

PREFACE

Nobel Prize-winning physicist Richard Feynman once noted that nature has a far, far better imagination than our own. Few things in the universe illustrate this observation better than the cell. A tiny sac of molecules capable of self-replication, this marvelous structure constitutes the fundamental building block of life. We are made of cells. Cells provide all the nutrients we consume. And the continuous activity of cells makes our planet habitable. To understand ourselves—and the world of which we are a part—we need to know something of the life of cells. Armed with such knowledge, we—as citizens and stewards of the global community—will be better equipped to make well-informed decisions about increasingly sophisticated issues, from climate change and food security to biomedical technologies and emerging epidemics.

In *Essential Cell Biology* we introduce readers to the fundamentals of cell biology. The Fifth Edition introduces powerful new techniques that allow us to examine cells and their components with unprecedented precision—such as super-resolution fluorescence microscopy and cryoelectron microscopy—as well as the latest methods for DNA sequencing and gene editing. We discuss new thinking about how cells organize and encourage the chemical reactions that make life possible, and we review recent insights into human origins and genetics.

With each edition of *Essential Cell Biology*, its authors re-experience the joy of learning something new and surprising about cells. We are also reminded of how much we still don't know. Many of the most fascinating questions in cell biology remain unanswered. How did cells arise on the early Earth, multiplying and diversifying through billions of years of evolution to fill every possible niche—from steaming vents on the ocean floor to frozen mountaintops—and, in doing so, transform our planet's entire environment? How is it possible for billions of cells to seamlessly cooperate and form large, multicellular organisms like ourselves? These are among the many challenges that remain for the next generation of cell biologists, some of whom will begin a wonderful, lifelong journey with this textbook.

Readers interested in learning how scientific inquisitiveness can fuel breakthroughs in our understanding of cell biology will enjoy the stories of discovery presented in each chapter's "How We Know" feature. Packed with experimental data and design, these narratives illustrate how biologists tackle important questions and how experimental results shape future ideas. In this edition, a new "How We Know" recounts the discoveries that first revealed how cells transform the energy locked in food molecules into the forms used to power the metabolic reactions on which life depends.

As in previous editions, the questions in the margins and at the end of each chapter not only test comprehension but also encourage careful thought and the application of newly acquired information to a broader biological context. Some of these questions have more than one valid

answer and others invite speculation. Answers to all of the questions are included at the back of the book, and many provide additional information or an alternative perspective on material presented in the main text.

More than 160 video clips, animations, atomic structures, and high-resolution micrographs complement the book and are available online. The movies are correlated with each chapter and callouts are highlighted in color. This supplemental material, created to clarify complex and critical concepts, highlights the intrinsic beauty of living cells.

For those who wish to probe even more deeply, *Molecular Biology of the Cell*, now in its sixth edition, offers a detailed account of the life of the cell. In addition, *Molecular Biology of the Cell, Sixth Edition: A Problems Approach*, by John Wilson and Tim Hunt, provides a gold mine of thought-provoking questions at all levels of difficulty. We have drawn upon this tour-de-force of experimental reasoning for some of the questions in *Essential Cell Biology*, and we are very grateful to its authors.

Every chapter of *Essential Cell Biology* is the product of a communal effort: both text and figures were revised and refined as drafts circulated from one author to another—many times over and back again! The numerous other individuals who have helped bring this project to fruition are credited in the Acknowledgments that follow. Despite our best efforts, it is inevitable that errors will have crept into the book, and we encourage eagle-eyed readers who find mistakes to let us know, so that we can correct them in the next printing.

Acknowledgments

The authors acknowledge the many contributions of professors and students from around the world in the creation of this Fifth Edition. In particular, we received detailed reviews from the following instructors who had used the fourth edition, and we would like to thank them for their important contributions to our revision:

Delbert Abi Abdallah, Thiel College, Pennsylvania
 Ann Aguanno, Marymount Manhattan College
 David W. Barnes, Georgia Gwinnett College
 Manfred Beilharz, The University of Western Australia
 Christopher Brandl, Western University, Ontario
 Marion Brodhagen, Western Washington University
 David Casso, San Francisco State University
 Shazia S. Chaudhry, The University of Manchester, United Kingdom
 Ron Dubreuil, The University of Illinois at Chicago
 Heidi Engelhardt, University of Waterloo, Canada
 Sarah Ennis, University of Southampton, United Kingdom
 David Featherstone, The University of Illinois at Chicago
 Yen Kang France, Georgia College
 Barbara Frank, Idaho State University
 Daniel E. Frigo, University of Houston
 Marcos Garcia-Ojeda, University of California, Merced
 David L. Gard, The University of Utah
 Adam Gromley, Lincoln Memorial University, Tennessee
 Elly Holthuisen, University Medical Center Utrecht, The Netherlands
 Harold Hoops, The State University of New York, Geneseo
 Bruce Jensen, University of Jamestown, North Dakota
 Andor Kiss, Miami University, Ohio
 Annette Koenders, Edith Cowan University, Australia
 Arthur W. Lambert, Whitehead Institute for Biomedical Research
 Denis Larochelle, Clark University, Massachusetts
 David Leaf, Western Washington University
 Esther Leise, The University of North Carolina at Greensboro
 Bernhard Lieb, University of Mainz, Germany

Julie Lively, Louisiana State University
Caroline Mackintosh, University of Saint Mary, Kansas
John Mason, The University of Edinburgh, Scotland
Craig Milgrim, Grossmont College, California
Arkadeep Mitra, City College, Kolkata, India
Niels Erik Møllegaard, University of Copenhagen
Javier Naval, University of Zaragoza, Spain
Marianna Patrauchan, Oklahoma State University
Amanda Polson-Zeigler, University of South Carolina
George Risinger, Oklahoma City Community College
Laura Romberg, Oberlin College, Ohio
Sandra Schulze, Western Washington University
Isaac Skromne, University of Richmond, Virginia
Anna Slusarz, Stephens College, Missouri
Richard Smith, University of Tennessee Health Science Center
Alison Snape, King's College London
Shannon Stevenson, University of Minnesota Duluth
Marla Tipping, Providence College, Rhode Island
Jim Tokuhisa, Virginia Polytechnic Institute and State University
Guillaume van Eys, Maastricht University, The Netherlands
Barbara Vertel, Rosalind Franklin University of Medicine and Science, Illinois
Jennifer Waby, University of Bradford, United Kingdom
Dianne Watters, Griffith University, Australia
Allison Wiedemeier, University of Louisiana at Monroe
Elizabeth Wurdak, St. John's University, Minnesota
Kwok-Ming Yao, The University of Hong Kong
Foong May Yeong, National University of Singapore

We are also grateful to those readers who alerted us to errors that they found in the previous edition.

Working on this book has been a pleasure, in part due to the many people who contributed to its creation. Nigel Orme again worked closely with author Keith Roberts to generate the entire illustration program with his usual skill and care. He also produced all of the artwork for both cover and chapter openers as a respectful digital tribute to the "squeeze-bottle" paintings of the American artist Alden Mason (1919–2013). As in previous editions, Emma Jeffcock did a brilliant job in laying out the whole book and meticulously incorporated our endless corrections. We owe a special debt to Michael Morales, our editor at Garland Science, who coordinated the whole enterprise. He oversaw the initial reviewing, worked closely with the authors on their chapters, took great care of us at numerous writing meetings, and kept us organized and on schedule. He also orchestrated the wealth of online materials, including all video clips and animations. Our copyeditor, Jo Clayton, ensured that the text was stylistically consistent and error-free. At Garland, we also thank Jasmine Ribeaux, Georgina Lucas, and Adam Sendroff.

For welcoming our book to W. W. Norton and bringing this edition to print, we thank our editor Betsy Twitchell, as well as Roby Harrington, Drake McFeely, Julia Reidhead, and Ann Shin for their support. Taylere Peterson and Danny Vargo deserve thanks for their assistance as the book moved from Garland to Norton and through production. We are grateful to media editor Kate Brayton and content development specialist Todd Pearson, associate editors Gina Forsythe and Katie Callahan, and media editorial assistant Katie Daloia whose coordination of electronic media development has resulted in an unmatched suite of resources for cell biology students and instructors alike. We are grateful for marketing manager Stacy Loyal's tireless enthusiasm and advocacy for our book. Megan Schindel, Ted Szczepanski, and Stacey Stambaugh are all owed thanks for navigating the permissions for this edition. And Jane Searle's able management of production, Carla Talmadge's incredible attention to detail, and their shared knack for troubleshooting made the book you hold in your hands a reality.

Denise Schanck deserves extra special thanks for providing continuity as she helped shepherd this edition from Garland to Norton. As always, she attended all of our writing retreats and displayed great wisdom in orchestrating everything she touched.

Last but not least, we are grateful, yet again, to our colleagues and our families for their unflagging tolerance and support. We give our thanks to everyone in this long list.

Resources for Instructors and Students

INSTRUCTOR RESOURCES

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Smartwork5

Smartwork5 is an easy-to-use online assessment tool that helps students become better problem solvers through a variety of interactive question types and extensive answer-specific feedback. All Smartwork5 questions are written specifically for the book, are tagged to Bloom's levels and learning objectives, and many include art and animations. Get started quickly with our premade assignments or take advantage of Smartwork5's flexibility by customizing questions and adding your own content. Integration with your campus LMS saves you time by allowing Smartwork5 grades to report right to your LMS gradebook, while individual and class-wide performance reports help you see students' progress.

Interactive Instructor's Guide

An all-in-one resource for instructors who want to integrate active learning into their course. Searchable by chapter, phrase, topic, or learning objective, the Interactive Instructor's Guide compiles the many valuable teaching resources available with *Essential Cell Biology*. This website includes activities, discussion questions, animations and videos, lecture outlines, learning objectives, primary literature suggestions, medical topics guide, and more.

Coursepacks

Easily add high-quality Norton digital media to your online, hybrid, or lecture course. Norton Coursepacks work within your existing learning management system. Content is customizable and includes chapter-based, multiple-choice reading quizzes, text-based learning objectives, access to the full suite of animations, flashcards, and a glossary.

Test Bank

Written by Linda Huang, University of Massachusetts Boston, and Cheryl D. Vaughan, Harvard University Division of Continuing Education, the revised and expanded Test Bank for *Essential Cell Biology* includes 65–80 questions per chapter. Questions are available in multiple-choice, matching, fill-in-the-blank, and short-answer formats, with many using art from the textbook. All questions are tagged to Bloom's taxonomy level, learning objective, book section, and difficulty level, allowing instructors to easily create meaningful exams. The Test Bank is available as downloadable PDFs or Word files from www.norton.com/instructors.

Animations and Videos

Streaming links give access to more than 130 videos and animations, bringing the concepts of cell biology to life. The movies are correlated with each chapter and callouts are highlighted in color.

Figure-integrated Lecture Outlines

All of the figures are integrated in PowerPoint, along with the section and concept headings from the text, to give instructors a head start creating lectures for their course.

Image Files

Every figure and photograph in the book is available for download in PowerPoint and JPG formats from wwnorton.com/instructors.

STUDENT RESOURCES

digital.wwnorton.com/ecb5

Animations and Videos

Streaming links give access to more than 130 videos and animations, bringing the concepts of cell biology to life. Animations can also be accessed via the ebook and in select Smartwork5 questions. The movies are correlated with each chapter and callouts are highlighted in color.

Student Site

Resources for self-study are available on the student site, including multiple-choice quizzes, cell explorer slides, challenge and concept questions, flashcards, and a glossary.

CHAPTER 4 Protein Structure and Function 117

PANEL 4-1 A Few Examples of Some General Protein Functions 118

PANEL 4-2 Making and Using Antibodies 140

TABLE 4-1 Some Common Functional Classes of Enzymes 142

How We Know: Measuring Enzyme Performance 144

TABLE 4-2 Historical Landmarks in Our Understanding of Proteins 160

PANEL 4-3 Cell Breakage and Initial Fractionation of Cell Extracts 164

PANEL 4-4 Protein Separation by Chromatography 166

PANEL 4-5 Protein Separation by Electrophoresis 167

PANEL 4-6 Protein-Structure Determination 168

CHAPTER 5 DNA and Chromosomes 173

How We Know: Genes Are Made of DNA 173

How We Know: DNA Is the Genetic Material 173

How We Know: DNA Replication Is Semiconservative 173

How We Know: DNA Replication Is Bidirectional 173

How We Know: DNA Replication Is Discontinuous 173