

Preface

We enter a new century with this sixth edition of *Biology*, one that is exploding with excitement in biology. This first year of the new millennium has seen the completion of the Human Genome Project, with the full sequence of the human genome now available for research and exploration. Embryonic stem cells were cloned for the first time in the year 2000, and offer the potential for curing a wide range of ills, from spinal cord injuries to diabetes. Golden rice, a genetically modified crop to which has been added a battery of genes that overcome deficiencies in vitamin A and iron, was planted for the first time in Asian fields. Neurobiologists for the first time caught a glimpse of the molecular basis of learning. Even taxonomy, that bastion of conservative judgments, seems to be undergoing a sea change, with molecular phylogenies forcing the redrawing of many family trees, from angiosperm plants to insects and other arthropods.

There probably has never been a more exciting time to learn biology. Adding together the years, Dr. Raven and I have been teaching biology for more than 70 years, neither of us can remember any time as fraught with promise as today. We started teaching in the sixties, also exciting times. In those revolutionary years the black box surrounding the gene machine was stripped away, revealing for the first time how DNA achieves the constancy and diversity that are the hallmarks of life. For 40 years researchers have been amplifying that picture, learning in ever-greater detail how life works.

In the last few decades, the pace of biological research has accelerated, as we have learned for the first time how to manipulate genes. In agriculture this has led to waves of controversy, in medicine to advances universally applauded. But no matter how one views genetic engineering, no one questions that it is changing the science of biology in profound ways.

What is important about these changes in biology, what excites us like no past year, is the potential to influence our health, and that of our world. Biology as a science can—indeed, must—be more than simply a trip to the zoo, an investigation of what living things are like and how they work. These things are important parts of biology, of course, the knowledge that provides the core of the science. But it can't stop there. The knowledge of biology that has been gained, especially in the last decade, provides us with a tool of unprecedented power to improve the human condition and lessen human impact on the world we share with life's other creatures.

It is with this sense of a science alive with promise that we set out in the first year of this new century to produce the sixth edition of *Biology*.

Significant Enhancements to the Sixth Edition

Every revision of a successful text starts with a plan to update areas where advances have occurred. Thus the initial plans for this sixth edition of *Biology* were to correct any errors detected by its many users, and to incorporate new findings in rapidly advancing areas of research. In publishing terms, this was to have been a “light” revision. However, that is not what happened. Inspired by the suggestions of reviewers, we found ourselves adding chapters, overhauling the way in which key chapters were organized, adding material and then more material—soon we were knee-deep in a significant revision.

Much of the focus of this sixth edition revision was on evolution, ecology, and botany, areas where there was an opportunity for exciting improvement. To revise these chapters, we recruited two young energetic biologists to provide fresh perspective. They brought with them new approaches, fresh ideas, and up-to-date knowledge of their areas of expertise. Indeed, it has been so much fun to work with them that in future editions they will join us as full coauthors of the text.

Ecology and Evolution

Professor Jonathan Losos, our colleague at Washington University, has revised the evolution and ecology sections of the text, bringing more experimental science into our discussions. Presentation of the experimental data used to derive key conclusions and concepts is key to this revision. Our goal is to better aid students to understand how the concepts arose from the research. For this reason, you will see that graphs and charts are more plentiful in these chapters.

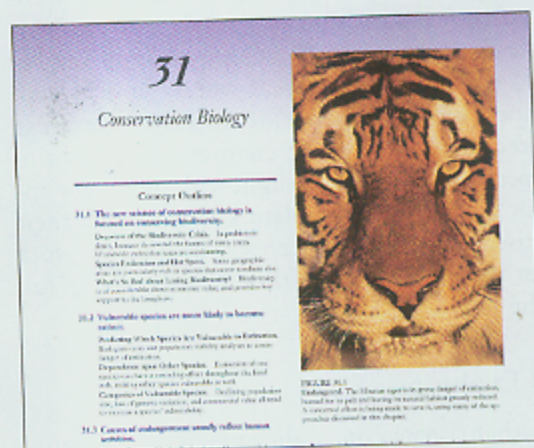
Botany

Professor Susan Singer of Carleton College has revised the botany chapters. The botany sections have benefited from a new approach where plant development takes center stage. A plant developmental biologist, she has placed the traditional discussions of evolutionary influences on plant form and function into a developmental context. Thus while evolution is still presented as the underlying explanation for the character of vascular tissue, seeds, flowers, and fruits, the developmental processes that produce these organs are now given more prominence. This does not lessen the evolutionary character of the treatment, but

rather serves to amplify it. Throughout all the botany chapters, there is an enhanced emphasis on the molecular aspects of plant life. Understanding the molecular underpinnings of plant form and function allows students to more clearly understand the evolutionary changes that have shaped them.

New Chapter: Conservation Biology (Chapter 31)

In the fifth edition, we presented a discussion of conservation biology on the *Biology* web site, as an “enhancement chapter.” The response to this material was so overwhelming that we have included such a chapter in this edition of our text. In our own classroom teaching we find students to be keenly aware of the problems of dwindling natural resources, and the need to tackle the issue concretely. We feel a chapter focusing on conservation biology will be appreciated by students and useful to professors.



Genomics “Enhancement Chapter”

The rapidly advancing field of genomics is so key to the future of biology that we felt it necessary to discuss it in some way in this sixth edition. Including a chapter in the text seemed rather pointless—so much of what we would cover will have changed after the first year. So we turn again to an “enhancement chapter.” We used enhancement chapters to expand information for the fifth edition of *Biology*, and as you see from above, after fine-tuning the conservation biology chapter, we now include it in this edition. The enhancement chapter on genomics can be found at <http://www.mhhe.com/raven6>. This new chapter expands upon the discussion of gene technology to present and explain the advances now being made with genomics. While the chapter discusses the technology involved and the genomes that have been uncoded, it focuses on the significance of this information to biology as a science, and on what it could mean to the future of medicine, agriculture, and many other fields.

Real People Doing Real Science

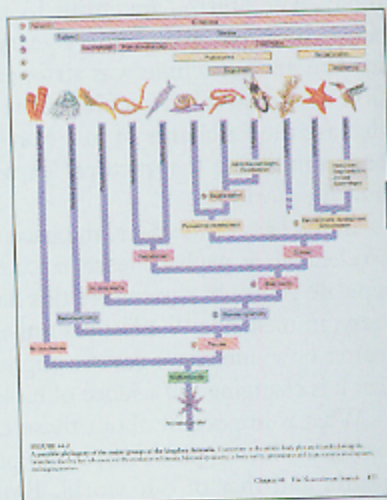
We have added an inquiry-based learning experience at the beginning of every Part that walks a student through the process of scientific inquiry by examining a particular experiment. We have titled this feature “Real People Doing Real Science.” After briefly reviewing the significance of the experimental question being addressed, we take the student through the actual experiment, discussing experimental design in depth, and then briefly describe the results and conclusion. This is but the first part of the learning experience. The student is then directed to the *Biology* sixth edition web site for an in-depth examination of the experiment. There a student can read the actual published research paper, allowing students to become more familiar with the primary literature. Then the student can carry out a “Virtual Experiment” where he or she is able to manipulate the parameters of the experiment and obtain data for analysis. We provide on-line questions and discussions to help the student better understand the thought process behind the experiment.



To explore this experiment further, go to the Virtual Lab at www.mhhe.com/raven6/vlab8.mhtml

A Thorough Revision

In addition to the extensive revisions of the ecology, evolution, and botany sections of the text, and the new chapter on conservation biology, we have thoroughly revised the rest of the text as well. Many chapters now sport radically different organizations, benefiting from extensive reviewer input. Pedagogy has been improved as well. We have included



phylogenetic guideposts throughout the discussions of diversity to clarify for the student where each group fits in the tree of life. (You will find these guideposts in chapters 35, 36, 37, and 44–48.)

The Chemical Building Blocks of Life (Chapter 3)

The organization of this chapter has been turned on its head, presenting lipids before carbohydrates. This gives a greatly improved sense of the relative biological importance of these macromolecules, and actually makes the material easier to learn.