



Preface

Because microbiology is an exceptionally broad discipline encompassing specialties as diverse as biochemistry, cell biology, genetics, taxonomy, pathogenic bacteriology, food and industrial microbiology, and ecology, our goal has been to provide a balanced introduction to the discipline. A microbiologist must be acquainted with many biological disciplines and with all major groups of microorganisms: viruses, bacteria, fungi, algae, and protozoa. Students new to the subject need an introduction to the whole before concentrating on specialized areas that might be of more interest to them. *Microbiology*, sixth edition, provides a balanced introduction to all major areas of microbiology for a variety of students. Because of this balance, the book is suitable for courses with orientations ranging from basic microbiology to medical and applied microbiology. Students preparing for careers in medicine, dentistry, nursing, and allied health professions will find the text just as useful as those aiming for careers in research, teaching, and industry. While two quarters/semesters each of biology and chemistry are assumed, we provide a strong overview of the relevant chemistry in appendix I.

OUR STRENGTHS

Main Themes

Seven themes permeate the text. They recur regularly and help integrate the specific information in an orderly manner. The seven themes are:

1. Development of microbiology as a science
2. Nature and importance of the techniques used to isolate, culture, observe, and identify microorganisms
3. Control of microorganisms and reduction of their detrimental effects
4. Importance of molecular biology and biochemistry for microbiology
5. Medical significance of microbiology
6. Ways in which microorganisms interact with their environments and the practical consequences of these interactions
7. Influences that microorganisms and microbiological applications have on everyday life

These themes help unify the text and enhance continuity. The student should get a feeling for what microbiologists do and for how their activities affect society.

Strong Biochemical Presentations

Despite the great variety in microbial structure and function, microorganisms share a biochemical unity that is basic to all life processes. Furthermore, specialized functions of individual microbial cells can only be described in biochemical terms. Thus it

is not possible to understand microbiology in any fundamental sense without a consideration of biochemical mechanisms and the metabolic pathways common to all life. We provide biochemical background in two ways:

- First, you will find many illustrations that clarify the molecular processes being discussed in every chapter (for example, figures 9.19, 10.28, 11.17, and 31.19). The biochemical links are highlighted and described throughout.
- Second, two illustrated appendices (I and II) present graphic presentations of the Chemistry of Biological Molecules and Common Metabolic Pathways. This makes them easy to locate for reference purposes, and accessible for study and review.

Organizational Flexibility

Our flexible organization allows every instructor to sequence chapters and topics to suit their own syllabus. Each chapter is as self-contained as possible to promote this flexibility. For example, chapter 17, "The Viruses: Bacteriophages," contains all information critical to understanding the structure and function of bacteriophages. Students do not need to hunt through several chapters to assemble the information. They can return to chapter 17 to refer to specific details easily, making review a natural part of their study activities.

Readability

Because a student can not learn from a text they can not read, careful attention has been paid to the presentation of information in *Microbiology*, sixth edition. Comprehension is facilitated by a relatively simple, direct writing style. Information is broken up with numerous section headings and organized in an outline format within each chapter. The American Society for Microbiology's *ASM Style Manual* conventions for nomenclature and abbreviations were followed as consistently as possible. To help students with the many new terms they will encounter in the study of microbiology, new terminology is boldfaced when first used and clearly defined. Every term in the extensive glossary includes a page reference.

Study-Friendly Features

All students need help organizing their study time to maximize success. We have reorganized several key features to help them with this critical task. For example, the usefulness of the chapter summaries has been improved by organizing the summary statements under the appropriate chapter section number and title. A student can now go directly in the summary to a specific chapter section, rather than having to search for the desired statements. References in appendix V also are organized by numbered section headings within each chapter to facilitate the location of supplemental readings for specific topics.

In addition, no other text on the market today presents the reference resources that are part of *Microbiology*, sixth edition. These rich resources make it possible for students to expand their study, extend their reading, and use their text as a reference for many semesters to come. They include:

- A Review of the Chemistry of Biological Molecules (appendix I) is a visual reference on the chemistry of organic molecules. Definitions and line art provide a review or an introduction depending on the student's needs.
- Common Metabolic Pathways (appendix II) provides illustrations of nine critical biochemical pathways in one location, making review and reference more convenient for the student than if they were embedded in the text.
- Classification of Prokaryotes (appendix III) summarizes the latest classification as reflected in the second edition of *Bergey's Manual of Systematic Bacteriology*.
- Classification of Viruses (appendix IV) provides a visual directory to a selected group of common viruses. The physical characteristics, family, and genera for each are provided.
- The Recommended Reading material (appendix V) is organized by chapter and provides direction to additional information for interested students.

NEW TO THIS EDITION!

Our New Look . . . Design

The interior of *Microbiology*, sixth edition, has been completely redesigned. Students today are very sensitive to visual presentations and our new design presents information within the framework of a bright, clean, modern-looking environment. We believe this appealing new look will help students move into the content and focus on the important topics. New icons call attention to the numbered main heads, and colorful headings help the students recognize shifts in focus. All of the boxed essays have been organized around five main themes and identified by category (Historical Highlights, Techniques & Applications, Disease, Microbial Diversity & Ecology, and Microbial Tidbits).

And . . . Illustrations

Tied in to this bright new look is our continuing improvement of our art program. New illustrations have been added to most chapters, and many older figures have been revised to improve their usefulness. Particular attention has been paid to consistency in the use of color. We have also tried to employ colors in such a way that the figures are easier to understand.

Not Just a New Look . . . New Content

Due to the fast pace of discoveries in the life sciences, substantial changes and updates have been made to keep the adopters of the sixth edition at the cutting edge of information. A summary of important new material by parts includes:

Parts One–Six (chapters 1–18) introduce the foundations of microbiology: the development of the field, the structure of mi-

croorganisms, microbial growth and control, metabolism, molecular biology and genetics, DNA technology and genomics, and the nature of viruses.

New and Significantly Updated Topics

Chapter 3—Protein secretion in procaryotes; fimbriae and bacterial movement

Chapter 6—Thermophile survival in high-temperature environments and the effect of salt on microbial growth

Chapter 11—Antiparallel nature of DNA

Chapter 12—Atomic structures of RNA polymerase and ribosomes; regulation by sRNA

Chapter 15—Thoroughly updated information on completed genomes

Chapter 18—Construction of the poliovirus from its genome sequence; mechanism of prion action; virus entry into host cells

Part Seven, The Diversity of the Microbial World (chapters 19–27) contains a survey of the procaryotes that closely follows the general organization of the second edition of *Bergey's Manual of Systematic Bacteriology*. Although principal attention is devoted to bacteria, the fungi, algae, and protozoa receive more than usual coverage.

New and Significantly Updated Topics

Chapter 19—Use of signature sequences in phylogenetic analysis; updated discussion of the classification system in the second edition of *Bergey's Manual of Systematic Bacteriology*

Chapter 20—Methane-consuming archaea and protein secretion in the archaea

Part Eight, Ecology and Symbiosis (chapters 28–30) focuses on the relationships of microorganisms to other organisms and the environment (microbial ecology). Aquatic and terrestrial microbiology are introduced here.

New and Significantly Updated Topics

Chapter 28—Methods of microbial ecology; discussion of lichens as controlled parasitic relationships; genomic reduction resulting from endosymbiosis; coevolution of gut microorganisms; inclusion of latest information on the hyperthermophile, *Geogemma barossii*

Chapter 29—Addition of *Cryptosporidium* to U.S. drinking water standards; removal of nitrogen and phosphorus by on-site water treatment processes; Canadian geese as a reservoir for *Giardia* and *Cryptosporidium*

Chapter 30—Occurrence of polyprosthecate bacteria such as *Verrucomicrobium*; the role of the oxidative burst in plant-microbe interactions; mycorrhizal interactions with achlorophyllous plants

Parts Nine and Ten, Nonspecific (Innate) Resistance and the Immune Response; Microbial Diseases and Their Control (chapters 31–33 in Part Nine and 34–40 in Part Ten) are concerned with pathogenicity, resistance, and disease. The disease survey is organized taxonomically on the chapter level; within each chapter diseases are covered according to mode of transmission. This provides flexibility and allows the student to easily locate information on a disease of interest.

New and Significantly Updated Topics

Chapter 31—Cathelicidin antimicrobial peptides; pattern-recognition receptors on macrophages, and Toll-like receptors in nonphagocytic host defense

Chapter 33—Vaccine table includes the latest recommendations approved for use in the United States including five new vaccines

Chapter 34—Use of actin-based motility by bacterial pathogens to spread within the host

Chapter 35—The Etest for antibiotic sensitivity; expansion of information on drug inactivation by chemical modification; discussion of antibiotic resistance genes on genetic elements other than plasmids

Chapter 37—New essays on the first recorded incidence of biological warfare and the SARS epidemic

Chapter 38—New or expanded discussion of smallpox, West Nile virus, and hepatitis G virus

Chapter 39—Weaponization of anthrax and expanded information on anthrax

Part Eleven, Food and Industrial Microbiology (chapters 41 and 42) concludes the text with an introduction to these fields.

New and Significantly Updated Topics

Chapter 41—Norwalk-like viruses in food and water; malo-lactic fermentation in wine production; use of probiotic *Lactobacillus* in feed to reduce the occurrence of *E. coli* in beef cattle

Chapter 42—Discussion of newest approaches for recovery from nature of previously “unculturable” microorganisms

SUPPLEMENTARY AND MEDIA MATERIALS**For the Student**

- A **Student Study Guide** by Linda Sherwood of Montana State University is a valuable resource that provides learning objectives, study outlines, learning activities, and self-testing material to help students master course content.
- The **Microbiology, sixth edition, Online Learning Center** (www.mhhe.com/prescott6) provides self-quizzes, terminology exercises, study tips, web resources, etc., to aid students in mastering and integrating content.
- The sixth edition of **Laboratory Exercises in Microbiology** by John P. Harley has been prepared to accompany the text. Like the text, the laboratory manual provides a balanced introduction to laboratory techniques and principles that are important in each area of microbiology. The class-tested exercises are modular and short so that an instructor can eas-

ily choose only those exercises that fit his or her course. The sixth edition contains recipes for all reagents and media. New exercises in biotechnology have been added to this edition. A new appendix provides practice in solving dilution problems.

Dynamic Media

- **Microbes in Motion**, third edition, is an interactive, easy-to-use general microbiology CD-ROM that helps students actively explore and understand microbial structure and function through audio, video, animations, illustrations, slide shows, and text. Eighteen books cover topics from microbial genetics to vaccines.
- **HyperClinic**, second edition, CD-ROM allows students to evaluate realistic case studies that include patient histories and descriptions of signs and symptoms. Students can either analyze the results of physician-ordered clinical tests to reach a diagnosis, or evaluate a case study scenario and decide which clinical samples should be taken and which diagnostic tests should be run. More than 200 pathogens are profiled, 105 case studies presented, and 46 diagnostic tests covered.

For the Instructor

- The **Digital Content Manager CD-ROM** is the image resource for course presentations. The DCM contains virtually all of the line art, photos, and tables from *Microbiology*, sixth edition, as well as animations, videos, active-art, and a PowerPoint Lecture set for each chapter. See page xx for further details!
- **Instructor Testing and Resource CD-ROM** is offered free on request to adopters of the text. This cross-platform CD provides a database of over 2,500 objective questions for preparing exams and a grade-recording program.
- A set of 250 full-color acetate **transparencies** is available to supplement classroom lectures. These have been enhanced for projection and are available to adopters of the sixth edition.
- The **Online Learning Center** (www.mhhe.com/prescott6) provides multiple resources for course enhancement. Moreover, all the McGraw-Hill media resources are easily loaded into course management systems such as WebCT or Blackboard.

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