condition. It is suggested that small commercial trials of this wax treatment be made. A concentration of 6 to 8 per cent. solids in the emulsion is suggested.

It was found that the volatiles from one lot of apples may induce scald on a second lot. Susceptible varieties scald much sooner and more severely in the presence of volatiles from McIntosh apples than when stored alone. This was true both in ordinary cold storage practice and in "controlled atmosphere storage," where carbon dioxide and oxygen levels as well as temperature and humidity were controlled.

Progress has been made in "air conditioning" the storage atmosphere to rid it of these harmful volatiles, but absolute scald control by this method has not yet been attained. The more promising materials which have been used in the air-conditioning process have been various oils and activated charcoal. Failure to attain complete control of the disease by this method may be attributed partially to a lack of knowledge as to when the absorbing materials became saturated.

R. M. SMOCK
F. W. SOUTHWICK

DEPARTMENT OF POMOLOGY,
CORNELL UNIVERSITY

A GRASSHOPPER PROBLEM IN MECHANICS

A FRIEND on a farm, having to move a hive full of bees, asked me whether the hive would weigh less if the bees were stirred up so as to fly around inside the closed hive while she carried it. This suggested a similar—but mathematically simpler—problem: Will a suitcase containing a pound of grasshoppers weigh less if the grasshoppers are jumping so that half of them are constantly in the air in the suitcase than if all are constantly at rest?

If a grasshopper of mass m jumps with a vertical velocity v, the downward impulse on the suitcase is mv when he jumps and also when he alights, which will be $2v/g$ seconds later if he strikes nothing; therefore if n grasshoppers are in the air half the time, the average downward impulsive force due to the change in momentum is one half of $2nmv$ divided by $2v/g$, that is $\frac{1}{2}nmg$; and this added to the weight of those at rest gives the dead weight of all. In other words, the total average weight is the same whether they are jumping or not. This is, of course, the kinetic theory explanation of the downward pressure exerted by the weight of a gas. It should be noted, however, that only the average weight is the same. If a box containing a single grasshopper is suspended from a sensitive spring balance, every time he jumps the box will receive a downward kick. So the indicated weight of any body not at absolute zero is partly static and partly kinetic, and is a statistical average sum of varying static and impulsive forces.

The hive-and-bees problem is more complex; but in this case also, of course, the total average weight must be the same no matter what the actions or motions of the bees and other parts inside the closed container may be.

This problem is doubtless very old, though I do not happen to have run across it before. References to previous discussions of it will be appreciated.

GORDON S. FULCHER

WASHINGTON, D. C.

SCIENTIFIC BOOKS

EPILEPSY

Epilepsy and Cerebral Localization. By WILDER PENFIELD and THEODORE C. ERICKSON. 607 pp. Springfield, Illinois: Charles C Thomas. 1941.

A RARE kind of devotion to suffering humanity and science is needed to keep a man working at a disease such as epilepsy. The patients are deeply distressed and distressing to the physician because many can not be given much aid. Lennox in his recent book, "Science and Seizures," has shown this spirit and has written a book from the medical and social view-point. Now comes "Epilepsy and Cerebral Localization," by Penfield and Erickson, from the surgeon's point of view. But these men are more than surgeons; they have approached the entity called "epilepsy" from the physiological standpoint; they have made histological studies and finally, with the aid of the special laboratories of Dr. Jasper and Mrs. Erickson, respectively, they have taken up electroencephalography and psychology, as related to epilepsy.

A series of proven cases of focal epilepsy treated by craniotomy provided the major source of material for physiological, psychological and anatomical studies of the human cerebral cortex over a ten-year period. The histology of cerebral scars, the cytology of the brain, the structure and control of cerebral vessels and the physiology of cerebral blood flow have formed the subjects of what might be called their preliminary research. During the process of clinical elaboration, collateral studies were made upon patients suffering from all types of convulsive states by electroencephalography and pneumoencephalography as well as by the analysis of seizure pattern and clinical picture. At the same time related medical literature has been freely used. For students of neurophysiology the direct observations made upon the cerebral cortex of conscious patients and the descriptions of patterns

of epileptic discharge provide valuable material. The chapter on cranial roentgenography treats chiefly the atrophic lesions of the brain and skull. Because of the fact that war came upon the world before the completion of the manuscript, Chapter XIX on acute head injuries has been added. The treatment of atrophic cerebral lesions and of brain tumors is described in practical detail. An exhaustive report is made of the results of operations (Chapter X). Over a ten-year period 165 operations were performed for the removal of cerebral or meningocerebral scars. Thirty-four of these proved to be "negative explorations"; in 62 there was removal of a meningocerebral cicatrice; in 53 the cicatrix was cerebral only. Since operation 22 per cent. of the former and 19 per cent. of the latter patients have been entirely free from attacks. An additional 54 per cent. of the patients with meningocerebral scars were conspicuously improved, the corresponding figure for purely cerebral scars being 40 per cent. Only 11 per cent. of the former and 3 per cent. of the latter showed no improvement at all. In short, these operations are well worth doing and if the scar involves both meninges and brain, there is a nine to one chance of clinical improvement and a one to four chance of cure, with an operative mortality of 4 per cent. Moreover, the improved techniques of pneumoencephalography are a great aid in determining which cases should be explored surgically. For example, many brain tumors are found, some of them removable. The results from removal of encapsulated tumors are about 20 per cent. cured of seizures and 40 per cent. conspicuously improved; infiltrating tumors only do about half as well.

The chapters on "Seizure Patterns" and "Mechanism of Epileptic Seizures" bring much important data to the physiologist who is interested in the function of the human brain. The authors define epilepsy as the tendency to recurring epileptic seizures. "An epileptic seizure is a state produced by an abnormal excessive neuronal discharge within the central nervous system. An epileptic seizure is therefore a symptom of disease, but epilepsy itself should not, strictly speaking, be used as a name for that disease." Seizures have one common feature: a direct influence upon the central nervous system, which results in recurring explosive neuronal discharges. On pathological grounds, they differ widely. Anatomically, the part of the central nervous system wherein the neuronal discharge occurs may vary greatly, but there is a common physiological mechanism which produces the outward manifestations of a seizure.

From a practical point of view, in the consideration of many of the epilepsies, the cause is readily recognized, *e.g.*, cases of brain tumor, traumatic scar of the cerebral cortex and hypoglycemia. Such types have been called *symptomatic epilepsy*. But after one names the long list of pathological lesions that may affect the brain and after the obvious extra-cerebral causes are enumerated there remains a residue, an all-too-numerous group of cases in which the cause can not at present be found. To these patients the term *cryptogenic epilepsy* (of obscure origin) has been applied. This group will contain a large number of cases in which there is a strong familial tendency and in which the electroencephalographic record has a characteristic form, the spike and slow wave described by Gibbs, Gibbs and Lennox. Many of these cases will be found to fall into the clinical classification of "petit mal."

The careful clinical research for focal symptoms; the operations under local anesthesia and the refined exploration of the cortex in conscious patients have brought in a wealth of important material. The clinical descriptions of various seizures and their classification in relation to localization and electroencephalography is also a distinct advance. The medical profession has been too willing to put the attacks into three vague and loosely defined categories: "grand mal," "petit mal" and "psychomotor attack." As generally used, these terms are meaningless from the physiological standpoint and inadequate clinically. If used accurately in their classical sense, they would not cover the field at all. Penfield brings this out in his clinical analysis and Jasper substantiates the neurological observations with the electroencephalogram (Chapter XIV). Jasper makes four salient points:

(1) Epilepsy, as viewed by electroencephalography, consists of recurring paroxysmal high voltage waves, electrical signs of excessive synchronized neuronal discharge or *hypersynchrony*. Often, but not always, there are associated abnormal rates of cerebral discharge or dysrhythmia, tachyrhythmia or bradyrhythmia.

(2) The epilepsies may be divided into three principal groups with regard to localization of abnormal waves: (a) *localized* to a specific cortical area of one hemisphere, (b) *bilaterally synchronous* from homologous areas of the two hemispheres, and (c) *diffuse* wide-spread disorganized abnormal waves often with generalized cerebral tachyrhythmia or bradyrhythmia.

(3) The form of local cortical epileptic discharge recorded near its source is the same from any superficial cortical area while the form of clinical seizure depends upon the function of cortical area of onset and path of march.

(4) There is a close correspondence between cortical localization by the E.E.G. and the localization arrived at by analysis of the nature of onset of the clinical seizure.

The book is obviously written from a wide experience in surgical cases, but the authors have also seen in their clinic and practice a large number of epileptics of the cryptogenic type and they have two chapters on these more medical aspects (XI and XII).

The inheritance of epilepsy is discussed and the data are well presented, but it seems to me that the obvious conclusion is not drawn, *i.e.*, that "idiopathic epilepsy" is identical with "inherited epilepsy," and that all other cases have cerebral lesions. Of course there is always the group of "cause unknown" ("cryptogenic," if you prefer Greek) because the doctor lacks diagnostic means. At any rate I feel that the time has come to drop the term "idiopathic."

Under "extracerebral causes" are discussed various systemic variants of circulation, water metabolism, etc., which effect fits. The authors clearly state that epilepsy is cerebral and that these are really precipitating causes, if causes at all. Nevertheless, some are important in treatment.

In a disease where the most important symptom is clouding of consciousness or loss of it, the subject of "consciousness" must come up for discussion. At the end of Chapter VI, on "Functional Levels in the Central Nervous System," the highest level is considered "the level of consciousness" and four pages are given to a discussion which I consider the weakest part of the book. I can not believe that consciousness is a one-level affair and I do not agree that there is an area of "highest level of integration," the integrity of which is essential to consciousness. That such a "level of final integration" lies within the diencephalon seems most improbable. The epileptologist certainly knows a lot about *un*consciousness, but he is taking chances when he lightly discusses consciousness in a few pages without careful definition of what he means. It remains the great mystery.

This book contains little about the end results of epilepsy seen in institutions; it does not discuss many of the problems that arise in large epileptic hospitals. From that point of view the book is not a treatise on the care of the epileptic. The authors are not distracted by the older clinical writings which look on epilepsy as a "disease" that "leads to deterioration." They start physiologically and hold to their physiology, applying it to clinical phenomena. Therefore, and because of its scope and data, I think this is the best book ever written on epilepsy.

STANLEY COBB

SOCIETIES AND MEETINGS

THE EIGHTH ANNUAL WASHINGTON CONFERENCE OF THEORETICAL PHYSICS

THE topic of the Eighth Annual Washington Conference of Theoretical Physics, held on April 23, 24 and 25 in Washington, D. C., at the George Washington University, under the joint auspices of the Carnegie Institution of Washington and the George Washington University, was "The Problems of Stellar Evolution and Cosmology."

This topic represents essentially the further development of discussions at the Fourth Conference of May, 1938, on "Problems of Stellar Energy-Sources." During the four years since that conference, many problems pertaining to the process of energy-production in stars became completely clarified and present now a solid basis for further advances in this field. There seems hardly any doubt that the so-called "carbon cycle," first proposed by Dr. H. Bethe at the Fourth Conference, actually represents the source of energy for our sun and for all other stars of the "main sequence." It is also becoming more and more certain that the energy-source of the so-called "red-giant stars" lies in the thermonuclear reactions of the three light elements, lithium, beryllium and boron, as was proposed by Dr. G. Gamow and Dr. E. Teller.

But, whereas we know the particular nuclear reactions which are responsible for the energy-production in various types of stars, the problem of stellar evolution, that is, changes with time of the observable characteristics of a star particularly in its application to the "red giants," still presents serious difficulties. Because of the absence of any appreciable convection-currents through the entire body of the star, it seems that the nuclear transformation of various chemical elements in the star should take place in a spherical shell, the radius of which is steadily increasing in the process of evolution. This necessitates the study of the so-called "shell-model" of a star as first proposed by Gamow during the Fourth Conference. Study of this model was considerably advanced during the last year by Dr. S. Chandrasekhar and Dr. M. Schoenberg, who reported their results at the first session of the Eighth Conference.

It was shown by Chandrasekhar that the growth of the "shell" does not extend all the way to the surface of the star but stops when the shell envelops 35 per cent. of the total mass of the star. When the shell, for example, corresponding to the transformation of lithium, has reached its maximum extent, the star undergoes a rapid process of gravitational contraction and the new shell corresponding to the next element (beryllium in this case) starts to grow from the center.

Schoenberg has investigated a special case (of particular interest for the sun and the stars of the main sequence) where the molecular weight of the stellar matter changes as the result of the nuclear transformations in the growing shell. His calculations lead to the interesting conclusion that, at the end of its hydrogen-evolution, our sun will increase in luminosity only by a factor of three and not by a factor of one