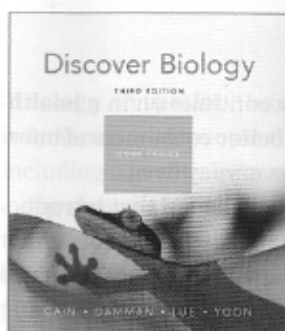


Preface



Seeking a cure for cancer. Exploring the wondrous diversity of life. Unraveling the mysteries of our development. These are but a few of the many reasons why biology is a gripping subject for us and, we hope, for students using this book. These topics are simultaneously intensely interesting and critically important. Because the scientific understanding of fundamental biological principles is growing by leaps and bounds, this is an exciting time to write, teach, and learn about all areas of the biological sciences.

Just consider that researchers are beginning to unlock the secrets of the human genome, allowing us to explore in unprecedented detail both the causes of and potential treatments for a host of human genetic disorders. And ecologists have begun to make real progress in understanding and predicting events that affect all of the world's ecosystems, such as the transport of pollutants and the contribution of human activities to global warming.

Discoveries such as these, along with a host of others, mean that biology is the subject of news stories on a daily basis. In recent months, for example, the news has focused on both the disturbing (the dangers posed by highly lethal varieties of the flu) and the encouraging (signs of progress in global efforts to restore the ozone layer that protects us from UV light). As these and other news reports show, biology carries important ramifications not only for individuals, but for all human societies, and it touches our lives every day as well as in long-term ways we are only beginning to comprehend.

This Book Is Written for Students

The very things that make biology so interesting—the rapid pace of new discoveries and the many applications of these discoveries by human societies—can make it a difficult subject to teach and to learn. The problem is only exacerbated by the wide variation in background and interests that nonmajors, ranging from nursing and other allied health students to business majors and liberal arts students, bring to the course. When we set out to write the third edition of *Discover Biology*, we asked ourselves, How can we convey the excitement, breadth, and relevance of biology to this varied group of students without burying them in facts and definitions?

We have answered this question in several ways. In considering which topics and details would be included in the book from among the vast group of possibilities, our goals were to

- highlight fundamental concepts
- provide human examples alongside comparative examples from other species
- discuss material of applied importance
- reveal something surprising or fascinating about the natural world

We also responded to this question by writing clear, streamlined chapters and by emphasizing the development of biological literacy to provide students with tools that will

serve them well whether they continue on in a health-related field or simply become better consumers of information about biology in their everyday lives.

Over years of teaching, we have found that introductory, non-science students learn best from short chapters that provide a clear overview of key concepts, since these concepts serve as a “coat rack” on which to hang the details of the topic under consideration. We also think it is important to provide compelling examples that make the material come alive for students.

As described in detail below, to put our views into practice, we begin all our chapters with a single main message, a small set of key concepts, and an opening vignette to pique students’ interest as they start reading. In the body of the chapter, we develop the main message to a depth that only slightly exceeds what can be covered in one class period. We illustrate key concepts with both applied topics and compelling examples from the natural world. We end the chapters by revisiting the key concepts and testing the student’s ability to understand and apply those concepts.

Changes in the Third Edition: A Thorough Overhaul

As we began to revise the second edition of *Discover Biology*, we listened carefully to the comments of students and instructors who were using the book. They provided invaluable help, both by describing the book’s strengths and by pointing out places where there was room for improvement. We also benefited greatly from the thoughtful responses to survey questions provided by dozens of instructors. These instructors took the time to examine the book closely and to provide us with extensive feedback on all of its features. During the long hours we spent carefully revising each chapter, the guidance and encouragement we received from these comments served us extremely well.

The message from all these comments was loud and clear: Stay with the existing model of chapters that emphasize key concepts, applied examples, and breaking news stories, but work to add more human examples and to more fully develop the presentation of critical topics in the cell biology unit. Here, as always, our primary focus was on the student—we cut text that provided students with either too much or too little

information, and we added text as needed to strengthen the explanation of fundamental concepts.

With this third edition, we have also strengthened our emphasis on developing biological literacy and illustrating the broad-based relevance of biology through the addition of new boxes called “Science Toolkit,” “Biology on the Job,” and “Biology Matters,” new pedagogical elements such as marginal terminology notes and pronunciation guides, and the unique “Biology in the News” feature, all of which will be discussed in more detail below.

Keeping these basic principles in mind, we dove in. The book has undergone its most extensive revision since the first edition, with the four goals mentioned above as the yardstick. For example, in Unit 2 (“Cells: The Basic Units of Life”), we have strengthened our presentation of fundamental concepts by writing a new chapter on membrane transport and cell communication (Chapter 6) and by adding new sections on isotopes, the four levels of protein structure, steroids, cilia and flagella, and the connection between metabolic rates and life span.

Similarly, our changes to Unit 4 (“Evolution”) and Unit 5 (“Interactions with the Environment”) aim to improve our coverage of fundamental concepts while simultaneously strengthening the human context. We have met these goals in Unit 4 by adding a unique new Interlude on human evolution (Interlude D, “Humans and Evolution,” which describes how people affect—and are affected by—evolution); by expanding our coverage of the fossil record (for example, new sections on the origin of mammals and on exciting fossil discoveries that show that whales are most closely related to even-toed ungulates, such as pigs, camels, and hippos); and by increasing our coverage of the evolution of resistance to our best efforts to kill bacteria and other pathogen and pest species. In Unit 5, we have strengthened our coverage of how ecosystems work, and we have added a new Interlude (Interlude E, “Building a Sustainable Society,” which provides a message of hope at the close of a unit that includes a lot of troubling information); new material on the connection between the delivery of water to New York City and ecosystem services; new material on science and public policy (the “Science Toolkit” box in Chapter 25 on repairing the ozone layer); and summaries of real news articles about topics such as the worldwide spread of Teflon and related chemicals throughout the environment (Chapter 24, “Marvel Chemicals Pop Up in Animals All Over World”).

Features of the Third Edition: Approaches and Tools to Improve Student Learning

A primary goal of the third edition is to improve the biological literacy of our readers

Becoming biologically literate involves several challenges: understanding the fundamental concepts and becoming comfortable with the terminology of the field; acquiring some conceptual and critical skills to make sense of new information; and seeing the connections between the concepts covered in this text and the world around us. The third edition includes several features, some new, some honed from the previous two editions, that aim to prepare students to become biologically literate participants in society.

Several small additions to the new edition aim to help the varied audience of nonmajor students become competent and comfortable with biological terminology. **"Helpful to know" marginal notes** provide hints such as how to remember the difference between similar terms, or how prefixes and suffixes can be used as clues to a term's meaning. **In-text pronunciation guides** will increase students' confidence as they incorporate new terms into their vocabulary.

We think it is critical that students understand the biology behind the news; only in this way can they make informed choices when the issues involve biology—as more and more issues do. As part of our effort to help students become critical consumers of information about biology, each chapter in *Discover Biology* concludes with a unique feature called **"Biology in the News."** Each of these features includes a quote from a real news article, followed by a summary of the article and a discussion highlighting the issues raised by the news topic. "Evaluating the News" questions then encourage students to think about the social and ethical implications of the biological issues, providing a forum for students to develop critical thinking skills and apply what they learn in the textbook to real problems.

New **"Science Toolkit"** boxes provide insights into the methods, ideas, and tools that scientists employ, with the goal of helping students interpret the science and research presented not only in this text, but by the media and other sources.

We believe that biological literacy also involves seeing the connections between the science and our own lives.

"Biology on the Job" boxes, unique to this text, feature interviews with people from a wide variety of fields—including a genetic counselor, a baker, a wildlife curator, a dog show judge, and many more. These boxes explore the connections between their day-to-day jobs and the biological topics in this text. With another new feature, **"Biology Matters,"** we present specific information of practical importance to students' lives. From making environmentally responsible choices to the importance of knowing your blood type to the ethical issues raised by prenatal genetic screening, these boxes provide a down-to-earth connection to the science that we hope will engage and motivate students to make informed choices in their own lives.

Finally, biological literacy must involve engagement with the major biological issues of the day. Each of the book's five units ends with an essay devoted to a significant issue confronting society: loss of biodiversity, cancer, genomics, humans and evolution, and efforts to build a sustainable society. These **Interludes** draw on the biological concepts introduced earlier in the unit and give in-depth consideration to how biology is connected to the rest of our lives. By including five different Interlude essays, we provide instructors with a menu of choices to adapt to the needs of their own courses.

The art and text work together to tell a story

In this and the previous two editions of *Discover Biology*, we worked hard to create beautiful, instructional art and to select superb photographs that integrate seamlessly with the text to guide students through even the most difficult material. Like the text, the figures in *Discover Biology* are streamlined to convey simple, direct messages that allow students to focus on essential concepts. Most figures in the book include balloons that highlight crucial information or explain the flow of an illustration. A large number of the figures are new; we also used feedback from students and reviewers to revise many figures from the second edition so as to further improve their ability to help "tell the story."

Chapters remain focused on a few key concepts

Each chapter's **main message** appears at the beginning of the chapter, along with a **chapter outline** and a list of **key concepts**. The chapter text also begins here with a vignette designed to capture students' interest and lead

them into the material they will learn about in the chapter. The topics of these vignettes range from the story of the Iceman Ötzi (the mummy found in a melting glacier in Europe) to an examination of why lichens are so sensitive to air pollution to the use of forensic genomics to determine whether the Russian Grand Duchess Anastasia escaped execution in 1918 (she did not).

Following the vignette is an **overview** of the topics to be covered. Two levels of headings organize the material in a clear and straightforward fashion; second-level headings are usually in the form of declarative sentences that convey a key point or summarize an important message. Each chapter concludes by returning to explore the topic introduced in the vignette in more detail.

Chapters close with a **Chapter Review** section, featuring a summary of important points, a set of questions that review and apply key concepts, a list of key terms, a self-quiz, and the "Biology in the News" feature. Answers to all key concept and self-quiz questions are in the back of the text, along with a complete glossary and an index.

An expanded and enhanced set of instructor resource materials facilitates lecture preparation

For this edition we focused on improving and expanding the resources available to instructors. Highlights of this revision include new editable PowerPoint lecture outlines that feature text slides, selected images, and Concept Quiz "clicker" questions designed to encourage classroom participation. Additional figures and media elements are available on the multi-disc Norton Media Library Instructor's CD-ROM. For instructors who use WebCT or BlackBoard, our new course cartridge integrates selected elements from the media supplements that accompany *Discover Biology*. In response to requests from adopters of the second edition, we have also thoroughly overhauled and expanded our Test Bank, which now includes a broader selection of question types and difficulty levels. This item has been carefully examined by the authors and by outside reviewers to ensure that the questions therein offer a fair and accurate test of the content presented in each chapter of *Discover Biology*. New test-making software by ExamView makes it easy for instructors to adapt our bank of questions to suit their course needs.

For more detailed information about these and other resources available to instructors, please see p. iv.

DiscoverBiology.com helps students get the most from their reading assignments

No textbook about a subject as broad as biology can stand alone. Some topics require additional information or hands-on practice. In these cases, alternative media such as animation and interactive exercises can help students understand difficult material. For the third edition, *Discover Biology* offers an improved and comprehensive online study guide. A CD-ROM version of DiscoverBiology.com is also available.

For more information about this and other resources available to students, please see p. v.

We Thank the Many People Who Helped Us with This Revision

The process of getting from the kernel of an idea to a finished book involves a veritable army. Here we get to recognize and thank some of the major participants. First, we thank all of the manuscript reviewers of this and the first two editions, who are listed on pages xviii-xx. Together, their criticism and encouragement contributed enormously to the crucial rewriting necessary to achieve a consistent level, clarity, and accuracy. Thanks also to Susan McGlew of Sinauer Associates and to Erin O'Brien and Chris Curcio of W. W. Norton for arranging and coordinating all of the reviews. We received valuable insights from several focus groups that took place near Chicago and in Portland, Oregon, and in particular we received useful advice from Tom Firak and Cecelia Hutchcraft of Oakton Community College; Deb Firak of McHenry County College; Barb Anderson, Lynn Fancher, Lynda Randa, Shyla Akkaraju, and other colleagues from the College of DuPage; Doug Ure, Chemeketa Community College; and April Fong, Mica Jordan, and other colleagues from Portland Community College.

As we revised *Discover Biology*, each of us contacted scientists from around the world to ask about their research or about breaking stories in their field of expertise. We are grateful for the time these scientists spent answering our many questions. We are also grateful for the scientific papers, illustrations, and photos

they provided to help us as we worked on the third edition. We have communicated with many more scientists than we can thank individually, but collectively we thank them here. We are deeply in their debt.

It has been a great pleasure to work with Richard Morel, who joined us as a contributing author on this edition and made major contributions to Unit 2 ("Cells: The Basic Units of Life"). His formidable energy and creativity resulted in many improvements to the text and illustrations.

The talented artists at Dragonfly Media Group translated the ideas and sketches of the authors into beautiful art. Craig Durant, Mike Demaray, and Rob and Caitlin Duckwall deserve special thanks for their creativity, attention to detail, and speed. The wonderful photographs in the book were assembled by Motoko Oinuma, Ede Rothaus, Daniella Jo Nilva, and Neil Hoos, who endured many a round of rejects before they and we were satisfied. Susan Middleton, the manuscript editor, did a superb job of keeping the entire project on track, with good humor and amazing attention to detail. It is thanks to her that the level of writing is as clear and consistent across chapters as it is. Norma Roche did a great job in copyediting the manuscript. She has a knack for identifying troublesome sentences, and best of all, for fixing them.

There were many other people at W. W. Norton who played critical roles in bringing this third edition to fruition. Sarah England and Erin O'Brien worked miracles, keeping everything organized and on schedule and finding interesting photos on short notice. Rubina Yeh developed a striking new design for the book that holds to our original vision of an uncluttered book in which all of the elements have strong pedagogical value. Her clean design helps students focus on what is important. It is also extremely attractive. JoAnn Simony and Chris Miragliotta shepherded the book very effectively and creatively through the production process.

Getting the text right is only half the challenge in introductory biology. Many individuals have lent their talent and time to create a strong support package for the third edition.

We thank April Lange and Karen Misler for taking charge of the supplements to make sure we have the strongest possible support package. David Demers (Sacred Heart University), Ed Dzialowski (University of North Texas), and Stephen Lebsack (Lynn-Benton Community College) developed the study guide, approaching the task with enthusiasm and care.

In this edition we have expanded our offerings for instructors. We are grateful to Richard Morel for his careful work on the Test Bank, which builds on the foundation laid by Susan Weinstein in the second edition. It has now been significantly expanded and improved. We are also thankful to Donald Slis (State University of New York-Plattsburgh), Douglas Oba (University of Wisconsin/Marshfield), and Alana Synhoff (Florida Community College) for their work in developing the new instructor PowerPoint lecture outlines. We believe these will be a real asset for instructors. We appreciate the professionalism and expertise that Sumanas Inc. brought to bear on the development of the multimedia resources that accompany this text, especially the animations available to instructors and students.

We thank Andy Sinauer of Sinauer Associates and Vanessa Drake-Johnson of W. W. Norton for their editorial guidance as this text has evolved from an idea to a finished book, and now to a third edition.

This Book Is a Work in Progress

Like the field of biology itself, any textbook aiming to describe it is a work in progress. We hope you will contact us with your comments, questions, and ideas as you use this book.

Michael L. Cain
mcain@bowdoin.edu

Hans Damman
hdamman@shaw.ca

Robert A. Lue
robert_lue@harvard.edu

Carol Kaesuk Yoon
cky@cnw.com