

Preface

Microbiology continues to undergo revolutionary changes through the impact of new developments in cell, molecular, and environmental biology. Microbes make excellent research tools for the study of many fundamental biological problems and have been used for a variety of interesting and fundamental studies. Yet microorganisms are more than research tools; they are of considerable importance and interest in themselves. I believe that it is the task of the microbiologist to provide an understanding of the nature and diversity of microorganisms and of their place in human society and the world at large. Thus this textbook emphasizes the microbe itself—its functional, ecological, and evolutionary relationships—as well as the activities it carries out that are of interest to humans. The approach throughout is fundamental, firmly rooted in principles, but with considerable emphasis on how these principles are applied to practical problems.

The success of the first two editions is a good indication that the book's approach has broad appeal. But advances in the past few years have been so profound that whole new chapters and sections had to be written. Pity the poor textbook writer! The field of microbiology continues to develop at a rapid rate, yet the length of the textbook must remain within bounds, if it is to serve the needs of the student. This has presented me with numerous problems in preparing this third edition, and a number of compromises had to be made in order to keep the book a suitable length. I trust that readers will appreciate the fact that this text represents an up-to-date distillation of the field of microbiology and will not be disturbed by a lack of encyclopedic coverage.

All of the currently exciting fields, such as plasmid genetics, macromolecular synthesis and regulation, energetics and membrane function, host-parasite relations, and biogeochemistry, have been given considerably expanded coverage. A major new chapter was written on epidemiology, illustrating many of the principles of envi-

ronmental microbiology. Many areas only covered briefly in the second edition have been given more extensive coverage, and just a few of these are listed here. Sections on the role of molecular oxygen and iron nutrition have been added to Chapter 5, "Biosynthesis and Nutrition." In Chapter 6, which deals with the autotrophic way of life, a discussion of anoxygenic photosynthesis has been included. Chapter 7, "Growth and Its Control," now contains sections on antimicrobial agents and disinfectants. In Chapter 9, on macromolecules, space is devoted to DNA structure and synthesis, mRNA synthesis, the role of RNA polymerase, and the mechanisms of repression. Chapter 10, "Viruses," now contains sections pertaining to viral genetics and restriction enzymes. Discussions of mutagenesis, the biophysics of plasmids, genetics and evolution of plasmids, and recombinant DNA research have been added to Chapters 11 and 12. Chapter 13, which deals with microbial activities in nature, has been expanded to include sections on global biogeochemical cycles for carbon, nitrogen, and sulfur, biogeochemistry of methane, and bacterial iron oxidation and reduction. The action of exotoxins and endotoxins, phagocytosis, clinical microbiology, and chemotherapy have been added to Chapter 15, "Host-Parasite Relationships." The discussion of immunology in Chapter 16, now presents information on antibody formation, complement and complement fixation, and cellular immunity. In Chapter 17, rabbit myxomatosis is used as a model of epidemiology, and additional topics include respiratory infections, venereal diseases, and food- and waterborne diseases.

An extensive update of material on photosynthesis and the autotrophic way of life has been included, reflecting current considerable research activity in this field, possibly due to interest in the sun as a source of energy. The chapter on representative procaryotic groups has been extensively rewritten and expanded, to present new information and to provide a source book of material on the most important groups of bacteria. As much as possible, this chapter has been keyed to the 8th edition of *Bergey's Manual of Determinative Bacteriology*.

Summaries have now been provided for the majority of chapters. The reference lists have been updated, and the use of annotations, so popular in the second edition, has been retained.

A major new feature of this edition, and one that I am especially proud of, is the addition throughout the text of short historical vignettes called "A Bit of History." I have always regretted that my book did not have more historical material, yet I was loath to add it to the body of the text, as it often causes more confusion than enlightenment at the time the student is trying to grasp fundamental principles. By the use of separate vignettes, the flow of the text is not impeded, yet the desirable enrichment material is available. Through the use of special typography for these sections, they do not actually add much to the length of the text.

In order to save space and to provide more detailed reference material on certain topics, a number of appendices have been added for this edition. Appendix 1, on energy calculations, should provide a useful source of data for constructing oxidation-reduction reactions for a wide variety of microbial processes. Appendix 3, on biochemistry, provides a detailed and useful summary of the major pathways of biochemical processes. Because of the addition of this appendix, it has been possible to simplify somewhat the biochemical material in the main body of text. I have also moved the material on the mathematics of growth and on microscopy to two appendices, where it is available for the more advanced student, yet does not impede the flow of the text.

Reflecting current usage, the term *blue-green algae* has been abandoned, and the term *cyanobacteria* substituted. This has presented an additional problem, because the term *photosynthetic bacteria*, previously used to mean the "purple and green bacteria," takes on a different meaning. Thus when the term *photosynthetic bacteria* is now used, it refers to the whole group, including organisms with either photosystem I alone, or both photosystems I and II. Those photosynthetic bacteria which possess only photosystem I are now called *purple and green bacteria*.

I am most grateful for the extensive help given to me by Dr. Martha Howe in the preparation and revision of the chapters on viruses and genetics. Without her help, the updating of these rapidly expanding fields could not have been accomplished. Any errors in the final text are, of course, my own. I have been most appreciative of comments through the years by students and other users regarding errors, and I would greatly appreciate learning of errors in the present edition. Although the use of an IBM Correcting Selectric has made it possible for me to type much of the revision myself, Mrs. Charlene Knaack Singh, in her usual competent manner, typed a major part of the revision. Finally, I acknowledge the help and assistance in numerous ways of my wife, Dr. Katherine M. Brock, who managed to find time from her many responsibilities to help get this rather difficult revision carried through to completion.