away from a review style and discuss his own ideas in any detail.

Murdock's reviews are comprehensive and well balanced, as one would expect from someone who has produced a stream of interesting and relevant experimental papers. For each of his three basic types of memory (item, association, and order), models with mathematically simple properties are compared to see which best accounts for the standard sort of human experimental evidence that can be related to them; much stress is placed on the adequacy of mathematical predictions. Memory is viewed as being homogeneous; it is implicitly assumed, for instance, that all types of association operate similarly, so that to associate a name with a face involves basically the same sort of mechanism as to learn that one concept is superordinate to another.

Murdock makes this assumption of homogeneity explicit in considering the relation between short-term and long-term memory. Thus the short-term memory situation is studied as a simple means of understanding long-term memory. This approach depends crucially on the incorrectness of the commonly held view that in some respects short-term memory is the more complex situation because it involves additional specific mechanisms whose contribution can be ignored in long-term retention. Murdock presents only very terse arguments against this view; they involve supposed contradictions between estimates of the capacity of primary memory and the way total displacement of even relatively unprocessed information does not occur. In my opinion Murdock's arguments are not conclusive. For instance, his arguments about capacity, even when they appear to relate to the same short-term memory system, ignore the very different retrieval demands of different tasks. Moreover, he ignores the considerable amount of evidence for differing properties of different systems and the neuropsychological evidence that they can be differentially localized anatomically.

In his final chapter, Murdock describes three models of his own, that memories are stored as on a temporally organized conveyor belt, that retention of associations fluctuates in an all-or-none manner, and that serial-order information is retained by a type of nesting model. The plausibility of the first two seems to rest only on their inherent a priori simplicity and on their rough quantitative fit with data. They receive no convincing experimental support, nor are they a part of any overall functional model of brain organization. The third model, stemming from the famous Lashley serial-order problem, seems more interesting. Perhaps if the arguments for these models had been extended a more convincing case could have been made.

For its mass of well-organized information the book is essential reading for a graduate student beginning research in the field. It fails, however, to present a compelling new theoretical perspective. Murdock believes his overall approach to be correct because human memory research has reached the stage of the "collection and documentation of empirical findings and relationships of reasonable reliability and generality." Unfortunately for this pre-Kuhnian view, the same statement could have been made in a book written in 1955, but there would be little overlap between the two books.

TIM SHALLICE
Psychology Department,
National Hospital for Nervous
Diseases, London, England

Transport Phenomena

Transport Phenomena in Aqueous Solutions. TIBOR ERDEY-GRÚZ. Translated from the Hungarian by I. Ruff. Halsted (Wiley), New York, 1974. 512 pp., illus. $37.50.

This book presents the rich variety of data on and molecular models of transport phenomena in aqueous solutions from the point of view of one who shared an era in the development of the field with such giants as Debye and Onsager. The transport phenomena treated are viscosity, diffusion, and electrolytic conduction. The style of presentation is that of a comprehensive review article that offers the reader a broad sampling of data and models based, in the main, on concepts of activated-state theory or hydrodynamics applied to molecular dimensions. Those who have dealt with Harned and Owens will find the phenomenology familiar but generally less replete with mathematical detail, more readable, and augmented with welcome qualitative molecular interpretation. These highly useful, physically clear, but qualitative concepts are supplemented with references to more recent, potentially quantitative, developments based upon equilibrium statistical mechanics, Kubo's formulation of transport phenomena, and synthetic data from molecular dynamics calculations. However, serious effort to explain or evaluate these newer methods and results is notably absent.

An introductory chapter on the structure of liquids gives appropriate emphasis to the unique structural features of water. This chapter reduces the host of data, calculations, models, and conjectures that the complexity and importance of this subject elicit to a concise, readable, and remarkably neutral survey of the concepts that form an essential part of the classic notions of the molecular mechanisms of transport in aqueous solutions.

The chapter on viscosity presents the contributions of activated-state and free-volume theory for pure and solvent and electrolyte systems through the comments, data, and interpretations of an appropriate cross section of workers in the field. A more extensive chapter on diffusion deftly deals with the more apparent than real, but often irritating, complexities of various frames of reference in multicomponent systems, reviews activated-state theory as well as less renowned theories, and clearly presents the Onsager relations. Examples of data and analysis of multicomponent and electrolyte solutions are interwoven into an illustration of the kind of empirical physical and chemical information that one may derive from diffusion measurements. Extraction of molecular information relevant to, say, hydration of ions stands revealed as a painfully qualitative step in the context of the kind of models that fall within the scope of this work. As is not always the case in presentations of the subject, the notation, format, and expositional skill of the author succeed in giving a view of the forest as well as the trees.

The chapter on electrolytic conduction uses much the same format but includes more illustration in the form of discussion of experimental data. Here again the physical motivation behind corrections to Stokes's law and the fundamentals of the Debye-Hückel-Onsager treatment of conduction are presented clearly, along with pertinent discussion of molecular models such as the special mechanisms of conduction available to protons by means of exchange reactions. Effects derivable from mixed solvents, as well as the host of named effects (the Wein effect, for example), are also described and illustrated. A substantial appendix of almost 100 pages develops the ramifications of Debye-Hückel theory and gives considerable attention to the notion of hydration shells as revealed by various experimental techniques. Again classic methods are clearly, faithfully, and interestingly presented, but more recent and definitive results, such as have been obtained from nuclear magnetic resonance, receive scant attention.

This book summarizes the results of a great era in the investigation of transport phenomena. It is a convenient, authoritative, and readable reference work, but it is not designed to explain or to stimulate current work at the forefront of the field.

D. C. DOUGLASS
Bell Telephone Laboratories,
Murray Hill,
New Jersey