

PREFACE

WOW! A new title, a new design, and a meticulously reviewed and revised second edition are here in *Biology: Understanding Life*, second edition. Our title has changed from our first edition title, *Biology Today*. My name has changed too—in fact, so much has changed with our second edition that you may only recognize the clear, concise, and accurate writing for which so many of you complimented us. We thank you for those compliments.

This textbook is written for nonmajors college students or for mixed groups of majors and nonmajors students who may have no background in biology. Therefore, I have organized and written the text presupposing no prior knowledge. That is also the reason that this general biology book has a human focus—some or most of your students may be “science-shy” but will still find the human body inherently interesting. But *Biology: Understanding Life* does not stop there—it includes comprehensive attention to all the topics general biology courses most often address.

An Overview of the Revision

The many professors we surveyed and met with commented that the writing approach and style of the first edition worked well for their students. They appreciated the complete explanation of concepts, which were placed in a context with which students could relate and construct meaning. I have retained that approach and style and, working in conjunction with an outstanding Mosby development team, have added other features to expand

our student focus and help students learn in ways in which *they* suggest will help. Two new student-oriented features are:

- ▶ *In-text glossary with pronunciation guide of bold-faced terms.* All bold faced terms are defined, and all difficult-to-pronounce scientific words have a pronunciation guide. In addition to this important new feature, special attention has been given to defining all new and unfamiliar words within the narrative to aid student understanding. Often, tables or charts help by listing important words, such as the names of hormones or sexually-transmitted diseases, and then listing their definitions or descriptions along with other pertinent information. A glossary of important terms and their definitions is also included in an appendix at the back of the book.
- ▶ *Answers to student questions.* This special feature was developed by surveying over 1000 students across the country enrolled in introductory biology courses for nonmajors. We asked them to list questions that bothered, intrigued, or otherwise interested them. From their many responses, we extracted the most frequently asked questions that fit within the content areas of our 38 chapters, including questions on evolution, AIDS, drug testing, birth control, ethical guidelines in genetic engineering, and the use of animals in research. We titled this feature “Just Wondering . . .” and think that students will be drawn to the questions of their peers and will be interested in the answers.



While talking to and surveying students, we did not forget the professors! They told us that we needed to expand our discussions of biotechnology and genetic engineering, and should include more information on sexually transmitted diseases, cancer, and drugs. They asked that we move the information on cell division from its position at the beginning of the book to a later chapter dealing with DNA. Chapter 18 (DNA, Gene Expression, and Cell Reproduction) reflects this move. Also, they asked that we increase our focus on the methods of science, emphasizing to students, as Harvard paleontologist Stephen J. Gould once put it, that “scientists reach conclusions for the damndest of reasons: intuitions, guesses, and redirections after wild goose chases . . .” For this reason, we have modified our approach to scientific methodologies in Chapter 1, retaining our explanation of classical scientific methods, but pointing out that step-wise methods are only one way in which scientists do their work. In addition to these revisions in Chapter 1, in response to professors’ comments, we have included the following:

- *Twenty essays on “How Science Works.”* These essays focus on the applications, processes, and methodologies of science as well as on the tools and discoveries of scientists. The topics are diverse and include “Is There Bias in Science?” “Tracking the HIV Epidemic,” “DNA Sequencing,” “The Evolution of Food Guides,” and “The Merging of Sciences: Using the Theory of Plate Tectonics to Understand Evolution.”
- *A new chapter titled “Biotechnology and Genetic Engineering.”* Months of work went into the development of this chapter, and included the help of molecular biologists and biological artists to help provide a visually instructive chapter that included accurate and up-to-date content written for the nonmajor. This chapter begins with the history of classical biotechnology so that students can better understand the context of the work that is being done today at the molecular level. After describing natural gene transfer among bacteria, the chapter describes human-engineered gene transfer using eukaryotes. The chapter ends with an extensive discussion of the applications of molecular biotechnology, such as the production of proteins for therapeutic use, the development of genetically engineered vaccines, gene therapy, and food biotechnology.
- *Inclusion of material on sexually transmitted diseases, cancer, and drugs.* First, a listing of com-

mon sexually transmitted diseases (STDs) and pertinent information students should know about them is presented as a table in Chapter 21, Sex and Reproduction. Then, descriptive material about STDs, including discussions of the organisms that cause each disease, is incorporated into Chapter 25 (Viruses and Bacteria), Chapter 26 (Protists and Fungi), and Chapter 29 (Invertebrates: Patterns of Structure, Function, and Reproduction). Mutations and the molecular biology of cancer is included in Chapter 20 (Human Genetics). In addition, Chapter 13 (Nerve Cells and How They Transmit Information) now includes the following topics: How Drugs Affect Neurotransmitter Transmission, Drug Addiction, and Psychoactive Drugs and Their Effects.

Revision of the Art Program

Many professors commented that a revision of our textbook would benefit by a careful review of the art program. Therefore, we and our expert reviewers analyzed each illustration for accuracy, coherence and flow with the manuscript, continuity in the use of color, and accuracy and helpfulness of the accompanying legends. As a result, over 80% of the illustrations in this book have been re-rendered. In addition to a dedication to content accuracy, the following criteria were used as guiding principles as the art program was reviewed, modified, and reconceptualized:

- Illustrations and photographs should be used to make abstract concepts more concrete and to enhance student understanding.
- The content of the narrative and the art should match—concepts, processes, or structures should not be presented in the art that are not discussed in the narrative. Additionally, the narrative and the art should be integrated in a meaningful way.
- Illustrations that depict processes should use a clear, simple layout. For complex processes, numbered steps should be used.
- Legends should be a helpful guide to the illustration. The legend should not introduce material that is not in the text.
- Art should be visually appealing so that students are prompted to “take a look.”
- Color should be consistent among structures. For example, students should always see cytoplasm depicted in a particular color, DNA in another, and cell membranes, in a third. This consistency

helps students to visually recognize structures and to more easily understand the illustrations.

We hope that you are as pleased with our new art program as are we and our reviewers. Not only do we think that the art program in this textbook is an excellent learning tool, we think that the new design of *Biology: Understanding Life* creates an exceptionally inviting look for students.

Organization of the Book

We have made only slight modifications in the organization of *Biology: Understanding Life* based on feedback from professors. In general, this textbook is organized in a traditional "micro" to "macro" approach, and is divided into seven parts encompassing 38 chapters. Although the chapters have been placed in a particular sequence, special care has been taken to write the chapters so each can stand alone, affording the professor the opportunity to restructure the sequence of the book to meet the needs of his or her students and classes.

Part One introduces students to scientific methodologies and the unifying themes of biology. A chapter on the basics of chemistry completes this introductory part. *Part Two* discusses the structure of cells and the various ways in which they capture, use, and store energy. *Part Three* uses the human body as a vertebrate example to discuss systems. *Part Four* begins with a discussion of DNA, gene expression, and cell reproduction. This molecular foundation leads to the study of Mendelian genetics and human genetics. *Part Four* ends with a discussion of sex, reproduction, and development. Students then study evolution in *Part Five*, beginning their study with the scientific evidence of evolution and concluding it with a discussion of origins and the evolution of the five kingdoms of life. After describing viruses, *Part Six* discusses the anatomy and physiology of bacteria, protists, fungi, plants, and animals. It concludes with a discussion of biotechnology and the roles these organisms (including humans) play in genetic engineering. The concluding section of the book, *Part Seven*, begins with two chapters that delve into animal behavior. The next four chapters describe populations, communities, ecosystems, and biomes, respectively. The final chapter of the book approaches the topic of "environmentalism" and helps students understand the interactions between humans and the environment that are so crucial today.

Within this organization, the chapter changes from the first edition are:

- ▶ The first edition Chapter 3 (Cell Structure and Function) and Chapter 4 (Cell Membranes) have been merged, resulting in the second edition Chapter 3 (Cell Structure and Function). Overlapping material regarding cell membranes has been revised and condensed in the new chapter.
- ▶ The first edition Chapter 5 (Cell Division) has been incorporated with Chapter 24 (The Molecular Basis of Inheritance), resulting a single chapter in the second edition: Chapter 18 (DNA, Gene Expression, and Cell Reproduction). This chapter has also been relocated.
- ▶ Chapter 13 (Nerve Cells and How They Transmit Information) now includes a discussion of psychoactive drugs.
- ▶ The sequence of chapters in Part 4, How Humans Reproduce and Pass on Biological Information (Part 5 in the first edition) has been changed. Chapter 18 (DNA, Gene Expression, and Cell Reproduction) now opens this part (rather than closes it) to lay groundwork for the rest of the chapters. Also, Chapter 19 (Patterns of Inheritance) and Chapter 20 (Human Genetics) are placed before Chapter 21 (Sex and Reproduction) and Chapter 22 (Development Before Birth) rather than after these chapters. Chapter 20 now includes a discussion of the molecular biology of cancer in the context of human genetics.
- ▶ Chapter 26 (The Evolution of the Five Kingdoms of Life) and Chapter 27 (Human Evolution) now comprise a single chapter in the second edition: Chapter 24 (The Evolution of the Five Kingdoms of Life). The overlapping content of the two first-edition chapters has been revised and merged, resulting in a more coherent single chapter. No content has been sacrificed, however, in this new, longer chapter.
- ▶ Chapter 25 (Viruses and Bacteria), Chapter 26 (Protists and Fungi), and Chapter 29 (Invertebrates: Patterns of Structure, Function, and Reproduction) have added information regarding sexually transmitted diseases. This information is included within these chapters so that students can first gain an understanding of the types of organisms that cause these diseases before studying the diseases themselves.
- ▶ Chapter 31 (Biotechnology and Genetic Engineering) is a new chapter. It is included at the end of Part 6, which describes viruses and the

five kingdoms of organisms, some of which are used in genetic engineering. In this way, students first study bacterial structure, for example, before they are introduced to the use of bacterial plasmids in gene transfer. They also study plants and animals before reading information regarding the ways in which they are involved in applications of genetic engineering.

All these chapter changes result in a textbook that is now composed of 38 chapters instead of the former 40 chapters but that includes the topics addressed in the first edition and more. Overlap and redundancy have been omitted, but additions of new features such as the in-text glossary, "How Science Works" and "Just Wondering . . ." boxes, and additional information has resulted in some chapters being lengthened.

Chapter Organization and Features

The chapters of *Biology: Understanding Life* have an organization that is designed to engage student interest and help students learn. Each chapter opens with a photo and accompanying vignette that are eye-catching, thought-provoking, and interesting. Together, the photo and vignette lead the student directly into the chapter content. Sometimes these vignettes explain something that may already be familiar to the student in a context that relates to the chapter material. For example, Chapter 17 (Hormones) begins with a vignette about the dangers of anabolic steroids. Other vignettes focus on unusual phenomena that nevertheless have a biological explanation. Chapter 12 (Excretion) opens with a discussion about why some species of turtles "cry" and how this crying is related to salt and water balance.

Opposite the opening photo page are a listing of four key concepts discussed within the chapter, and a short outline (using the first-level and second-level headings only) of the chapter content. The key concepts and outlines act as advance organizers for students, providing them with a roadmap and conceptual framework from which to begin their reading and study.

Within each chapter are concept summaries that provide synopses of the content as key points in the chapter. They are short (usually no more than three sentences long) and effectively review preceding material. Students will find them valuable when reviewing for examinations.

Two types of boxed essays are incorporated within chapters of *Biology: Understanding Life*. A stu-

dent-oriented "Just Wondering . . ." box is included in each chapter. As mentioned previously, these boxes were developed from questions that general biology students asked when we surveyed students. Each box is placed near the content with which it fits or expands upon best. The topics are diverse and interesting. We thank the more than 100 students who helped with this feature.

In addition to "Just Wondering . . ." boxes, we have included 20 "How Science Works" boxes. These essays are an outgrowth of professors' desire to focus on scientific processes and methodologies. Again, the topics are diverse and interesting. They focus on the applications, processes, and methodologies of science as well as on the tools and discoveries of scientists. We hope this feature will answer well what you asked for . . . and more.

Each chapter closes with a summary that lists the key concepts in the preceding content. Two categories of questions follow. Knowledge and comprehension questions comprise the first category. Knowledge-level questions center on recall of information. Comprehension-level questions go further and ascertain whether a student understands the information. Critical thinking questions make up the second category of questions. Critical thinking questions are of four types: application, analysis, synthesis, and evaluation. The Instructor's Manual identifies each question in the textbook by chapter number and lists its specific question type for each category. The answers to the questions are found in Appendix A of the textbook.

Along with Appendix A, three other appendices are found in the back of the textbook. Appendix B is a table of classification of the five kingdoms of life. Because of the human focus of this book, mammals are classified through class, and the birds and reptiles are classified through order. Appendices C and D are new to this edition. Appendix C is the Periodic Table of Elements (which has been deleted from Chapter 2). Appendix D is Unit Conversion and will help students with measurements in various versions.

The glossary provides the pronunciation, and derivation for key terms in the textbook. It also gives the chapter in which each term is defined. This glossary is complete and easy to use and will help students immeasurably as they move through the text.

Ancillaries

Outstanding supplements enhance the teaching and learning.



Exploring Biology Today Laboratory Manual

Ann Wilke

(0-8151-9341-6)

This laboratory manual features 30 two-hour experiments based on the learning cycle. This method of investigation allows students to manipulate objects, draw conclusions, and apply knowledge based on observation.

Instructor's Manual to Accompany Exploring Biology Today

(0-8151-9342-4)

This resource clearly shows lab instructors and teaching assistants *how* to foster critical-thinking

skills in their students. In addition, it offers direction in setting up materials for successful completion of experiments.

Biology Newsletter*

(0-8151-1833-8)

Offering great material to supplement lectures, this valuable bi-annual update features expert opinions on late-breaking and controversial topics in biology.