on the directions of research on photosystem II. The second volume deals mostly with theoretical aspects and sophisticated spectroscopic analysis methods of charge separation and electron transport in the reaction center and in model systems but also includes sections on topics not usually reviewed in this context, such as the structure and spectroscopic characteristics of carotenoids and infrared vibrational spectroscopy. The work's wide spectrum of approaches illustrates the interdisciplinary nature of the research that is currently performed to investigate basic processes in photosynthesis and emphasizes the importance of this research for progress on broader issues, including structure-function relationships in membrane-protein complexes and electron transfer events in biological systems.

The large amount of information presented here may overwhelm the reader who is not thoroughly familiar with at least some aspects of photosynthetic reaction centers or electron transfer. Also, like many multiauthored works, the volumes have suffered from a long publication lag, and many chapters include references only through 1991, except perhaps for work from the authors' own laboratories. Nevertheless, *The Photosynthetic Reaction Center* will be a valuable resource for all those interested in this important system.

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The Gram-Positive World

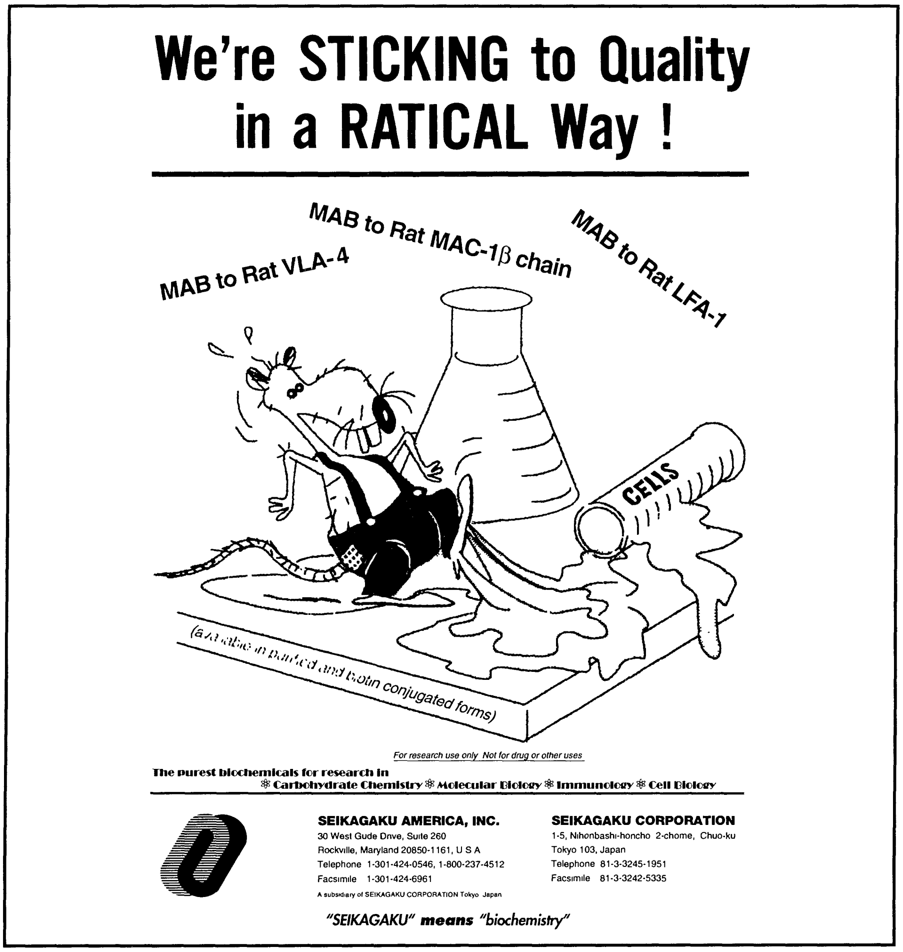
***Bacillus subtilis* and Other Gram-Positive Bacteria.** Biochemistry, Physiology, and Molecular Genetics. ABRAHAM L. SONENSHEIN, JAMES A. HOCH, AND RICHARD LOSICK, Eds. American Society for Microbiology, Washington, DC, 1993. xiv, 987 pp., illus. $125; to ASM members, $98.

Bacillus researchers have long been plagued by frustration with the inefficiency of their efforts. There has often been an expectation on the part of some of their colleagues that *Bacillus* findings should conform to the *Escherichia coli* paradigm, and *Bacillus* researchers have been obliged to devote valuable time and energy to explaining why this expectation is unjustified. Some of this frustration is evident in *Bacillus subtilis and Other Gram-Positive Bacteria*, many of whose chapters open with an account of how the particular aspect of *Bacillus* under discussion diverges from the *E. coli* model.

The book demonstrates that *B. subtilis* occupies a special place in the Gram-positive world. Modeled on the *E. coli* "Bible," *Escherichia coli and Salmonella typhimurium: Cellular and Molecular Biology* (1987)—also published by the American Society for Microbiology—but consisting of a single volume rather than two, the book contains 64 papers by more than 100 contributors. About 15 percent of the chapters are devoted to species other than *B. subtilis*. As the book shows, Gram-positive organisms, although diverse, share many physiological and structural features that distinguish them from the more extensively studied Gram-negative species. Aside from the classic differences in cell wall and cell envelope, areas of divergence include methods of genetic exchange, transcription and translation machinery, postexponential-phase phenomena (especially endospore formation), chromosome topology, and aspects of chromosome replication, modification, and repair.

The book is divided into ten major sections. The first, which introduces the reader to some of the major Gram-positive organisms and their most interesting features, opens with a chapter on the systematics and ecology of *Bacillus* that catalogs the heterogeneity among the more than 70 *Bacillus* species. A subsequent chapter on *Staphylococcus* deals with pathogenicity, plasmids, and resistance determinants that function in *Bacillus*. Chapters on *Clostridium, Streptococcus, Lactococcus* and *Lactobacillus, Streptomyces, Pasteuria* (a frequently overlooked genus parasitic on nematodes), and *Bacillus anthracis* (one of the few *Bacillus* species pathogenic for humans or animals) each devote a few pages to a subtopic that has benefited from direct analogy to *B. subtilis*. These chapters and those devoted to genetic maps of similar organisms (in the section on chromosome structure) demonstrate similarities among the five most extensively characterized Gram-positive organisms and provide an excellent overview of our current knowledge of the genetics, physiology, and metabolism of each of these species. The chapter on phages, although limited in scope, is a very worthy contribution.

A section on metabolism and its regulation contains a brief synopsis and overview of significant metabolic pathways in *B. subtilis* (that is, intermediary metabolism).



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Other chapters cover aspects of transport, metabolism, and respiration as well as biosynthesis of the major amino acid families, vitamins, purines, and pyrimidines. A group of chapters on postexponential-phase phenomena (analogous to the discussion of operons and regulation of multigene systems in the *E. coli* Bible) deals mostly with endospore development and control but also considers motility and chemotaxis.

It has taken *Bacillus* researchers years to convince the rest of the scientific community (especially manuscript reviewers) that, unlike *E. coli*, Gram-positive organisms do not metabolize hundreds of carbon or nitrogen sources or use cyclic nucleotides for catabolite repression. Rather, they depend on more elaborate use of extracellular enzymes and on negative regulatory mechanisms. In this way *Bacillus* metabolism differs substantially from that in enteric species. These differences in metabolism are also emphasized in a section on production of commercial products, which contains chapters on fermentation, peptide antibiotics, extracellular enzymes, proteases, and insect toxins, which are also largely postexponential-phase occurrences.

The actual chromosome structure of *B. subtilis* is detailed in three separate chapters. The sixth (and latest) edition of the genetic map now necessitates the chromosome's diagrammatic representation as a series of 12 vertical segments but clearly draws attention to regions where the densities of known markers differ by several orders of magnitude. More recent additions of physical mapping data from pulsed-field gel electrophoresis and YAC (yeast artificial chromosome) clones make the first contributions toward relating the genetic markers to physical size and real chromosomal distances. A single table depicts the extent to which YAC clonal isolates represent chromosomal segments. However, no use is proposed for these clones; there is no suggestion of their stability, nor is any clue given as to how an increase in complexity (through the addition of one single-copy *Bacillus* fragment to the already complicated chromosomal complement of *Saccharomyces*) will make the study of that *Bacillus* DNA any more enlightening.

Genetic exchange and genetic engineering are the focus of a group of six chapters, which present much of what is known about DNA uptake, recombination, transposons and their uses, integrational vectors, plasmids, and temperate

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[1] *BioTechniques, 12(4)*, 580 (1992)

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Vignettes: Wildlife Without Fear

Swarms [of bees] often attach to tree branches in impressive, hanging conglomerations. Beekeepers seek out such swarms because they are easy to capture and place in a managed hive. You may have seen photographs of beekeepers scooping up bees by the handful or allowing the bees to swarm all over their bodies. They do this by applying pheromone or some honey first, so that the bees will be attracted to them. Another trick is to put a queen bee on your chin so that the swarming bees form a "bee beard." . . . These tricks are NOT recommended for amateurs.

—*Greg Flakus*, in *Living with Killer Bees: The Story of the Africanized Bee Invasion* (Quick Trading Company)

I recently encountered an approach that some see as an alternative to the removal of animals from the wild. Without moving anything but my eyes, I could see a thirty-five-pound iguana lizard, a ten-foot python, and more than a hundred red, yellow, and black king snakes. The situation was one that any comfort-loving herpetologist would enjoy. I was not standing in a tropical jungle; I was in the lobby of a Florida hotel.

—*Whit Gibbons*, in *Keeping All the Pieces: Perspectives on Natural History and the Environment* (Smithsonian Institution Press)

phages having the most utility as vectors for genetic manipulation. Unlike the *E. coli–S. typhimurium* manual, the book offers no description of how to manage these processes experimentally. For example, the chapter on transformation describes the many ways in which *Bacillus* can be induced to exchange genetic material (particularly useful is the discussion of the genetic pathways required for competence development), but there is no summary of how one would go about making a culture competent. Nor does the book contain information comparable to that in the *E. coli–S. typhimurium* volume on selectable markers for use in genetic manipulation and suggestions of the concentrations of antibiotics by which wild-type *E. coli* can be expected to be inhibited.

In addition to its limited usefulness for the experimentalist, the book has other drawbacks. The index is of uneven quality, often directing the reader to trivialities or omitting significant entries. Moreover, there is no coverage of capsular materials from various *Bacillus* derivatives, stress responses, macrofiber filamentation, unbalanced growth, or storage granules. In fact, poly-β-hydroxybutyrate, the ubiquitous storage material of *Bacillus*, is not mentioned anywhere in the book. Despite these flaws, the book's effective organization and general approach make it ideal for the uninitiated or for the *Bacillus* expert seeking information about a specific field. In the end it succeeds in pointing out how widely *B. subtilis* and its close Gram-positive relatives diverge from *E. coli* and its cousins, and for that reason alone is a valuable contribution.

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