



p r e f a c e

Animal Diversity is a textbook tailored for the restrictive requirements of a one-semester or one-quarter course and is appropriate for both non-science and science majors of varying backgrounds. This third edition of *Animal Diversity* presents a survey of the animal kingdom with emphasis on diversity, evolutionary relationships, functional adaptations, environmental interactions, and certainly not least, readability. We also continue with several pedagogical aids for students: opening chapter dialogues that relate a theme or topic drawn from the chapter; chapter summaries and review questions to aid student comprehension and study; accurate and visually appealing illustrations; in-text derivation of generic names; chapter notes and short essays that enhance the text by offering interesting sidelights to the narrative; pronunciation of taxa in the tables of classification; and an extensive glossary providing pronunciation, derivation, and definition of terms used in the text.

Organization and Coverage

The sixteen survey chapters of animal diversity that form the central theme of this book are prefaced by four chapters with discussions of the principles of evolution, ecology, classification, and animal architecture. Throughout this revision we updated references and worked to simplify and streamline the writing style.

Chapter 1 begins with a brief explanation of the scientific method—what science is (and what it is not)—and then moves to a discussion of evolutionary principles. Following an historical account of Charles Darwin's life and discoveries, the five major components of Darwin's evolutionary theory are presented, together with important challenges and revisions to his theory and an assessment of its current scientific status. This approach reflects our understanding that Darwinism is not a single, simple statement that is easily confirmed or refuted. It also prepares the student to dismiss the arguments of creationists who misconstrue scientific challenges to Darwinism as contradictions to the validity of organic evolution. The chapter ends with discussion of micro- and macroevolution. The essay on the animal-rights controversy is also updated.

Chapter 2 on ecology is new to this third edition, derived from the 11th edition of its larger sibling, *Integrated Principles*

of Zoology, in which it was completely revised and updated. It explains the principles of ecology, with emphasis on populations, community ecology, and variations in life history strategies of natural populations. The treatment includes discussions of niche, population growth and its regulation, limits to growth, competition, energy flow, and nutrient cycles.

Chapter 3 on animal architecture is a short but important chapter that defines the organization and development of body plans distinguishing major groups of animals. This chapter includes a picture essay of tissue types and a section explaining important developmental features associated with the evolutionary diversification of the bilateral metazoa.

Chapter 4 treats classification and phylogeny of animals. We present a brief history of how animal diversity has been organized for systematic study, emphasizing current use of Darwin's theory of common descent as the major principle underlying animal taxonomy. Continuing controversies between the schools of evolutionary taxonomy and phylogenetic systematics (cladistics) are presented, including a discussion of how these alternative taxonomic philosophies affect our study of evolution. Chapter 4 also emphasizes that current issues in ecology, evolution, and conservation biology all depend upon our taxonomic system. For this edition we added a new boxed essay illustrating use of molecular phylogenetic procedures, and updated higher-level phylogeny and taxonomy of the bilateria.

The sixteen survey chapters are a comprehensive, modern, and thoroughly researched coverage of the animal phyla. We emphasize the unifying architectural and functional theme of each group. Structure and function of representative forms are described, together with their ecological, behavioral, and evolutionary relationships. Each chapter begins with succinct statements of "Position in the Animal Kingdom" and "Biological Contributions." Students have found these opening statements, a distinctive feature of this text, to be important in assisting their approach to each chapter.

The classifications in each chapter are positioned following other coverage of a particular group, in most cases immediately preceding the summary at the end of the chapter. Discussions of phylogenetic relationships are written from a cladistic viewpoint, and cladograms have been presented where possible. These show the inferred branching events in each group's history and the origin of some of the principal shared derived characters. Traditional phylogenetic trees have

been drawn to agree with cladistic analyses as closely as possible. Because cladistics is not embraced by all teachers, we have presented cladograms as supplemental to the conventional Linnaean classifications.

Some of the principal changes in these survey chapters follow. Chapter 5 on protozoan groups was completely revised for this edition. Molecular sequencing of bases in genes has revealed that the former phylum Protozoa embraces numerous phyla of varying evolutionary relationships. These groups of animal-like unicellular eukaryotes are grouped in this chapter as a convenience without implying that they form a monophyletic group. In chapter 8 (acoelomate animals) we rewrote the section on turbellarians to emphasize their paraphyly, yet retaining the class Turbellaria because the taxonomic complexity of a strictly cladistic classification is beyond the scope of an introductory textbook.

While still covering all pseudocoelomates in a single chapter (chapter 9), we now group the various phyla in superphyla Lophotrochozoa (Rotifera, Acanthocephala, Gastrotricha, and Entoprocta) and Ecdysozoa (Nematoda, Nematomorpha, Kinorhyncha, and Priapulida). In the phylogeny section of chapter 12 (arthropods), we revisited the Lophotrochozoa-Ecdysozoa question, as well as the possibility of polyphyly of Arthropoda. We discuss the new hypothesis that myriapods are a sister group to all other arthropods and that insects and crustaceans form a monophyletic group. Chapter 13 (lesser protostomes) was reorganized to group lophotrochozoans (Sipuncula, Echiura, Pogonophora, Brachiopoda, Ectoprocta and Phoronida) and ecdysozoans (Pentastomida, Onychophora, Tardigrada, and Chaetognatha) together. Chaetognatha were transferred to this chapter on the strength of evidence that they are protostomes, despite their morphological similarities with deuterostomes. Molecular evidence strongly supports placement of lophophorate phyla in Protosomia, and the division of their coelom similar to deuterostomes must be convergent.

In chapter 15 (vertebrate beginnings) we revised and shortened discussions of pharyngeal filter-feeding, ancestry and evolution of chordates, and Garstang's hypothesis of larval evolution. The many changes in chapter 16 (fishes) include revision of origin and evolution of fishes, and fish classification. In current classifications the traditional term Osteichthyes as applied to all bony fishes does not describe a monophyletic grouping; rather the two major lineages of bony fishes are now divided into two classes containing ray-finned fishes (Actinopterygii) and lobe-finned fishes (Sarcopterygii). In chapter 19 (birds) we revised the section on origin and relationships to explain the recently adopted division of living birds into paleognathous and neognathous groups, replacing the older terminology of ratite and carinate to describe flightless and flying birds, respectively. Among the many changes in chapter 20 (mammals) were revisions of the sections on horns and antlers, glands, food and feeding, primate classification, and human evolution.

Teaching and Learning Aids

Vocabulary Development

Key words are boldfaced and derivations of generic names of animals are given where they first appear in the text. In addition, derivations of many technical and zoological 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 provides pronunciation, derivation, and definition of each term.

Chapter Prologues

A distinctive feature of this text is an opening essay placed in a panel at the beginning of each chapter. Each essay presents a theme or topic relating to the subject of the chapter. Some present biological, particularly evolutionary, principles; others illuminate distinguishing characteristics of the group treated in the chapter. Each 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.

Chapter Notes

Chapter notes, which appear throughout the book, augment the text material and offer interesting sidelights without interrupting the narrative.

For Review

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

Art Program

The appearance and usefulness of this text are much enhanced by numerous 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 the authors' other zoology texts through several 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 won awards from the Association of Medical Illustrators, American Institute of Graphic Arts, Chicago Book Clinic, Printing Industries of America, and Bookbuilders West. Bill and Claire also are recipients of the Art Directors Award.

Web Pages

At the end of each survey chapter is a selection of related internet links dealing with the chapter's topics. The URLs for the pages are found in the text's Online Learning Center at www.mhhe.com/zoology (click on this book's cover).

Supplements

Instructor's Manual

The Instructor's Manual provides a chapter outline, commentary and lesson plan, and a listing of resource references for each chapter. We trust that this material will be particularly helpful for first-time users of the text, although experienced teachers also may find much of value. The Instructor's Manual is available on this text's Online Learning Center at www.mhhe.com/zoology (click on this book's cover).

Computerized Test Bank

Test questions are available as a computerized test generation system for IBM-compatible and Macintosh computers. Using this Brownstone Testing 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.

Animal Diversity Laboratory Manual

The laboratory manual by Cleveland P. Hickman Jr. and Lee B. Kats, *Laboratory Studies in Animal Diversity*, is designed specifically for a survey course in zoology.

Transparency Acetates

A set of full-color transparency acetates of important textual illustrations is available for instructors with this edition of *Animal Diversity*. 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 to instructors in this unique textbook supplement. Both invertebrates and vertebrates are represented. Descriptions, including specific names of each animal and brief overview of the animal's ecology and/or behavior, accompany the slides.

Life Science Animations

Difficult concepts like DNA replication, oxidation, and respiration can be learned through animation in this two CD-ROM set. This instructor tool provides 300 animations to present complex life science processes in a method that fosters easier learning and review.

Student Study Guide

The *General Zoology Student Study Guide* by Jane Aloï and Gina Erickson is a useful tool for student review and study. It provides self-testing, valuable study tips, and chapter summary activities, including critical thinking exercises.

Animal Diversity Online Learning Center

The Internet provides a new route for learning and studying. McGraw-Hill has designed a website to support the Zoology field of study. This Online Learning Center provides live links to related Internet sites that are described in *Animal Diversity's* end-of-chapter pedagogy. In addition, you will find on-line quizzing, information about careers in Zoology, key terms flash cards, a cladistics laboratory, Zoology Essential Study Partner, and much more. You can find this site at www.mhhe.com/zoology. Just click on the cover of *Animal Diversity*.

Digital Zoology

Digital Zoology Interactive CD-ROM by Jon Houseman is an interactive guide to the specimens and materials covered in zoology laboratory and lecture sessions. Laboratory modules contain illustrations, photographs, annotations of the major structures of organisms, interactive quizzes, and video clips. Interactive cladograms within lab modules provide links to interactive synapomorphies of the various animal groups. Key terms throughout the program link to an interactive glossary. This CD-ROM is the perfect student study tool to promote learning both in and outside of the zoology laboratory, and also comes with an accompanying student workbook and website to provide additional study tips, exercises, and phyla characteristics.

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