

PREFACE

A random perusal of recent publications in such disparate fields as bacterial genomics and Internet encryption or organic chemistry and astrophysics shows that scientific reductionism, the practice I liken to the drilling of ever deeper holes, is thriving more than ever. Synthetic endeavors, such as scanning both nearby terrain and distant horizons, preoccupy only a small minority of scientists but their frequency and scope are increasing. One of the principal reasons for the rejuvenation of scientific syntheses (which used to make up such a large part of nineteenth century science) is the growing realization that the very survival of modern civilization is inextricably tied to the fate of our environment, to changes in the Earth's biosphere. And anybody with even the most basic understanding of the environment realizes that in order to minimize the impact on the biosphere modern societies need integrated, multidisciplinary studies that inform by the breadth of their syntheses.

I wrote *The Earth's Biosphere* to further this fundamental understanding. I have tried to do that by (1) offering a new synthesis that is informed by the latest advances in a multitude of disciplines, ranging from geochemistry and geophysics to ecology and energetics, (2) explaining both well-known and largely unknown fundamentals of the biosphere's structure and dynamics, and (3) trying to convey the many amazing attributes of the Earth's realm of life. These remarkable characteristics are met at every scale, from sub-cellular to planetary—the elaborate organization of protein machines within every living cell, the incredible abilities of microbial metabolism in both mundane and extreme environments, the grand-scale transfers of heat in the Earth's ocean and atmosphere, and the life-sustaining complexities of global biogeochemical cycles.

I have also tried to use some of my professional advantages and personal predilections—bridging the natural and the social sciences—in order to write a multifaceted

book that does not fit easily into any simple categories. I know that some readers will find this approach too broad or too taxing. Their patience may be particularly tried as they encounter many pages devoted to the intricacies of microbial life—but this more-detailed focus on bacteria and archaea is merely an acknowledgment of the still underappreciated dominance and ubiquity of these organisms in the biosphere and of their irreplaceable roles in the cycles of life.

I am also sure that some specialists will feel that many topics have not been given enough attention or that explanations of some particulars would have benefited from a greater detail or from a more subtle understanding. I plead guilty on all counts. Syntheses cannot be written as lengthy encyclopedias and, no matter how hard one tries, subtle, confident understanding of myriads of details making up the mosaic of life is beyond anyone's abilities. Such are the perils of this nonreductionist intellectual adventure; its rewards, I hope, are some new perspectives.

As with any book of this kind, I am indebted to thousands of scientists whose work I cite, admire, or criticize and without whose findings and ideas I would not have been able to scan the global horizon and deliver this new synthesis. My particular thanks go to Marty Hoffert, John Katzenberger, and David Schwartzman, who read the entire typescript, corrected some lapses, and suggested numerous additions and improvements.

Any remaining mistakes and misinterpretations are mine—and only mine. As any true interdisciplinarian I have been always aware of numerous weaknesses in my quest for grand syntheses, and I have never had any illusions about the impact of my books. I just do my best. But I am also always mindful of Seneca's sobering verdict regarding our understanding of the world in general:

Veniet tempus quo posterī nostri tam apertā nos nescisse mirentur. (The day will come when posterity will be amazed that we remained ignorant of matters that will to them seem so plain.)