

PREFACE

With this edition we continue the tradition of excellence begun by the late J. E. Wodsdalek of the University of Minnesota with the first edition of the General Zoology Laboratory Guide in 1938. In recognition of his contributions as sole author of the first five editions of this book prior to his death, we continued to recognize Dr. Wodsdalek as coauthor of this book from the sixth through the eleventh editions.

A solid foundation in basic zoology is essential for students who are preparing for careers in biology, zoology, genetics, physiology, medicine, veterinary medicine, agriculture, environmental science, conservation, and many other fields. Other students also benefit from the study of animals because animals are an important part of nature, which surrounds us, and also because animals have contributed to human life and welfare in innumerable ways since the dawn of civilization. Animals affect each of us every day whether or not we are aware of it. Some knowledge of zoology is therefore essential to every educated person.

Meaningful laboratory experiences are a vital part of learning zoology, and this book is designed to facilitate laboratory study of selected animals. In the laboratory students learn the importance of careful observation, of following specific instructions, and of seeing relationships of structure and function. By carrying out well-designed scientific experiments in the laboratory students learn to **do** science instead of merely listening to someone **talk** about science.

In writing this book I have tried to remember my own days as a student and the questions I had while studying various kinds of animals for the first time. I have attempted to provide descriptions, illustrations, and appropriate guidance for meaningful laboratory study of animals. Although I agree with the spirit of Louis Agassiz' admonition, "Study nature, not books," I believe that students can benefit most in their study of nature when aided by appropriate instructions and illustrations.

I can remember some of my own frustration in zoology labs when I attempted to follow some vague verbal description of anatomical structures with no illustrations or other visual aids to help me locate important structures or to give me some appropriate orientation. I have written the exercises in this book with the intention of reducing such frustration and with the intention of making student experiences in the zoology laboratory interesting, rewarding, and meaningful.

I continue to emphasize the study of living and anesthetized animals whenever feasible because students should learn that zoology is the study of animal life rather than the study of dead animals. Live animals give students the opportunity to observe and experiment with behavior and to do simple physiological experiments as well as to see the natural color and texture of body parts. Preserved specimens serve well for many anatomical studies, but students should always have the opportunity to observe and to work with living animals whenever possible. Few of us would choose a stuffed or embalmed dog or cat for a pet if given the option.

This edition of the manual continues the tradition of more than fifty years of excellence in providing students with a comprehensive introduction to zoology and to the major animal phyla. This book is written to aid students and teachers in many colleges and universities operating with different schedules, resources, and preferences, so I have intentionally included more material than can reasonably be covered in the time available in a two-semester general zoology course. We expect instructors to select those parts of the guide and those animals they deem most appropriate for their own classes. With judicious selection of chapters and of animal types this book can also be used for one-semester and one-quarter zoology classes.

Changes in This Edition

A major innovation in the twelfth edition is the addition of full-color illustrations throughout the book. The success of the full-color illustrations included in several chapters of the last edition encouraged us to make more extensive use of color in this edition. Color photographs of dissections give students much more realistic views of what animals actually look like in the laboratory and help them to distinguish different organs and tissues.

We have found that adding color to drawings not only helps to differentiate various parts, but can also be very useful in showing relationships between different parts of an animal and, when properly done, can help students identify organs belonging to different organ systems.

We have added more than 150 new illustrations in this edition and have greatly increased the number of color photographs. Many of the photographs are from expert dissections done by Dr. Larry Grimes and photographed by Mr. Ken Taylor. Many other photographs are from the extensive collections of the Carolina Biological Supply Company.

Among the new material added in this edition is an exercise on the anatomy and dissection of the cockroach. Several teachers have told us that they prefer to use the cockroach rather than the grasshopper to introduce students to insect morphology. Since we are now including both insects in this edition, teachers now have an easy choice of forms. I am grateful to Dr. John Meyer for information on cockroach anatomy and to Christina Devorshak for her expert dissections.

We have also added a new exercise on the anatomy and biology of the nematode *Caenorhabditis elegans*. *C. elegans* has been an important research animal for many genetic studies in recent years. More than 50 genes have been identified in this species, and it will continue to be a useful research animal with many important applications in research. Students should learn about such important species in an introductory zoology course.

Another important addition is a new introductory chapter on animal morphology (chapter 9). In this chapter we discuss some basic features of the organization of the animal body that should help students compare different types of animals and better understand some of the morphological features important in determining possible phylogenetic relationships among animals.

We have made significant changes and additions in nearly every chapter of the book. New information, improved explanations, and additional illustrations have been added to many chapters, including the chapter dealing with microscopy. We have expanded and updated the material on laboratory safety and on the care and handling of animals in the laboratory. Both topics are extremely important and have received much attention in the past few years. We hope that these changes and additions will make this lab guide more helpful. As always, we will welcome your comments and suggestions for further improvement.

Basic Features of This Manual

In this edition we have continued the basic organization and pedagogical features of the previous edition. A **Correlation Chart** is provided at the beginning of the book to help teachers and students coordinate the laboratory exercises with appropriate chapters in several of the popular zoology textbooks in current use. Important pedagogical features of the book include **boldface headings** within each chapter to indicate the major divisions of each exercise.

We also use **boldface** in the text to identify important terms (ideas, structures, processes) that students should remember and understand. The most important of these boldface terms are included in the list of **key terms** at the end of the chapter in which they are first introduced.

Several chapters provide space for students to add their own drawings of particular animals or structures to aid them in learning and remembering things observed during their laboratory study. The book also provides several blank tables and pages of graph paper for students to record and plot data from their laboratory observations and experiments.

Each chapter begins with a list of specific **objectives** that identifies important principles, concepts, and facts that students should learn as a result of their laboratory study. I have found that a specific list of laboratory objectives helps students focus their attention on the important material in each lab. I also suggest that instructors modify and add to these lists of objectives as appropriate for their own classes. Such lists of objectives can be most helpful in ensuring that students understand what they will be tested on and that the tests actually focus on students' understanding of the important principles, concepts, and processes.

Most chapters in this book start with a brief **introduction** with pertinent background material to help orient students for the exercises to follow. A **materials list** is provided showing the specimens and other materials needed for each exercise. Most chapters have one or more lists of suggested **demonstrations**, which are suggested to supplement the main studies of each exercise.

At the end of each chapter is a list of **key terms** introduced in that chapter. Chapters also have blank pages provided for students to add their own notes and sketches. If students use these pages to record their observations they will have a consolidated record of their laboratory work bound in a single place instead of a scattered bunch of papers and drawings likely to be lost.

I have tried to make this laboratory manual a convenient, user-friendly companion for laboratory study. I hope every student has as much fun and satisfaction in zoology lab as I have had.

Anatomy Films

From my many years of teaching zoology laboratories I have learned that it is very helpful to give students an overview of the anatomy of an animal to be studied and/or dissected before they undertake the anatomical study on an actual specimen themselves. It's a lot like football players viewing game films before facing a major rival football team. They might do all right without knowing what kinds of plays the opposition typically runs and who their key players are, but they are not likely to win the championship without some good scouting information.

An excellent way to prepare for a serious anatomical study of an animal is to view a good film or video of the anatomy of that animal prior to beginning work with an actual specimen. Such preparation for the lab study gives