
Pectoral girdle: Clavicle, Scapula
Thoracic cage: Sternum, Ribs, Costal cartilages
Humerus, Vertebral column, Pelvic girdle, Ulna, Radius, Carpus, Metacarpal bones, Phalanges, Femur, Patella, Fibula, Tibia, Tarsus, Metatarsal bones, Phalanges

▲ **Figure 14.1** Adult Skeleton: Anterior View.

458 CHAPTER 14 Bones and Joints of Skeletal System

LO 14.1 Word Analysis and Definition

S = Suffix P = Prefix R = Root R/CF = Combining Form

WORD	PRONUNCIATION	ELEMENTS	DEFINITION
cartilage	**KAR**-tih-lij	Latin *gristle*	Nonvascular, firm connective tissue found mostly in joints
chiropractic	kie-roh-**PRAK**-tik	S/ *-ic pertaining to* R/CF *chiro- hand* R/ *-practic efficient*	Diagnosis, treatment, and prevention of mechanical disorders of the musculoskeletal system
chiropractor	kie-roh-**PRAK**-tor	S/ *-or a doer*	Practitioner of chiropractic
detoxification	dee-**TOKS**-ih-fih-**KAY**-shun	S/ *-fication remove* P/ *de- from, out of* R/CF *toxi- poison*	Removal of poison from a tissue or substance
ligament	**LIG**-ah-ment	Latin *band, sheet*	Band of fibrous tissue connecting two structures
muscle **musculoskeletal**	**MUSS**-el **MUSS**-kyu-loh-**SKEL**-ih-tal	Latin *muscle* *-al pertaining to* *musculo- muscle* *-skelet- skeleton*	Tissue consisting of contractile cells Pertaining to the muscles and the bony skeleton
orthopedic (also spelled **orthopaedic**) **orthopedist**	or-thoh-**PEE**-dik or-thoh-**PEE**-dist	S/ *-ic pertaining to* R/CF *ortho- straight* R/ *-pedi- child* S/ *-ist specialist*	Pertaining to the correction and cure of deformities and diseases of the musculoskeletal system; originally, most of the deformities treated were in children Specialist in orthopedics
osteopath	**OS**-tee-oh-path	R/ *osteo-* R/CF *-path disease*	Practitioner of osteopathy
osteopathy	**OS**-tee-**OP**-ah-thee	R/ *osteo- bone* S/ *-pathy disease*	Medical practice based on maintaining the structural integrity of the musculoskeletal system
tendon	**TEN**-dun	Latin *sinew*	Fibrous band that connects muscle to bone

Exercises

A. Identify the components of the skeletal system and the functions of the bones. *Choose the correct organ or tissue being described.* LO 14.1

1. Band of strong tissue that connects two structures (such as bone to bone).
   a. muscle b. ligament c. tendon d. cartilage
2. Tissue containing contractile cells.
   a. muscle b. ligament c. tendon d. cartilage
3. Firm connective tissue found mostly in joints.
   a. muscle b. ligament c. tendon d. cartilage
4. Fibrous band that connects muscle to bone.
   a. muscle b. ligament c. tendon d. cartilage

B. Identify the professionals related to the skeletal system. *Many professionals specialize in different aspects of the care of the skeletal system. It is important to understand their specialty. Refer to the Introduction section of this chapter to assist you matching the specialty with its correct description.* LO 14.A

Term	Meaning
____ 1. orthopedist	a. treats pain by physical therapeutic measures.
____ 2. chiropractor	b. treats mechanical disorders of the musculoskeletal system.
____ 3. podiatrist	c. makes and fits orthopedic devices
____ 4. physical therapist	d. specialist in the treatment of the skeletal system
____ 5. orthotist	e. specialist in the treatment of disorders and injuries of the feet

LESSON 14.1 Functions of the Skeletal System 459

Exercises

A. Describe how the lesson-based organization of the material will help you learn more efficiently. LO W.6

1. _____

B. Detail how to use the chapter Learning Outcomes to develop a study outline for the chapter material. LO W.6

1. _____

Exercises

A. Identify the structures that make up the knee joint. *Given the description, identify the structure that makes up the knee joint. Fill in the blanks.* LO 14.24

1. This cartilage is tough and functions to cushion and add stability to the joint._____
2. This bone protects the anterior portion of the knee joint. It is embedded in a tendon. _____
3. The femur articulates with this leg bone. _____
4. This lower leg bone is on the lateral side of the leg. _____
5. Ligaments that form a "cross" are termed _____ ligaments.
6. Ligaments that stabilize the knee joints on the lateral and medial sides are termed _____ ligaments.

B. Use medical terminology in written documentation. *June has come to the emergency department complaining of sudden knee pain. After reading the description, insert the medical term that correctly replaces the description.* LO 14.25, 14.A

June has just recently taken up the sport of running. She ran too many miles her first week, causing a sharp pain to develop in front of her kneecap **1.**(_____). The physician believes that the pain is due to a softening of the cartilage **2.**(_____) of the kneecap. June thought it best to not run long distances, and instead practice sprinting with sudden stopping and starting. This resulted in an over flexion of her knee **3.**(_____), which caused a sudden tearing of her ACL.

LO W.6 Innovative Learning Aids (continued)

Section and Chapter-End Exercises

Each spread ends with exercises designed to allow you to check your basic understanding of the terms you just learned. These checkpoints can be used by instructors as assignments or in-class activities or by students for self-evaluation.

At the end of each chapter, you will find chapter review of exercises that ask you to apply what you learned in all the lessons of a chapter. These exercises reinforce learning of each chapter's terms and help you go beyond mere memorization to think critically about the medical language you use. In addition to reviewing and recalling the definitions of terms learned in the chapter, you will be asked to use medical terms in new and different ways.

Study Hint Boxes

Study Hint boxes are found throughout the exercise sections. They reinforce, and remind you to use, basic study skills.

Chapter 1 Review

The Anatomy of Medical Terms

E. Use your newly acquired knowledge of medical language to correctly answer the following questions. Let the roots and combining forms be your guide. Choose the correct answer to complete each statement. (LO 1.1, 1.2)

1. This term means one who studies the skin.
   a. dermatologist
   b. urologist
   c. neurologist
2. This term relates to the intestines and the stomach.
   a. gastroenterology
   b. cardiology
   c. dermatology
3. This term relates to the process of breathing.
   a. apex
   b. toxic
   c. respiratory
4. This term relates to the stomach.
   a. gastritis
   b. gynecology
   c. dermatitis
5. This term relates to a joint.
   a. urethritis
   b. arthritis
   c. neuralgia

F. Use the correct medical term to complete the sentence. Use the words to complete each sentence below. Fill in the blanks. (LO 1.1, 1.4)

bladder breech cardiologist ileum ilium kidney lymph malleolus trapezium ureter urethra

1. A _____ is a specialist in the care of the heart.
2. The _____ is a tube from the kidney to the bladder.
3. Urology is the study of diseases of the _____ and _____.
4. A segment of the small intestine is the _____.
5. _____ means the buttocks, not the head, present first at delivery.
6. _____ is the tube from the bladder to the outside.
7. _____ is a fluid collected from body tissues.
8. A bone in the wrist is the _____.
9. The bony protuberance at the ankle is the _____.
10. The _____ is a bone in the pelvis.

G. Case report questions. Read Case Report 1.4. You should feel more comfortable with the medical terminology now and will be able to answer the questions that follow. (LO 1.4)

Case Report (CR) 1.4

You are

. . . a medical assistant employed by Russell Gordon, MD, a primary care physician at Fulwood Medical Center.

Your patient is

. . . Mrs. Connie Bishop, a 55-year-old woman who presents with a swelling in her lower abdomen and shortness of breath. She has no gynecologic or gastroenterologic symptoms. Her previous medical history shows recurrent dermatitis of her hands since a teenager and an arthroscopy for a knee injury at age 40. Physical examination reveals a circular mass 6 inches in diameter in the left lower quadrant of her abdomen. There is no abnormality in her respiratory or cardiovascular system.

Your role is to maintain her medical record and document her care, assist Dr. Gordon during his examinations, explain the examination and treatment procedures to Mrs. Bishop, and facilitate her referral for specialist care.

Study Hint
Many elements have more than one meaning. You must know the different meanings because that will make a difference in the use of the medical term.

1. What type of skin problem has Mrs. Bishop had since she was a teenager? _____
2. Which term in the case study means *pertaining to the stomach and small intestines*? _____
3. Her knee injury required what type of procedure? _____
4. Does she have any issues with her lungs or heart? (yes or no) _____
5. Do her symptoms indicate a possible problem with her ileum? (yes or no) _____

H. Because much of clinical documentation centers on surgeries, knowledge of surgical suffixes is most important—especially for coders. (LO 1.2)

Matching
Match the definition in the first column the correct term it is describing in the second column.

Term	Meaning
____ 1. scopy	A. surgical repair
____ 2. desis	B. visual examination
____ 3. plasty	C. surgical fixation

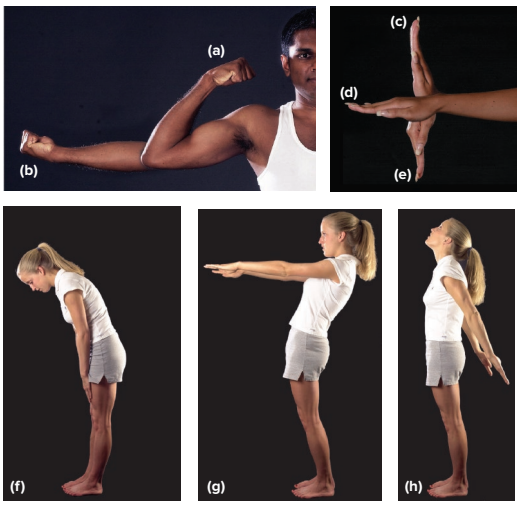
Combine these suffixes with the combining form** arthr/o **and fill in the blanks with the correct medical term.

4. The surgeon wants a closer look inside Mr. Parker's knee so he is scheduled for an _____ tomorrow morning.
5. Mary Collins has torn her knee ligaments playing high school basketball. Her treatment plan includes scheduling an _____ to reattach them. (fixation)
6. June Larkin had a bad skiing accident while on vacation. Her tendons and ligaments in her knee will require extensive surgery to get her walking again without crutches. She needs an _____. (repair)

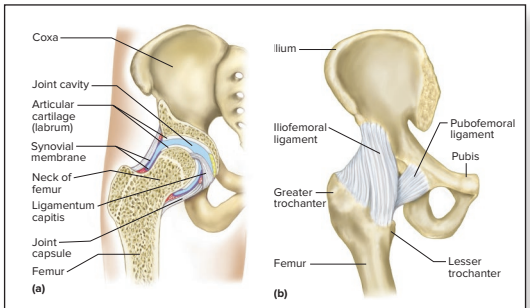
Congratulations! You are on your way to learning medical terminology.

Vivid Illustrations and Photos

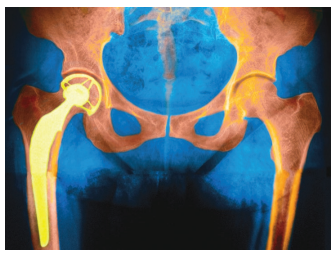
Colorful, precise anatomical illustrations and photos lend a realistic view of body structures and correlate to the clinical context of the lessons.



▲ **Figure 14.10 Joint Flexion and Extension.** (*a*) Flexion of the elbow. (*b*) Extension of the elbow. (*c*) Extension of the wrist. (*d*) Neutral position of the wrist. (*e*) Flexion of the wrist. (*f*) Flexion of the spine. (*g*) Flexion of the shoulder. (*h*) Extension of the shoulder. (a-h) ©McGraw-Hill Education/Tim Vacula, photographer.



▲ **Figure 14.25 Hip Joint.** (*a*) Right frontal view of a section of hip joint. (*b*) Ligaments of hip joint.



▲ **Figure 14.29 Total-Hip Replacement.** Colored x-ray of prosthetic hip. ©AJPhoto/Photo Researchers, Inc.

Exercises

A. Pick one of the photos above and explain how it helps you understand the material better. LO W.6

1. _____

_____

_____

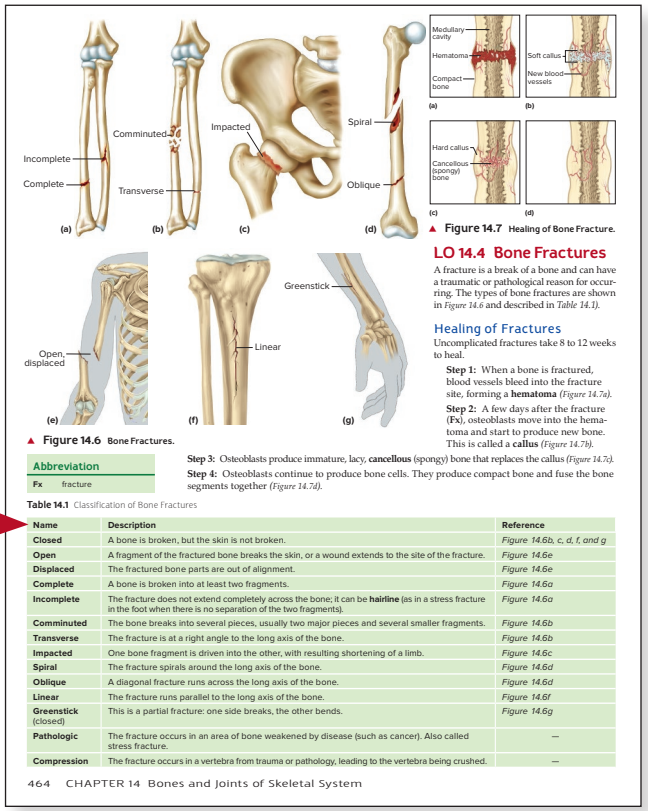
B. Practice precision in medical terminology. *Choose any five terms in the illustration of the hip joint above. See the term, hear it, and write it down. Make sure you spell it correctly.* LO W.6

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

LO W.6 Innovative Learning Aids (continued)

Tables

Meaningful tables aid in summarizing concepts and lesson topics.



▲ **Figure 14.6** Bone Fractures.

▲ **Figure 14.7** Healing of Bone Fracture.

LO 14.4 Bone Fractures

A fracture is a break of a bone and can have a traumatic or pathological reason for occurring. The types of bone fractures are shown in *Figure 14.6* and described in *Table 14.1*).

Healing of Fractures

Uncomplicated fractures take 8 to 12 weeks to heal.

Step 1: When a bone is fractured, blood vessels bleed into the fracture site, forming a **hematoma** *(Figure 14.7a)*.

Step 2: A few days after the fracture (**Fx**), osteoblasts move into the hematoma and start to produce new bone. This is called a **callus** *(Figure 14.7b)*.

Step 3: Osteoblasts produce immature, lacy, **cancellous** (spongy) bone that replaces the callus *(Figure 14.7c)*.

Step 4: Osteoblasts continue to produce bone cells. They produce compact bone and fuse the bone segments together *(Figure 14.7d)*.

Abbreviation

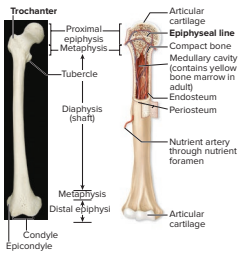
Fx	fracture

Table 14.1 Classification of Bone Fractures

Name	Description	Reference
Closed	A bone is broken, but the skin is not broken.	*Figure 14.6b, c, d, f, and g*
Open	A fragment of the fractured bone breaks the skin, or a wound extends to the site of the fracture.	*Figure 14.6e*
Displaced	The fractured bone parts are out of alignment.	*Figure 14.6e*
Complete	A bone is broken into at least two fragments.	*Figure 14.6a*
Incomplete	The fracture does not extend completely across the bone; it can be **hairline** (as in a stress fracture in the foot when there is no separation of the two fragments).	*Figure 14.6a*
Comminuted	The bone breaks into several pieces, usually two major pieces and several smaller fragments.	*Figure 14.6b*
Transverse	The fracture is at a right angle to the long axis of the bone.	*Figure 14.6b*
Impacted	One bone fragment is driven into the other, with resulting shortening of a limb.	*Figure 14.6c*
Spiral	The fracture spirals around the long axis of the bone.	*Figure 14.6d*
Oblique	A diagonal fracture runs across the long axis of the bone.	*Figure 14.6d*
Linear	The fracture runs parallel to the long axis of the bone.	*Figure 14.6f*
Greenstick (closed)	This is a partial fracture: one side breaks, the other bends.	*Figure 14.6g*
Pathologic	The fracture occurs in an area of bone weakened by disease (such as cancer). Also called stress fracture.	—
Compression	The fracture occurs in a vertebra from trauma or pathology, leading to the vertebra being crushed.	—

Keynotes and Abbreviations

Keynote and Abbreviation boxes offer you additional information correlating with the lesson.



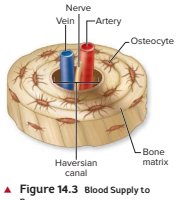
▲ **Figure 14.2** Femur: Long Bone of the Thigh.
(a) ©McGraw-Hill Education/Christine Eckel, photographer.

LO 14.2 Bone Growth and Structure

Bone Growth

Factors that affect bone growth include

1. **Genes.** Genes determine the size and shape of bones and the ultimate adult height.
2. **Nutrition.** Calcium and phosphorus are needed to develop good bone density.
3. **Exercise.** Exercise increases bone density and total bone mass.
4. **Mineral deposition.** Calcium and phosphate are taken from plasma and deposited in bone.
5. **Mineral resorption.** Calcium and phosphate are released from bone back into the plasma when they are needed elsewhere. For example, calcium is needed for muscle contraction, communication between neurons, and blood clotting. Phosphate is a component of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).
6. **Vitamins.** Vitamin A activates **osteoblasts**; vitamin C is essential for collagen synthesis; vitamin D stimulates absorption of calcium and phosphate, its transport, and its deposition into bones.
7. **Hormones.** For example, growth hormone stimulates the epiphyseal plate to calcify, and estrogen and testosterone accelerate bone growth after puberty and maintain bone density *(see Chapter 17)*.



▲ **Figure 14.3** Blood Supply to Bone.

Keynote

Minerals are deposited in bone when the supply is ample and released when they are needed elsewhere.

Structure of Bones

Long bones are the most common type of bone in the body *(Figure 14.2a)*.

The shaft of a long bone is called the **diaphysis**. Each end of the bone is called the **epiphysis** and is expanded to provide extra surface area for the attachment of ligaments and tendons.

Sandwiched between the diaphysis and epiphysis is a thin area called the **metaphysis**. Thin layers of cartilage cells in the **epiphyseal plate** enable the diaphysis (bone shaft) to grow in length. When growth stops, compact bone grows into the epiphyseal plate and forms the **epiphyseal line** *(Figure 14.2b)*.

A tough connective tissue sheath called **periosteum** covers the outer surface of all bones and is attached to the compact or **cortical** bone by tough collagen fibers. The periosteum protects the bone and anchors blood vessels and nerves to the surface of the bone.

The hollow cylinder inside the diaphysis is called the **medullary cavity.** It contains bone **marrow** and is lined by a thin membrane called the **endosteum**. The marrow is a fatty tissue that contains blood cells in different stages of development *(see Chapter 11)*.

The endosteum and periosteum contain **osteoblasts**, cells that produce the matrix of new bone tissue. This process is called **osteogenesis**. Bone **matrix** consists of cells, collagen fibers, a gel that supports and suspends the fibers, and calcium phosphate crystals that give bone its hardness.

When osteoblasts are incorporated into the new bone, they become **osteocytes**. These cells, which maintain the matrix, reside in small spaces in the matrix called **lacunae**.

Osteoclasts are produced by the bone marrow. They dissolve calcium, phosphorus, and the organic components of the bone matrix. There is a continual balancing act going on as osteoclasts remove matrix and osteoblasts produce matrix. If osteoclasts outperform the osteoblasts, then **osteoporosis** occurs, as with Mrs. Vargas.

All bones are well supplied with blood *(Figure 14.3)*. The blood vessels travel through the bone in a system of small **central (haversian) canals**. Because of its good blood supply, bone heals well.

Case Report (CR) 14.2 *(continued)*

By age 65, more than 80% of people have some degree of joint degeneration. Mr. Johnson had always been very physically active, putting a lot of pressure on his weight-bearing joints. At different times in his life, he had been overweight, adding to the pressure.

X-rays of his lower back showed **osteoarthritis** of his lower lumbar intervertebral joints and marked osteoarthritis of his left hip joint *(Figure 14.12a and b)*. He received a left total-hip replacement **(THR)** and physiotherapy **(PT)** for his lower back.

Abbreviations

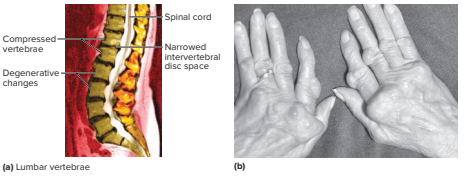
DJD	degenerative joint disease
MCP	metacarpophalangeal
OA	osteoarthritis
PIP	proximal interphalangeal
PT	physiotherapy (physical therapy)
RA	rheumatoid arthritis
THR	total-hip replacement

LO 14.7 Diseases of Joints

Osteoarthritis (OA) is caused by the breakdown and eventual destruction of cartilage in a joint. It develops as a result of wear and tear and is most common in the weight-bearing joints: the knee, hip, and lower back *(Figure 14.12a)*. Because it is a wear-and-tear disease, it is sometimes called **degenerative joint disease (DJD)**. The degenerative process begins in the articular cartilage, which cracks and frays, eventually exposing the underlying bone.

Rheumatoid arthritis (RA) is a chronic, inflammatory disease that can affect many joints, causing deformity and disability. In *Figure 14.12b*, the hand deformities of RA—swelling of the **metacarpophalangeal (MCP)** and **proximal interphalangeal (PIP)** joints with **ulnar deviation** of the fingers—are shown. The disease process initially causes inflammation of the synovial membrane and then spreads to all other parts of the joint. Rheumatoid arthritis is three times as common in women and often begins in the thirties and forties.

Bursitis is inflammation of a **bursa** that can result from overuse of a joint, repeated trauma, or diseases such as RA.

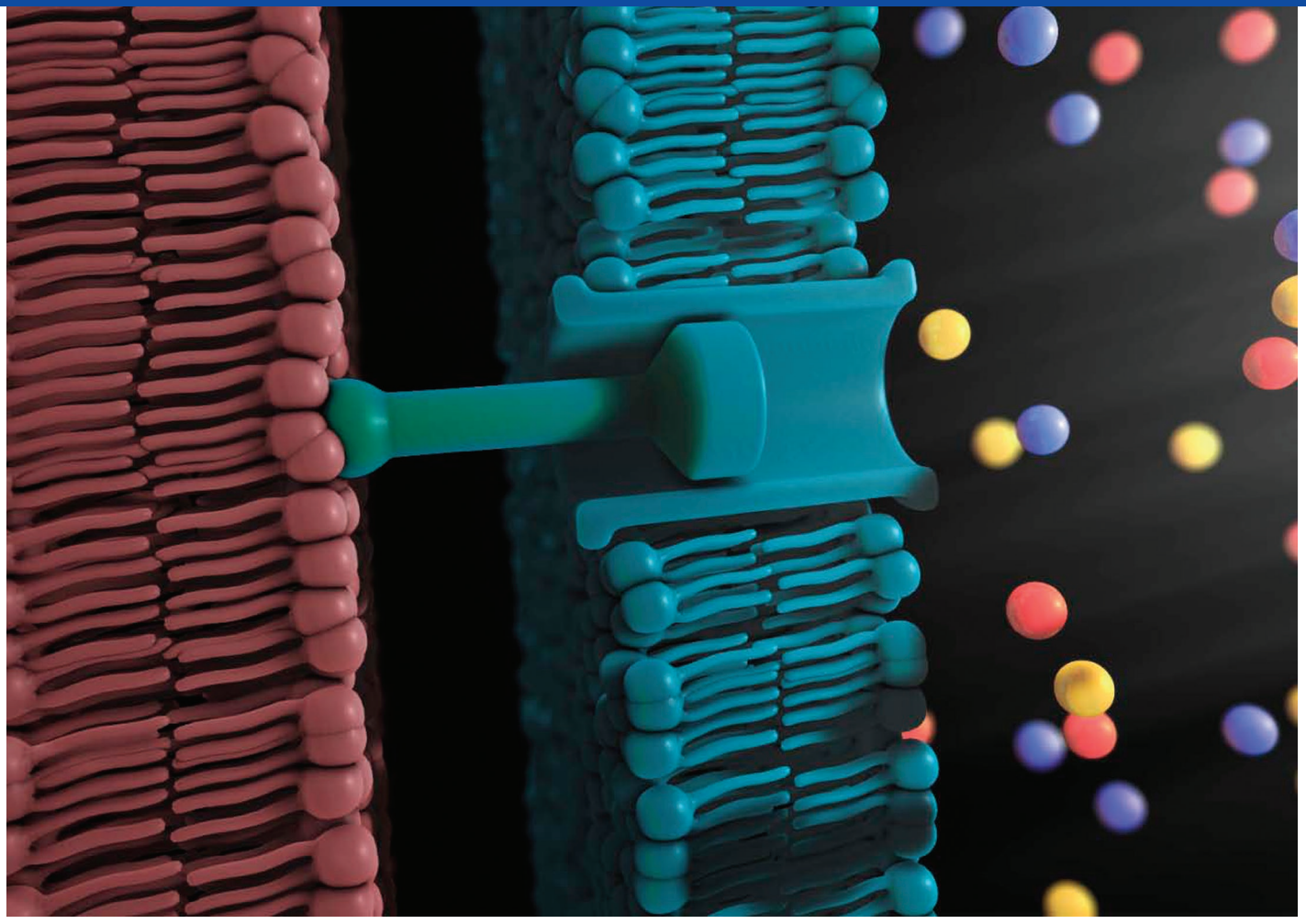


▲ **Figure 14.12** Arthritis. (a) Magnetic resonance imaging (MRI) scan of lumbar vertebrae showing degenerative changes due to osteoarthritis. (b) Rheumatoid arthritis of the hands (a) ©Du Cane Medical Imaging Ltd./Photo Researchers, Inc. (b) ©VisualDx

Notes

The Anatomy of Medical Terms

The Foundation of Medical Language



CHAPTER 1

Chapter Learning Outcomes

The technical language of medicine has been developed logically from Latin and Greek roots because it is in Latin and Greek cultures that the concept of treating patients began. This medical language provides all the health professionals involved in the care of a patient with the ability to communicate with each other by using medical terms with precise meanings. To be a qualified health professional it is necessary to be able to speak the language of medicine.

Medical terms are built from individual parts, or elements, that form the anatomy of the word. The information in this chapter will enable you to:

LO 1.1 Recognize the logic of the language of medicine in individual medical terms.

LO 1.2 Identify the **roots** and **combining forms** of medical terms.

LO 1.3 Demonstrate the importance of **suffixes** and **prefixes** in forming medical terms.

LO 1.4 Identify medical terms taken directly from Greek, Latin, or Old English words.

LO 1.5 Differentiate between medical terms that are spelled and/or pronounced similarly.

Case Report (CR) 1.1

You are

. . . a **respiratory therapist** working with Tavis Senko, MD, a **pulmonologist** at Fulwood Medical Center.

You are communicating with

. . . Mrs. Sandra Schwartz, a 43-year-old woman referred to Dr. Senko by her primary care physician, Dr. Andrew McDonald, an **internist**. Mrs. Schwartz has a persistent abnormality on her chest x-ray. You have been asked to determine her **pulmonary** function prior to a scheduled **bronchoscopy**.

This summary of a Case Report

. . . illustrates for you the use of some simple medical terms. Modern health care and medicine have their own language. The medical terms all have precise meanings, which enable you, as a health professional, to communicate clearly and accurately with other health professionals involved in the care of a patient. This communication is critical for patient safety and the delivery of high-quality patient care.

From her medical records, you can see that 2 months ago Mrs. Schwartz developed a right upper lobe (RUL) **pneumonia**. After treatment with an **antibiotic**, a follow-up chest x-ray (CXR) showed some residual collapse in the right upper lobe and a small right **pneumothorax**. Mrs. Schwartz has smoked a pack a day since she was a teenager. Dr. Senko is concerned that she has lung cancer and has scheduled her for a **bronchoscopy**.

Lesson 1.1

THE LANGUAGE OF HEALTH CARE

The Construction of Medical Words

Lesson Objectives

Your confidence in using and understanding the medical terms in this book will increase as you become familiar with the logic of how these terms are constructed. The information in this lesson will enable you to:

- **1.1.1** Build and construct medical terms using their elements.
- **1.1.2** Select and identify the meaning of essential medical term roots.
- **1.1.3** Define the elements combining vowel and combining form.
- **1.1.4** Identify the combining vowel and combining form of essential medical terms.
- **1.1.5** Define the elements suffix and prefix.
- **1.1.6** Select and identify the meaning of the suffixes and prefixes of essential medical terms.

ROOTS:

- A **root** is the constant foundation and core of a medical term.
- **Roots** are usually of Greek or Latin origin.
- All medical terms have *one* or *more* **roots**.
- A **root** can appear anywhere in the term.
- More than one **root** can have the same meaning.
- A **root** plus a **combining vowel** creates a **combining form**.

LO 1.1 The Logic of Medical Terminology

Understanding and being comfortable with the technical language of medicine are keys to a successful career as a health professional. Your ability to use and understand the technical language to communicate verbally and in writing are essential for patient safety, high-quality patient care, precise interaction with other health professionals, and your own self-esteem as a health professional.

Your confidence in using medical terms will increase as you understand the logic of how each term is built from its individual parts, or elements. In addition, understanding the logic of this process will help you analyze or deconstruct an unknown medical term and break it down into its elements so that its meaning can be understood.

The **elements** of a medical term are its **roots**, **suffixes**, and **prefixes**, and the vast majority of these elements are derived from Latin and Greek origins. Throughout this book, when words are broken down, the elements will be color coded.

LO 1.2 Roots

Every medical term has a **root**—the element that provides the core meaning of the word. For example, in Case Report 1.1:

- The word *pneumonia* has the **root *pneumon-***, taken from the Greek word meaning *lung* or *air.* The Greek **root *pneum-*** also means lung or air. *Pneumonia* is an infection of the lung tissue.
- Dr. Tavis Senko is a *pulmonologist.* The **root *pulmon-*** is taken from the Latin word meaning *lung.* A *pulmonologist* is a specialist who treats lung diseases.

LO 1.2 Combining Forms

Roots are often joined to other elements in a medical term by adding a **combining vowel,** such as the letter "**o**," to the end of the **root**, like ***pneum-***, to form **pneum/o-**.

Throughout this book, whenever a term is presented, a **slash (/)** will be used to separate the combining vowel from the **root.** Other examples of this approach are as follows:

- Adding the **combining vowel** "**o**" to the Latin **root *pulmon-*** makes the **combining form *pulmon/o-*.**

Any vowel, "a," "e," "i," "o," or "u," can be used as a **combining vowel**.

- The **root** ***respir-*** means *to breathe.* Adding the **combining vowel** "**a**" makes the **combining form** ***respir/a-***.

- The **root** ***bronch-*** is derived from the Greek word for *windpipe* and is one of the two subdivisions of the trachea that carry air to and from the lungs. Adding the **combining vowel** "**o**" to the **root** ***bronch-*** makes the **combining form** ***bronch/o-***.

Many medical terms contain more than one **root**; when two roots occur together, they are always joined by a **combining vowel**, as in the following example:

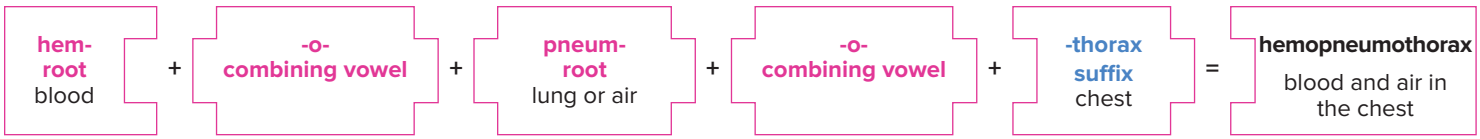
- The word **hemopneumothorax** has the **root** ***hem-***, from the Greek word meaning *blood;* the **root** ***pneum-***, from the Greek word meaning *air* or *lung;* and the **suffix** ***-thorax***, from the Greek word meaning *chest.* The **combining vowel** "**o**" is added to these two roots to make the **combining forms** ***hem/o*** and ***pneum/o-***. A combining vowel is used to join a root (***pneum-***) to a suffix that begins with a consonant (***-thorax***). A **hemopneumothorax** is the presence of air and blood in the space that surrounds the lungs in the chest. As blood and air fill the pleural cavity, the lungs cannot expand and respiration is not possible, thus forcing the affected lung to collapse.

COMBINING FORMS:

- Combine a **root** and a **combining vowel**.
- Can be attached to another **root** or **combining form**.
- Can precede another word element called a **suffix.**
- Can follow a **prefix**.

Keynote

- Throughout this book, look for the following patterns:
  - **Roots**, **combining forms**, and **combining vowels** will be colored **pink**.
  - **Prefixes** will be colored **green**.
  - **Suffixes** will be colored **blue**.
- Different **roots** can have the same meaning. *Pulmon-* and *pneumon-* both mean *lung, air.*



Exercises

A. Review what you have just learned about roots and combining forms. *Select the correct answer to the statement.* **LO 1.1**

root **combining form** **combining vowel** **suffix** **prefix**

1. Roots and combining forms can go before a _____.
2. This element does not have a meaning; it serves to make the word easier to pronounce: _____.
3. A _____ can go before a root.
4. The _____ is the root plus a combining vowel.

B. Identify the word parts of a medical term. *Use the provided medical term to correctly answer the questions.* **LO 1.2**

1. In the word **pneumonia,** the root is:
   a. *pneum-* **b.** *pneumon-* **c.** *-ia* **d.** *-nia*
2. In the medical term **pulmonologist,** the root is:
   a. *pulm-* **b.** *pulmon-* **c.** *-logist* **d.** *-gist*
3. The combining vowel in the medical term **respiratory** is:
   a. *-a-* **b.** *-o-* **c.** *-i-* **d.** *-e-*

SUFFIX:

- a group of letters
- positioned at the end of a medical term
- attaches to the end of a **root** or **combining form**
- can have more than one meaning
- if a **suffix** begins with a consonant, add a **combining vowel** to the **root**
- if a **suffix** starts with a vowel, no **combining vowel** is needed
- an occasional medical term can have two **suffixes**

▲ **Figure 1.1 Dermatitis due to a latex glove.**
©Dr. P. Marazzi/Photo Researchers, Inc.

Case Report (CR) 1.2

You are

. . . a **genetic** nurse working with **geneticist** Ingrid Hughes, MD, PhD, in the Genetics Department at Fulwood Medical Center.

Your patient is

. . . Mrs. Geraldine Long, a 37-year-old administrative assistant who has been referred by primary care physician Susan Lee, MD. Mrs. Long has twin girls who are 12 years old. She is an award-winning ballroom dancer who does not smoke, drinks alcohol occasionally, and rehearses her dance routines four or five days each week. Her mother, aged 62, is being treated for ovarian cancer. Her mother's sister is being treated for breast cancer and has been found to carry a **gene mutation** associated with breast cancer. Mrs. Long's **mammogram** is normal. She has requested **genetic screening**.

LO 1.3 Suffixes

In the above Case Report 1.2 , the **root genet-**, meaning origin or gene, is teamed with the **suffix -ic**, which means *pertaining to,* to form the word genetic, *pertaining to a gene.* Again, the **root genet-** is teamed with the **suffix -ics**, which means *knowledge of,* to form the word **genetics**, *the knowledge of or the science of the inheritance of characteristics.* Also, the **root genet-** can be teamed with two **suffixes**, **-ic**, *pertaining to,* and **-ist**, *a specialist,* to form the word genet**icist**, *pertaining to a specialist in genetics.* There can be more than one **suffix** in a single word.

Using the combining form of **cardi/o**, in the medical specialty of cardio**logy**, a cardio**logist** will often diagnose a cardio**pathy**. The **suffix -logy**, which means *study of;* the **suffix -logist**, which means *one who studies* or *a specialist;* and the suffix **-pathy**, which means *disease,* all give different meanings in the sentence "in the specialty of cardio**logy**, a cardio**logist** will often diagnose a cardio**pathy**."

Another example of the use of **suffixes** is in the medical specialty of dermato**logy**, when a dermato**logist** will often diagnose a case of dermat**itis** *(Table 1.1, Figure 1.1).*

Table 1.1 Use of Suffixes

Complete Word	Root or Combining Form	Suffix	Meaning of Suffix	Meaning of Word
dermatitis	**dermat-**	**-itis**	*inflammation*	*inflammation of the skin*
dermatologist	**dermat/o-**	**-logist**	*one who studies*	*one who studies the skin, specialist in dermatology*
dermatology	**dermat/o-**	**-logy**	*study of*	*study of the skin*

In *dermatitis,* the **suffix -itis** starts with a vowel, so there is no need for a **combining vowel**, and the **suffix** is attached directly to the **root**.

In a different example of the use of **suffixes**, an orthopedic surgeon operating on a joint can perform an arthro**scopy**, an arthro**desis**, or an arthro**plasty**, all different operations with different outcomes, as shown in *Table 1.2.*

Table 1.2 Different Meanings of Suffixes

Complete Word	Combining Form	Suffix	Meaning of Suffix	Meaning of Word
arthroscopy	**arthr/o-**	**-scopy**	*visual examination*	*visual examination of a joint*
arthrodesis	**arthr/o-**	**-desis**	*fixation*	*fixation of a joint*
arthroplasty	**arthr/o-**	**-plasty**	*surgical repair*	*repair of a joint*

You always need a **combining vowel** before a **suffix** that begins with a consonant (e.g., dermat**o**logy, arthr**o**plasty).

Classification of Suffixes

One strategy to help you understand medical terms is to divide **suffixes** into different types, such as diagnostic, surgical, pathologic, and descriptive or adjectival.

Diagnostic Suffixes

This group of **suffixes**, when added to a **root** or **combining form**, produces a medical term that is a diagnosis or a procedure or test to identify the nature of an illness.

The **roots/combining forms hem/o** and **hemat/o** both mean *blood.* Adding diagnostic **suffixes** can produce a variety of diagnostic medical terms throughout the body systems *(Table 1.3).*

▲ **Figure 1.2 Hematoma (black eye) following a fall.** ©Dr. P. Marazzi/Photo Researchers, Inc.

Table 1.3 Diagnostic Suffixes

Diagnostic Suffix	Meaning of Suffix	Word Example	Meaning of Word Example
-chezia	*pass a stool*	hemat/ochezia	*passage of a bloody stool*
-crit	*to separate*	hemat/ocrit	*percentage of red blood cells in the blood*
-gram	*record*	cardi/ogram	*record derived from the heart*
-graph	*instrument for recording*	cardi/ograph	*instrument for recording the heart*
-lysis	*destruction*	hem/olysis	*destruction of red blood cells*
-oma	*tumor, mass*	hematoma *(Figure 1.2)*	*collection of blood in a tissue*
-philia	*attraction*	hem/ophilia	*an inherited blood disease*
-ptysis	*spit*	hem/optysis	*to cough up bloody sputum*
-rrhage	*to flow profusely*	hem/orrhage	*to bleed profusely*
-rrhoid	*to flow*	hem/orrhoid	*painful anal swelling of venous blood*
-uria	*urine*	hematuria	*blood in the urine*

As you go through each body system in the book, there will be additional diagnostic **suffixes** you will learn in relation to the actual diagnoses made at that point in the book.

Surgical Suffixes

When added to a **root** or **combining form**, surgical **suffixes** produce medical terms that describe the invasive surgical procedure performed on the body *(Table 1.4).*

Table 1.4 Surgical Suffixes

Surgical Suffix	Meaning of Suffix	Word Example	Meaning of Surgical Procedure
-centesis	*surgical puncture*	arthr/ocentesis	*surgical puncture of a joint space with a needle*
-desis	*fixation*	arthr/odesis	*surgical fixation of the bones of a joint*
-ectomy	*surgical removal*	appendectomy	*surgical removal of the appendix*
-plasty	*surgical repair*	rhin/oplasty	*surgical repair of the nose*
-rrhaphy	*surgical suture*	herni/orrhaphy	*surgical suture of a hernia*
-stomy	*surgical formation of an opening*	trache/ostomy	*surgical formation of an artificial opening into the trachea into which a tube is inserted*
-tomy	*surgical incision*	trache/otomy	*surgical incision into the trachea*
-tripsy	*crushing*	lith/otripsy	*crushing of a stone (calculus), e.g., in the ureters*

Pathologic Suffixes

When added to a **root** or **combining form**, this type of **suffix** produces a medical term that describes a symptom or sign of a disease process *(Table 1.5)*.

Table 1.5 Pathologic Suffixes

Pathologic Suffix	Meaning of Suffix	Word Example	Meaning of Pathologic Term
-algia	*pain*	arthralgia	*pain in a joint(s)*
-ectasis	*dilation*	bronchiectasis	*chronic dilation of bronchi*
-edema	*accumulation of fluid in tissues*	lymphedema	*swelling in tissues as a result of obstruction of lymphatic vessels*
-emesis	*vomiting*	hematemesis	*vomiting of blood*
-genesis	*form, produce*	oste/ogenesis	*formation of new bone*
-itis	*inflammation*	cystitis	*inflammation of the urinary bladder*
-oma	*tumor, mass*	hematoma	*mass of blood leaked outside blood vessels into tissues*
-osis	*abnormal condition*	cyanosis	*dark blue coloration of blood due to lack of oxygen*
-pathy	*disease*	neur/opathy	*any disease of the nervous system*
-penia	*deficiency, lack of*	erythr/openia	*decrease in red blood cells*
-phobia	*fear of*	agoraphobia	*an unfounded fear of public places that arouses a state of panic*
-stenosis	*narrowing*	arteri/ostenosis	*abnormal narrowing of an artery*

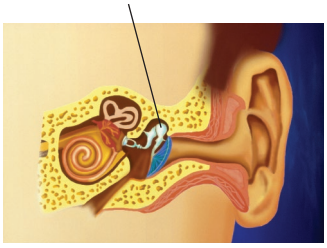
Adjectival Suffixes

As you learn new medical terms in each body system chapter in this book, you will see that there are 28 **suffixes** that mean *pertaining to.* These **suffixes** are used as adjectives to describe the **root**. Examples of adjectival **suffixes** are:

- **-ac cardiac** pertaining to the heart
- **-ary pulmonary** pertaining to the lungs
- **-ior posterior** pertaining to the back of the body

Those 28 **suffixes** are listed in the Keynote on this page.

Ossicles



▲ **Figure 1.3 Ossicles of the middle ear.** ©VEM/Photo Researchers, Inc.

Noun Suffixes

Several **suffixes** do not fall under any of the earlier classifications but maintain the **root** or **combining form** as a noun *(Table 1.6)*.

Table 1.6 Noun Suffixes

Noun Suffix	Meaning of Suffix	Word Example	Meaning of Word Example
-iatry	*treatment, medical specialty*	psychiatry	*diagnosis and treatment of mental disorders*
-ician	*expert, specialist*	pediatrician	*medical specialist in children's development and disorders*
-icle	*small, minute*	ossicle *(Figure 1.3)*	*small bone, relating to the three small bones in the middle ear*
-ist	*expert, specialist*	dentist	*specialist in disorders of the orofacial complex*
-istry	*medical specialty*	dentistry	*specialty in disorders of the orofacial complex*
-ole	*small, minute*	arteriole	*small artery*
-ule	*small, minute*	venule	*small vein*

Note that in *Table 1.6*, three **suffixes** mean "small," two **suffixes** mean "specialist," and two **suffixes** mean "medical specialty."

Keynote

Adjectival **suffixes** meaning *pertaining to:*

-ac, -al, -ale, -alis, -ar, -aris, -ary, -atic, -ative, -eal, -ent, -etic, -ial, -ic, -ica, -ical, -ine, -ior, -iosum, -ious, -istic, -ius, -nic, -ous, -tic, -tiz, -tous, -us.

LO 1.3 Prefixes

Prefixes are added directly to the **root** or **combining form** and do not require **combining vowels**.

For example, you can add the different prefixes **peri-** and **endo-** to the same **root**, **cardi-**, to produce the different words **peri**cardium and **endo**cardium, which have very different meanings, as shown in *Table 1.7.*

Table 1.7 Use of Prefixes

Complete Word	Prefix	Meaning of Prefix	Meaning of Word
pericardium	**peri-**	*around*	*structure around the heart*
endocardium	**endo-**	*inside*	*structure inside the heart*

Note that **-um** is a **suffix** meaning *structure.*

Similarly, **epi**gastric, **hypo**gastric, and **endo**gastric all have the same **root**, **gastr-**, but because of the different prefixes, **epi-**, **hypo-**, and **endo-**, have very different meanings, as shown in *Table 1.8.*

Table 1.8 Different Meanings of Prefixes

Complete Word	Prefix	Meaning of Prefix	Meaning of Word
epigastric	**epi-**	*above*	*pertaining to above the stomach*
hypogastric	**hypo-**	*below*	*pertaining to below the stomach*
endogastric	**endo-**	*inside*	*pertaining to inside the stomach*

Note that **-ic** is a **suffix** meaning *pertaining to.*

PREFIX:

- one letter or a group of letters
- precedes a **root** to give it a different meaning
- can have more than one meaning
- never requires a **combining vowel**
- can have two **prefixes** in an occasional medical term

Exercises

A. Building onto the elements of roots, combining vowels, and combining forms are the prefixes and suffixes of medical terminology. *Prefixes and suffixes are additional word elements that give further meaning to a root or combining form. Develop your knowledge of more word elements with the following exercise. Choose T if the statement is true. Choose F if the statement is false.* **LO 1.1, 1.2, 1.3**

1. In a medical term, the suffix will always appear at the end. T F
2. Every medical term has to have a prefix. T F
3. In the terms **arthroscopy** and **arthrodesis,** the combining form is the same, but the suffix is different. T F
4. If a suffix begins with a consonant, you will need a combining vowel before it. T F

B. Identify the meaning of the word by the suffix. *The medical terms below are commonly used by people who are not necessarily in the medical field. Using what you may already know, identify the meaning of the suffix of medical terms. Match the definition on the left with the correct term it is describing on the right.* **LO 1.3**

1. _____ a specialist
2. _____ afraid of
3. _____ study of
4. _____ removal of
5. _____ inflammation of

a. agoraphobia
b. pneumonectomy
c. dentist
d. dermatitis
e. biology

Your learning goal is to understand the logic of medical language.