as later recognized by nonscientists. One might, however, profitably regard the jabberwocky isomorphemes as strictly formal correspondences or analogies, useful—as the wide-ranging and unexpected sources consulted by Feuer indicate—for raising questions and suggesting where to look for answers. So understood, Feuer's book is valuable in itself and, one may hope, a harbinger of more refined studies in the sociology of scientific knowledge.

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References and Notes

1. P. Forman, "Weimar culture, causality, and quantum theory, 1918–1927: Adaptation by German physicists and mathematicians to a hostile intellectual environment," *Hist. Stud. Phys. Sci.* **3**, 1 (1971).
2. Compare the reviews of Heisenberg's *Physics and Beyond* by K. Hufbauer, *Isis* **62**, 558 (1971) and by P. Forman, *Science* **172**, 687 (1971).
3. Feuer makes much of Einstein's use of "relativity" in the paper of 1905; but nothing can be inferred from this since, as Feuer knows, Poincaré, whose conservatism and classicism rest on an anti-Einsteinian emotional line, had earlier used the same word in the same sense.
4. J. L. Heilbron and T. S. Kuhn, "The genesis of Bohr's atom," *Hist. Stud. Phys. Sci.* **1**, 211 (1969).
5. E. Broda, *Ludwig Boltzmann* (Deutscher Verlag der Wissenschaften, Berlin, 1957).
6. See the account of the meeting in *Verh. Ges. Dtsch. Naturforsch. Ärzte* **67**, 28, 32 (1895); W. Ostwald, *Lebenslinien: Eine Selbstbiographie* (three vols.) (Klasing, Berlin, 1926–1927), vol. 2, p. 197ff; A. Sommerfeld, "Das Werke Boltzmanns," *Wien. Chem. Ztg.* **47**, 25 (1944).

Surface Structures

Bacterial Membranes and Walls. LORETTA LEIVE, Ed. Dekker, New York, 1973. xx, 496 pp., illus. $38. Microbiology Series, vol. 1.

The investigation of bacterial surface structures has advanced through unintegrated attack on a multiplicity of limited objectives. Chemical analyses of structural polymers, investigation of the mechanism of their biosynthesis, and the inhibition of these mechanisms by antibiotics have naturally led to an interest in associated membrane functions, and the stated aim of this book is to juxtapose the available data so as to facilitate a concerted approach to some of the difficult problems that remain. These problems, mostly related to the control of biosynthesis and morphology, are easily stated, but it is hard to design experiments to deal with them. While the quality of the nine reviews making up this volume is generally high, few of the authors have provided guidelines for an interdisciplinary approach to such problems. For the most part, then, the book is simply a useful collection of reviews.

Leonard Mindich's chapter is concerned chiefly with the composition and assembly of protoplast membranes. It is a good review, but it does not provide a coherent treatment of the biochemical genetics of lipid biosynthesis in *Escherichia coli*, and there is no statement of conclusions or perspectives.

The chapter by Ghuysen and Shockman on biosynthesis of peptidoglycan starts with a routine review of peptidoglycan structure. It continues with a discussion of biosynthesis that emphasizes kinetic analyses of the few soluble enzymes available for study and places undue stress on the unproven identity of the soluble D,D-carboxypeptidases and physiologically functional transpeptidases of *Streptomyces*. The chapter ends with an excellent review of autolytic enzymes and their potential functions, much of it deriving from Shockman's own studies. In this and other chapters, the phenotypes of bacterial mutants with alterations in cell surface phenomena (wall synthesis or breakdown, cell shape and division, membrane and transport functions) are discussed. Usually such mutations have pleiotropic effects and interpretation is problematical even when the lesion is biochemically identified.

Hiroshi Nikaido's outstandingly clear discussion of lipopolysaccharides and the outer membrane layer of gram-negative cell wall is reasonably successful in fitting the data into a comprehensible pattern. Because lipopolysaccharides are components of the outer membrane of gram-negative bacterial cell walls, and are synthesized within the plasma membrane, the discussion leads into the membrane-associated phenomena of polymerization, transport, ligation, and assembly into functional supramolecular arrays.

The section on transport commences with an excellent discussion of binding proteins by Rosen and Heppel. This chapter gives careful consideration to functional and operational definitions of binding proteins, transport proteins, and periplasmic enzymes and to the significance of these with respect to active transport. The inclusion of data on yeast and fungi is useful, as is the discussion of approaches to unsolved problems.

Ronald Kaback's chapter on transport mechanisms is less successful because it attempts to cover too much material on the mechanism of direct coupling of active transport to energy production of respiration and does not discuss chemiosmotic coupling. The controversy over coupling remains very much alive, and the reader would benefit from a thorough discussion of the matter. This article is exemplary in its coverage of recent literature.

The excellent review of colicins by Salvador Luria places proper emphasis on problems that need reexamination and clarifies the function of colicin E3. The functions of E1, K, and (to a much greater extent) E2 remain a matter of confusion. There is no discussion of megacins and gonocins or of colicin factor DNA replication. This short chapter is otherwise comprehensive, and it raises provocative questions about structural, regulatory, and evolutionary aspects of colicins.

Alexander Tomasz's review of the mechanisms of transformation is an interesting account of the author's own work on competence. Other matters related to transformation, such as the molecular biology of the uptake of single-stranded DNA, are excluded. This review does, however, cover aspects of transformation that are clearly related to the biology of bacterial cell surfaces.

The section on morphogenesis and reproduction begins with a chapter by Pardee, Wu, and Zusman on cell division. They state that "the combination of facts and bold hypotheses have allowed a guess as to the general appearance of the picture of bacterial cell division, but much remains to be discovered before the puzzle can be sorted out and a complete picture emerges." This is not an overstatement. Hypotheses of a very general nature concerning the linkage between genome replication and cell division continue to outstrip experimental demonstration by a considerable margin. This review covers basic models of cell division, notably those of Helmstetter and Cooper, without attempting to present many of the hard data. As a result, it is somewhat superficial, and moreover little attempt has been made to update the information. There are some curious omissions: for example, in the discussion of the separation of replicating strands, no mention is made of Albert's work on bacterial and phage unwinding proteins. There are other oversimplifications of the data, and the review does little to clarify a very confusing field.

The final chapter, by Henning and Schwarz, discusses the problems of studying the determination of cell shape. The most serious problem is clearly that of separating the pleiotropic effects of events (mutation, drug action, metabolic imbalance) that affect such tertiary phenomena as the three-dimensional arrangement of structural and other polymers. The determination of this arrangement probably depends on the spatial and temporal integration of biosynthetic and hydrolytic enzyme actions as well as on the often-postulated self-assembly properties of protomers. Like other workers in the field, the authors fail to come up with a comprehensive plan of attack for dealing with these problems. Much of their discussion is predicated on the work of Brinton on the self-assembly of *Bacillus brevis* T layer protein into cylinders in vitro. This phenomenon is now known to be an artifact seen only in partially degraded material, so this promising lead seems to be another dead end.

This book will provide source material for future work in the biology of bacterial cell surfaces, and it is useful to have reviews of these related subjects collected in one volume.

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Reactions Involving Boron

Organoboranes in Organic Synthesis. GORDON M. L. CRAGG. Dekker, New York, 1973. xvi, 422 pp., illus. $24.50. Studies in Organic Chemistry, vol. 1.

This book is concerned with a field of organic chemistry that has developed almost totally within the last 15 years. It discusses three related topics: the hydroboration reaction to form carbon-boron bonds, reactions of carbon-boron bonds to yield functional groups or carbon-carbon bonds, and reduction of functional groups by boranes containing at least one boron-hydrogen bond. The author's intention was to provide a comprehensive review, and in this he has succeeded very well.

The book is divided according to type of transformation (for example, hydroboration of alkynes is the subject of one chapter). Subdivisions are according to the structure of the compounds involved in the transformations. To orient the reader there is at the beginning a concise review chapter, including references to the fuller discussions elsewhere in the book.

The literature appears to have been covered well into 1972. There are a long and detailed subject index and a thorough author index. At the beginning of the book there is a table of abbreviations, identification of some of which is vital for the uninitiated; the author is to be commended for displaying this so prominently.

Regrettably, the book is photographically reproduced from the typed manuscript, and the pages, though clear and free of typographical errors, appear "busy" and cluttered.

It should be noted that this book appeared not long after *Boranes in Organic Chemistry* by H. C. Brown, the leading investigator in this field. Brown's book—derived from a series of lectures encompassing his researches in several diverse areas—is more limited to his recent novel contributions to organoborane chemistry, although the history of the field, including numerous personal insights, is presented. Cragg's book (which is dedicated to Brown) is considerably drier but more extensive in its coverage.

In summary, *Organoboranes in Organic Synthesis* provides an excellent way to become familiar with the possibilities for applying these recently developed methods to synthesis, even for those not thoroughly familiar with organic synthesis.

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Properties of Plasmids

Bacterial Plasmids. Conjugation, Colicinogeny and Transmissible Drug-Resistance. G. G. MEYNELL. MIT Press, Cambridge, Mass., 1973. xiv, 164 pp., illus. $14.95.

Recently, articles have appeared in *Science* and the weekly news magazines describing the joining of DNA containing the genes from a South African toad with the DNA of a bacterial plasmid and the subsequent use of this hybrid DNA to transform bacterial cells so that the cells produced an animal gene product. These articles have contained interesting speculations on the possible beneficial applications of these new genetic techniques in agriculture and medicine. It has also been pointed out, however, that the results of this kind of genetic manipulation with antibiotic resistance genes could pose a danger to mankind, and a committee of the National Academy of Sciences has appealed to investigators throughout the world to refrain from attempting certain kinds of experiments until the hazards can be evaluated (*Science*, 26 July, p. 303). With this increased interest in plasmids, the general scientific reader is fortunate that he can consult this well-written book by Meynell for more information on the subject. The book was published in 1973 and, although it does not include the recent experiments discussed in the news magazines, it does provide the necessary background for understanding them. It is written in such a way as to emphasize the similarities in the various genetic and molecular properties of bacterial plasmids. Many of these properties are known to be shared by the extrachromosomal DNA of eukaryotic cells, and Meynell is particularly interested in presenting the information about bacterial plasmids in a general way so that it will be useful to those working with other organisms as well.

By concentrating on the similarities between plasmids and forgoing a detailed catalog of how each plasmid differs from others, Meynell has produced a concise, unified, and easy-to-read book. It covers all aspects of transfer, integration, replication, and maintenance of plasmids as well as the physical characterization of plasmid DNA. Plasmid genetics and the control and regulation of plasmid gene product biosynthesis are thoroughly handled. The book is fact-filled, and no space has been wasted on unnecessary elaboration. This concise style of writing may mean that some readers will want more information about the methods and details of the experiments. For this, the reader will have to go to the original work, but the task has been simplified because the author has provided extensive references, citing over 650 articles, of which about 20 percent were published in the '70's.

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