Book Reviews

Animal Learning

The Psychology of Animal Learning. N. J. MACKINTOSH. Academic Press, New York, 1974. xiv, 730 pp., illus. $18.50.

In physiological fields, there is seldom disagreement about the basic nature of a process and what is relevant to it. The study of animal respiration, for instance, deals with the anatomical and biochemical factors involved in oxygen intake and distribution. In principle, the study of animal learning ought to be similarly unified, since learning is the biological process by which animals adapt to causal relationships they encounter during their lifetimes. But in practice the factors that can supply coherence to learning are far more ephemeral than those that supply coherence to physiology and there is remarkably little agreement about the nature of the learning process.

The wide variety of tasks that investigators can invent and somehow induce animals to learn do not easily lend themselves to scientific organization. Consequently most students of learning structure their field by relatively artificial means; they tend to specialize in relatively narrow sets of problems, adhere to arbitrary theoretical positions, and define most of the rest of the field as irrelevant. The two leading schools of the last three decades, the Hullian and the Skinnerian, have been so far apart in their methods and ideologies that they seldom have interacted scientifically. Others are concerned with minitheories, theories so narrow that they hardly extend beyond the data on which they are based. Indeed, a growing number of scientists are beginning to feel that learning is not a process, like respiration or digestion, but a catchall term that refers to a large number of separate evolutionary adaptations to particular types of environmental situations.

In spite of all this, Mackintosh is an adherent of the traditional belief that learning is a general process that applies to many species in wide varieties of learning situations. In that spirit, he has written a critical review of the animal learning literature, selecting topics likely to interest those who share this belief: classical conditioning, instrumental learning, incentive, conditioned reinforcement, frustration, avoidance, punishment, contrast, extinction, generalization, and discrimination. He has avoided topics of interest to those concerned primarily with species differences in learning or with types of animal learning uniquely relevant to human behavior. A noteworthy omission is the exciting recent work on the learning of sign language by chimpanzees. Those, like this reviewer, who agree with Mackintosh's goals will regard his selection of topics as appropriate. Those who do not consider learning to be a general process or who believe that the traditional topics are unimportant will regard his book as a last hurrah.

Although Mackintosh's subject matter is traditional, he departs significantly from the behavioristic strategy that has been dominant among those who regard learning as a general process. Historically, the hallmark of behaviorism has been the belief that learning consists entirely of changes in muscular and glandular reactions. Because the ancient belief in a separate process of acquisiton of knowledge (or association) has been correlated with a mentalistic metaphysics for the last two millennia, it has been anathema to behaviorists. The definitive evidence summarized by Mackintosh that learning can occur in the absence of muscular or glandular reactions has usually resulted only in grudging minor revisions of most behavioristic positions. Mackintosh, however, supports the older theory that a common association process underlies all learning about sequences of events even when the resulting changes in behavior are as different as in the following sequences: a light cue followed by a sound, depression of a lever followed by food, a buzzer followed by painful electrical shock, a taste experience followed by sickness. Unlike traditional behaviorism, this approach prevents the similarities in different learning situations from being obscured through an overconcern with the details of how behavior changes. The differences in behaviors produced by a common association process can then be treated in detail, but as a logically separate issue. In this way, Mackintosh integrates a great deal of old and new material far more successfully than behaviorists do.

The style often is telegraphic and there are no major theoretical themes other than associationism. Therefore I found the many extremely sophisticated analyses of scientific papers and subdisciplines difficult to read and occasionally, when the material was new to me, I needed to consult the original sources. But this effort was well worthwhile. There is little nitpicking and hence the frequent severe criticisms of parts of the learning literature are very telling. However, I felt that the evaluation of operant schedules of reinforcement was so hypercritical as to be unfair and that the treatment of probability learning was superficial. Since there are no blatant errors, these feelings probably reflect my personal biases, and other readers may have different biases.

This book will become very influential if only because it has no competitor now and will probably not have one soon. Few have the breadth of knowledge and sophistication to survey the literature as Mackintosh has. The only likely alternative to his book would be a collection of chapters written by specialists in different aspects of learning. Although individual chapters in such a book might well be even more sophisticated than those in Mackintosh's, there also would be much less coherence. On a number of occasions, Mackintosh points up similarities in work done by investigators with different ideologies. For instance, Hullians and Skinnerians have both been concerned with causing animals to emit behaviors that produce painful electrical shock, but each group has seemed ignorant of the work of the other. This material, which probably would be in different chapters of a multiauthored survey, is in a single section of Mackintosh's book. Mackintosh also has carefully explained the similarity of the Hullian study of frustration and the Skinnerian study of contrast, two similar topics studied independently for over a decade. Such features ensure that any experienced investigator of animal learning will gain important new insights from reading this book.

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Iron as a Metabolite

Microbial Iron Metabolism. A Comprehensive Treatise. J. B. NEILANDS, Ed. Academic Press, New York, 1974. xviii, 598 pp., illus. $42.

The amazing versatility of iron as a metabolite can be best appreciated through a consideration of its various roles in the life support systems of prokaryotes. The need for a treatment of microbial iron metabolism that can facilitate such consideration