Microorganisms (or microbes, as they are also called) are small organisms. Most are so small that they cannot be seen without a microscope. Most microorganisms are harmless to humans and, in fact, many are helpful. They play fundamental roles in ecosystems everywhere on earth, forming the backbone of many food webs. People use them to make biofuels, medicines, and even foods.

### 1: Depth and Breadth of Microbiology

Microorganisms (or microbes, as they are also called) are small organisms. Most are so small that they cannot be seen without a microscope. Most microorganisms are harmless to humans and, in fact, many are helpful. They play fundamental roles in ecosystems everywhere on earth, forming the backbone of many food webs. People use them to make biofuels, medicines, and even foods.

- 1.1: What Our Ancestors Knew
- 1.2: Spontaneous Generation
- 1.3: Foundations of Modern Cell Theory
- 1.4: A Systematic Approach
- 1.5: Types of Microorganisms
- 1.6: Tools and Media Used for Bacterial Growth

### 2: Chemistry and Biochemistry

- 2.1: Atoms, Isotopes, Ions, and Molecules - The Building Blocks
- 2.2: Water
3: Microscope and the Cell

Through a microscope, we can examine microbial cells and colonies, using various techniques to manipulate color, size, and contrast in ways that help us identify species and diagnose disease. This chapter explores how various types of microscopes manipulate light in order to provide a window into the world of microorganisms. By understanding how various kinds of microscopes work, we can produce highly detailed images of microbes that can be useful for both research and clinical applications.

- 3.1: How Microscopes Work
- 3.2: Staining Microscopic Specimens and Descriptions
- 3.3: Cells as Living Things

4: Prokaryotic Diversity

This chapter will examine the diversity, structure, and function of prokaryotes. Prokaryotes have an important role in changing, shaping, and sustaining the entire biosphere. They can produce proteins and other substances used by molecular biologists in basic research and in medicine and industry.

- 4.1: Unique Characteristics of Prokaryotic Cells
- 4.2: Prokaryote Habitats, Relationships, and Microbiomes
- 4.3: Prokaryote Examples

5: The Eukaryotes of Microbiology

- 5.1: Characteristics of Eukaryotic Cells
- 5.2: Eukaryotic Microbe Examples

6: Mechanisms of Microbial Genetics

- 6.1: Using Microbiology to Discover the Secrets of Life
- 6.2: Structure, Function and Copying of DNA
- 6.3: Structure, Function and Production of RNA
- 6.4: Protein Synthesis (Translation)
- 6.5: Mutations
- 6.6: How Asexual Prokaryotes Achieve Genetic Diversity
7: Microbial Metabolism
- 7.1: Energy, Matter, and Enzymes
- 7.2: Gene Regulation and Operon Theory
- 7.3: Catabolism of Carbohydrates
- 7.4: Catabolism of Lipids and Proteins
- 7.5: Photosynthesis and the Importance of Light

8: Microbial Growth
- 8.1: How Microbes Grow
- 8.2: Oxygen Requirements for Microbial Growth
- 8.3: The Effects of pH on Microbial Growth
- 8.4: Temperature and Microbial Growth
- 8.5: Other Environmental Conditions that Affect Growth

9: Acellular Pathogens
- 9.1: Viruses
- 9.2: The Viral Life Cycle
- 9.3: Isolation, Culture, and Identification of Viruses
- 9.4: Viroids, Virusoids, and Prions

10: Modern Applications of Microbial Genetics
- 10.1: Microbes and the Tools of Genetic Engineering
- 10.2: Visualizing and Characterizing DNA
- 10.3: Whole Genome Methods and Industrial Applications
- 10.4: Genetic Engineering - Risks, Benefits, and Perceptions

11: Control of Microbial Growth
- 11.1: Controlling Microbial Growth
- 11.2: Using Physical Methods to Control Microorganisms
- 11.3: Using Chemicals to Control Microorganisms
- 11.4: Discovering Antimicrobial Drugs
- 11.5: Drug Targets on Microorganisms
- 11.6: Drugs for Non-prokaryote Microbes
- 11.7: Mechanisms for Resistance
11.8: Testing the Effectiveness of Antimicrobial Chemicals and Drugs

12: Microbial Interactions Flora and Pathogenicity
- 12.1: Normal Microbiota of the Body
- 12.2: Characteristics and Steps of Infectious Diseases
- 12.3: Virulence Factors in Bacteria
- 12.4: Virulence of Eukaryote Microbes and Viruses
- 12.5: How Diseases Spread

13: Innate Nonspecific Host Defenses
- 13.1: First Line defense - Physical, Mechanical and Chemical Defenses
- 13.2: Second Line Defenses: Cells and Fluids
- 13.3: Inflammation and Fever
- 13.4: Pathogen Recognition and Phagocytosis

14: Specific Adaptive Host Defenses
- 14.1: Architecture of the Immune System
- 14.2: T and B Lymphocytes
- 14.3: Vaccines
- 14.4: Practical Applications of Monoclonal and Polyclonal Antibodies
- 14.5: The Language of Epidemiologists
- 14.6: Tracking Infectious Diseases

15: Exercises
- 15.1: Chapter 1 exercises
- 15.2: Chapter 2 exercises
- 15.3: Chapter 3 exercises
- 15.4: Chapter 4 exercises
- 15.5: Chapter 5 exercises
- 15.6: Chapter 6 exercises
- 15.7: Chapter 7 exercises
- 15.8: Chapter 8 exercises
- 15.9: Chapter 9 exercises
- 15.10: Chapter 10 exercises
- 15.11: Chapter 11 exercises
- 15.12: Chapter 12 exercises
- 15.13: Chapter 13 exercises
- 15.14: Chapter 14 exercises

- **Back Matter**
  - Index