

Biology of

ANTIMATS

Seventh Edition

HICKMAN • ROBERTS • LARSON

Seventh Edition

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preface

Biology of Animals is a textbook for use in introductory zoology courses and is helpful for students of varying backgrounds. You have before you the seventh edition of the text, and like some animals, the book has evolved dramatically through its history. Nevertheless, we have retained the overall organization and distinctive features that have found favor with so many students and professors. These features include emphasis on evolution, animal diversity and adaptations, principles of zoological science, and not least, readability. We also continue the learning aids that have helped students: opening prologues for each chapter that relate a theme or topic drawn from the chapter to engage student interest; chapter summaries and review questions to aid student comprehension and study; accurate and visually appealing illustrations; in-text derivations of generic names; boxed notes and essays that enhance and enlarge on text material; pronunciations of taxa in the tables of classification; and an extensive glossary providing pronunciation, derivation, and definition of terms used in the text.

New For This Edition

Throughout the book we updated and sometimes rewrote sections of text, and we updated references. Many illustrations were revised or replaced. We rewrote many review questions, seeking to provoke thought and to reduce emphasis on rote memorization. We replaced the end paper on Origin of Life and Geologic Time Table with a revised version in full color.

Many readers of this text know that it has a larger sibling, *Integrated Principles of Zoology*. Because we alternate revising the two books, changes instituted in a revision of one can be incorporated into and benefit the next revision of the other. For example, full-color cladograms with illustrations of representatives of animal groups were introduced in *Integrated Principles*, tenth edition, and we use them now in this edition of *Biology of Animals*. Both books emphasize the importance of cladistics in modern taxonomy. Another feature we brought from *Integrated Principles* was not new to the last edition of that book, but it has been popular with students: succinct statements of “Position in the Animal Kingdom” and “Biological Contributions” at the beginning of each survey chapter.

Organization and Coverage

Part I: Evolution of Animal Life

The chapters in Part I introduce the evolution of animals. In chapter 1, we explain the principles of science, provide a brief review of the chemistry of life (students lacking introductory chemistry should refer to the appendix on Basic Structure of Matter), and trace the early evolution of life on earth from its primitive beginning some 3 billion years ago to the appearance of eukaryotes toward the end of the Precambrian. We added a boxed essay on the animal rights controversy. Chapter 2 moves to the organization of eukaryotic cells and discusses mitosis and control of cell division. We added new sections on exocytosis, apoptosis, cyclins, and cdk's, and updated and reillustrated the discussion of oxidative phosphorylation and electron transport. Chapter 3 focuses on the basic principles of heredity and molecular genetics. We added a paragraph on translational control of gene expression and revised the discussion of the genetics of cancer to include the Ras protein and p53. Encoded by a tumor-suppressor gene, p53 has reached public attention because of its connection with smoking and lung cancer. Chapter 4 (Evolution of Animal Diversity) begins with an historical account of Charles Darwin's life and discoveries. The five components of Darwin's evolutionary theory are presented, together with important challenges and revisions to this theory and an assessment of its current scientific status. The chapter ends with discussion of microevolution and macroevolution. Chapter 5 (Ecology and Distribution of Animals) was completely rewritten and reorganized for this edition with greater emphasis on principles of populational and community ecology and animal distribution.

Part II: Animal Form and Function

The nine chapters in this part treat animal form and function, animal behavior, and reproduction and development. In chapter 6 on animal architecture we begin with the basic uniformity of organization of animals and follow with discussion of the integumentary, skeletal, and muscular systems. We updated several sections (complexity and body size; injurious effects of sunlight; ameoboid movement; myoneural junction; energy of

muscle contraction), added invertebrate examples to the discussion of rigid skeletons, and added a new illustration of a fish skeleton. In chapter 7 (Homeostasis) we emphasize the importance of homeostasis, which permeates all physiological thinking. This chapter includes discussions of some of the accessible examples of homeostasis: osmotic regulation among animals in different habitats (here we revised and updated the explanation of contractile vacuole function), the prominent role of the kidney in body fluid regulation, and temperature regulation. In chapter 8 (Internal Fluids and Respiration) we revised and reillustrated the sections on respiration and gas exchange.

New with this edition is an entire chapter devoted to immunity (chapter 9). The chapter provides in-depth treatment of both vertebrate and invertebrate immunity, with emphasis on the importance of cytokines.

Chapter 10 is a comparative treatment of feeding mechanisms, digestion and the organization of the alimentary canal, and the nutritional requirements of animals. Chapters 11 and 12 cover nervous and endocrine coordination in detail. In chapter 11 (Nervous Coordination) we revised and updated sections on the sense of smell, memory, flatworm nervous system, and the chemistry of vision. Several illustrations were replaced with new, full-color art. In chapter 12 (Chemical Coordination) we added new sections on the pineal gland and melatonin function, prostaglandins, and cytokines. Chapter 13 (Animal Behavior) begins with distinction between proximate and ultimate causation and explains the different experimental approaches to animal behavior. It continues with discussions of control of behavior (genetic and learned) and social behavior, including communication among animals. We reorganized chapter 14 (Reproduction and Development) and inserted a new section on invertebrate reproductive systems, broadened the explanation of the proposed benefits of sex, and explained nongenetic sex determination. In the development section of this chapter we moved the section on development of systems and organs to follow the treatment of early development, and we added a new section on the common vertebrate heritage with a new illustration of phylotypic stages in vertebrate embryogenesis.

Part III: The Invertebrate Animals

The 17 chapters of Parts III and IV are a comprehensive, modern, and thoroughly researched coverage of the phyla of animals. We emphasize the unifying architectural and functional theme of each group. The structure and function of representative forms are described, together with their ecological, behavioral, and evolutionary relationships. We aid the student's comprehension of each chapter by drawing out the underlying themes and distinctive features of each group.

The invertebrate chapters were thoroughly updated and many fine new color photographs were chosen to replace existing illustrations. Following are some of the more significant changes in these chapters. A new note in chapter 16 (Animal-like Protista) mentions *Toxoplasma* as an opportunistic infection in AIDS; the importance of *Cryptosporidium* as a global

diarrheal infection, important in AIDS patients, and the newly emerging disease caused by *Cyclospora*. The popular media have carried recent accounts on these emerging infections. Several changes in chapter 19 (Acoelomate Animals) include a table showing the important trematode parasites of humans. Changes in chapter 20 (Pseudocoelomate Animals) include revision of *Trichinella* coverage and the addition of a paragraph on dog heartworm. In the mollusc chapter (chapter 21) we have revised the classification of gastropods. In chapter 23 (Arthropods) we revised the section on arthropod phylogeny giving more emphasis to insects and included a new cladogram. Included in this chapter for the first time are many fine photographs of insects by photographer Jim Castner. A number of new illustrations were added or substituted in chapter 24 (Lesser Protostomes and Lophophorates) and chapter 25 (Echinoderms, Hemichordates, and Chaetognaths). We changed the title and content of chapter 25 because of the current uncertainty regarding the position of the chaetognaths.

Part IV: The Vertebrate Animals

The six chordate chapters were updated with new information and rewritten in many places to enhance clarity. Many new illustrations were added or replaced old illustrations. In chapter 26 (Vertebrate Beginnings) we added a new section on conodonts. In chapter 27 (Fishes) we revised the sections on elasmobranch biology and on fish reproduction and growth, and we added a new illustration of a shark. In chapter 28 (The Early Tetrapods and Modern Amphibians) we added a new illustration showing the evolution of the tetrapod limb. We also revised the discussion of amphibian reproduction to include tropical frogs. In chapter 29 (Reptiles) we added a discussion and a brief description of worm lizards (amphisbaenians); added a new essay and illustration on dinosaurs; and added new illustrations of reptile skin and the amniotic egg. In chapter 30 (Birds) we rewrote parts of the section on digestion, added a comment on the numbers of song birds killed by house cats, and had several illustrations redrawn. A significant change in chapter 31 (Mammals) is the transfer of the discussion of human evolution from chapter 4 to this chapter. We feel that the narrative flow is better here, as well as being more appropriate in this location.

Learning Aids

Vocabulary Development

Key words are boldfaced, and the derivations of generic names of animals are given where they first appear in the text. In addition, the derivations of many technical terms are provided in the text; in this way students gradually become familiarized with the more common roots that recur in many technical terms. An extensive glossary of more than 1000 terms provides pronunciation, derivation, and definition of each term.

Chapter Prologues

A distinctive feature of this text is an opening essay at the beginning of each chapter. Each essay draws out some theme or topic relating to the subject of the chapter. Some prologues present biological, particularly evolutionary, principles; others (especially those in the survey sections) illuminate distinguishing characteristics of the group treated in the chapter. Each one is intended to present an important concept drawn from the chapter in an interesting manner that will facilitate learning by students, as well as engage their interest and pique their curiosity.

Boxed Notes

Boxed notes, which appear throughout the book, augment the text material and offer interesting sidelights without interrupting the narrative. We prepared several new notes for this edition and revised many of the existing ones.

For Review

Each chapter ends with a concise summary, a list of review questions, and annotated selected references. The review questions enable students to self-test retention and understanding of the more important chapter material.

Art Program

The appearance and usefulness of this edition have been further enhanced with many new full-color paintings by William C. Ober and Claire W. Garrison. Bill's artistic skills, knowledge of biology, and experience gained from an earlier career as a practicing physician have enriched this text through six of its editions. Claire practiced pediatric and obstetric nursing before turning to scientific illustration as a full-time career. Texts illustrated by Bill and Claire have received national recognition and have won awards from the Association of Medical Illustrators, American Institute of Graphic Arts, Chicago Book Clinic, Printing Industries of America, and Bookbuilders West. They are also recipients of the Art Directors Award.

Supplements

Instructor's Resource Guide and Test Bank

The Resource Guide provides a chapter outline, test bank, commentary and lesson plan, and resource listing for each chapter. We expect this supplement to be particularly useful to first-time users of the text.

Laboratory Manual

The laboratory manual by Cleveland P. Hickman, Jr., Frances M. Hickman, and Lee B. Kats, *Laboratory Studies in Integrated Zoology*, now in its ninth edition, has been extensively rewritten and reillustrated. It was designed to accompany a year-long course in zoology but can be adapted conveniently for semester or term courses by judicious selection of exercises. The popular wall chart, "Chief Taxonomic Subdivisions and Organ Systems of Animals," is available on request.

Computerized Test Bank

The test questions contained in the Instructors' Resource Guide are available as a computerized test generation system for IBM-compatible and Macintosh computers. Using this system, instructors can create tests and quizzes quickly and easily. Instructors can sort questions by type or level of difficulty, and can add their own questions to the bank of questions provided.

Transparency Acetates

A set of full-color transparency acetates of important textual illustrations is available with this edition of *Biology of Animals*. Labeling is clear, dark, and bold for easy reading.

Animal Diversity Slides

A set of animal diversity slides, photographed by the authors (CPH and LSR) and Bill Ober on their various excursions, are offered in this unique textbook supplement. Both invertebrates and vertebrates are represented. Descriptions, including specific names of each animal and a brief overview of the animal's ecology and/or behavior, accompany the slides.

Student Study Guide

This guide, new in 1997, provides students with additional help in testing their comprehension of difficult concepts. The study guide will feature brief introductions, objective questions/answers and essay questions.

NetQuest: Exploring Zoology

This **new** supplement provides a variety of Internet addresses to correlate to the key zoological topics in this text. Now you can easily locate interesting and current information on the web, regarding almost any subject in zoology. The text includes a brief overview of each topic and suggested "activities."

Life Science Animation Video Series

These videotapes feature physiological processes that occur at the cellular/molecular level. For the scope of this book, the following are appropriate: Tape #1 Chemistry, The Cell, and Energetics; Tape #2 Cell Division, Heredity, Genetics, Reproduction and Development; Tape #3 Animal Biology #1; and Tape #4 Animal Biology #2.

Life Science Living Lexicon CD-ROM

This is an interactive program that features a glossary of common biological roots, prefixes, and suffixes; a categorized glossary, and a section describing the classification system.

BioSource Videodisc

The videodisc contains 10,000 images organized by phyla and provides a complete tour of the animal and plant kingdom. It is supported by a reference manual that contains a sequential listing of all images and their correlating bar codes.

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We wish to thank the following zoologists who suggested numerous improvements and whose comments were of the greatest assistance to us as we approached this revision. We are especially indebted to Lawrence Hurd of Washington and Lee University, Lexington, Virginia, who made a major contribution to the revision of chapter 5.

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Although we make every effort to bring to you an error-free text, errors of many kinds, including those of fact and emphasis, inevitably find their way into a text book of this scope and complexity. We will be grateful for readers who have comments or suggestions concerning

content to send their remarks to Adora Pozolinski, Developmental Editor, WCB/McGraw-Hill, 2460 Kerper Boulevard, Dubuque, IA 52001. You can also contact her at <http://www.mhhe.com/zoology>.

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