BOOKS

The Mathematical Theory of Diffusion and Reaction in Permeable Catalysts, Vol. I, Rutherford Aris, Oxford University Press, New York, 1975. $39.50.

A psychologist friend of ours says that reviewers can be divided into those who must have, and those who couldn't have gone to charm-school; and that every normal reviewer begins his task by looking at the bibliography. This reviewer's qualifications: No charm-school, otherwise normal.

The handling of the bibliography forecasts it, the book confirms it: Rutherford Aris has succeeded in giving us a highly comprehensive treatise of the subject without being encyclopedic; he manages critical selectivity, yet without undue omissions. He covers principal developments and references in the text and adds brief Additional Bibliographical Comments after each chapter—a good method. It is refreshing to have the references accompanied by their own titles to lay "the sinews, if not the flesh and skin, on what otherwise are but dry bones".

We were frankly surprised at the magnitude of analysis that has by now accumulated, and greatly impressed by the way Rutherford Aris has taken these many pieces and placed them into a consistent and functional scaffold using his own extensive analysis as the flux and the binder. Even the short historical sketches are meticulously developed and instructive.

The title is wordy, but could hardly be shortened. For, while the catalysts (of the title) may be the most familiar examples, other—such as liquid/gas and (immiscible) liquid/liquid—systems in which molecular transformations proceed could be rightfully included. The author makes some valiant attempts to point to the interdisciplinary applicability by including occasional mention of such systems as cells, fluids, and membranes.

No one can ever avoid "errata", but just one comment on "phi's", φ and ϕ and Φ. The Thiele modulus has been all sorts of things including φ for many authors. In the main, it's ϕ in this book; but φ's appear on some figures, and they should be ϕ. And then there are Φ's which are ϕ's modified or generalized in certain ways. Unfortunately, we and others have used the "big phi" Φ to represent the characteristic modulus which contains the observables only (observed rates, not rate constants), and equals $\phi^2\eta$ in Aris' notation. This formulation which is most important to the experimentalist is little used by Aris.

The book is an indispensable bible for every institution, library, department, etc. involved in pushing the horizons of knowledge, and for any individual doing theoretical analysis in the field. It is generally instructive for the applied mathematician. The experimentalist will gain some orientation in the introduction portion of the text, and learn where to go for help; it does not attempt any serious bridging to the world of experimental encounter. As the author says "It is important not to be limited to realistic values as the locus of reality is actually moving with the tides of science and technology and to sell the freedom of theory for the temporary relevance of experiment would be unconscionable".

It covers the real and it covers the conceivable. It is an impressive record of a systematic and adventurous journey of mathematical analysis into the behavioral consequences of a vast spectrum of conditions—well organized, classified and developed.

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Biochemical Reactors, B. Atkinson, Pion Limited, London (1974). 267 pages. £5.00.

In this book Professor Atkinson develops and presents models for the behavior of idealized fermentation reactors. Following a brief historical introduction to this ancient art and its nomenclature, he deals with kinetics both as isolated reactions and coupled reaction-diffusion problems. The models are based primarily on flat-plate and spherical geometries (microbial films and flocs), and might be of value in fields relatively unrelated to fermenter design. Next comes a useful chapter on parameter measurement before two chapters on the design of reactors. The chemical engineer will find these to be a satisfying link between his prior knowledge of reactor design and considerations unique to microbial processing. Also included is an interesting design problem involving a trickle-flow fermenter. The only disappointing part of the text is a pair of chapters on reactors containing soluble or immobilized enzymes. A good deal of recent literature, particularly on immobilized enzyme kinetics and reactors, has not been tapped, and the overall treatment is fairly qualitative.

With its emphasis on idealized models, this book should be an especially valuable reference for biochemical engineers involved in the design or analysis of fermentations. Their chief reservation probably would be that many of Professor Atkinson's ideas appear not to have been tested by comparison with real data. The critics could be more at fault for this problem than the author, however, because of the traditional secrecy which has surrounded much microbial processing. Even if several specific models are found to be inadequate, *Biochemical Reactors* will be a great success if it stimulates a more active interchange of data and ideas between the process bioengineer and the theoretician.

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"Fundamentals and Modeling of Separation Processes," C. D. Holland, Prentice-Hall. 430 pages. $24.95

For the chemical engineer who was trained in the "old school", this book will introduce him to the new world of chemical engineering calculations. As he reads the first chapter, at first he wonders why the book was written at all. The author starts out describing the simple heat and mass balances of evaporator systems, solving an example by the conventional trial-and-error method. "So what's new?", you think. "I learned this stuff back in 1939."

In the middle of the chapter, the author reveals his reasons for this easy approach, and you suddenly find yourself knee-deep in matrix algebra. As you compare the new method with the old, the transition becomes easier, and the new methods begin to make sense.