

Preface

Biology, the study of life in all its manifestations, no doubt began with the first stirrings of curiosity in our early ancestors, taking root as these early humans applied their intelligence to the problems of tracking game and collecting plant materials. Biology became a more formalized intellectual endeavor soon after people could record their knowledge in pictures or words, and it continues today as a fundamental part of a good education.

Anyone can watch with interest and even inspiration as a bee lands on a fragrant flower. But the experience is far richer for the observer who understands that the shape of the insect and the shape of the blossom have evolved as complements to each other; that the flower is the plant's showy, tasty, fragrant advertisement, attracting animals that will inadvertently assist in the plant's reproduction; and that the bee has elaborate mechanisms for finding the flower and communicating its location to other members of the hive. The study of biology has vast practical applications, as well, in understanding our bodies and personal health, in grappling with the ethical questions that face us as citizens, and in sensing both our place in the web of interdependent living things and our need to help protect the delicate ecological balance that sustains us all.

For these reasons, the basic Principles of Biology course is a popular one on college campuses. Students who plan to pursue careers in life science, medicine, agriculture, and a broad range of other disciplines (listed in Chapter 1) usually take an introductory biology course, as do many nonmajors (students from unrelated fields) who are simply curious and want to learn the principles that underlie health, fitness, nutrition, genetic engineering, acid rain, the greenhouse effect, and dozens of other current topics.

At most schools, biology majors and nonmajors take introductory biology together, and these "mixed" courses can present the instructor with a real challenge. In particular, which textbook will give the majors the solid foundation of facts and concepts they need while providing the nonmajors with a source that is not overly detailed or presented at too high a level? We designed *Essentials of Biology* to address this need.

This book is a condensation of the well-received *Biology* that we first published in 1988. *Essentials of Biology* maintains the same authoritative selection of topics and the same reader-friendly presentation that has made *Biology* so popular for two-semester courses, but it also incorporates a number of new features that will make it successful for shorter courses or mixed enrollments.

Essentials follows the same levels-of-organization approach we took in *Biology*. The first part, From Atoms to Cells, discusses the building blocks of all matter; biological molecules, the stuff of cells and organisms; the flow of energy in living things; the parts of cells and how they function; and the central energy pathways of cellular respiration and photosynthesis that sustain all living organisms, directly or indirectly.

The second part, Like Begets Like, covers cellular reproduction, the mechanisms of heredity, and how genes and chromosomes control the daily functions of living cells. In this part, students see how genetics developed as a field, from the earliest studies of cell division to the latest applications of recombinant DNA; how researchers study human genetics, a subject of high student interest; and, in a block of chapters on development, how genes carry out their foremost task—controlling the formation of the embryo and young organism. As in *Biology*, development serves as the conceptual bridge between genetics and the remaining topics in the book, which are all at the level of whole organisms or their systems.

The third part, Order in Diversity, presents a clear picture of the wide spectrum of organisms and their basic characteristics. It starts with the origins of life on this planet and progresses through the kingdoms of organisms that emerged, describing the fascinating diversity of living things, their evolutionary relationships, and how each major group may have arisen.

The fourth and fifth parts, Plant Biology and Animal Biology, describe the physiology, or day-to-day functioning, of the most complex groups, the plants and animals, and how they interact with their environments and with each other.

The final part, Population Biology, introduces the sciences of evolution and ecology—from the way populations change over time, to the interactions of the earth's physical forces, to the way groups of organisms relate to those forces and to each other. An important part of this discussion is how environment, ecology, and behavior have shaped our own species' origin and history; how human evolution and activity have affected the earth's ecosystems; and how our future actions will continue to influence them—for better or worse—in the coming centuries.

While the general organization of topics in *Essentials* is the same as in *Biology*, we made some dramatic changes to create a shorter book useful for mixed audiences of student readers. We combined several chap-

ters, reducing the total number from 51 to 46. We removed 25 to 40 percent of the material in each chapter by streamlining the prose; shortening the chapter introductions and endings by substituting point-by-point lists; removing some examples where fewer strong examples could make the same points; cutting some concepts and some detail, but leaving all those topics that our panel of academic reviewers felt were essential for students in a one-semester course; and designing hundreds of new and vastly improved figures that are closely coordinated to the text and can help students visualize and understand biological structures and processes more easily than through lengthier prose discussions. The result is a greater emphasis on essential concepts, a clearer presentation through words and illustrations, a greater proportion of space devoted to unifying themes and take-home messages, and a de-emphasis on detail.

In addition, we updated every chapter with relevant new research and applications of interest to students. We replaced many of the original boxed essays from *Biology* with new student-oriented subjects. And we added some new pedagogical features, including an advance organizer in the chapter introduction, underlined take-home messages for easy study and review, a very complete index to improve the book's utility as a reference, and the use of visual icons in many figures to help the student grasp the physical context for a structure or process (for example, see Guided Tour, page xxviii).

In all, *Essentials* maintains the same well-chosen and clearly explained subjects as *Biology*—thanks to our team of authors, consultants, contributors, and reviewers. But through vigorous revision and condensation, we have created an entirely new, up-to-date textbook with all the topics a biology major needs to know, presented in a way that will interest and give equal access to non-majors.

We hope our strategy will be a winning one for the users of this book. And we hope our work will provide a foundation of knowledge from which the reader—whether future scientist or informed citizen in a non-scientific field—can understand the stream of discoveries sure to come in biology in the decades ahead, as well as to participate in the democratic process of regulating and utilizing the fruits of those discoveries.

Acknowledgments. We are indebted to hundreds of people for their help in undertaking and completing this project. None have done more than our consultants, Dr. John Postlethwait of the University of Oregon and Dr. Howard Schneiderman of the University of California, Irvine, and Monsanto Company, who were the primary formulators of the book's outline and organization. In addition, Dr. Postlethwait contributed heavily to the chapters on genetics, provided invaluable advice on matters large and small throughout the project's devel-

opment, and designed virtually all of the new figures for the book.

Once again, we extend our warmest appreciation to those who contributed to *Biology*, as well as the reviewers from various colleges, universities, and institutions who provided critical feedback and recommendations for cutting and revising (see page xi). Their input was very important to our goals of authoritativeness and effective presentation, and it was much appreciated.

Many scientists, photographers, and artists contributed to the book's art program by allowing us to use or modify drawings and to print or reprint photographs. Their names and the figure references for their work appear in the Credits and Acknowledgments section at the end of the book.

A long and complex science book such as this, couched in readable prose and illustrated with hundreds of photos, drawings, charts, graphs, tables, boxes, and appendices, demands the tender loving care of a talented team of professionals at all stages of development. We are indebted to Hal Lockwood, Janet Greenblatt, Stuart Kenter, Carol Dondrea, Blake Edgar, Pattie Myers, Karen Judd, Bev Fraknoi, Lesley Walsh, Sandy Woods, Richard Lynch, Judith Levinson, and Renee Deprey.

Our deepest gratitude goes to Eirik Børve, our collaborating publisher, who has, at every step of the way, placed his intelligence, energy, and exceptional management skills behind our goal of teaching biology in the most effective manner possible. So much teaching and learning at the college level depends on carefully published textbooks, and we feel that Mr. Børve represents the very best in his field.

Finally, we express warmest appreciation to each other. A collaboration between a professional biologist and a widely published writer is truly a beneficial education for both parties.

Even with the careful contributions of our aforementioned friends and colleagues, errors of fact or interpretation may have found their way into the book. For these, we alone assume responsibility and stand ready to correct them.

We sincerely hope that the students and instructors who use this book will find it a stimulating introduction to the intricate, fascinating, and beautiful world of life on earth.

Janet L. Hopson and Norman K. Wessells

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