tween what he terms, "experimental" and "pathological" pain. Many observers have recognized that two different types of pain exist, and have sought to define them in various ways. Thus we find reference in the literature to deep and superficial pain, cutaneous and visceral pain, epicritic and protopathic pain, etc. Recognizing the dichotomy of pain, none of the suggested definitions has proven satisfactory. Dr. Beecher's separation is inaccurate and does not contribute toward a better understanding of the problem. As Dr. Hardy and his co-workers point out, Dr. Beecher has classified pain on the basis of the psychic response engendered by the particular circumstances under which the pain is experienced (i.e., in the laboratory or in the hospital bed). His use of the term experimental pain suggests that this is some sort of hothouse variety that has to do only with scientific inquiry.

Several years ago, Dr. Revici and I suggested that pain be separated into two types, defined as physiological and pathological. The advantage of these terms in understanding the fundamental differences between the two types of pain has become increasingly apparent, and their general acceptance would resolve many of the semantic debates such as the one that appeared in SCIENCE.

Physiological pain is induced when noxious external stimuli are applied with sufficient intensity to healthy intact tissues, having specific pain end organs. Such pain is a sensorial sensation, similar in every respect to other sensations such as sight, hearing, taste, touch, etc., each of which has its own specific end organs as well as transmission pathways and centers of reception in the brain, and serves to provide the organism with information regarding its surroundings. Physiological pain serves as a warning signal to the organism that the stimulus applied represents a threat to its tissues. Using the means immediately at its disposal, the organism normally responds to physiological pain by fleeing from or fighting off the noxious stimulus in an effort to maintain the integrity of its tissues.

Pathological pain originates within tissues whose metabolism has been deranged as the result of damage or disease. Such pain is thus a sign of existing injury rather than a warning to the organism of impending danger. The impulses that give rise to pathological pain appear to be transmitted from abnormal foci along pathways ordinarily transmitting other sensations such as touch, cold, heat, and physiological pain, as well as by way of the autonomic system. The organism responds to pathological pain by endeavoring to place the injured part at rest in order to protect it and thereby facilitate recovery.

It is evident that physiological and pathological pain are fundamentally different in their origin, transmission, and significance to the organism as well as in the responses they arouse. In view of these basic differences, it is obvious that methods of study developed for one will not be satisfactory for the other. While physiological pain is readily investigated under the experimental conditions of the laboratory, using normal tissues, it is more than a laboratory reality. Pathological pain existing only in relation to diseased or damaged tissues is most effectively studied in subjects in whom such lesions exist. Our own studies have been concerned with the character of the metabolic changes within abnormal tissues that give rise to pathological pain.

ROBERT A. RAVICH

Institute of Applied Biology
Brooklyn, New York

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Book Reviews

Flying Saucers. Donald H. Menzel. Cambridge, Mass.: Harvard Univ. Press, 1953. 319 pp. Illus. $4.75.

In these days when we are regularly having our attention called to articles and books claiming that the flying saucers are interplanetary space ships and are receiving circulars offering for sale pictures, purporting to be photographs of flying saucers, it is refreshing to see a book which makes a sensible interpretation of the oft repeated stories.

Dr. Menzel begins with stories of "saucers" and strange lights since the present scare started in 1947. He shows the difficulty of explaining these old stories by pointing out that nearly all give estimated size and distance, although any trained person should know that he cannot tell how far away such an object is. He checked one story and found it necessary to change date, direction of motion, and other details. He gives another story as follows: ". . . on February 9, 1913. A great procession of slowly moving meteors moved diagonally across the United States and Canada, from Saskatchewan to Bermuda." This sensational story is based on nothing more than a fine shower of shooting stars in the Toronto area, a very few fireballs or shooting stars observed in other places, and practically nothing from the United States.

In spite of errors and exaggerations in the stories, Dr. Menzel gives plausible, although not always complete, explanations, for all reports discussed. He makes considerable use of mirages, sundogs, and other phenomena of meteorological optics, and devotes several dozen pages and some notes in the appendix to these phenomena. On the much advertised green fireballs, he comments, correctly, "Any astronomer who avers that green meteors are new, or that the color must come from burning copper, cannot be much of an authority."

Readers will find the pages on hoaxes, and on the

"Strange signes from Heaven" observed before the present scare, well written and interesting. On these earlier sightings, Dr. Menzel goes back to the vision of the four living creatures in Ezekiel. He points out that the ghosts of radar are essentially mirages, and that they had caused considerable trouble during World War II. He closes the book with speculations on space travel and instructions on what to do if one sees a flying saucer.

A point which I would emphasize, more than Dr. Menzel has, is that nearly all reports telephoned to me, and using the word, "saucer," have been found to refer, certainly or probably, to the brilliant spot of sunlight reflected by a metal plane, and observed from the critical angle. Of course, I am asked to explain plenty of other phenomena such as mirage effects, but the observers do not call these "saucers." I would also emphasize that if a real space ship or enemy missile should appear over the U.S., the numerous reports would make available plenty of data for calculated figures on path, height, and speed, instead of the meaningless guesses now being published.

C. C. WYLIE
Department of Mathematics and Astronomy
State University of Iowa

Physiological Foundations of Neurology and Psychiatry. Ernst Gellhorn. Minneapolis: Univ. Minnesota Press; London: Geoffrey Cumberlege, Oxford Univ. Press, 1953. 556 pp. Illus. $8.50.

Integration of what is known of the basic physiology of the neuron and neuronal groups or networks, with the factors involved in the problems of nervous and mental disease, is a combination of the greatest hope and despair for all investigators in these fields. For this reason, even if there were no others, an effort to perform that integration (in the present meager state of our knowledge) by as eminent a neurophysiologist as Dr. Gellhorn, will be of unquestionable interest to anyone involved with the complexities of the nervous system and its role in the total behavior and maintenance of the living organism.

Many problems and functional levels are discussed under the six following primary groupings: (1) intrinsic and extrinsic factors regulating neuronal activity; (2) contributions to the physiology and pathology of movements; (3) the physiological basis of consciousness; (4) some aspects of autonomic physiology; (5) integrations; and (6) applications.

These major divisions allow the author to include a wide variety of topics in his discussion, covering subjects from the Adrian-Bronk law, electromyography, convulsions and consciousness, to autonomic activity, conditioning, and some physiological concepts relating to mental disease and therapy. In general, the author has discussed a certain number of problems of interest to him (and to which he has contributed during his many fruitful years of investigation) and has tried to find logical places for them in the over-all picture of organismal activity. This necessitates, of course, a certain bias both in commission and omission and leaves much room for controversy. It might not have been amiss to start the title of the book with the word "Some" and to have altered the word "Foundations" to "Correlates."

A great deal of valuable factual information is presented here, so much that one feels somewhat fearful, in a sense, of belittling it. Nonetheless, the feeling is inescapable that many important factors have been slighted in favor of the hypothalamic-cortical system, even in areas where they would fit into the picture the author is trying to create. For example, recent work relating to the role of rhinencephalic structures in emotion and behavior is greatly underplayed. Many of the new findings concerned with the functions of the hippocampus, fornix, cingular gyrus, amygdala, and other associated areas are of the greatest importance not only in our general considerations of emotion and behavior, but also in regard to our understanding of the "autonomic" nervous areas and functions. So much of this work raises new possibilities that one can no longer comfortably envision the hypothalamus as the answer to the neurophysiological maiden's prayer—most certainly *not* if it is being discussed just as its role as an autonomic center. Such centers are too widespread in the central nervous system to allow any one of them completely to overshadow all the others, especially those which have been shown to be of the first importance in somato-visceral integration and correlation.

If it seems unphysiological to suggest one of many interrelated neuronal groups as a multifunctional center of far more importance than other associated groups, in the same way it does not seem completely sound to suppose that the reactions to various stimuli to which the whole organism is subjected can be interpreted by constant reference to any one center. To be sure, certain things will affect the hypothalamic-cortical relationships and this is a part of the whole that must be taken into account, but there is no obvious reason for making this particular relationship more important, let us say, in trying to explain the effects of shock therapy, than bulbo-reticular thalamo-cortical interrelations, or generalized somato-visceral correlations, or changes in permeability of neuronal surfaces, etc., almost ad infinitum.

Lack of space prevents complete discussion of many other problems arising from this type of presentation, such as some questionable views concerning the theory of carbon dioxide therapy, and the interpretation of results obtained with the oxygen electrode. In contrast to these are some highly stimulating expositions of problems of convulsive activity, consciousness, and homeostasis. The entire book is a most provocative one despite its limitations and will serve physiologists, neurologists, psychiatrists, and others as a summary of much of the material now in the forefront of investigation of the nervous system.

ROBERT G. GRENELL
Psychiatric Institute
University of Maryland, Baltimore