

PREFACE

This manual came into being as the result of a workshop held at the Center for Marine Biotechnology in July, 1990. The workshop reflected the unique phylogeny and extraordinary metabolic properties of a group of organisms that was then called the Archaeobacteria. It also reflected the awkward nature of the beasts themselves. The Archaea, as they are now called, contain the most oxygen-sensitive anaerobes, the most extreme thermophiles, and halophiles whose salt-dependent enzymes require a rethinking on the methods of protein biochemistry. It is clear that the factor limiting archaeal research was the need for a central, comprehensive source of specialized methods. A group at the Center of Marine Biotechnology—Al Place, Hal Schreier, Esther Fleischmann, and Frank Robb—responded to this need by producing a small technical manual consisting of contributions from the participants at the workshop. Our original manual, funded by the U.S. Office of Naval Research and printed at the Center of Marine Biotechnology, provided a sampler of experimental methods.

Jeffrey Miller prompted the interest of Cold Spring Harbor Laboratory Press in the project, which led to the assembly of the present set of protocols, with overviews of the halophiles, methanogens, and thermophiles and a number of appendices. Carl Woese, whose studies on the small ribosomal subunit RNA first established that the Archaea are organisms very different from bacteria, emphatically describes the battle to establish this group in their rightful position as “honorary eukaryotes” with

prokaryotic cell organization. This goes against the grain, so to speak, of the dogma that prokaryotes are monophyletic. Because of this, the Archaea have suffered through successive awkward names, such as Archaeobacteria, Archeobacteria, Archeote, and the like.

There are signs that the apprenticeship of the group as a microbial sideshow is about to end. The Archaea recently received a significant salute through the choice of two methanogens (*Methanothermus fervidus* and *Methanobacterium thermoautotrophicum*) and a sulfur-reducing hyperthermophile, *Pyrococcus furiosus*, as organisms targeted for genomic sequencing by the Microbial Genomes Initiative funded by the U.S. Department of Energy. The sulfur-oxidizing thermophile, *Sulfolobus solfataricus*, has been chosen by the Canadian Center for Advanced Studies for a 3-year genomic sequencing program. Another new development is the unexpected emergence of Archaea as a major component of the prokaryotic biomass in oceanic waters. Three “sightings” of previously unrecognized archaeal populations in Antarctic and Alaskan waters, where the Archaea can constitute up to 30% of the submicrometer population, are summarized by Gary Olsen in a *Nature* (371: 657–658 [1994] News and Views) article. These enigmatic cells, which may be major players in global microbial ecology, are unknown in terms of their physiology, since none have been cultured. This underlines the need for specialized methods for isolation and culturing. In the midst of this battle for recognition, it is clear that the Archaea isolated thus far

harbor unique molecular adaptations that are tailor-made for applications in molecular biology and biotechnology, such as thermostable DNA polymerases for PCR, methanogenesis as an alternative fuel source, and bacteriorhodopsin for production of computer chips. Knowing the high potential that Archaea have for both basic and applied science, it is our hope that this manual will provide a practical user guide for new and established investigators in archaeal research.

As Editors, we owe a great deal to the initial contributors to the workshop and the first manual. All of the authors have provided outstanding copy and have shown patient attention to detail. The archaeal research community possesses an unrivaled level of cooperation, and without it, this manual could not have been completed. The strong response provided CSHL Press with a far larger publishing job than they had anticipated. The artistic talents of Scott Fuqua evident throughout the manuals are greatly appreciated. We have also had gen-

erous sponsorship from five organizations, as detailed in the Acknowledgments, particularly from the U.S. Office of Naval Research which has supported the project and the Center of Marine Biotechnology from the outset. The University of Maryland is also to be thanked for housing all of the editors, except Shil DasSarma, who is at the University of Massachusetts at Amherst.

Finally, we wish to thank John Inglis, Nancy Ford, Dotty Brown, Mary Cozza, and Susan Schaefer of Cold Spring Harbor Laboratory Press. Their skill and professional acumen is truly impressive.

Frank Robb
Al Place
Kevin Sowers
Hal Schreier
Shil DasSarma
Esther Fleischmann

February 5, 1995