

PREFACE

No area of biological science in recent times has become so prominent in the public eye as microbiology. The most exciting discoveries involving microorganisms have important and extensive application. Recombinant DNA technology, for example, has revolutionized microbiology and related areas of science. It behooves all students, whether majors or nonmajors in microbiology, to understand the modern concepts of this science in order to comprehend the many current advances that are affecting and will affect our lives. It is inevitable that microbiology will play an even more important role in the future.

Most microbiology textbooks on the market today are impressive because of their meticulous coverage of specific areas of microbiology (such as ecology, infectious disease, and molecular biology), but few cover in any detail all the major divisions of microbiology. My purpose in writing this book is to provide the student with a glimpse into the major divisions of microbiology. Genetics, immunology, and molecular biology have contributed significantly to our understanding of the science of microbiology. I have tried, therefore, to describe the various aspects of microbiology in more modern terms. The infectious disease section of this book, for example, provides a biochemical rationale for the infectious disease process. The extensive coverage of topics makes this book appropriate for premedical, predental, allied health, agricultural, and animal science students as well as biology and microbiology majors.

DESCRIPTION OF CONTENTS

General Microbiology is divided into eight major parts. The first of six chapters in Part 1, "Introduction to the Microbial World," gives a historical background of microbiology, presenting the most significant past and present discoveries in this science. Chapter 2, "Biochemical Back-

ground for Microbiology," presents an overview of biochemistry with particular attention to the types of biochemical reactions and structures that are encountered later in the book. Careful study of this chapter will provide the student with all the biochemical information necessary for comprehension of later material. Chapter 3, "Introduction to Microscopic Technique," is placed in this section so that students may become acquainted with the various types of instruments used to observe microorganisms, because the last two chapters in this section contain numerous photomicrographs. Chapters 4 and 5 discuss the general characteristics of prokaryotes and eukaryotes and are extensively illustrated. The chapter on eukaryotes is more comprehensive than comparable chapters in other textbooks of this type. The current use of eukaryotes in present-day technology necessitates a better understanding of this group of microorganisms. The last chapter of this section, "Viruses," includes the general structure and function of plant, animal, bacterial, and fungal viruses, as well as a discussion of how viruses are cultivated and how they are affected by chemical and physical agents.

Viral replication is reserved for Chapter 16 because it can be considered a "growth process" and because replication requires a better understanding of microbial genetics, which is discussed in Chapters 9 through 12.

Part 2, "Microbial Structure and Function," consists of two chapters dealing with the relationship between structure and function in prokaryotes and eukaryotes. Both chapters are abundantly illustrated and give students a chance to apply what they have learned about the general characteristics of eukaryotes and prokaryotes in Chapters 4 and 5.

Part 3, "Microbial Genetics," is divided into four chapters. Three of the chapters discuss the functions of DNA: replication and mutation, synthesis and regulation of proteins, and recombination and gene transfer. These three chapters

are presented in a historical sequence because the basics of microbial genetics are still new to the student. The last chapter in this section is devoted to eukaryotic genetics, a subject that receives little attention in other textbooks. The recent discovery of some basic differences in the transcription of DNA in eukaryotes has opened up a whole new field of scientific endeavor that also has applications in prokaryotic systems and in viruses.

Part 4, "Microbial Metabolism and Growth," consists of four chapters. The first chapter, "Energy Production in Microorganisms," deals with all the mechanisms for obtaining energy in microorganisms, including photosynthesis. This is followed by chapters that deal with nutrition (including a discussion of mineral metabolism), microbial growth in eukaryotes as well as prokaryotes, and mechanisms used by microorganisms to control growth at the enzymatic level. The final chapter in this section deals with the replication of viruses and also includes a discussion of the current mechanisms and role of viruses in tumor development.

Part 5, "Environmental and Applied Microbiology," consists of five chapters dealing with the ecology of soil and water microbiology as well as the applied areas of food and industrial microbiology. These chapters are unusual not simply because they are present in the book, but rather because of the nature of the material presented. They introduce the latest concepts in the field of applied microbiology and demonstrate the importance of understanding earlier chapters on structure and function, nutrition, biosynthesis, and metabolic control.

Part 6, "Infection and Immunity," consists of four chapters and is introduced with a chapter on host-parasite interaction. This chapter describes the mechanisms used by microorganisms to cause disease as well as the host's nonspecific mechanisms for warding off infection by virulent microorganisms. The last three chapters deal with immunity and contain an up-to-date discussion of the components of the immune system and a description of the type of tests used to detect infectious agents or their products. The section concludes with a discussion of immune disorders in humans.

Part 7, "Microorganisms and Infectious Disease," consists of eight chapters. Chapter 22, "Host-Parasite Interactions," is an important introduction to this material because it discusses the general mechanisms used by all microorganisms in the infectious disease process. The chapters in this section discuss the general characteristics of infections caused by specific microbial agents (such as bacteria or viruses). The diseases

caused by these agents are then separated, based on the organ affected. Only the major diseases are discussed in any detail; the less important ones are outlined in tables. For most of the major diseases discussed I have given some historical background that illustrates a particular aspect of the infectious disease process. I strayed from the usual pattern of organization in Chapters 30 and 33. Sexually transmitted diseases (Chapter 30) are given special place because of the increasing number of microbial agents that are involved in these diseases and the number of cases worldwide. Chapter 33, "Hospital-Associated Diseases," is given special attention because the transmission of these diseases is so different from diseases acquired outside the hospital.

Part 8 is devoted to diseases in animals and plants. The chapter on plant diseases is more extensive than any comparable chapter in other microbiology textbooks. Plants are capable of resisting microbial attack in ways that are not seen in human or animal infection. The fascinating mechanisms associated with the infectious disease process in plants are therefore discussed in some detail.

PEDAGOGICAL FEATURES

This book was written with considerable concern for the students who will be studying it. Each chapter in *General Microbiology* begins with an introductory section that provides the student with a chapter purpose. Each chapter is also concluded with a summary of its major concepts. Questions for study and extensive lists of selected readings, separated by books and journals, appear at the ends of chapters to aid the student and to provide for more in-depth understanding. In reading and studying the chapters, students will be greatly helped by the key terms, which appear in **boldface italic type**, and the considerable illustrations and line drawings using a second color. A large number of electron micrographs are used judiciously to demonstrate points and are appropriately labeled where needed. The many color plates have been carefully chosen for their instructive value, especially when staining and biochemical reactions are illustrated. An extensive glossary defining the major key terms in each of the chapters is included at the end of the book. Appendixes consist of the classification scheme of *Bergey's Manual*, a basic review of mathematical terms, and a comprehensive review of the techniques used for identification of various groups of microorganisms.

ANCILLARY MATERIALS

General Microbiology Laboratory Manual has been prepared by E. Ronald Wright, PhD, of Case Western Reserve University. Comprehensive and complete, it contains 46 laboratory exercises organized to follow the sequence of topics in *General Microbiology*. Each exercise refers to corresponding pages in the text and contains instructions for completing the experiments plus results sheets that may be completed and handed in to the instructor.

General Microbiology Study Guide, also prepared by E. Ronald Wright, is a direct companion to the text and provides students with the opportunity to reinforce their knowledge and develop a further understanding of microbiology. Each chapter includes study outlines, key terms, and carefully designed practice questions with answers.

Instructor's Manual, available on request to all adopters of the text, contains a descriptive rationale for each chapter and an extensive test bank.

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