

Preface

We cannot teach people anything; we can only help them discover it within themselves. Galileo Galilei

Over the years, it has been my privilege to meet many of the adopters of my texts at various meetings around the country. At one such meeting, I met a professor who told me that he and his colleagues were using my book, *Human Biology* for an anatomy and physiology course because they wanted to use a Mader text. When I returned home, I pondered over this and decided that I would write an anatomy and physiology text so that professors teaching that course would have a more appropriate Mader textbook. Thus, began the development of this text, *Understanding Human Anatomy and Physiology*, which is now in its fifth edition.

I wanted to write a text that would appeal to a wide audience—from those in traditional allied health fields to others who are a bit removed from traditional endeavors. The book should be clear and direct, with objectives that are achievable by students who have no previous science background and even by those who are science shy. This goal was reached.

Diane Kelly, of Broome Community College, writes, “I think the text is very readable, clear, and user friendly. The art is a wonderful complement to the author’s writing; together, the information is clearly presented.”

Mader texts are well known for their pedagogical features, and those for this text are described in the Guided Tour on pages XV–XX. Also, as with other Mader texts, the illustrations are excellent.

William J. Burke, of Madison Area Technical College, states, “This text has some very good art. It is well labeled and has a good color scheme that helps it stand out. The inclusion of the many tables and charts is also an excellent learning tool for the students.”

My vision for *Understanding Human Anatomy and Physiology* encompasses three goals. I want students to develop a working knowledge of (1) anatomy and physiology that is based on conceptual understanding rather than rote memory; (2) medical terminology that will increase the student’s confidence in their chosen field; and (3) clinical applications to broaden their horizons beyond the core principles.

Dr. Philip Swartz, of Houston Community College system, writes, “Each chapter includes salient clinical concepts that will be fascinating to the reader and enhance his or her understanding of the material being presented.”

About the Author

Sylvia S. Mader

In her 20-year career with McGraw-Hill, Dr. Mader has written an impressive collection of textbooks. Aside from *Understanding Human Anatomy and Physiology*, now in its fifth edition, Dr. Mader has written *Biology*, eighth edition; *Human Biology*, eighth edition, and *Inquiry into Life*, tenth edition, through which Dr. Mader has successfully helped innumerable students learn biology as well as human anatomy and physiology.

Dr. Mader’s interest in anatomy and physiology began when she took courses at the Medical School of St. Andrews University, in Scotland, during her junior year abroad. As a fledgling faculty member, she was called upon to teach a variety of courses, among them was human anatomy and physiology. As a textbook writer she discovered that the teaching and learning techniques she so successfully used in the classroom were appropriate for her biology texts and then later for her anatomy and physiology text. Dr. Mader’s direct writing style and carefully constructed pedagogy provide students with an opportunity to learn the basics of biology and anatomy and physiology.

What's New to This Edition?

New Design and Illustrations

A new, colorful design and revised illustrations enhance the features of *Understanding Human Anatomy and Physiology*, fifth edition.

Organization

This edition follows the same general sequence as the earlier editions. It is divided into five parts:

Part I, "Human Organization," provides an understanding of how the body is organized and the terminology used to refer to various body parts and their locations. Chapters 2 through 4 describe the chemistry of the cell, cell structure and function, and the tissues and membranes of the body.

Part II, "Support, Movement, and Protection," includes the integumentary system in addition to the skeletal and muscular systems.

Part III, "Integration and Coordination," explains that the nervous and endocrine systems are vitally important to the coordination of body systems, and therefore homeostasis, while the sensory system provides the nervous system with information about the internal and external environments.

Part IV, "Maintenance of the Body," describes how the cardiovascular, lymphatic, respiratory, digestive, and urinary systems contribute to the maintenance of homeostasis.

Part V, "Reproduction and Development," concerns the reproductive systems, development, and the basics of human genetics, including modern advances.

Homeostasis

The theme of homeostasis is strengthened in this edition. As before, Chapter 1 describes how various feedback mechanisms work to maintain the internal environment within a narrow range. New to this edition, each systems chapter ends with a major section on homeostasis to accompany the "Human Systems Work Together" illustration. This section describes how the system under discussion, with the help of the other systems, maintains homeostasis.

New Readings

Understanding Human Anatomy and Physiology, fifth edition, has two types of readings. Previously, the book had two types of readings called Medical Focus and MedAlert. In this edition, the readings are Medical Focus and What's New. Some of the Medical Focus readings from the fourth edition have been removed, and most of the others have been revised. The What's New readings, which are new to this edition, tell of treatments

that are now experimental but promise to be particularly helpful in the future. For example, a What's New box in the first chapter tells about organs made in the laboratory that are now being transplanted into patients. The What's New reading in Chapter 8 describes a "pacemaker" for Parkinson disease.

Chapter Openers

Scanning electron micrographs, X-rays, and MRI images open the chapters for a closer look into the wonders of the human body. The integrated outline has been retained with the addition of a numbering system for each major concept found in the chapter, including the summary.

Visual Focus

Visual Focus illustrations are included in several chapters. With the addition of boxed statements, these in-depth illustrations, which contain several art pieces, cover a process from start to finish. For example, Figure 7.3 outlines contraction of a muscle from the macroscopic to the microscopic perspective.

Chapter End Matter

This edition includes updated Selected New Terms, Summaries, Study Questions, Objective Questions, Medical Terminology Reinforcement Exercises, and Website Links to the Online Learning Center.

Objective Questions

Labeling exercises have been added to chapters 8, 11, 14, and 18 to reinforce the concepts of the chapter.

Chapter Updates and Additions

Chapter 1: Organization of the Body

New illustrations, tables, and a reading titled "Organs for Transplant" introduce the student to the human body. The discussion of negative feedback now includes temperature control as an example and also includes a discussion of positive feedback, as requested by reviewers.

Chapter 2: Chemistry of Life

This chapter has been reorganized and rewritten to help students understand fundamental chemistry concepts. Carbohydrates, lipids, proteins, and nucleic acids each have their own major section.

Chapter 3: Cell Structure and Function

Cellular Organization, Crossing the Plasma Membrane, and The Cell Cycle are clearly defined as chapter sections. Tables

3.1, 3.2, and all art are new to this edition. The Medical Focus reading, “Dehydration and Water Intoxication” is also new to this edition.

Chapter 4: Body Tissues and Membranes

Each type of tissue now has its own major section. In addition to body membranes, connections between cells and different types of glands are discussed in respective sections. Art and tables have been revised for this chapter.

Chapter 5: The Integumentary System

Section 5.5., Homeostasis, is new to this edition. It shows how the various functions of the skin assist the body in maintaining homeostasis. Also discussed are hyperthermia and hypothermia, which occur when homeostasis has been overcome. The section is accompanied by an updated Human Systems Work Together illustration.

Chapter 6: The Skeletal System

New illustrations, each of which is on the same or a facing page to its reference, much improve this chapter. More information is given about each bone and joint discussed. The chapter ends with a review of the many ways the skeletal system helps maintain homeostasis.

Chapter 7: The Muscular System

The first two illustrations in this chapter are new: The first shows the three types of muscles, and the second describes the connective tissue coverings within and around a skeletal muscle. Instructors and students will appreciate the new in-depth discussion of the sources of energy for muscle contraction, which is also accompanied by a new illustration.

Chapter 8: The Nervous System

This chapter was rewritten. In particular, the discussion of the cerebrum has been expanded to include not only the various lobes but also the areas within these lobes. The somatic system of the peripheral nervous system is now clearly defined, and the spinal reflex has been moved to this section. New illustrations support improved discussions of all aspects of the nervous system.

Chapter 9: The Sensory System

Types of senses, rather than types of receptors, are now used to organize this chapter. The discussions of the anatomy and physiology of the eye and ear are better organized, with an emphasis on how information regarding vision and sound is generated and transmitted to the brain. The sense of equilibrium is now divided into rotational and gravitational equilibrium.

Chapter 10: The Endocrine System

An overview of the endocrine glands now precedes an improved discussion of each gland. A new illustration shows how the adrenal medulla and the adrenal cortex are involved in short-term and long-term stress, respectively. Other new illustrations pertain to regulation of blood calcium, regulation of blood pressure, Addison disease, and Cushing syndrome. The chapter also includes a discussion of chemical signals in general and how hormones affect cellular metabolism.

Chapter 11: Blood

A detailed description of the composition and function of blood now opens the chapter. There follows a more comprehensive look at the formed elements. The section on platelets centers around hemostasis, including coagulation. The transport function of blood is illustrated by considering capillary exchange. The last section of the chapter, Blood Typing and Transfusions, is supported by new art that clearly illustrates blood types and agglutination.

Chapter 12: The Cardiovascular System

An overview of the cardiovascular system, supported by an illustration, offers a much-improved introduction to the chapter, which has been reorganized into five parts: the anatomy of the heart, the physiology of the heart, the anatomy of blood vessels, the physiology of circulation, and circulatory routes. A better discussion of cardiac output and peripheral resistance improves the presentation of the chapter.

Chapter 13: The Lymphatic System and Body Defenses

As requested by reviewers, the lymphatic organs are now divided into those that are primary and those that are secondary. The discussion of specific immunity is much improved by new illustrations depicting the action of B cells and T cells. A new reading on emerging diseases modernizes the chapter.

Chapter 14: The Respiratory System

An improved Table 14.1, which includes a description of the respiratory organs, adds to the discussion of the respiratory system. The respiratory membrane is better described and is accompanied by a new illustration. The section entitled Mechanism of Breathing is better organized so that regulation of breathing rates now has its own subsection. Following reviewers' suggestions, the chapter is more student friendly because gas exchange and transport no longer require a knowledge of partial pressures. All readings are new or extensively revised.

Chapter 15: The Digestive System

New illustrations of stomach and small intestine anatomy add to the improved and extended discussion of these topics. Chemical digestion now benefits by having its own separate section. The Medical Focus reading “Human Teeth” has been moved to a logical location early in the chapter. Liver structure, function, and disorders are more logically and thoroughly presented. The chapter ends with an added discussion of three eating disorders: obesity, bulimia nervosa, and anorexia nervosa.

Chapter 16: The Urinary System and Excretion

The functions of the urinary system are discussed more thoroughly than in the fourth edition. The discussion of a nephron has been improved by the addition of micrographs. The role of the loop of the nephron and various hormones in water reabsorption is better explained, and the topic of acid-base balance has been expanded to discuss all the ways the body can adjust the pH of the blood. The chapter ends with a discussion of treatments for kidney failure.

Chapter 17: The Reproductive System

The topic of meiosis has been moved to this chapter so that spermatogenesis and oogenesis can be better understood by students. Coverage of the reproductive organs has been improved by the inclusion of both sagittal and posterior views of the systems. Following reviewers’ suggestions, the menstrual (instead of the ovarian and uterine cycles) is discussed. New Health Focuses are provided on endocrine-disrupting contaminants, shower checks for cancer, and preventing transmission of STDs.

Chapter 18: Human Development and Birth

The addition of new figures depicting fertilization, extraembryonic membranes, and the primary germ layers improves this chapter. Extensive revision is obvious due to the addition of new readings entitled “Therapeutic Cloning” and “Preventing Birth Defects.” A discussion of the development of male and female organs has been added, and the chapter ends with a new and extended discussion of the effects of pregnancy on the mother.

Chapter 19: Human Genetics

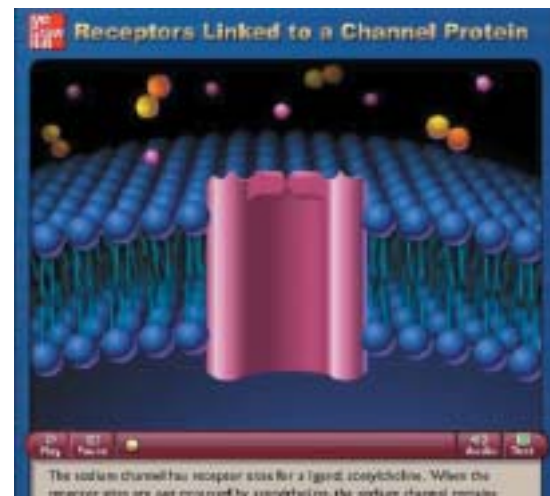
Aside from having all sections revised and updated, the chapter uses cystic fibrosis to show the connection between a genetic disorder and the function of a protein and to illustrate the levels of genetic counseling, from doing a pedigree to performing a preimplantation genetic study. The chapter ends with a Medical Focus outlining the future benefits from the modern field of genomics.

Teaching and Learning Supplements

McGraw-Hill offers various tools and teaching products to support the fifth edition of *Understanding Human Anatomy & Physiology*. Students can order supplemental study materials by contacting their local bookstore. Instructors can obtain teaching aids by calling the Customer Service Department at 800-338-3987, visiting our A & P website at www.mhhe.com, or contacting their local McGraw-Hill sales representative.

The *Digital Content Manager*, 0-07-246443-7, is a multimedia collection of visual resources that allows instructors to utilize artwork from the text in multiple formats to create customized classroom presentations, visually-based tests and quizzes, dynamic course website content, or attractive printed support materials. The digital assets on this cross-platform CD-ROM are grouped by chapter within the following easy-to-use folders.

- **Active Art Library** Key Process Figures are saved in manipulable layers that can be isolated and customized to meet the needs of the lecture environment.



- **Animations Library** Numerous full-color animations of key physiological processes are provided. Harness the visual impact of processes in motion by importing these files into classroom presentations or course websites.
- **Art Libraries** Full-color digital files of all illustrations in the book, plus the same art saved in unlabeled and gray scale versions, can be readily incorporated into lecture presentations, exams, or custom-made classroom materials. These images are also pre-inserted into blank PowerPoint slides for ease of use.
- **Photo Libraries** Digital files of instructionally significant photographs from the text—including cadaver, bone, histology, and surface anatomy images—can be reproduced for multiple classroom uses.

- **PowerPoints** Ready-made image presentations cover each of the 19 chapters of the text. Tailor the PowerPoints to reflect your preferred lecture topics and sequences.
- **Tables Library** Every table that appears in the text is provided in electronic form. You can quickly preview images and incorporate them into PowerPoint or other presentation programs to create your own multimedia presentations. You can also remove and replace labels to suit your own preferences in terminology or level of detail.

Instructor Testing and Resource CD-ROM, 0-07-246441-0, is a cross-platform CD-ROM providing a wealth of resources for the instructor. Supplements featured on this CD-ROM include a computerized test bank utilizing Brownstone Diploma® testing software to quickly create customized exams. This user-friendly program allows instructors to search for questions by topic or format, edit existing questions or add new ones, and scramble questions and answer keys for multiple versions of the same test.

Other assets on the Instructor's Testing and Resource CD-ROM are grouped within easy-to-use folders. The Instructor's Manual and Clinical Applications Manual are available in both Word and PDF formats. Word files of the test bank are included for those instructors who prefer to work outside of the test generator software.

The *Instructor's Manual*, by Dr. Patrick Gallart includes chapter summaries and outlines, suggested student activities, answers to objective questions and to medical terminology reinforcement exercises, and a list of audiovisual materials. The Instructor's Manual is available on Instructor Testing and Resource CD-ROM and the Instructor Edition of the Online Learning Center.

McGraw-Hill provides 200 *Overhead Transparencies*, 0-07-246438-0 of key text line art and photographs.

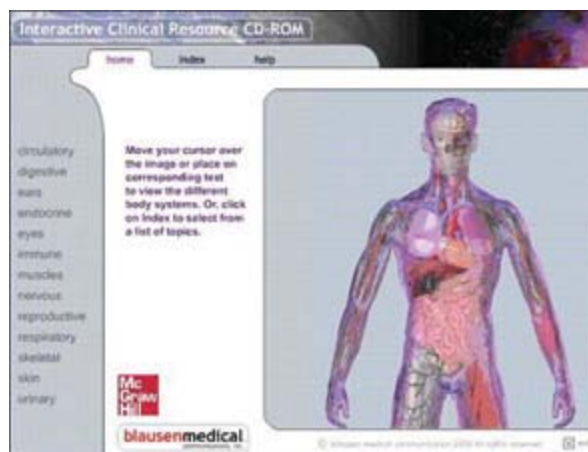
English/Spanish Glossary for Anatomy and Physiology, 0-07-283118-9, is a complete glossary that includes every key term used in a typical two-semester anatomy and physiology course. Definitions are provided in both English and Spanish. A phonetic guide to pronunciation follows each word in the glossary.

Course Delivery Systems With help from our partners, WebCT, Blackboard, TopClass, eCollege, and other course management systems, professors can take complete control over their course content. These course cartridges also provide online testing and powerful student tracking features. *Understanding Human Anatomy & Physiology* Online Learning Center is available within all of these platforms.

For the Student

Interactive Clinical Resource CD-ROM

The *Interactive Clinical Resource CD-ROM* offers one hundred and fifty one 3D animations and 3D models of human disease and disorders. It also contains 13 sections of clinical



content (and nearly every body system) including Urinary, Skeletal, Reproductive, Nervous, Muscular, Immune, Digestive, Circulatory and Endocrine. The *Interactive Clinical Resource CD-ROM* may be used as a classroom lecture tool or study guide for students post lecture. Students can use the *Interactive Clinical Resource CD-ROM* to play the 3D animations, explore the 3D models, print the associated text and view the slides with labels and definitions of key structures related to the disease/disorder. Students will learn how the various diseases/disorders affect the human body system along with possible treatments. The *Interactive Clinical Resource CD-ROM* is the perfect way to reinforce and relate the physiological concepts taught in the classroom to real life.

Online Learning Center (<http://www.mhhe.com/maderap5>)

The OLC offers an extensive array of learning and teaching tools. The site includes quizzes for each chapter, links to websites related to each chapter, clinical applications, interactive activities, art labeling exercises, and case studies. Instructor resources at the site include lecture outlines, technology resources, clinical applications, and case studies.

- **Student Center, Online Essential Study Partner**
The ESP contains 120 animations and more than 800 learning activities to help your students grasp complex concepts. Interactive diagrams and quizzes will make learning stimulating and fun for your students. The Essentials Study Partner can be accessed via the Online Learning Center.

