cine." Despite the efforts of a few dynamic young recruits, the average age of homeopathic practitioners has steadily increased. Kaufman predicts the sect's demise within two or three decades.

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Afferent Processes

Animal Psychophysics. The Design and Conduct of Sensory Experiments. WILLIAM C. STEBBINS, Ed. Appleton-Century-Crofts, New York, 1970. xiv, 434 pp., illus. $18.75.

The editor of this unique compendium cites Claude Bernard (1865) on the impossibility of studying psychophysics in the dumb brutes: "Experimental studies of sense organs must be made on man because animals cannot directly account to us for the sensations they experience." The limits of Bernard's imagination have been exposed by a century of fruitful investigations capitalizing on the behavior—both unlearned and learned—of animals.

Recent advances in the experimental control of behavior, stemming in large part from Skinner's operant conditioning methods, have notably enhanced the power and accuracy of studies of afferent processes and mechanisms in animals. The present volume assembles 18 reports from 27 authors who share a devotion to operant conditioning in some form as a basic element in their diverse inquiries, all gathered under the heading of psychophysics. This heading, as usual, comprises processes as different as stimulus transduction by sensory end-organs and the categorization, interpretation, or ranking of stimuli by the intact organism.

The book is intended to be methodological—meaning it deals with training procedures, with rules for the presentation of stimuli, and with instrumentation—but happily it is more besides. Compositely the papers afford a view not elsewhere available of the state of the art, together with some of the best products of the art, and offer an intimation of how far the art might be extended. The detailed information supplied concerning the measurement of thresholds and similar parameters is what one would ordinarily have to obtain from the investigators in person—the particulars left out of journal articles, pieces of useful lablore, mention of alternatives and of false possibilities tried and discarded.

The merit of the whole book is of a different genus from the virtues of its parts. Some contributions are long on methods, others on findings, and a couple on neither. James Smith's chapter summarizes a long program of work at Florida State University on many species and on the ordinary sense modalities plus some exotic ones. The conditioned-suppression method used by Smith is described in its application to mutant mice by Barbara Ray. Reviews of programs of research on audition are presented by Stebbins and by Gourevitch, and Dalland writes about ultrasound and bats. Weiss and Laties bring an overview of their extensive studies of pain and analgesia, of course with a pharmacologic side. This work has a motivational aspect, but even more so does the other contribution on somatic sensitivity, Harry Carlisle's chapter about rats pressing bars to douse themselves with radiant heat. These experiments deal not with cues so much as with reinforcements on their sensory side and with regulation; more precisely said, the behavior studied is jointly controlled by brain interoceptors and by exteroceptors sensitive to the same conditions, and thus we have the larger phenomenon of homeostasis, in which sensation is just an element.

Vision comes in for four chapters: Berkley's on training visual discriminations in the cat; a brief one by Glickstein and colleagues on striate cortex lesions; Yager and Thorpe's on color vision in the goldfish, which lends support to the Hering-Hurvich-Jameson theory of opponent processes; and one in which Scott and Milligan take up the difficult and delicate problem of measuring visual motion aftereffects in the monkey and report impressive results.

Three chapters, by Moody, Miller *et al.*, and Reynolds, are given over to reaction-time methods. The most positive results are shown by Moody, who has used equal reaction time as a null method for measuring light and sound intensities. Titration and tracking methods, like those of von Békésy which were first applied to animals by Ratliff and Blough, are here discussed by Rosenberger. The general principles of psychophysics and a bit of the classical methods are sketched at the outset by Stebbins, but that whole new way of thinking about sensory experiments in general called the theory of signal detection is brought in by John Nevin in the last chapter. Nevin's studies are guided by the theory, but his data are not compatible with the simple notion that the signal distribution remains fixed on the decision-axis under varied reinforcement conditions, or with the idea of a single criterion maintained by the animal for all signals.

One original theoretical effort is made—an attempt by the Mallotts to bring sensation and perception rather generally into the framework of stimulus control and cognate concepts from the language of conditioning. The effort is not successful; the claim that sensation and perception experiments can be distinguished by whether or not the experimenter knows exactly when to reinforce seems to this reviewer plainly false. The attempt to put under the heading of multidimensional generalization the diverse topics of illusions, sensory scaling, and stimulus matching emerges as a confusion. These difficult questions will have to be settled at a future date, as both psychophysics and the study of behavior advance, helped along by this book.

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Pharmacology

Molecular Properties of Drug Receptors. A Ciba Foundation Symposium, London, Jan. 1970. RUTH PORTER and MAEVE O'CONNOR, Eds. Churchill, London, 1970 (U.S. distributor, Williams and Wilkins, Baltimore). x, 298 pp. + plates. $14.

The purpose of this symposium was to bring pharmacologists and protein chemists together and let them discuss the "state of the art" as far as pharmacologic receptors are concerned. Thus the proceedings begin with a historic review of pharmacologic receptors; several well-known receptor systems are described; recent information about active sites of several enzymes and methods that can be used to study conformational changes are discussed; and finally, the participants share their thoughts about how to characterize and isolate the "elusive" pharmacologic receptor.

As with previous Ciba Foundation symposia, the publication of discussions following each paper as well as several general discussions adds a delightful style to the book and gives the reader insight into the thinking of the participants. The fact that the chairman (F. H. C. Crick) is not a pharmacologist broadened the discussions in an interesting manner.

The coverage of pharmacologic receptor systems is not broad and, except for one paper on the adenyl cyclase system (S. E. Mayer), only acetylcholine receptors are covered (S. Thesleff and P. G. Waser).

The section discussing methods used to study protein structure and configurational changes is quite good. An elegant paper by Beddell, Monet, and Phillips on crystallographic studies of lysozyme points out the dangers of drawing conclusions about substrate-enzyme binding without data on the structure of the complex. Indeed, it is somewhat unsettling to the reviewer that seeming small changes in the structure of the substrate may lead to very different binding to the active site. One's ideas about specificity of the active site may be changed after reading this paper. Application of nuclear magnetic resonance spectroscopy is discussed by Jardetzky, fluorescent spectroscopy by Stryer, and affinity labeling by Singer. The nonexpert will gain insight about the value of these techniques, since they are presented by experts at a conceptual level as well as an experimental level.

Finally, ideas of how pharmacologic receptors "work" are discussed under the heading of conformational change. Wyman reviews subunit interaction in hemoglobin, and Changeux, Blumenthal, Kasai, and Podleski present a scheme for conformational changes during membrane excitation, based largely on data from eel electroplax experiments.

At the end of the symposium the participants discussed the present and the future. It was obvious to all that only the surface has been scratched in this field but progress is being made. All pharmacologists and others who think about drug receptors would be well advised to read this interesting volume.

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Biogenous Deposits

The Micropalaeontology of Oceans. Proceedings of a symposium, Cambridge, England, Sept. 1967. B. M. FUNNELL and W. R. RIEDEL, Eds. Cambridge University Press, New York, 1971. x, 828 pp., illus. $55.

The most common deposit on the surface of our planet is biogenous pelagic ooze. Biopelagites are derived principally from coccolithophorids, foraminiferans, radiolarians, diatoms, and to a lesser extent pteropods. Minor and occasional constituents are benthonic foraminiferans, silicoflagellates, dinoflagellates, and ostrocods, as well as pollen and spores. The distribution of the various organic remains is governed by biologic, ecologic, and sedimentologic processes determining production, transfer, dissolution, and redeposition. These processes vary from area to area and through geologic time. Thus there are many variables entering into the patterns of biopelagic sedimentation, and the deep sea record is difficult to interpret in terms of the history of the oceans.

As a fitting preparation for the tremendous task of reading the oceanic history from the record recovered by the Deep Sea Drilling project, a working group of the Scientific Committee on Oceanic Research (SCOR), chaired by E. Seibold, organized an international symposium four years ago in Cambridge, England. The present volume is the somewhat belated product of this meeting. The book contains 52 papers by 45 authors (mainly from the United States, the Soviet Union, and Great Britain). The papers are organized into six sections: on zoogeography, on sedimentation and facies patterns, on Quarternary sequences, on pre-Quaternary distribution, on methods and systematics, and on stratigraphy.

The first author in each section sets the stage with an important review paper. J. A. McGowan looks at species patterns of the Pacific, what they are, how they are maintained, and how they developed. In discussing pattern development he severely criticizes several papers interpreting the Pleistocene foraminiferal record. This interest on the part of an ecologist is most heartening, for it is ecological information that is most sorely needed to make these interpretations.

A. P. Lisitzin contributes a wealth of quantitative information on siliceous and calcareous microfossils in suspension and on the ocean floor. Lisitzin emphasizes the great loss of silica occurring before sedimentation is achieved: compared with the 80 to 160 $\times 10^9$ tons a year produced, only 0.3 $\times 10^9$ tons can be sedimented if output equals river input for a sedimentation efficiency of 0.2 to 0.5 percent (not 2 to 5 percent as stated). Most of this destruction takes place in the upper waters. The predominant role of the Antarctic belt of silica accumulation with rates of up to 1 g/cm^2 per thousand years is strikingly illustrated. The creation of this sink through establishment of the circumpolar current (separation of Australia, opening of Drake Passage) should play a major role in the interpretation of ancient silica deposits. Lisitzin shows that, like silica supply, carbonate supply is controlled by fertility, whereas preservation patterns are controlled largely by increasing solution with depth. His explanation of the familiar but paradoxical carbonate increase with depth to about 2000 meters in the Atlantic, as decreasing dilution by terrigenous and siliceous materials, ignores intense dissolution in the shallow hemipelagic sediment off continents, where supply of organic matter leads to development of interstitial CO_2. A similar effect prevents the simple horizontal extrapolation of the level "at which carbonate solution in bottom sediments begins" across the fertile equatorial region (figure 11.9). This level varies in depth between and within oceans. Lisitzin's main point, however, that solution increase level and critical (or compensation) depth are strictly separate phenomena is clearly brought out and certainly bears repeating in view of the widespread confusion on the matter. His north-south profiles of the critical depth (10 percent $CaCO_3$) are especially useful. The user of the numbers given in Lisitzin's tables should note carefully the methods by which they were obtained, if necessary by consulting the original reference.

E. Olausson approaches the carbonate system by stressing the role of deep circulation patterns, as well as the supply of organic matter to the ocean floor in producing sedimentation patterns. His attempts at reconstruction of the Pleistocene ocean environment are most instructive, even though the reader may be baffled at times by the barrage of facts with which Olausson supports his arguments.

The compilation of pre-Quaternary