

Preface

For many years, bacteria or prokaryotes, unlike eukaryotes, have been thought of as microorganisms without organelles, as “bags of enzymes” and as an enveloped collection of randomly placed macromolecules. With the advent and use of the electron microscope in the 1950s, followed by decades of tremendous development of new technologies for analyzing prokaryotic cells down to the nanometer level, we now know that these nucleus-free cells are far from being disorganized. They are, in fact, extremely complex with regard to structure and (micro)compartmentalization. In addition, without getting into the semantics of what constitutes a “true” organelle, it is clear that prokaryotes often compartmentalize using some sort of coating or barrier essentially constituting an organelle. Examples of these are numerous, some of which, including carboxysomes and magnetosomes, are discussed in detail in this volume.

Given the changes in way we look at prokaryotes based on the previous paragraph, it seems only natural that we would now examine how prokaryotes use nanosystems to microcompartmentalize and exploit what we learn in a new, burgeoning scientific field we refer to as nanotechnology. This volume we believe is among the first to be devoted entirely to nanomicrobiology and the nanosystems of bacteria.

The emphasis of this volume is on those processes or nanostructures that have machine-like function and geomicrobial activities that occur at a specific site within or on the cell, again demonstrating the importance of microcompartmentalization by prokaryotes. The authors of the chapters in this book are leaders in these specific fields, thus ensuring they provide state-of-the-art reviews of their specific topics. We hope to convey that the rapidly evolving field of nanosystem technology embraces many areas for the development of futuristic scientific, commercial and medical endeavors. In addition, the biological and physical features of these bacterial structures should stimulate scientists and others interested in nanotechnology research to adapt some of these principles to their research efforts.

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