

Preface

Essentials of Biology was written to engage non-major students in the study of biology and inspire them to learn more. It continues to be traditional in its approach and organized around the major concepts of biology. However, the book is succinct enough to be appropriate for a one semester course.

Three primary goals guided the revision of *Essentials of Biology*, Second Edition:

1. build upon the strengths of the first edition,
2. increase student awareness of evolution and why it is a central concept of biology,
3. add more applications to enhance the relevancy of the content for students.

Strengths of *Essentials of Biology*

Content Organization Writing Style Illustrations Pedagogy

The content and organization of *Essentials of Biology* continues to be solid—accurate and up-to-date, and logical. Equally important, the text reaches out to the student because it has a conversational writing style and an exciting illustration program. The design and illustration program of the book is appropriate for those who are accustomed to being visually stimulated, and instructors can easily

use these same great illustrations in lecture or as part of assignments.

"Essentials of Biology is an outstanding textbook for the non-major. The material is clear and specific, but not intimidating. The text contains numerous graphics, diagrams, etc. to enhance student-learning. This text invites students to open it and read!"

Barbara J. Salvo
Carthage College

The *Essentials of Biology* Learning System also helps beginning biology students by guiding them through each chapter. The chapter-opening page lists the key concepts to give students an overview of

the chapter. The opening vignette captures students' interest and encourages them to begin their study of the chapter. Distributed throughout each chapter are *Check Your Progress* questions designed to foster confidence as readers proceed through the chapter. The chapter end matter gives students an opportunity to review the chapter and test themselves on how well they understand the concepts. *Thinking Scientifically* questions allow students to apply their knowledge to concrete scientific explorations. Most chapters now end with a *Bioethical Issue* that can be used as a basis for class discussion.

Four contributors joined me in revising *Essentials of Biology*, and their varied backgrounds and extensive teaching experience

further enhanced the strengths of the book. Andrew Baldwin, *Mesa Community College*, revised the evolution and ecology chapters. Rebecca Roush, *Sandhills Community College*, revised Chapters 22-26 of the animal structure and function chapters. Stephanie Songer, *North Georgia College and State University*, revised the diversity of life and several animal structure and function chapters. Michael Thompson, *Middle Tennessee State University*, revised the cell, genetics, and plant chapters.

We worked collaboratively to improve this new edition, and through my review of every chapter, the book retains the hallmark features of a Mader text: accurate and current content, logical organization of chapters, clear writing, well-developed visuals, and a strong pedagogical system. For more information on the features of this book, see the Guided Tour on pages vii-xi.

Increased Evolution Coverage

For several years now, biology has been undergoing a revolutionary change. Molecular biology is indeed wedded to evolution and the binding together of these two fields of biology has opened up a vista into the evolutionary relationships of organisms never before possible. With the help of nucleic acid sequencing, we can now more confidently reconstruct the evolutionary history of life. *Essentials of Biology* makes full use of our newfound knowledge and relates the evolutionary consequences for the broadest categories, the domains, and for each of the kingdoms.

Being good educators we realized that students need a firm foundation in the principles of evolution in order to fully appreciate the phylogenetic data now available to biologists. Reviewers will find a renewed emphasis on evolution that begins in the first chapter with a new section devoted to evolutionary principles and a generalized tree of life. The evolution chapters in Part III, *Evolution*, received special attention before Part IV, *Diversity of Life*, specifically

discusses the evolution of various groups and presents new evolutionary trees for protists, plants, fungi, and animals. Increased evolution coverage is also weaved throughout this edition, and a *Thinking Scientifically* question that pertains to evolution is presented at the end of each chapter (identified with an icon, left) to help students realize that evolution is pertinent to all aspects of biology.

"This text clearly presents topics in biology in such an interesting fashion that it is sure to intrigue and fascinate students. The text is also written in such a way as to be quite understandable by the non-science student."

Kathleen Pelkki,
Saginaw Valley State University



Additional examples of the increased evolution coverage are noted below in the overview of changes.

Relevancy of Biology

More applications have been added to the second edition of *Essentials of Biology* to increase the relevancy of the text. In reviews, instructors emphasize the need to relate the concepts of biology to students' lives. Such relevant examples help students understand the concepts, and increase their chances of remembering the concepts.

Each chapter opens with a brief story that relates the biological concepts of that chapter to something of interest to students. For example, Chapter 2 introduces chemistry by discussing how exposure to extreme levels of radiation can cause sunburn, hair loss, or cancer. Chapter 25 discusses saturated, unsaturated, and trans fats to open the nutrition chapter.

Most chapters also end with a Bioethical Issue; a brief reading about an ethical issue related to biology that confronts our society. Examples of topics covered include cloning, global climate change, water pollution,

health risks associated with certain plastics, gene therapy, and blood doping.

Additional examples of relevancy are given below in the overview of changes.

Overview of Changes to *Essentials of Biology*, Second Edition

Chapter 1 A View of Life

This chapter previews the text by discussing the characteristics of life, principles of evolution, organization of the biosphere, and the scientific process. An expanded section on evolution including a generalized tree of life, is new to this edition. The scientific process includes a new example of a controlled experiment that is more applicable to students' lives.

Part I The Cell

This part was revised to emphasize the dynamic nature of cells. Chapter 3, *The Organic Molecules of Life*, has been enriched with new references to health concerns including high-fructose drinks, trans fats in processed foods and the abuse of steroids to gain muscle mass. Chapter 5, *The Dynamic Cell*, has been reorganized to place enzymatic reactions next to the discussion of metabolic pathways. In Chapter 6, *Energy for Life*, the diversity of photosynthetic process is explained as adaptations to different environments.

New bioethical issues occur in this part including *Human Cloning*, *Arsenic in Drinking Water*, and *Are Carbon Offset Credits Effective?*

Part II Genetics

This part has been updated to be more applicable to students' everyday lives. In Chapter 9, *Sexual Reproduction*, the importance of meiosis for the generation of variations so necessary to evolution is stressed. Chapter 11, *DNA Biology and Technology*, now contains a new illustration (Fig. 11.9) to introduce the topic of protein synthesis. The discussion of genomics and bioinformatics has been moved from Chapter 13 to this chapter. The Human Genome Project is reviewed, and the current emphasis on genomic variation between individuals is also addressed. Further, the contributions of genomics to our knowledge of evolutionary ties between species is discussed. In Chapter 12, *Gene Regulation and Cancer*, an improved section on the genetics of cancer is supported by new Figure 12.15.

New bioethical issues occur in this part including *Selecting the Sex of Your Child*, *Should BPA be Banned?*, and *Gene Therapy Trials*.

Part III Evolution

This part is much improved by current examples of the evolutionary process. In Chapter 14, *Darwin and Evolution*, Alfred Russell Wallace's contribution to Darwin's theory is emphasized, and Darwin's theory is better explained. In Chapter 15, *Evolution on a Small Scale*, an improved discussion of a Hardy-Weinberg equilibrium is supported by a new figure. Examples of genetic mutations have been updated by a discussion of SNPs (single nucleotide polymorphisms). Figures 15.10-15.11, which describe the different types of natural selection, have been clarified and revised. Chapter 16, *Evolution on a Large Scale*, contains two new sections: 16.2 is now a discussion of the fossil record, and 16.3 now gives a review of systematics that includes an improved discussion of cladistics and its relationship to Linnaean classification.

"I think the revisions made so far and the process of updating this textbook will continue to make it one of the sought after texts for general biology."

Bo Sosnicki, Piedmont Virginia Community College

Part IV Diversity of Life

This part has been updated to include a more comprehensive look at the evolutionary relationships of organisms. In Chapter 17, *The First Forms of Life*, both the origin of the first cell and the origin of the eukaryotic cell are now included. Chapter 18, *Land Environment: Plants and Fungi*, has been thoroughly revised to include a new evolutionary tree of plants, and a discussion that traces their evolution from an algal ancestor and emphasizes five significant events as they became fully adapted to land. Chapter 19, *Both Water and Land: Animals*, now includes a new evolutionary tree of animals and a discussion that traces their evolution from an ancestral protist. The tree emphasizes number of germ layers, type of symmetry, and type of embryonic development. Human evolution, which is in this chapter, was updated to include the new designation, hominins, which also includes the chimpanzees.

Part V Plant Structure and Function

Chapter 20, *Plant Anatomy and Growth*, and Chapter 21, *Plant Responses and Reproduction*, were revised to make the material more student friendly and to emphasize the specific adaptations of flowering plants that have resulted in their great success on land.

Part VI Animal Structure and Function

Various applications and analogies have been inserted and more material was added to selected topics. For example, in Chapter 24, *The Maintenance Systems*, digestive enzymes are reviewed in a new section. In Chapter 26, *Defenses*

Against Disease, the new terms “acquired immunity” and “innate immunity” are introduced. The emphasis on homeostasis is maintained in this part, and new applications have been provided to enliven the discussion. The bioethical issues have been updated and expanded.

Part VII Ecology

The principles of ecology are more thoroughly reviewed in this section. The interplay between ecology and evolution is emphasized because adaptations are often a response to ecological factors. In Chapter 32, *Human Impact on the Biosphere*, the negative human impacts on the environment are counter balanced by an expanded section that shows how humans can foster sustainability.

What's New to This Edition

Increased Evolution Coverage

- Chapter 1 now introduces students to the principles of evolution and includes a generalized tree of life. The process of science contains a more applicable example of a controlled study.
- Plant and animal biology now begin with evolutionary trees based on nucleic acid sequencing and emphasizing the innovations that have occurred since they evolved from protistan ancestors.
- Thinking Scientifically questions that pertain to all aspects of evolution have been added and are identified with an icon.



Improved Genetics

The relationship between genetics and cancer is highlighted and a reorganization has resulted in expanded coverage of genomics and bioinformatics as they apply to student lives.

Expanded Ecology

The negative impact of human activities on the environment is balanced by a new section on sustainability that gives examples of ways humans can and do contribute to the sustainability of the planet.

Additional Applications

Many new and/or improved applications and analogies have been added to the text. They will help students relate all aspects of biology to their lives and the world around them.



CONNECT

McGraw-Hill CONNECT Biology is a web-based assignment and assessment platform. Instructors can deliver assignments, quizzes, and tests easily online. Students can practice important skills at their own pace and on their own schedule.

Enhanced Instructor Presentation Tools

All line art figures in *Essentials of Biology*, Second Edition are available to instructors for presentation purposes in an easy-to-use table of assets. Included are enhanced image PowerPoints, (including editable art, tables, and photos), lecture PowerPoints with animations, animation PowerPoints, as well as labeled and unlabeled JPEG images. With the help of a content expert, figures have been split or stepped out as necessary to ensure optimal quality during presentations.

Electronic Books

If you or your students are ready for an alternative version of the traditional textbook, an innovative and inexpensive electronic textbook is available for *Essentials of Biology*, Second Edition. Smart, interactive, searchable, and portable, the electronic book comes with a powerful suite of built-in tools that allow detailed searching, highlighting, note taking, and student-to-student or instructor-to-student note sharing. In addition, relevant animations and videos are integrated into the textbook content for a true multimedia learning experience.