sage is that simple explanations of regulatory outcomes do not stand the scrutiny of those who study the intricate details of the regulatory process.

One might expect that an economist, finding major deficiencies in the efforts of his colleagues to explain regulatory behavior in terms of the instrumental model of utility maximization, would look for ways to improve the model rather than accept different models. The major strength of this book is that Temin is willing to break free of disciplinary constraints when doing so facilitates understanding the behavior of the various actors in drug regulation—the FDA, the pharmaceutical manufacturers, the physicians, the pharmacists, and the medicine-taking public. His concern is not whether the instrumental behavior mode is pertinent, but when.

Current drug policy is predicated on the assumption that individuals cannot be expected to act instrumentally in selecting medicines for self-treatment. This assumption appears to be correct at least for some modern medicines, for many diseases, and for most individuals. However, it does not necessarily follow that a paternalistic regulatory system can transfer the individual's proxy for instrumental behavior to those who can and will exercise it in his or her best interest.

Extensive pre-marketing assessment of new drugs is predicated on the assumption of physicians' incapacity to act instrumentally in choosing drugs for their patients. With very few exceptions, the patient population of a single physician provides an inadequate data base for determining whether or not a particular drug is an effective treatment for a particular disease. Hence, an FDA role in approving new drugs seems justified, but the appropriate character and amount of regulation are more problematic. For example, when is information on safety and efficacy sufficient for the physician to act instrumentally on the patient's behalf? Is the answer the same for subspecialists and for generalists?

As a patient, one might be reassured by the thought of a medical professional carefully choosing, from among a menu of medicines evaluated by the federal government, the one that is optimally suited to treat one's particular condition. Temin's review of the literature on prescribing behavior does not support this reassuring view of physician decision-making. Customary behavior based on community norms and personal habit is most common; instrumental behavior is the exception.

The patient is the subject of the command behavior of the physician. The logic of this hierarchical arrangement lies in the physician's superior knowledge about diagnosis and treatment and in the patient's psychological and physical vulnerability. But the patient's willingness to accept the hierarchy logically assumes that it acts instrumentally in his or her behalf. Temin argues persuasively that, in general, the medical hierarchy has neither the analytic framework nor the data to evaluate drug therapy instrumentally before issuing prescription commands to the patient.

Taking Your Medicine is a comprehensive and scholarly examination of the history and policy issues surrounding drug regulation. Temin uses the work of researchers from many disciplines extensively and effectively, but the most impressive aspect of the book is his own synthesis, which is an insightful policy analysis unhampered by disciplinary barriers that obscure facets of complex problems.

Temin's analysis of current regulatory policy alternatives is broadly in the instrumental mode, but it acknowledges the institutional and cognitive limits of the actors in the process. He presents a persuasive case for reforms such as more patient information to support more patient responsibility for risk-taking, less pre-marketing and more post-marketing surveillance of new drugs, and a system of phased or restricted release of new drugs that takes explicit account of differences in physicians' qualifications. In the past, such logically attractive proposals have unfortunately evoked customary responses from the various communities that are involved with drug regulation. *Taking Your Medicine* should convince some participants in the policy process to evaluate them more objectively.

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A Simple Behavioral System

Bacterial Chemotaxis as a Model Behavioral System. DANIEL E. KOSHLAND, JR. Raven, New York, 1980. xiv, 194 pp., illus. $18. Distinguished Lecture Series of the Society of General Physiologists, vol. 2.

In Daniel E. Koshland, Jr., the field of bacterial chemotaxis has one of its most visible and vocal advocates. The strength of this book derives from his irrepressible enthusiasm about the beauty of biological mechanisms and the direct applicability of observations in bacterial systems to the complex problems of behavior in higher organisms. The weakness of the book derives from the compromises involved in its having been "written for both the educated layman and the specialist."

A common theme throughout the book is that the study of simple biological systems yields principles that can be applied to complex organisms. The first two chapters and the final chapter are aimed at the general reader. The first two introduce bacterial chemotaxis and may well seduce the reader into venturing into subsequent chapters. The final chapter, "Bacteria and higher behavior," discusses observations showing how behavior includes genetic and biochemical components and how defects in these components can result in abnormal behavior.

The bulk of the volume (chapters 3 through 7) is a description of the current understanding of bacterial chemotaxis, emphasizing the interests and contributions of the author and his laboratory. These chapters are directed toward readers with biological training, who will likely find much of interest in them. A chapter on adaptation, a central feature of most sensory phenomena, is weighted toward consideration of mathematical models for adaptation, which may slow down some readers. Since biochemical components are not as yet identified for most of the features of the models, I think the chapter would have been more informative if emphasis had been on the specific experiments that relate adaptation to protein carboxyl methylation. The correlation between the two processes is particularly relevant to the theme of the book, since this specific protein modification occurs in many higher cells but its role is understood only in bacterial chemotaxis.

The successes of molecular biology demonstrate the power of deducing principles from the study of simple biological systems and then applying those principles to the understanding of more complex systems. Koshland does a service in trying to communicate to the general reader that this strategy is likely to prove powerful in the study of behavior. As yet the only applicable lessons derived specifically from the study of bacterial chemotaxis are that the principles of molecular genetics and biochemistry established in the study of metabolism and macromolecular synthesis also apply to the components of a sensory system.

Throughout the book, examples of chemotactic studies are used to illustrate the way in which those principles apply to simple behavioral systems and might apply to complex systems. The fervor

with which Koshland proselytizes a faith in the significance of the study of bacterial chemotaxis should be effective in generating outside interest and support, but it also confronts those of us in the field with the responsibility to get on with our experiments.

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Highly Anisotropic Solids

The Physics and Chemistry of Low Dimensional Solids. Proceedings of an institute, Tomar, Portugal, Aug. 1979. LUIS ALCÁCER, Ed. Reidel, Boston, 1980 (distributor, Kluwer Boston, Hingham, Mass.). x, 436 pp., illus. $50. NATO Advanced Study Institutes Series C, vol. 56.

There are several classes of unusual materials that can be described as "low-dimensional." Every year since a meeting at Lake Arrowhead in 1974, they have been the subject of a convention of synthetic chemists, experimental physicists, and theorists meeting at a retreat in North America or Europe. In August and September 1979 such a conference was held in Tomar, Portugal, and the present volume contains the papers presented at that meeting. All of the papers published were invited and are, in principle, of a review or tutorial nature. Naturally, many of the authors took the opportunity to present their own recent work and to stress in review the importance of their earlier work. Therefore it will probably be impossible for a reader to obtain an unbiased summary of each aspect of the field.

The electronic properties of the solids discussed at Tomar are all so highly anisotropic that for "low-dimensional" one might well substitute "quasi-one-dimensional." Interest in the chemistry whereby such anisotropy can be achieved in electrical conductivity or magnetic interactions, and the unusual physical phenomena that result, is the reason for the high level of activity in the field. There are basically three classes of material that fall into the quasi-one-dimensional category: organic charge-transfer salts, polymers, and a variety of inorganic chainlike metal complexes. The chemistry of each is described in several papers. It was hoped, in the infancy of the field, that by studying the properties of such materials, particularly the organics, it would be possible to develop a scheme for "molecular architecture," that is, to tailor the molecules in such a way as to produce specific solid-state properties. That goal remains elusive, and indeed, as Wudl, Bechgaard and Andersen, and Miller all point out, the most interesting materials obtained to date have resulted largely from serendipity.

Research on other aspects of the subject has, however, resulted in greater reward. The instabilities that result from the Fermi surface geometry of a one-dimensional metal, the wide temperature range over which fluctuations toward the more stable low-temperature state can be observed, and the existence of unusual mechanisms for the propagation and scattering of electric current carriers have all been demonstrated. Theoretical advances have been made in dealing with the interactions of many electrons with each other and with the ions of the lattice. At the time of the Tomar meeting neither superconductivity nor spin-density waves were known in organic materials. Since both have since been discovered it is fair to say that *The Physics and Chemistry of Low Dimensional Solids* is already outdated.

Nevertheless the book may be useful in some ways. The tutorial lectures by Schultz and Chaikin could serve as an introduction for graduate students entering the field. Schultz's treatment of the Ginsburg-Landau formalism is clearer than any I am aware of in a textbook. The papers by Thomas and Weger are much more specialized and certainly require either prior knowledge of the field or extensive parallel reading (both do give relatively comprehensive bibliographies). Thomas presents a case study of a particular subclass of materials, and Weger reviews some of the theoretical work aimed at explaining the electrical conductivity of organic charge-transfer metals.

I believe that the greatest use of the book will be as a reference volume for workers already broadly familiar with the field. Particularly noteworthy is the paper by Jérome in which he describes the extensive studies by the Orsay group of the pressure dependence and thermoelectric power of TTF-TCNQ, the fruitfly of organic conductors. Many data that are widely scattered or unavailable in the journal literature are collected here, and the paper is the most recent survey available of the experimental situation in the controversy concerning the transport properties of this remarkable material.

Many other subjects are covered, but I believe that at the time of the meeting they were either in a state of flux or past the point of vigorous activity, and they are reviewed better elsewhere. The controversial concept of solitons, in polyacetylene and in magnetic chains, which certainly germinated before 1979, has flourished only more recently. The observation of quasi-harmonic noise in the non-ohmic regime of niobium triselenide was also a new phenomenon in 1979. That a book can become so much out of date in two years is testimony to the progress and excitement of a vigorous field of research.

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(Continued on page 250)