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# Preface to the Fourth Edition

The field of geomicrobiology has been receiving wider recognition than ever before among environmental microbiologists and earth scientists since the first appearance of the third edition of this book in November 1995. This is happening because of an ever-increasing awareness of the influence of microbial activity in shaping the habitable part of our planet. The pace of research on various aspects of geomicrobiology in the last few years has significantly accelerated and produced new discoveries of geomicrobial phenomena and yielded new insights into previously established phenomena. The topic of geomicrobiology was specifically addressed in the program of recent annual meetings of the American Society of Microbiology (ASM) and, since the year 2000, has been allotted a special section in the table of contents of the journal *Applied and Environmental Microbiology*, published by ASM. A journal exclusively devoted to the subject, the *Geomicrobiology Journal*, has been published independently of ASM since 1978. The timely publication of *Geomicrobiology: Fourth Edition, Revised and Expanded*, puts the new advances in the field in perspective.

This fourth edition incorporates the important new findings of geomicrobial significance of the last five years. Some of these findings were made by the

application of new physical and biological analytical techniques. They enlarged our concept of the total size of the microbial habitat enormously because living microorganisms have been detected below the Earth's surface at significantly greater depths than heretofore. They have also expanded our understanding of the great diversity among the microbes in all the habitable parts of the Earth. Intensive investigations are ongoing to determine the interrelationships among the microorganisms in these habitats and the nature of their activities from a geomicrobial standpoint. This edition reflects some modifications in the thinking about the origin of life on Earth and its early evolution, but a divergence of views remains.

In regard to specific geomicrobial processes, the fourth edition reflects the increase in our understanding of the microbial weathering of rocks and minerals. It contains a new chapter that deals with a probable role of microbes in the formation of bauxites. The chapters on iron and manganese incorporate the latest findings in regard to the physiology of microbial oxidation and reduction of ionic forms of these metals and some of their minerals and the diversity of the organisms involved. They also contain a more extensive discussion of the microbial role in anaerobic biodegradation of organic carbon than in earlier editions. The chapters dealing with sulfur, arsenic, and selenium compounds incorporate the latest findings with regard to microbial oxidation and/or reduction of corresponding forms of these elements. The section on microbial metal sulfide oxidation in Chapter 19 has been extensively modified. It reflects the important recent discovery that acidophilic *Thiobacillus ferrooxidans* (recently renamed *Acidithiobacillus ferrooxidans*) seems to be a secondary rather than a primary player in mobilizing metal from metal sulfide ores in heap-, dump-, and in situ leaching and in generating acid mine drainage, at least in more advanced stages. This chapter also examines a current controversy concerning the mechanism by which acidophilic iron bacteria oxidize metal sulfides. New references have been added to the chapter on the geomicrobiology of fossil fuels.

The chief aim of the fourth edition of *Geomicrobiology*, like that of the earlier editions, is to serve as an introduction to the subject and to be of use as a text as well as an up-to-date reference book. The book includes discussion of the older literature as well as the recent literature, which is important for an appreciation of the development of the different areas of geomicrobiology. As in the earlier editions, the reference lists at the end of each chapter are not exhaustive but include the literature I deem most important. Related literature can be located by cross-referencing. As in previous editions, a glossary is included to provide definitions of scientific terms that may be unfamiliar to some readers.

I have retained some of the drawings prepared by Stephen Chiang for the first edition. A few illustrations from the third edition have been replaced, and a few entirely new ones have been added. I am indebted to a number of persons and publishers for making available original photographs or allowing reproduction of

previously published material. They are acknowledged in the legends of the individual illustrations.

I owe thanks to Donna Bedard for very helpful comments on the molecular aspects discussed in Chapter 7. My thanks also go to Jill Banfield, Katarina Edwards, and Francisco F. Roberto for reading Chapter 19, and to Ronald Oremland for reading Chapters 13 and 20. I am indebted to Sigal Lechno-Yossef for help with the digital photomicrography setup in the biology department.

The continued belief of Marcel Dekker, Inc., in the importance of this book has encouraged me greatly in preparing this fourth edition. Special thanks go to Sandra Beberman, Vice President, Medical Division; Michael Deters and Moraima Suarez, Production Editors; and the editorial staff.

Responsibility for the presentation and interpretation of the subject matter in this edition rests entirely with me.

*Henry Lutz Ehrlich*