PREFACE

A New Biology Book with a Modern Perspective

In addition to being active researchers and experienced writers, our author team has taught majors biology for years. We have taught with the same books that you have. Our goal in creating something new is to offer something better—a comprehensive, modern textbook featuring an evolutionary focus with an emphasis on scientific inquiry.

Through our classroom experiences and research work, we became inspired by the prospect that a new Biology text could move biology education forward. In listening to educators and students, it became clear that we needed to concentrate our efforts on seven crucial areas. These are described briefly below. We will return to each in more detail in the pages that follow.

1. **Experimentation** During the 1970s and 1980s, biological information began to expand at an exponential rate. Biology textbooks grew and to some extent the content suffered as the scientific process was squeezed out by the avalanche of new details. We are committed to striking a better balance between general concepts and experimentation by showing the connection between scientific inquiry and the principles that are learned from such experimentation, especially through the Feature Investigation sections in every chapter.
2. **Modern content** Science is a moving target. Although the content and organization of our Biology textbook is not a dramatic departure from other books, we have added modern content that will better prepare students for future careers in biology. Toward this end, we have received content reviews from over three hundred faculty members from around the world. We are convinced they have helped us produce a book with the most up-to-date content possible.

Striking examples where we feel the content demonstrates a modern approach with an emphasis on recent experimentation include the following:

- Chapter 6 of our Cell Biology Unit explores cell biology at the level of "systems biology" in which the cell is viewed as a group of interacting parts. This allows students to understand how the parts of a cell work together.
- Our Genetics Unit takes a "molecular first" approach so that students will first understand what a gene is, and then consider how genes affect the traits of organisms.
- The Evolution Unit often takes a molecular perspective, and highlights cladistic methods to generate evolutionary relationships. This approach connects evolution at the molecular level and at the level of organisms in their native environments.
- The Diversity Unit has incorporated the newest information regarding evolutionary relationships among modern species. The connection between evolutionary innovation and reproductive success allows students to appreciate why organisms have certain types of traits.
- In our Plant Biology Unit, a much more modern connection has been made between plant structure, function and genetics. Recent information from *Arabidopsis* is often discussed.
- Each chapter in our Animal Biology Unit ends with a section on the modern Impact on Public Health, including the molecular basis of many diseases. In addition, Neuroscience is covered as a mini-Unit of its own, with three complete chapters incorporating some of the most recent information in this exciting area of biology.
- The Ecology Unit also incorporates an evolutionary theme and has an expanded discussion of species interactions. This approach provides students with a deeper understanding of evolutionary adaptations that organisms have.

3. **Evolutionary Perspective** A study of the processes and outcomes of evolution serves to unify the field of biology and the units of our text. Whether describing evolutionary mechanisms at the molecular level or surveying the diversity of life through a view of modern systematics, an understanding of evolution serves to connect and integrate the disciplines of biology.
4. **A Visual Outline** We were determined to create a new art program using both graphics and photography to serve as a "visual outline." We have worked with a large team of scientific illustrators, photographers, educators and students to build an accurate, up-to-date and visually appealing new illustration program that is easy to follow, realistic and instructive.
5. **Ensuring Accuracy** We chose to work as a team of authors to create this new Biology text because the information in our discipline is increasing so rapidly. Each member of our team has experience researching and writing in our respective areas, allowing us to combine efforts to stay abreast of the field. Likewise, we have worked with a much larger team of reviewers, advisors, editors, and accuracy checkers to ensure that this text is as current and accurate as humanly possible.
6. **A Learning System** Starting with a simple outline at the beginning of each chapter, we have focused on the crucial topics in a clear and easy to follow manner. We emphasize

critical thinking and active learning by constantly returning to how science is done, and through several pedagogical devices including our Biological Inquiry Questions which appear often in figure legends throughout the text. We end each chapter with a thorough review section which returns to our outline and emphasizes higher level learning through multiple question types.

7. **Media—Teaching and Learning with Technology**
Our new book is accompanied by a vast array of electronic teaching and learning tools. We have focused on creating new student content that is built upon learning outcomes and assessing student performance. We have also created an unprecedented array of presentation and course management tools to enable instructors to enhance their lectures and manage their classrooms more effectively. Finally, we are committed to offering several electronic book and customized print options to best fit your needs.

Experimentation in Biology Reveals General Principles

Biology is the study of life. The primary way that biologists study life is through experimentation. In this textbook, we have maintained a parallel focus on the general principles of biology and experimentation.

Each chapter is divided into a few sections focusing on general principles in biology. These sections begin with an overview of why the topic is important. We then describe the features of the topic that we and our reviewers have felt are the most important and sometimes the most difficult to grasp.

In describing the principles of biology, we have woven experimentation into each chapter. To be prepared for a career in biology, students need to understand the techniques that are used in biology and bolster their critical thinking skills. Each chapter has a Feature Investigation that shows the steps in the scientific process (for example, see Figure 10.13, p. 200). These investigations include a description of the methods and end with an analysis of the data. This deeper approach allows students to appreciate how the general principles of biology were derived from experiments.

In addition, many scientists are mentioned throughout each chapter with a brief description of how their work contributed to the general principles of biology, reinforcing a sense that biology is an enterprise carried out by scientists around the world. This will prepare students for their next step into the scientific literature in future courses.

An Emphasis on Evolution Provides a Modern Perspective

Evolution is the unifying theme that connects the various areas of biology. We have chosen to explain this theme from a modern perspective by relating the information in each chapter to the genetic material, namely the genomes of organisms. Likewise, because most genes encode proteins, a logical extension is to also relate information to proteomes—the collection of proteins that a cell or organism can make.

We use our Genomes and Proteomes subsections as one way to integrate the various disciplines of biology. For example, let's consider our Cell Biology Unit. In this unit, we emphasize how gene regulation is responsible for the differences between a nerve and muscle cell and how descent with modification occurs at the protein level to produce families of proteins with related cellular functions. Likewise, let's consider our Ecology Unit. In this unit we explain how the modification of particular genes has enabled organisms to compete effectively in their environment. The Ecology Unit also considers how the genomes of organisms have evolved in response to environmental changes over many generations.

As a team, our authors are committed to the idea of integrating the various disciplines in Biology, not separating them. We feel it important, fun, engaging, and actually easy to highlight the evolutionary theme of biology by relating information in each chapter to Genomes and Proteomes. They are intended to provide "perspective". We keep returning to the idea that everything in biology stems from the evolution of genomes, and that genomes primarily encode proteins that ultimately provide organisms with their traits. We feel strongly that this approach provides a modern perspective that will serve our readers well in their future careers. The Genomes and Proteomes subsections are just one way that we integrate the various fields of biology. Genes, proteins, and the molecular mechanisms of life are discussed throughout the entire book.

Textbook Illustrations Are a Key to Learning

In discussions with many of our students, we have come to realize that many, probably most students, are visual learners. They read the textbook for information, but when it comes time to study, their main emphasis is on the figures. Likewise, instructors often rely heavily on good illustrations for their lectures. Therefore, a top priority in the development of our Biology textbook has been the conceptualization and rendering of the illustrations.

As you will see when you scan through this book, the illustrations are very easy to follow, particularly those that have multiple steps. We have taken the attitude that students should be able to look at the figures and understand what is going on, without having to glance back and forth between the text and art. Many figures contain text boxes that explain what the illustration is showing. In those figures with multiple steps, the boxes are numbered so that students will understand that the steps occur in a particular order. In some cases, the numbering was critical when the illustration involved features that could not be presented in a linear manner. For example, a description of hearing in Figure 45.7 is much easier to follow because we have guided the student through the process by using numbered text boxes.

Likewise, technology can help us to engage, to educate and even to inspire our students. As you will see when you skim through the pages, the drawings in this textbook are technologically advanced. They are primarily intended to educate the student and we have maintained a commitment to simplicity. Even so, the illustrations in this textbook are also aimed at being interesting and inspiring. Art elements are drawn with a strong sense of realism and three-dimensionality. The illustrations come to life, which, after all, is important to students who are interested in the study of life. We expect students to occasionally look at a figure and think, "Wow, that's cool!" We invite you to skim through the pages and see for yourself.

Accuracy Is a Top Priority

Inaccuracies in a science textbook come from two primary sources. The first is human error. Authors, editors, and illustrators occasionally make mistakes. Fortunately, such mistakes are rare. Each chapter of our Biology book has been read by dozens of people, including several accuracy checkers whose sole job was to find mistakes. Using our 360-degree developmental process (p. viii), we have worked to ensure an unprecedented level of content accuracy in our textbook.

A second and more common source of error is out-of-date material. Biology is continually changing. New information arrives on a daily basis. Some of this information makes us realize that past information was incorrect. Therefore, textbooks that fail to maintain a current perspective become progressively more inaccurate and misleading. Having an experienced author team with extensive research credentials helps to build a textbook with the most current and accurate information. In addition, over three-hundred faculty members have reviewed our Biology textbook for its content.

We are confident that our book has the most modern content that the industry has to offer. This modern perspective pushes the accuracy of our book to the highest standard possible. In future editions, we will continue to strive for cutting-edge content that maintains a high level of accuracy. In future editions, we will continue to employ the help of many reviewers and accuracy checkers to maintain our commitment to modern content and accuracy.

Our Review Process Ensures a Textbook with the Right Content

If the best writer in the world wrote a textbook single-handedly without input from others, the book would not turn out well. Extensive and open-minded reviews are essential to producing a book that is superior. As we developed our book, we took the attitude that we must always return to a previous draft, analyze it critically, and then revise it accordingly.

From an author's perspective, the review process can be pretty daunting. We turn in chapters that we think are letter perfect, and then receive back reviews that make us painfully aware that writing a textbook is harder than it looks. At the start, we created a process that would make it easier for the editors and reviewers to critically evaluate our work. The first-draft chapters were sent to many outside reviewers who are faculty that either teach General Biology, are experts in the topics found in the chapter, or both. Each first-draft chapter was reviewed by up to 15 different people.

The reviews were collected and provided to the author of a given chapter and the editorial staff. Our editors read the chapters and the reviews, and then gave each author advice on how to make the next draft better. A second important type of input also occurred at the first-draft stage. For each unit, we conducted Focus Groups in which faculty members who had reviewed the chapters of an entire unit came together for a two-day meeting to discuss the chapters with the authors and editors. While written feedback is great, face-to-face discussion often brings out bigger-picture issues that may not be found in written reviews.

At the second-draft stage, we decided upon an innovation that profoundly enhanced the quality of our Biology book. Although the illustrations in a Biology textbook are very expensive to make, we realized that a strong connection between the text and illustrations is critical to produce a superior textbook. Instead of making the illustrations at the final-draft stage, which is typical of textbook publishing, we made them very early in the process. This helped us in two ways. First, reviewers could see the art as the book developed, and make critical changes to it. Second, it allowed the authors and editors to develop a keen sense of consistency between the text and art.

Also at the second-draft stage, we assembled the text and illustrations into a format that looked like a chapter from an actual textbook. We had to keep reminding the reviewers that "These are not finalized chapters. These are early drafts that we want you to critically evaluate." This format allowed the reviewers, authors, and editors to understand how the pieces of the book would fit together. Although it was an exhaustive and rigorous process, adopting this step early in the writing process allowed us to produce a book with a sharp consistency between the text and figures.

We Are Committed to Serving Teachers and Learners

Writing a new textbook is a daunting task. To accurately and thoroughly cover a course as wide ranging as biology, we felt it was essential that our team reflect the diversity of the field. We saw an opportunity to reach students at an early stage in their education and provide their biology training with a solid and up-to-date foundation. We have worked to balance coverage of classic research with recent discoveries that extend biological concepts in surprising new directions or that forge new concepts. Some new discoveries were selected because they highlight scientific controversies, showing students that we don't have all the answers yet. There is still a lot of work for new generations of biologists. With this in mind, we've also spotlighted discoveries made by diverse people doing research in different countries to illustrate the global nature of modern biological science.

As active teachers and writers, one of the great joys of this process for us is that we have been able to meet many more educators and students during the creation of this textbook. It is humbling to see the level of dedication our peers bring to their teaching. Likewise, it is encouraging to see the energy and enthusiasm so many students bring to their studies. We hope this book and its media package will serve to aid both faculty and students in meeting the challenges of this dynamic and exciting course. For us, this remains a work in progress and we encourage you to let us know what you think of our efforts and what we can do to serve you better.

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The Next Step in Textbook Development

- 10 developmental editors
- 7 developmental focus groups
- 7 art focus groups
- 25+ accuracy checkers
- more than 1,200 reviews by over 350 reviewers across the world
- 11 multiple-day symposia with over 215 majors biology educators participating
- an art development team who worked closely with the authors
- media board of consultants
- 3 photo consultants

The following groups of individuals have been instrumental in ensuring the highest standard of content and accuracy in this textbook. We are deeply indebted to them for their tireless efforts.

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