als science, and electrical engineering. The authors are an international cast of distinguished researchers, including the formidable Mott, now in his 88th year, all very active in various facets of HTSC research ranging from both applied and theoretical physics to solid-state and quantum chemistry. Although the range of coverage is broad, I would have liked to see a more thorough description of the novel aspects of magnetic flux structures and properties in the cuprates, a very active and important area of current research, as well as a chapter on the materials science of cuprates, especially the nature of crystal lattice defects, their pinning of magnetic flux and their contributions to granularity. (These topics are at the very heart of the difficulties in realizing the technological potential of HTSC.) The quality of the chapters is uniformly rather good, and they will provide a nice introduction to various features of HTSC for the novice, especially graduate students embarking on their own studies of the fascinating materials and phenomena of high-temperature superconductivity.

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Vignettes: Fields of Science

Chemistry is an empirical science, and the textures of things get into the memory: the viscosity, mobility and viscidity of different liquids, and the gritty, unctuous or glassy feel of solids; the indescribable but unforgettable smells of things (for our language of stinks is impoverished and textbooks fall back on "a characteristic odour" in their lists of properties); colours and their changes; and the tastes of things, tried voluntarily or accidently through a mismanaged pipette; bubblings, test-tubes becoming too hot to hold, sharp colour changes, sudden turbidities and precipitations are the stuff of chemistry: a science where the secondary qualities of things (ideas linked to sense data) are of great importance if one is to get a sense of what is going on in reactions.

—*David Knight*, in *Ideas in Chemistry: A History of the Science* (Rutgers University Press)

In some fields, ideas can be actuated quite quickly . . . . In other fields, it takes years to articulate an idea . . . . The contrast between "zombie biology" and physics illustrates this point: The molecular biologist Sydney Brenner once thought of founding a journal called the *Journal of Zombie Biology*, not for the biology of zombies, but for zombie biologists. His reason: "Because that's all you have to do. You just have to wind yourself up in the morning, and go to the lab and just do things . . . many of the answers come from just doing things. Biology isn't a subject in which you can have great thoughts in the bath." The nuclear physicist Leo Szilard (who left physics to work in biology) once told Brenner that he could never have a comfortable bath after he left physics. "When he was a physicist he could lie in the bath and think for hours, but in biology he was always having to get up to look up another fact."

—*Paula E. Stephan* and *Sharon G. Levin*, in *Striking the Mother Lode in Science: The Importance of Age, Place, and Time* (Oxford University Press)

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Cytotoxins and Cytolysins

Sourcebook of Bacterial Protein Toxins. J. E. ALOUF and J. H. FREER, Eds. Academic Press, San Diego, CA, 1991. xii, 518 pp., illus. $175.

Although approximately 240 protein bacterial toxins have been identified, our understanding of their action on the eukaryotic cell is limited to a relative few. Diphtheria toxin and cholera toxin have been well characterized, and the field is rapidly advancing for others such as the membrane-damaging cytolysins and the clostridial neurotoxins. In the common path of such progress a protein that is capable of disrupting cell physiology and perhaps causing cell death is isolated from a bacterial pathogen and implicated as a virulence factor. The molecular mechanism of action is identified, permitting categorization of the protein as a cytotoxin if it is an enzyme with an intracellular mode of action or as a cytolysin if it is membrane-damaging. An interesting extension to this area of research is the recent use of bacterial toxins as molecular tools to study cell physiology. Isolation of the toxin structural gene can then be followed by mutational analysis, which is used to investigate structure-function relationships and better assess the role of the toxin in disease. Once the active site of the toxin has been identified and modified these findings can be used in the development of superior vaccines.

As research progresses and the mechanisms of action, primary amino acid sequences, and x-ray crystallographic structures are elucidated for an increasing number of protein bacterial toxins, there emerge distinct similarities and family classifications. Examples are the ADP-ribosylating toxins, which constitute the largest category of cytotoxins, and the family of Shiga toxins, which are produced by *Shigella dysenteriae* and *Escherichia coli*. One of the most exciting aspects of toxin research is that the families identified are not restricted to bacteria but include toxins produced by plants, insects, other invertebrates, and reptiles. The identification of prokaryotic and eukaryotic toxins with similar structures and mechanisms of action indicates an evolutionary correlation and suggests that at one time these proteins had a role in the normal processes of cell physiology. This hypothesis is supported by studies demonstrating that bacterial toxins and endogenous ADP-ribosyl transferases have common substrates in eukaryotic cells.

The *Sourcebook of Bacterial Protein Toxins* is a collection of 22 reviews covering these aspects of toxin research. The contributions dissect a variety of protein toxins and the cell processes they affect on a molecular level. The chapters with the broadest coverage describe a particular toxin or family of toxins, providing detailed descriptions of the commonly used purification techniques, molecular mechanisms of action, genetic regulation, and structure-function analysis. Additional chapters provide more specialized supporting information regarding enzymatic reactions, bacterial processing and secretion of extracellular toxins, receptor binding, entry, and trafficking within the target cell. This arrangement causes some repetition, but the contributions are well indexed, making the book a good source on specific topics of interest. In addition, there are contributions devoted to the techniques used to study bacterial toxins and their effects, including the patch-clamp, which is used to investigate the effect that cytolysins have on membrane voltage potential, and transposon mutagenesis, which is used to investigate the genetic regulation of toxin production.

This book would be most appreciated by researchers interested in the molecular mechanisms of bacterial toxins or their use as tools to define eukaryotic cell processes. Although it includes a brief description of pathogenesis for each toxin, it is not a reference for clinical application. Many different sections express the common theme that recombinant toxins can be used as therapeutic agents, however. For example, the final chapter describes the construction and use of hybrid toxins composed of the enzymatic portions of diphtheria toxin and *Pseudomonas aeruginosa* exotoxin A fused to interleukins, melanocyte-stimulating hormone, and CD4 to kill malignant or viral-infected cells. The purpose of these molecular chimeras may not always be to kill target cells, but to alter cell physiology and affect a desired change. As is suggested in the concluding remarks of the chapter on clostridial neurotoxins, botulinum and tetanus toxins may someday be engineered to treat disorders of the central nervous system.

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