

Book Review

On Not Judging a Book by Its Cover

Stress Proteins in Biology and Medicine.

**Edited by R. Morimoto, A. Tissières,
and C. Georgopoulos.**

Cold Spring Harbor, New York: Cold Spring Harbor
Laboratory Press. (1990). 450 pp. \$97.00.

The title of the new monograph from the Cold Spring Harbor Laboratory Press, *Stress Proteins in Biology and Medicine*, leaves something to be desired. The book is about heat shock proteins, not all kinds of stress proteins, and the phrase “in biology and medicine” is a loose way to convey the notion of functionality. What readers will find in this multiauthored monograph is a first-rate account of the cellular heat shock response, focusing on the function and regulation of its best-known components: the half dozen or so families of universal heat shock proteins.

The book provides exactly what most readers appreciate—comprehensive, reasonably current information presented in an accessible format. The four major experimental systems (bacteria, yeast, *Drosophila*, and vertebrates) are well represented, along with a few contributions of a very broad sort (a survey of the variety of biological adjustments to fluctuating thermal environments, the nature and function of fever, and the relationship of stress proteins to infectious disease).

Half an hour of browsing suffices to teach one the ways and byways of the book. The first chapter (an overview by the editors, Richard Morimoto, Alfred Tissières, and Costa Georgopoulos) guides the reader to the remaining 17 chapters. Moreover, it is an outstanding primer on the heat shock field; experts, students, and interested scientists from other fields of biology can learn much from a reading. The content and organization of this chapter reflect the expertise of its trio of authors; unfortunately, the rhetoric and style do not match its content—some paragraphs are quite unclear. A strong editorial pen could have turned this essay into a true gem.

Handy tables and figures throughout the book summarize a vast amount of information. For a concise guide to the seven families of conserved heat shock proteins, see Table 1 of the first chapter; for a survey of the infectious agents that induce immune responses to these proteins, turn to Table 1 of Chapter 7. An overview of mammalian heat shock proteins and their partners in stress responses, the glucose-regulated proteins, is found in Table 2 of Chapter 10 (an encyclopedic chapter by W. Welch that excellently summarizes current information from mammalian cell biology). Making sense of the complex hsp70 families of yeast and humans is aided by consulting Figures 1 of Chapters 13 and 14. Table 1 of Chapter 9 is a handy guide to the ten best-studied bacterial heat shock genes transcribed by the sigma-32 form of RNA polymerase.

Induction and regulation of the heat shock response are presented by some of the foremost investigators in this field. One can't do much better than have Carol Gross and her colleagues team up with Takashi Yura on the regulation of the bacterial system, followed by the insights of Costa Georgopoulos and Maciej Zylicz (and colleagues) gained from the bacteriophage lambda world. Similarly, the eukaryotic mechanisms are dealt with by leading experts and their associates, including Elizabeth Craig and Richard Morimoto (expression of the hsp70 family of yeast and vertebrates, respectively), Alfred Tissières, Carl Wu, and Susan Lindquist (developmental, transcriptional, and posttranscriptional regulation, respectively, of heat shock protein synthesis in *Drosophila melanogaster*), and John Lis (structure of the regulatory regions of heat shock genes).

Clearly, molecular aspects of regulation are far from slighted, but the pervasive theme of the book is biological function. Function is dealt with at many levels, from the intact multicellular animal to individual cells and unicellular organisms, and from function of the integrated response in vivo to the activities of individual heat shock proteins. The most exciting aspect is of course the emerging view that many of the prominent heat shock proteins (the hsp70, hsp60, DnaJ, and GrpE families) interact with newly made proteins to aid their assembly under normal conditions, and that following hyperthermia their role is expanded (and their synthesis increased) “to promote the refolding and reassembly of proteins that have become denatured as a result of hyperthermia or other abuse” (p. 287). This “chaperone” concept, succinctly expressed by Hugh Pelham in an elegant overview of the functions of hsp70 (Chapter 10), is one of the two outstanding contributions of heat shock studies to modern cell biology (the other being the universality and the degree of genetic conservation of this stress response). It is not yet a fully developed idea, and some of its most important implications have yet to be discussed publicly, much less explored experimentally. These undoubtedly will be the subject of future monographs on the heat shock response; the current volume conveys the impression of a field in its inception rather than its maturity.

Less rewarding are the sections of the book dealing with possible overall function of the total heat shock response. The search for an overarching cellular consequence that would explain the universal retention of the response has been unsuccessful. Advocates of the view that induced thermotolerance is the Rosetta stone from which one will eventually learn to read the answer are well represented in the book, but studies of thermotolerance are still entangled in controversy over the role of heat shock proteins in the phenomenon. Experimental study of thermotolerance has not been as productive in yielding new insights as has been the study of individual heat shock proteins.

The book does have flaws—minor ones. Instances of inconsistency in nomenclature (DnAK, DnaK; HSP70, hsp70; and the like) are annoying, but seem to result more

from a lapse in copyediting than from an insensitivity of the editors. The decision to use "stress protein" and "stress response" as equivalents of "heat shock protein" and "heat shock response" deserves explanation, but the editors offer none; the implication that the synthesis of heat shock proteins is a general stress response is too significant not to be discussed explicitly. Including "medicine" in the title of this book raises expectations that are not fully met. The involvement of heat shock proteins in the complex interactions of bacteria and viruses with mammalian host cells is an important development in the field of infectious disease. On the other hand, the chapters dealing with hyperthermia as a treatment for cancer make only a tenuous connection with the biology of the heat shock response; their inclusion may be justified on the grounds of informing readers that such therapy exists, but star billing was unnecessary.

On the positive side, the book accurately reflects one of the exciting features of heat shock studies—the extent to which studies on widely diverse organisms contribute useful ideas and information to each other. This cross-fertilization is evident not only in the editors' overview chapter, but within almost every specialized chapter. Finally, I believe that many readers will experience, as I did, the delight of coming upon the unexpected and unconventional, or the simply elegant. For me it happened to be the experiments of Elizabeth Craig, the narrative of Hugh Pelham, and the innovative presentation of information by Costa Georgopoulos (namely, his Table 2) that brightened my day; other readers will have their own favorites.

The Cold Spring Harbor Monograph Series includes many classics: *The Lactose Operon*, *The Bacteriophage Lambda*, *The Molecular Biology of Tumor Viruses*, and sequels to these three, *Ribosomes* and *The Molecular Biology of the Yeast *Saccharomyces**. The present work, the 19th in the series, is a notable addition and a fitting contribution to the centennial celebration of the founding of the Cold Spring Harbor Laboratory.

Frederick C. Neidhardt

Department of Microbiology and Immunology
University of Michigan Medical School
Ann Arbor, Michigan 48109-0620

Books Received

Maxwell, R. A., and Eckhardt, S. B. (1990). *Drug Discovery*. The Humana Press, Inc., New Jersey. 438 pp. \$79.50.

Wegrzyn, S., Gille, J.-C., and Vidal, P. (1990). *Developmental Systems*. Springer-Verlag, New York. 122 pp. \$39.50.