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.

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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.

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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

extensive and includes numerical investigations of the basic properties of the reformulated equations as well as an analysis of noncylindrical axons and of synapse thresholds.

Despite its sometimes erroneous presentations of physiological background material the book provides stimulating reading. Since it offers a number of increasingly difficult approaches to essentially only two, albeit large and complicated, problems, it can be recommended as supplementary reading for students in biomathematics.

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Comparative Endocrinology

Steroids in Nonmammalian Vertebrates. DAVID R. IDLER, Ed. Academic Press, New York, 1972. xii, 504 pp., illus. $28.50.

While nonmammalian endocrinology has been used in a practical way for a long time—witness the use of the capon comb for the assay of androgens, the pigeon crop sac for the assay of prolactin, and both the male and female frog for the identification of human chorionic gonadotropin in urine—the development of comparative endocrinology as a discipline has occurred largely during the last decade. In recent years introductory textbooks and review articles have appeared and symposia have been held, but this is one of the first scholarly treatises on a broad segment of the subject. The book suffers from the common afflictions of treatises written by many authors, but it is a valuable addition to the literature.

One of the primary aims of the book as set forth in the preface is to evaluate the identification and quantitation of the steroids that various authors have claimed to be present in the various nonmammalian vertebrates. After an introductory chapter in which the significance of steroid studies in nonmammalian vertebrates is discussed, a chapter is devoted to the values and the limitations of the different techniques that have been used in steroid studies. The authors attempt to weigh these in terms of their significance in identifying and measuring steroids. This necessarily involves subjective decisions, but the long experience of the authors, and particularly the editor, makes the evaluation a valuable guide to the significance of published work.

A chapter by Lofts and Bern is an excellent discussion of the evolution and functional morphology of the steroid-forming tissues. This is followed by an extensive critical consideration of the chemical structures, biosynthesis, and metabolism of cortical steroids in fish. The nature and biosynthesis of cortical steroids in amphibians, reptiles, and birds are well dealt with in the next chapter, but there is no discussion of their catabolism. The chapters by Ozon on the androgens and estrogens of the lower vertebrates are excellently organized but are summaries rather than exhaustive critiques. The final chapter by Chester Jones and co-workers on the biological actions of the steroid hormones gives a good general review, but its value is somewhat impaired because the literature is reviewed only through 1969 and much of the work on mechanisms of steroid action on nonmammalian target tissues which has been so enlightening is omitted.

Tables have been used effectively throughout the book and will serve as excellent sources for checking data on identification, biosynthesis, metabolism, and physiological action of steroids in the nonmammalian vertebrates. Although coverage is somewhat uneven, the book is a valuable reference work.

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NMR and Magnetism

Nuclear Magnetic Resonance in Ferro- and Antiferromagnets. E. A. TUROV and M. P. PETROV. Translated from the Russian edition (Moscow, 1969) by E. Harnik. Israel Program for Scientific Translations, Jerusalem, and Halsted (Wiley), New York, 1972. viii, 206 pp., illus. $24.

This work is the first text to deal with the subject of nuclear magnetic resonance in magnetically ordered materials, one which has developed rapidly since the late 1950's. The English text is a fine translation.

The contributions to the book are divided between Turov and Petrov, with Petrov being responsible for two of the ten chapters. The authors state that the aim of the book is to bridge the gap between scientists concerned with nuclear magnetic resonance and those concerned with problems in magnetism. They emphasize the microscopic advantages of the technique of NMR. Most of the interesting problems that have been and are continuing to be studied are treated at least briefly, and clearly, in the text. Included is a good deal of the original theoretical work that has been done by the Russian school in this field, some of it by Turov and his colleagues.

The emphasis of this book is on the theoretical discussion of static and dynamic properties of the nuclear spin system in a magnetically ordered material. The coupling of electron and nuclei is discussed very clearly in terms of the most fundamental and successful models. The relationship of theory to experiment is very clearly presented for the problems considered. Spin phonon interactions and nuclear and electron spin modes are discussed. The authors provide extensive discussion of the dynamic effect in the resonance frequency on both the electron and nuclear systems in antiferromagnets and in weak ferromagnets. They include also a brief description of nuclear acoustic resonance in magnetic materials. The book contains a very helpful chapter presenting a discussion of spin polarization at nonmagnetic ions largely applied to insulating compounds.

The text is an excellent introduction to its subject, highly recommended to both communities for which the authors intended it. One hope of the reviewer was to find a more complete discussion of the role of impurities in magnetically ordered metals as well as the relationship of such studies to direct measurements of spin polarization in alloys. Also worth adding to the text would be a discussion of hybrid methods of measuring hyperfine interactions. The authors are not to be blamed for this absence, inasmuch as these fields have been developing very rapidly since the original publication of the work in 1969. A valuable appendix is included, which is, however, not quite complete, largely because of the rapid expansion of experimental work in this field. Finally, this reviewer hopes to find in a future edition of this work extensive discussion of the contributions of Turov and his colleagues to the magnetic resonance problems for nuclei in multidomain materials.

The presentation is well suited for intermediate and senior-level graduate students interested in magnetism. The missing formula (5.81) on page 104 is contained in the Russian edition.

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