
PREFACE

Microbiology embraces functional disciplines at all levels, from the behavior of population of atoms to the behavior of population of microorganisms. Microorganisms undergo profound changes during their transition from planktonic organisms to cells that are part of a complex, surface-attached community. These changes are reflected in the phenotypic characteristics developed in response to a variety of environmental conditions. This book gives an insight into the microbial world. It features a comprehensive account of various topics including systematics; diversity of microbes in the environment; microbes in agriculture, food, and industry; microbial interactions; microbial metabolism; microbial diseases; and the diagnostic approaches.

In the coming few decades, it is the Archaea and the extremophilic microorganisms found in harsh and unusual environment that will occupy the center stage of microbiology in view of their tremendous importance in industrial applications. However, the excitement of modern microbiology extends far beyond Archaea and extremophiles. Microbiologists are debating the novel, philosophical, and controversial but fascinating concept of bacteria as global superorganisms, and focus on bacterial biofilms is likely to have a profound influence on environmental and medical microbiology in the twenty-first century. We have attempted to cover these and all other similar aspects of modern microbiology that are not commonly seen in existing books. We have covered the older traditional microbiology rather briefly and concisely but the major focus has been on recent development.

The authors have designed a chapter on "Gene Technology," covering latest technologies relevant to the understanding of molecular aspects of microbes. This chapter offers a straightforward approach to learning the core principles associated with "Omics" technologies and their applications to the world of microbes. Omics technology if studied in isolation provides us certain specific snapshots of complex biological systems. Genomics, transcriptomics, proteomics, and metabolomics have enhanced our understanding of biological system by several folds and helped in providing insights into the biomedical research. Each of these omics technologies is limited in scope, as it can explain only one aspect of biological system. It is desirable to integrate snapshots provided by different omics technologies to get a holistic picture of complex biological system. Such challenging task of integration of omics technology is undertaken by the new discipline "Systems Biology."

Microbes are of major economic, environmental, and social importance and are being exploited for production of a wide range of products of commercial significance. The chapter on industrial applications of microbes deals with their role in production of enzymes, foods, probiotics, chemical feedstock, fuels and pharmaceuticals, biofertilizers, traditional fermentation-based beverages, and development of clean technologies used in waste treatment and pollution control. Developments in bacterial genomics of lactobacilli

and bifidobacteria would dramatically alter the scope and impact of the probiotic field, offering tremendous new opportunities with accompanying challenges for research and industrial application. The genetic and molecular approaches used to study bacterial and fungal biofilms, host immune evasion, and drug resistance have been discussed. Current evidence indicates that several microbes, especially bacteria and viruses, encode miRNAs, and over 200 viral miRNAs involved in manipulation of both cellular and viral gene expression have now been identified. Small noncoding RNAs have been found in all organisms, primarily as regulators of translation bioterrorism. This book discusses our current knowledge of these regulatory genetic elements and their relationship to infection.

Each chapter starts with a prologue to the concept and finally ends with a vision for future approach and challenges. The authors have tried to foresight some of the innovative areas of microbes and their involvement in the near future. Some of the topics of interest are metagenomics, pharmacogenomics, biochip technology, aptamers, microorganisms on space, functional genomics for improvement of plants, and next generation diagnostic industry.

This book responds to the requirement of students of undergraduates and graduates in microbiology and medicine. Each topic has been approached as a separate topic, and large illustrations in the chapters can help students and researchers to understand better. An effort has been done to reach at the individual level. Students can master key concepts and develop insights into the latest technologies of microbial relevance. This book is self-explanatory and written in a lucid language. A large compilation of references have been added at the end of each chapter. This book can be a source reference to all innovative people interested in microbes. We welcome suggestions and comments for improvement of this book.

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