

PREFACE

Laboratory *Studies in Animal Diversity* offers students hands-on experience in learning about the diversity of life. It gives students the opportunity to become acquainted with the principal groups of animals and to recognize the unique anatomical features that characterize each group as well as the patterns that link animal groups to each other. Although this manual was written to accompany a particular textbook, *Animal Diversity*, it can easily be adapted to use with any other introductory zoology text and with a variety of course plans. Every effort has been made to provide clear instructions and enough background material to create interest and an understanding of the subject matter. Many illustrations complement the written word.

Features

- Special projects entitled "Experimenting in Zoology" appear at the ends of certain exercises. Some of these activities can be completed within a single laboratory period; others extend for a longer time. In all these project exercises, the student follows experimental procedures, records and analyzes quantitative data, and draws conclusions from the results. Many instructors will want their students to gain additional experience by writing a laboratory report in which the student states the objectives, methods followed, results

obtained, and conclusions that can be drawn from the results. The Experimenting in Zoology exercises are: Effect of Temperature on the Locomotor Activity of *Stentor* (Exercise 4); Planaria Regeneration Experiment (Exercise 7); Behavior of the Medicinal Leech, *Hirudo medicinalis* (Exercise 10); The Phototactic Behavior of *Daphnia* (Exercise 12); Aggression in Paradise Fish, *Macropodus opercularis* (Exercise 16); and Analysis of the Multiple Hemoglobin System in *Carassius auratus*, the Common Goldfish (Exercise 16).

- All exercises are designed to be interactive, with questions placed throughout the text, and spaces for students to write down their responses and observations. This "active learning" approach involves students in the exercise and encourages them to think about the information as they read. Some questions may require students to consult their textbook for the answers. A few exercises have questions in the figure legends, to be answered in the spaces provided when the student consults the figure. Examples of this interactive approach are found in Exercises 15 through 20.
- This laboratory manual provides many aids for the student. Throughout the exercises, working instructions

are clearly set off from the descriptive material. Function is explained along with anatomy. Topic headings help the student mentally organize the material. Metric tables and definitions of special terms appear on the inside front and back covers for convenient use. Much of the artwork was designed to assist the student with difficult dissections.

New to This Edition

- We have added a new interactive exercise on how to make a cladogram in Exercise 2, Introduction to Animal Classification. The exercise explains how to map characters onto trees and how to choose between different possible evolutionary pathways using the Principle of Parsimony.
- We have made several taxonomic updates that parallel the accompanying textbook, *Animal Diversity*, fifth edition. Birds are now recognized as a subclass within the class Reptilia. Birds and reptiles share several derived characters, including distinct skull and ankle characteristics and the presence of beta-keratin in the skin. This unites birds and nonavian reptiles as a monophyletic group. All modern nonavian reptiles are now placed in the diapsid group. Turtles, formerly considered anapsids, are

treated (controversially) as derived diapsids. Another change is inclusion of homopteran insects in the order Hemiptera; the order Homoptera is now obsolete.

- Classifications, where appropriate, are included with the text, together with a new cladogram showing the position of the group within the Eucarya, and a "pie" diagram showing the relative sizes of the major taxa in a phylum.
- The new Appendix A includes directions for preparing the exercises in this manual. For each exercise, we have listed the materials required, directions for preparing solutions, suggestions for maintaining and working with the living materials, suggestions for demonstrations, and a list of appropriate references, most of which are annotated. This information is convenient for the instructor as well as for

students who may later wish to consult or implement an exercise.

Supplements

- A supplement to Exercise 2, entitled "Taxonomic Classification and Phylogenetic Trees," can be found on the main text's website. This interactive exercise, prepared by Louise Wootton of Georgian Court College, leads the student through the construction of a dichotomous key, an exercise in phenetic analysis, and the construction of a cladogram. Visit www.mhhe.com/hickmanad5e and click on "Cladistics Laboratory" to access this exercise.

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The authors also express their appreciation to the editors and support staff at McGraw-Hill Higher Education who guided this revision, especially Patrick Reidy, Executive Editor; Margaret Horn, Developmental Editor; and Joyce Watters, Project Manager. Although we make every effort to bring to you an error-free manual, errors of many kinds inevitably find their way into a book of this scope and complexity. We will be grateful to readers who send comments or suggestions concerning content. Please address these remarks to Patrick Reidy, Executive Editor, The McGraw-Hill Companies, 501 Bell Street, Dubuque, Iowa 52001. Patrick may also be contacted by email at patrick_reidy@mcgraw-hill.com.