Preface

To better study the complex phenomena that occur in nature, scientists have artificially split their analysis into many disciplines, each addressing a limited number of issues. Reductionism has been and continues to be a necessary step to better handle the complexity of the phenomena studied and to cope with the limits of the technologies available. Oversimplification in biology, however, is often a dangerous route that analyzes phenomena under artificial conditions far from real life. Our generation of microbiologists did not escape this trend. We have learned to isolate and grow bacteria and viruses under laboratory conditions that these organisms would never encounter in vivo. Similarly, cell biologists have learned to grow cells in perfectly aseptic tissue cultures, forgetting that in real life these cells, when part of functional tissues and organs, may interact with a variety of microbes.

The name "cellular microbiology" was used for the first time in 1996 (1) to describe a new emerging discipline in which it was no longer enough to study pathogenic bacteria in artificial laboratory conditions such as agar plates and Erlenmeyer flasks, but they had to be studied in the real world, while interacting with the cells of their hosts.

The new name was immediately successful: pioneering scientific meetings entitled "cellular microbiology" (3, 4, 6) were organized; a new scientific journal (2, 5) was initiated; sections of scientific journals were named "cellular microbiology"; and cellular microbiology has also been the name given to many new research departments.

Two books on cellular microbiology were published in 2000. The first edition of this book has been very successful and has been selected as a text of choice in many courses. In today's world, however, even very innovative textbooks become rapidly obsolete because of technological progress. Since the first edition, the field of microbiology has gone through perhaps the most dramatic revolution since Pasteur. In less than 3 years most of the genomes of pathogenic bacteria became available. Microarray technology has allowed global analysis of gene expression, and proteomics has advanced biochemical studies to universal observation of the protein world. Hence the need for

a new edition of the book, which incorporates genomic and proteomic studies of the microbial world. It is clear that genomics, proteomics, and postgenomics have not changed the concept of cellular microbiology; rather, they have made the field easier to approach and more easily accessible to all scientists. These new technologies powerfully allow the study of gene and protein expression of both the pathogen and the host within the same experiment. Clearly, cellular microbiology has entered the era of "system biology" with a resurrection of bacterial and also cellular physiology. Last but not least, the in vivo imaging revolution allows the spatiotemporal study of microbes interacting with cells, not only in tissue-cultured cells but also in ex vivo explants and in animals. All of these concepts are now included in this new edition. Exploitation of the cytoskeleton plasticity was previously discussed in many chapters. The role of the plasma membrane structure, which is now increasingly documented, is also introduced. Finally, we have crossed the boundaries of the bacterial world and included new pathogens such as viruses and new hosts such as plant cells.

The second edition of this textbook is an attempt to provide to students and scientists the vision of a new science where microbiology and cell biology merge into a mature discipline.

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