

Preface

THE CASE FOR SCIENTIFIC LITERACY

Climate change, biofuels vs. food and forests, bioengineering, stem cells in medicine, potential flu pandemics, the plight of polar bears and pandas, human population growth and sustainability—our students are bombarded with biology-related information and misinformation as well. The concerns that are sweeping our increasingly connected human societies are very real, urgent, and interrelated. Never have scientifically literate societies been more important to humanity's future. As educators, we feel humbled before this massive challenge. As authors, we feel hopeful that the Tenth Edition of *Biology: Life on Earth* will help lead introductory biology students along paths to understanding.

Scientific literacy requires a foundation of factual knowledge that provides a solid and accurate cognitive framework into which new information can be integrated. But more importantly, it endows people with the mental tools to apply that knowledge to their lives. Scientifically literate citizens can better understand and evaluate information from the press and Internet, distinguish fact from fiction, and make informed choices in both their personal lives and in the political arena.

This Tenth Edition of *Biology: Life on Earth* continues our tradition of:

- Helping instructors present biological information in a way that will foster scientific literacy among their students.
- Helping to inspire students with a sense of wonder about the natural world, fostering an attitude of inquiry and appreciation for the knowledge gained through science.
- Helping students to appreciate how science illuminates life, and to recognize the importance of what they are learning to their future roles in our rapidly changing world.

WHAT'S NEW IN THIS EDITION?

Each new edition gives the authors a fresh opportunity to ponder: "What can we do better?" With extensive help from reviewers, developmental editors, and our coauthors, we've answered this question with the following major changes:

- **NEW Learning Goals and Learning Outcomes** Learning Goals now begin each chapter, alerting students to the major concepts within the chapter and the expectations for student learning. Learning Outcomes at the end of each chapter restate the Learning Goals, serving as a recap of the chapter's coverage. References to the relevant Learning Outcomes are provided for each Fill-in-the-Blank and Review Question. The Learning Outcomes also correlate with those found on MasteringBiology.
- **NEW Check Your Learning self-assessment questions** Following each major chapter section, a list of questions prompts students to evaluate their understanding of the material within the section.

xviii

- **INCREASED emphasis on human health** In this edition, we have incorporated more information about health issues—which are both inherently interesting and important to students—into our nonphysiology chapters. For example, Chapter 2 now includes a discussion of radiation therapy in cancer treatment, Chapter 5 now relates membrane fluidity to "Why Your Fingers Fumble and Go Numb in the Cold," and Chapter 9 features a new Case Study, "Body, Heal Thyself."
- **CUTTING-EDGE biotechnology** The tenth edition covers important advances in this exploding and crucial area of biological research. These advances include medical applications of stem cells, the importance of epigenetics, and the use of DNA barcoding for species identification.
- **SEVEN NEW "Case Studies"** Our tenth edition features seven entirely new Case Studies that highlight topics of emerging relevance in today's world. An example is the timely "Unstable Atoms Unleashed," which explores radioactivity through the events of the 2011 tsunami that devastated Japan's Fukushima power plant.
- **MORE flexibility for users** Our former "A Closer Look" essays are now entitled "In Greater Depth" to highlight their usefulness for those instructors who wish to cover complex topics in more detail. These essays are specifically designed to be assigned by the instructor—or not—providing flexibility in the depth of coverage. The In Greater Depth topics include, for example, step-by-step reactions of cellular respiration and revised descriptions of C_4 and CAM photosynthesis. This feature will support instructors who want to teach a more challenging course or cover specific topics in greater depth, and it will also satisfy students who wish to investigate a topic more thoroughly.

BIOLOGY: LIFE ON EARTH, TENTH EDITION

... Is Organized Clearly and Uniformly

Navigational aids help students explore each chapter. An important goal of this organization is to present biology as a hierarchy of closely interrelated concepts rather than as a compendium of independent topics.

- In addition to the new Learning Goals, each chapter opens with "At a Glance" features, which allow users to see how the chapter topics are organized.
- Major sections are introduced as broad questions that stimulate thinking about the material to follow; subheadings are statements that summarize their specific content.
- A "Summary of Key Concepts" section ends each chapter, providing a concise, efficient review of the chapter's major topics.

... Engages and Motivates Students

Scientific literacy cannot be imposed on students—they must actively participate in acquiring the necessary information and skills. To be inspired to accomplish this, they must first recognize that biology is about their own lives. For example, we help students acquire a basic understanding and appreciation of how their own bodies function by including information about diet and weight, drugs (including tobacco and alcohol), and birth control options and how each works.

We fervently hope that students who use this text will come to see their world through keener eyes, for example, perceiving forests, fields, and ponds as vibrant and interconnected ecosystems brimming with diverse life-forms rather than as mundane features of their everyday surroundings. If we have done our job, students will also gain the interest, insight, and information they need to look at how humanity has intervened in the natural world. If they ask the question: “Is this activity sustainable?” and then use their new knowledge and critical thinking skills to seek some answers, we can be optimistic about the future.

In support of these goals, the Tenth Edition continues to offer these revised and updated features:

- **Case Studies** Each chapter opens with an attention-grabbing Case Study directly relevant to the chapter topic. Case Studies, including “Flesh-Eating Bacteria” (Chapter 36), “Bionic Ears” (Chapter 39), “Mussels Muscle In” (Chapter 27), and “Some Like it Hot—And Stinky!” (Chapter 44), are based on news events, personal interest stories, or particularly fascinating biological topics. Discussion of each Case Study continues throughout each chapter in boxed features that relate the topic to appropriate sections of the text. The “Case Study Revisited” at each chapter’s end explores the topic further in light of what the chapter has covered.
- **Boxed Essays** Four categories of essays enliven this text. “Earth Watch” essays explore pressing environmental issues; “Health Watch” essays cover important or intriguing medical topics, and “Science in Action” essays explain how scientific knowledge is acquired. Although the main body of the text always provides a clear, general explanation of each topic, our “In Greater Depth” essays make this text versatile for different levels of instruction.
- **Engaging “Have You Ever Wondered” Questions and “Links to Everyday Life” Boxes** These short features explore questions that students might ask their instructors and illustrate the real-world applications of the text material to the students’ lives.
- **BioEthics Questions** Many topics explored in the text are controversial and have ethical implications for human society. These include human cloning, genetically modified crops, and human impacts on other species. The BioEthics icon  alerts students and instructors to the possibility for further discussion and investigation.
- **Critical Thinking Questions** At the end of each “Case Study Revisited” section, in selected figure captions, and in the “Applying the Concepts” section at the end of each

chapter, our critical thinking questions stimulate students to think about science rather than to simply memorize facts.

- **End-of-Chapter Questions** The questions that conclude each chapter allow students to review the material in different formats—fill-in-the-blank, essay, and critical thinking questions—that help them to study and test what they have learned. Additional critical thinking questions at the end of each Case Study and in selected figure captions stimulate students to think about and apply science to possible real-life situations. Answers to the fill-in-the-blank and figure caption questions are included in the back of the book. Answers or hints for the essay and critical thinking questions are included on the MasteringBiology Web site. Multiple choice type questions can be found in the reading quizzes and practice quizzes in MasteringBiology, as well as in the Instructor Test Bank.
- **Key Terms and a Complete Glossary** Boldfaced key terms are defined clearly within the text as they are introduced. These terms are also listed at the end of each chapter, providing users with a quick reference to the chapter’s important vocabulary. The glossary, carefully written by the authors, provides exceptionally complete definitions for all key terms, as well as for many other important biological terms.

... Is a Comprehensive Learning Package

The Tenth Edition of *Biology: Life on Earth* is a complete learning package, providing updated and innovative teaching aids for instructors and learning aids for students.

Chapter-by-Chapter Summary of Important Changes

Following the revision of chapters in response to reviews by instructors and experts, the text and artwork were carefully reviewed by each of the other two authors and a developmental editor. The coauthors provided valuable insights to one another, integrating the chapters more thoroughly, improving consistency between chapters, and explaining complex concepts more clearly. Our developmental editors brought trained eyes for order and detail to our work, helping us make the writing even more student friendly. Following this intense scrutiny, each initial revision underwent a second, sometimes extensive revision. Specific changes include the following:

- **Chapter 1: An Introduction to Life on Earth** has undergone a major reorganization and now introduces the concept of life and how it evolved before delving into how scientists study life. A new “Links to Everyday Life: A Solar-Powered Big Mac?” explains how sunlight ultimately provides the calories in all the foods we eat. Another new “Links to Everyday Life: When Your Car Won’t Start” applies the scientific method to a familiar problem. Many new photos illustrate this chapter. Figure 1-11 illustrating the tree of life has been revised for consistency with later chapters.