electroscopes, first without lead shields and then with lead shields 3.1 cm. thick, we have been able to show that certainly 20 per cent. of the cosmic-ray particles existing at 22,000 feet have energies under 115 million volts, as heretofore shown, and since the rays found at that altitude are quite homogeneous a very large percentage is presumably under that energy.

All these new but very direct approaches to the energy problem seem, then, to leave no escape from the conclusion that though the mode of approach to energy through absorption coefficients can no longer be relied upon, yet *the major part of the ionization of the atmosphere by cosmic rays is due to incoming rays of an energy corresponding in order of magnitude to the synthesis of one of the lighter elements out of hydrogen.* Whether this chief band corresponds better to the energy of formation of helium out of hydrogen or of oxygen out of hydrogen these direct methods are not yet sufficiently precise to determine, though it is hoped that they may soon be made so.

It seems to be becoming popular now for the astronomers to use this synthesis-hypothesis instead of the annihilation hypothesis to explain the evolution of the heat energy by the stars. Indeed, the annihilation hypothesis seems at present to be in a state of eclipse, and the question may then be raised whether synthesis can explain both the cosmic-ray and stellar energy. There is no reason why it may not be called upon for both purposes, but with a different mechanism. The most essential element in the foregoing hypothesis as applied to the cosmic rays is the formation of clusters of hydrogen atoms which I have called hydrogen dust, and of course such clusters could not possibly either be formed or hold together save a exceedingly low temperatures, where there are ver few impacts to destroy them. This kind of atom synthesis would then be one in which a heavy nuclei might be formed out of hydrogen by one single clamping act. If this kind of an act were possible in th atmospheres of the stars we should of course obtai cosmic rays from stellar sources, which we do not d In Professor Lawrence's experiments, however, v find synthesis taking place when hydrogen atoms a thrown with enormous energy into the nuclei of oth atoms, and of course this kind of process may tal place inside the stars because of the enormous ter peratures existing there, so that it is at least concei able that within the stars atomic synthesis results this step by step atom building while out in inte stellar space the other catastrophic type of ato building occurs.

There is one final result of all our recent measurments, both with airplanes and with balloons ascening close to the top of the atmosphere, with which might conclude. It is that according to our estimat the total cosmic-ray energies falling into the earth approximately one half of the total energy coming from the stars, while, inasmuch as the stellar energ is much more intense in our galactic system than intergalactic space, the cosmic energy out there is ver much more intense. From the astronomical estimat of the distribution of the nebulae we conclude that t total radiant energy in the universe existing in th form of cosmic rays is from 30 to 300 times great than that existing in all other forms of radiant energ combined.

A HISTORY OF THE NATIONAL RESEARCH COUNCIL 1919--1933

VIII. DIVISION OF ANTHROPOLOGY AND PSYCHOLOGY[1]

By Professor A. T. POFFENBERGER
CHAIRMAN

THE Division of Anthropology and Psychology is an offspring of two committees of the Division of Medical Sciences of the National Research Council, namely, the Committee on Anthropology and the Committee on Psychology. In the course of a reorganization of the Council following the Armistice, these two committees were invited to consider plans for the formation of "sections" of the Council. A happy decision of the far-sighted representatives of these two fields, at a meeting on October 20, 1919, consolidated anthropology and psychology into the single divisi as it now exists.

This newly constituted division, at the first meeti after its authorization, adopted the following obj tives: (1) To coordinate research activities now progress or in prospect; (2) to encourage the dev opment of research personnel, by a systematic sear for promising material, by furnishing to possil research students information about facilities a opportunities, and by fostering the establishment fellowships and facilities for training; (3) to fos a small number of selected research projects; and (to act *in an advisory capacity* on research proje

[1] This is the eighth of a series of ten articles prepared to describe briefly the nature of the activities with which the National Research Council has been engaged during the past fourteen years.

within our field, when such counsel is requested by *duly constituted agencies.*

These objectives have formed the guiding principles of the division during the thirteen years of its existence, and have unified the varied activities of its frequently changing personnel. Particularly important was the clear intention to act as adviser only when such counsel is requested, rather than to attempt to dictate policies to the research workers of the country.

The early activities of the new division were largely influenced by interests aroused through the exigencies of war. With the restoration of normal conditions, however, theoretical problems, whose importance some members had stressed from the beginning, and practical studies less intimately linked with Government agencies, came to play a larger and larger part. However, a Committee on Military Psychology, to which problems could be referred, persisted in a dormant condition until 1930.

The interest naturally aroused by the war in the diverse constituents of our population led to the study of racial groups in the United States. Several committees were organized to attack relevant problems, notably those on "An Anthropological and Psychological Study of the People of the United States," and on "Analysis of Army Data," and especially that on "Scientific Problems of Human Migration." This last committee, formed in 1922, numbered in its membership representatives of biology, sociology, anthropology and psychology. In psychology many projects were organized, notably those on the construction of an international mental test, on the measurement of primitive forms of human response, and on the measurement of mechanical abilities. Immediate results could not be expected in projects of such magnitude. However, "there have been added in the way of research experience and equipment, a series of tests to minimize language handicaps in mental measurement; a special group of tests for rating and analyzing mechanical aptitude; some fundamental pioneering in the analysis of personality; . . . an attempt to reach the fundamental psycho-neural responses upon the basis of which to project tests of social effectiveness; an effort to develop an approach to organic differences in peoples through pathological data; and an attempt to test out qualitative anthropometric characters as a method in the analysis of races."

Allied in technique to racial testing, but with distinct objectives, the work on the National Intelligence Tests represents another major activity of the division. As early as 1919 a committee was invited to capitalize the research on tests carried on during the war by developing and standardizing an intelligence scale for the group examination of school children. A set of such tests was prepared by experts selected by the division, and published by the World Book Company of Yonkers, New York, under contract with the National Research Council. Through the distribution of approximately seven million copies of the various scales and forms of this test, a needed impetus was given to the movement for the examination and mental classification of school children.

Among the earliest and most successful activities of the division are those of the Committee on State Archeological Surveys. Originally limited in scope to the problems of four Midwestern states, it has gradually extended its operations until to-day it is one of the recognized scientific agencies of the country. It coordinates the work of institutions employing trained specialists, educates amateurs in matters of scientific technique and strives to prevent the spoliation of sites and the destruction of evidence through uninformed vandalism. It has created a Ceramic Repository at Ann Arbor, Michigan, title to which is vested in the National Research Council. It publishes an annual report in the *American Anthropologist* of all "archeological field investigations in the United States and Canada," and maintains a directory of individuals and organizations in North America interested in anthropology. The publication of the "Guide Leaflet for Amateur Archeologists" and of another by a related committee, "In Quest of Glacial Man" (the latter intended for the guidance of contractors and engineers in the course of deep excavations), has done much to arouse an interest in the preservation of valuable archeological materials.

A Committee on Child Development was created in 1924 as a successor to a committee on child welfare which had cooperated in an advisory capacity with the office of the Surgeon General of the Public Health Service before the establishment of the Division of Anthropology and Psychology. It was felt that a more active committee representing "the institutes and other research workers in the field of child welfare could play a useful part in bringing the workers together, assisting them to think out their problems, establish their standards and coordinate their work." This committee, comprising representatives from psychology, anthropology, genetics, pediatrics, nutrition and medicine, has periodically circulated a digest of the pertinent literature on child welfare to those engaged in research, has awarded a series of 116 scholarships and 14 fellowships for the training of experts in the field of child development where personnel was lacking, and has performed a coordinating function among the various institutes for child welfare and the isolated workers through conferences and the visits of an executive secretary.

An interest in the human factors in highway regulation and safety, which developed within the division in 1922, crystallized in 1924 into a Committee on the Psychology of the Highway. Many specific problems have been attacked and substantial results achieved. The report of a part of this work appeared under the title "Psychological Principles in Automotive Driving" (1931). The studies coming within the range of this committee have involved the active collaboration of psychologists with physicists, optometrists, engineers, commercial organizations and officials connected with the regulation of traffic. This project furnishes an excellent illustration of how a small initial expenditure by the Council may stimulate far greater contributions from other sources and result in achievements of a recognized importance.

Experiences with rotation tests for aviators during the war led to a conference on the subject in 1920, followed by the organization of a committee on Nystagmus, later known as the Committee on Vestibular Research. Membership on this committee was extended to the Divisions of Biology and Agriculture and of the Medical Sciences, and a series of research projects of both theoretical and practical importance was outlined. Among these were researches on the mechanisms of nystagmus within the ear and within the brain stem and cerebellum, and the influence of habituation and of retinal and other forms of sensory stimulation upon reaction to vestibular stimulation.

A conference called in 1928 to prepare an adequate formulation of the problems relating to the deaf and hard of hearing resulted in the appointment of a Committee on Research for the Deaf and Hard of Hearing, comprising representatives from the fields of psychology, physics, otology and from institutions for the training of the deaf. This committee enlisted the services of some fifty specialists to deal with such problems as the measurement of capacity and achievement in the deaf, their emotional and social adjustments, methods of instructing the deaf, and special aids to hearing. A consolidated report of the activities of these subcommittees was presented to a second conference held in 1929, to which sixty-seven specialists from various fields were invited. Although financial support for a program of research in its entirety has been lacking thus far, interest has been maintained and activity continued to the present by way of a Committee on Auditory Deficiency, whose membership coordinates all the interests concerned in the problems of the deaf and hard of hearing. Aid has been secured for several specific pieces of research suggested in the composite plan adopted by the second conference, and it is known that others have been begun independently.

The youngest committee of the division, appointed in 1931, is that on psychiatric investigations, which has for its object a preliminary survey of the present state of psychiatry, its scientific foundations and therapeutic technique. The program comprises the enlistment of representatives of six aspects of psychiatric work, each of whom has presented his case in writing. These written reports are to be discussed and revised and offered to a wider circle of critics for constructive discussion. It is too early to predict the outcome of this committee's work, but it has immeasurable theoretical and practical potentialities for clarifying and systematizing this difficult field.

It is impossible, within the space available, to review the work of the many other committees of the division, dealing with vital psychological and anthropological problems. Among these are: the committee on the gifted student problem (1920–25), growing out of an earlier committee on research talent, which is responsible in large measure for the present interest in the gifted college and university student; and the committee on the experimental study of human emotions (1926–28) which held conferences and prepared a systematic research program not actively prosecuted because of lack of financial support. Something should be said, however, of the Committee on Psychological Abstracts, which cooperated with the American Psychological Association in promoting an abstract journal of psychological literature. Beginning in 1919, plans were formulated and financial aid sought, with the result that early in 1927 the first number of *Psychological Abstracts* came from the press. It was at once accepted as the indispensable tool of every active psychologist. Similarly, the publication of an index to the first forty volumes of the *American Anthropologist* has been appreciated in that field.

There have been numerous conferences, which have rendered valuable service in specific fields. For instance: there was a conference on experimental psychology (1928) to consider the needs of laboratory psychology and to seek means of encouraging its growth. Among its recommendations was the establishment of a National Institute of Psychology, which has since been independently incorporated; a conference on State Archeological Surveys in 1929, which greatly augmented interest in the preservation of valuable archeological materials throughout the Middle West; a somewhat comparable conference on Southern Prehistory to discuss similar problems in the southeastern United States, held in 1932; a joint conference (1930) with representatives of the Social Science Research Council for consideration of a specific plan for the study of racial differences in the growth period, whose results have not yet materialized; a conference of editors and business managers of anthropological and psychological periodicals which

discussed problems and united on a series of recommendations to authors and editors; a series of three conferences on the measurement of individual differences (1930–31), reports of which were made available for distribution and have enjoyed a wide circulation.

Since the creation of the Board of National Research Fellowships in the Biological Sciences in 1923, seventy-two awards have been made in this division—58 in psychology and 14 in anthropology, being approximately one third of the applications in psychology and one half of those in anthropology. Any attempt to arrive at an objective evaluation of the effects of such fellowships is beset with peculiar difficulties. The effect should be cumulative over the years. Nevertheless, it has been shown by a statistical survey of the fellows in psychology that they stand well in the upper third of their associates in the judgment of those who know them. The less tangible results in the way of keeping alive the spark of enthusiasm for pure research in those who might otherwise fall by the wayside can never be computed.

The Division of Anthropology and Psychology initiated (1929) another program of the National Research Council in aid of scientific progress, second only to the fellowships in importance; namely, the grants-in-aid of research. Financial aid, usually in small amounts, is awarded to individuals to cover needs that can not otherwise be met, in the way of apparatus, materials, technical assistance and, in special cases, field expenses. Aid of this nature has been extended to twenty-five individuals in anthropology and to twenty in psychology in amounts which average between five and six hundred dollars. Results of this service are difficult to compute in tangible units, but the encouragement of the isolated research worker, and the stimulation of institutions to support their own research will alone justify the existence and the continuation of such awards.

The Division of Anthropology and Psychology is at the same time a unit of the National Research Council and an assembly of representatives of the sciences of anthropology and psychology in the United States. With a minimum membership of nineteen, comprising a chairman and vice-chairman, and delegates chosen by the American Psychological Association, the American Anthropological Association and the Educational Research Association, together with six delegates-at-large nominated by the membership in session, it is and should be a medium for the facilitation of expression and for coordination of research in anthropology and psychology.

The following persons have served as chairmen since the organization of the division:

1919–1920—W. V. Bingham
1920–1921—Clark Wissler
1921–1922—C. E. Seashore
1922–1923—Raymond Dodge
1923–1924—Albert E. Jenks
1924–1925—R. S. Woodworth
1925–1926—George M. Stratton
1926–1927—A. V. Kidder
1927–1929—Knight Dunlap
1929–1930—Fay-Cooper Cole
1930–1931—Madison Bentley
1931–1932—Robert H. Lowie
1932–1933—A. T. Poffenberger

SCIENTIFIC EVENTS

BEIT MEMORIAL FELLOWSHIPS

A MEETING of the trustees of the Beit Memorial Fellowships for Medical Research was held on July 11, at which the annual report was adopted.

Fellowships during the present year were held by twenty-five workers, this number including one special fellowship of £1,000 in tropical medicine.

Among the distinctions gained during last year by past Beit fellows the trustees are glad to record the election of Dr. A. S. Parkes to the fellowship of the Royal Society, he being the fifth fellow who has now received that honor. Professor D. T. Harris has been appointed to the chair of physiology at the London Hospital, and Professor I. de Burgh Daly to the chair of physiology in the University of Edinburgh. Dr. G. F. Marrian was awarded the W. J. Mickle fellowship of the University of London for 1932, in sequence to another Beit fellow, Dr. P. Eggleton, in 1931.

The deed creating the Beit Memorial Trust in 1909 gave the trustees power after the expiration of twenty years to alter in some respects the regulations for award of fellowships, and they have now resolved to exercise that power in one important direction.

The opportunities for medical research have altered greatly since the trust was established. In 1909 there were in England only a few studentships. The single gift by Sir Otto Beit, with its annual income of £11,000, straightway added thirty junior fellowships to the number. This benefaction a few years after Lord Iveagh's gift of £250,000 for the building and endowment of the Lister Institute marked the beginning of the great stream that now gives such enrichment of the opportunities for scientific medicine in England.

Government help soon followed on an even greater scale, providing through the Medical Research Committee in 1914 and through the clinical units created by the Board of Education in 1919 an annual revenue now approaching £180,000, of which a not inconsider-