method by which the activity is initiated may vary in different cases, but whether it depends on two sorts of cell, one producing an excitant, the other responding to it, or on a single cell type producing its own excitant does not affect the conclusion that there do exist systems which are rhythmically active without external excitation, either in the form of nervous input or alterations in blood composition.

Seeking New Evidence

It is thus clear that no new type of nerve function has to be postulated to account for the action of the centers that are responsible for endogenous behavior patterns. Our present knowledge of neurophysiology is sufficient to provide two possible models, the one depending on reflex excitation by way of intracentral receptors, the other on locally produced excitants. The difficulty is to devise experiments that will enable us to decide between the two possibilities. The difficulty arises from the fact that, even if they are basically self-excitatory, the centers that are concerned with endogenous patterns must be subject to some modulating influences exerted by blood composition serving to correlate and integrate their activities. One might, for instance, be tempted to conclude that if vacuum sexual activities never occur in a castrated animal, then there can be no autoexcitant production in the relevant centers. This does not follow, since clearly there would have been selection, in the past, to limit the production of any such autoexcitant to a level which remains subliminal in the absence of the appropriate hormone; otherwise the animal will waste its energies in behavior which is inappropriate, or which it is incapable of carrying to its functional conclusion.

A direct attack, by excising centers and finding out whether an excitant is extractable from a center that was just about to discharge at the moment of death but not from one which was not ready to react, is feasible but has not yet been attempted. In view of the variety of substances that are extractable from the central nervous system, this is probably a type of experiment in which the chance of getting a meaningful answer is small.

A second method of investigation lies in further exploitation of the technique of stimulation of brain centers with implanted electrodes. With this technique it has already been possible to locate areas whose stimulation results in the performance of normal patterns of behavior. A full "mapping" of any one species would make it possible to study such things as the variations in threshold, in relation to previous activity, of any particular center, the effects on it of removal of its connections with other areas, or the effects of simultaneous stimulation of other centers or of alterations in blood composition, to name only the most obvious possibilities. Until such investigations have been made, it is premature to assume that the types of behavior that are studied by the ethologists cannot be based on the same sort of nervous functioning that simpler reflex forms of behavior are based on, or to abandon the view that the complexities of the central nervous system are based on complexities of arrangement and interconnection. At the same time, it must be recognized that, although the idea of centers' generating their own excitation may not be attractive to physiologists, autoexciting systems are not unknown in their own domain of physiology. The fact that, in vertebrates, such systems have been clearly demonstrated only in peripheral organs like heart and gut does not prove that they cannot exist within the central nervous system.

It is unfortunate that the use by ethologists of such descriptive expressions as "accumulation of action-specific energy" has, in the past, tended to repel physiologists and conceal from them the fact that the work of the ethologists has brought to light phenomena of extreme importance for the understanding of behavior—phenomena which demand analysis not only on their own level, by the methods of ethology, but simultaneously by physiological techniques. Prechtl concludes his paper by expressing the hope that it will not only serve to bring to the notice of ethologists some of the more recent developments in neurophysiology but will also draw to the physiologists' attention problems raised by ethology which only physiological techniques can solve. "'Tis a consummation devoutly to be wished." (*18*).

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W. C. Mendenhall, Geologist

Walter Curran Mendenhall devoted his life to service in the U.S. Government. It appears that even when he was attending college at Ohio Normal University (now Ohio Northern University) he was attracted to geology and, after his first field work with the U.S. Geological Survey, decided to make a career in that organization. Except for several short absences—a year at Harvard University and another at Heidelberg—he was employed continuously on the survey from 1894 until his retirement in 1943. During those 49 years, he rose from geologic aide to assistant geologist, to geologist, to chief of section, to chief of two branches (now divisions), and to director.

His first assignment to field work was with M. R. Campbell in studies of Appalachian coal fields in West Virginia, Tennessee, and Kentucky during 1895, 1896, and 1897. Following this, he was one of the small group who did pioneer exploration in Alaska, during four seasons between 1896 and 1902, with a diversion for one season in the Cascade Range with G. O. Smith. Those not familiar with frontier conditions, especially as they existed in Alaska 60 years ago, find it almost impossible to understand the physical difficulties involved in geologic work. In the early days, traverses were made on foot or in canoes along the principal streams, and mental vigor had to be maintained in the face of constant hard labor. The work in Alaska yielded 12 reports and short papers. In his summary of geologic work in Alaska in 1906, Alfred H. Brooks, then chief of the Alaskan Branch, pays tribute to Mendenhall's work.

His next assignment was the study of ground-water conditions and problems in southern California, first in the basins south of the San Gabriel and San Bernardino Mountains, then in the Mojave Desert, and then in the San Joaquin Valley. This work continued from 1903 to 1909 and yielded 12 reports and related papers. The records of this work are still essential background in the present water problems in those regions.

From 1908 until his retirement in 1943, Mendenhall held administrative assignments in Washington headquarters, first in charge of ground-water investigations, then as chairman of the Land Classification Board (later the Conservation Branch), which must classify all public lands and approve assignment of those lands to private owners. This extended from 1911 until 1922, when he was appointed chief geologist, to succeed David White. When George Otis Smith, the director of the survey, was appointed to the Federal Power Commission in 1930, Mendenhall became acting director, until 1931, when he was confirmed as director. He retired in March 1943 at the age of 72. For the next 15 years he lived quietly at his home in Chevy Chase, Maryland, playing golf, reading, and seeing his friends. In 1926 the honorary degree of Sc.D. was conferred on him by the Colorado School of Mines; in 1932 the same degree was conferred on him by the University of Wisconsin, and in 1944 he was awarded the Penrose medal of the Society of Economic Geologists.

Most of those who have served in scientific bureaus in the Government think that those who are appointed to high administrative status should have demonstrated capacity in scientific work. It is natural, therefore, that his superiors should have turned to Mendenhall, with his early splendid record in geologic field work and his demonstrated capacity as an adviser and critic in field problems, for administrative duties. That he continued in this work for the rest of his life may be explained by his high sense of duty in the execution of assigned tasks and by his feeling of loyalty to the organization. In the great growth of the survey during the war years, it was Mendenhall's chief concern that standards in men and workmanship be maintained at high level.

It may be possible to understand much of Mendenhall's life by recalling some of the influences of his ancestry, youth, and early environment. He was born in Ohio of Quaker parents in 1871, and, until he went to college, he lived on a farm under the influence of the simple forms of Quaker life. Even though in his later life he ceased to maintain contacts with the sect, much of their attitude toward life and daily demeanor had been impressed upon him. With his mother, as long as she lived, he used the forms of speech of the Quakers. In his contacts during his mature life he was friendly but reticent, more inclined to listen than to speak, and rarely speaking of his inner thoughts. Even as chief geologist and director he disliked speaking in public. In the science of geology, where progress depends on myriad observations and on thought and discussion, Mendenhall approved of discussion but disliked arguments. Quite unemotional himself, he was suspicious of fervor. Many who knew him well agree that one of his outstanding qualities was integrity in thought and action, and none who knew him ever suspected him of having a selfish purpose.

"His was a proud spirit but proud of simplicity, proud of integrity, proud of genuineness and independence and tolerance, never of place or power or trappings; and proud of reputation only as evidence that his own well-based but unassertive self-respect found support in the opinions of men." These words were written by Mendenhall in 1935 in the memorial that he prepared on the life and work of David White. The ways in which men describe their associates also reveal much of their own aspirations, understanding, and sense of values. Those who knew Mendenhall intimately agree that this description of David White reveals much of his own character, motives, and demeanor.

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R. S. Lull, Vertebrate Paleontologist

For many years, one of the most popular lecturers in science at Yale University was Richard Swann Lull, who is remembered with respect and affection by the thousands of students who took his course on organic evolution. Tall, straight, impressive in appearance, he was a gifted speaker, with unusual ability to dramatize his subject.

Lull was born at Annapolis, Maryland, on 6 November 1867, the son of Captain Edward Phelps Lull of the United States Navy, one of the original explorers of the interoceanic canal routes in Central America, and Elisabeth Burton Lull. Since his youthful ambition to follow a naval career was thwarted by deafness, he entered Rutgers University, in 1888, where he played rugby football, set a record with the 16-pound shot, and won the Suydam national science prize and sophomore oratory medal. In 1893 he received his B.S. degree in zoology and, in 1895, the M.S. degree. He accepted an assistant professorship in zoology at Massachusetts State Agricultural College (Amherst) in 1893 and there commenced his studies of the Triassic reptile footprints in the collection of nearby Amherst College. In 1903 he received his Ph.D. from Columbia University and, in 1906, came to Yale as assistant professor of paleontology and associate curator of the Peabody Museum of Natural History. He was Sterling professor of vertebrate paleontology from 1922 until his retirement, in 1936. From 1922 until 1938 he was director of the Peabody Museum and, from 1933 until 1949, editor of the *American Journal of Science.*

Dinosaurs constituted Lull's main scientific interest. He completed the monograph on the Ceratopsia, or horned dinosaurs, which had been commenced by O. C. Marsh and J. B. Hatcher, and later published a revision. He monographed the duck-billed dinosaurs and wrote many shorter reports on dinosaurs. Other large vertebrates also claimed his attention—elephants and mammoths, whose evolution he summar-