

Preface vii

About the Author xi

Safety and Waste Disposal Procedures xiii

Unit 1: The Fundamentals

Lab 1: The Microscope 1

Lab 2: Working with Culture Media and Pure-Culture Transfer 13

Lab 3: Creating and Storing Pure Cultures 27

Lab 4: Quantitative Plate Counts 43

Unit 2: Staining Microbes

Lab 5: Simple Staining and Cell Morphology 65

Lab 6: The Gram Stain 81

Lab 7: The Acid-Fast Stain 95

Lab 8: The Endospore Stain 109

Unit 3: Effects of the Environment on Microbial Growth

Lab 9: Media Components, Bacterial Nutrition, and Sterilization 121

Lab 10: Bacterial Enzymes and Use of Nutrients 143

Lab 11: Temperature and Bacterial Growth 165

Lab 12: Osmotic Pressure 177

Lab 13: Environmental pH, Fermentation, and Buffers 189

Lab 14: Oxygen 201

Lab 15: Disinfectants and Antiseptics 213

Lab 16: Ultraviolet Light 225

Lab 17: Antibiotic Sensitivity Test 235

Lab 18: Minimum Inhibitory Concentration Assay 245

Unit 4: Identifying Medically Significant Bacteria

Lab 19: Introduction to Isolating and Identifying Bacteria: Isolation of *Bacillus* Species 257

Lab 20: The Polymerase Chain Reaction and the Identification of *Bacillus cereus* from Soil Samples 271

Lab 21: *Streptococcus* and *Enterococcus* 295

Lab 22: *Staphylococcus* and *Micrococcus* 309

Lab 23: *Pseudomonas*, a Gram-Negative Genus 329

Lab 24: The Family Enterobacteriaceae 347

Lab 25: Assays for Identification of Enteric Species 359

Lab 26: Identification of Unknown Enteric Species 381

Lab 27: Identification of Enteric Bacteria Using the Enteropluri System 389

Lab 28: Immunoassay Identification of *Salmonella* 403

Unit 5: Applied Food and Water Microbiology

Lab 29: Milk Microbiology 413

Lab 30: Water Analysis 435

Lab 31: Enterics in Meat 455

Lab 32: Microbiology and Chemistry of Wine 471

Unit 6: Microbial Ecology

Lab 33: The Nitrogen Cycle 491

Lab 34: Winogradsky Columns 509

Lab 35: Antibiotic Producers in Soil and Selection for *Streptomyces* 531

Unit 7: Viruses

Lab 36: Bacteriophages and Bacteriophage Titers 545

Lab 37: Bacteriophage Typing 559

Appendix 1: Using Glass and Plastic Serological Pipettes A-1

Appendix 2: Using Digital Micropipettors A-9

Glossary G-1

Credits C-1