preface

We enthusiastically present the seventh edition of this book with numerous updates on topics of vigorous contemporary research. We continue to preserve essential qualities of the text that students and professors liked in the first six editions. The reception accorded *Foundations of Parasitology* has been most gratifying. Your comments and suggestions are always welcome. Keep them coming.

SCOPE OF THIS BOOK

This textbook is designed especially for upper-division courses in general parasitology. It emphasizes principles, illustrating them with material on the biology, physiology, morphology, and ecology of the major parasites of humans and domestic animals. We have found that these are of most interest to the majority of students. Other parasites are included as well, when they are of unusual biological interest.

The first three chapters delineate important definitions and principles in evolution, ecology, immunology, and pathology of parasites and parasitic infections. Chapters on specific groups follow, beginning with protozoa and ending with arthropods. Presentation of each group is not predicated on students having first studied groups presented in prior chapters; therefore, the order can vary as an instructor desires. As always we have strived for readability, enhancing words with photographs, drawings, electron micrographs, and tables.

NEW TO THIS EDITION

This edition integrates a wealth of new discoveries and literature. Many areas of parasitology are theaters of intense research effort and fruitful results. As always, addition of material compelled us to prune out an equal amount of text and illustrations so as not to increase book length, but we hope that we have been judicious in our reshaping. We have continued to include trenchant quotations at the beginning of each chapter. Well, maybe some of them are not so trenchant. Nevertheless, we hope these observations of pioneering researchers, as well as references to literature and even pop culture, will broaden your view of parasitology. Their curiosity piqued, some readers have asked us for sources of quotations, so we have included these where possible.

The numerous changes in chapter 1 included updating the table on global prevalence of various human parasites. We added a new section entitled "Parasitology for Fun and Profit" to emphasize the fascinating study of parasites. We are including some URLs for the World Wide Web because many students enjoy taking advantage of those resources. Concepts in chapters 2 and 3 are briefly covered, but understanding them is *essential* to understanding the rest of the book. Chapter 2 has been completely reorganized and retitled "Parasite Systematics, Ecology, and Evolution." We increased emphasis on molecular systematics and on cladistics, providing some examples here and a plethora of examples in chapters to follow. We added a short section on evolution of virulence. Propelled in large measure by modern molecular methods, immunologists continue their torrent of discoveries. The 1980s and 1990s saw enormous increases in our understanding of the role and mechanisms of cytokine function and witnessed our realization of the importance of immunopathology in parasitic diseases. Thus, chapter 3 has again undergone major surgery. It has been rewritten, reorganized, and expanded, including a new section introducing antimicrobial peptides (defensins) and Toll-like receptors and new tables listing the many ways that protozoan and helminth parasites evade host defenses. The figure illustrating effects of cytokines on various cells has been redrawn and made easier to follow.

"Form and Function" chapters on protozoan parasites, trematodes, cestodes, nematodes, and arthropods have again been updated and rewritten significantly to provide a stronger base of knowledge with which to investigate each group further. When available, we include cladograms to show phylogenetic relationships of some of the major groups.

We again modified the classification section of chapter 4, making it consistent with all the major taxonomic literature published since the sixth edition. We continue use of the words "protozoa" and "protozoans" as common names with no taxonomic status and that refer to a number of phyla. Chapter 5 on Kinetoplasta includes new information on antigenic variation in trypanosomes, *Leishmania*-host cell relationships, and the important new anti-leishmanial drug miltefosine. In chapter 6 we change usage from *Giardia lamblia* to *Giardia duodenalis* to be consistent with the latest nomenclatural decisions about this important parasite. Several examples in this chapter cite the importance of molecular techniques to diagnosis and contributions to the overall biology of the organisms. Other protistan chapters address the exploding body of knowledge about opportunistic parasitic infections in immunocompromised persons and the amazing diversity of coccidians as revealed by the active systematic research on these parasites.

Chapter 7 on amebas has been reworked considerably to ensure consistency with current literature on ameba systematics, and we added a short section on the role amebas play in transmission of Legionnaire's disease. In chapter 8 we added information on vaccination of poultry against coccidian infection, on the debate about *Neospora caninum,* and on *Cryptosporidium.* Both chapters 8 and 9 have information on the important membranous organelle known as an apicoplast. Intense scrutiny of malaria continues, reflecting its widespread importance as a human disease, and chapter 9 has been revised accordingly. We retained the expanded table comparing *Plasmodium* spp. and updated methods of diagnosis, role of cytokines in pathogenesis and immunity, progress toward vaccines, and drug action and resistance. A new figure has been added that illustrates fluctuations in body temperature

(fever phases) in falciparum compared with vivax malaria and relationship of the temperature fluctuations to phases of schizogony.

Chapter 13 incorporates significant new material on systematics of flatworms, one of the most controversial areas in parasitology. Changes in chapter 16 on strigeiform trematodes include a new diagram of schistosome anatomy. We reworked the section on schistosome life cycles, especially the description of worm migration in definitive hosts and the requirement for an intact host immune system for worm maturation. In chapter 17 we added a discussion of *Ribeiroia ondatrae,* the parasite that appears responsible for much deformity in frogs, widely reported in the media in recent years. In chapter 18 we rewrote the section on the remarkable behavior modification induced in ant hosts by *Dicrocoelium dendriticum* and added a close-up photo of infected ants clinging to vegetation with their mandibles.

Changes in chapter 19 on monogeneans include updated coverage of their anterior attachment organs, feeding habits, and the egg-forming region and mechanism in *Gyrodactylus.* Several new figures replaced those in the sixth edition. We subjected chapter 20 on cestode form and function to substantial revision, including substitution of the simple strobila diagram with a diagram containing more instructional value. Sections on tegument and on calcareous corpuscles were reorganized and rewritten, adding a diagram to help students interpret the electron micrograph of tapeworm tegument. A completely new section on "Effects of Metacestodes on Hosts" was added that emphasizes "parasite induced trophic transmission." In chapter 21 we rewrote the section on *Diphyllobothrium* to recognize that *D. dendriticum,* rather than *D. latum,* is the most common species in humans. Morphological and molecular evidence continue to support abandonment of the name *Taeniarhynchus* for *Taenia saginata.* We revised discussion of Asian *Taenia,* recognizing that it is a separate species (*Taenia asiatica*) and the sister species of *T. saginata,* both of which are only distantly related to *T. solium.*

The chapters on nematodes have been revised in many ways. Some noteworthy changes include coverage of the seven (so far) sibling species of *Trichinella;* evidence that the amazing life cycle of *Strongyloides* spp. is probably under neuronal control; updated material on role of worm secretions in hookworm disease; current evidence on whether *Ascaris lumbricoides* and *A. suum* are separate species; and the identity of *Enterobius gregorii.* In chapter 29 on filarial worms we added the crucial role of *Wolbachia* in biology of the worms and pathogenesis of filarial infections.

Chapter 31 is an entirely new chapter on those amazing worms, Nematomorpha. This chapter brings together all findings of the most recent research on this group, especially the life cycle work. The seventh edition of *Foundations of Parasitology* is the *only* text to date (including invertebrate and zoology texts) that has this information. Chapter 32 on Acanthocephala has an expanded discussion of recent molecular work linking this phylum to Rotifera. A major addition is a cladogram and discussion on phylogenetic relationships within Acanthocephala.

Form and function of arthropods has now become chapter 33: major changes include the sections on development, especially with respect to genetic control of development; the sections on molting, especially discussion of molecular mechanisms; and sections on diapause, particularly hormonal mechanisms. Readers of the classification coverage in this chapter will find that we have included Pentastomida within Arthropoda as a subclass of crustacean class Maxillopoda. Chapter 34 adopts the currently most authoritative classification of Crustacea. In this chapter we include a photo of a shark embryo parasitized by trebiid copepods; these amazing organisms enter the uterus of pregnant sharks, attacking the uterine wall as well as the surface of the embryos, thus becoming endosymbiotic ectoparasites!

Chapter 35 covers Pentastomida and includes an explanation of its demotion from phylum status to a subclass of Crustacea. Much information has been added to the remaining chapters on insects, such as use of endectocides for control of lice, potential for bed bugs to transmit hepatitis viruses, a dramatic set of photos showing myiasis in a frog, and a dramatic picture of a strepsipteran emerging from a fire ant. The section on plague has been extensively reworked.

Chapter 41 on ticks and mites has new material on tick behavior, especially their attraction to human breath, on dogs as carriers of various tick-borne infections, and on chorioptic mange as a veterinary problem.

INSTRUCTIVE DESIGN

Students using the seventh edition of *Foundations of Parasitology* are guided to a clear understanding of the topic through our careful use of study aids. Essential terms, many of which are defined in a complete glossary, are boldfaced in the text to provide emphasis and ease in reviewing. The glossary itself was revised and many new terms added. In response to student requests, we again provide pronunciation guides for glossary entries. Numbered references at the end of each chapter make supporting data and further study easily accessible. Clear labeling makes all illustrations approachable and self-explanatory to the student.

We have again been fortunate indeed to have William C. Ober and Claire W. Garrison draw many new illustrations for this edition. Their artistic skills and knowledge of biology have enhanced other zoology texts coauthored by Larry Roberts. Bill and Claire bring to their work a unique perspective resulting from their earlier careers as physician and nurse, respectively.

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