

CECIE STARR BEVERLY McMILLAN



HUMAN BIOLOGY

EIGHTH EDITION



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CECIE STARR

Belmont, California

BEVERLY McMILLAN

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Preface

Instructors who teach introductory human biology for non-science majors have long told us that their overall goal for their course is to familiarize students with how the human body works and provide them with tools that will help them make well-informed choices as consumers and voters. This aim makes sense. Most students who use this textbook will never take another science course, yet they will need to make decisions that require a basic understanding of the process of science and fundamental biological principles.

In planning this revision, we asked instructors to review each chapter and suggest changes that would make the text as a whole even more effective in helping to meet the goals of their course. Their responses pinpointed two areas: include even more information on health issues, especially infectious disease and cancer, and reinforce the principle of homeostasis in the functioning of body systems. This excellent advice drove two major changes in this edition. Instead of treating infectious disease as a separate, chapter-length topic, we updated and integrated that information into expanded discussions of diseases and disorders in relevant chapters. In all systems chapters (except Chapter 16 on reproductive systems) we also added a full-page, illustrated *Connections* summary of how each organ system contributes to overall homeostasis in the body.

Several reviewers suggested moving our treatment of digestion so that it immediately precedes the discussion of the urinary system, and that change we have implemented as well. We also split the text's coverage of ecology into two chapters, one focused on basic principles and the second dealing with the impacts of human activities on ecosystems. Highlighted discussions include current thinking about global climate change and alternative energy sources.

We revised the text to make it as clear and straightforward as possible, keeping in mind that English is a second language for a fair number of students. We included new tables to summarize important points, and added more than 165 new photographs and new and simplified diagrams—visual elements that we know help students better understand basic concepts and the health impacts of diseases and disorders.

Changes for This Edition

Links to Key Concepts The previous edition of *Human Biology* included tools that link concepts within and between chapters. For this edition we enhanced these tools, to reinforce the concept that the functioning of tissues, organs, and organ systems are part of an integrated whole. Every chapter introduction has a section-by-section list of *Key Concepts*, each with a simple title. A brief list of *Links to Earlier Concepts* at the beginning of each chapter helps remind students of relevant concepts presented in previous chapters.

Sentence-Form Figure Captions All figure captions in this edition are introduced with a simple sentence that encapsulates the central concept represented by the illustration or photograph.

Take-Home Messages At the end of each chapter section, a *Take-Home Message* question pinpoints the main concept(s) covered in the section. It is followed by bulleted summaries of the section's key concepts.

Media-Integrated Summaries We have always offered a wealth of online media for students. In this edition, chapter summaries integrate even more information about the relevant animations, tutorials, and videos.

Chapter-Specific Changes We scrutinized every chapter for opportunities to make the writing clearer, and we have added dozens of new photographs and other illustrations. We summarize the highlights here.

Chapter 1, Learning about Human Biology New, two-page *Focus on Health* section introduces the topic of infectious disease as a central health concern that will be discussed in relevant chapters throughout the textbook.

Chapter 2, Chemistry of Life New chapter introduction on trans fats. Simplified text and streamlined art on atom structure, structure of carbohydrates and proteins, and the pH scale.

Chapter 3, Cells and How They Work New chapter introduction on the effects of consumed alcohol on liver cells. New illustrations of cell structure, diffusion, osmosis, electron transport chains, and a summary of aerobic cellular respiration. New *Focus on Health* on mitochondrial diseases.

Chapter 4, Tissues, Organs, and Organ Systems Streamlined text and new illustrations on muscle and nervous tissue.

Chapter 5, The Skeletal System New illustration of knee joint. New full-page *Connections* section on the role of the skeletal system in maintaining homeostasis.

Chapter 6, The Muscular System Revised text and added new art on muscle contraction. Expanded discussion of muscle diseases and disorders. New full-page *Connections* section on the role of the muscular system in homeostasis.

Chapter 7, Circulation: The Heart and Blood Vessels New placement of this chapter before blood and the respiratory system, with new chapter introduction. Expanded coverage of cardiovascular diseases and disorders, with a new section on infections, cancer, and heart defects. *Connections* section on the role of the cardiovascular system and blood in homeostasis.

Chapter 8, Blood New placement following the cardiovascular system.

Chapter 9, Immunity and Disease New chapter introduction on cervical cancer. Streamlined/new text and art for sections on antibody-mediated and cell-mediated defenses. New sections on HIV/AIDS and on understanding and avoiding infectious disease.

Chapter 10, The Respiratory System New text and art on breathing controls. Expanded discussion of respiratory diseases and disorders, with a new section on pathogens and lung cancer. *Connections* section on the role of the respiratory system in homeostasis.

Chapter 11, Digestion and Nutrition Updated text/art on dieting and nutritional guidelines. Expanded discussion of digestive system diseases and disorders, with a new section on relevant infectious diseases. *Connections* section on the role of the digestive system in homeostasis.

Chapter 12, The Urinary System Expanded coverage of urinary system diseases and disorders, including cancers, infections, and harm from drugs. *Connections* section on the role of the urinary system in homeostasis.

Chapter 13, The Nervous System Revised text and new art on divisions of the nervous system. Streamlined discussion of psychoactive drugs. Expanded coverage of nervous system diseases and disorders, including cancers, infections, headache, and autism spectrum disorders. *Connections* section on the role of the nervous system in homeostasis.

Chapter 14, Sensory Systems New text/art on olfactory pathways, inner ear structure, visual pigments and processing.

Chapter 15, The Endocrine System New section on growth hormone functions and disorders. Discussion of thyroid, parathyroid hormones now in an integrated section. Expanded text on blood sugar disorders. New text on gonads and reproductive hormones. *Connections* section on the role of the endocrine system in homeostasis.

Chapter 16, Reproductive Systems New chapter introduction on multiple births. New art on the male reproduc-

tive system and structure of sperm. New art summary of the menstrual and ovarian cycles. New section on fertilization (moved from development chapter) with accompanying new art. Added section on reproductive cancers.

Chapter 17, Development and Aging New chapter introduction on intersex developmental disorders. New *Focus on Health* on twinning. New photograph of amniocentesis procedure. Shortened discussion of aging effects on major body systems.

Chapter 18, Cell Reproduction New diagrams of chromosome duplication and the cell cycle.

Chapter 19, Introduction to Genetics New chapter introduction on genetics of skin color. New diagram on independent assortment. New text and art on sickle-cell anemia and on ABO blood types as an example of codominance. New subsection on effects of environmental factors on gene expression.

Chapter 20, Chromosomes and Human Genetics New diagrams of gene linkage and mapping of cystic fibrosis gene to chromosome 7. New photographs for X inactivation and example of related disorders. *Science Comes to Life* on pharmacogenetics.

Chapter 21, DNA, Genes, and Biotechnology New chapter introduction on genetically modified foods. New, simplified diagrams of steps of gene transcription and translation. New photograph of DNA fingerprinting. New text on cloning.

Chapter 22, Genes and Disease: Cancer Chapter refocused on cancer causes, diagnosis, treatment, and prevention. New introduction on breast cancer susceptibility genes. New diagram of steps in the development of colorectal cancer. New text on how cancers are categorized and named. Expanded sections on cancer diagnosis and treatments.

Chapter 23, Principles of Evolution New photograph of gene-based variation in human skin color. New diagram of homologous structures (vertebrate limbs). New diagram and photograph for discussion of mass extinction events.

Chapter 24, Principles of Ecology New chapter introduction on global climate change. New food web diagram. Topics concerning human impacts on ecosystems now the focus of Chapter 25.

Chapter 25, Human Impacts on the Biosphere Chapter introduction on sea level rise. New section on the concept of "ecological footprint" and renewable versus non-renewable resources. Expanded section on climate change and global warming. New illustrations of thermal inversion, acid rain damage, location of the ozone layer, retreating glaciers due to warming, groundwater depletion/contamination, water pollution, recycling, desertification, deforestation, loss of biodiversity, other chapter topics. New *Explore on Your Own* urges students to find ways to reduce their personal carbon footprint.

Appendices New Appendix VI showing maps of human genes and a selection of associated functions and diseases.

Acknowledgments

This edition of *Human Biology* incorporates thoughtful comments and critiques of dozens of instructors, listed on the following page, who are committed to excellence in teaching science to non-science majors. Our bright new design, *Key Concepts*, *Impacts/Issues* essays, *Take-Home Messages*, custom videos and online learning resources—such features are responses to their insights from the classroom.

The publishing professionals at Cengage continue to justify our belief that they are the best team in educational publishing. Peggy Williams, thank you for championing our vision and creativity. Kristina Razmara built a world-class technology package for both students and instructors. Andy Marinkovich and Michelle Cole made sure that production went smoothly. Mandy Hetrick and her associates at Lachina Publishing Services were in the trenches every day for months, implementing the new design and managing the myriad tasks that yield a quality textbook. Many thanks to John Walker, our Art Director, who championed our new design and cover. Thanks also to our Executive Marketing Manager Stacy Best for making sure our book is seen by as many as possible, to Linda Sykes for her creative and resourceful photo research, to Elizabeth Momb for managing our extensive print supplements program, and to Alexis Glubka for her conscientious, good-natured editorial assistance. Together this team created an extraordinary resource for students and the dedicated instructors who strive to provide the best in biology education.

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