properties, it is no surprise to find operant researchers attempting to relate these properties to one of their main concerns, reinforcement. Terrace (chapter 4) reiterates his evidence that negative discriminative stimuli are negative reinforcers: an animal will work to get rid of them. Honig *et al.* (chapter 2) use the reinforcing property in their "advance procedure," arguing that the speed with which a subject rids himself of a negative stimulus is a more sensitive measure of inhibition than is a reduction of responsiveness in the presence of the stimulus. Weisman and Litner (chapter 10) suggest that the appearance of a Pavlovian fear inhibitor serves to reinforce avoidance responding. Despite these various claims, it remains uncertain to what extent the inhibitory and the reinforcing effects of stimuli go hand in hand.

Pavlov demonstrated with dramatic effect the recovery of a weak response in the presence of an unfamiliar stimulus; such "disinhibition" provided impressive evidence that the response had been actively suppressed, not permanently weakened. However, analogous demonstrations in instrumental conditioning have been relatively recent. Brimer (chapter 8) suppressed lever-pressing in various ways (even satiation!), and then revived the response by presenting a novel stimulus. He proposes that such disinhibition is the best way to detect inhibition. Hearst, on the other hand, relegates disinhibition to "symptoms or byproducts" of inhibitory control. There seems to be general recognition, however, that the more fundamental issue concerns not so much the "best measure" as how the various phenomena are interrelated and whether they reflect a common process.

Pavlovian "induction" and instrumental "behavioral contrast" have been thought to reflect inhibition in roughly the same fashion as do contrast effects in sensory systems. Unfortunately, the argument that such is the case, at least for behavioral contrast, is far from clear. While Ison and Krane (chapter 7) attribute behavioral contrast to a temporary aftereffect of nonreinforcement, Halliday and Boakes (chapter 3) find no simple account adequate. Despite numerous studies, it is not evident that behavioral contrast occurs in many species, or is generally important.

Pavlov has often been criticized for his heavy reliance on physiological speculation. The final section of this volume provides a sample of work that is gradually giving substance to a neurophysiology of behavioral inhibition. Several authors, particularly Douglas (chapter 20), strongly implicate the hippocampus in the control of "withheld" responses in such instances as extinction, habituation, waiting tasks, and successive discrimination. Both behavioral techniques and physiological methods are gaining in sophistication, but as yet no single description of mechanisms for inhibitory control commands general agreement.

This brief review cannot hope to suggest the variety of data, method, and cogent discussion to be found in this volume. Though some papers fail in clarity or content, most have something to say. The variety, applicability, and generality of the inhibition concept are scrutinized, its relations to attention and frustration are examined, its temporal properties probed, and its place in motivational and reflex systems is considered. Contributions come from widely separated laboratories, including Eastern Europe and the Soviet Union. Though the specialist will have encountered most of the essential ideas and data in journals or other symposia, he will find this a convenient source book, and he will appreciate the relative brevity and clarity with which some of the best-known authors restate their work. Advanced students and nonspecialists will find represented in this volume a large proportion of the most central ideas and data of this now rapidly expanding area.

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Enzyme Proteins

Hemoglobin and Myoglobin in Their Reactions with Ligands. ERALDO ANTONINI and MAURIZIO BRUNORI. North-Holland, Amsterdam, 1971 (U.S. distributor, Elsevier, New York). xx, 436 pp., illus. $30. Frontiers of Biology, vol. 21.

This is a book which focuses on the relationship between structure and function in hemoglobin and myoglobin, which are far and away the best studied of proteins. The first four chapters give details of preparation of the proteins, encyclopedic information about the chemical, optical, and electronic properties of various derivatives and their liganded forms, and finally an excellent discussion of molecular structure, drawing heavily on x-ray data.

The middle chapters of the book constitute an intensive review of what is known about ligand binding in hemoglobin and myoglobin from different points of view. The greatest strength of the book is well illustrated in these chapters, for these proteins are seen to be especially well-studied examples of what are after all general properties of many if not most enzyme proteins. In most cases, the especial advantage of knowing so much about structure and being able to relate this to functional data is emphasized.

A discussion of association-dissociation behavior and ligand-dependent changes in conformation and the presentation of detailed information on the equilibrium and kinetics of the reactions of these heme proteins with ligands and on the functional behavior of chemically modified protein, as well as on the oxidation-reduction behavior of these heme proteins, constitute the bulk of the book. The book has an excellent penultimate chapter on structure-function relationships, and the final chapter is a summary of the various theories of ligand binding in which Hüfner, Hill, Adair, and Pauling are paid due respect for their pioneer efforts. Finally, the various modern theories and quantitative models which attempt to take account of conformation changes as the basis of regulatory phenomena are explored. The Monod-Wyman-Changeux model and the Koshland induced-fit model are the two best known in this group, and they are impartially presented.

The book as a whole is coherent and tightly written, with a plethora of detail in the middle chapters. For anyone who works on hemoglobin or contemplates doing so, this book will be a unique and invaluable asset. For anyone interested in the general problem of structure-function relationships in proteins the book will make interesting reading. The stated aim of the book was to give a comprehensive account of the present knowledge of these heme proteins with ligands. In this the authors have succeeded.

This book is weighty testimony to the enormous experimental contribution of the "Rome" group to our understanding of hemoglobin and myoglobin. If the reader is not careful he may even come to the conclusion that hemoglobin is after all an Italian molecule.

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