axes, makes little sense when applied to phytophagous insects where the niche "units" appear to be plant tissues interconnected by the host's translocation system. The authors are unanimously aware of such difficulties and call for more critical data detailing species interactions.

Descriptive natural history has become somewhat passé of late. Yet the reach of the most interesting conclusions drawn in this symposium is limited by the lack of comparative data on such mundane matters as the size, food habits, and dispersal capacity of insects in particular habitats. One of the greatest achievements of this stimulating volume is its demonstration of how theory, experiment, and observation combine to form a context from which natural history can draw renewed vitality.

RICHARD B. ROOT
Section of Ecology and Systematics
and *Department of Entomology,*
Cornell University,
Ithaca, New York 14850

Comparative Studies

Contrasts in Behavior. Adaptations in the Aquatic and Terrestrial Environments. ERNST S. REESE and FREDERICK J. LIGHTER, Eds. Wiley-Interscience, New York, 1979. xiv, 406 pp., illus. $27.50.

The diversity of coral-reef fishes and the complexity of the social, ecological, and physical environment they inhabit have stimulated widespread interest in their biology over the last decade. Behaviorists and ecologists, especially, are drawn to the reef, with the result that coral-reef fishes are beginning to rival songbirds as research subjects. *Contrasts in Behavior* testifies to this surge in interest. All but one of the 12 contributions deal wholly or largely with reef-dwelling fishes, each reviewing a different aspect of their biology and contrasting their behavior with that of terrestrial animals (mainly vertebrates). As reviews and in drawing contrasts, the papers vary widely in utility and depth. The best, Warner's treatment of hermaphroditism and unisexuality, discusses the occurrence of such modes of sexuality in animals and then speculates on the factors that permit their expression in some groups, such as reef fishes, but not in others, such as the "higher" vertebrates. Miller's review of agonism and Hobson's of aggregation are also well done and draw useful comparisons between various animal groups. A few of the papers in the book consist mainly of previously unpublished data and include only superficial comparisons with the behavior of terrestrial vertebrates; such papers are of interest and value but clearly belong in a refereed journal where their contents are subject to critical review before publication. Other contributions are dated, largely, one suspects, as a result of the long time lag (almost four years) between the symposium upon which the book is based and its publication. Keenleyside's discussion of parental care in birds and fishes, for example, was stimulating a few years ago but has been rendered superficial by theoretical treatments of such care by Maynard Smith, Williams, Dawkins, and others. Finally, the logic of a few papers is questionable. Loiselle and Barlow's "Do fishes lek like birds?" is an excellent review of lekking (the aggregation of territorial males at traditional courting grounds for the sole purpose of displaying to, and mating with, attracted females) but largely ignores the first half of the question—"do fishes lek?"—in favor of the last—"like birds." Although the term is widely used in the fish literature (two other authors in the book use it, for example), Loiselle and Barlow's paper would be stronger if it began with a more critical examination of whether an aggregation of males competing for the best position to launch pelagic gametes is truly comparable to an avian lek (a comparison seemingly analogous to that between individuals aggregating around a food source and those regularly spaced about one another in a school or flock). The proximate factors that result in such aggregations seem very different. One is therefore suspicious of any analysis that treats them as variations of a single phenomenon.

Though valuable as reviews, most of the papers in *Contrasts in Behavior* do not measure up to the editors' stated objective—the generation of useful insight into the universal "principles" of behavior. Although the expectation is raised that workers in one area will use secondary literature (reviews and the like) in others to generate such insight, the most successful contrasts are drawn by authors clearly familiar with the primary literature. Most of the other comparisons made between aquatic and terrestrial systems lack depth. Harmelin-Vivien's statement, for example, that herbivores forage both day and night in a terrestrial system (the African savannah) but only during the day on the reef could have been made only in ignorance of the numerous and well-studied invertebrates that forage over the reef at night and are an important component of the reef ecosystem. The editors should have been more demanding of such authors and, by eliminating such superficial comparisons, strengthened an otherwise stimulating and meritorious book.

RONALD E. THRESHER
Department of Biological Sciences,
University of Sydney,
Sydney, N.S.W. 2006, Australia

Brain Biochemistry

Cyclic Nucleotides, Phosphorylated Proteins, and Neuronal Function. PAUL GREENGARD. Raven, New York, 1978. x, 124 pp., illus. $12. Distinguished Lecture Series of the Society of General Physiologists, vol. 1.

One of the major themes of the rapidly expanding field of neuroscience is the role of cyclic nucleotides as mediators of neurotransmitter action. A most important current question has to do with the mechanism whereby the regulation of cyclic nucleotide formation by extracellular transmitter substances is translated into the diverse biological responses of target cells. This short volume outlines Greengard's approach to this question. While recognizing alternative hypotheses and the results of others, he describes the work from his own laboratory, which supports the hypothesis that cyclic nucleotides act primarily by activating protein kinases that specifically phosphorylate proteins. This suggests that the specificity of the effects of cyclic nucleotides is primarily dependent upon the substrate specificity of the activated protein kinases. Evidence is presented for a much wider role for phosphorylated proteins. Greengard proposes that the protein kinase mechanism provides the final common pathway for the expression of the specificity of a variety of agents in addition to the cyclic nucleotides, including steroid hormones and calcium.

The book has many carefully simplified outlines of the criteria for the evidence presented. For example, table 1 presents some criteria for evidence about one of the most current and important concerns in neuroscience—the mediation by a cyclic nucleotide of a postsynaptic permeability change. Selected examples are then described for neurotransmitter-sensitive adenylate cyclases in the nervous system for dopamine, serotonin, histamine, and norepinephrine. In each case the criteria mentioned

in table 1 are briefly illustrated, allowing rapid comprehension by the reader and perhaps implying, without justification, a unity of evidence.

The first of the three chapters in the book sets the stage for its main contribution—the presentation of evidence for protein phosphorylation that is dependent on cyclic adenosine monophosphate (cyclic AMP) and of evidence concerning the nature of the substrate proteins phosphorylated. The presence and distribution of cyclic AMP-dependent proteins are briefly discussed, and the possible participation of specific protein kinases in a general mechanism for the expression of hormonally initiated biological events is outlined. Cyclic AMP-dependent dissociation of these kinases into regulatory and catalytic subunits is introduced as a likely mechanism for all of the cyclic AMP-mediated metabolic and physiological effects.

The main emphasis is on the evidence for a functional complex, localized in the postsynaptic membrane, which links receptors, adenylate cyclases, cyclic AMP-dependent kinases, protein substrates for the kinases, and specific phosphatases for dephosphorylating the resultant phosphoproteins. In this model the specificity of the system is inherent in the altered biological effects of the specific protein phosphorylated, which for events in the postsynaptic neuronal membrane is proposed to result in a change in membrane potential. Evidence is presented indicating that all of the components mentioned above are present in the postsynaptic membrane. A protein, designated protein I, is shown to be present only in neuronal synaptic membranes and synaptic vesicles, to appear simultaneously with synapse formation during development, and to be a substrate for a membrane-bound protein kinase and protein phosphatase. This protein specifically undergoes phosphorylation in the presence of cyclic AMP. In brain slices conditions that lead to depolarization and elevation of cyclic AMP also result in phosphorylation of protein I. Presumably protein I may be related to an intrinsic protein such as an ion channel or an electrogenic pump. As the author points out, there is no direct evidence that protein I is the hypothetical phosphoprotein that mediates the effect of cyclic AMP on the postsynaptic permeability change. However, the attractiveness of the system has stimulated major research interest in many laboratories.

A model system that is similar but more amenable to investigation, the avian erythrocyte, exhibits hormonally sensitive cyclic AMP-dependent changes in ion permeability. In this system hormones stimulate both changes in ion permeability and cyclic AMP-dependent phosphorylation of a specific protein. The phosphorylation of this protein, not of protein I, appears to be correlated with the influx of sodium ions into the cell. Similar experimental results have been obtained for the isoproterenol-stimulated phosphorylation of a protein and the influx of potassium ions in the plasma membrane of turkey erythrocytes.

A book of this character, based upon a lecture, cannot possibly serve as a technically complete or unbiased reference work. However, as an up-to-date primer for persons both within and outside of this multidisciplinary field, it does reflect the excitement and dynamic possibilities of neuroscience in particular and the physiological sciences in general. Furthermore, the book provides a wealth of current references to key research reports and reviews and will be an invaluable aid to neuroscientists.

C. R. CREVELING
Laboratory of Bioorganic Chemistry, National Institute of Arthritis, Metabolism and Digestive Diseases, Bethesda, Maryland 20205

Nuclear Physics

Ions Lourds et Mésons en Physique Nucléaire. Nuclear Physics with Heavy Ions and Mesons. Papers from a summer school, 1977. ROGER BALIAN, MANNQUE RHO, and GEORGES RIPKA, Eds. North-Holland, Amsterdam, 1978 (U.S. distributor, Elsevier, New York). In two volumes. 1x, 1018 pp., illus. $133.25. Les Houches, Session 30.

During the 1960's the nuclear physics community enjoyed the considerable (and immensely useful) luxury of looking forward each year to a new crop of review articles generated by the advanced summer schools of Brandeis University, the University of Colorado, and Les Houches in France and the Enrico Fermi School of Physics in Varenna. With the 1970's came troubles for science funding in the United States, and the U.S. schools fell by the wayside, leaving the torch in the hands of the French and Italians, who themselves have only intermittently dedicated their annual efforts to nuclear physics. The summer of 1977 was one of these occasions, and these two volumes provide the welcome fruits of the efforts of ten experts (nine theorists and one intrepid experimentalist), whose reflections should provide food for thought to a wide variety of nuclear physicists.

The choice of topics for this 30th session of the Les Houches seminars was a felicitous one, for the summer was devoted to two of the most rapidly growing subfields of nuclear physics, heavy-ion and intermediate-energy physics. Though young, these two subfields are already becoming increasingly specialized and are rapidly growing apart. The summer school was a valiant attempt to stave off a further split by pointing out how many concepts and techniques the two subfields have in common.

The two volumes are themselves dedicated, separately, to heavy-ion and meson-nucleus problems. The volume on heavy ions begins with lectures by David M. Brink that deal with applications of multiple-turning-point JWKB (Jordan-Wentzel-Kramers-Brillouin) methods to elastic scattering and summarize ℓ-space parametrizations that have been employed for elastic angular distributions. This theme is followed by Richard Schaeffer, who provides an introduction to the use of semiclassical methods for elastic heavy-ion scattering, with primary emphasis on the concept of "complex trajectories," that is, radial JWKB turning points at complex r (equivalently, complex impact parameter) as a means of describing refraction and diffraction in the same formalism. George F. Bertsch concentrates on the transport theory of deep inelastic collisions. He employs the density-matrix formulation in terms of the Wigner distribution function, supplemented by semiclassical approximations that reduce the Liouville equation to the more tractable Vlasov equation. Drawing on the extensive scrutiny to which the equation in this form has been subjected in the field of plasma physics, Bertsch is able to indicate the extent to which analytic solutions can be expected, and, failing analytic solutions, he is able to obtain conservation laws and a consistent treatment of small-amplitude density oscillations.

With the appearance of heavy-ion beams, high ($\ell \leq 25\ \hbar$) angular momentum states have become accessible to intense experimental scrutiny. Zdzislaw Szymański provides a theoretical survey within the Hartree-Fock-Bogolyubov model, with primary emphasis on the "backbending" of rotational bands as they cross.

Finally, Herman Feshbach addresses the problem of relativistic heavy-ion col-