

Preface

In preparation for this revision, we invited instructors who teach introductory biology for non-majors students to meet with us and discuss the goals of their course. Nearly always, their goal was something like this: "To familiarize students with the way that science works and provide them with the tools they need to make well-informed choices as consumers and as voters." This makes sense. Most students who use this book will not be biologists, and many will never take another science course. Yet they certainly need to make decisions that require an understanding of the process of science and of basic biological principles.

We provide these future decision-makers with an accessible introduction to science. Throughout this edition, we emphasize that biology is not a body of facts, but rather an ongoing endeavor carried out by a diverse community of people. We underscore this point by describing current research and providing photos and videos of the scientists who do it. We explain not only what is known, but also how it was discovered, and how our understanding has changed over time. At the same time, we highlight the role of longstanding scientific theories, most notably the theory of evolution, which is a unifying theme in this book.

We revised every page of text to make it as straightforward and clear as possible, keeping in mind that English is a second language for many students. We added new tables to summarize important points and streamlined figures to eliminate unnecessary complexity.

CHANGES FOR THIS EDITION

Links to Key Concepts New to this edition are tools that link concepts within and between chapters. These tools reinforce the concept that each new idea in science rests on a foundation of other ideas.

Every chapter introduction has a section-by-section list of *Key Concepts*, each with a simple title. We repeat the titles at the top of appropriate text pages as ongoing reminders of the chapter's conceptual organization. A brief list of *Links to Earlier Concepts* helps remind students of relevant concepts that they encountered in previous chapters. For instance, students are advised that before reading about neural function, they may wish to scan an earlier chapter section on active transport. Icons are repeated in text page margins.

Media-Integrated Summaries We have always offered a wealth of online media for students. With this edition, we have made it easier for students to determine which online material supports each section. We have integrated information about the relevant animations, tutorials, and videos into the section summaries.

Chapter-Specific Changes Every chapter was extensively revised for clarity; this edition has 350 new photos and almost 170 new or updated figures. A page-by-page guide to new content and figures is available upon request, but we summarize the highlights here.

- **Chapter 1, Invitation to Biology** New essay about discovery of new species. Greatly expanded coverage of critical thinking and the process of science.
- **Chapter 2, Life's Chemical Basis** Chemistry of bonding revised to include electronegativity; new pH art.
- **Chapter 3, Molecules of Life** New art demonstrating protein structural organization; other art reorganized.
- **Chapter 4, Cell Structure and Function** Microscopy section updated; plasma membrane art simplified; new focus section on biofilms; cytoskeleton section reworked.
- **Chapter 5, Ground Rules of Metabolism** Energy and metabolism sections reorganized and rewritten; much new art, including molecular model of active site.
- **Chapter 6, Where It Starts—Photosynthesis** New essay on global warming emphasizes role of photosynthesis in the cycling of atmospheric carbon dioxide.
- **Chapter 7, How Cells Release Chemical Energy** All art showing metabolic pathways revised and simplified.
- **Chapter 8, How Cells Reproduce** Updated micrographs of mitosis; cancer section updated.
- **Chapter 9, Meiosis and Sexual Reproduction** Opener revised to include Red Queen hypothesis; new essay on evolutionary connection between mitosis and meiosis.
- **Chapter 10, Observing Patterns in Inherited Traits** Updated essay on cystic fibrosis; new figures for coat color genetics in dogs, and environmental effects on *Daphnia* phenotype.
- **Chapter 11, Chromosomes and Human Inheritance** Chapter reorganized; expanded discussion and new figure on the evolution of chromosome structure.
- **Chapter 12, DNA Structure and Function** New opener essay on pet cloning; adult cloning section updated.
- **Chapter 13, From DNA to Protein** New, simplified figures for transcription and translation.
- **Chapter 14, Controls Over Genes** Chapter reorganized; eukaryotic gene control section rewritten; updated X chromosome inactivation photos; new lac operon art.
- **Chapter 15, Studying and Manipulating Genomes** Chapter reorganized; gene library and PCR section rewritten; genetic engineering sections updated and expanded.
- **Chapter 16, Evidence of Evolution** Heavily revised; reorganized with Chapter 17 to emphasize evidence-based thinking. Revised opener essay on evidence leading to inference; updated geologic time scale; comparative morphology section rewritten with new figure; comparative embryology photo series added; cladistics section rewritten; new, updated tree of life.
- **Chapter 17, Processes of Evolution** Heavily revised; reorganized with chapter 16 to emphasize evolution as a process. Revised rats/warfarin essay; sections on sexual selection, reproductive isolation, sympatric speciation, and macroevolution rewritten; examples added: directional selection in the peppered moth, reproductive isolation in stalk-eyed flies, genetic drift in flour beetles, mechanical isolation in sage, sympatric speciation in palms, and ring species.
- **Chapter 18, Life's Origin and Early Evolution** Information about origin of agents of metabolism updated. New discussion of ribozymes as evidence for RNA world.