

PREFACE

Since its inception, microbiology has been an applied as well as a basic science. These two faces of microbiology are reflected in the principal changes we've incorporated into this third edition: expansion of our use of Case Histories and recognition of the increasing impact of genomics on all biology, perhaps especially microbiology.

Possibly the most important application of microbiology, certainly the most personally relevant, is using the vast knowledge gained from studying microorganisms to treat an individual patient suffering from a particular infectious disease. In previous editions, we emphasized this application in the form of Case Histories, adopting them as a learning tool and our book's trademark. (Just as basic microbiological knowledge is essential for rational treatment of infectious diseases, Case Histories remind, correlate, and stimulate interest in that basic knowledge.) In this third edition we've expanded our use of Case Histories, adding the subtitle—A Case Histories Approach—as emphasis. We've attempted to draw more clearly the link between Case Histories and underlying, basic microbiology by adding a series of "Case Connections" after each chapter-opening Case History.

With respect to basic science, biologists have long known that all a cell is and does is encoded in and directed by the DNA of its genome. Now, with ever-increasing precision, biologists are learning how to read the information encoded in a cell's DNA and interpret its meaning. This new field of "genomics" is rapidly changing all aspects of microbiology, from knowledge of the extent of the diversity of various microorganisms to means of devising rapid ways of identifying microorganisms and rational means of treating infectious diseases. In this third edition we dedicate half of Chapter 7 to the methods of genomics and refer throughout the book to their application to various fields of microbiology.

We'll still visit all aspects of microbiology—basic and applied, including medical, environmental, agricultural, and industrial. One primary emphasis is medical: two entire parts (Parts III and IV) of the book deal with microbial diseases. These follow a consideration of the basic science of microbiology (Part I) and a survey of the various kinds of microorganisms (Part II). Finally, we examine the way humans use microorganisms and the essential roles microorganisms play in Earth's ecology (Part V).

We maintain the approach and attitude of previous editions, including emphasis on the why of metabolism and genetics as well as the what. However, there are changes.

Some of these reflect the scientific progress that has occurred since publication of the second edition, such as the great advances that have been made utilizing new molecular methods to identify microorganisms and the new effective vaccines that have been introduced. We've altered the presentation of immunology to reflect the major advances in the component now called innate immunity (formerly called nonspecific defenses).

Some Specific Changes Incorporated into the Third Edition

- The powerful observational new tools offered by scanned-proximity probe microscopes, including scanning tunneling microscopes and atomic force microscopes.
- The much used molecular staining method employing green fluorescent protein.
- Expansion of the coverage of the molecular structure of peptidoglycan.
- Introduction of the concepts of anoxygenic and oxygenic photosynthesis.
- A half chapter on genomics with accompanying figures and tables.
- A section on biofilms.
- Change of the presentation of bacterial taxonomy to reflect the phylogenetic approach in the latest *Bergey's Manual*.
- Discussion of "black mold" and "sick buildings."
- A section with accompanying table on emerging diseases.
- Introduction of the concepts of innate and adaptive immunity, reflecting modern usage and expanded knowledge.
- Expansion of the coverage of anthrax and bioterrorism.
- Expansion of the coverage of AIDS, describing the continuing pandemic.

Student-Support Features

The book contains a number of features designed to assist your learning and organize your study.

Learning Goals. Each chapter begins with a succinct list of Learning Goals to help you focus on its overall aims.

Boldface Terms. Certain terms are highlighted in boldface type the first time they occur. We consider them important and suspect they might be new to you. They are defined in the context in which they occur, and those that might not be adequately defined in a dictionary are included in the Glossary at the back of the book.

Boxes. We've included three kinds of boxes—Case Histories, Sharper Focus, and Larger Field.

- Case Histories explore real clinical cases (most from Catherine Ingraham's medical practice). We hope these stories will help you remember the details of the text material more easily. These Case Histories occur throughout the text. Those at the beginning of most chapters play a critical role: they set the stage for much that follows in the chapter. You'll probably want to refer back to these from time to time as you progress through the material that follows.
- Sharper Focus boxes examine a chapter topic in more detail. Just as you can see greater level of detail by focusing a microscope, these boxes (which appear in every chapter) reveal more information about interesting chapter topics.
- Larger Field boxes connect text material to our world. Just as you can expand a microscope's field to see more background around an organism, these boxes expand a chapter topic to its larger context—environmental aspects, history, news events, etc. They emphasize the connections of microbiology to all facets of our lives—beyond the medical aspects explored in the Case Histories.

CD Connection. In most chapters there are one or more "CD Connections" marked by a CD-ROM icon and carrying directions to particular sites on the CD-ROM as well as a brief account of what the site shows. For the most part the designated sites are film loops that quickly convey information that might be difficult to grasp from words alone. For example, one shows how the many flagella on certain bacterial cells coalesce into a single structure that propels the cell through its liquid environment. One look explains it all.

Suggested Readings. Each chapter contains suggested readings. To save space these references to books and scientific journals have been pruned to include only the most helpful and informative sources of information, most of which will lead you to more highly specialized information.

Chapter Summaries. You'll find some summaries within chapters that reiterate in a different way material that you might find difficult to grasp in a single reading. In addition, each chapter ends with a somewhat detailed summary. These are provided to help you recall and organize the material you read in the chapter.

Questions. We've included three kinds of questions at the end of each chapter—review, correlation, and essay.

- Review Questions are just that. They're not designed to make you think, only to recall and to reassure yourself that you've assimilated the material contained in the chapter.
- Correlation Questions are meant to offer a greater challenge. They ask you to collate different pieces of information and compare them or apply them to a new problem. A correct answer to these questions should assure you that you have gained a thorough understanding of the material. Congratulations are in order.
- Essay Questions ask you to deal with larger portions of a subject and add your own opinions.

Clinical Science

Because Part IV considers infectious diseases and how they affect various organ systems, it necessarily employs the terms and approaches used by clinicians who treat infectious diseases. So an introduction to clinical science is needed in order to understand the material presented in Part IV. This is presented at the beginning of Chapter 22.

ADDITIONAL LEARNING AIDS*

Study Guide

This helpful manual contains chapter outlines, key terms, a new feature called "Study Tips," study exercises of various question types, multiple-choice questions, discussion questions, and an answer key (ISBN: 0-534-55225-0).

InfoTrac® College Edition

Available exclusively from Brooks/Cole, this online library offers you unlimited access to more than 700 publications—at any time of the day. With *InfoTrac*, you can search for complete articles from periodicals including *Science*, *Discover*, *Annual Review of Microbiology*, and *Bioscience*. The password-protected site is updated daily, and a 4-month subscription is offered free to students who purchase new texts. An online student guide correlates each chapter in this text to InfoTrac articles (ISBN: 0-534-55224-2).

*Available to qualified adopters. Please consult your local sales representative for details.

Virtual Molecular Biology Lab CD/Web Site

Explore the world of molecular biology with a fun, accessible, and uniquely powerful CD-ROM. This virtual laboratory environment allows you to make the connection between the lab and the classroom by performing virtual experiments and correlating the experiments to concepts presented in the classroom. The virtual environment allows you to “use” equipment to conduct ten of the most common molecular techniques, giving you a sense of being in a live lab to either augment or replace live lab time. Concept and textbook correlations presented throughout the experiments reinforce the relationship between scientific concepts and how science is conducted. Manipulate live data from GenBank to perform cutting-edge research!

Electronic Companion to Accompany *Beginning Microbiology*, from Cogito Learning Media, Inc.

This interactive CD-ROM, authored by John Ingraham, includes a comprehensive tutorial, quizzes, and exercises about microbiology. This CD-ROM allows you to study the details of microbiology and to visualize the complex

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John's career has been academic microbiology. He received his Ph.D. from the University of California, Davis, where he worked on microbial physiology and metabolism, including such topics as the malolactic fermentation, fusel oil formation, factors precluding microbial growth at low temperatures, biosynthesis of pyrimidine nucleosides, and denitrification. He's published over a hundred research papers as well as five textbooks.

processes you learn about in the course. “CD Connections” in the textbook guide you to the CD-ROM for further study.

Microbiology remains, particularly with the advent of genomics, a vital and fast-moving field. Although it presents serious challenges in the form of emerging infectious diseases and the increased resistance of dangerous pathogens to our armamentarium of antibiotics, powerful tools are now available to address these threats. It will be a contest. The words of the most famous microbiologist of all, Louis Pasteur (1822–1895), which seemed appropriate at the time of the first edition, are even more relevant now: “*Messieurs, c'est les microbes qui auront le dernier mot.*” (“The microbes have the last word.”) We'll have to wait to see what they tell us.

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