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OF

CHARLES ELWOOD MENDENHALL

1872–1935

BY

J. H. VAN VLECK

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C. E. Mendenhall

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With the passing of Professor Charles Elwood Mendenhall, at Madison, Wisconsin, on August 18, 1935, America lost one of its leading figures in physical science. Seldom has a man revealed so completely a combination of notable achievement and lovable character.

Charles Mendenhall was born at Columbus, Ohio, on August 1, 1872. He was the distinguished son of a distinguished father. Thomas Corwin Mendenhall, his father, was a prominent physicist, after whom the physical laboratory at Ohio State University is named. The senior Mendenhall was one of the first professors appointed to that institution, and later was in turn president of Rose Polytechnical Institute, superintendent of the U. S. Coast and Geodetic Survey, and president of Worcester Polytechnical Institute. Thus, Charles Mendenhall's scientific heritage was great, and he proved himself worthy of it in every way. His father, too, was a member of the National Academy, and the two Mendenhalls are the only instance of father and son both in its ranks in the physics section.

Mendenhall was of Pennsylvania Quaker and Colonial New England stock. Although, at least in later years, he had no professed denominational religious faith, one always recognized in him the quiet sincerity, simplicity, modesty, and meticulous honesty which one traditionally attributes to Quaker origin and environment. On his father's side, his ancestry * can be traced back to the founders of the Penn colony who came to this country in 1686 and settled in Delaware county, establishing the vil-

* For further geneological data on his father's side, see the biography of Thomas Corwin Mendenhall, written in this series by Henry Crew (Volume XVI, 7th memoir).

lage now called Concordville. In this neighborhood there is, at the present time, a station named Mendenhall on the Octoraro branch of the Maryland division of the Pennsylvania Railroad. His mother, Susan Allen Marple Mendenhall, was born at Columbus, Ohio, and likewise had ancestors of English descent, though not of Quaker affiliation. One of her Colonial forefathers was Major Solomon Allen, who carried Major André back to West Point after André was captured as a spy in the Revolutionary War.

EARLY LIFE

At the age of six, Charles Mendenhall was taken by his parents to Japan, where he spent three years. During that period, only twenty-five years after Commodore Perry's celebrated visit, his father held a professorship of physics in the Imperial University of Tokio. This post was one of four pioneer professorships created by the Japanese government to introduce Occidental science and ways of thought. The other three appointees were W. S. Chaplin, in civil engineering, E. F. Fenollosa, in philosophy, and E. S. Morse in zoology. Mendenhall's contact with Japanese culture and environment during his early boyhood perhaps unconsciously kindled his life-long fondness for Japanese art, and interest in Japanese statesmanship and diplomacy. Furthermore, two of the pioneer professors, Fenollosa and Morse, were instrumental in making the Occident become conscious of the high worth of Japanese art, and probably performed an even more valuable service in bringing the latter back to America than in taking Western science to Japan. Fenollosa became the first authority on Japanese prints, while Morse was ultimately made keeper of Japanese pottery at the Boston Museum of Fine Arts. In Japan, Charles Mendenhall was the childhood friend of Morse's son, John. This friendship continued through later life in America, like that between the two fathers. This contact with the younger and older Morse was doubtless an influence which continued and augmented Mendenhall's appreciation of Japanese Art. Although one thinks first of his love for Japanese prints, Mendenhall retained a lively interest in other aspects of Japanese culture and customs. In the closing months of his life, he remarked to a colleague that rice was the one food which still appealed to him, stating that this was probably because of Japanese diet in his early days. That same last summer, but, unfortunately too late for reply, he asked a childhood friend, Tsunejiro Miyaoka, to send him maps of the old Tokyo of his boyhood, and of the city of the present day, in order that he might compare the two.

In 1881, at the age of nine, Mendenhall returned with his parents to America. He then spent three years at Columbus, where his father was again professor, and the two following years at Washington. His elementary education was in the public grammar and high schools. His father's acceptance of the presidency of Rose Polytechnical Institute took him to Terre Haute, Indiana, in 1886. Although he was a student at this Institute, he did not matriculate there until after his father resigned as president to become superintendent of the U. S. Coast and Geodetic Survey. He received the degree of A.B. from Rose Polytechnical Institute in 1894. Shortly before graduation, he was elected to Phi Beta Kappa and Sigma Xi. One of his undergraduate friends, A. M. Hood, writes, "Charles was a serious student. I never talked with him much as to aspirations, but I have the impression that he intended to be a teacher and he was considered somewhat of a mathematical 'shark.' He was quiet and reserved but I considered him mighty good company, and our quartet evenings were most enjoyable." His main recreation and avocation was his music. He played first violin in the Rose Polytechnical orchestra, which was rather unusual in that it mustered a well balanced instrumentation of 17 pieces out of a total student body of about 250. In addition, he belonged to a quartet which practised once a week and played a few engagements in small towns surrounding Terre Haute.

During the summer of 1894, Mendenhall assisted George Putnam in making a transcontinental survey of the acceleration of gravity for the Coast and Geodetic Survey. Then he taught physics for a year at the University of Pennsylvania. He took these positions not merely for the experience, but in order to secure sufficient funds to commence post-graduate work. It was his father's theory that a man should be self-supporting during the period of graduate study, although it was not a question of financial necessity in the Mendenhall family.

GRADUATE STUDY

In the fall of '95, Mendenhall began graduate work at Johns Hopkins University, from which he received the Ph.D. degree in 1898. At this time, the great Rowland was at the peak of his reputation. Nevertheless, Mendenhall does not appear to have been in particularly close contact with Rowland as regards graduate work, though the latter was an intimate friend of his father. About 1896 or 1897 Rowland started working on his printing telegraph, and thereafter had little time to devote to the researches in progress in the laboratory. However, Mendenhall took courses both from Rowland and from Ames, who was subsequently president of Johns Hopkins University. In those days a graduate student was much more "on his own" than he is now. In fact, there is the classical story that when Mendenhall's father, Thomas Corwin Mendenhall, asked Rowland what he did for his graduate students, he answered, "I neglect them," (the last thing, incidentally, that could ever be said of Charles Mendenhall after he became professor). A student was expected to do his own shop work, and did not have the assistance of a corps of mechanics and the like. Naturally, the first attempts of a graduate student in the shop were apt to be rather crude, and Rowland's personal mechanic, whose services were not available to students, referred to Mendenhall and his companions as the "wood-butchers." However, his ability was recognized by the university, which awarded him a fellowship, and by the other graduate students, who regarded him as a man of unusual promise and brilliance. Among his student friends may be mentioned L. J. Briggs, N. E. Dorsey, W. J. Humphreys, W. T. Mather, J. T. Mohler, F. A. Saunders, and C. W. Waidner. Dr. Briggs, now Director of the Bureau of Standards, writes, "During our student days together, I was impressed with Mendenhall's great kindliness, his overwhelming curiosity as to how things worked, and his immediate readiness to disclose through questions his own lack of knowledge of some subject, in order to remedy the situation on the spot. I think this latter trait may have resulted in part from his intimate and happy companionship with his father, of whom he often spoke."

Because of family ties, summer heat in Baltimore, or absence of shop facilities during vacation at Johns Hopkins University, Mendenhall spent the summer of 1895 at his parents' home at Worcester. Since his father was then president of Worcester Polytechnical Institute, he naturally had access to the shops of that institution. He availed himself of this opportunity to construct during the course of the summer much of the apparatus which he subsequently used at Hopkins.

Mendenhall's problem for his doctor's thesis was one proposed by Reid, with supplementary suggestions from Ames. It was the study of radiation from a black body. Instead of having an ordinary luminous surface, he endeavored to actually construct a "Hohlraum," as theory indicated that the radiation escaping from a small orifice in such a cavity should be that characteristic of ideal black body distribution even though this property is not possessed by the material forming the walls of the cavity. In the latter part of his research for his doctor's degree, Mendenhall had the cooperation of Frederick A. Saunders, who is at present chairman of the physics department of Harvard University but was then likewise a candidate for the Ph.D. at Johns Hopkins. Saunders was at first assigned merely to assist Mendenhall with the apparatus which the latter had already partially constructed, for Saunders was then somewhat the junior of the two in training and experience. Later, however, it developed that there was enough to the problem provided by Mendenhall's apparatus to supply doctors' theses for each of the two men. Mendenhall made his dissertation on the radiation at higher temperatures (500°-1100° C) while Saunders studied a somewhat lower range. The results were published in a joint article which did not appear until three years after Mendenhall received his Ph.D. In his early work on black body radiation, Mendenhall had the benefit of frequent contact with C. G. Abbot, who was then in charge of the Astrophysical Observatory established by Langley at the Smithsonian Institution. He frequently consulted with Abbot on the construction of sensitive galvanometers, which presented one of the most serious technical difficulties in the radiation problem. An outgrowth of his struggle with galvanometers was a joint paper with C. W. Waidner, who was a fellow graduate student at Johns Hopkins and later a colleague at Williams, on the construction of galvanometers of unusual sensitivity.

Throughout his life Mendenhall retained his interest in the subject of black body radiation. His last paper on this subject was in 1929, on an ingenious electrical method of determining the Stefan-Boltzmann constant which, however, proved to be a disappointment as far as supplying an accurate value of Planck's constant *h*. There must have been an interesting contrast in refinement and delicacy between the apparatus which he used in 1897 and that which he employed in 1929, since his experimental technique kept abreast of the modern developments in high vacua, electrical thermometry, etc. The original experiments of Mendenhall and Saunders were made at atmospheric pressure, and absorption by CO and H_2O caused a great deal of trouble. As electrical methods were not then available, the black body was kept at a high temperature by means of gas burners. One can imagine the difficulty in maintaining a uniform heated surface by such means. It is thus little wonder that in publishing their doctor's dissertation, Mendenhall and Saunders modestly stated that the results were "largely negative," especially in view of the extensive existing German work.

WILLIAMS COLLEGE

During 1898-1901 Mendenhall was instructor at Williams College. The members of its staff still point with pride to the remains of a dividing engine and other apparatus which he constructed while there. He always retained a great affection for Williams, and in many ways almost regarded it as his Alma Mater, for a variety of reasons. In the first place, he was no longer under the same strain that he was as a self-supporting graduate student. Also, after all, Williams was a college rather than a technical school, and especially, there was the opportunity for excursions with colleagues into the nearby New England hills. Among his friends at Williams were Ralph Perry, now professor of philosophy at Harvard, and Frank Mather, who later became professor of art and archaeology at Princeton.

UNIVERSITY OF WISCONSIN

In 1901 the calling of R. W. Wood to Johns Hopkins left a vacancy in the physics department at the University of Wisconsin for some one who specialized in light. Mendenhall was appointed assistant professor to fill the position, and, except for a brief interim during the war, he served continuously on the staff at Wisconsin for thirty-four years. His promotion was rapid. He was made associate professor in 1904 and full professor in 1905. Although he was not officially chairman until 1926, he took an active part in the administration of the research activities of the department long before this date. In particular, he was always a vital force in the direction of the research work of graduate students, and his presence was instrumental in making the University of Wisconsin one of the leading centers for graduate work in physics. Among his colleagues in the physics department at various periods of his professorship at Wisconsin may be mentioned G. S. Fulcher, L. R. Ingersoll, Max Mason, J. R. Roebuck, B. W. Snow, W. F. Steve, Augustus Trowbridge, H. B. Wahlin, Warren Weaver, R. C. Williamson, and the writer. Trowbridge left Wisconsin in 1906 to accept a professorship at Princeton, but the intimate friendship between him and Mendenhall continued. They visited each other frequently for long periods, and carried on joint researches. War work also brought them together in Washington in 1917-20.

No biography of Charles Mendenhall would be at all adequate which did not stress his great and affectionate interest in his students. Never have I known a man who followed the research activities of his students with more devotion. Mendenhall was a teacher in the true sense of the word. By this I do not mean mere class room lecturing. Such instruction was never his first love. Rather it was by informal conference over research projects and difficulties that he did so much to guide and inspire the graduate students at Wisconsin. At almost any hour of the day he might be seen in his office talking to one or more men. I do not mean to imply that he "mollycoddled" his students. This was something which never could be said of Mendenhall, and he expected them to build their apparatus themselves.

He had the objectivism characteristic of the true scientist. He knew that if there was a problem to be solved, and this could be done by a student, so much the better, for in this way the student would gain a wealth of experience whereas a more mature professor would not profit correspondingly if he performed the experiment himself. One always felt that Mendenhall's aim was to get the research done, not to advance his own reputation. A colleague once remarked, "Mendenhall would be a greater experimentalist if he did not give so much time to his students." This remark is probably true, if a man's scientific career is judged simply by the volume of papers bearing his name. The total output of a laboratory is a more altruistic measure. Over thirty-five students took their doctorates under Mendenhall while he was at Wisconsin, many of whom have had notable research careers. In influence on their lives and scientific attainment, the work of Charles Mendenhall bulks large.

Although Mendenhall's teaching work was, first and last, primarily of a graduate nature, one should not form the impression that he never gave undergraduate instruction. His undergraduate work was naturally greatest during his early years at Wisconsin, but it is interesting to note that in 1931, when the University was feeling the brunt of the depression, Mendenhall unselfishly added the difficult experimental lectures in one of the beginning courses in physics to his teaching schedule in order to lighten the burden on the department caused by a curtailment in personnel.

Mendenhall was instrumental in bringing to Wisconsin many noted European physicists as visiting lecturers for periods ranging from a week to a year. Among them may be mentioned Born, Brillouin, Debye, Dirac, Fowler, Franck, Lorentz, Schrödinger, Sommerfeld, and Wentzel. Contact with these men was a valuable stimulus to the work of the department, especially as their visits were mostly during the period before America became of age in mathematical physicists. In 1922, an imposing symposium in theoretical physics was held in Madison, with H. A. Lorentz presiding. In his knowledge of foreign physicists and negotiations with them, Mendenhall was aided by the various European trips which he made while a professor at Wisconsin, either during sabbatical leave or summer months. His visit to England in 1919, as scientific attaché, will be described later.

After 1926, Mendenhall served continuously as chairman of the department until his death. Under his supervision, it ran with a rare smoothness and harmony, due largely to the universal respect for his personality, and confidence in his judgment. Other members of the department regarded him almost as a father. Some of the most difficult decisions which a chairman must face are in connection with the appraisal of the young men in his department, such as assistants subsidized in graduate work. In his attitude towards them he showed freedom from prejudice, and a proper balance between scientific integrity and human kindness, two virtues which, alas, are often incompatible. He did not hire and fire excessively in an over-zealous search for outstanding men. He recognized the strong points of even the humblest and the weakest graduate student, but he did not let his sympathy for them degenerate into sentimentality, nor did he develop the philosophy that the under-dog is always right, a foible particularly common in academic circles.

In the administrative affairs of the University outside his own department, Mendenhall displayed a moderate but adequate interest, and he always had a deep feeling of loyalty to his institution. He was not by temperament a "committee man," nor was he a too-conscientious attender of faculty meetings, for his real heart and soul were in the research activities of his department. However, these statements should not be construed as meaning that he escaped all committee work. Near the end of his life he headed one of the most important university committees, that which selected the candidates for honorary degrees.

SCIENTIFIC RESEARCH WORK AND PUBLICATIONS

We have already alluded to Mendenhall's continued interest in pyrometry and the optical radiation from hot bodies, which, directly, or indirectly, motivated many of his research problems. His most notable achievement in this field is probably the invention of the V-wedge method in 1911. Here a long strip of the radiating material is bent (or else two strips joined together), so that the cross-section is that of a narrow V. The material is heated by passing a current through it longitudinally. The radiation escaping from the interior of the "V" is that characteristic of an ideal black body, since the inside serves as substantially a "Hohlraum" because of the many reflections before escape. The radiation from the outside is, on the other hand, that characteristic of the metal itself. The great advantage of the method is that, besides the uniformity of temperature assured by electrical heating, it is possible to compare, at one and the same time, and hence under similar conditions, the characteristic and black-body radiations. This device constitutes a material simplification in pyrometry, as it enables one to determine the proper corrections needed to obtain the true from the empirical temperature. Mendenhall and his students used the V-wedge method to study the radiations of many materials—tungsten, tantalum, carbon, and others. They also employed it to make an accurate determination of the melting-point of molybdenum.

One of his interesting earlier papers was on the ring pendulum. Such an instrument consisted of an oscillating body bounded by two concentric cylinders, with the inner surface resting on a knife-edge. This problem was an outgrowth of his work with the Coast and Geodetic Survey, and was also a heritage from his father. The older Mendenhall had hoped to work on this kind of pendulum, but became occupied by presidential duties at Worcester Polytechnical Institute, and referred the project and its supporting grant from the National Academy of Sciences to Charles. The latter showed that accurate determinations of g could be simply made by means of the ring pendulum, but it is rather difficult to determine exactly the degree of precision, as the experiments were made at Madison, while the best available standard determinations for comparison are at Washington.

During the last fifteen or so years of his life, research in physics was everywhere dominated by problems growing out of the quantum theory of atomic structure. It is thus natural that during this period Mendenhall turned his attention increasingly to the photoelectric effect and thermionic emission, where he and his students made notable contributions. With characteristic patience and thoroughness, they showed that it was a matter of prime importance to purify the surface by very protracted outgassing, far longer than previously thought necessary. Only in this way was it ultimately possible to secure agreement between the thermionic and photoelectric thresholds. As we have intimated, Mendenhall was very generous in turning problems over to students, so that much of his research scarcely comes to light in the bibliography. In particular, it is rather startling that except for presidential or other general addresses, the list of his publications gives no evidence of his continued interest in the photoelectric effect, and of his real influence on this field through the work of his students. In fact, the University of Wisconsin was for many years the country's leading center for research on photoelectric problems.

A noteworthy characteristic of Mendenhall's research was his breadth of interest, shown by the varied nature of his investigations, although most of them could be grouped under the general heading, "properties of the solid state." Seldom could a man more properly be called an "all-round" experimental physicist. His standards of publication were very high. The caution, patience, and thoroughness with which he prepared his articles might well serve as a model and antidote for those too prone to rush rapidly into print. Mendenhall was by temperament a coöperator rather than an individualist. So it is not surprising that a considerable number of the papers listed in the bibliography were written jointly, the other author being sometimes a man of established reputation, sometimes comparatively obscure. The article with R. W. Wood on the effect of electric and magnetic fields on the emission lines of solids was a pioneer contribution in a field which is today attracting increasing attention. It was an indirect result of the war, as the latter prevented Mendenhall from going to Europe for his sabbatical in 1915, so he went to Johns Hopkins for a semester instead.

A very pretty experiment, though not one of his most important, was one made jointly with Max Mason on the stratified subsidence of fine particles, a problem suggested by Warren Mead of the Geology Department at Wisconsin (now chairman at Massachusetts Institute of Technology). Mendenhall and Mason showed, both theoretically and experimentally, that particles immersed in a fluid tend to settle in strata when the two opposite walls of the containing vessel are at different temperatures. This behavior is a thermal effect, each stratum being at a different temperature. Rather spectacular stratified colorization effects can be obtained when the lines of flow are demarked by using particles of fluorescein.

We must not overlook Mendenhall's contributions to the elementary text-books of physics. He never wrote a complete volume himself, but composed the section on heat in the third and all subsequent editions of "Physics for Students of Science and Engineering" edited by A. W. Duff and written by a variety of authors. This book has run through many printings and is probably the most popular text in engineering colleges today. In the closing year of his life, he wrote about forty percent of a new work, "College Physics," by C. E. Mendenhall, A. S. Eve, and D. A. Keys, the last two being professors of physics at McGill University. He knew that he did not have long to live and was anxious to place his financial affairs in the best possible shape. He died a week before the appearance of the first finished copies, but he did read with great care both the galley and page proofs, and showed an iron nerve in dealing with this rather laborious task during the last months of his life. In fact his last work on the book was only two days before he entered the hospital.

OTHER SCIENTIFIC ACTIVITIES AND HONORS

Mendenhall was accorded the recognition which comes to a man of the highest scientific standing. He was elected to the National Academy of Sciences in 1918 and was chairman of the Section of Physics during the period 1924-1927. Other scientific organizations to which he belonged include the American Philosophical Society, the American Academy of Arts and Sciences, the American Physical Society, the Optical Society of America, the American Association for the Advancement of Science, and the Cosmos Club. In each case he had the rank of fellow if this distinction existed.

He was president of the American Physical Society from 1923-25. At previous dates, he had served terms as associate editor of the Physical Review, and as councillor of the American Physical Society. As a past president of the Society, he was privileged to attend its council meetings continuously from 1925 on, and his presence and opinions were always appreciated. He was vice-president of the Optical Society of America in 1921. Later he was on the editorial board of the Journal of the Optical Society. He was also an associate editor of the Reviews of Modern Physics. Among his incidental scientific activities were participation in the annual assay of the U. S. Mint in 1909, and membership on the research committee of the Westinghouse Laboratory. He spent parts of two summers, about 1913, in research at the Nela Laboratory in Cleveland, and was at times a guest in the private laboratory of Loomis at Tuxedo.

He was elected vice-president of the American Association for the Advancement of Science in 1929. The writer remembers hearing in Cleveland in 1930 his interesting retiring vice-presidential address on "Recent Developments in Photoelectricity," in which he so aptly described the Pauli exclusion principle as a "piece of social legislation to avoid the overcrowding of electrons," a characterization which has since become more or less classic.

In 1926 he went abroad as a travelling professor for the International Education Board to assist in a broad survey of physical science in Europe. This appointment was a distinct recognition of Mendenhall's wide ability and judgment.

Particularly noteworthy were his connections with the National Research Council. As chairman of the Division of Physical Sciences of this organization, from 1919 to 1920 and as member for a longer period, he was influential in effecting the transition from war-time to peace-time activities of that body. When the National Research Council sponsored the International Critical Tables, he was made a member of the editorial board. His greatest service for the Council, however, was on the Board for National Research Fellowships in Physics, Mathematics, and Chemistry to which he belonged since 1924, or for practically its entire existence. The composition of the Board included three representatives in physics. Mendenhall's colleagues in this capacity were K. T. Compton, R. A. Millikan, and later F. K. Richtmyer. To the three physical representatives fell the brunt of the responsibility of the selection of the appointments to the National Research Fellowships in physics. These fellowships have been an enormous factor in bringing America from a secondary to a leading place in pure physics inside of the last fifteen years, especially in the atomic and theoretical aspects. Mendenhall took very conscientiously his share of the responsibility of selecting the appointees. I can vividly remember his poring assiduously, and of course sometimes a little wearily, over the laundry cases which were shipped him from the central office in Washington, loaded, surprisingly, not with clothes, but with the detailed credentials of many dozen applicants. As far as I can judge, there has been remarkably little criticism of the N.R.C. fellowship appointments in physics, despite the rather tenuous decisions that must sometimes be made. I am told by a member that Mendenhall's presence on the board helped signally in the establishment of high objective standards.

WAR RECORD

In 1917, Mendenhall was called to Washington, supposedly for a few weeks. Actually, he was away from Madison over three years. He was made a major in the Science and Research Division of the Signal Corps. R. A. Millikan was at the head of this division, which was later transferred to the aviation corps, and Mendenhall was his right hand man and personal friend. It is hard to attribute to Mendenhall any one specific accomplishment, as he served in a roving capacity, supervising the activities of many different sections, the work of which was quite varied. Because of his wide background, his advice proved invaluable on many occasions. Through his official position he played an important part in the organization of American scientists for war service. He was especially active in handling scientific devices and inventions for war purposes, and in selecting scientific personnel for their development and use. At that time, the aeroplane was somewhat of a novelty in military circles, and its advent presented a variety of research problems which accounted for a substantial part of the work of the division. (Incidentally, the bibliography of his publications includes a survey of aeronautical instruments which he wrote for the Aerial Age Weekly; this article was a direct result of his war-time activity and interests.) Such subjects arose as finding vibrationless mountings for aeroplane cameras, indication of direction changes by the gyroscopic principle, covers for gasoline tanks which would prevent their being ignited by bullets, etc. The offices of the division were on 16th Street, but the experimental work was done either at the Bureau of Standards or the Langley flying field. Extensive aeroplane tests were also made at Dayton, Ohio, where for a while Mendenhall went about once every week. He spent part of the summer of 1917 at New London, and was influential in starting the organization of the experimental station there.

Mendenhall wore the army uniform, not because he loved brass buttons, but because it was required, probably inasmuch as around Washington a uniformed man could command more attention in connection with requests for equipment, etc., necessary to the research work. He was never a lover of red tape, and fortunately a regular army captain was detailed to attend to the routine military correspondence of the division. Military formality and Quaker simplicity are scarcely compatible. He was told he must issue orders as to when the young lieutenants under him should wear overshoes. Forthwith, he assembled them together, and solemnly commanded them to wear overshoes "whenever they d— pleased." On the crowded street cars enroute to the Bureau of Standards, Mendenhall sometimes held Warren Weaver (now director of Physical Sciences for the Rockefeller Foundation) on his lap to give more room. One can imagine the consternation of army ritualists at such intimacy between a major and a private.

Immediately following the war, in 1919, he was transferred from aviation to the Department of State and as successor to Dr. Henry A. Bumstead, he served for six months as scientific attaché to the American Embassy in London. At the same time he acted as London representative of the Research Information Service. He was one of the group which went to Brussels in 1919 to participate in the organization of the International Research Council and the allied unions. While in Great Britain, he enjoyed the companionship of many leading English physicists —Bragg, Rutherford, Schuster, Thomson, and especially A. V. Hill, in biophysics, with whom he had much discussion on recalcitrant galvanometers, a subject which had interested him ever since his doctor's thesis.

The National Research Council at first functioned largely through the Research Division of the Signal Corps, and started as a war time organization. In fact, Mendenhall's initial wartime appointment was under the joint auspices of the Signal Corps and the National Research Council. His post-war services in the latter organization have been cited earlier in this memoir.

FAMILY LIFE

On February 14, 1906, Mendenhall married Dorothy M. Reed, of Talcottville, New York. Their acquaintance had been one of long standing. Miss Reed was a graduate medical student at Johns Hopkins University while Mendenhall was working for his Ph.D. in 1895-1898. During that period, he saw her often and was a devoted friend. She received her M.D. from Johns Hopkins University in 1900, and (in 1901-2) was the first woman to be given a fellowship by this institution. Prior to her marriage, she had a distinguished record in medical research, and discovered the Dorothy Reed cell, which is the diagnostic cell of Hodgkin's disease. Also, she is a recognized authority on matters of child health. In fact, her desire for a professional career made their courtship one of long duration. In her married life, she has continued her interest in the medical care of small children. She established a chain of free clinics for them at Madison in 1915, and has served ever since as the sponsor and as one of the doctors. She has been a lecturer at the University of Chicago, and elsewhere, and is a medical officer of the Children's Bureau in Washington. She has served on the faculty of the University of Wisconsin since 1913, originally as an assistant professor and later as a lecturer. Mrs. Mendenhall was awarded an honorary degree recently by Smith College, her alma mater.

Mendenhall's two surviving sons, Thomas Corwin and John Talcott, are both entering professional careers. Thomas, the older of the two, received his A.B. cum laude from Yale in 1932. He spent three years at Oxford on a Rhodes Scholarship in 1933-36. The coming year he will be an assistant in the history department at Yale University. John, the younger son, graduated from Harvard in 1935, cum laude also, and is at present a student in the Harvard Medical School.

Mendenhall always took a tremendous interest in his children, and a natural pride in their accomplishments. I have never seen him look happier than when, just after the award of the Rhodes Scholarship to his son, Thomas, the graduate students in physics at Madison began the weekly colloquium by giving a Wisconsin sky-rocket cheer for "Tom Mendenhall's father."

At Madison, Mr. and Mrs. Mendenhall lived in a large house within walking distance of the University. If their home life could be summarized in one word, this would be "hospitality," especially where physicists are concerned.

They showed a genuine kindness to any physicist who was at Wisconsin, from the humblest graduate student to the most distinguished visiting professor. Mendenhall's concept of the duties of a chairman involved responsibilities which did not end when he set foot outside the physics laboratory. On almost any Sunday afternoon, Mr. and Mrs. Mendenhall were "at home" to the staff and students of the department. If an overcoat was wanted for a needy assistant, or if a dinner party was in order for a Nobel prize winner passing through Madison, they managed to provide it. Particularly noteworthy was Mrs. Mendenhall's constant and well-qualified attention to the medical care of the children of the young married instructors in the physics department.

Although Mendenhall had a natural and praiseworthy interest in all colleagues in the physics profession, and was always willing to "talk shop" with them, the impression should not be gathered that his circle of friends was confined to physicists. He was a member of at least three dining or literary clubs, and socially was one of the prominent members of the Wisconsin faculty.

OTHER INTERESTS

Mendenhall's fondness for art was by no means confined to the Japanese form, which has already been mentioned. Also, we have described his musical activities in student days. His keen appreciation for good music continued throughout his life. During his earlier years in Madison, he continued to play in string quartets. About 1920, however, he gave up playing the violin. He was active in musical circles, and was for a period a director of the Madison Orchestral Association, which brought leading symphonies and soloists to the city.

Mendenhall's love of art and beauty is nicely revealed in a diary which he wrote intermittently during his wedding trip to Europe in 1906. Part of this describes in considerable detail an important eruption of Vesuvius, which naturally interested a physicist. The rest, however, is largely an appreciation of the romantic hill towns of Italy. For instance, he says, "Subiaco, when it appears suddenly, seems as much more picturesque than Tivoli as Tivoli is than—Hoboken, say. A rushing stream—two fine bridges—a cone of houses crowned by a citadel—and backed by snow covered mountains, for the Sabines are the foothills of the Abruzzi, which boast the highest mountain in Italy."

Mendenhall played tennis occasionally in his early years, but he always continued his membership in the faculty tennis club at Wisconsin, possibly partly for the occasional use of his children, but primarily because he believed in the cause. His chief outdoor activity, however, was fishing—a peaceful sport for a peaceful man. It was mainly dry-fly fishing for trout in rapid streams which appealed to him. Whenever he was too tired with hard work, he would depart for a fishing trip in central or northern Wisconsin. For longer fishing expeditions, he would occasionally go to Colorado, Canada, or the Black Hills. On these trips he was sometimes accompanied by his son, John, or by the late Professor Neil Dodge, who was chairman of the English department of the University of Wisconsin and was perhaps Mendenhall's most intimate friend in Madison. Fishing was more to Mendenhall than a mere sport; it was a great solace and an escape from the cares of every day life. He had fished since childhood. A lovely stretch of water shaded by beautiful trees inspired him with joy, and gave him a feeling that all was right in the world.

The mechanics of housekeeping never appealed particularly to Mendenhall. His desk at Sterling Hall (the Physics Laboratory at Wisconsin) was always a great comfort to me, as it could almost invariably be found in even greater apparent disorder and more cluttered with papers than my own. He had, however, a sixth sense for the particular cluster in which a given letter accumulated, and was always quite bothered when the secretary placed his desk in order. He had two offices in the building, and he greatly preferred the one in the basement, which had less of a swivel-chair appearance and which was nearer to the research rooms. He spent much time in the students' own rooms, talking with them about their work, and I often had difficulty in finding him when his secretary told me that he was "in the building" but was not in either of his own two offices. When he became interested in "talking shop" he did not always bother to hunt up an ash tray, and once his graduate students presented him with a brushbroom to serve instead.

CLOSING YEARS OF HIS LIFE

During his last years, Mendenhall was not in especially robust health, and thirteen months before his death he was told by physicians that he had an incurable disease, and that he could probably expect only a year or two to live. Such news could not fail to be a shock to a man who was then only 61 years old, and in the prime of his scientific work. His serene demeanor and quiet fortitude during this trying period were testimonials of a character at peace with the world. He never told even his most intimate friends of his condition, and kept plugging away at the work of the laboratory with a freedom from complaint which was really heroic. When, later, more severe illness took him to a hospital, not far from Sterling Hall, his room there served as an office to which graduate students and instructors—"my men," as he called them,—could come for the discussion of their research problems. To the very end he retained an interest in all the affairs of the department. It was perhaps fitting that a great scientist, who was born on a university campus and had spent all his life in an academic environment, should die in a university hospital only a stone's throw from the physics laboratory which he loved so dearly.

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