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 hundred, as was previously concluded from the old homogeneous model.

Considerable discussion followed Schoenberg's statement that in the process of shell-growth, the potential energy of the star reaches a minimum, and that the star may become unstable at this particular point of its evolution and be subject to periodic pulsations of the Cepheid-variable type. It was indicated by Teller that, according to Cowling's theory of stellar stability, pulsations of the type proposed by Schoenberg should not be expected.

On the question of the "mixing-up" process in a stellar interior, Dr. G. Randers reported his calculations of the convection-processes in rotating stars. His conclusion is that the so-called "Eddington convection currents" are balanced by the more rapid rotation of the stellar equatorial regions and hence no exchange of material between the deep interior of the star and its surface should be expected.

Following the reports on the "shell-model" the discussion shifted to the problem of the correlation of various theoretical viewpoints on stellar evolution and the observational facts on the relative abundance of stars of various types. Dr. H. Shapley gave a general survey of the observational evidence and stressed the point that the familiar pattern of the Russell diagram is essentially based on the study of one particular part of our stellar system (a large-scale region surrounding the sun) which should not be considered as a fair sample of the entire stellar universe. Indeed, it has been found that the relative number of various star-types is quite different for the central and outer regions of the galaxies; quite different results are also obtained in globular and irregular stellar clusters. Thus, in any attempt to correlate the theoretical picture of stellar evolution with the observational material, one must necessarily take into account this general stellar population in various parts of the universe.

The second important problem of the conference (mostly during the session on April 24) was that of the expanding universe and the related question of the origin of chemical elements during the early stages of the expansion. It should be noted that there is still considerable disagreement among investigators as to whether our universe is an expanding one. In a recent publication Dr. E. Hubble, interpreting the observed red-shift as due to Doppler-effect of receding nebulae, arrives at a conclusion not in accordance with geological evidence. Thus his calculated age of the universe is only about one billion years, that is, considerably shorter than the geologically estimated age of the earth. However, Gamow indicated that Hubble's result is based on the distance-scale obtained by assuming that the intrinsic luminosity of nebulae remains constant even if their ages differ by hundreds of millions of years. The above-mentioned discrepancy is easily explained by assuming that the luminosity of nebulae may decrease during such long periods of time by a few per cent. A decrease of this order might well be expected because of changes during stellar evolution and the escape ("evaporation") of stars from separate nebulae. Thus the solution of the problem of the expanding universe must await more information regarding the evolutionary history of separate nebulae.

The other angle of the problem was discussed by Dr. L. H. Thomas, who reported his attempt to explain the red-shifts in the spectra of distant light-sources as resulting from the interaction of the traveling light-quanta with the free electrons in interstellar space. His calculations were entirely on the basis of classical electrodynamics, but there is still the question whether his result will hold in quantum-mechanical treatment.

It is, however, desirable to retain the hypothesis of the expanding universe, since it provides a basis by which a great many phenomena may be explained. The most important of these is the riddle of the origin of chemical elements—a process requiring high temperatures and densities such as could have existed only in the early stages of an expanding universe. It may be easily shown that under the most extreme conditions now existing in the interior of various stars, only the lightest elements of the periodic system could be transformed from one to the other. To explain the presence and the observed relative abundance of all heavier elements—in particular the existence of uranium, thorium, etc.—one must necessarily assume that two or three billion years ago the density of matter in space exceeded ten million times that of water and the temperature was as great as several billion degrees. These are just the conditions corresponding to the early stages of the expanding universe.

The attempts to explain the observed relative abundance of various chemical elements have been hitherto followed in two different directions: (1) That the present abundance arises from some kind of chemical equilibrium between various nuclei at certain high temperature and density; (2) that the origin of elements is a breaking-up process similar to the recently discovered process of uranium-fission. Both points of view were discussed during the second session of the conference and it was agreed that the second point of view is the more probable. In his report on the "equilibrium-theory" Chandrasekhar indicated that the observed abundance of the elements from oxygen to argon may be well represented by an equilibrium-state corresponding to a temperature of 8×10^9 °C and density of 10^7. On the other hand, the abundance of heavier elements calculated under these assumptions decreases much too rapidly; thus the computed abundance of the elements at the end of the periodic table is 10^{10} times smaller than the observed values. Empirically, the abundance-curves run almost horizontally, beginning at the middle of the periodic system which, as it is easy to see, can not correspond to any state of chemical equilibrium.

Discussion centered mainly around the possibility that the heavy elements originated at still higher temperature and density and that their relative proportions were later "frozen up" in the process of expansion. This discussion led to the conclusion that the "freezing up" process could hardly take place since, in the presence of free neutrons, heavy elements would be transformed into light ones (through the "neutron-evaporation"), even at much lower temperatures. It seems, therefore, more plausible that the elements originated in a process of explosive character, which took place at the "beginning of time" and resulted in the present expansion of the universe. Some details of such breaking-up process of the heavy fragments of primary nuclear matter which would finally lead to the ordinary nuclei of the known stable elements were discussed by Teller.

The third day of the conference was devoted to fundamental problems of physical constants and the properties of elementary particles. Teller presented his criticism of Dirac's recent view that the number of elementary particles in the universe and also the value of the gravitational constant are slowly changing with time. He indicated that, assuming Dirac's hypothesis, one would expect large changes in the luminosity of the sun, which is contrary to geological evidence.

Thomas presented his recent attempt to build up a formalism for consistent quantization of the electromagnetic field which would eliminate the difficulties inherent in the infinite self-energy of elementary particles.

Dr. W. Pauli discussed the theory of the "meson" on the assumption of zero-spin and concluded that this assumption is not very satisfactory.

Twenty-six investigators from 15 universities and research organizations took part in the conference. These were: British Central Scientific Office (Greenwich Observatory), R. d'E. Atkinson; Carnegie Institution of Washington, J. A. Fleming; Catholic University of America, K. F. Herzfeld; University of Chicago (Yerkes Observatory), S. Chandrasekhar, G. Randers and M. Schoenberg; Columbia University, W. E. Lamb, A. Nordsieck, F. Perrin and S. Rosenblum; Harvard University, C. L. Critchfield and H. Shapley; Institute for Advanced Study, W. Pauli; the Johns Hopkins University, D. R. Inglis; Ohio State University, L. H. Thomas; Princeton University, S. Rosseland; National Bureau of Standards, G. Chertog; Navy Department, Bureau of Ships, R. Richtmyer; Naval Ordnance Laboratory, T. Page; Naval Research Laboratory, R. Gunn; George Washington University, H. V. Argo, Th. B. Brown, G. Gamow, Miss M. F. Langs, R. J. Seeger and E. Teller. Several leading nuclear physicists and astronomers from various parts of the country who had also accepted invitation to take part in the conference could not do so because of urgent unexpected demands of their national-defense problems.

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REPORTS

THE FIRST ANNUAL REPORT OF THE CHAIRMAN OF THE NATIONAL SCIENCE FUND

LAST year when the Board of Directors[1] of the National Science Fund met to complete the organization of the National Science Fund, our country was still at peace. On December 7, 1941, midway in the first year's development program, it was necessary to stop and reconsider the aims of the fund and to determine whether under war conditions the National Science Fund could and should continue. The Executive Committee concluded that although the National Science Fund may not stand in the full current of military progress, war makes it imperative to put forth our greatest efforts to assure continued adequate support for basic research in science. Even though fundamental research should fail to produce a single discovery applicable to the war, it still would be essential to the future peace. Vice-president Henry A. Wallace has made it clear that he understands how important it is for us to face these realities: "From the practical standpoint of putting first things first, at a time when there are not enough hours in a day and every minute counts, planning for the future

[1] The Board of Directors for the year 1942–43 is composed of the following: *Chairman:* William J. Robbins; *Vice Chairman:* Winthrop W. Aldrich; Roger Adams, James R. Angell, James F. Bell, Albert F. Blakeslee, Isaiah Bowman, Arthur H. Compton, James B. Conant, Edwin G. Conklin, John W. Davis, Luther P. Eisenhart, Homer L. Ferguson, Herbert S. Gasser, Walter S. Gifford, Ross G. Harrison, Carlton J. H. Hayes, Herbert Hoover, Jerome C. Hunsaker (Treasurer), Frank B. Jewett, Ernest O. Lawrence, Frank R. Lillie, Archibald MacLeish, Robert A. Millikan, Harvey S. Mudd, Alfred N. Richards, Elihu Root, Jr., Harlow Shapley, Tom K. Smith, Lewis L. Strauss, Harold H. Swift, George H. Whipple.