
Preface

Overview

Microbiology: Fundamentals and Applications covers the broad vistas of microbiology, providing students with a basis for understanding the various aspects of this field. It is intended for students who require a knowledge of microbiology for their future careers, as well as for students who desire a knowledge of microbiology for use in their daily lives. The depth of topic treatment is sufficient to satisfy and to stimulate student interest in the exciting field of microbiology.

The book is intended to be comprehensive and to meet the varied teaching needs of different institutions. Undoubtedly, there is more material in this text than can be reasonably handled in a one-semester course. Instructors may pick from the various chapters to meet their own needs. The text is designed to be flexible so that the order of chapters and topics covered are subject to the instructor's creativity. To aid in this endeavor, the first weight headings have been numbered for ease in assigning individual sections. Students can supplement the coursework by reading topics of interest that are omitted by the instructor from the formal class presentation.

There has been a general updating of material throughout this edition. Topics such as biotechnology and acquired immune deficiency syndrome have been expanded, as these are at the forefront of public attention in microbiology today. In these areas, both fundamental background information and applied aspects have been added to increase understanding.

General Organization of the Second Edition

Each chapter has the following general structure:

- Text of chapter
- Postlude

- Suggested supplementary readings
- Study questions
- Situational problems

The book is organized from the basic to the practical. Following an examination of the historical development of microbiology and the basic techniques of the microbiologist, the fundamental aspects of microbiology are examined in sections on structure, metabolism, genetics, and taxonomy. These sections build from the subcellular to the whole-organism level and establish the fundamental aspects of microbiology needed to understand the practical or applied aspects of microbiology covered in later chapters. Later chapters examine the practical ecological, industrial, and medical aspects of microbiology. There is a balance between the fundamental and applied aspects of microbiology.

The book includes coverage of both the eukaryotic and prokaryotic microorganisms, and, although the emphasis is undoubtedly placed on bacteria, eukaryotic organisms and viruses are also thoroughly covered. By comparing the similarities and differences among viruses, bacteria, and eukaryotic microorganisms, the student will develop an understanding of the basis for some of the applied aspects of microbiology, such as the use of antimicrobial agents in treating infectious diseases.

Several major changes have been made in the second edition of the text. There has been a major reorganization of chapters. The first chapter of the text still concerns the scope of microbiology and some of the early historical developments, but it has been greatly abbreviated to avoid overwhelming students with the history of all fields of micro-

biology and the associated terminology with these new subjects. Sections of the original historical discussion have been added to the postludes of the appropriate chapters.

The second chapter of the text covers microscopy and the third discusses the structures of prokaryotic and eukaryotic cells. The retention of a discussion of eukaryotic cells is critical for comparative purposes so that students understand the fundamental differences between prokaryotes and other organisms.

The growth and reproduction of bacteria, originally discussed in the chapter with viral replication and growth of eukaryotes, is moved towards the beginning of the book as the initial chapter on microbial metabolism. Bacterial reproduction is now combined with the discussion of nutrition. This chapter is followed by the discussion of microbial metabolism which, in turn, is followed by the discussion of microbial genetics.

The next section, entitled Survey of Microorganisms, begins with the chapter on virology. The consolidation of most of the material on virology into a single chapter on the viruses is perhaps the greatest organizational change between the first and second editions. Material on the structure of viruses, the replication of viruses, and viral taxonomy is included in this unified chapter on virology, which bridges the gap from the molecular-level discussion of the preceding chapters to the whole-organism level that takes place in the following chapters on bacterial taxonomy and the classification of eukaryotic microorganisms. Information on reproduction of eukaryotic microorganisms, previously found together with the discussion of bacterial and viral reproduction, has been included in the chapter on taxonomy of eukaryotes. This change should accommodate users of the book who do not wish to include eukaryotes in their discussions.

The survey of microorganisms section is now followed by coverage of environmental microbiology. The earlier placement of this section is aimed at tying this information more closely to the discussion of fundamental aspects of microbiology. The environmental section now has four chapters; the additional chapter is concerned with environmental effects on microorganisms and the distribution of microbes in nature. A chapter devoted to biogeochemical cycling and population interactions, one concerning agricultural microbiology, and one concerning water quality and pollutant biodegradation are retained in this section.

The environmental section is followed by the food and industrial microbiology section which in turn is followed by the medical section, which includes a discussion of immunology. Placement of medical microbiology at the end of the book allows instructors who do not cover this topic to easily omit it from their courses and students who want to use this material as a reference source can easily find the appropriate information. Within the medical section, the chapter on clinical microbiology that appeared in the first edition has been eliminated and the information incorporated into a unified chapter on prevention, diagnosis, and treatment of diseases caused by microorganisms.

Special Features

Analytical Process Boxes Within most chapters where methodological processes are discussed, analytical boxes have been added. These analytical boxes set off material, describing the procedures used by microbiologists to gain the information on the topics being discussed.

Discovery Process Boxes The discovery boxes, a popular feature of the first edition, have been retained and several new ones have been added. These boxes augment the figure captions, illustrating how discoveries were made. They highlight the paths scientists have followed in developing the knowledge that fills this text.

Illustrations The book is elaborately illustrated, and each figure is accompanied by a clear and detailed figure legend. There has been a thorough review and upgrading of art, including additional use of color and use of overlay labels for many micrographs. These enhance the use of illustrations as teaching aids.

Key Terms Within the text, key terms have been highlighted. These terms are defined in the glossary and in the text near where they are introduced. Succinct definitions of key terms permit students to continue reading and understanding the section without having to fully grasp every nuance of a term or to turn to the glossary if they are unfamiliar with a term. Every effort has been made to ensure that terms and concepts are clearly defined.

Postludes Each chapter ends with a postlude that summarizes and places the information discussed in the chapter in proper perspective. As noted, historical information about the material covered in each chapter has been added to the postludes. The postludes remain more than simple summaries, attempting to place the information discussed in the chapters into a broader context of history and science.

Supplementary Readings List There has been a thorough updating of the suggested reading lists to include the latest articles. This list is meant neither to be complete, nor of great depth, but to supplement the text for more advanced courses and to sustain the interest of the student who finds a particular topic relevant to his or her purpose for having enrolled in an introductory microbiology course.

Questions Each chapter has a set of review questions intended to allow students to test their own comprehension of the material they have just examined.

Situational Problems Situational problems have been added at the end of each chapter to cause students to think and to develop an in-depth understanding of microbiology. These problems should be challenging and interesting to students.

Glossary of Microbiological Terms An extensive glossary has been included to help the student understand the information of the book. Key terms highlighted in the text when first introduced are included in the glossary.

Glossary of Bacterial Genera There is an abridged glossary of bacterial genera that can be used as a handy reference for the descriptions and key features of the more common bacteria.

Appendices The appendices include the metric system and a review of basic chemistry. The chemistry appendix can act as review or remedial material to ensure that students have ready access to the chemical principles they need to understand microbiology.

Supplements

Laboratory Manual "Experimental Microbiology" by A. Brown, K. Dobra, L. Miller, and R. M. Atlas. This laboratory manual provides an extensive compilation of laboratory exercises that can be used for introductory laboratory courses.

Instructor's Manual Outlines of text chapters and extensive listing of audiovisual material that can be used with each chapter.

Laboratory Instructor's Manual Helpful hints for laboratory exercises and sources of needed materials.

Transparencies Collection of transparencies from the text that can be used to illustrate lecture material.

Slides Collection of 35 mm slides that can be used to illustrate lecture material.

Test Bank Computerized collection of test questions compiled by H. Peery that can be used for preparing exams.

Computer Aided Instructional Package "Micro-micro" by J. Snyder, G. Weinberg, and R. M. Atlas. This computer aided instructional package contains 42 lessons in general and medical microbiology. It can be run on Apple II series and IBM PC compatible microcomputers. The lessons can be used to review topics, such as enumeration of microorganisms, as well as to learn more advanced topics, such as specific areas of clinical microbiology.

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