cal, and military context. The authors document, for instance, how military considerations tend to predominate over environmental considerations in the formation of a regulatory regime. Events in the Middle East, especially the wars of 1967 and 1973, set in motion a chain reaction, including changes in transportation routes and the size and fragility of tankers, that exacerbated the problem. The authors completed their study too early to note similar consequences due to events in Iran and Afghanistan in 1979. All proposals to control pollution that would affect military movements or trade in strategic goods have so far been unacceptable to the major oil-consuming and shipping nations. Similarly, developing nations are reluctant to accept environmental standards they feel threaten their economic development.

The authors end by making recommendations to improve the regulatory regime that is emerging through such conferences as those called by IMCO, the U.N. Environmental Program (UNEP), and the interminable yet useful sessions of the Third U.N. Conference on the Law of the Sea. These include strategies to deal with factors "intrinsic" and "extrinsic" to the oil pollution issue. The former include improved chartering contracts to provide greater accountability from oil companies for the behavior of independently owned tankers flying flags of convenience and increased port-state powers to deal with substandard vessels and crews. Recent versions of a draft comprehensive ocean treaty emerging from the Law of the Sea Conference point in the direction the authors prescribe. An enlarged IMCO with a more efficient legislative process than is afforded by traditional conference diplomacy and with greater secretariat initiative is also urged. Among the extrinsic factors discussed are the importance of technological and economic growth, especially among the developing countries (the Group of 77) and economic strategies to internalize environmental costs. Last but not least, the authors urge the introduction of alternative energy sources or a slowdown in energy demand in the developed world. All in all, they have contributed a useful study on the general problem of world order by focusing in commendable but judiciously selected detail on one aspect of one problem—ocean pollution.

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Lemurs

Nocturnal Malagasy Primates. Ecology, Physiology, and Behavior. P. CHARLES-DOMINIQUE, H. M. COOPER, A. HLADIK, C. M. HLADIK, E. PAGES, G. F. PARIENTE, A. PETTER-ROUSSEAUX, and A. SCHILLING. Academic Press, New York, 1980. xii, 216 pp., illus. $27.50. Communication and Behavior.

This collection is the work of nine French biologists of the Museum National d'Histoire Naturelle, Brunoy. Half the chapters report on a series of visits of one or two months' duration (between November 1973 and July 1974) to a western sclerophyllous and deciduous forest near Morondava, Madagascar. Most of the reports discuss lemuriform primates that have seldom been studied in the wild; many of the observations are preliminary reports on the natural history of these lemurs. Five of the perhaps 11 species of nocturnal Malagasy lemurs are dealt with, and tantalizing glimpses of their "eco-ethology" are provided. The remaining five chapters report laboratory observations of learning and annual cycles; some reports summarize three years of work at Brunoy. Though well presented, much of this material is available elsewhere. The book will be welcomed as a convenient English summary of much of the French research on nocturnal lemurs. Unfortunately, it is not a summary of what is known about nocturnal lemurs, because much previous work is not given adequate citation.

The authors have made an admirable attempt to integrate their field and laboratory observations. However, these observations are intertwined to an extent that it is often difficult to determine whether or not a particular behavioral or physiological pattern has actually been observed under natural conditions. For example it is stated that *Cheirogaleus medius* hibernates "for at least 6 consecutive months and, in some instances, up to 8 months" (p. 53). When, where, and how often was this observed? Here torpor is claimed to be an adaptation to a seasonally variable food supply while another plausible hypothesis—that torpor is a response to microclimatic change—is not explored. With the exception of the introductory chapter, which outlines the flora and climate of the study site, the field reports are primarily anecdotal. Information on hours of observation and sample sizes, tables of raw data, statistical tests, and standard ecological indices are almost entirely absent. For example, the statements that "seasonal variation in diet follows food availability" (p. 55), that two lemur species collect the "same absolute quantity of animal prey" (p. 60), and that "allogrooming is frequent between males, females, and juveniles" (p. 85) are presented without supporting data. Many of these assertions may be insightful, but there is danger that such untested generalizations will become established in the literature because they are the only statements extant about these rarely studied taxa.

Overall, this book can serve neither as a general review of nocturnal Malagasy lemurs nor as a detailed reference. But, though the authors generally fail to provide adequate hypotheses and tests, their observations could serve as a basis for framing hypotheses. Sadly, very few field studies of Malagasy lemurs have been attempted during the last five years. The lemurs may become extinct before we can pursue hypotheses derived from preliminary studies such as these.

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Annelids

Aquatic Oligochaete Biology. Proceedings of a symposium, Sidney, B.C., Canada, May 1979. RALPH O. BRINKHURST and DAVID G. COOK, Eds. Plenum, New York, 1980. x, 530 pp., illus. $55.

In *Aquatic Oligochaete Biology* the editors have succeeded in presenting an overview of what is known, and unknown, about their favorite organisms. The book is the proceedings of a meeting held at the Patricia Bay facility, British Columbia. It demonstrates clearly the variety of interest in and approaches taken to oligochaete biology by what amounts to a who's who of specialists on the group. There are taxonomic reviews (Harman, Erséus), zoogeographic reviews (Timm), and reviews of reproductive biology (Brinkhurst) and of various aspects of ecology (Caspers, Diaz, Giere), in addition to a series of papers reporting original research on a variety of topics from morphological variability to sensitivity to chemical pollutants. A series of papers demonstrate the influence of various anthropogenic agents on the populations of worms, and there is even a review of the content of the book in the form of a postscript by Brinkhurst.

For me, as a polychaete systematist and biologist, the most impressive feature of the book is the amount and quality of information available about some of

the most common and widely dispersed species, for example the tubificids *Limnodrilus hoffmeisteri* and *Tubifex tubifex*. Both these species are associated with eutrophic environments and can tolerate high concentrations of various metal ions (Chapman *et al.*). As the papers in this volume clearly indicate, a tremendous amount of research on these two and on a limited number of other widespread and common species is being done. The result is that the information on oligochaete production biology, ecology, and life histories is based on studies on a fraction of the species. The more "weedy" species are becoming extremely well known, and the biology of species living in polluted environments is much better understood than the biology of species living in areas of minimal human influence. Another consequence of this investigatory pattern has to do with population biology. Giere points to some interesting differences among populations in tolerance to stress in widely dispersed species and indicates that these populational differences may represent genetic differences. This theme is also sounded by Judith Grassle, the only person at the meeting who was not an oligochaete expert, on the basis of her work on the polychaete *Capitella capitata*, and is discussed by Brinkhurst in his postscript. Thus, though synecological patterns of normal environments remain poorly understood, the autecology of a limited number of species has been well enough investigated that populational subgroupings and genetic interactions can be characterized. Such investigations lead in turn to reinterpretations of taxonomic criteria and of the species concept as applied to the group. Since many oligochaetes reproduce mainly, or nearly exclusively, nonsexually, the results are of interest to biologists in general.

The main impetus for increased study of aquatic oligochaetes was of course the finding that a few forms were highly successful in extremely polluted waters (Caspers), but the result of the activity has been an increased understanding of the extremely important role these worms play in the ecology of soft, freshwater benthos in general. The paper by McCall and Fisher on bioturbation in Lake Erie is a case in point, as are the papers by Birtwell and Arthur on worms in the River Thames and Diaz on the transition between the marine and freshwater environments in estuarine situations.

Papers by non-English-speaking contributors were all, I suspect rather extensively, reworked by Brinkhurst. The net effect is a unity of style and format rare in proceedings volumes; it is a bit startling, however, to find a characteristically elegant Brinkhurstian turn of phrase in a paper by, say, a Russian author. With few exceptions, typographic errors are unobtrusive, and the references appear to be reasonably complete. Parts of Brinkhurst's systematic appendix are unnecessary in the context and would have been better presented in a systematic paper in a journal.

The book is important for its summary of ideas and information on aquatic oligochaetes and will be useful as a baseline survey on these worms.

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Insects in Neurobiology

Receptors for Neurotransmitters, Hormones and Pheromones in Insects. Proceedings of a workshop, Cambridge, England, Sept. 1979. DAVID B. SATTELLE, LINDA M. HALL, and JOHN G. HILDEBRAND, Eds. Elsevier/North-Holland, New York, 1980. xviii, 310 pp., illus. $48.75.

Insects may be tolerated in neurobiology, but they are rarely admired. More often they are disdained by students of higher organisms for their lack of relatedness to mammals. Nevertheless, they have always managed to capture a small share of the general interest because of some singular characteristic such as the strangeness of their behavior or the geometrical complexity of their neuroanatomy. Now, as the study of receptors in the nervous system expands to take in the insects, they reveal once again a unique feature or two that should keep them from being relegated to the lowly status of poor relation to the vertebrates.

The collection of papers under consideration here presents a kaleidoscopic picture of research on biochemical, physiological, developmental, and behavioral issues unified by a concern with receptors, or the activators of receptors, in the insect nervous system. The subject matter encompasses much of what is currently of interest in the general realm of transmitter and receptor research: peptide transmitters, transmitter-sensitive adenyl cyclases and the role of cyclic nucleotides in neural responses, receptors for neuromodulators, a spectrum of cholinergic receptors from the central nervous system, and single-channel properties of a glutamate receptor. Also included are studies of the physiology of olfactory cells responsive to pheromones, studies of the ontogeny of receptors during neural development, and one paper on receptors in nonneural tissues for the molting hormone, ecdysone.

The studies that have made the best use of the chosen class of organism are those concerned with the biology of the receptors and their effectors, that is, with the functions the receptors mediate in the various parts of the animal where they are to be found. A paper by James Truman on eclosion hormone in the moth is a particularly good example. It explores the actions of a peptide secreted by the brain at the end of metamorphosis that sets off in the abdominal ganglia the sequence of neural events necessary for the pupa to emerge from the cocoon. Not only does this peptide (with its implicit receptors) act as a behavioral trigger, it subserves developmental functions in such a way that a ganglion, once exposed to eclosion hormone and activated, cannot respond to subsequent exposures. Moreover, in one species, many of the neurons actually degenerate in response to the peptide after they have served their behavioral function. Here the emphasis is on the role of the receptor rather than on the less accessible mode of its action, but the paper establishes a context in which the preliminary work that has been done on mode of action can be furthered.

At a level intermediate between an eclosion hormone, with its global effects, and an acetylcholine or glutamate receptor, with its more classical action, lie octopamine and its receptors, which are discussed in a paper by Peter Evans. This transmitter, found quite generally in insect nervous systems and studied most effectively in the locust muscle, has been shown to exert a modulatory effect on neuromuscular transmission, increasing both the muscle tension generated for each motor neuron impulse and the rate of the muscle's subsequent relaxation. Investigations into the mode of action of the transmitter were initiated with the demonstration of octopamine-sensitive adenyl cyclase activities in the cockroach thoracic ganglion and in the firefly light organ, another putative site of the transmitter's action. If octopamine participates in a general arousal system, as Evans suggests, then these insects may provide an excellent opportunity for studying the organization and strategies of such a system at the level of the whole nervous system as well as at the level of the macromolecules involved in the response.

Of the many studies dealing with the pharmacology, biochemistry, and physi-