do not promote revolutionary leadership; he sees the weakness of the communist position as the promotion of the wrong kind of revolutionary leadership, a kind which is likely to make disastrous mistakes once it gets into power.

In a sense, this work is a lively resurgence of an important if somewhat subterranean stream of American thought, that of institutional economics. This is a book in the tradition of Commons, Veblen, and Mitchell, but it is Commons without obscurity, Veblen without rancor, and Mitchell without statistics. I am convinced that the social sciences must develop along these lines, and that the social sciences must be both unified and dynamic. We still have a long way to go, however. If this is a work of insight rather than of science it is because of the absence of an adequate system of social instrumentation. Most great advances in science seem to have come from a combination of new theoretical insight with new methods of instrumentation. This is true even of the Keynesian economics, the success of which depended in no small measure on the development of national income statistics. The cognitive theory of social change, which Solo is propounding, will remain in the realm of insight until we develop an adequate information system for what might be called a mass cognitive structure. This we do not now have, and in its absence we have to rely on illustration rather than demonstration. It may be that the real importance of Solo's book is as a demolition job. In chapter 7, for instance, he demolishes in a few pages almost 200 years of capital theory, apparently with a single firecracker, but with astonishing thoroughness. He does a similar job in chapter 11 on what might be called vulgar Malthusianism, although he is very well aware of the real importance of the demographic crisis. These, I believe, are necessary demolition jobs. As in urban renewal, however, it is harder to build new structures than to clear away the old ones, and while there are some fine blueprints in these pages, a great deal of the actual building is yet to come.

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## The Inner and Outer Causes of Behavior

**Mechanisms of Animal Behavior.** PETER MARLER and WILLIAM J. HAMILTON, III. Wiley, New York, 1966. 783 pp., illus. $14.95.

The problems of selection and organization are particularly acute for the compilers of a textbook on animal behavior. The subject is so diffuse, embracing neurophysiology at one end and at the other including a good deal of ecology. Everyone will have his own ideas on how best to bring some semblance of order to this vast and diverse material. Marler and Hamilton try to do so by concentrating on what might be called the middle ground of this range. I find their title somewhat misleading because they do not define or discuss what they understand by the term "mechanism," either in physiological or behavioral terms, but state their aim as the analysis of the interplay between internal and external factors in determining when behavior occurs and what form it takes. Clearly certain aspects of behavior are best suited for analysis on these terms. Social behavior is deliberately omitted, nor is there any general account of evolution or learning, although much that is relevant to these topics can be found here.

Marler and Hamilton begin with a number of chapters on short- and long-term rhythmicity in behavior. Here we can pose most directly the question of exogenous versus endogenous control. An account of circadian rhythms is typical of the best parts of the book. It is clearly written, shows a remarkable familiarity with the whole range of literature in English and German, and never loses sight of the selective forces which have operated to produce the behavior we observe.

The other chapters in this opening section, covering, among other topics, reproductive cycles, feeding, exploration, aggression, and conflict, are rather less successful. They provide good reviews of the literature, integrating ethological and psychological work, but the way the book is oriented hampers the development of certain themes which are of great relevance here—the problem of specific motivational states and their physiological basis, for example. I think the account of aggression and conflict is not long enough to do justice to the importance of recent ethological work for behavior studies in general.

These criticisms fall into perspective when set alongside the central section of the book. This core of ten chapters accounts for about half its length and concerns the characteristics of animal sense organs and the way they are employed in communication and orientation. This section is quite outstanding, and nobody, undergraduate or research worker, can fail to be stimulated by it.

Animals never respond to more than a fraction of the potential stimuli which impinge upon them. This section begins with a general discussion of factors that lead to "stimulus filtering" and those situations which may favor the evolution of selectivity or generality of responsiveness. There follow accounts of the main sensory modalities, chemoreception, vision, and audition. Each is prefaced by some account of the physical basis of perception and details of sensory capacities through the animal kingdom. The full references will enable anyone who wishes to do so to augment the sensory physiology which is provided here, but Marler and Hamilton's treatment will prove sufficient for most behavior workers. The authors then survey the "uses" to which each modality has been put. The range of literature covered is huge, and it is reviewed with such perceptiveness that the common functional and adaptive features of otherwise disparate material are clearly revealed. Habitat selection by birds, egg-mimicry by cuckoos, disruptive coloration in herbivores, eye-spots in moths, honey-guide patterns on flowers, and the visual aspects of threat and courtship display in birds, fish, lizards, and fireflies—this sample of topics covered under visual communication will give some idea of the breadth of approach. Other accounts are equally broad, and one must mention a particularly good, up-to-date account of acoustical orientation in bats. Throughout this section experimental work is described attractively and clearly and the text is lavishly illustrated, so that the work the authors draw on can be examined in some depth.

In the closing section of their book, Marler and Hamilton turn to the consideration of behavioral development, emphasizing the interaction of genetic and environmental factors. The forma-

tive role of the early sensory environment in determining the stimulus objects that will evoke responses in later life is contrasted with the relative environment-independence of many motor patterns. The material here is also handled well. Marler himself has made distinguished contributions to the study of bird song development, and there is no better example than this of the complex range of genetic and environmental influences that contribute to the behavior of the adult animal.

The organization of this book is very different from that of many other texts on behavior. Topics (for example, the response of young game birds to an overhead predator) which are more usually dealt with as a single item here receive mention under several headings with different emphasis. There is inevitably some repetitiveness, but there are also advantages when one uses the book as a work of reference, which it undoubtedly will become. For subsequent editions I would appeal for a much fuller subject index, less species-oriented, in order to make this facility usable to the maximum.

In conclusion, I consider that this book has a great deal to offer both undergraduate and postgraduate students and is also an invaluable sourcebook for research workers. The authors are to be congratulated on a distinguished addition to the literature of behavior.

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## Manual of Medical Virology

**Diagnostic des Maladies à Virus.** R. SOHIER. Éditions Médicales Flammarion, Paris, 2nd ed., 1967. 971 pp., illus. $32.

The reviewer is moved to wonder why the first edition of this encyclopedic reference book has escaped notice in the English medical literature. One can only attempt to amend the oversight by describing the handbook, which is a genuine enrichment of the literature of techniques that have proved valuable in the diagnosis of infections caused by viruses. The author is a well-known French virologist who, in collaboration with seven eminent colleagues, analyzes critically and describes in detail every step of the methods presently in use in human medical virology. After a brief discussion of the characteristics and classification of the viruses, the general procedures for the collection of suitable specimens and staining smears, the various methods of propagation and isolation in the embryonated egg, the choice and composition of tissue cultures, and the reactive cytology are painstakingly detailed. Under the headings enteric, respiratory, dermotropic, neurotropic, or hepatotropic, the systematic steps for accurate identification of viruses are described, then summarized in highly informative tables. The chapter on the use of indicator hosts suitable for isolation of viral material discusses not only the choice of animals and their humane housing and care, but also the importance of their physical condition and the various effective routes of infection. For example, a table on page 200 lists the best size and length of hypodermic needle for inoculating different species of animals by various routes. Certain methods, such as the safe infection of mice by the nasal route or of the embryonated egg, are illustrated by useful sketches. Equally complete and informative are the descriptions of immunological methods in vivo and in vitro, including the fluorescent antibody technique. An appendix is devoted to the conservation of viruses by lyophilization. In a special section comprising more than 620 pages the etiologic diagnoses of viral infections of the respiratory or enteric tract with and without cutaneous eruptions, as well as infections caused by arboviruses and, in special chapters, yellow fever, dengue, rabies, and other diseases, are discussed systematically according to epidemiology, clinical manifestations, pathogenesis, selection of specimens for examination, isolation and differentiation of the viral agent, and serodiagnosis. The presentation is remarkably clear and didactically very skillful, and the detailed tabulations assist in quick orientation. Those dealing with the arboviruses deserve particular consideration and study. Twenty-two plates illustrate diagnostically significant cellular and tissue alterations in light and fluorescent microscopic photographs. Each of the 13 chapters concludes with an extensive bibliography covering the relevant international literature to 1963. In this, the second edition, the chapters on Bedsonia, measles, and arbovirus have been brought up to date. Continued rejuvenation is provided for by the sturdy loose-leaf-binder format which permits the replacement of obsolescent material with newer pages of text or revised prescriptions or formulas for improved tissue cultures. With its detailed 40-page alphabetical index and table of contents this unique handbook is recommended to the linguistically equipped, both as a reliable reference work on biomedical methodology for the clinical pathologist and virologist and as an introduction and guide for the general biologist interested in the experimental procedures of virology.

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## Sensory Functions

**Animal Sonar Systems.** Biology and Bionics. NATO Advanced Study Institute Symposium, Frascati, Italy, September–October 1966. R. G. BUSNEL, Ed. Laboratoire de Physiologie Acoustique, Jouy-en-Josas, France, 1967. 2 vols., 1233 pp., illus. Paper, 35 F.

The list of contributors to this volume reads like a Who's Who of animal sonar, and the topics discussed range from the expected echolocation in bats and porpoises through "facial vision" in the blind to the tracking of odorous targets by snakes and dogs. Almost anything you want to know about animal sonar, from the mode of transmission to the structure of the received echoes, is to be found in the two volumes, but will take a bit of searching—there is no index. Most of the book is written in English, but a few of the papers and some of the discussions are in French. Many of the formal papers are followed by informal discussion, much of it informative and provocative.

The book is divided into 11 sections, each comprising several papers. The first, consisting apparently of contributed papers, ranges rather widely and includes such topics as synthesizing the waveforms of bats' pulses, obstacle avoidance in bats and men, and the role of spatial memory. The remaining sections are entitled: Discrimination and Identification by the Animal's Sonar, General Features of Orientation Sounds and the Performances Achieved by the Animal's Sonar, Resistance to Interfering Signals, In-