of decrement they find in old or demented individuals with that seen in persons with various types of brain disease (such as focal lesions) and cognitive dysfunction (such as alcohol intoxication). This emphasis on relating the psychological performance of the elderly to the state of their brains is evident in the initial chapters, which give brief overviews of the neuroanatomical and neurophysiological changes seen in aging and dementia. These chapters seek to provide a biological context in which cognitive researchers might better interpret their results and frame their experimental questions. Thus, a chapter on electrophysiology describes techniques, such as event-related potentials, that provide converging evidence concerning the information processing changes researchers have documented in the elderly.

One of the more interesting aspects of the book is the inclusion of chapters by two prominent neuropsychologists who approach this field with a very different perspective from that of the other authors. Winocur compares the memory interference problems seen in animals and humans with hippocampal lesions with the memory decrements found in the elderly, especially the institutionalized elderly. Moscovitch examines the pattern of neuroanatomical changes in the aged in light of the behavioral deficits known to follow focal lesions to different brain regions; from this, he predicts the nature of the cognitive deficits that should occur in aging and dementia. Such a search for common patterns in the effects of age and various types of brain dysfunction may prove to be a very useful approach for understanding cognition in the aged. In order for this to occur, however, it will be necessary to go beyond the simplistic reciting of similarities between age changes and neuropsychological deficits that is evident in several chapters (for example, that by Horn).

Just as Winocur and Moscovitch seek to relate decrements seen with age and with brain damage, so Craik and Byrd examine similarities in the patterns of memory encoding shown by elderly persons and by young persons who have diminished attentional resources due to fatigue, intoxication, or divided attention. Such modeling of age deficits in the young appears to be a very powerful technique for teasing out the underlying causes of age changes in cognition.

A number of other chapters focus on possible confounding variables in aging research, such as biological (for example, health) and social (for example, education) differences between young and old subjects, the effects of institutionalization, and the fear of memory loss. A particularly important chapter in this respect is that of Lachman *et al.*, who tested an assumption basic to most cognitive psychology—that results obtained with volunteer subjects are generalizable to the population at large. There has been some concern that research findings in gerontology have been distorted by a systematic bias in subject recruitment, especially among the elderly. The data reported by Lachman *et al.* should help ease this concern.

On the whole, the book is a valuable contribution to the growing literature on the psychology of aging. Besides providing a number of excellent reviews of aging literature and theory, it demonstrates the advantage of viewing age changes in the larger context of other types of cognitive dysfunction.

ROBERT D. NEBES
Western Psychiatric Institute and Clinic, University of Pittsburgh, Pittsburgh, Pennsylvania 15213

Epithelia

The Paracellular Pathway. Papers from a conference. STANLEY E. BRADLEY and ELIZABETH F. PURCELL, Eds. Josiah Macy, Jr. Foundation, New York, 1982 (distributor, Independent Publishers Group, Port Washington, N.Y.). viii, 382 pp., illus. Paper, $15.

When Farquahar and Palade some 20 years ago described the junctional complexes of mammalian epithelia, the idea that epithelial cells were joined by space-occluding tight junctions strongly biased serious consideration of extracellular or paracellular transport. Roughly a decade later, the "classical" finding of Farquahar and Palade had been exhaustively probed, and, in a series of ultrastructural and electrophysiologic studies, the space between cells was "opened." By the time of the symposium of which this book is the proceedings, there remained virtually no controversy that tight junctions are not truly tight. Unfortunately, it appears that something like another decade of research may be required to fully understand the principles of regulation of paracellular flow and how the zonulae occludentes participate in this regulation. Indeed, the theme of this book is a search for some unifying concept that can successfully replace the tight junction concept of 20 years ago.

The book is divided into five sections (general considerations; kidney; liver; gallbladder; and cornea and choroid plexus). Without the discussions that follow each report several important issues would not have been addressed and we would not have the opinions of Boulpaep, Erlij, Forker, Giebisch, Goodenough, Machen, van Os, and Renkin, who made no formal presentations. A 30-page concluding discussion offers a broad perspective of the subject and draws attention to necessary future work. The contributions are generally not simply rehashes of old material, although there are some useful reviews.

There is now a strong dependence between the students of structure and the students of function; this has not always been the case. There is a genuine effort in the papers to correlate morphologic and physiologic data. A central theme of the symposium is the need to understand better the structure of the tight junction. Is it static or fluctuating? How do two cells come together there? Does the junction contain specific permeation sites, or is its permeability due only to discontinuities or assembly errors in the strands of contact between cells? Bullivant presents a cohesive report on the freeze-fracture analysis of junction structures in which he clarifies terminology again (always useful) and points out junctional geometries under consideration. Revel considers junctions between cells in a general way and points out that it may be premature to assign functions to these structures.

A major subject of agreement in the book is that existing nomenclature is far from helpful. It is suggested that the designations "tight" and "leaky" may best be discarded, for the classification of the epithelial world into two camps has not stood up to the last ten years of investigation; Boulpaep and Wright are eloquent on this subject. A real contribution of the volume is that it contains a compendium of nearly all of the varieties of epithelia with respect to tightness. It is clear that there are electrically leaky epithelia with very high resistance to water flow (for example, the thick ascending limb, which is discussed by Andreoli and Hebert) and that there is no obvious association between electrical and hydraulic conductivities. Wright makes a strong plea that a new terminology be established for just this reason, and Boulpaep suggests that on purely electrical grounds one might be better advised to classify epithelia on the basis of the relative conductivities of cellular and paracellular pathways. Though the tight junction is generally regarded as

rate-limiting in paracellular transport, it is now agreed that it is necessary to consider as well the lateral intercellular spaces as potentially significant barriers. This is brought out strongly by Rector in his report on passive transport in the renal proximal tubule and by Boulpaep in the concluding discussion in which he considers the need for a distributed resistance model to accurately describe epithelial electrical characteristics. In the concluding discussion, Revel clarifies the relevance of electron microscope descriptions of the paracellular route and forcefully reminds us that there may well be material of consequence that is not recorded by electron microscopy. Revel's statement, which virtually ends the book, is in some respects a suitable place to begin reading.

A fair degree of sophistication has gone into the detailed study of paracellular pathways in each of several epithelia, with the result that each appears unique. Schultz and Fromm (colon), Reuss (gallbladder), Wright and Zeuthen (choroid plexus), Fischbarg (cornea), and Lambert *et al.* (the glomerulus, where all the transport is paracellular) contribute detailed summaries of their chosen subjects. These reports encompass a tremendous amount of information and expose the reader to a galaxy of powerful techniques. Coble, Leader, and Spring offer a scrupulously detailed report of an effort to study intercellular space osmolality via refractive index determinations but necessarily conclude that this approach cannot provide the data of interest.

Boyer, Bradley, and Javitt each review attempts to investigate paracellular transport in the liver. It is evident that much may be learned from the study of this organ but that it poses special difficulties and requires rather different techniques from those that are comfortably applied to isolated epithelia.

Both Burg and Tisher review the paracellular permeability properties of each of the nephron segments. In Burg's review of the physiologic findings he uncovers examples of almost every possible combination of ionic conductivity, hydraulic conductivity, potential difference, and permselectivity. Tisher uncovers similar examples when reviewing lanthanum permeability studies of the various nephron segments. Interestingly, Goodenough, a premier microscopist, offers the sternest challenge to the use of lanthanum as a relevant permeability marker and to the use of fixatives in these studies, whereas Wright and Fischbarg, proper physiologists, rise to the defense of glutaraldehyde as a reliable tool.

Bentzel *et al.* and Cereijido and Meza have carried the subject of paracellular transport a bit further. Each discusses preliminary attempts to study paracellular transport regulation by intracellular means. In each case, there is some evidence for cytoskeletal involvement in the regulation of permeability. Perhaps these investigations most fully acknowledge that a holistic approach to transepithelial transport is necessary.

This book will be worthwhile reading for all who profess an interest in epithelia, and it can be a useful summary to update information on cell-cell junctions for a great many others.

DONALD R. DIBONA
Department of Physiology and Biophysics, University of Alabama, Birmingham 35294

The Sun's Magnetic Field

Solar Magnetohydrodynamics. ERIC R. PRIEST. Reidel, Boston, 1982 (distributor, Kluwer Boston, Hingham, Mass.). xx, 472 pp., illus. $99. Geophysics and Astrophysics Monographs, vol. 21.

Evidence of magnetic fields is seen in almost all observations of the sun. Their presence is the cause of an enormous variety of structures in the solar atmosphere—sunspots, spicules, and coronal loops, to mention just a few. The truly remarkable behavior of these structures, the detail with which they can be observed, and of course the accessibility of the sun as a testing ground for new observational techniques have kept interest in solar physics constant and high. From the theoretical side, it is fair to say that much of our understanding of cosmical magnetic fields has its origin in studies of the sun's magnetic field.

In magnetohydrodynamics, the behavior of magnetized plasmas is studied in the fluid approximation. That is, the plasma is considered to be given by its macroscopic properties; microscopic effects like those due to the different properties of electrons and ions are neglected. This approximation is a particularly good one for most (but not all) solar magnetic phenomena. Priest's book deals with magnetohydrodynamics from a specifically solar perspective, and in this sense it is the first of its kind. Factors that are important in the laboratory but not on the sun, such as a nonzero viscosity or the effect of an external confining device, are mentioned only briefly. On the other hand the book pays special attention to the effects of gravity, such as the rapid outward density decrease in the sun, as well as to the very inhomogeneous nature of the solar magnetic field. The special importance of such factors (not to mention the difficulties they create in building quantitative models) is one of the reasons for the gradual development of a typically "solar" branch of magnetohydrodynamics over the past 20 years.

The book serves several purposes. The first set of chapters (70 pages) gives a concise general introduction to solar physics, mostly from a phenomenological point of view. In a second set the basic methods of magnetohydrodynamics are developed, with special emphasis on the key concepts and on physical insight rather than mathematical development. Examples illustrating the methods are taken directly from the solar literature. A third set of chapters (occupying about half of the volume) is an account of current theories for specific observed phenomena. The account is amazingly complete, covering, among other phenomena, dynamo effects, sunspots, prominences, spicules, coronal heating, and even a few nonmagnetic phenomena like the photospheric 5-minute oscillation. This completeness has been achieved through an economical style and an obvious talent for expressing the essence of a physical idea in a few sentences. In cases where mutually incompatible models exist for a given phenomenon, the models are described separately, the direct confrontation being avoided. The author's preference for a particular style of models is noticeable, of course, in that more space is given to models with limited but clearly defined applicability than to general theories of uncertain relevance. This preference is considered a bonus rather than a limitation by the reviewer.

Because the book contains a great deal of information, inevitably some topics are described in a rather compact way. This compactness of presentation may not be appreciated by some readers. The overall impression, however, is one of clarity of aims and economy of means. A point of minor criticism concerns the quality of the graphical illustrations, which are often somewhat unappealing.

The book should be eminently suitable for a course in solar physics. (The book grew from a course taught at the University of St. Andrews.) Also, it provides a comprehensive review of present magnetohydrodynamical models in solar phys-