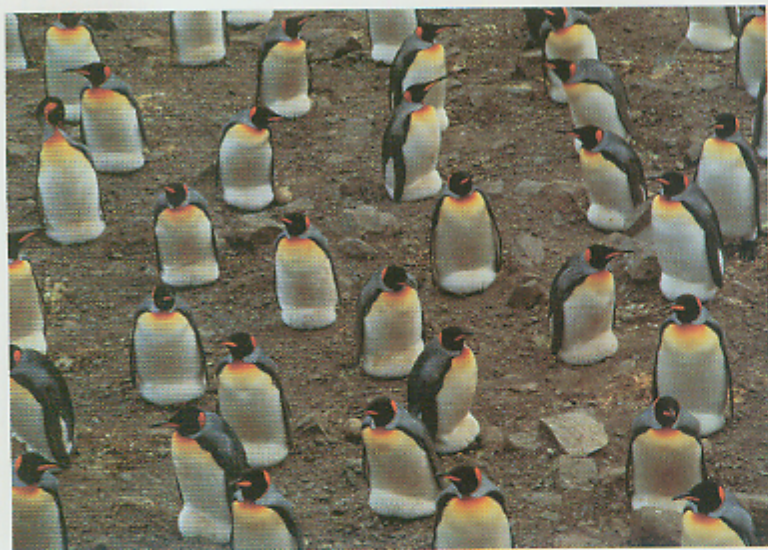




Today, understanding the concepts of biology and their connections to our lives is more important than ever. Whether we're concerned with our own health or the health of our planet, a familiarity with biology is essential. This basic knowledge and an appreciation for how science works have become elements of good citizenship in an era when informed evaluations of health issues, environmental problems, and applications of new technology are critical.

The "connections" to which the title of this book refers include many such practical applications of biology—and go beyond them. Biology has important connections with the other natural sciences and with the humanities and social sciences as well. And the study of life has no coherence without an understanding of the connections among the different areas of biology and an appreciation of the grand unifying theme of evolution. From its first edition, the hallmarks of this book have included an emphasis on connections within biology and between biology and other fields, along with a focus on engaging students from a wide variety of majors. In this fourth edition, we have increased the emphasis on connections to our everyday world in both the chapter opening essays and the newly labeled "Connection" modules.

We could not have hoped to meet our ambitious goals for this book without extensive discussions with teaching colleagues throughout the world and feedback from many of the hundreds of instructors and hundreds of thousands of students who have used our earlier editions. We have been gratified by their enthusiastic responses and have paid close attention to their thoughtful suggestions for improvement. For this edition, we set out to create a book that would be an even more effective tool for learning biology. In addition, we worked to ensure that the book would integrate smoothly with the rich program of supporting materials on the CD-ROM and web site that accompany the book.

How can we help students learn—and enjoy—biology? How can we help instructors teach biology? Our responses to these questions are reflected in the teaching strategies we

bring to the book. In this new edition, we build on the approach that has been so successful in earlier editions. Below we describe our main teaching strategies as they are embodied in *Biology: Concepts & Connections*, Fourth Edition.

Focus Students on the Main Ideas of Biology

Biology is a vast subject that gets bigger every year, but a general biology course is still only one or two terms long. In that brief time, we explore all of life, from molecules to ecosystems, while also trying to share the excitement of important research breakthroughs. For beginning biology students confronting this avalanche of information, it can seem as important to memorize all the scientific terms and facts as it is to master and apply the major ideas. This situation changes, however, when students acquire a framework of key biological concepts into which they can fit the many new things they learn. It is this framework of concepts that will serve them long after they have forgotten specific facts and terms.

Concept Modules *Biology: Concepts & Connections* was the first introductory biology textbook to use concept modules to help students recognize and focus on the main ideas of each chapter. The heading of each module is not simply a topic name but a carefully crafted statement of a biological concept. Printed in large type, each concept heading serves as a focal point for a module, and all of the module's text and illustrations converge on that concept with explanation and, often, evidence. For example, "Sensory receptor cells convert stimuli into electrical energy" announces a key concept in Chapter 29 (Module 29.2). The text and illustrations introduce the general principles of sensory reception and transduction, using the human sense of taste as an example. In this and other modules, we integrate the words and pictures to an unprecedented degree: The text walks the student through the illustrations, just as an instructor would do in class. In teaching a sequential process, such as the functioning of the receptor cells of the taste buds (Figure 29.2A), we number the steps in the text to correspond to numbered steps in the figure. The synergy between a module's verbal and graphic components transforms the concept heading into an idea with meaning to the student.

Integrated Media Printed in red immediately following the text in many modules are one or more references to interactive Activities and Thinking as a Scientist investigations to be found on the student CD-ROM and web site. In this edition, we provide the titles of the activities on the text page.

Checkpoint Questions At the end of every module is a checkpoint question that reinforces the module's message. These questions encourage students to test themselves as they proceed through a chapter. Some questions simply ask the student to restate the main concept or a corollary; others test understanding of the supporting evidence or ask the student to connect the concept to another concept in the book; still others require the student to carry out a calculation using information in the module. Feedback is provided on the spot: The answer is printed upside down beneath the

question. These questions are intended to make students think about the material they are studying and to build their confidence. In summary, each module provides everything a student needs to master a concept.

General Headings How do we help students see the connections between concepts? We group the modules under prominent general headings, printed on orange bars, which form an overarching framework for the chapter. Students first see these general headings and subordinated concepts and connections in the outline at the beginning of a chapter. At the end of the chapter, the general headings organize the Chapter Summary. To provide further help in tying concepts together, we make frequent use of overviews, reviews, and explanatory transitions at the beginnings or ends of modules. The modules of each chapter tell a continuous story.

Relate Biological Concepts to Everyday Life

Connection Modules Students are more motivated to study biology when they can connect it to their own lives and interests—for example, to health issues, economic problems, environmental quality, ethical controversies, and social responsibility. In this edition, yellow “Connection” banners mark the numerous application modules that go beyond the core biological concepts. You can preview the Connection module headings on the front endpapers of the book.

Introductory Essays In this edition, the illustrated essays that open the chapters vary in approach. Over half of these essays are new, and many of them discuss topics that relate to daily life. For example, Chapter 10, “Molecular Biology of the Gene,” now opens with an essay on herpes infections. Other introductory essays continue our earlier tradition of featuring a nonhuman organism and describing how it is adapted to its environment. One example is our new essay for Chapter 13, “How Populations Evolve,” which focuses on the blue-footed boobies of the Galápagos Islands. Our hope is that essays like this one will nurture students’ appreciation for biological diversity.

Science, Technology, and Society Questions At the end of each chapter, one or more “Science, Technology, and Society” questions encourage students to use the concepts they have learned in thinking about various social and environmental issues.

Adapt This Book to Fit Your Course

Though a biology textbook’s table of contents must be linear, biology itself is more like a web of related concepts without a single starting point or prescribed path. Courses can navigate this network starting with molecules, with ecology, or somewhere in between, and most courses omit some topics. *Biology: Concepts & Connections* is uniquely suited to serve this variety of courses. The seven units of the book are largely self-contained, and most of the chapters within a unit can be assigned in a different order without much loss of coherence. Moreover, the modular format of the chapters makes it easy to omit or to relocate modules within a syllabus.

Relate Biological Concepts to the Unifying Theme of Evolution

The history of life on Earth goes back more than three and a half billion years, and this past is the key to the present diversity of organisms. As the unifying theme of this textbook, evolution elevates biology from a collection of facts to a coherent study of changing life on a changing planet. In *Biology: Concepts & Connections*, students study the structure, function, and behavior of organisms in an evolutionary context. And throughout the book, students learn to view the unity and diversity of life—the similarities and differences among organisms—as the dual consequences of descent with modification. Our enhanced coverage of evolution in Chapter 1 and Unit III of this edition strengthens this unifying theme.

Help Students Understand the Process of Science

A biology course should make students familiar with the scientific process, in particular with the posing and testing of hypotheses. With an improved introduction to the process of science in Chapter 1, students will be better equipped to appreciate the many examples throughout the book of how scientific concepts emerge from observations and experimental evidence. The book also puts human faces on science with “Talking About Science” modules. A number of these profiles of interesting scientists are new to this edition.

In the review material that concludes each chapter, questions called “Thinking as a Scientist” give students some personal practice with science as a process. The CD-ROM and web site also provide interactive “Thinking as a Scientist” investigations. In fact, this book will work best for students who participate actively in learning about biological concepts and their applications.



Introductory biology is the only science course that many students will take during their college years. Long after today’s students have forgotten most of the specific content of their biology course, they will be left with general impressions and attitudes about science and scientists. We hope this new edition of *Biology: Concepts & Connections* helps make those impressions positive and supports the instructor’s goals for sharing the fun of biology. To help us produce an even better text in the next edition, please send your comments and suggestions to one of the following authors:

Neil Campbell

Department of Botany and Plant Sciences
University of California
Riverside, CA 92521

Jane Reece

Benjamin Cummings
1301 Sansome Street
San Francisco, CA 94111

Martha Taylor

Biological Sciences
Comstock Hall
Cornell University
Ithaca, NY 14853