

# Microbiology

MICHAEL J. PELCZAR, JR.

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# Preface

"Messieurs, c'est les microbes qui auront le dernier mot." Pasteur

For the major part of the twentieth century the physical sciences have dominated science and engineering. This situation was due to a large degree to the development of the atomic bomb, and the achievements of the Soviet Union in outer space. The successful launching of the first satellite into space (Sputnik) in 1957 by the Soviet Union accelerated physical science research and development programs in the United States by the government, by universities, and by industry. We became engaged in a race for leadership in science and technology.

We are now experiencing a rapid shift of national priorities in research and development. As we approach the twenty-first century, we see biology emerging as one of the top priorities in the field of science, and among the biological sciences microbiology has gained new stature. Microorganisms and their activities are increasingly central to many of the concerns of society both nationally and internationally. The problems of the global environment, the recognition of the need to recycle natural resources, the discovery of recombinant DNA and the resulting high technology of genetic engineering—these and other developments have placed microbiology in the limelight.

Microbiology is emerging as the key biological science. Microorganisms provide the models used in molecular biology for research. This research at the molecular level has provided, and continues to provide, the answers to numerous fundamental questions in genetics, metabolism, and cell forms and functions. Microorganisms also provide model systems for studying the relationships between species in mixed populations.

There is growing recognition of the potential of microorganisms in many applied areas. The ability of microorganisms to decompose materials such as herbicides, pesticides, and oils in oil spills; the potential of microorganisms as food supplements; the exploitation of microbial activity to produce energy such as methane gas for rural consumption; and the potential of new therapeutic substances produced by microorganisms—these and other uses of microorganisms are becoming increasingly attractive.

Recombinant DNA technology, commonly referred to as genetic engineering, is one of the principal thrusts of the emerging high technologies in the biological sciences. Recombinant DNA technology makes it feasible to consider genetically manipulated (engineered) microorganisms for commercial production of new and valuable products for a variety of purposes, e.g., medicinals, fuel, and food.

This fifth edition of MICROBIOLOGY retains many of the features that have proved successful in the first four editions, particularly the balance between fundamental or basic microbiology and applied microbiology. This approach emphasizes the importance of integrating new knowledge gained through basic research with applied research and development programs. A strong continuum

of research and development, from the basic to the applied, facilitates the development of benefits for society.

One of the new features of this edition is a presentation of the classification of bacteria in a totally new format following the scheme introduced in the first volume of the recently published *Bergey's Manual of Systematic Bacteriology*. (One of us, Noel R. Krieg, served as editor of the first volume.)

We have also expanded and revised the material on metabolism, bacterial genetics, and genetic engineering and reorganized the section on microorganisms and disease. Careful attention has been given to updating of information in all aspects of the discipline. Many new summary tables have been developed, and new illustrations selected. New review questions, and updated references, follow each chapter.

The subject material is presented in eight parts. As a new feature, each part now opens with an essay providing added insight into the material that follows. Each chapter begins with a chapter outline and an introduction. Many chapters now contain boxed essays highlighting important discoveries and developments in microbiology. As in the past, the order of arrangement of chapters lends itself to adjustments in any sequence desired by the instructor.

A considerable amount of the artwork has been drawn by Dr. Erwin F. Lessel (a microbiologist in his own right). We have found this to be a distinct asset in terms of improving the pedagogical value of illustrations.

Three valuable supplementary publications are available to accompany this new edition: an INSTRUCTOR'S MANUAL, a STUDENT'S GUIDE, and LABORATORY EXPERIMENTS IN MICROBIOLOGY. Each has been revised to conform with the subject matter in the fifth edition of MICROBIOLOGY. We have provided extensive cross-referencing among these four publications. The INSTRUCTOR'S MANUAL includes suggested lecture and laboratory schedules, chapter summaries, sources of audiovisual aids, sources of laboratory equipment and reagents, as well as sample test questions. The STUDENT'S GUIDE has been developed to assist the student in his or her efforts to comprehend the subject matter. It provides for each chapter a concise statement of the content (an overview), a comprehensive topical outline, and a series of self-study questions of several types.

The writing of a textbook on a subject as comprehensive as microbiology requires considerable assistance from a large number of professional colleagues. Among these, we wish to acknowledge the following persons who were generous in their assistance, particularly in commenting upon drafts of various chapters: Phillip M. Achey, University of Florida; Ronald L. Crawford, University of Minnesota; Loretta C. Ellias, Florida State University; Louis R. Fina, Kansas State University; Thomas R. Jewell, University of Wisconsin-Eau Claire; Ted R. Johnson, St. Olaf College; Robert J. Janssen, University of Arizona; David Kafkewitz, Rutgers University; Joseph S. Layne, Memphis State University; Haideh Lightfoot, Eastern Washington University; David Pramer, Rutgers University; Ramond J. Seidler, Oregon State University; Robert Todd, South Dakota State University; Anne H. Williams, Evergreen Valley College; and Fred D. Williams, Iowa State University.

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## **PREFACE**

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We are grateful to our colleagues at the McGraw-Hill Book Company, Kathleen Civetta, Editor; James W. Bradley, Editing Supervisor; and Charles Hess, Production Supervisor, for their pleasant cooperation and assistance in the task of preparing and publishing this book. Thanks are due also to Karen Jacques and Edna Khalil for their skillful assistance in the preparation of manuscript.

In the writing of this text, each chapter has been the primary responsibility of one author. However, each of us has read and critiqued all the chapters. As previously mentioned, we have had the benefit of reviews of each chapter from several of our professional associates. In the end we take collective responsibility for the complete content of this text.

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