Book Reviews

Phylogenetic Topics in Ethology

Function and Evolution in Behaviour. Essays in Honour of Professor Niko Tinbergen, F.R.S. GERARD BAERENDS, COLIN BEER, and AUBREY MANNING, Eds. Clarendon (Oxford University Press), New York, 1976. xxxii, 394 pp., illus. $41.

The plethora of symposia and collections of original papers tends to dull our interest in any new volume, but this one honoring a Nobel laureate is worth more than passing attention. The introductory section on the life and career of Niko Tinbergen is the happy combination of, presumably, Gerald Baerends's knowledge of academia in the Netherlands and the elegant prose of Colin Beer and Aubrey Manning, two of ethology's most articulate practitioners. These three former students of Tinbergen's have compiled contributions from many of his other students and associates in a collection that not only samples important areas of modern ethology but (perhaps more important) also documents the intellectual legacy left us by Tinbergen at his retirement from Oxford.

As is suggested by the title—which is not to be confused with *Function and Evolution of Behavior*, a book of readings published by Addison-Wesley—this volume is concerned with the adaptive significance of behavior on the one hand and with the phylogeny of behavior, especially as traced by comparative ethology, on the other. These two topics, according to Tinbergen's own thinking, encompass at least half of the endeavor of behavioral analysis, the other half concerning the input-output control of behavior (including physiological mechanisms) and the ontogeny of behavior. The choice was made because function and evolution "have been at the heart of Tinbergen's ethology, at least during his time at Oxford." To some of us, though, Tinbergen's outstanding contribution stems from his interest in immediate control principles in behavior ("causation," in his own terms).

About half the volume is devoted to "function," as slippery a concept in behavioral biology as it has been in biology as a whole. To some workers function suggests the working of a structure in a reasonable or expected manner, as in the case of an arm functioning as a lever. To others function is a synonym for selective advantage, and several authors in this volume point out both the convenience and the dangers of drawing inferences about the latter kind of function from studies of the former. This part 1 is at best a disjointed collection of papers, ranging from a brief and general discussion by Hinde of conceptions of function to meticulous studies of function in the first sense by Beer, van Iersel, and Patterson. Roeder contributes a provocative, straightforward discussion of cybernetic ideas pertaining to neurophysiology and behavior, including the very useful notion of feedforward (Mittelstaedt's term for anticipatory controlling feedback) and much emphasis on the possible role of aggravating (or "positive") feedback in behavior.

Manning provides a useful overview of the genetic substrate for natural selection in behavior, but only two chapters deal directly with function in the second sense. Kruuk comes to the obvious conclusion that carnivore species requiring cooperative hunting are more social in behavior than others. Liley and Seghers studied intraspecific variation in morphology and behavior of guppies in Trinidad, finding the guppies from springs and headstreams, where the water is clear, cool, and fast-running and there are few predators, to be large, brightly colored, and predominantly female. Guppies in lower streams and in rivers are small, are dull in color, and have an equal sex ratio; they school and show vigorous avoidance responses in their warm, turbid, slow-moving waters with many predators. Liley and Seghers brought these fish into the laboratory first for experiments that showed size differences to be determined by the interaction of genetics and rearing conditions and then for experiments confirming size-selective predation by their predators. By employing a combination of comparative and experimental methods, Liley and Seghers have provided an honest study of what Tinbergen calls "survival value."

On the whole, part 1 is a somewhat disappointing rehash of old concepts without substantial improvement in either the precision and clarity with which they are formulated or their empirical foundations. The selective factors shaping the ontogeny of behavior are nowhere considered, individual differences among animals are hardly mentioned, and consideration of current sociobiological issues is virtually absent.

Part 2, entitled Comparison and Evolution, is a potpourri of contributions that I found intrinsically more interesting than the previous papers. In part, the authors seem more relaxed about carrying out their assignments, as almost anything written in ethology has some relation to evolution or to comparison among species, or to both. Even the topic of evolution has two interpretations: the effect of behavior on the evolution of the species and the evolution of behavior itself. Lindauer discusses effects of orientation and learning abilities on evolution and Immelmann treats the importance of imprinting in habitat choice and speciation, whereas Robinson traces the evolution of predatory behavior in spiders and Moynihan deals with the phylogeny of color patterns and ritualized behavior in cephalopods. Moynihan suggests (perhaps with tongue in cheek) that adaptations for crypticity should be called "anti-displays" and that ritualized behavior should be taken to include both displays and anti-displays. A noteworthy contribution by Marler on strategies of behavioral development largely concerns song-learning in birds and its evolutionary significance. Studies by Nelson on boobies and by Tschanz and Hirsbrunner-Scharf on alcid chicks are comparisons among species that yield more information about adaptive strategies than about phylogeny, and hence might best be read along with part 1.

Perhaps the most original contributions in part 2 are those of Baerends and Frank McKinney. Baerends has made a thoughtful review of the notion that social signals arise in evolution from combinations of incipient motor patterns of two simultaneously activated complexes of behavior, such as fighting and fleeing. This central concept of Tinbergen's has come under criticism on various grounds, and Baerends attempts to dissect the issues to show where the unsolved problems lie, rather than blindly defending the original ideas of his mentor. This chapter is characterized by attention to literature other than that generated from Oxford, which tends to channel many of the chapters in this volume. Finally, McKinney has not only shown how different habitats of duck species promote different behavioral adaptations, he has made spectacular progress in understanding the diversity of signals

in ducks. Beer's earlier chapter shows some progress in understanding gull displays by noting their variations more carefully, but one is left with bewilderment. McKinney begins to sort out displays by spatial analysis. Why does the male green-winged teal do so many different things in the vicinity of the female? McKinney's data show convincingly that the angular orientation of the male's position relative to the female, his distance from her, and the orientation of his body relative to her all play a part in dictating the exact display given. McKinney also emphasizes that rape is a common, normal reproductive strategy in some ducks, a piece of knowledge without which reproductive behavior would seem chaotic.

In one sense, these chapters are truly "essays in honour of Professor Niko Tinbergen," showing he was so far ahead of his times in thinking about behavior that his followers have made little new progress. Deeper honor is paid here and there with new ideas that stem from the foundation laid by the mentor. If McKinney's chapter foretells the future, we may really be blazing a new trail where Tinbergen left off, rather than trimming branches along the old path.

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Biological Membranes

Membrane Biogenesis. Mitochondria, Chloroplasts, and Bacteria. ALEXANDER TZAGOLOFF, Ed. Plenum, New York, 1975. xviii, 460 pp., illus. $29.50.

With the emergence of the "fluid mosaic model," it has become clear that biological membranes are highly dynamic supramolecular structures whose biosynthesis and assembly pose new types of questions for the cell and molecular biologist. Among the matters that need explanation are: the means by which the cell handles the synthesis of membrane proteins and transports them, as well as phospholipids, from their location of synthesis to their point of deposition within the membrane; the degree to which the synthesis of membrane lipids and proteins is coordinated; the role played by the more hydrophobic (integral) membrane proteins in the attachment of the more hydrophilic (peripheral) membrane proteins to the membrane; the mechanism (or mechanisms) by which membrane proteins and lipids are assembled so as to form an asymmetric, bimolecular leaflet; and the nature of the protein-protein and protein-lipid interactions that must ultimately determine where and when new proteins and lipids are inserted into the "fluid mosaic." Add to these questions relating to the organization of genes (both structural and regulatory) that code for membrane components and, in the case of mitochondria and chloroplast membranes, the intracellular location (extranuclear or nuclear) of the genes involved, and one has a glimpse of the framework within which the newly emerging field of membrane biogenesis is developing.

The appearance of a book on membrane biogenesis is timely because this field is still somewhat fragmented as a result of the wide assortment of experimental systems and approaches in use. It was with this in mind that Tzagoloff assembled this collection of reviews dealing with the in vivo biogenesis of three popular experimental membrane systems: mitochondrial, chloroplast, and bacterial.

One of the strengths of the book lies in its emphasis on experimental approach and its detailed consideration of the problems that can be encountered in studying membrane biogenesis in vivo. These qualities are perhaps most evident in the papers by Ellis on the biosynthesis of membrane proteins by isolated chloroplasts and by Weiss and co-workers on the biosynthesis of two of the electron transport components (cytochrome c oxidase and cytochrome b) of the inner mitochondrial membrane. Although this approach to reviewing new developments in a field is of great heuristic value, it is regrettable that many authors have chosen not to discuss their results in the general context of membrane biogenesis or to draw upon the results of parallel experiments with other experimental systems. The introductory chapter by Tzagoloff compensates in part for this shortcoming by integrating the results derived from all the other chapters into a useful, albeit brief, overview of membrane biogenesis. Other integrative papers include the excellent ones by Mindich on the use of bacterial mutants which are auxotrophic for glycerol to study the coordination between membrane protein and phospholipid synthesis and by Ohad on the development of photosynthetic membranes.

This book has two obvious weaknesses. First, some important subjects (for example, turnover of membrane constituents and biogenesis of the endoplasmic reticulum and plasma membrane) have been omitted. And second, some authors have devoted sizable portions of their reviews to subjects of no immediate relevance to membrane biogenesis (for example, the evolution of extra chromosomal genomes and the mechanisms of ethidium mutagenesis in mitochondria).

On the whole, this volume should be of interest to teachers and scientists concerned with cell biology, membrane biochemistry, and organelle biogenesis, and it should be particularly useful to students encountering the field for the first time.

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Actions of Drugs

Cellular Pharmacology of Excitable Tissues. TOSHIO NARAHASHI, Ed. Thomas, Springfield, Ill., 1975. x, 538 pp., illus. $35.50.

This collection of reviews encompasses much of the field of cellular pharmacology. There are chapters on the synaptic physiology of the motor end plate, the autonomic nerve-effector junction, the autonomic ganglia, and the central nervous system; on smooth muscle, cardiac, and squid axon membranes; and on electromechanical coupling and contractile mechanisms in smooth and skeletal muscle. A great deal of information is presented, generally lucidly, and anyone concerned with cellular pharmacology, including graduate and medical students and neurophysiologists, should read the book.

The title is misleading, or at least overly narrow, since the book is largely physiology. In most of the chapters a reader will look in vain for lists of compounds and their action on a particular system or mechanism. After describing the details of normal functioning of a system, most of the authors more commonly discuss the action of a potassium ion than a drug, a nontherapeutic agent than a therapeutic one. This is not a criticism, since other sources of material on actions of drugs are available. But cellular pharmacology stripped of most of this material is indistinguishable from physiology.

In all collections of papers quality, style, and approach vary. In this book there is more variation than necessary. Bianchi, in a particularly fine chapter on the pharmacology of the contraction of skeletal muscle, and Wit and Hoffman, in their chapter on the pharmacology of the cardiac action potential, do analyze the actions of numerous agents, including many of the principal therapeutic ones. Most chapters are broad reviews, but those of Somlyo and Narahashi are