PREFACE

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

It is no exaggeration to claim that microbial cells have, in the past several decades, provided a most unusual and useful model for the study of life processes: genetics at the molecular level, biosynthetic pathways, biochemical cytology, metabolic control mechanisms, and a variety of physiological phenomena. The elucidation of such phenomena through the experimental study of microorganisms has resulted in many of the Nobel Prizes awarded for Physiology and Medicine in recent years. It is in fact inconceivable that any student today could study genetics, biochemistry, or even evolution without some appreciation of and familiarity with microorganisms. Microbiology and microorganisms are, moreover, of central importance to major issues of concern to our society at large — e.g., the exploration for life in space, the potentials and hazards of genetic manipulation, and the massive immunization of whole populations. The importance of microbiology both as a basic science and as an applied science can hardly be overemphasized.

A dual emphasis on the basic and applied aspects of microbiology has been a feature of all three previous editions of *Microbiology* and is reflected again in the two main themes of this 4th edition, namely, (1) a characterization of the microorganisms that constitute the microbial world and (2) the role of microorganisms in our environment. Within these major guidelines, however, the internal revision has been very extensive. A major change in format is the introduction of each chapter by an outline. The new scheme of bacterial classification presented in the 8th edition (1974) of *Bergey's Manual for Determinative Bacteriology* has been adopted. The chapters on metabolism and genetics have been completely updated, rewritten, and reorganized. Similarly, the subject of virology has been reorganized and rewritten. A new chapter on "Fundamentals of Microbial Ecology" has been added to Part Six as an introduction to the field of environmental and applied microbiology.

All illustrations and tabular material were reassessed for their pedagogic value, and many new and superior ones have been selected for incorporation in the 4th edition. A number of excellent scanning elec-

tron micrographs have been added. Considerable attention was also given to improving the level of presentation throughout the text, and new summary tables have been developed to assist the student in coordinating large amounts of information.

As in the previous editions this book is written for students having their first academic experience with the world of microbes. Yet it should also challenge and stimulate students who have had previous courses in other biological sciences. We have attempted to present the material clearly and concisely and in a logical sequence so that it will be understood by students who have had limited exposure to science. In doing so, we are aware that the arrangement will not be acceptable to everyone. The instructor should feel no compulsion to follow the sequence we have presented since the material can be presented with equal effectiveness when it is rearranged to fit individual preference. For example, Part Five on "Microorganisms and Disease" can easily be interchanged with Part Six on "Environmental and Industrial Microbiology."

We have also made frequent reference to historical developments in microbiology, as we feel that an acquaintance with the development and foundation of a science is essential to an appreciation of it. As Goethe said, "The history of science is science itself." Specific historical implications that relate to modern microbiology as an evolving science are developed in the text as the various aspects of the science are considered in detail. The interdisciplinary ancestry of microbiology is emphasized, as is the present dependence of all of biology on microbiology.

Schemes of classification of microorganisms have been placed in Appendix A, where they are readily available for reference. Characteristics of selected genera of bacteria, algae, fungi, and protozoa are arranged separately in Appendix B. The glossary, Appendix C, has been enlarged and should be especially useful to the student.

A laboratory manual, study guide, and instructor's manual are available for use with this text. In the laboratory manual the arrangement of experiments closely parallels the order of subject material presentation in this book. References are given in each experiment to corresponding chapters in the text. Similarly, the study guide is keyed to this book and is provided for those students who desire additional assistance in learning the subject material.

In the preparation of this edition the two senior authors have been joined by Dr. E. C. S. Chan, Department of Microbiology and Immunology at McGill University, who brings to the authorship a long and successful experience in teaching microbiology.

We would also like to take this opportunity to acknowledge the generous cooperation of our colleagues around the world. They have reviewed manuscript copy, suggested topics for deletion or more emphasis, supplied illustrations, and in many other ways made very significant and constructive contributions. In particular, we wish to

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