many passages. Illustrations include 25 pictures of Merriam and persons or places associated with him. The bibliography of primary and secondary sources is extensive. Unfortunately, there is no index. The text is reproduced from typescript of uneven quality. Misprints are fairly numerous, but most are flagged in a list of 56 errata pasted in the back.

CLAUDE ALBRITTON
Institute for the Study of Earth and Man, Southern Methodist University, Dallas, Texas

Cytogenetics of Malignancy

Chromosomes and Cancer. JAMES GERMAN, Ed. Wiley, New York, 1974. xxviii, 756 pp., illus. $35. Chromosomes Series, vol. 1. A Wiley Biomedical-Health Publication.

This volume is the first in a proposed series on chromosomes and related topics. It is appropriate that the initial subject is the chromosomal basis of cancer, since the relationship of these topics has been the subject of speculation from the time of Boveri. (It is also true that the intrinsic interest in cancer has recently been augmented by the glitter of federal gold.)

It is probable that the high expectations engendered by this combination of topics could never be met by any book. The multifarious nature of cancer, with its plethora of questions and dearth of answers, has necessitated multiple authorship. While the list of authors is most impressive, their very multiplicity exaggerated the problems of organization and coordination. Although the editor's words give evidence of the effort he has made to solve these problems, as well as to achieve comprehensibility for the nonspecialist, it is this reviewer's opinion that these goals have only partially been met.

It should first be noted that there is no introductory chapter covering chromosomes and their structure in general terms, despite the professed concern for the nonspecialist. In particular, no review of chromosome nomenclature or chromosome banding is included. It is likely that much of the planning for this book was undertaken before the current techniques of chromosome banding were developed. In many chapters, the latest citations are from 1972. Since chromosome banding did not attain widespread application until 1971, significantly less than half of the current information from this technique has been covered by many of the contributors.

The rapidity with which new developments occur in cytogenetics shortens the lifetime of some arguments. Ohno's chapter, for example, explores the possibility that malignancy is a recessive condition. Under this scheme, mutation leading to malignancy would be more likely to develop in an aneuploid cell that is monosomic for part of a chromosome and hence possibly hemizygous for some critical loci. At the time the chapter was written, the Philadelphia chromosome was thought to be a deletion, and its association with chronic myelogenous leukemia is cited as support for Ohno's thesis. Unfortunately for the thesis, the Philadelphia chromosome is now believed to be part of a reciprocal translocation and is *not* evidence for hemizygosity. No footnote to acknowledge this new information is included in Ohno's chapter, although the information appears in several other chapters. Such unevenness in information flow is found repeatedly in the book.

Several of the sections of the book are sufficiently basic in approach and broad in subject matter to remain valuable despite the passage of time. Comings's chapter "What is a chromosome break?" and Evans's chapter on ionizing radiation are particularly excellent. Their lucid explanation of basic concepts and their copious diagrams are worth special mention.

Other sections are of value for their synthesis of published information or their summarization of their authors' research or both. About one-third of the book has these virtues and may well provide the principal justification for reading or purchasing the book. The clinical cytogeneticist, hematologist, and oncologist will find the information useful for interpreting the cytogenetic phenomena encountered in their patients.

The interface between two such explosively developing fields ought to be an area of intellectual ferment. Only two chapters conveyed such an atmosphere to me. O. J. Miller's review of cell hybridization in the analysis of the malignant process is thorough and beautifully written. Miller effectively transmits his conviction that this tool will be a major source of new understanding of malignancy. Bloom and his co-authors are equally successful in their presentation on the development of established human lymphocyte cell lines and their cytogenetic characterization. No cancer researcher can afford to omit these writings from his readling list.

The excellence of the sections by Miller and Bloom points out how much the reader benefits from contributions preparing him for future developments. It is always easier to judge the importance of topics in retrospect, but there are some omissions that it seems to me should have been obvious. One of the themes pervading this book is the probable importance of aneuploidy as a determinant of, at least, tumor phenotype. This is essentially a problem in gene dosage, about which much could have been written. Testing for gene dosage in aneuploid states in turn requires a knowledge of the chromosomal location of specific loci. There was more than enough information available several years ago to warrant giving this subject significant space.

In summary, this book will provide a good review of the facts known prior to 1973 but will not alert the reader to the areas that are exciting in 1975.

My last comment is directed to the publisher. The book is printed on heavy, glossy paper that should withstand many years of usage. The binding, however, significantly deteriorated during the first reading.

PARK S. GERALD
Children's Hospital Medical Center, Boston, Massachusetts

Models of Memory

Human Memory. Theory and Data. BENNET B. MURDOCK, JR. Erlbaum, Potomac, Md., 1974 (distributor, Halsted [Wiley], New York). xii, 362 pp., illus. $12.95. Experimental Psychology Series.

Over the last 15 years work on human memory has undergone two changes of paradigm. About 1960 the stranglehold of interference theory was broken, to be replaced mainly by information-processing approaches. Yet it was soon discovered that apparently simple critical experiments in the new paradigm were in fact very complex, and the number of plausible models escalated. This metaproblem has led more recently to some widening of the empiricist methodology typical of experimental psychology: the use of a broader relation between theory and data and of ideas derived from linguistics, artificial intelligence, phenomenology, and neuropsychology.

Whether these new methods will be more fruitful is not yet clear, but at present they represent the more exciting parts of the field. Murdock's book, however, stands very squarely within the paradigm of the 1960's. The experimental situations and narrow quantitative models considered stem directly from the work on human memory of that time. The organization of the book makes this clear with four pairs of chapters comparing theories and data on item information, associations, serial order, and free recall, the first two pairs being primarily concerned with recognition memory and paired associates. Only in a final chapter does Murdock move

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