teria on which a differential diagnosis could be made with considerable accuracy; in certain observations from which not wholly convincing conclusions were drawn as to the spread of the disease, and certain methods of palliative symptomatic treatment like hydrotherapy, and more recently, increased feeding. Contrast with this the advances during the last thirty-five years, which marks the era of bacteriology. The parasitic cause of the disease was determined. The demonstration of this microorganism gave us a means of certain diagnosis of the disease; threw light on the nature of the disease process itself; conclusively settled its method of spreading; and has given the only efficient means for specific prevention and therapy.

You will be convinced from this example that advances in applied medicine lie through laboratory investigation rather than through observations made at the bedside, at least in so far as the infectious or parasitic diseases are concerned. Equally persuasive data, from the laboratory standpoint, could be given in relation to the diseases of disturbed metabolism which involve the sciences of chemistry and physiology. You will further readily believe from the complexities of this one problem that I have tried to suggest, that successful prosecution of work of this sort may well monopolize the attention of a large group of workers. The number of these workers is limited only by the opportunities that are available; a reserve supply of eager and potentially productive minds is always at hand. The work itself is, however, not self-supporting, such advances as we may be able to make in the prevention and cure of disease bringing no pecuniary reward. It is fortunate indeed for our welfare that the contributions to human health are not patented as are contributions to human comfort and luxury.

The opportunities for advances in the medical sciences come, in part through private benefaction, in part through public funds wisely administered, when, as in this university, opportunities are given not only for the dissemination of acquired knowledge, but also for its advancement. This ulitization of public funds for any particular research is justified, apart from any preconceived notion as to its promise of practical reward.

Frederick P. Gay
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CHARLES WILLARD HAYES

The geologist, geographer and explorer, known to colleagues and friends as "Willard" Hayes, died, after a long illness, at his home in Cleveland Park, Washington, D. C., February 8, 1916. He was fifty-seven years old, and in the twenty-eighth year of his professional career.

Hayes was born at Granville, Ohio, graduated at Oberlin (A.B.) 1883, and received his doctor's degree at Johns Hopkins University in 1887. His entry, in the same year, to the scientific staff of the U. S. Geological Survey was, as with most young men joining scientific bureaus of the government, a continuance of the student and research life. Hayes's studies were destined to contribute to a fuller understanding of the principles of geology and physiography; to better the methods of geological investigation and to make more practical, as well as more comprehensive and thorough, the application of geology to economic problems.

The first assignment of Hayes was as assistant to Russell, who, under the direction of Gilbert, then chief geologist, was making a general geologic section across the southern Appalachians. After a year of apprenticeship Hayes succeeded Russell, and began the areal geologic mapping, which he had satisfied himself was the only way to solve the complex structure of this region. It was in the course of this work that he demonstrated, in the folded strata, the existence of flat overthrust faults some of which have a horizontal dis-

placement of several miles, and proved that they are characteristic and essential features of Appalachian structure where the thrust was concentrated on a single fold. The discovery of these faults, the importance of which was first recognized by Hayes, and their coincident mapping in another area by Keith, with subsequent fuller elaboration by Keith, Willis and Campbell, established what may, in effect, be regarded as a geologic principle that has influenced the interpretation of geologic structures in many other parts of North America.

Meanwhile modern physiography, largely an American product, which was then being organized and made a science by Powell, Gilbert, Russell and Davis, found an enthusiastic disciple in Hayes, who, with Campbell, began to apply the principles of the new science in the interpretation of the surface features of the field in which he was at work. Their first paper, "Geomorphology of the Southern Appalachians," published in the *National Geographic Magazine,* is regarded generally as the standard work on the physiography of the region covered, and as having laid a broader foundation for physiographic investigation in general.

In 1891, Hayes participated as geologist in an Alaska expedition by Lieut. Frederick Schwatka, during which a region between the Yukon and Copper Rivers, not previously seen by white men, was traversed with topographic sketching and observations on the geology, geography and mineral resources. Some results of this, at that time very difficult exploration, including data on the northern limit of Pleistocene glaciation in Alaska, on recent volcanic activity, and on the distribution of gold and copper in the region, were contributed in the *National Geographic Magazine* for that year. To the insight then gained by Hayes of the possibilities of mineral wealth in Alaska which then was little known, was due, in no small part, the organization, later, by the Geological Survey of the systematic investigation of the geology and mineral resources of Alaska.

As Hayes became more strongly identified in the economic work of the Geological Survey, more attention was given by it to the systematic investigation of the non-metalliferous and the fuel mineral resources of the country. As a result of his special interest and personal accomplishments in this department of the survey activities, he was, in 1899, placed in charge of the newly established Section of Non-metalliferous Resources. In 1902, he was made chief geologist of the survey, in which position he continued until his resignation in 1911.

At the request of the military governor of Cuba, Hayes was, in March of 1900, detailed to make a reconnaissance of the economic geology of that island. The principal results of his observations on the island, supplemented by those of his assistants, T. Wayland Vaughan and A. C. Spencer, were contributed in a report to General Wood.

In response to a request from the State Department, Hayes was, in 1907, detailed to make a geological investigation in Nicaragua and Costa Rica, primarily for the advice of the Nicaragua Canal Commission. Some accounts of this work, which occupied also a part of the following year, were embodied in several papers, chief among which is his report to Admiral Walker, president of the commission, on the "Geology and physiography of a region adjacent to the proposed Nicaragua canal." This is a principal source of information as to the geology of that part of Central America.

On account of the interest taken by citizens of the United States in the important discoveries of oil in Mexico, and of the apprehension as to the effects of these discoveries upon the oil industry of this country, Hayes, in company with David T. Day, was, in 1909, selected to visit the new developments in the southern republic. Following his return to this country, a report was transmitted to the President, a summary of which appeared as a Senate Document (No. 79), stating that the Mexican oils were of fuel grade, being inferior to most of the American oils, and that their principal markets were likely to be found in Mexico itself and in other foreign countries.

In 1910, Hayes was, by request of the War Department, sent to Panama to procure data

relating to the geologic conditions in the Canal Zone and, especially, in the Culebra Cut. A report by him on the causes of the landslides and other failures in the sides of the cut, and of means for their prevention, submitted to the Secretary of War, was, in summary form, included in the President's message to Congress. Hayes's recommendation, which led to the appointment of a geologist to serve regularly with the Canal Commission, was a wise provision and it would appear to be no fault of these geologists that some of the subsequent disasters were not averted.

In 1901, Hayes began the study of the problems of oil and gas geology, his first investigations being in the Coastal Plain of Texas and Louisiana. Largely as a result of this work, and the growing appreciation of the enormous value of the study of geologic structure in the search for oil and gas, Hayes's services were persistently sought by private interests engaged in the development of oil pools. Finally, in recognition of his ability in oil geology and his success in the Geological Survey as organizer and administrator, he was irresistibly solicited to become vice-president and manager of the "Compania Mexicana de Petroleo 'El Aguila,'" a position which, in October, 1911, he resigned from the survey to accept and which he held until the time of his death. In the new service, he recruited a staff of young geologists, with which he was able, with most brilliant economic results, to accomplish, in effect, a geological reconnaissance of about one half of the Province of Vera Cruz, before the abandonment by the United States of Tampico and Vera Cruz, combined with illness and other circumstances, made it necessary for him to leave Mexico and his work unfinished. From this illness he never recovered.

During his career of twenty-four years in the U. S. Geological Survey, Hayes's geologic work, whether as assistant or as chief geologist, was comprehensive, original, efficient and constructive. He examined in detail and mapped the geology of sixteen quadrangles in the southern Appalachian region, for nine of which the results were published in folios of the Geologic Atlas. He made examinations of non-metalliferous deposits, iron ores, and features of geologic importance in many parts of the country. He was the author, alone or in conjunction with other geologists, of seven papers, published in the annual reports, and of thirteen in bulletins of the Geological Survey. A large number of papers were printed in the publications of various learned and professional societies of which he was a hard-working, helpful and productive member. In 1908 the honorary degree of LL.D. was conferred on him by Oberlin.

It was a privilege to be associated with Hayes. With a master mind, he was genial, philosophical and stimulating. With a penetrative insight of men and things, he sympathetically encouraged, steadied, strengthened and put on a higher level the work of his assistants, while to his colleagues he gave friendly criticism, wise counsel, and unstinted and unselfish assistance.

DAVID WHITE

A SCHOOL OF NURSING AND HEALTH AT THE UNIVERSITY OF CINCINNATI

THE University of Cincinnati has taken over the school of nursing and health of the Cincinnati General Hospital and has put it under the immediate direction of the dean and faculty of its college of medicine. The university has already been given control of the laboratories of the hospital and, through its medical faculty, of doing all the medical, surgical and research work at the hospital. Appreciating the service rendered to the people of Cincinnati by the medical faculty, the city authorities requested the university to undertake the direction of the school of nursing and health also. The university will thus be responsible for all of the educational and scientific work of the entire hospital and its various branches. When the new medical college building is completed, as it is expected it will be early next year, the work of the medical college, the pathologic institute and the school of nursing and health will be assembled in one place, as they already are in one organization.

Nursing will become a skilled and learned