development of savanna types of country, presumably resulting in serious exposures of the larger reptiles at least, to almost direct untempered insolation.

Although no information is available it is probable that in common with the terrestrial poikilothermous vertebrates of to-day, the early Mesozoic reptiles may have relied upon a suffusion of melanin or other comparable heat-absorbing pigment for temperature regulation, a characteristic which appears to be of vital importance in the survival of desert lizards in order to achieve and control the body temperatures requisite for the normal functioning of physiological activities. The necessity for pigmentation by heat-absorbing substances would seem to have been particularly necessary if the commonly accepted concept of dense vegetation, heavy blanketing clouds and abundant water vapor existed on and above the earth's surface during Triassic, Jurassic and early Cretaceous times. With such pigmentation and lacking the capacity for color change, progressive reduction in the amount of water vapor or clouds would be accompanied by a disastrous rise in the body temperature of exposed reptiles. It is notable that desert snakes with no known capacity for color change are almost altogether either crepuscular, nocturnal or subterranean in habitat. The diurnal racers appear to survive excessive heat through their capacity for swift retreat to shade and in hot weather the trend is toward a crepuscular existence.

Additional evidence for progressively higher temperatures appears to be provided through the thermal evolutionary sequence as seen in the changes exhibited from the fishes to mammals and birds in which there is a distinct tendency toward the adoption of progressively higher body temperatures with an increasingly unfavorable susceptibility to cooling. This trend toward the optimum temperatures of complete homoiothermism and its perfection in the birds may reflect a gradual development in the environment of conditions feasible for the initial steps toward thermal control without excessive expenditures of energy due to internal-external temperature discrepancies, that is, in a gradual increase in available heat.

A much confused but apparently similar thermal-evolution relationship among plants is highly suggestive.

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SCIENTIFIC BOOKS

THE CARNEGIE INSTITUTION OF WASHINGTON AND DR. MERRIAM

Published Papers and Addresses of John Campbell Merriam. Publication No. 500, The Carnegie Institution of Washington.

Cooperation in Research. Publication No. 501, The Carnegie Institution of Washington.

MANY readers of SCIENCE doubtless noted with interest that Dr. John Campbell Merriam, president of the Carnegie Institution of Washington since 1921, had retired on December 31, 1938, in order that he might be free to devote his time to research and writing, and that the board of trustees of that institution, in appreciation of his far-sighted leadership, had appointed him president emeritus, with provision for the support of his studies.

Soon afterward the trustees also made arrangements for the publication of a testimonial volume to Dr. Merriam (Publication No. 501). Previously to this, the trustees had authorized the republication of the "Published Papers and Addresses of John Campbell Merriam"; this publication (No. 500) fills four large volumes, comprising 2,672 pages, an index, a bibliography and many illustrations. Both publications are of exceptional importance not only because they contain a great mass of valuable scientific and educational records and results, but also because they afford abundant evidence, direct and indirect, of the development of the Carnegie Institution itself under the influence of Dr. Merriam's far-reaching and constructive methods and philosophy.

Neither Dr. Merriam nor the Carnegie Institution could ever be fairly classed with those who learn "more and more about less and less"; they stand indeed at the opposite pole from that famous senior wrangler who gloried in the practical uselessness of his subject. Professor Chester Stock's appreciative article at the close of Publication No. 501 makes it clear that Dr. Merriam, a student all his life, has never ceased to extend and develop his first-hand knowledge of many sciences: botany, paleobotany, invertebrate paleontology, geology, vertebrate paleontology, archeology, anthropology and related fields; also that as an administrator he has gained such an insight into the methods and objectives of the physical sciences, history and philosophy that he has achieved far-reaching success in organizing and integrating the activities of many otherwise disconnected agencies in these diverse fields.

With this clue in hand we may thread our way with rising enthusiasm through the far-flung labyrinth of his scientific papers and addresses. However, the future historian who desires to study the earliest published writings of Dr. Merriam will be disappointed when he turns to the bibliography and reads the statement: "Not listed are several short articles between 1889 and 1891," which articles one would naturally

search for possible early indications of the trends which characterize Dr. Merriam's maturity. The first paper of Volume I is Dr. Merriam's doctorate thesis in the University of Munich: *"Ueber die Pythonomorphen der Kansas-Kreide."* This work by a young man of twenty-four is a finished piece of analysis, ending in an illuminating table of the contrasts of the three leading genera of American Cretaceous mosasaurs. It would do credit to a paleontologist of many more years of experience. At Munich he evidently found in his famous master, Professor Karl A. von Zittel, the clarity and precision in analysis and the insight that results in synthesis, which have always been the rocks upon which he has built. (We trust, by the way, that Dr. Merriam will not resent our analyzing him as he has analyzed his mosasaurs, ichthyosaurs and Tertiary mammals!)

The necessary limitations of space prohibit more than a mention of Dr. Merriam's papers (1895–1908) on the Triassic Ichthyosaurs of California and Nevada, culminating in his great monograph of 1908. This may safely be characterized as one of the major documents of vertebrate evolution and should be on the list of seminar discussions for all graduate students in that field. Regretfully we must pass over Dr. Merriam's intensive and extensive explorations and studies of the geology and paleontology of the John Day Basin of Oregon (Oligocene), of the late Tertiary and Pleistocene faunas of California, Nevada and Idaho (Vol. I and Vol. II in part) and his numerous papers on the Pleistocene mammalian fauna of the famous "tarpits" at Rancho La Brea, which the visitor to Los Angeles may now view both at Hancock Park and the Los Angeles Museum (Vol. II in part). Nor may we do more than refer to the "Tertiary Mammalian Faunas of the Mohave Desert," containing, with other papers in Volumes II and III, most important documents of mammalian evolution during the late Tertiary.

With his vast experience in the history of vertebrate and invertebrate life it was almost inevitable that Dr. Merriam should also take a special interest in the paleontological evidence bearing on the origin and emergence of man, especially in Western North America. All that may be said here is that he has succeeded, largely by direction of researches supported by the Carnegie Institution, in bringing to light much new evidence of the association of human artifacts of relatively advanced cultural stage with a mammalian fauna which has the aspect of late Pleistocene or early Recent provenience; the age of which in a recent memoir by Edgar B. Howard is tentatively estimated as of about 10,000 years. Thus Dr. Merriam's work tends strongly to confirm the relatively late arrival of man in America as compared with his history in Europe and Asia.

The fourth volume is devoted chiefly to Dr. Merriam's numerous addresses and papers relating to history, biography, problems relating to nature, research and publication, research and government, Carnegie Institution addresses and extracts from presidential Annual Reports.

When in 1936 Dr. Merriam was awarded the gold medal of the American Institute, the present writer referred to him as "both author and interpreter of an epic poem of unsurpassed grandeur. This poem is not written in verse but in the sober language of science. It is the epic of the history of vertebrate life on the Pacific coast, and the story is told in a long series of publications, chiefly in the bulletins of the Department of Geology in the University of California, but of late years also in the paleontological memoirs and papers of the Carnegie Institution of Washington. More than sixty localities scattered over California and the adjoining states have yielded the historical documents, in the shape of fossilized animal and plant remains, upon which this great epic has been built up."[1] With the fuller documents contained in Volumes I–IV of Publication 500 before us, the foregoing citation is seen to be even an understatement.

The volume "Cooperation in Research" (Publication 501), by staff members and research associates of the Carnegie Institution, comprises fourteen papers on the physical sciences, thirteen on the biological sciences, seven on history (mostly American archeology), five on paleontology and geology, three on philosophy and interpretation. In the first paper, entitled "An Adventure in Scientific Collaboration," Dr. Arthur L. Day, chairman of the Advisory Committee in Seismology, describes the large-scale cooperation between the Carnegie Institution as a whole and numerous other research foundations, the end being the development of the science of seismology from an "uninspiring status" to its present prominence and importance. During the course of this work the U. S. Coast and Geodetic Survey, the U. S. Geological Survey, the Navy Department and other government agencies collaborated with various universities, observatories and geological societies of California, and their work was supported and endorsed by still another group of organizations. The results have contributed greatly to the knowledge, not only of earthquakes and their causes, but also of the physical properties of the successive zones of the interior of the earth, of the conditions under which the oceans and the continents are held in equilibrium, as well as those under which severe disturbances of the rock strata take place.

For cooperation on a smaller scale among the members of a special group, one may turn to the paper by

[1] *The Scientific Monthly*, 42: 4, 377–380, April, 1936.

the editor of the publications of the institution, Dr. Frank F. Bunker, on "Cooperative Research, Its Conduct and Interpretation." As an example of the fruitful results that may be obtained by the functional integration of a closely cooperating group, the editor selects the story of the activities of the Division of Plant Biology, under direction of Dr. H. A. Spoehr, in research on photosynthesis from the year 1911 through twenty-eight years.

Dr. Bunker explains the success of scientific research in our times as due to the same principle of cooperation. He writes:

> Again, as never before, there is team work among investigators who recognize neither national nor group boundaries. Neither are there "trade secrets" in scientific research. Progress reports are continually being interchanged among the workers throughout the world and thus each shares what he has learned with all the others; so, also, each borrows from others and builds upon what he borrows.
>
> An army of investigators, then, trained for the tasks, relieved of economic worry, supplied with every facility required, and working in tacit cooperation, accounts for the epoch-creating achievements now being made in the various fields of scientific research.

In the Year Book of the Carnegie Institution for 1934 Dr. Merriam wrote:

> As yet comparatively little attention has been given to the idea that science may have made its most noteworthy contribution through influences which aid in determining attitudes of mind and objectives. In other words, we have been concerned more largely with discussion of the extent to which science affects our environmental conditions than with the possibility that it helps to give us new points of view and a bettered attitude toward life. The great significance of this difference becomes apparent when we consider that influences determining point of view and attitude furnish major sources of human initiative, and are among the most important guiding elements in life.

These sentences take on new and startling aspects when we consider to what extent diverse points of view and attitude have determined conflicting human initiative within the past few months.

Thousands of people have doubtless gained a wider perspective and "a bettered attitude toward life" both from Dr. Merriam's own writings and from the numerous scientific and educational activities that have been sponsored by the Carnegie Institution under his guidance. Meanwhile "Cooperation in Research" affords a small-scale model of a cooperating society of diverse groups working in harmony, toward which a war-torn Europe may yet turn.

WILLIAM K. GREGORY

REPORTS

WORK OF THE CANADIAN NATIONAL RESEARCH COUNCIL

THE twenty-first annual report of the National Research Council has been issued. The work of the council falls naturally into two main divisions: the research investigations carried out in the laboratories at Ottawa, and the activities of the numerous committees that have been organized by the council to investigate specific problems and sometimes to plan and direct research which may be carried on in the universities or other institutions having special facilities for studies in certain subjects.

Special mention is made in the current report of the formation of the Associate Committee on Medical Research under the chairmanship of Sir Frederick Banting, co-discoverer of insulin. The method of forming this committee may be considered as typical. Preliminary discussions by representatives of the Canadian Medical Association, Royal College of Physicians and Surgeons, the Department of Pensions and National Health and the National Research Council resulted in the calling of a conference for the consideration of all matters relating to medical research in Canada. At this conference a composite picture of medical research was presented when each institution represented at the meeting reported on the scope of the researches on which it was engaged. On the recommendation of the conference the Associate Committee on Medical Research was formed.

Since then the correlation of medical research in Canada has been fostered through interchange of visits by research workers and group-planning of investigations in many fields. A distinct contribution to the furtherance of organized research in the medical field has thus been made.

Similar committees function under the council in many fields: aeronautics, asbestos, coal classification and analysis, field crop diseases, fire hazard testing, forestry, gas research, laundry research, leather, magnesian products, market poultry, metallic magnesium, parasitology, plant hormones, potato research, radio, radiology, survey research, weeds and wool.

In the laboratories there are four main divisions: biology and agriculture; chemistry; mechanical engineering, including aeronautics and hydraulics; and physics and electrical engineering. Supplementing these are a section on codes and specifications and the research plans and publications section. In addition there are the general administrative services necessary to such an organization.

Direction of the National Research Laboratories is vested in the president and all matters of policy are