Martini’s *Essentials of Anatomy and Physiology 8e* brings a legacy of superb illustration and text–art integration with a suite of new digital tools

The New Eighth edition takes the most popular features from the book and builds them out into effective interactives within the eText and Mastering A&PTM
Spotlight Figures Visually Summarize Difficult Physiological Processes, Making Them Easier to Understand

These highly visual one- and two-page presentations of tough topics provide a bridge between readings and related figures and photos to communicate information in a student-friendly, visually effective format.
NEW Spotlight Figure Videos Bring This Effective Text Feature to Life


So What?

Why is it important to understand inflammation and regeneration?

SmartArt Video: Endochondral Ossification

Watch the SmartArt Video for chapter 6, and then complete the question at right.

Part A

A hard ossified bone in an adult actually begins within the embryo as a miniature version composed of ____________.

- elastic cartilage
- hyaline cartilage
- dense regular connective tissue
- dense irregular connective tissue
- fibrocartilage

Submit Request Answer

Coaching Activities in Mastering A&P™ allow instructors to assign the videos to ensure students view them.
Build Your Knowledge Integration Figures
Emphasize That the Body Systems Work Together, Not in Isolation

Build Your Knowledge Integration features show students how body systems affect each other and work together to maintain homeostasis.

Integumentary System
- The Integumentary System prevents excessive fluid loss through skin surface; produces vitamin D₃, important for the renal production of calcitriol; sweat glands assist in elimination of water and solutes
- The urinary system eliminates nitrogenous wastes; maintains fluid, electrolyte, and acid-base balance of blood that nourishes the skin

Respiratory System
- The Respiratory System assists in the regulation of pH by eliminating carbon dioxide
- The urinary system assists in the elimination of carbon dioxide; provides bicarbonate buffers that assist in pH regulation

Cardiovascular System
- The Cardiovascular System delivers blood to glomerular capillaries, where filtration occurs; accepts fluids and solutes reabsorbed during urine production
- The urinary system releases renin to elevate blood pressure and erythropoietin (EPO) to accelerate red blood cell production

Skeletal System
- The Skeletal System provides some protection for kidneys and ureters with its axial division; pelvis protects urinary bladder and proximal portion of urethra
- The urinary system conserves calcium and phosphate needed for bone growth

Muscular System
- The Muscular System controls urination by closing urethral sphincters. Muscle layers of trunk provide some protection for urinary organs
- The urinary system excretes waste products of muscle and protein metabolism; assists in regulation of calcium and phosphate concentrations

Nervous System
- The Nervous System adjusts renal blood pressure; monitors distension of urinary bladder and controls urination
- The urinary system eliminates nitrogenous wastes; maintains fluid, electrolyte, and acid-base balance of blood, which is critical for neural function

Endocrine System
- The Endocrine System produces aldosterone and ADH, which adjust rates of fluid and electrolyte reabsorption by kidneys
- The urinary system releases renin when local blood pressure drops and erythropoietin (EPO) when renal oxygen levels fall

Lymphatic System
- The Lymphatic System provides adaptive (specific) defense against urinary tract infections
- The urinary system eliminates toxins and wastes generated by cellular activities; acid pH of urine provides innate (nonspecific) defense against urinary tract infections

Digestive System
- The Digestive System absorbs water needed to excrete wastes at kidneys; absorbs ions needed to maintain normal body fluid concentrations; liver removes bilirubin
- The urinary system excretes toxins absorbed by the digestive epithelium; excretes bilirubin and nitrogenous wastes from the liver; calcitriol production by kidneys aids calcium and phosphate absorption

Urinary System
The urinary system excretes metabolic waste and maintains normal body fluid pH and ion composition.
- Regulates blood volume and blood pressure
- Regulates plasma concentrations of sodium, potassium, chloride, and other ions
- Helps to stabilize blood pH
- Conserves valuable nutrients
NEW Interactive Versions of These Figures Allow Students to Explore at Their Own Pace

NEW! Build Your Knowledge Interactives give students the chance to navigate the inter-relationships among body systems within the eText.

Build Your Knowledge Coaching Activities are assignable in Mastering A&P and provide hints and wrong answer-specific feedback to ensure mastery of the concepts.
The Most Affordable and Efficient Way to Learn—Pearson eText

Pearson eText is a simple-to-use, mobile-optimized, personalized reading experience. It allows students to easily highlight, take notes, and review key vocabulary all in one place—even when offline. Seamlessly integrated videos, rich media, and embedded interactives engage students and give them access to the help they need, when they need it.

Students can stop randomly searching online for study tools and flashcards that may not be credible or applicable to their course. Pearson eText contains study tools that align directly to the textbook adopted. Students can personalize a study notebook with the highlights and notes they take during reading, as well as the ones instructors share with the class, effectively creating a study guide.
NEW! PAL 3.1 Mobile, Customizable Flashcards allow students to create a personalized, mobile-friendly deck of flashcards and quizzes using images from the virtual Practice Anatomy Lab 3.1. Students can use the checklist to filter down to the images referenced in the course. For optimal viewing, access the flashcards on a mobile device using Mastering login credentials.

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**Interactive Physiology 2.0** are based on the award-winning tutorial program that helps students understand the most difficult physiological concepts. Updated and delivered in two formats for use with today’s wide range of mobile devices and browsers.

**A&P Flix** are high-quality animations that remain trusted and among the most favored learning tools by instructors within the Mastering suite.

**Pearson eText** is available within Mastering when packaged with a new book, as an upgrade students can purchase online, or, with this title, can be adopted as a stand-alone item. Students can use the built-in Notebook to organize their notes, highlights and notes from their instructor.
Welcome to the Eighth Edition of Essentials of Anatomy & Physiology! This textbook introduces the essential concepts needed for an understanding of the human body and helps students place information in a meaningful context, develop their problem-solving skills, and prepare for a career in a medical or allied health field. In this edition, we continue to build on this text’s hallmark quality: a clear, effective visual and narrative presentation of anatomy and physiology. During the revision process, the author and illustrator team drew upon their combined content knowledge, research skills, artistic talents, and 50-plus years of classroom experience to make this the best edition yet.

The broad changes to this edition are presented in the New to the Eighth Edition section below. Also below are the sections Learning Outcomes and Chapter-by-Chapter Changes in the Eighth Edition.

New to the Eighth Edition

In addition to the technical changes in this edition, such as updated statistics and anatomy and physiology descriptions, we have simplified the presentations to make the narrative easier to read. We have also focused on improving the integration of illustrations with the narrative. These are the key changes in this new edition:

- Improved readability uses simpler, shorter, more active sentences to make reading and studying easier for students. In all chapters, the Flesch/Kincaid reading levels have been decreased.

- Improved text-art integration throughout the illustration program enhances the readability of figures. Tabular information is now integrated into the figures so that the relevant text is located immediately next to each part of a figure. Increased color saturation was also applied to the art throughout the text.

- Terminology has been updated based on Terminologia Anatomica and Terminologia Histologica, our references for anatomical and tissue terms. We continue to use possessive forms of diseases when the proposed alternative has not been widely accepted, e.g., Parkinson’s disease and Huntington’s disease.

- Mastering A&P®, Pearson’s online learning and assessment system, contains new assignable activities tied to features in the book, including 10 narrated, annotated Spotlight Videos that walk students through these popular features to explain core concepts, and a Build Your Knowledge interactive widget that allows them to see how body systems work together to maintain homeostasis. In addition, many Spotlight figures have Coaching Activities in Mastering, and the Body System figures correspond to Concept Map Coaching Activities that will bring home the concept of body system integration. Instructors can assign homework from proven media programs such as Practice Anatomy Lab” (PAL”) 3.1 and Interactive Physiology®—all organized by chapter—and have assignments automatically graded. Mobile friendly Dynamic Study Module questions help students study effectively and efficiently by allowing them to quiz themselves anytime, anywhere. In the Mastering A&P Study Area, students can access a full suite of self-study tools, including Bone and Dissection videos and A&P Flix.

Learning Outcomes

The chapters of the Eighth Edition are organized around specific Learning Outcomes that indicate what students should be able to do after studying the chapter.

- Learning Outcomes appear in chapter-opening numbered lists, as well as directly below each relevant chapter section heading.

- Full-sentence chapter headings do more than introduce new topics; they state the core fact or concept that will be presented in the section. There is a one-to-one correspondence between the Learning Outcomes and the full-sentence section headings in every chapter.

- Checkpoints are located at the close of each section and ask students to pause and check their understanding of facts and concepts. The Checkpoints reinforce the Learning Outcomes presented on the chapter-opening page and below chapter section headings, resulting in a systematic integration of the Learning Outcomes over the course of the chapter. Answers are located in the blue Answers tab at the back of the book. All the Checkpoints have been reviewed, and questions were added or revised to reflect our improved readability.

All assessments in Mastering A&P are organized by the Learning Outcomes, making it easy for instructors to organize their courses and demonstrate results against goals for student achievement.
Chapter-by-Chapter Changes in the Eighth Edition

This annotated Table of Contents provides select examples of revision highlights in each chapter of the Eighth Edition.

Chapter 1 An Introduction to Anatomy and Physiology
- Section 1-1 revised (cellular differentiation replaces differentiation; the same kind of organisms replaces similar, but not identical, organisms; Organisms exhibit movement. replaces Organisms can move.)
- Figure 1-4 Negative Feedback: Control of Body Temperature revised (new title)
- Figure 1-10 Relationships among the Subdivisions of the Body Cavities of the Trunk revised (visceral layer of serous pericardium replaces visceral pericardium, parietal layer of serous pericardium replaces parietal pericardium)
- Review Questions: Level 1 revised (answer to question 21 corrected)
- Related Clinical Terms revised (acute and chronic terms added; injury added to definition of radiology)

Chapter 2 The Chemical Level of Organization
- Section 2-1 revised (clarified definition of radiation)
- Spotlight Figure 2-7 Chemical Notation revised (simplified introduction and replaced spelled out numbers with numerals to better integrate the Visual Representation and Chemical Notation columns)
- Section 2-8 revised (clarified that, in physiology, the term electrolyte applies to both the ionizable substance and its ions)
- New Clinical Note (Too Sweet on Sugar replaces Fatty Acids and Health)

Chapter 3 Cell Structure and Function
- Section 3-7 Learning Outcome revised (sequence of interphase and mitosis now correlates with section discussion)
- Table 3-1 revised (propagation of nerve impulses replaces conduction of nerve impulses)
- Figure 3-5 Diffusion Across the Plasma Membrane revised (color of water molecules now matches those in Chapter 2 figures)
- Figure 3-9 The Sodium-Potassium Exchange Pump revised (corrected relative sizes of sodium and potassium ions)
- Spotlight Figure 3-7 Protein Synthesis, Processing, and Packaging revised (added magnification of TEM illustrating exocytosis)
- Section 3-10 revised (cellular differentiation replaces differentiation)

Chapter 4 The Tissue Level of Organization
- Figure 4-1 An Orientation to the Body’s Tissues revised (nervous tissue replaces neural tissue)
- Figure 4-2 Cell Junctions revised (basal lamina replaces clear layer and reticular lamina replaces dense layer)
- Figure 4-3 The Surfaces of Epithelial Cells (added Lateral surfaces and Basal surface labels)
- Figure 4-4 Simple Epithelia revised (moved part letters to highlight tissue types and enhance text-art integration)
- Figure 4-5 Stratified Epithelia revised (moved part letters to highlight tissue types and enhance text-art integration)
- Figure 4-6 Methods of Glandular Secretion revised (Modes changed to Methods in figure title and letters added to different parts of the figure to enhance text-art integration)
- Table 4-2 revised (Method of Secretion replaces Mode of Secretion)
- Clinical Note Marfan’s Syndrome revised (Marfan replaces Marfan’s)
- Figure 4-9 Loose Connective Tissue revised (moved part letters to highlight tissue types and enhance text-art integration)
- Figure 4-10 Dense Connective Tissue revised (moved part letters to highlight tissue types and enhance text-art integration)
- Figure 4-11 Types of Cartilage revised (moved part letters to highlight tissue types and enhance text-art integration)
- Figure 4-14 Muscle Tissue revised (moved part letters to highlight tissue types and enhance text-art integration)
- Figure 4-15 Nervous Tissue revised (new title Nervous Tissue replaces Neural Tissue)

Chapter 5 The Integumentary System
- The text now uses subcutaneous layer as the primary term and hypodermis as the secondary term.
- Figure 5-1 The General Structure of the Integumentary System revised (Subcutaneous layer replaces Hypodermis)
- Spotlight Figure 5-2 revised (part labels added to better align text and art)
- Section 5-2 heading revised (shortened to Epidermal pigmentation and dermal circulation influence skin color)
- Figure 5-5 Hair Follicles and Hairs revised (Subcutaneous layer replaces Hypodermis in part b)
- Figure 5-6 Sebaceous Glands and Their Relationship to Hair Follicles revised (Subcutaneous layer replaces Hypodermis)
- Figure 5-7 Sweat Glands revised (Eccrine sweat gland replaces Merocrine sweat gland as primary term, Subcutaneous layer replaces Hypodermis)
• Build Your Knowledge revised (added in females, specialized integumentary glands secrete milk to Integumentary System functions)
• Level 1: Reviewing Facts and Terms revised (answers to questions 5 and 9 corrected)

Chapter 6 The Skeletal System
• Figure 6-1 A Classification of Bones by Shape revised (bone art enlarged, added Sectional view label to part c)
• Clinical Note: Types of Fractures and Steps in Repair revised (replaced x-rays of Displaced fracture and Spiral fracture)
• Figure 6-8 The Skeleton revised (enlarged figure and increased color and contrast; added Sternal label)
• Figure 6-9 The Axial and Appendicular Divisions of the Skeleton revised (Rib cage replaced Thoracic cage to correlate with the Axial Skeleton bone count; coxal bone deleted from Hip bone box)
• Figure 6-10 The Adult Skull, Part I revised (added leader dots to leader lines of Coronal suture, Squamous suture, and Lambdoid suture)
• Figure 6-12 Sectional Anatomy of the Skull revised (added forked leader to Frontal sinuses label)
• Figure 6-13 The Paranasal Sinuses revised (Ethmoidal cells replaces Ethmoidal sinuses)
• Figure 6-16 The Vertebral Column revised (color coded Vertebral regions to match art in later chapters)
• Figure 6-17 Typical Vertebrae of the Cervical, Thoracic, and Lumbar Regions revised (changed color in icon art to match Figure 6-18 icon art)
• Figure 6-19 The Sacrum and Coccyx revised (adjusted position of Lateral sacral crest leader line in part b)
• Figure 6-20 The Thoracic Cage revised (added thoracic cage definition)
• Figure 6-24 The Right Radius and Ulna revised (RADIUS and ULNA labels changed to Radius and Ulna to match use in other figures in chapter)
• Figure 6-25 The Bones of the Wrist and Hand revised (rearranged terms in Proximal Carpals box to match sequence as discussed in the text)
• Section 6-10 revised (Plane movement replaces Gliding movement)
• Figure 6-26 The Hip Bones and the Pelvis revised (Sacroiliac joint replaces Sacroiliac joint)
• Figure 6-33 Rotational Movements revised (added a red dot to mark the location of the joint involved in rotational movements of the head)
• Section 6-11 heading and Learning Outcome revised (joints replaces articulars)

Spotlight Figure 6-35 Synovial Joints revised (Plane joint replaces Gliding joint; gliding inserted into Plane joint Movement text)
• Figure 6-40 The Knee Joint revised (added PCL abbreviation after Posterior cruciate ligament and ACL abbreviation after Anterior cruciate ligament labels)

Chapter 7 The Muscular System
• Figure 7-1 The Organization of Skeletal Muscles revised (added part letters to enhance text–art integration)
• Figure 7-2 The Organization of a Skeletal Muscle Fiber revised (enhanced art)
• Figure 7-3 Changes in the Appearance of a Sarcomere during Contraction of a Skeletal Muscle Fiber (added Relaxed myofibril label in part a and Relaxed myofibril label in part b)
• Spotlight Figure 7-4 Events at the Neuromuscular Junction revised (updated ACh receptor membrane channel art and added text to step 5)
• Figure 7-6 Steps Involved in Skeletal Muscle Contraction and Relaxation revised (updated ACh receptor membrane channel and T tubule/Sarcoplasmic reticulum art)
• Figure 7-10 Muscle Metabolism revised (in part c, the hydrolysis of ATP replaces pyruvate as the source of hydrogen ions at peak activity)
• Table 7-12 Muscle Terminology revised (Terms Indicating Specific Regions of the Body moved to left column to better correlate with anatomical terminology introduced in Chapter 1)
• Figure 7-17 Muscles of the Pelvic Floor revised (in part b, transverse perineal replaces transverse perineus)

Chapter 8 The Nervous System
• Section 8-1 revised (recognized the enteric nervous system (ENS) as a third division of the peripheral nervous system)
• Figure 8-5 Schwann Cells and Peripheral Axons revised (added neurolemmocytes as a secondary term for Schwann cells; neurolemma replaces neurilemma)
• Figure 8-14 Gross Anatomy of the Spinal Cord revised (lumbosacral enlargement replaces lumbar enlargement; ventral roots replaces anterior roots; dorsal roots replaces posterior roots; spinal ganglion replaces dorsal root ganglion)
• Figure 8-15 Sectional Anatomy of the Spinal Cord revised (spinal ganglion replaces dorsal root ganglion)
• Figure 8-16c The Brain revised (Medial view replaces Sagittal section, Brainstem replaces Brain stem)
• Section 8-8 The PNS connects the CNS with the body’s external and internal environments, Cranial Nerves revision (added sentence: If the full name of the cranial nerve is...
given, then only the Roman numeral is needed, such as optic nerve (II). This addition affects cranial nerves figure labels and text narrative.

- Figure 8-22 The Basal Nuclei revised (removed amygdaloid body from Basal Nuclei box since it is considered a component of the limbic system)
- Figure 8-25 The Cranial Nerves, parts a and b revised (N preceding Roman numeral of named optic nerves is deleted)
- Figure 8-26 Peripheral Nerves and Nerve Plexuses revised (leader line from Femoral nerve corrected)
- Figure 8-27 Dermatomes revised (CN V replaces N V)
- Figure 8-29 A Stretch Reflex revised (quadriceps muscles replaces muscles in second line of caption)
- Figure 8-31 The Posterior Column Pathway revised (Primary Sensory Cortex changed to Primary Somatosensory Cortex; Dorsal root ganglion changed to Spinal ganglion)
- Figure 8-32 The Corticospinal Pathway revised (brainstem replaces brain stem)
- Figure 8-35 The Parasympathetic Division revised (N changed to CN; added postganglionic neuron on rectum art)
- Table 8-2 The Effects of the Sympathetic and Parasympathetic Divisions of the ANS on Various Body Structures revised (EYE: Sympathetic Effects - Focusing for distance vision replaces Focusing for near vision; Parasympathetic Effects - Focusing for close vision replaces Focusing for distance vision)

Chapter 9 The General and Special Senses
- Figure 9-3 Tactile Receptors in the Skin revised (added myelin sheath to afferent nerve fiber in Tactile Discs box; bulbous corpuscle replaces Ruffini corpuscle; lamellar [pacinian] corpuscle replaces lamellated [pacinian] corpuscle)
- Figure 9-4 Baroreceptors and the Regulation of Autonomic Functions revised (changed carotid sinus to carotid sinuses and added a second leader; aortic arch replaces aortic sinus and corrected position of leader line)
- Figure 9-6 The Olfactory Organs revised (in part a, changed Olfactory nerve fibers (N I) to Olfactory nerve fibers (I); in part b, dendritic bulb replaces knob)
- Figure 9-7 Taste Buds and Gustatory Epithelial Cells revised (new title; in part a, eliminated line spacing between the four primary taste sensations to indicate that all portions of the tongue provide sweet, salty, sour, and bitter sensations; in part b, gustatory epithelial cell replaces gustatory cell)
- Figure 9-8 The Accessory Structures of the Eye revised (lateral angle replaces lateral canthus and medial angle replaces medial canthus)
- Figure 9-10 The Sectional Anatomy of the Eye revised (in parts a and c, fovea centralis replaces fovea; in part b, neural layer replaces neural part and pigmented layer replaces pigmented part; part c caption revised [Superior view of dissection of the right eye replaces Horizontal dissection of the right eye])
- Figure 9-11 Retinal Organization revised (pigmented layer of retina replaces pigmented part of retina and neural layer of retina replaces neural part of retina; fovea centralis replaces fovea)
- Figure 9-14 Focal Point, Focal Distance, and Visual Accommodation revised (in part a, text in art changed to "Light rays from a distant source (object) are parallel", and caption revised by adding "the greater the angle of arriving light rays and"; art in parts d and e exchanged to better match art in parts a, b, and c)
- Spotlight Figure 9-16 Refractive Problems revised (added "a process called accommodation" to the end of introductory paragraph)
- Figure 9-18 The Structure of Rods and Cones revised (pigmented epithelium replaces pigment epithelium)
- Figure 9-20 The Visual Pathways revised (Optic nerves [III] replaces Optic nerves [N II])
- Figure 9-21 The Anatomy of the Ear revised (Facial nerve [VII] replaces Facial nerve [N VII] and Vestibulocochlear nerve [N VIII] replaces Vestibulocochlear nerve [N VIII])
- Figure 9-23 The Internal Ear revised (ampullary crests replaces cristae)
- Figure 9-24 The Semicircular Ducts revised (ampullary crest replaces crista ampullaris; ampullary cupula replaces cupula; Vestibular nerve replaces Vestibular branch)
- Figure 9-25 The Utricula and Saccule revised (macula of utricule replaces macula)
- Figure 9-27 Sound and Hearing revised (Cochlear nerve replaces Cochlear branch of cranial nerve VIII)
- Figure 9-28 Pathways for Auditory Sensations revised (Vestibulocochlear nerve [VIII] replaces Vestibulocochlear nerve [N VIII]; in step 5, auditory replaces acoustic)

Chapter 10 The Endocrine System
- Figure 10-1 Organs and Tissues of the Endocrine System revised (deleted Secretes from the examples of Organs with Secondary Endocrine Functions)
- Figure 10-2 The Role of Target Cell Receptors in Hormone Action revised (neurons replaces neural tissue; skeletal muscle fiber replaces skeletal muscle tissue)
- Figure 10-4 Hypothalamic Control over Endocrine Function revised (added color coding to boxed text to enhance links between hypothalamic structures and functions)
Figure 10-8 Pituitary Hormones and Their Targets revised (changed color of adrenal gland secretion oval to enhance link with revised boxed text color in Figure 10-4)

- Section 10-4 Title revised (The thyroid gland synthesizes thyroid hormones that affect the rate of metabolism replaces The thyroid gland lies inferior to the larynx and requires iodine for hormone synthesis)

- Table 10-1 The Pituitary Hormones revised (under Target column, Interstitial endocrine cells of testes replaces Interstitial cells of testes)

- Figure 10-10 The Homeostatic Regulation of the Blood Calcium Ion Concentration revised (clarified that figure discusses calcium ion concentration in blood and calcitonin’s limited role in bone deposition)

- Table 10-2 Hormones of the Thyroid Gland and Parathyroid Glands revised (principal cells replaces chief cells)

- Figure 10-13 The Endocrine Pancreas revised (bile duct replaces common bile duct)

- Figure 10-14 The Homeostatic Regulation of the Blood Glucose Concentration revised (added Homeostatic to figure title and clarified normal blood glucose levels is a range)

- Clinical Note Diabetes Mellitus revised (updated estimated number of people in the U.S. with some form of diabetes)

- Clinical Note Endocrine Disorders revised (congenital hypothyroidism replaces cretinism and infantile hypothyroidism)

- Build Your Knowledge revised (clarified that vitamin D₃ is a precursor to calcitriol production in the Integumentary System box)

Chapter 11 The Cardiovascular System: Blood

- Spotlight Figure 11-1 The Composition of Whole Blood revised (clarified definition of hematocrit; updated normal hematocrit range for adult males and adult females)

- Section 11-3 Abundance of Red Blood Cells section revised (described the composition of the three layers observed after centrifugation of whole blood)

- Section 11-3 Structure of RBCs section revised (clarified that a flexible cell membrane accounts for ability of RBCs bend and squeeze through capillaries)

- Section 11-3 Sex and Iron Reserves revised (Sex and Iron Reserves replaces Gender and Iron Reserves)

- Figure 11-3 Recycling of Hemoglobin revised (clarified that Fe²⁺ is an iron ion; added label to large intestine)

- Clinical Note Abnormal Hemoglobin revised (sickle cell disease [SCD] replaces sickle cell anemia [SCA])

- Figure 11-6 Blood Types and Cross-Reactions revised (corrected shapes of anti-A and anti-B antibodies)

- Figure 11-7 Blood Typing Testing revised (added “clumping” or “no clumping” under test results for clarification)

- Figure 11-9 The Vascular, Platelet, and Coagulation Phases of Hemostasis revised (added Endothelium label for clarification)

Chapter 12 The Cardiovascular System: The Heart

- Section 12-1 revised (clarified that pericardium includes an outer fibrous pericardium and an inner serous pericardium)

- Figure 12-1 The Location of the Heart in Thoracic Cavity revised (parietal layer of serous pericardium replaces parietal pericardium, visceral layer of serous pericardium replaces visceral pericardium)

- Figure 12-3 The Position and Anatomy of the Heart revised (parts are rearranged; part a art now shows the position of the heart)

- Figure 12-4 The Heart Wall and Cardiac Muscle Tissue revised (parietal layer of serous pericardium replaces parietal pericardium, visceral layer of serous pericardium replaces visceral pericardium)

- Spotlight Figure 12-5 The Heart: Internal Anatomy and Blood Flow revised (tricuspid valve replaces right atrioventricular valve, mitral valve replaces left atrioventricular valve)

- Figure 12-6 The Valves of the Heart revised (tricuspid replaces right AV [tricuspid] valve, mitral valve replaces left AV [bicuspid] valve)

- Figure 12-8 Action Potentials in Cardiac Contractile Cells and Skeletal Muscle Fibers revised (new figure title; cardiac contractile cell replaces cardiac muscle cell, skeletal muscle fiber replaces skeletal muscle)

- Figure 12-11 The Cardiac Cycle revised (Changed color of central Cardiac cycle to enhance text and art)

- Figure 12-12 Heart Sounds revised (new part a art avoids crossing of leader lines)

- Figure 12-13 Autonomic Innervation of the Heart revised (Vagus nerve [X] replaces Vagus [N X])

Chapter 13 The Cardiovascular System: Blood Vessels and Circulation

- Figure 13-2 The Structure of the Various Types of Blood Vessels revised (clarified internal, or lumen, diameters of blood vessels)

- Figure 13-8 The Baroreceptor Reflexes of the Carotid Sinuses and Aortic Arch revised (new Figure title; Baroreceptors in carotid sinuses and aortic arch replaces Baroreceptors in aortic and carotid sinuses)

- Figure 13-18 The Venous Drainage of the Abdomen and Chest revised (hemi-azygos replaces hemiazygos)

- Figure 13-19 A Flowchart of the Tributaries of the Superior and Inferior Vena Cavae revised (Hemi-azygos replaces Hemiazygos)
• Figure 13-20 The Hepatic Portal System revised (clarified drainage of left and right gastroepiploic veins)
• BYK Integrator (lactate replaces lactic acid)
• Review Questions Level 1 Column B revised (aortic arch and carotid sinuses replaces aortic and carotid sinuses)

Chapter 14 The Lymphatic System and Immunity
• Definition of the term “immune response” revised from “a defense against specific antigens” to “the body’s reaction to infectious agents and abnormal substances”
• Figure 14-1 The Components of the Lymphatic System revised (added CNS lymphatic vessels to the art; Other Lymphoid Tissues and Organs heading replaces Lymphoid Tissues and Organs heading because lymph nodes are organs)
• Spotlight Figure 14-4 Origin and Distribution of Lymphocytes revised (hemocytes replaces hematopoietic stem cells)
• Figure 14-6 The Structure of a Lymph Node revised (cortex replaces outer cortex; paracortex replaces deep cortex)
• Figure 14-9 The Body’s Innate Defenses revised (clarifies the roles of complement)
• Figure 14-11 Forms of Immunity revised (artificially acquired replaces artificially induced)
• Figure 14-12 An Overview of Adaptive Immunity revised (former title “An Overview of the Immune Response”; new title emphasizes that adaptive immunity is part of the “immune response”)
• Figure 14-17 An Integrated Summary of the Immune Response (new title corresponds with broadened definition of the term “immune response”; regulatory T cells replaces suppressor T cells)

Chapter 15 The Respiratory System
• Figure 15-1 The Structures of the Respiratory System revised (Respiratory bronchioles replaces Smallest bronchioles)
• Figure 15-2 The Respiratory Mucosa revised (mucus replaces mucus layer)
• Figure 15-3 The Nose, Nasal Cavity, and Pharynx revised (posterior internal apertures replaces internal nares, and nostrils replaces external nares)
• Clinical Note Cystic Fibrosis revised (added text to clarify that cystic fibrosis affects not only the respiratory system, but also the digestive and reproductive systems)
• Figure 15-4 The Anatomy of the Larynx and Vocal Cords revised (glottis in the open position art and photomicrograph now positioned next to each other)
• Figure 15-5 The Anatomy of the Trachea revised (main bronchi replaces primary bronchi and lobar bronchi replaces secondary bronchi)
• Figure 15-6 Bronchial Branching and a Lobule of the Lung revised (new figure title; segmental bronchi replaces tertiary bronchi)
• Figure 15-7 Alveolar Organization revised (pneumocyte type I replaces type I pneumocyte, and pneumocyte type II replaces type II pneumocyte; blood air barrier replaces respiratory membrane)
• Figure 15-8 The Gross Anatomy of the Lungs revised (added caption “The lobes are shown as though transparent to make the main branching of the bronchial tree visible”)
• Spotlight Figure 15-10 Pulmonary Ventilation revised (clarified rib cage structures and that accessory respiratory muscles are only active in forced breathing)
• Figure 15-11 Pulmonary Volumes and Capacities revised (TV replaces V_T as abbreviation for tidal volume; clarified table describing sex differences)
• Spotlight Figure 15-16 The Control of Respiration revised (CN replaces N)
• BYK Integrator revised (deleted nourish from Integumentary System description)

Chapter 16 The Digestive System
• Section 16-1 revised under Secretion, added salts to the substances released into the digestive tract
• Section 16-1 revised (clarified that the enteric nervous system [ENS] consists of the myenteric plexus and submucosal plexus)
• Figure 16-1 The Components of the Digestive System revised (mechanical digestion replaces mechanical processing, chemical digestion replaces chemical breakdown)
• Figure 16-2 The Structure of the Digestive Tract revised (included muscularis mucosae within the Mucosa box, muscular layer replaces muscularis externa)
• Figure 16-4 The Oral Cavity revised (frenulum of tongue replaces lingual frenulum)
• Figure 16-6 Teeth: Structural Components and Dental Succession revised (cement replaces cementum, alveolar process replaces bone of alveolus, deciduous teeth replaces primary teeth, permanent teeth replaces adult teeth)
• Figure 16-8 The Anatomy of the Stomach revised (muscular layer replaces muscularis externa; added gastrin-producing G cells to part d caption)
• Spotlight Figure 16-9 Regulation of Gastric Activity revised (muscular layer replaces muscularis externa; neural inhibition and hormonal inhibition added to Intestinal Phase KEY)
• Figure 16-11 The Intestinal Wall revised (muscular layer replaces muscularis externa; Goblet cells [intestinal mucous cells] replaces Mucous cells)
• Figure 16-13 The Pancreas revised (bile duct replaces common bile duct)
• Figure 16-14 The Surface Anatomy of the Liver revised (bile duct replaces common bile duct)
• Figure 16-15 Liver Histology revised (portal triad replaces portal area; interlobular bile duct replaces bile duct, interlobular artery replaces branch of the hepatic artery proper,
interlobular vein replaces branch of hepatic portal vein; stellate macrophages replaces Kupffer cells
• Figure 16-16 The Gallbladder revised ( bile duct replaces common bile duct)
• Figure 16-17 The Large Intestine revised (teniae coli replaces tenia coli because there is no singular form to refer to one of the longitudinal smooth muscle bands)
• Spotlight Figure 16-18 Chemical Events in Digestion (clarified large organic molecules are chemically broken down before absorption)
• BYK Integrator revised (clarified mechanical and chemical digestion functions in Digestive System box)

Chapter 17 Metabolism and Energetics
• Figure 17-2 Nutrient Use in Cellular Metabolism revised (electron transport chain replaces electron transport system)
• Figure 17-4 The Citric Acid Cycle revised (electron transport chain replaces electron transport system)
• Spotlight Figure 17-5 Electron Transport Chain and ATP Formation revised (new figure title and clarified the role of chemiosmosis in ATP formation)
• Figure 17-6 A Summary of the Energy Yield of Aerobic Metabolism revised (electron transport chain replaces electron transport system)
• Figure 17-7 Carbohydrate Metabolism revised (clarified that gluconeogenesis only involves noncarbohydrates; deleted Other carbohydrates box from art)

Chapter 18 The Urinary System
• Section 18-1 revised (metabolic wastes replaces organic wastes)
• Figure 18-2 The Position of the Kidneys revised (clarified locations of last thoracic and third lumbar vertebrae to better correlate with text)
• Figure 18-4 The Blood Supply to the Kidneys revised (part a, added segmental artery label; part b, renal pyramid replaces medulla, and added interlobar artery and interlobar vein labels to better correlate with part a)
• Figure 18-5 A Representative Nephron and the Collecting System revised (highlighted general functions of descending limb and ascending limb in the Nephron Loop box with bullet points; descending thin limb replaces thin descending limb)
• Figure 18-6 The Renal Corpuscle revised (in part a, capsular outer layer replaces parietal epithelium, visceral layer replaces visceral epithelium; in part b, fenestrated capillary endothelium replaces capillary epithelium, foot processes of podocytes replaces filtration slits; in part c, foot processes replaces pedicels)
• Figure 18-10 The Renin-Angiotensin-Aldosterone System and Regulation of GFR revised (new figure title; systemic veins replaces venous reservoirs)
• Figure 18-11 Organs for Conducting and Storing Urine revised (new figure title; ureteral orifices replaces ureteral openings)
• NEW Figure 18-12 The Control of Urirnation
• Figure 18-14 Ions in Body Fluids revised (caption revised to emphasize electrical neutrality within each fluid compartment)
• BYK Integrator Urinary System revised (excretes replaces removes)

Chapter 19 The Reproductive System
• Section 19-1 revised (sperm replaces spermatozoa/spermatozoon as the primary term)
• Figure 19-2 The Scrotum, Testes, and Seminiferous Tubules revised (sperm replaces spermatozoa)
• Section 19-2 revised (dartos muscle replaces dartos; sustenocytes replaces sustentacular cells; prostate replaces prostate gland)
• Figure 19-3 Spermatogenesis revised (sperm replaces spermatozoa/spermatozoon)
• Figure 19-6 The Penis revised (foreskin replaces prepuce)
• Spotlight Figure 19-7 Regulation of Male Reproduction revised (interstitial endocrine cells replaces interstitial cells; sperm replaces spermatozoa)
• Figure 19-10 Ovarian Follicle Development and the Ovarian Cycle revised (ovarian follicle replaces follicle; in caption, clarified that ovarian follicles enter the 28-day ovarian cycle as tertiary ovarian follicles)
• Section 19-3 revised (functional layer of endometrium replaces functional zone of endometrium, and basal layer of endometrium replaces basilar layer of endometrium)
• Figure 19-12 The Female External Genitalia revised (bulb of vestibule replaces vestibular bulb)
• Spotlight Figure 19-14 Regulation of Female Reproduction revised (ovarian follicle replaces follicle; temperature ranges added for both Celsius and Fahrenheit scales; and Menses label changed to Menstrual Phase)
• BYK Integrator Reproductive System revised (kidneys excrete replaces kidneys remove in Urinary System box)

Chapter 20 Development and Inheritance
• Figure 20-1 Fertilization revised (in part b, changed step 2 title and text in steps 3 and 4; clarified when DNA synthesis occurs, sperm replaces spermatozoan)
• Figure 20-3 Events in Implantation revised (cytotrophoblast replaces cellular trophoblast, syncytiotrophoblast replaces syncytiotrophoblast)
• Figure 20-4 The Inner Cell Mass revised (extra-embryonic replaces extraembryonic, changed Gastrulation from day 12 to day 15)
• Spotlight Figure 20-5 Extra-Embryonic Membranes and Placenta Formation revised (added mucus plug to week 10/step 5 art)
• Figure 20-6 The Placenta and Placental Circulation revised (Mucus plug replaces Cervical (mucous) plug)
• Figure 20-7 Development during the First Trimester revised (new part a Week 3 art and new Week 4, 8, and fiberoptic photographs)
• Figure 20-8 Fetal Development in the Second and Third Trimesters revised (new photograph of 6-month-old fetus)
• Figure 20-16 The Milk Ejection Reflex (new title replaces The Milk Let-Down Reflex)
• Figure 20-16 A Map of Human Chromosomes revised (Down Syndrome replaces Down’s Syndrome; Marfan’s Syndrome replaces Marfan Syndrome; Sickle Cell Disease replaces Sickle Cell Anemia)
• Section 20-8 The Human Genome revised (new title; added description of gene-editing technique CRISPR/Cas9)

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