Preface

Over the past 30 years, environmental microbiology has emerged from a rather obscure, applied niche within microbiology to become a prominent, ground-breaking area of biology. Environmental microbiology's rise in scholarly stature cannot be simply explained, but one factor was certainly pivotal in bringing environmental microbiology into the ranks of other key biological disciplines. That factor was molecular techniques. Thanks largely to Dr. Norman Pace (in conjunction with his many students) and Gary Olson and Carl Woese, nucleic acid analysis procedures began to flow into environmental microbiology in the mid-1980s. Subsequently, a long series of discoveries have flooded out of environmental microbiology. This two-way flow is constantly accelerating and the discoveries increasingly strengthen the links between environmental microbiology and core areas of biology that include evolution, taxonomy, physiology, genetics, environment, genomics, and ecology.

This textbook has grown from more than a decade of efforts aimed at presenting environmental microbiology as a coherent discipline to both undergraduate and graduate students at Cornell University. The undergraduate course was initially team-taught by Drs. Martin Alexander and William C. Ghiorse. Later, W.C. Ghiorse and I taught the course. Still later I was the sole instructor. Still later I became instructor of an advanced graduate version of the course. The intended audience for this text is upper-level undergraduates, graduate students, and established scientists seeking to expand their areas of expertise.

Since the first edition of this book in 2008, the discipline of environmental microbiology has made a large number of key advances: in methodologies, in defining evolutionary diversity, and in deepening our understanding of both genetic and biochemical mechanisms of biogeochemical reactions that maintain our world. The goal of his second edition is to make these advances accessible to new students of environmental microbiology. All topics covered by the first edition have been thoroughly updated. A new section has been added to Chapter 5 (diversity) on microbial biogeography. A new section has been added to Chapter 6 (methodologies) that focuses on next-generation sequencing and omics technologies.

Environmental microbiology is inherently multidisciplinary. It provides license to learn many things. Students in university courses will rebel if the

subject they are learning fails to develop into a coherent body of knowledge. Thus, presenting environmental microbiology to students in a classroom setting becomes a challenge. How can so many disparate areas of science (e.g., analytical chemistry, geochemistry, soil science, limnology, public health, environmental engineering, ecology, physiology, biogeochemistry, evolution, molecular biology, genomics, bioinformatics) be presented as a unified body of information?

This textbook is my attempt to answer that question. Perfection is always evasive. However, I have used five core concepts (see Section 1.1) that are reiterated throughout the text, as criteria for selecting and organizing the contents of this book.

The majority of figures presented in this book appear as they were prepared by their original authors in their original sources. This approach is designed to illustrate for the reader that advancements in environmental microbiology are a community effort.

A website with downloadable artwork and answers to study questions is available to instructors at www.wiley.com/go/madsen/enviromicrobio2e.

I hope this book will stimulate new inquiries into what I feel is one of the most fascinating current areas of science. I welcome comments, suggestions, and feedback from readers. I thank the many individuals who provided both direct and indirect sources of information and inspiration. I am particularly grateful to P.D. Butler for her astonishing dedication, kindness, and organizational skills that made completion of the book manuscript possible and to W.C. Ghiorse for his unbounded enthusiasm for the art and science of microbiology and Ian Hewson for reviewing section 6.10. I also apologize for inadvertently failing to include and/or acknowledge scientific contributions from fellow environmental microbiologist friends and colleagues across the globe. (Without imposed boundaries, this writing project would never have been completed.) Forward we go!

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