

PREFACE

Biological science can and should be one of the most stimulating subjects a college student encounters. Nothing else, after all, has such immediate personal relevance as the phenomenon of life; and biological science, as the study of life, sheds light on what every individual experiences in himself and observes around him. Given the inherent excitement of the subject, there is no excuse for an introductory biology course to be dull.

A textbook for today's students must do justice to the newer areas of biological science without neglecting the older that provide the foundation upon which the new rests. I have tried for an accurate and honest picture of the current state of our knowledge (and ignorance) in each of the major areas, without prejudice to any one of them; thus such topics as cellular ultrastructure, photosynthesis and respiration, molecular genetics, and developmental biology have been carefully examined, but not at the expense of "whole organism" and population biology.

The above paragraphs by William T. Keeton, in the prefaces to the first and second editions, are equally appropriate today. My objective has been to maintain the integrity of Dr. Keeton's approach in this edition,

while at the same time introducing a number of important changes that will suit the needs of today's students. Fortunately, Dr. Keeton was able to begin this revision before his untimely death, and I have had the benefit of his special insight and experience.

My own teaching experience with *Elements of Biological Science* led me to believe that the third edition should be more than a shortened version of Dr. Keeton's longer book, *Biological Science*. Hence, though many of the most important revisions of the latter have been preserved in *Elements*, users of the new edition will find in virtually every chapter changes that reflect the needs of students of a shorter course. A survey of the opinions of users of the previous edition of *Elements*, though it yielded many conflicting responses, helped to establish a general framework for the revision. Nothing, after all, can replace the experience of teachers in the classroom and a healthy respect for the complexities of teaching a diverse and complicated subject to first-year students. I thank the many teachers who took the time to advise us through that questionnaire.

Like the third edition of *Biological Science*, *Elements* now places new emphasis on weak bonds and

their role in biological processes. Introduced early in Chapter 2, weak bonds are used throughout, to explain such phenomena as protein conformation, regulation of enzyme activity, nucleic acid structure, the special properties of water, and membrane structure. Discussions of many topics have been added or updated in this edition; among them are the fluid-mosaic model of the cell membrane, the chemiosmotic hypothesis, the concept of parental investment, altruistic behavior, the cell cycle, the function of guard cells, gas exchange in birds, the immune response, cancer, the gradualist versus the punctuated-equilibrium concept of speciation, the mechanism of gene action, and (particularly) recombinant DNA technology. Some more specialized topics from *Biological Science* have been omitted, abbreviated, or simplified to meet the needs of the students who take a short survey course. *Elements* continues to be designed for those who teach a two-quarter or one-semester course, and for those who merely want a less extensive text than *Biological Science*.

Elements divides the more lengthy, complicated chapters of *Biological Science* into two, sometimes three, smaller chapters. For example, basic chemistry is now presented in two chapters ("Some Simple Inorganic Chemistry" and "Some Simple Organic Chemistry"), since students seem to want their chemistry in bite-sized chunks; the topic of energy transformations has been given like treatment for similar reasons. For a number of topics, such as nutrient procurement and internal transport, this approach means that plants and animals are now treated in separate chapters. An immediate advantage of these changes is increased flexibility for teachers who do not follow the topical sequence of the book. It is now easier, in courses that present metabolism before photosynthesis, for instance, or that separate plant and animal physiology, to make assignments in the text without asking students to stop reading in mid-chapter. But despite the division of chapters along plant and animal lines, *Elements* retains the original philosophy of stressing the similarity in diversity; it discusses the problems faced by all forms of life—plant, animal, or microbe—and compares alternative "solutions" to these problems. Cells are now discussed in two chapters, but we have retained one of the most significant advantages of Keeton's approach: an examination of the cell membrane serves as a conceptual introduction to the biology of subcellular structures.

Though *Elements of Biological Science* is a survey of organismal biology, it places emphasis on some topics of particular human social significance. Among these are the digestion of lactose by adults, thromboembolic and hypertensive disease, trisomy, diet and atherosclerosis, the effects of vitamin A deficiency,

the mode of action of neurological drugs, and the differences between red and white skeletal muscle and their implications for human activity.

A clean, readable page layout allows a synchrony of text and illustrations lacking in many other books. Ruth Mandel, our photo editor, has spent many hours ferreting out new photos. I am grateful to her for these, and for her efforts in laying out the text. Spectacular color photos, chosen for sound pedagogical reasons, are now interspersed throughout. Line art has been carefully re-evaluated for the needs of the short course; many captions have been rewritten to provide additional interpretation of complex subjects. As before, the drawings and diagrams are largely the work of Paula DiSanto Bensadoun, and they continue to clarify difficult concepts and to provide useful visual summaries.

A variety of study and teaching aids accompany this textbook. For the first time, a summary—"Concepts in Brief"—is included at the end of each chapter. This tests student recall of major concepts by providing a brief synopsis of important points. In addition, a complete glossary and an exceptionally thorough index are included at the end of the book. Also, for the first time, a teacher's manual and a study guide accompany the text. The teacher's manual provides practical teaching suggestions and references, and includes a test bank of exam questions drawn from many years of class testing. The study guide details key concepts, objectives, and suggested readings, and provides the student with a series of study questions to test mastery of the material.

I have had considerable help from a number of individuals in the preparation of this edition. Joseph Calvo, Carolyn Eberhard, Jean Hardy, Barbara Keeton, John Kramer, Robert Turgeon, Jerry Waldvogel, and the students in Cornell's Biology 101-102, Biology 105-106, and Biology 109-110 have all contributed in some way.

Special appreciation is due to all the people at W. W. Norton who worked with me, and especially to James Jordan, whose advice and encouragement kept me going. His suggestions contributed enormously to improving the presentation of this text. I also owe particular thanks to Esther Jacobson, whose watchful eye and careful attention to detail saved me from innumerable errors and inconsistencies. It has been a pleasure to work with so many fine people.

Finally, I thank the late William T. Keeton, who made biology the most exciting and vital part of my academic life. I hope that this book will be a suitable memorial to him.

Carol Hardy McFadden
Ithaca, New York