Human Anatomy & Physiology

Eighth Edition

FLORIDA EDITION

Elaine N. Marieb
Katja Hoehn

Taken from:
Human Anatomy & Physiology, Eighth Edition
by Elaine N. Marieb and Katja Hoehn

Learning Solutions

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About the Authors

We dedicate this work to our students both present and past, who always inspire us to “push the envelope.”

Elaine N. Marieb

For Elaine N. Marieb, taking the student’s perspective into account has always been an integral part of her teaching style. Dr. Marieb began her teaching career at Springfield College, where she taught anatomy and physiology to physical education majors. She then joined the faculty of the Biological Science Division of Holyoke Community College in 1969 after receiving her Ph.D. in zoology from the University of Massachusetts at Amherst. While teaching at Holyoke Community College, where many of her students were pursuing nursing degrees, she developed a desire to better understand the relationship between the scientific study of the human body and the clinical aspects of the nursing practice. To that end, while continuing to teach full time, Dr. Marieb pursued her nursing education, which culminated in a Master of Science degree with a clinical specialization in gerontology from the University of Massachusetts. It is this experience, along with stories from the field—including those of former students now in health careers—that has informed the development of the unique perspective and accessibility for which her texts and laboratory manuals are known.

In her ongoing commitment to students and her realization of the challenges they face, Dr. Marieb has given generously to provide opportunities for students to further their education. She contributes to the New Directions, New Careers Program at Holyoke Community College by funding a staffed drop-in center and by providing several full-tuition scholarships each year for women who are returning to college after a hiatus or attending college for the first time and who would be unable to continue their studies without financial support. She funds the E. N. Marieb Science Research Awards at Mount Holyoke College, which promotes research by undergraduate science majors, and has underwritten renovation and updating of one of the biology labs in Clapp Laboratory at that college. Dr. Marieb is also a contributor to the University of Massachusetts at Amherst where she generously provided funding for reconstruction and instrumentation of a cutting-edge cytology research laboratory that bears her name. Recognizing the severe national shortage of nursing faculty, she underwrites the Nursing Scholars of the Future Grant Program at the university.

In 1994, Dr. Marieb received the Benefactor Award from the National Council for Resource Development, American Association of Community Colleges, which recognizes her ongoing sponsorship of student scholarships, faculty teaching awards, and other academic contributions to Holyoke Community College. In May 2000, the science building at Holyoke Community College was named in her honor.

Dr. Marieb is an active member of the Human Anatomy and Physiology Society (HAPS) and the American Association for the Advancement of Science (AAAS). Additionally, while actively engaged as an author, Dr. Marieb serves as a consultant for the Benjamin Cummings Interactive Physiology® CD-ROM series. This text—Human Anatomy & Physiology, Eighth Edition, Florida Edition—is the latest expression of her commitment to the needs of students in their pursuit of the study of A&P.

When not involved in academic pursuits, Dr. Marieb is a world traveler and has vowed to visit every country on this planet. Shorter term, she serves on the board of directors of the famed Marie Selby Botanical Gardens and on the scholarship committee of the Women’s Resources Center of Sarasota County. She is an enthusiastic supporter of the local arts and enjoys a competitive match of doubles tennis.
Katja Hoehn

Dr. Katja Hoehn is an instructor in the Department of Chemical and Biological Sciences at Mount Royal College in Calgary, Canada. Dr. Hoehn’s first love is teaching. Her teaching excellence has been recognized by several awards during her 14 years at Mount Royal College. These include a PanCanadian Educational Technology Faculty Award (1999), a Teaching Excellence Award from the Students’ Association of Mount Royal College (2001), and the Mount Royal College Distinguished Faculty Teaching Award (2004).

Dr. Hoehn received her M.D. (with Distinction) from the University of Saskatchewan, and her Ph.D. in Pharmacology from Dalhousie University. In 1991, the Dalhousie Medical Research Foundation presented her with the Max Forman (Jr.) Prize for excellence in medical research. During her Ph.D. and postdoctoral studies, she also pursued her passion for teaching by presenting guest lectures to first- and second-year medical students at Dalhousie University and at the University of Calgary.

Dr. Hoehn has been a contributor to several books and has written numerous research papers in Neuroscience and Pharmacology. She oversaw the recent revision of the Benjamin Cummings Interactive Physiology® CD-ROM series modules, and coauthored the newest module, The Immune System.

Dr. Hoehn is also actively involved in the Human Anatomy and Physiology Society (HAPS). When not teaching, she likes to spend time outdoors with her husband and two boys, compete in triathlons, and play Irish flute.
When I first started teaching Anatomy and Physiology, I lacked the one thing most important for success: a coherent philosophy of what I wanted the students to learn. All of that changed the first time I picked up Elaine Marieb’s 4th Edition of *Human Anatomy & Physiology*. From the beginning, I saw a clear and coherent philosophy guiding the text. I didn’t really become an effective teacher until I understood the importance of working from a consistent philosophy. Elaine Marieb’s work was an important contributor to my development.

There were three themes that emerged from the book that really helped me with my teaching philosophy: understanding the importance of homeostasis, the relationship between structure and function, and the interrelationships between systems. In this text, no concept is more important than homeostasis. A good teacher always wants his or her students to see the bigger picture, and this text provides many opportunities to relate homeostasis to other concepts. The Homeostatic Imbalance sections use diseases and disorders to teach through comparison with the state of homeostasis. Often, students will have specific questions that I can’t answer about a disorder. This section offers a far more understandable explanation than students can find through other sources.

The text covers all areas of Anatomy and Physiology in great detail while reflecting the most current research. The level of detail in this book does not mean that it is difficult to understand. The book is accessible, and once you start reading it, you really want to keep reading. Often, as I am reading the text, I find myself getting excited about how I can use it in my class to make my lectures more interesting and relevant.

The support materials will make teaching your class easier no matter what approach you use. The media manager software allows teachers using a lecture style to quickly create lessons containing graphics and animations. Teachers who use a more inquiry-based approach will find the software and supporting material useful in creating hands-on activities that teach important concepts.

Finally, there is a high level of integration between the textbook and the print resources and supporting websites. The myA&P™ Website contains a wealth of material available to extend and connect lessons. The Interactive Physiology™ CD that comes packaged with the textbook has activities of different levels that are appropriate for either a quick review or more in-depth coverage of the hard-to-understand physiology content.

By combining the best of current research and teaching resources with a consistent philosophy, *Human Anatomy & Physiology* is certain to make both teachers and students more successful in their A&P course.

John Murnan
Etowah High School
Woodstock, GA
To the Student: How to Use This Book

**Introduce yourself to the chapter**

**Chapter outlines** provide a preview of the chapter and let you know where you’re going.

**Focus on key concepts**

**Student objectives** have been integrated into the chapter and give you a preview of what content is to come and what you are expected to learn.

**NEW! Check Your Understanding** questions ask you to stop, think, and to check your understanding of key concepts at the end of major sections.

**Homeostatic Imbalance** sections are integrated within the text and alert you to the consequences of body systems not functioning optimally. These pathological conditions are integrated with the text to clarify and illuminate normal functioning.

**Illustrated tables** summarize complex information and serve as a “one-stop shopping” study tool.

**Next Generation Sunshine State Standards for Anatomy & Physiology**

The Next Generation Sunshine State Standards describe the knowledge and process skills that you are expected to learn before graduating from high school.
**Follow complex processes step-by-step**

**NEW! Focus figures** help you grasp tough topics in A&P by walking you through carefully developed step-by-step illustrations that use a big-picture layout and dramatic art to provide a context for understanding the process.

**Overview** provides a quick summary of the key idea of the figure.

**Big picture orientation** provides you with a concrete starting point for the process.

**Step text** walks you through the process step-by-step.

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**Figure 9.8 FOCUS**

**Events at the Neuromuscular Junction**

When a nerve impulse reaches a neuromuscular junction, acetylcholine (AcH) is released. Upon binding to sarcolemma receptors, AcH causes a change in sarcolemma permeability leading to a change in membrane potential.
Visualize structures

NEW! Stunning 3-D anatomy art is rendered in a dramatically more dynamic, realistic style with vibrant, saturated colors to help you visualize key anatomical structures.

NEW! Bone art features realistic bone color and texture with a consistent style from figure to figure.
Make connections

Making Connections at the end of each body system helps you understand the relationships between body systems with this three-tiered presentation:

- **System Connections** highlights the interrelationship between all of the body systems.
- **Closer Connections** focuses in greater depth on selected system interrelationships.
- **Clinical Connections** case study encourages you to apply chapter concepts to clinical situations.

**System Connections**

- **Skeletal System**
  - Skin provides protection for internal organs and is involved in the regulation of body temperature and behavior.
- **Muscular System**
  - Skin provides a barrier to the external environment and is involved in the regulation of body temperature and behavior.
- **Cardiovascular System**
  - Skin provides protection for internal organs and is involved in the regulation of body temperature and behavior.
- **Respiratory System**
  - Skin provides protection for internal organs and is involved in the regulation of body temperature and behavior.
- **Digestive System**
  - Skin provides protection for internal organs and is involved in the regulation of body temperature and behavior.
- **Urinary System**
  - Skin provides protection for internal organs and is involved in the regulation of body temperature and behavior.
- **Nervous System**
  - Skin provides protection for internal organs and is involved in the regulation of body temperature and behavior.
- **Endocrine System**
  - Skin provides protection for internal organs and is involved in the regulation of body temperature and behavior.

**Clinical Connections**

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**Closer Look** boxes on timely subjects such as medical technology, new discoveries in medical research, and important societal issues broaden your horizons and present scientific information that can be applied to your daily life.
Learn the language

Phonetic spellings are provided for words that may be unfamiliar to you to help you with pronunciation.

Color-coded chapter and unit tabs help you find information quickly and easily.

Learn the language

Phonetic spellings are provided for words that may be unfamiliar to you to help you with pronunciation.

Color-coded chapter and unit tabs help you find information quickly and easily.

Review what you’ve learned

Review questions at the end of each chapter, including multiple choice/matching, short answer, and Critical Thinking and Clinical Application questions, help you evaluate your progress.

Chapter summaries with page references provide excellent study aids.

Answers to Check Your Understanding, Clinical Connections, and end-of-chapter Multiple Choice and Matching Review Questions can be found in Appendix G.
To the Student: How to Use myA&P

**Check your readiness**

- **Get Ready for A&P** gets you prepared for your A&P course. Take the diagnostic test to see where you need review.

**Prepare for exams**

- **Chapter Quizzes and Practice Tests** help you assess your understanding of the chapter and prepare for your exams.
- **Games and activities** featuring Art Labeling Exercises, Memory Games, and Crossword Puzzles and Histology, Bone, and Muscle Reviews. Also included are new **MP3 Tutor Sessions** that carefully coach you through the most difficult A&P concepts including calcium regulation, the visual pathway, and gas exchange during respiration.

NOTE: High school customers should refer to page xx for additional details on website access.
Master tough concepts in A&P

NEW! A&P Flix animations provide carefully developed step-by-step explanations with dramatic 3-D representations of structures that show action and movement of processes, thereby bringing difficult-to-teach A&P concepts to life. Each animation includes gradable quizzes as well as study sheets for practice and assessment.

NEW! Practice Anatomy Lab™ 2.0 allows you to view hundreds of images of the human cadaver, anatomical models, histology slides, the cat, and the fetal pig and to take practice quizzes and simulated lab practical exams.

PhysioEx™ laboratory simulations allow you to conduct simulated experiments as part of your A&P lab.
As educators, clinically trained individuals, and perennial students, we are continually challenged by the learning mind. What works best to get students over conceptual hurdles and to help them apply new information to the world they personally understand? Our clinical backgrounds have served our teaching and writing purposes well. Perhaps even more important, our clinical experience has allowed us to view our presentations through our students’ eyes and from the vantage points of their career interests.

For this edition, as for those preceding it, feedback from both student and teacher reviews indicated areas of the text that needed to be revised for clarity, timeliness, and just plain reduction of verbal meatiness. Overall, feedback was positive, verifying that the approach of explaining fundamental principles and unifying themes first as a strong base for all that comes later is still viable. Furthermore, it is clear that backing up these explanations with comfortable analogies and familiar examples enhances the students’ understanding of the workings of the human body.

Unifying Themes

Three integrating themes that organized, unified, and set the tone of the first edition of this text continue to be valid and are retained in this edition. These themes are:

Interrelationships of body organ systems. The fact that nearly all regulatory mechanisms require interaction of several organ systems is continually emphasized. For example, Chapter 25, which deals with the structure and function of the urinary system, discusses the vital importance of the kidneys not only in maintaining adequate blood volume to ensure normal blood circulation, but also in continually adjusting the chemical composition of blood so that all body cells remain healthy. The unique Making Connections feature is the culmination of this approach and should help students think of the body as a dynamic community of interdependent parts rather than as a number of isolated structural units.

Homeostasis. The normal and most desirable condition of body functioning is homeostasis. Its loss or destruction always leads to some type of pathology—temporary or permanent. Pathologize conditions are integrated with the text to clarify and illuminate normal functioning, not as an end in and of themselves. For example, Chapter 19, which deals with the structure and function of blood vessels, explains how the ability of healthy arteries to expand and recoil ensures continuous blood flow and proper circulation. The chapter goes on to discuss the effects on homeostasis when arteries lose their elasticity: high blood pressure and all of its attendant problems. These homeostatic imbalances are indicated visually by a pink symbol with a fulcrum:

Whenever students see the imbalance symbol in text, the concept of disease as a loss of homeostasis is reinforced.

Complementarity of structure and function. Students are encouraged to understand the structure of an organ, a tissue, or a cell as a prerequisite to comprehending its function.

Concepts of physiology are explained and related to structural characteristics that promote or allow the various functions to occur. For example, the lungs can act as a gas exchange site because the walls of their air sacs present an incredibly thin barrier between blood and air.

NEW TO THE EIGHTH EDITION

The Eighth Edition represents a monumental revision with an entirely new art program and text presentation that build upon the hallmark strengths of the previous seven editions. With every edition, our goal is powerful but simple—to make anatomy and physiology as engaging, accurate, and relevant as possible for both you and your students. The changes to the Eighth Edition are all driven by the needs of today’s students, as we seek to make the learning of key concepts in A&P as easy as possible for them. Key concepts are important because of the overwhelming amount of material in this course. Mastering this material gives students an anchor and structure for managing this wealth of information. Below are the ways in which we’ve revised the Eighth Edition to make this book the one where learning happens most effectively, followed by a detailed list of specific chapter-by-chapter content changes.

A whole new art program. The drive for this revision began as a simple list. We sat down together and created a chapter-by-chapter list of the key concepts in A&P where students struggle the most. This list became the basis for our art revision plans. We first boiled it down to some of the toughest topics to get our list of Focus figures. This new Focus feature highlights tough topics in A&P and walks students step-by-step through complex processes that are difficult to teach and visualize. In each case, we scrutinized the process and worked through countless revisions to break it down in the most logical and easy-to-follow way possible for students. We hope you’ll be as pleased with the results as we are.

We also revised and reconceptualized many of the process figures in the book to make them easier to follow and to learn from. Where appropriate we have added blue step...
text that serves as our author voice guiding students step-by-step through complex processes. The blue text clearly separates the process steps from the labels, making the figures easy to navigate.

Flipping through the Eighth Edition, you can see that our new art is dynamic, three-dimensional, and realistic, with dramatic views and perspectives that use vibrant, saturated colors. Using our list of key concepts, we targeted critical figures in anatomy and worked closely with the artistic team on making these figures superior in rendering and in conveying the key pedagogical information and structures that students need to learn from the figure, striking a perfect balance between realism and teaching effectiveness.

Finally, we’ve also added a wealth of new figures and photos to enhance learning, many of which are listed below.

**Improved text presentation.** New text features also serve to focus students on key concepts. We have integrated the student objectives to fall within the chapter, giving students a preview in smaller chunks of what they are expected to learn in a given section. We’ve also added new Check Your Understanding questions that ask students to stop, think, and check their understanding of key concepts at the end of major sections. These changes along with a brand-new design make the book easier than ever to study from and navigate. We have also edited the text throughout with a refined writing style that retains our hallmark analogies and accessible, friendly style while using simpler, more concise language and shorter paragraphs. These changes make the text easier for students to manage as they face the challenging amount of information in this course.

**Factual updates and accuracy.** As authors we pride ourselves on keeping our book as up-to-date and as accurate as possible in all areas—a monumental task that requires painstaking selectivity. Although information changes even as a textbook goes to press, be assured that our intent and responsibility to update was carried out to the best of our ability. We have incorporated updates from current research in the field as much as possible; many of these updates are included below in the chapter-by-chapter changes. A more complete list, along with references for selected updates, is available from your Pearson sales representative and in the Instructor Guide to Text and Media.

**Chapter-by-Chapter Changes**

In addition to the specific changes listed below, chapters open with a correlation to the Florida Next Generation Sunshine State Standards.

**Chapter 1 The Human Body: An Orientation**
- New PET scan for A Closer Look on medical imaging

**Chapter 2 Chemistry Comes Alive**
- Updated information on molecular chaperones

**Chapter 3 Cells: The Living Units**
- New step art for endocytosis (Figure 3.12)
- Updated discussion of types of endocytosis accompanied by new endocytosis step art (Figure 3.12)
- New Figure 3.13 provides a comparison of three types of endocytosis
- New Figure 3.20 with step text on the signaling mechanism for targeting new proteins to the ER
- New Focus on Primary Active Transport: The Na⁺-K⁺ Pump (Figure 3.10)
- New Focus on G Proteins (Figure 3.16)
- New Focus on Mitosis (Figure 3.33)
- New diagrams accompany photos in figure showing the effects of varying tonicities on living red blood cells (Figure 3.9)
- New photomicrographs accompany all cell organelle illustrations, including new Figure 3.28 on microvilli
- Revised text and new figures for translation (Figure 3.35)
- New information on the origin of peroxisomes based on recent research

**Chapter 4 Tissue: The Living Fabric**
- New Figure 4.1: Overview of four tissue types
- New photomicrographs for pseudostratified ciliated columnar epithelium (Figure 4.3d), goblet cells (Figure 4.4), and elastic connective tissue (Figure 4.8f)
- New Table 4.1 compares four main classes of connective tissue
- Updated A Closer Look on cancer

**Chapter 5 The Integumentary System**
- New Figure 5.3: Two regions of the dermis, with three new photomicrographs
- New Figure 5.4: Dermal modifications result in characteristic skin markings, with one new photomicrograph
- New photos: partial and full thickness burns (Figure 5.10)

**Chapter 6 Bones and Skeletal Tissue**
- New Figure 6.4 shows comparative morphology of bone cells
- New Figure 6.14 shows that vigorous exercise can lead to large increases in bone strength
- Updated information on homocysteine as a marker of low bone mass density and bone frailty; additional information on age-related bone changes and treatments

**Chapter 7 The Skeleton**
- New photo of midsagittal section of the skull (Figure 7.5c)
- New photos for inferior and superior views of the skull (Figures 7.6b, 7.7b)
- New photos of the sphenoid bone, superior and posterior views (Figure 7.9)
- New photo of right lateral view of the maxilla (Figure 7.11)
- New MRI of lumbar region in sagittal section showing herniated disc (Figure 7.17)
- New photo of midsagittal section of the thorax (Figure 7.22)
- New X ray of the foot (Figure 7.34)
- New Figure 7.37: The C-shaped spine of a newborn infant
- New Homeostatic Imbalance: xiphoid process projecting posteriorly
Chapter 8 Joints
- Figure 8.1 expanded to show a comparison of different types of fibrous joints; added gomphosis
- Added new views for knee, shoulder, and mandible joint

Chapter 9 Muscles and Muscle Tissue
- New Focus on Events at the Neuromuscular Junction (Figure 9.8)
- New Focus on Excitation-Contraction Coupling (Figure 9.11)
- New Focus on the Cross Bridge Cycle (Figure 9.12)
- New Figure 9.7: Phases leading to muscle fiber contraction
- New Figure 9.20: Comparison of energy sources used during short-duration and prolonged-duration exercise
- New Figure 9.24: Cross section of the three types of fibers in skeletal muscle
- New Figure 9.30: Formation of a multinucleate skeletal muscle fiber by fusion of myoblasts

Chapter 10 The Muscular System
- New cadaver photo of the anterior and lateral regions of the neck (Figure 10.9c)
- New cadaver photo of superficial muscles of the thorax (Figure 10.13b)
- New cadaver photo of muscles crossing the shoulder and elbow joint (Figure 10.14d)
- New cadaver photo of superficial muscles of the superior gluteal region (Figure 10.20b)

Chapter 11 Fundamentals of the Nervous System and Nervous Tissue
- New Focus on Resting Membrane Potential (Figure 11.8)
- New Focus on Action Potential (Figure 11.11)
- New Focus on Chemical Synapse (Figure 11.17)
- Updated role of satellite cells
- Updated discussion of nitric oxide and carbon dioxide; added paragraph on new class of neurotransmitter endocannabinoids
- Updated the roles of neurotropins in signaling the growth cone during neuronal development
- Updated information in A Closer Look on overcoming cocaine addiction
- Updated information on neurotransmitters (histamine, somatostatin, substance P, CCK) in Table 11.3
- New Figure 11.10: The spread and decay of a graded potential
- New Figure 11.15: Action potential propagation in unmyelinated and myelinated axons
- New photo, a neuronal growth cone (Figure 11.24)

Chapter 12 The Central Nervous System
- Updated location of cortex receiving vestibular input based on new fMRI studies
- New Homeostatic Imbalance on brain tumors in different regions of the brain: the anterior association area and the posterior parietal region
- Updated discussion of regulation of respiratory rhythm in the medulla
- Updated discussion of occurrence of theta waves in adult electroencephalogram
- Updated mechanisms of onset of sleep and wakefulness, the role of orexins (hypocretins) in narcolepsy, and recent finding that orexin antagonists promote sleep in humans
- Updated survival of strokes and stroke treatment
- Updated cause and treatment of Parkinson’s disease
- Updated treatments for Alzheimer’s disease
- New Figure 12.17 on the cerebellum with side-by-side illustration and photo showing a sagittal view
- New photo of frontal section of the brain (Figure 12.10)
- New photo of inferior view of the brain showing the regions of the brain stem (Figure 12.14)
- New EEG photo (Figure 12.20)

Chapter 13 The Peripheral Nervous System and Reflex Activity
- Updated axon regrowth and treating spinal cord injuries
- Updated Homeostatic Imbalance on cause and treatment of trigeminal neuralgia
- Updated origin and course of the accessory nerves (CN XI)
- New Focus on the Stretch Reflex (Figure 13.17)
- New cadaver photo of the brachial plexus (Figure 13.9)
- New cadaver photo of the sacral plexus (Figure 13.11)
- New Homeostatic Imbalance on hyperalgesia and phantom limb pain

Chapter 14 The Autonomic Nervous System
- New Homeostatic Imbalance on autonomic neuropathy

Chapter 15 The Special Senses
- Updated laser procedures to correct myopia
- Updated the mechanism of light adaptation in rods
- Updated taste cell specificity
- Updated the mechanism of transduction for all five taste modalities
- Updated treatment of age-related macular degeneration

Chapter 16 The Endocrine System
- New Figure 16.7 on regulation of thyroid hormone secretion
- Updated hormones released by the thymus and by adipose tissue
- Added new information about incretins and osteocalcin
- Simplified and updated A Closer Look on diabetes mellitus

Chapter 17 Blood
- Updated discussion of erythropoietin—new understanding of how hypoxia induces erythropoiesis
- Updated treatment of sickle-cell anemia—new drug clotrimazole
Chapter 18 The Cardiovascular System: The Heart
• New cadaver photo of frontal section of the heart (Figure 18.4f)
• New photomicrograph of cardiac muscle (Figure 18.11)

Chapter 19 The Cardiovascular System: Blood Vessels
• Updated function of pericytes
• Updated relationship between obesity and hypertension
• Updated development of arteries and veins
• Updated systolic blood pressure as a better predictor of complications of hypertension in those older than 50
• Updated hypertension and its treatment—angiotensin II receptor blockers

Chapter 20 The Lymphatic System and Lymphoid Organs and Tissues
• Updated information on Hassall’s corpuscles from current research

Chapter 21 The Immune System: Innate and Adaptive Body Defenses
• Added dermcidin—an important antimicrobial in human sweat
• Updated number of types of human TLRs
• Updated information that dendritic cells can obtain foreign antigens from infected cells through gap junctions
• Updated role of the T\(_{h}2\) type of helper T cells in immunity
• Updated statistics on HIV/AIDS
• Updated treatments of autoimmune diseases and multiple sclerosis
• Added new type of T\(_{h}\) cell, T\(_{h}17\)
• New Figure 21.2 on phagocytosis
• New SEM of a dendritic cell (Figure 21.10)
• New computer-generated image of an antibody (Figure 21.14)
• New Homeostatic Imbalance on parasitic worms

Chapter 22 The Respiratory System
• Updated role of alveolar type II cells in innate immunity
• Updated mechanism for hypercapnia following administration of oxygen to patients with COPD
• Updated therapy for cystic fibrosis
• New photomicrograph showing a portion of the tracheal wall (Figure 22.6)

Chapter 23 The Digestive System
• New X ray of the mouth of a child showing the permanent incisors forming (Figure 23.10)
• New photomicrograph of small intestine villus (Figure 23.22)
• New photo of a peptic ulcer lesion and SEM of \(H. pylori\) bacteria (Figure 23.16)
• Updated discussion of the process of HCl formation within the parietal cells
• Expanded section on histology of the small intestine wall; added function of Paneth cells’ secretions

Chapter 24 Nutrition, Metabolism, and Body Temperature Regulation
• Vitamin and mineral tables have been simplified for ease of student learning
• New sections and coverage of obesity, short- and long-term regulation of food intake, and additional regulatory factors
• New photo, atomic force microscopy, reveals the structure of energy-converting ATP synthase rotor rings (Figure 24.10)

Chapter 25 The Urinary System
• New photo of a frontal section of kidney (Figure 25.3)
• New photomicrograph of cut nephron tubules in new figure of renal cortical tissue and renal tubules (Figure 25.6)
• New intravenous pyelogram (Figure 25.19)
• Updated structure and possible function of extraglomerular mesangial cells
• New Homeostatic Imbalance on chronic renal disease and renal failure

Chapter 26 Fluid, Electrolyte, and Acid-Base Balance
• Added clarification of difference between edema and hypotonic hydration
• New paragraph on angiotensin II

Chapter 27 The Reproductive System
• New SEM of sperm (Figure 27.8)
• New photomicrograph of the endometrium and its blood supply (Figure 27.13)
• New photo of mammogram procedure, plus new photos of a normal mammogram compared to one showing a tumor (Figure 27.16)
• New photomicrographs showing stages of follicular development (Figure 27.18)
• New section on erectile dysfunction
• Added new human papillomavirus vaccine
• Expanded discussion of interactions along the hypothalamic-pituitary-ovarian axis with reconceptualized figure
• Updated transmission of herpes virus
• Updated descent of the testes
• Updated hormone replacement therapy for women

Chapter 28 Pregnancy and Human Development
• New photomicrograph of a blastocyst that has just adhered to the uterine endometrium (Figure 28.5)
• New Figure 28.8 showing detailed anatomy of the vascular relationships in the mature decidua basalis
• New Figure 28.13, flowchart showing major derivatives of the embryonic germ layers
• Updated information on the initiation of labor and on contraception

Chapter 29 Heredity
• New photomicrograph of human sex chromosomes (Figure 29.5)
• New Figure 29.8 comparing amniocentesis and chorionic villus sampling
• Updated discussion of stem cells
• Updated discussion of epigenetics and nontraditional methods of gene regulation
Supplements for the Teacher

**NEW! Instructor Resource DVD**

(0-321-50704-5)

The Instructor Resource DVD (IRDVD) organizes all instructor media resources by chapter into one convenient package that allows you to easily and quickly pull together a lecture and to show animations, including brand-new A&P Flix, from your PowerPoint® presentations. The IRDVD contains:

- **NEW! A&P Flix**
  Movie-quality A&P Flix animations of key concepts invigorate classroom lectures. These animations provide carefully developed, step-by-step explanations with dramatic 3-D representations of structures that show action and movement of processes, bringing A&P concepts to life. Using the A&P Flix animations, you can help students visualize tough-to-teach A&P concepts such as muscle actions, excitation-contraction coupling, generation of an action potential, and more. These animations can be launched directly from your PowerPoint presentations.

*Note: These animations are available on the myA&P" companion website with gradable quizzes as well as printable study sheets for practice and assessment.*
• **All art, photos, and tables** from the book in JPEG and PowerPoint format, as well as all photos from *A Brief Atlas of the Human Body, Second Edition*. Labels have been enlarged in easy-to-read type for optimal viewing in large lecture halls.

• **Instructor Guide to Text and Media**

• **Test Bank**

• **Illustrations offered in customizable PowerPoint formats**, including Label-Edit Art with editable leaders and labels and Step-Edit Art that walks through multistep figures step-by-step.

• **Quiz Show Game chapter reviews** that encourage student interaction

• **Updated, customizable PowerPoint Lecture Outline slides**, available for every chapter, that combine lecture notes, illustrations with editable labels, photos, tables, and animations.

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**BONUS!**
**IRDVD includes Practice Anatomy Lab (PAL) 2.0 Instructor Resource DVD**

PAL IRDVD includes customizable images from PAL 2.0 in JPEG and PowerPoint format. PowerPoint slides also include embedded links to relevant animations and PRS-enabled active lecture questions for use with or without clickers. Quizzes and lab practical are available in Microsoft Word and Computerized Test Bank formats.

(For a description of PAL, please see page xxi.)
The following supplements are available to qualified adopters:

**myA&P™ Website** now includes everything students need to practice, review, and self-assess for both the A&P lecture and lab.

- Chapter-specific resources include Chapter Quizzes and brand new Chapter Practice Tests; Games and Activities, featuring Art Labeling Exercises, Memory Games, and Crossword Puzzles; Histology, Bone, and Muscle Reviews; Flashcards; a Glossary; and more!
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- **NEW! Practice Anatomy Lab™ 2.0** is an indispensable virtual anatomy practice tool that gives students 24/7 access to the most widely used lab specimens (includes self-study quizzes and gradable lab practicals).
- **PhysioEx™ 8.0** supplements traditional wet labs safely and cost-effectively (includes gradable quizzes and printable review sheets).
- **Instructor Gradebook** allows instructors to track student assessment.
- **Instructor Resource Section** includes IP Exercise Sheet Answer Key, and items from the IRDVD, including JPEG images (labeled and unlabeled sets), Label-Edit Art and Step-Edit Art, Active Lecture Questions, and Quiz Show Game Questions.

High School teachers can obtain teacher and student preview or adoption access in one of two ways:

- By registering online at www.PearsonSchool.com/Access_ request.
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### Course Management

**NEW! New assessment items** in the course management system of your choice, including CourseCompass, Blackboard, WebCT, and others. In addition to the Gradeable Quizzes from the myA&P™ Website and the Test Bank, you will now have access to Instructor Test Item assessments for:

- Get Ready for A&P (Diagnostic and Cumulative Tests and Chapter Pre- and Post-Tests).
- Interactive Physiology®
- PhysioEx™ 8.0

- Quizzes and lab practicals from Practice Anatomy Lab™ 2.0, including images and questions not available in the student product. Instructors can modify the questions to reflect the content they want their students to be quizzed and tested on.
- Post-Test versions of the new Chapter Practice Tests on the myA&P™ Website.

In order to utilize this material a teacher must already have the appropriate course management systems.

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(0-558-66257-9)

This fully revised guide includes detailed objectives, lecture outlines, activities, online media resources, answers to end-of-chapter questions, and Interactive Physiology® exercise sheets and answer key. All the illustrations from the text are indexed as thumbnails in the Visual Resource Guide so you can easily locate and make the best use of the available media.

**Printed Test Bank**

(0-321-55884-7)

With more than 3600 test questions, this Test Bank has been updated with new and revised questions that cover all major topics at a range of difficulty levels. All questions in the printed Test Bank are available in Word and TestGen formats on the IRDVD. Both electronic options are cross-platform and allow instructors to easily generate and customize tests.

**Transparency Acetates**

(0-321-55888-X)

This package includes all illustrations, photos, and tables from the text—approximately 800 images—with labels that have been enlarged for easy viewing in the classroom.

**Human Anatomy & Physiology Laboratory Manuals**

Elaine N. Marieb's three widely used and acclaimed laboratory manuals complement this textbook and are designed to meet the varying needs of most laboratory courses: Human Anatomy & Physiology Laboratory Manual: Cat Version, Ninth Edition Update; **Main Version,** Eighth Edition Update; and **Pig Version,** Ninth Edition Update. Included with each laboratory manual is the PhysioEx™ 8.0 CD-ROM and a registration code for online access. PhysioEx™ 8.0 features 12 experiments and a Histology Tutorial.

**Downloadable Teacher Resources**

Most of the teacher supplements and resources for this book are available electronically from the Instructor Resource Center. Upon adoption or to preview, please go to PearsonSchool.com/Advanced and click “Online Teacher Supplements”. You will be required to complete a one-time registration subject to verification before being emailed access information to download materials.
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- Fully rotatable human skull and 17 other rotatable skeletal structures
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Available for purchase only (0-321-54725-X).

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10-System Suite

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Modules
- Muscular System
- Nervous System I
- Nervous System II
- Cardiovascular System
- Respiratory System
- Urinary System
- Fluids & Electrolytes
- Endocrine System
- Digestive System
- NEW! Immune System

An IP-10 CD is included in the student edition. A replacement CD is available for purchase (0-13-135784-0).
(0-321-51704-0)
This book and online component was created to help you be better prepared for your A&P course. This hands-on book (available for purchase) helps you get up to speed in your knowledge of basic study skills, math review, basic chemistry, cell biology, anatomical terminology, and the human body. Features include pre-tests, guided explanations followed by interactive quizzes and exercises, and end-of-chapter cumulative tests. The online component includes a gradable diagnostic pre-test and post-test, self-study quizzes with feedback, animations and links, a glossary, and flashcards. It is available via myA&P™.

New to the Second Edition
• New topics have been added, including coverage of pH, energy, and meiosis, as well as tips on how to minimize anxiety surrounding tests, and more.
• A more robust Companion Website includes new activities and tutorials on key topics and new myeBook content.
• A new preface for instructors explains how to use the book.
• All assessments are now available in course management platforms, including WebCT, Blackboard, and CourseCompass™. Separate Instructor Test Item versions of the Diagnostic Test, Cumulative Test, and the chapter Pre- and Post-Tests can now be easily imported into these course management systems.

(0-13-196324-4)
This full-color atlas includes 107 bone and 47 soft-tissue photographs with easy-to-read labels. This new edition of the atlas contains a brand-new, comprehensive histology photomicrograph section with more than 50 slides of basic tissue and organ systems. Featuring photos taken by renowned biomedical photographer Ralph Hutchings, this high-quality photographic atlas makes an excellent resource for the classroom and laboratory, and is referenced in appropriate figure legends throughout the text. Available for purchase.

Study Guide
(0-321-55873-1)
Revised to accompany the Eighth Edition of Human Anatomy & Physiology, the study guide offers a wide variety of exercises that address different learning styles and call on students to develop their critical-thinking abilities. The three major sections, Building the Framework, Challenging Yourself, and Covering All Your Bases, help students build a base of knowledge using recall, reasoning, and imagination that can be applied to solving problems in both clinical and nonclinical situations. Available for purchase.

Additional Supplements Available for Purchase
The Physiology Coloring Book, Second Edition By Wynn Kapit, Robert I. Macey, Esmail Meisami
The Anatomy Coloring Book, Third Edition By Wynn Kapit and Lawrence M. Elson
Human Cadaver Dissection Videos By Rose Leigh Vines, et al.
Student Video Series for Human Anatomy & Physiology, Volume 1
Student Video Series for Human Anatomy & Physiology, Volume 2

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