heriting "behavior" and inheriting "differences" in behavior. Indeed, as the author says, there is involved here a fundamental question that is a source of much confusion even to biologists themselves. The treatment will not help resolve this confusion.

A direct discussion of instinct begins on page 119. It deals essentially with two aspects of behavior: species-specific fixed action patterns, and drive (impulse to act). Many fascinating examples of the former are given. The point is made that there is no hard and sharp distinction between innate and learned behavior. Clearly there is some development. Examples are taken from the singing of birds, imprinting, and Harlow's experiments on early social development of the rhesus monkey. The general impression given is that so-called instinctive behavior is less firmly predetermined than it seems to be. The author argues, using as an example the repair of damaged wasp nests, that much of the stereotyped behavior is not mechanical as some experimental analyses might lead one to believe.

Studies of feeding behavior in the blowfly and in mammals provide examples of the experimental analyses of drive or motivation. The author points out initially that "feeding is a better term than hunger," but by the time the mechanisms have been described in both cases the story essentially reverts to the semantics of hunger and whether one is dealing with a sensation, a colloquial term, or multiple drives rather than a unitary one. The discussion of the drive to action concludes with comments on emotions, descriptions of the experimental work on self-stimulation, and experimental neurosis.

Intelligence is treated according to its dictionary definition of "the ability to adapt behavior to circumstances." The examples of adaptable behavior given include trial-and-error learning, conditioning, habituation, reward and punishment, teaching, and imitation.

A chapter entitled "The sources of human behavior" treats of other primates, with descriptions taken especially from the work of Schaller on the mountain gorilla and Kortlandt and Goodall on the chimpanzee. A few paragraphs on man's evolution follow, and the book concludes with three pages on the science of behavior in which the concept of voluntary behavior and the idea of mind are mentioned. The happy thought of identifying, directly rather than parenthetically, various aspects of experimental work with the people who have done it removes the dry impersonality that characterizes so many books on science. The frequent admission that "we do not know" also brings life to the subject and tends moreover to lend added weight and authority to the positive statements.

There are moments when the book seems overly involved in semantics. The author obviously finds some words acceptable (for example, "instinct" and "intelligence") and others not. "Threat" and "submission" are acceptable; "aggression" and "appeasement" are not; "hierarchy" is on the unacceptable list because of its etymology. Some words end up in quotation marks (for example, "retrieve"), while others (such as "forage") do not. The whole business quite naturally reflects an author's personal tastes.

On the other hand, the erudition and critical appraisal that are brought to this work give it great integrity. The errors of fact are few. (The observation that male moths are attracted to female from as great a distance as two miles has been accepted uncritically from the original literature, and the statement that most animals in nature are healthy is certainly open to challenge.)

For those who wish to satisfy a curiosity about animal behavior this is indeed a refreshing, authoritative, and provocative book. It is rich in examples. Barnett's vast knowledge of the field of behavior enables him to draw his descriptions from all phylogenetic levels so that one is left with a sense of the wholeness and integrity of the animal kingdom and its behavioral binding forces. Including man in the story, neither exalting his uniqueness nor denegating it, gives logical completeness to the story and at the same time imparts the relevance to events that some people require of their science.

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Mathematics in Astronomy

Introduction to Stellar Statistics. RUDOLF KURTH. Pergamon, New York, 1967. viii + 175 pp., illus. $8. International Series of Monographs in Natural Philosophy, vol. 10.

The phrase "stellar statistics" can be interpreted in two ways. On the one hand it can imply the theory and methodology of statistics and probability which are applicable to problems of astronomy. Or on the other hand it can mean the astronomical knowledge gained by studies of the distribution of stars and galaxies by statistical methods. The author of the book under review adopts the first interpretation. The book is essentially mathematical in character. Applications to astronomical problems are not carried out in detail. As the author writes, he has tried "(i) to provide the student not so much with details of knowledge but rather with some kind of conceptual system of reference which may help him to organize his knowledge; (ii) to hint at problems which, in my opinion, deserve a re-examination." It seems to the reviewer that the book would serve more valuably to introduce a mature statistician to some of the astronomical applications than to assist a student of astronomy who is attempting to establish a satisfactory statistical base for his knowledge of the stellar system. It would not be a particularly suitable textbook for a class in statistical astronomy.

In addition to a discussion of the elements of probability, statistical distributions, and tests of hypotheses, the book contains a chapter on the integral equations of stellar statistics. The author has used his own unique vector nomenclature throughout. The emphasis is on mathematical rigor, and several new procedures are introduced.

Applications of statistical techniques and descriptive parameters have been discussed for distributions of stellar brightnesses, stellar motions, galaxy distributions, stellar distances, and the like. No numerical examples are given, and the relation of the statistical description to the real universe is somewhat obscured by mathematical detail.

Three appendices give a list of suggested research problems, a discussion of quadratic forms on the unit sphere, and some recent results on the distribution of stellar velocities. The book concludes with a valuable list of references.

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