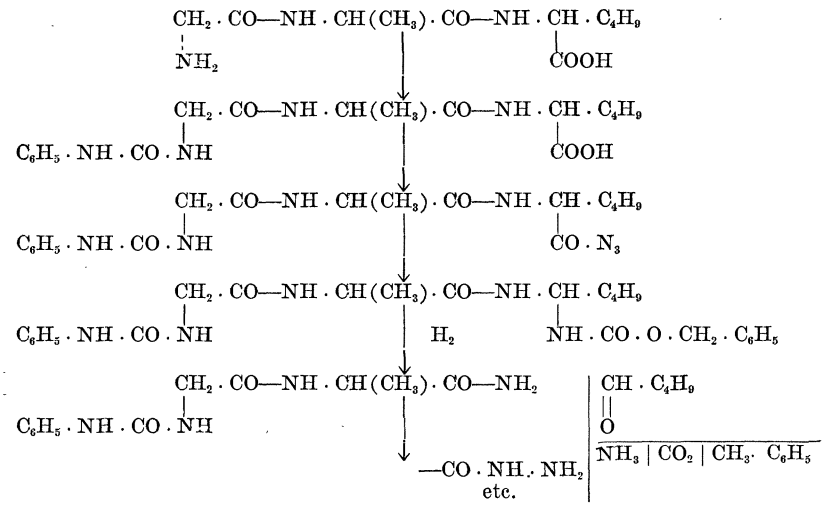
other could be detached by procedures which leave the normal peptide linkage intact.

L. Zervas and I have worked out such a method, which I should like to illustrate by the simplest example which we have studied, namely, the tripeptide, glycyl-l-alanyl-l-leucine. The first step is to block the free amino group by substitution. As a substituent we chose in the first place phenyl-isocyanate and prepared a phenylureide of the tripeptide. By thus neutralizing its basic function the tripeptide is converted into a true acid; from this the methyl ester can be prepared under very mild conditions with the aid of diazomethane. The ester is treated with the equivalent amount of hydrazine to yield the hydrazide which in turn is converted according to the method of Curtius into the azide. Such azides on treatment with alcohols readily yield urethanes. The essential point of our method consists in the fact that we choose benzyl alcohol and thus obtain a benzyl-urethane. Now we hydrogenate catalytically this urethane and are able to obtain on the one hand toluene and isovaleric aldehyde and on the other the phenylureide of glycylalaninamide. The original leucine has thus been split off in the form of the easily identifiable aldehyde containing one less carbon atom.

The remaining substituted peptide-amide can now be further treated with an equivalent amount of hydrazine, again converted into a peptide-hydrazide and through the azide with benzyl alcohol into the benzyl-urethane, etc.; the alanine is finally split off as acetaldehyde and can thus be easily identified. In this manner we are able to break down a peptide chain step by step from the carboxyl end obtaining the successive amino-acids in the form of easily recognizable derivatives.[4]



The above work was undertaken in view of the urgent need of improved analytic and synthetic methods for the study of proteins and proteolytic enzymes. Now that some progress has been made in this direction a general plan of attack on the problems of protein constitution lies at hand.

OBITUARY

WILLIAM MORRIS DAVIS

ON the fifth of February last there closed a life which profoundly affected the development of two earth sciences, geology and geography. For more than half a century William Morris Davis was a distinguished leader in these related fields. At the end of this period he possessed, in his eighty-fourth year, the same enthusiasm of purpose, the same flexibility of mind, the same penetrating powers of reasoning which made his career remarkable in the annals of American science. Only a few weeks before his death he crossed the continent during an exceptionally severe winter to deliver the Maiben lecture before the Boston meeting of the American Association for the Advancement of Science. When he lay down to rest his writing table was filled with work actively in progress.

Professor Davis enriched the science of geology by a long succession of able papers based on original studies covering a remarkable range of subjects. In 1882 there began a series of fifteen articles and monographs on the Triassic formations of the Connecticut Valley, out of which came our first full knowledge

[4] This process can no doubt be successfully applied to other classes of compound. Its application to sugars and saccharides is contemplated.

of the intrusive and extrusive trap sheets of this region, our first recognition and location of many oblique faults traversing the formations and our first satisfactory understanding of the extent to which topographic form could be utilized in unraveling faulted structures. To this early period belong papers on details of Appalachian structure in the Hudson Valley, which extended northward the known area of typical Appalachian folding and gave us a clearer conception than we had before possessed of the classic unconformity at Becraft Mountain. A series of papers on the distribution and origin of drumlins, on glacial erosion, on lakes and valleys, gorges and waterfalls and on the origin of cross-valleys laid the foundation of his later geomorphic studies.

In 1884 Davis published a short paper on the classification of plains, plateaus and their derivatives which contains the first published statement of the scheme of the erosion cycle, and which may therefore be held to mark the beginning of the modern conception of land-form evolution. At this same early period, in a report on the relation of the coal of Montana to older formations, Davis recognized the extensive degradation to which the Great Plains province had been subjected, and began developing work on the physical history of rivers which was to culminate in 1889 and 1890 in two brilliant essays: one on "The Rivers and Valleys of Pennsylvania," the other on "The Rivers of Northern New Jersey." These essays, highly original in both content and method, are remarkable for their close analysis of the influence of geologic structures upon stream development at successively lower horizons in strongly folded regions. Although they appeared but a decade after Davis's first published work, they exhibited such a mastery of deductive reasoning and such profound knowledge of the effects of geologic processes upon complex geologic structures that they remain to-day much-quoted classics of American geology.

With the year 1890 began a steady flow of important papers from Davis's skilful pen which at the time of his death, nearly half a century later, continued unabated. It is not possible, within reasonable space, to do more than indicate contributions of exceptional importance. The remarkable versatility of Davis's mind, and the breadth of his interests, is evidenced by papers, monographs and books of a geographical, meteorological and pedagogical character; but we shall for the most part confine our attention to the field in which his chief labors lay, geomorphology. His preparation and training were mainly in the field of geology; he drew his inspiration primarily from the great geologists of the early surveys—Powell, Dutton, Gilbert; and his life work has chiefly been concerned with the study of geological processes, acting on geological structures, through recent geological time.

Davis's "Geological Dates of Origin of Certain Topographic Forms on the Atlantic Slope of the United States" was for a quarter century the fundamental paper on which correlation of geomorphic features in this region rested, and is to-day frequently quoted. His papers on southern New England, in which the scheme of the fluvial erosion cycle is carried to its ultimate stage in the peneplanation of a vast area of resistant crystalline rocks, present a wholly novel interpretation of the later geological history of the region in question, an interpretation which in its main outlines is still accepted. Davis makes clear the fact that he did not originate the idea of land reduction to baselevel; but he gave name to a conception which had not previously gained wide currency, and so effectively pictured the process of land-form evolution by orderly, sequential stages that the idea of fluvial peneplanation spread rapidly throughout the world. In Great Britain the novel American conception encountered the firmly established theory of marine abrasion set forth by Ramsay nearly half a century before; but largely through the influence of Davis's pen the American view gradually gained a place for itself. In France progress was more rapid, while in Germany acceptance of the new idea was aided when Davis by field studies demonstrated peneplanation of the Hunsrück bordering the gorge of the Rhine. Into central Asia Davis carried the new conception of land evolution by demonstrating the peneplaned character of uplifted and tilted blocks of the earth's crust in Tian Shan. Later we find him in South Africa, where he was the first to discover and describe the peneplane of the high veldt and the baselevelling of the Cape Colony ranges. Thus not by his pen alone, but by appropriate field studies in four continents, Davis carried a great American idea to every quarter of the globe. To him, more than to any other, is due the fact that in almost every country where geological studies are prosecuted to-day, the investigator dates a long series of major geological events in terms of ancient erosion planes.

Nor were Davis's foreign studies confined to the problem of peneplanation. In France, Switzerland and Norway he threw needed light on the moot question of glacial erosion. British geologists find in his work on Mount Snowdon the most systematic discussion of alpine glacial erosion in their country; and in his studies of English rivers a new and fertile treatment of stream adjustments in successive erosion cycles. In France we look to Davis for the earliest account of the extensive drainage modifications on structures of the Paris basin. A study of Permian

glaciation in South Africa presents evidence that the ice could not have had its source in a mountainous region, while an account of folded mountains in the same continent traces the evolution of ranges of the Appalachian type. Similarly, in other countries we find his significant contributions to geomorphology in studies of fault phenomena, continental platforms, shoreline evolution and other problems.

No reference to Davis's shoreline studies can be complete which does not record the fact that his contributions in this field opened a new era in shoreline investigations. He closed the door on the old, empirical methods of shoreline description, and pointed the way to a genetic study of the effects of marine processes on variable geologic structures. He showed that there was a cycle of marine erosion just as truly as there were cycles of stream erosion and of glacial erosion. Every modern account of shoreline evolution is a tribute to the genius of William Morris Davis.

In earlier paragraphs emphasis has been placed especially on Davis's original ideas, and only incidentally on work which followed the lead of others. But even where he was not a pioneer Davis made noteworthy contributions to geomorphology. In the Grand Canyon region he was first to discover that the major faulting antedated the "Great Denudation" of Dutton, that the Esplanade had a structural and not a cyclic origin, and that the Colorado was not necessarily an antecedent stream but might more reasonably be interpreted as superposed from a course determined by geologic structures. In a notable series of papers on fault block mountains, he confirmed and extended ideas earlier promulgated by Gilbert, and cast the study of these forms into an entirely new mold by developing to an unprecedented degree the value of physiographic evidence of faulting. His paper on "The Sculpture of Mountains by Glaciers" has been widely quoted because of its artistically eloquent and scientifically convincing comparison of forms found in non-glaciated mountains and in formerly glaciated mountains of similar altitude. To him we owe our first full understanding of the relation of rock defense to the positions and patterns of river terraces, imperfectly appreciated by earlier writers. He added new evidence in support of the fluviatile origin of the fresh-water Tertiaries of the Rocky Mountain region, broadened our understanding of erosion in the Front Range of the Rockies, enriched by field studies our knowledge of desert rock planes in the Southwest, and gave us our first detailed comparison of such planes with those of humid regions. Following the lead of Darwin and Dana in the coral reef problem he visited thirty-five reef-encircled islands of the Pacific, and on the basis of years of study published a long series of articles and a volume indispensable to future workers in this field.

We have touched but a limited portion of Davis's record of scientific productivity. It is a record truly remarkable for breadth of field covered, for penetrating analysis of the problems treated, for quantity of new facts first established, for freshness and vigor of methods employed, and for number of novel and fruitful ideas contributed. His notable achievements in geomorphic research evidence a creative mind of high order whose talents were long and industriously devoted to the service of science. Such achievements could not fail to have a profound influence upon the development of both geology and geography. It is impossible to measure the full extent of that influence; but it is easy to point to evidences of its far-reaching character and to indicate some of the ways in which it has operated.

By his writings Davis practically created a new branch of geology, physiographic geology or geomorphology. Men have, of course, long given attention to the visible manifestations of geologic processes, and great contributions in this field are associated with the names of Hutton and Playfair, Lyell, Geikie and Ramsay, DeLapparent, LaNoë and De-Margerie, Von Richthofen and Penck, Powell, Dutton and Gilbert. But it was Davis who codified the work of these masters into a definite science, unified and vivified by a wholly new conception: the orderly evolution of landforms through systematic stages of development. It was he more than any other who gave precision to this new branch of geology by a large body of critical work, and it was he who had the largest share in creating an "American School" of geomorphology and giving to it international prestige.

By individual studies of high excellence in many foreign lands and by field discussions with foreign investigators on their own territory, Davis initiated a large volume of work in other countries. Thus by personal example and oral teaching he supplemented the labors of his pen in carrying the doctrine of land-form evolution throughout the world. In Europe a great range of geomorphic studies traces its inspiration directly to him. In Asia his studies of the Tian Shan peneplanation were fruitful in later studies widely extending his original ideas. The South African geologists base the later geologic chronology of their region on Davis's study of the high veldt, and describe the evolution of their terrain in terms of his theories of land-form evolution. It is doubtful whether any other American geologist or geographer is so frequently quoted over so great a proportion of the world's surface.

In the development of any science the rôle of the

critic is an important one. There can be no doubt that in this capacity Davis has rendered great service to the related sciences of geography and geology. His many published reviews of geomorphic work at home and abroad not only kept workers in this field in touch with the progress of events, but by their penetrating and constructive criticisms pointed the way to higher achievement. Davis was a crusader in the holy war against archaic theories and careless thinking; and if with the crusader's enthusiasm for a cause he sometimes handled his lance with pitiless skill, the victims have usually lived to forget the pain of criticism in the pride of work yet more skilfully accomplished. Geomorphology has not yet outgrown the faults inherent in the youth of any science; but few will doubt that its achievements are greater in quantity and higher in quality because of the analytical mind and critical powers of William Morris Davis.

Truly great teachers have ever exerted a profound influence upon the growth of a science; and as a teacher Davis was truly great. Through disciples in this and other lands who sat under his instruction in the university, or listened to his teachings in the field, or knew him only through the printed page, Davis has exerted incalculable influence. In the publications of federal and state surveys, in the class work of universities at home and abroad, in the changed scope and emphasis of text books of geology, the effects of his teachings are strikingly apparent. In so minor a matter as the method of illustrating relations of geologic structure to topographic form by block diagrams, one can trace his growing influence in the geologic literature of many countries. And this is but symptomatic of the deeper influence which has transformed the substance of geomorphic literature in every land. Not only in English, but also in German and in French he has carried his teachings to foreign lands both in lectures and in writings. To-day one of the best advanced treatises on geomorphology is his "Erklärende Beschreibung der Landformen," published in Leipzig and Berlin.

It is not easy to determine whether the geologist or the geographer is most greatly in his debt, but there can be no doubt that Davis profoundly affected the development of geography as he did that of geology. For high accomplishment in the geographic field he was admirably prepared first by training in astronomy, and practical work in the National Observatory at Cordoba, Argentina, where he discovered several new variable stars; then by many years of research and teaching in the field of meteorology, bearing fruit in a text book in this subject remarkable for clarity and logical presentation of matter, and a series of original papers which won for him election as corresponding member of the German Meteorological Society; and finally by his still more abundant work on the physiography of the lands. His vision of the field of geography was thus broad as well as penetrating.

It was not surprising that Davis's well-equipped and disciplined mind should bring about a great awakening in American geography. In a long series of papers on the teaching of geography he laid the foundations for a new conception of the subject in which scientifically organized content and scientific methods of instruction should replace a conglomeration of facts empirically presented. In lectures to teachers of geography, in training future teachers in his university classes and seminars, in founding the Association of American Geographers, and in organizing local and international geographical excursions he spread the doctrine of a new geography which should be as truly scientific in content and method as were its sister sciences. Although late in life he wrote that he would not class himself as a geographer, he is known throughout the world as one of the great leaders in this field, one who inspired new life in the geography of his own country and profoundly affected the course of geographic progress in others.

The extraordinary accomplishments of William Morris Davis for the sciences of geology and geography won cordial recognition from his colleagues in both fields. The Geological Society of America bestowed on him its two highest honors: the presidency of the society and the Penrose Gold Medal. The Association of American Geographers placed him twice in the presidency, the American Geographical Society awarded him its Cullum Geographical Medal, the National Council of Geography Teachers its Distinguished Service Award. Twice the British Association for the Advancement of Science made him an honored guest, once in South Africa and once in Australia. Twice he was called as exchange professor to foreign lands, spending one year in Berlin and one year in Paris, in each case lecturing in the language of the nation to which he was accredited. He was the recipient of many medals for signal service in geologic and geographic fields, held honorary doctorates from four foreign universities in three different continents and was elected to honorary membership in the scientific societies of a dozen countries. Few men whose honors came solely as the result of individual scientific labors, and in no degree as executives or other official representatives of great institutions or societies, have been accorded such world-wide distinction.

Among those who knew him intimately the memory of Davis the man will be treasured. His Quaker ancestry was perhaps responsible for a certain rigidity of discipline and a relentlessness in his antagonism to careless thinking which made him a severe master and an uncomfortable opponent. But those who could

endure the discipline and place high value on criticism as helpful as it was keen, found in Davis a loyal friend. He told a man his faults, but told others his virtues. Many a student and younger scientific colleague has learned to his surprise of opportunities opened to him by the quiet but effective intervention of the man who was his most vigorous critic. Beneath a brilliant and incisive intellect beat a warm heart capable of strong affection, whether for a great master like Gilbert or for his own disciples of a younger generation.

DOUGLAS JOHNSON

SCIENTIFIC EVENTS

PEAT INVESTIGATIONS AT THE INTERNATIONAL CONGRESS OF SOIL SCIENCE

THE projected arrangements for the third International Congress of Soil Science, to be held at Oxford, England, from July 30 to August 6, 1935, include a program of the Subcommission for Peat Soils.

As at the previous congress, the interests of American members will find expression in the organization under the chairmanship of Dr. A. G. McCall, the representative of the United States National Section, and Dr. R. V. Allison, chairman of the regional committee.

The outstanding part of the program is to be a major theme dealing with the comparative study of "low moor" peat land from the standpoint of morphological profile features and the influence of drainage on the physical, chemical and biological properties of peat soils. Regional examples will be drawn upon to establish an agreement on methods and technique. The contributions will be summarized in a paper of 30 minutes' duration, to be read at a plenary session of the congress, and to be followed by general discussion.

In addition there will be sessions open to papers and discussions on various subjects in peat investigations, such as surveys performed by government bureaus of different countries, cartographic work and aerial photography, ecological and geographic relationships, changes in climate since postglacial times, localization of peat industries, problems connected with the various uses of peat land resources, highway construction and amelioration.

Another question to be discussed is the classification of peat soils and the terminology required to express new concepts. Lacking any authoritative standard, it is hoped that a tentative statement may be presented to the commission for approval.

It is deemed desirable to stress American attendance and participation in the program. The session is open to any person engaged in some field of peat investigation or interested in its practical application. The British government has taken official cognizance of the International Congress of Soil Science and has invited the United States government to be represented by a limited number of delegates. Attention is directed also to the fact that during the congress facilities will be afforded to visit historic places, and that immediately after the congress there will be a three-weeks tour of England, Wales and Scotland.

Blanks for membership in the congress may be secured from the chairman of the National Section, Dr. A. G. McCall, U. S. Bureau of Chemistry and Soils, Washington, D. C. Manuscripts and reports for the congress are to be sent to Dr. R. V. Allison, at the same address.

THE RAINBOW BRIDGE-MONUMENT VALLEY EXPEDITION

AN expedition to continue exploration of the Rainbow Bridge-Monument Valley area on the Utah-Arizona border, one of the few little-known large areas remaining in the United States, will leave New York on June 28 under the direction of Ansel Franklin Hall, chief forester of the National Park Service.

According to an announcement in *The New York Times*, the tract to be visited, about three thousand square miles in extent, is known from exploration last year to contain interesting archeological, biological and other data. Its scenic features have led to discussion of the area as a national park.

Last year's expedition, under the leadership of Mr. Hall, mapped the principal features of the area, but did not succeed, in the time at its disposal, in reaching the less accessible parts, many of which are believed never to have been seen by a white man. A few Piute Indians, who are being made the basis of an ethnological study, live in the area.

Professor Charles Del Norte Winning, of New York University, has been appointed associate field director. He will be accompanied by about thirty specialists. Fifteen of these have already been appointed. Additional members will include biologists or specialists in particular fields of biology, such as herpetology or ornithology, and architects and artists to survey and sketch Indian cliff and mound dwellings, of which several have been discovered.

Besides Mr. Hall and Professor Winning, the staff as selected to date includes Gerald E. Marsh, of the University of California; John Wetherill, custodian of the Navaho National Monument; John E. Armstrong, of the University of California; Dr. Herbert E. Gregory, of Yale University, director of the Bishop Museum, Honolulu; Professor N. E. A. Hinds, of the University of California; Thorne E. Mayes, engineer of the General Electric Company, and Lyndon L. Hargrave, archeologist.

As was the case last year, the expedition is financed by its members, each being assessed $398. The field