bution is the chapter by M. F. Land on orientation and pattern recognition by jumping spiders. The account by Heisenberg of the use of behavioral mutants of *Drosophila* to dissect neurophysiological mechanisms of behavior provides a glimpse of an experimental approach that will become increasingly important in the next few years.

The authors' command of the English language varies considerably. Even more important, an occasional casualness in defining symbols and units in the figure captions makes a critical reading of some of the chapters an exasperating exercise. Considering the soft cover, the price of the book seems high and a potential barrier to wider dissemination. On this last point I should be pleased to be wrong.

T. H. GOLDSMITH
Department of Biology, Yale University, New Haven, Connecticut

Movement and Response

Behaviour of Micro-Organisms. Proceedings of a congress, Mexico City, Aug. 1970. A. PÉREZ-MIRAVETE, Ed. Plenum, New York, 1973. xviii, 302 pp., illus. $19.50.

This book contains updated papers presented at a symposium held during the 10th International Congress of Microbiology. The papers are excellent—either discussions of recent research by the authors and others, or reviews. The topics include chemotaxis, phototaxis, circadian rhythms, ciliary and flagellar structure and function, and ameboid and ciliate response and behavior. Some papers are updated from those given at the conference on motility of algae held in Santa Barbara in 1969. It is good to see them in print.

The book shows that research on behavior of microorganisms must be and is being pursued to the molecular-genetic events that determine the motility of the cell and its organelles.

The author-list bristles with veteran bwanas of symposial safaris, but also lists some new hunters. It is good to have a few new bwanas and porters, lest the safari tend to traverse the same old (sometimes barren) territories. Some new territories and new hunting techniques are revealed, among them Adler's patient spoor-tracking of chemoreceptor sites on bacteria; Davenport's new elephant gun, the elegant TV-computerized "bugwatcher"; the powerful binoculars of Satir and of Dimmitt *et al.* in their electron micrographs; the game-beating spectronic techniques of Nultsch, Diehn, and Tollin; and the jungle magic of cyclic adenosine monophosphate in Konijn's work inducing the trek of the acrasian grex.

Habituation and responses of ciliates are discussed by several authors. Inferences concerning the molecular bases of function are presented, and doubt is expressed about the durability of learning. The role of cations in ciliary movement is elucidated by Eckert and Naitoh.

I regret, with Adler (who organized the symposium), the absence of many important workers in the field. A supplementary list of recent reviews is a partial compensation. The lack is especially evident in the limited presentation on ameboid behavior—Allen and Haberey being the lone contributors. These authors correctly say that movements and behavior of one kind of ameba do not represent those of another and that although contraction is involved there is no agreement on how that mechanism is employed. Even Allen's own theory is perhaps applicable to only one or two kinds of amebas.

The book contains excellent, up-to-date material and deserves a place alongside Jennings's early classic in the field on the bookshelf of anyone interested in the topic.

EUGENE C. BOVEE
Department of Physiology and Cell Biology, University of Kansas, Lawrence

Biophysics

Mathematical Physiology. Blood Flow and Electrically Active Cells. H. MELVIN LIEBERSTEIN. Elsevier, New York, 1973. xvi, 378 pp., illus. $19.50. Modern Analytical and Computational Methods in Science and Mathematics, vol. 40.

Lieberstein's book differs from most texts on biomathematics in that it aims at providing general discussions of physiological principles in sufficient detail to supply the reader with the necessary background for evaluating the assumptions underlying the mathematical treatment. Rather than covering the entire spectrum of physiology, the author has limited the book to two systems (blood flow and electrically active cells) that have been subjects of his research over the past decade. The book is well written, the expositions are clear and concise, but the physiological concepts are sometimes unrealistic and the mathematics is probably too advanced to make the book suitable as a text except for students in mathematics.

The first part treats blood flow and wall tension problems on the basis of the thesis that arterial hemodynamics, including wall motion, can be completely determined from three simultaneous pressure measurements. It includes an interesting, albeit somewhat unrealistic, discussion of noninvasive measurement techniques for the evaluation of arterial disease, in which problems associated with pressure measurements are clearly and critically evaluated while dimensional measurements from roentgenograms are accepted at face value. However, all assumptions are clearly stated and the mathematical treatment is elegant and includes a variety of rather sophisticated methods (for example, the solution of nonlinear boundary value problems from converging solutions of sequences of linear boundary value problems, using nonlinear operators mapping one real Banach space into another). It is indeed unfortunate that the author seems unaware of the more recent experimental evidence that indicates that many of the assumptions made (shear-rate-independent viscosity, isotropy and nonviscous behavior of the arterial wall, extent of wall motion, the Windkessel model, and unmeasurability of flow profiles) are not valid. This section would have been significantly improved if some numerical investigation (as in the second part) and an updated bibliography had been included.

In the second part the author proposes a mathematical formulation of electrophysiology that is conceived as a unified description of the electrical activity of cells. Since one set of equations with various but reasonable changes in parameters is sufficient to describe all the known gross differences in electrical behavior, he considers each of the electrically active cells as modifications of the same design, despite widely varying functions, with only one common membrane mechanism. The entire section is based on the Hodgkin-Huxley equations. After a delightful history of the investigation of the electrical properties of membranes and cables, the system of Hodgkin-Huxley equations is reformulated. A numerical instability is removed by introducing the effects of inductance, which already contains Huxley's assumption of the propagation constant being a real number. The treatment is