Preface

We are surrounded by a world of microorganisms. They inhabit a range of environments from mountains and volcanoes to deep-sea vents. They can be found in the air we breathe, the food we eat, and even within our own bodies. They play a critical role in various processes that provide energy and make life possible. As long as human beings exist, we will continue to interact with countless numbers of microorganisms on a daily basis.

For these reasons, microbiology is and will remain a critical discipline. The knowledge and ability to recognize, coexist with, and manipulate microorganisms is one of the great challenges currently confronting humanity. Although much microbiological research is conducted in laboratories, the subjects and consequences of this research affect our everyday lives. Indeed, many important news items involve microbiology: major epidemics such as AIDS and drug-resistant tuberculosis; the eradication of major diseases such as smallpox; bacteria as causative agents of ulcers; technologies designed to increase food production; genetic engineering; and the Human Genome Project, which will identify all the genetic material within the human body.

A central theme that permeates this entire book, then, is that microbiology is a current, relevant, exciting central science that affects us all. In countless areas, from agriculture to evolution, from ecology to dentistry, microbiology is both contributing to scientific knowledge and solving human problems. This was true in past centuries, when Louis Pasteur was developing the first modern vaccines and Anton van Leeuwenhoek was making simple microscopes and glimpsing the microbial world for the first time, and it remains true today. As you read this text, you will get a sense of the history of this science, its methodology, its many contributions to humanity, and the many ways in which it continues to be on the cutting edge of scientific advancement.

Style, Organization, and Currency

This book is written chiefly for students of the health sciences, but it contains more than enough information to meet the needs of students majoring in biology. We have designed the book to serve the needs of both audiences by using an abundance of clinically important information to amplify and illustrate a thorough treatment of the general principles of microbiology.

We have made this text truly "user-friendly," in the belief that students who enjoy a course retain far more of its content for a longer period of time than those who take the course like a dose of medicine. We want students to experience microbiology as an exciting, dynamic, rapidly changing field that is important to human welfare. The development of microbiology—from Leeuwenhoek's astonished observations of "animalcules," to Pasteur's first use of rabies vaccine on a human being, to Fleming's discovery of penicillin, to today's race to develop an AIDS vaccine—has been one of the most dramatic stories in the history of science. The growth of our knowledge in recent years has done nothing to diminish the drama; microbiology is as intriguing now as it has ever been. There is no reason for a book to be any less interesting than its subject.

This book has deliberately been written in a simple, straightforward, functional style. Our aim is to make information as accessible as possible to students, not to dazzle or intimidate them. Throughout, we have emphasized the connection between microbiological knowledge and the students' personal experiences and career goals. It is this aim, as much as the demands of the microbiology curriculum, that accounts for the special attention we have given to the *clinical aspects* of microbiology and to public health issues.

In a field that changes so quickly—with new research, new drugs, and (unfortunately) new dis-

eases—it is essential that a text be as up to date as possible. We have tried to incorporate the latest information, not just on clinical practice, but on all aspects of microbiology. Special attention has been paid to such important, rapidly evolving topics as genetic engineering (Chapter 8), drug resistance, especially in tuberculosis (Chapter 14), and nosocomial infections (Chapter 16). Chapter 19 contains a newly expanded Essay on AIDS, and topics related to this disease are treated in several other chapters as well.

The organization of this text is designed to combine logic with flexibility. The chapter sequence will be useful in most microbiology courses as they are usually taught. Nevertheless, it is not essential that the chapters be assigned in their present order; thus, it should be possible to use this book in courses organized along quite different lines. The first part of the book (Chapters 1–4) provides the basic information—on the nature of the microbiology, on chemistry, on microscopy, and on cells—that underlies the rest of the course. The second part (Chapters 5–8) deals with the metabolism, growth, and genetics of microorganisms. Including two chapters on genetics allows for a thorough treatment of such important topics as mutation and genetic engineering, plus new techniques such as polymerase chain reaction (PCR). The third part (Chapters 9–12) comprises a survey of the major types of microorganisms, together with an introductory discussion of how they are classified.

The fourth part of the text (Chapters 13 and 14), devoted to control of microorganisms, includes material on physical control (sterilization and disinfection) and antimicrobial chemotherapy. The fifth part (Chapters 15–19) covers all aspects of the relationship between host and microorganism, including the disease process, epidemiology and nosocomial infections, nonspecific body defense mechanisms, and the immune system. Two chapters are allocated to immunology to permit a comprehensive discussion of immunization, immunologic tests, autoimmune disorders, and immunodeficiency diseases, including AIDS. The sixth part (Chapters 20–25) consists of a survey of infectious diseases, organized by the affected organ or system. Finally, the seventh part (Chapters 26 and 27) deals with environmental microbiology (including water pollution, water purification, and sewage treatment) and applied microbiology (including the microbiology of food).

The Art Program

Clear, attractive drawings and carefully chosen photographs can often contribute as much to the student's understanding of a scientific subject as the written text itself. We have been extremely fortunate once again to have the services of an extraordinary artist, William C. Ober, M.D., who, in collaboration with Claire Garrison, has executed many of the illustrations for this text. Bill and Claire combine technical skill with scientific understanding to a degree rarely found in even the best biological illustrators. In fact, they have been awarded nearly every important prize for biomedical illustration, including the Association of Medical Illustrators Award of Excellence, the American Institute of Graphic Arts Certificate of Excellence, and the Chicago Book Clinic award for art and design. The fact that all the drawings in this book are in full color has enabled us to make the maximum use of Bill and Claire's talents.

The use of color in the first edition was widely acclaimed by instructors and students. We have added many new color photos and line drawings to the second edition, responding particularly to reviewer and user comments requesting additions and changes. Throughout, color has been used, not just decoratively, but for its pedagogical value. For example, as in the first edition, similar molecules or cellular structures are colored the same way each time they appear, making them easier to recognize. The availability of color also makes it possible to present many subjects, such as staining reactions, as they are actually seen in the laboratory.

Special Features

The book includes three special features designed to broaden the scope of its coverage and maintain a high level of student interest and involvement with the material.

Each chapter contains a number of **Boxes** that deal with a wide variety of subjects. In the second edition, all boxes are placed in one of five categories, each of which is distinguished by an icon and a color banner.

Biotechnology Boxes report on recent developments in this exciting field, such as triple-stranded DNA, human hemoglobin produced by transgenic pigs, and the box reproduced on p. xxi on roach traps in which a fungus is the active agent.

Try It Boxes encourage students to make the transition from the textbook to their world through hands-on activities that enable them to experience the excitement of discovering things for themselves. Examples include culturing magnetotactic bacteria from local swamps and investigating which organisms grow in the cosmetic and health products found in students' own bathrooms.