

ture—was revolutionary according to textbook knowledge of the time, whereas the demonstration persuasive to the phage group depended upon the conventional generalization that proteins contain sulfur and never phosphorus, which was not expected to hold, either as a generalization or experimentally, below the 10 percent level. I find it also somewhat unexpected that the x-ray analysis of long spacings in macromolecules that led up to the structural studies of DNA are also considered to be unrevolutionary. Probably this is because each step was preceded by another one, and the giant step to helical structures and fibers could be technically supported in a most unromantic way. Nevertheless, if this reviewer put all of his favorite giant steps into Stent's competent framework, he would merely have slightly reduced the impact of a thought-provoking work that may send many of us scurrying to reexamine our motives and aims in the months ahead.

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Regulating Man

Physical Control of the Mind. Toward a Psychocivilized Society. JOSÉ M. R. DELGADO. Harper and Row, New York, 1969. xxii, 282 pp., illus. \$7.95. World Perspectives, vol. 41.

Until recent times, our knowledge of the human brain and its specialized functional regions came largely from the study of disease. Thus, the lesions of epilepsy with their propensity for localized activation of brain circuits provided a "Pandora's box" of information that could be interpreted in physiologic terms and thereby provide functional maps of the human brain. With the advent of electronic technology, nature's relatively crude experiments have been supplemented by accurate methods of electrode access and stimulus control so that now the clinician or neurophysiologist can activate virtually any selected neuronal population within the human brain. In *Physical Control of the Mind* Delgado gives us a timely review of what this technic can effect in the animal and in the human patient that has bearing on the control of the mind. If the book had appeared ten years ago, its impact would have been greater, since today it is very apparent that effective physical control of the mind is more likely to be achieved

through some of the powerful chemical agents that are being used by the youthful populace to "expand the mind" than through the technically difficult methods involved in applying an electrical stimulus to appropriate regions within the cranium.

Delgado has also attempted a more ambitious task, namely to define the philosophic and sociologic implications of these advances in scientific knowledge in line with the intent of the monograph series *World Perspectives* as stated on the dust jacket: "to reveal basic new trends in modern civilization, to interpret the creative forces at work today, in the East as well as in the West, and to point to the new consciousness which can contribute a deeper understanding of the interrelation of man and the universe, the individual and society, and the values shared by all society." With these goals in mind, Delgado sets in the first nine chapters an evolutionary background for the development of mind-brain concepts. The next seven chapters review the progress that has been made in the control of primate behavior in social groups by intracerebral stimulation. The remaining ten chapters discuss work on brain stimulation in patients and attempt a synthesis of human and animal studies. In the final chapter Delgado considers the social implications of work in this field and properly emphasizes the urgent need for further multidisciplinary research before social problems pass out of rational control.

By many readers the treatment of the mind-brain problem so intimately involved in stimulation experiments in man will be judged as simplistic and cavalier. One might illustrate Delgado's approach by quoting the definition of mind which he adopts, namely, "the intracerebral processing of extracerebral information." This appears to beg the question and is out of step with contemporary efforts to reach a more meaningful approach to this complex subject. An example of such an approach can be found in the monograph *Free Action* by A. I. Melden, which treats in great depth the philosophic-physiologic interface involved in such apparently simple voluntary acts as flexing the finger. Questions of equal complexity appear in relation to such effects as memory change, hallucination, and illusion produced by depth stimulation, and one would have welcomed a more penetrating analysis than is offered in this book.

The most informative chapters are

those in which Delgado describes his own work concerning the effects of electrical stimulation of the brain on the behavior of primates in a social environment. This is unique research bridging a gap between brain mechanisms and their expression as sociosexual forces in the group. Here we see Delgado's talent for technical inventiveness combined with his experience with the social structure of a primate colony to produce a unique addition to our knowledge of how brain mechanisms contribute to our understanding of social and group activities. Furthermore, this kind of research seems particularly relevant as providing basic data for use in the interpretation of the breakdown now becoming apparent in social groups and institutions at a human level. In this respect the book fulfills some of the wide-ranging objectives of the *World Perspectives* series.

In his closing chapters, Delgado ranges over a variety of topics including the ethical problems encountered in human experimentation and in the assessment of brain death. His final plea for a "psychocivilized" society is not very convincing, for it gives the impression of a demand for action on the basis of rather fragmentary data.

The general reader will find in this book much well-documented and useful information about aspects of brain function that is not readily available elsewhere.

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Nociperception and Analgesia

Pain. Proceedings of an international symposium, Paris, April 1967. A. SOULAIRAC, J. CAHN, and J. CHARPENTIER, Eds. Academic Press, New York, 1968. xii, 562 pp., illus. \$19.50.

The 54 contributors to this symposium sought in their 41 papers to cover the neural and psychic bases of pain; experimental methods for producing pain in animals and man and for evaluating analgesic agents; the biochemical and psychopharmacologic basis of action of such agents; the psychopharmacology of analgesics; the modification of neuroelectric activity by analgesics and local anesthetics; and finally some clinical applications of studies of those subjects. The editors have generously published in English all but three papers.

However, a knowledge of French still proves helpful in understanding the meaning of a text that was originally in that language.

Several of the chapters summarize a decade or two of their authors' work. For example, Beecher manages to compress into ten pages the basis for his conclusions on the quantitative measurement of pain in man, on which he has carried out studies since the late 1940's. These studies have culminated in the development of the "submaximal effort tourniquet method," in which a subject squeezes a hand exerciser 20 times after a tourniquet has been inflated around his upper arm and the time is measured at which he designates the pain as (i) slight, (ii) moderately distressing, (iii) very distressing, and (iv) unbearable. This simple maneuver proves to simulate the duration and severity of pain from surgical wounds and cancer well enough to permit quantification of the practical analgesic effects of drugs.

The first chapter is perhaps one of the most important because its 21 pages give Melzak and Wall adequate scope to develop and defend their now widely publicized "gate control theory of pain." In passing it may be noted that this important basic research was supported by the U.S. Department of Defense—a source from which support unhappily is no longer available to us.

In a chapter entitled "Neuropsychiatric aspects of pain" Serafetinides attempts to summarize the main findings on both the organic neurologic and the psychogenic types of pain in man as published in English in the decade ending in 1967. Szasz devotes his pages to a description of the man who habitually complains of pain that is undiagnosable and gives rise to "unrelievable suffering." He gives us little help in differentiating such a person from one whose suffering is related to occult organic disease.

Moving to the evaluation of analgesics in animals, we have the late R. K.-S. Lim's final word on this subject. Lim contends that "vocalization is the most specific central indicator of pain in animals." He adduces evidence that the antipyretic analgesics, such as aspirin, exert their effect at the periphery whereas the narcotic analgesics act centrally. His most convincing experiments involve cross-perfusion of a vasoisolated spleen with nerves intact. The vocalization response in the recipient dog to the painful procedure of intrasplenic injection of bradykinin is stopped when as-

pirin is injected into the circulation of the donor, but not when it is injected into that of the recipient. The converse is true for morphine. In the former situation, the drug can affect only the peripheral nerves in the spleen, whereas in the latter the drug action must be more central.

Geller and Axelrod recommend for evaluation of analgesics the tactic of Galambos whereby an animal, usually a monkey, learns that by pressing a lever he can decrease stepwise the intensity of electric shocks given him. The animal's response at the lever indicates the level of shock he is willing to tolerate.

Charpentier has studied the behavior of freely moving rats subjected to noxious electrical stimuli and automatically records their four main responses of startle, flight, squeak, and biting the electrodes. He has analyzed the effects on these responses of drugs and of bilateral focal intracranial lesions at six selected sites.

The principal chapters dealing with the biochemical basis of analgesia are on the relationship of chemical structure to morphinomimetic activity, by P. A. J. Janssen; on the analgesic and anticonvulsant activity of derivatives of dibenzazepine, by W. Theobald *et al.*; on the possible role of serotonin in pain, by Herold and Cahn; and on the relations between the analgesic activity of the compounds Bay 1470 and morphine, by Hoffmeister.

The section on the psychopharmacology of analgesics includes four chapters all dealing with psychotropic drugs and pain. In another chapter Herz and Metyš discuss the inhibition of nociceptive responses in animals by cholinomimetic agents which do not commonly alter the perception of pain in man. Wilhelmi and his colleagues from the Geigy Research Laboratories provide a summary of their 20 years of work on the analgesic and antiinflammatory properties of the agents originally called antipyretics.

The fifth section contains four chapters from as many nations on the electrical activity of the brain and the influence of drugs thereon. Essays from England, Italy, and Switzerland deal with analgesics, and one from the United States with local anesthetics.

In the final section Noordenbos leads off with an explanation of the physiological correlates of clinical syndromes of pain. Huguenard and Boissier in separate essays deal with "neuroleptanalgesia," "the state produced by combining a drug like chlorpromazine with a

short-acting analgesic." With such combinations major surgery can be carried out with the patient remaining awake and cooperative. White presents a succinct description of the neurosurgical operations for relief of pain in the torso or extremities, emphasizing the indications for and the advantages and the problems associated with sympathectomy, posterior rhizotomy, and cordotomy. Garcin deals with the peculiarly vexing problem of pain provoked by lesions of the central nervous system and refers to nearly all of the principal writers on the subject.

The Paris symposium was the first time authorities in so many disciplines concerned with pain had met together. This volume records what they would have liked to say had they been given enough time. Happily each was given an adequate number of pages to provide those outside his specific field with a working knowledge of what the sister discipline has to offer.

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Properties of Ores

The Ore Minerals and Their Inter-growths. PAUL RAMDOHR. Translated from the third German edition. With additions and corrections by the author. Pergamon, New York, 1969. xviii, 1174 pp., illus. \$54.

Paul Ramdohr's *Die Erzminerale und ihre Verwachsungen* has gone through three editions and is well known and widely used in the English-speaking world. But many students of the ore minerals have found the German editions difficult and have looked forward to an English translation of the latest edition. This has now been provided by a team of more than 30 translators organized by C. Amstutz.

For the uninitiated, the subject matter in the Ramdohr books is presented in three main sections: A genetic classification of ore deposits (80 pages in the translation); a discussion of ore textures and their genetic significance (200 pages); and a systematic description of the ore minerals, particularly their physical chemistry and paragenetic position and their characteristics in polished section (900 pages).

The English translation includes more than 750 photographs which complement the text and illustrate fea-