

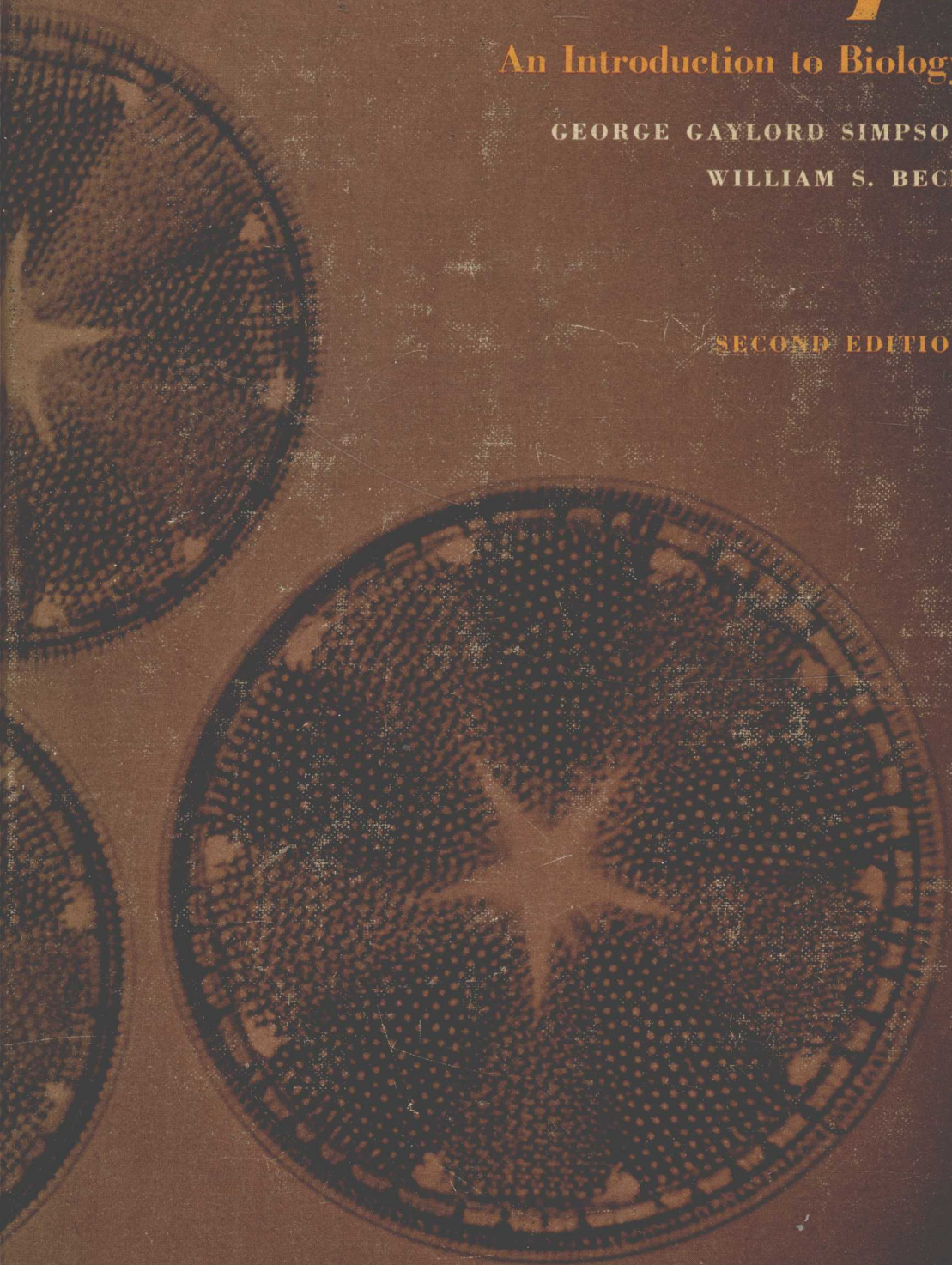
# *Life*

## An Introduction to Biology

GEORGE GAYLORD SIMPSON

WILLIAM S. BECK

SECOND EDITION





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## FROM PREFACE TO FIRST EDITION

This book is based on strong convictions. We believe that there is a unified science of life, a general biology that is distinct from a shotgun marriage of botany and zoology, or any others of the special life sciences. We believe that this science has a body of established and working principles. We believe that literally nothing on earth is more important to a rational living being than basic acquaintance with those principles.

This, then, is a "principles approach" to general biology. We have tried to give more than lip service to that aim, to keep principles always foremost in mind and to organize the whole text around them. We have tried to avoid the common error of presenting merely summary or introductory descriptions as principles. We recognize, however, that principles are meaningless unless they arise from concrete data and can be applied to particular problems. We have tried to underpin the principles with supporting facts and to show how the principles arise from these facts.

We have discussed how scientists approach problems, which of course is all that is meant by the catchword "scientific method." Where appropriate and convenient we have introduced in sufficient detail a number of particular examples of important biological problems and their solutions, partial or complete. This has usually been done by a historical approach here and there in the text, additional and complementary to the more general historical summary in the last chapter.

We hope to discourage the idea that merely learning a specialized vocabulary is educational in a broader sense or has any useful relationship to wisdom, but we have



not hesitated to use carefully defined technical terms when these really contribute to the easier communication and comprehension of principles. For selected examples we have introduced anatomical terminology in figures and their legends, where the user of the book may take it or leave it. These labeled drawings may also serve as a bridge between the text and the study of organisms in the laboratory, which is the place to learn such details of anatomy as may be useful or interesting to any particular reader.

The study of life is a lively science. Along with a body of well-established knowledge, it includes uncertainties, speculations to be tested, places where knowledge now ends and where the seeking of new knowledge should therefore begin. We have not concealed these dynamic aspects of the search. On the contrary, in appropriate places we have stressed them.

Like other human activities, biological teaching and research have fads that change from place to place and from time to time. We have tried to avoid them and to give as well-rounded a treatment as we could manage. We have, for instance, treated systematics and biogeography on the same level and to the same depth as, say, biochemistry or genetics. One of the fads we have avoided is centering the treatment on man, writing a human biology or using man as a "typical animal" (a horrid expression). We thoroughly agree that the best reason for studying biology is the most human reason: Know thyself! But too narrow a striving toward that objective is self-defeating, because a true understanding of man can come only from placing him in perspective in the whole realm of life. Man is used as an example when he is a good example, and the human implications of, for instance, population growth or the evolution of behavior are specified. The subject, however, is always considered to be broader than our own species.

The most general principle of all in biology is evolution. Most books on biology make such a statement, but many are lacking in conviction that it is really true. Some relegate evolution to a single chapter and treat all the rest of biology as if it really had nothing to do with evolution. Others adopt what they call an "evolutionary approach" and equate biology with the description of organisms in a "phylogenetic sequence." The sequence is never in fact phylogenetic, and this approach rarely teaches much about the real principles of evolution. We have tried to make evolution as pervasive as it really is in the world of life. Every topic has its evolutionary background and aspects.

Only those who have also tried to encompass our tremendous subject in one book know how difficult is the problem of organizing the material and how impossible is the achievement of a completely consistent and logical sequence. In general we have advanced by levels of inclusiveness: the cell as the basic unit in our subject; then the organism in itself; then like organisms in their reproductive capacity; the further reproductive processes and interactions that lead to evolutionary changes; the diversity wrought by those changes; the aggregations of the diverse organisms into populations and communities; the spread of such aggregations in the dimensions of space; and finally the history that embraces all previous levels and dimensions plus that of time.

This book is written neither for the nonprofessional nor for the student who is beginning a professional career, but for both at once. It is another of our convictions that grounding in the *principles* of *general* biology is equally useful to all. It is the most nearly indispensable (and the most interesting) view of the subject for the nonbiological student or the general public. It is at the same time the best basis from which to go on to specialization in botany, zoology, biochemistry, or any other of the life sciences.

We have received much help during the long years of preparing this book. Some aid cannot well be specifically acknowledged, but we can acknowledge with gratitude that the whole manuscript has been read and criticized in detail by W. H. Camp, A. D. Chiquoine, Waldo H. Ferguson, Albert S. Gordon, Ella Thea Smith, and Kenneth V. Thimann. Anne Roe has also read most of the manuscript and has more particularly helped with the discussion of behavior. Other friends criticized our treatments of specific subjects as follows: Frank H. Johnson; (cell theory and physiology) A. D. Hershey and A. E. Mirsky (genes); D. L. Lindsley (reproduction and genetics); J. T. Bonner (development).

It is a pleasure to give thanks to Charles Halgren and his associates at the CARU Studios for the execution of the figures. In illustrating our book we have, of course, drawn freely on earlier works. In all but a few instances, however, figures have been either redrawn or newly drawn for our particular purpose.

GEORGE GAYLORD SIMPSON  
COLIN S. PITTENDRIGH  
LEWIS H. TIFFANY

## PREFACE TO SECOND EDITION

In this revision, we have retained the general aims and approach announced in the Preface to the first edition. The revision has nevertheless been extensive, and much of the book has been rewritten, newly written, or reorganized. We have tried not only to take account of the many recent advances in knowledge, but also to improve the arrangement and precision of the text. Among the more obvious changes are these:

Purely introductory matter has been condensed and in part replaced by a more explicit and more extensive basis in biochemistry and molecular biology.

Biochemistry and a number of other topics have been given more sophisticated treatment throughout the text.

Reproduction has been treated in a more coherent sequence, being discussed first in terms of cellular processes and then through heredity to its fully organismal aspects. The study of reproduction thus precedes and introduces organismal physiology instead of following it.

The chapters on ecology (23–25) have been extensively reorganized.

Some repetition and redundancy have been eliminated; for example, protists are now discussed in essentially one and not several places.

In making this revision, we have profited from many helpful comments and constructive criticisms from teachers, students, and general readers. They are too numerous to mention individually, but we heartily thank them collectively. We must at least express

our gratitude to Dr. Miklos D. F. Udvardy, who, in addition to other assistance, prepared a careful and detailed plan for reorganization of the whole subject of ecology. Although we have not followed his plan exactly, we have benefited from it.

Dr. Otto T. Solbrig critically reread the whole book with special reference to its botanical materials, on which he gave us extensive advice. Dr. Anne Roe again reviewed the chapter on behavior (now Chapter 14).

It has been impracticable for Drs. C. S. Pittendrigh and L. H. Tiffany, coauthors of the first edition, to take part in the revision. It is, however, thankfully recognized that they supplied substantial parts of the basis for the present version. No invidious comparison is involved in noting that this is particularly true of Dr. Pittendrigh, who as second of the original three coauthors was also second in the magnitude of his contribution.

The new coauthor has been especially but not exclusively concerned with the more biochemical and physiological aspects of text—notably Chapters 2–5, 7, and 10–12. Both of us will be grateful for renewed comments from readers and users of the book.

GEORGE GAYLORD SIMPSON  
WILLIAM S. BECK



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