NATIONAL ACADEMY OF SCIENCES
BIOGRAPHICAL MEMOIRS
VOLUME XII—EIGHTH MEMOIR

BIOGRAPHICAL MEMOIR

OF

HORACE LEMUEL WELLS
1855-1924

BY

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PRESENTED TO THE ACADEMY AT THE ANNUAL MEETING, 1925

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Horace Lemuel Wells was born in New Britain, Connecticut, on October 5, 1855, of vigorous English ancestry long resident in New England, the first American ancestor on his father's side being Thomas Welles, the fourth Governor of Connecticut.

Governor Thomas Welles, stated to be a lineal descendant of the Essex branch of the De Welles family in England, was born in Essex County in 1598 and came out to the colonies in 1636 as private secretary to Lord Saye and Sele, who was interested in the Connecticut Patent and who in the year preceding had commissioned John Winthrop, son of Governor Winthrop of Massachusetts, to erect a fort at the mouth of the Connecticut River. When his lordship and company arrived at Saybrook he quickly became discouraged by the dreary aspect of his surroundings and the dim prospect of his golden dreams being realized and he soon returned to England, leaving his secretary to combat the difficulties and dangers of the wilderness as best he could.

Thomas Welles, nothing daunted by the new and strange conditions, proceeded up the Connecticut River with his company to Hartford. Here, in 1637, he was chosen one of the magistrates of the Colony, a position he held for a period of twenty-two years. He was the first Treasurer of the Colony under the new Constitution and in 1641 he was chosen Secretary of the Colony. In 1655 he was elected Governor and again in 1658. Thus, up to his death in 1660, Thomas Welles continually enjoyed the confidence of his fellow-citizens and served the new Colony in the highest posts within the gift of the colonists.* Horace Lemuel Wells was the eighth in direct line of descent from this eminent English colonist.

* These statements are taken from the "History of the Welles Family in England and Normandy." By Albert Welles. New York, 1876.

Nearer the modern end of the ancestral line there was an intermingling of the Wells blood with the Sedgwicks and Websters of New England, Horace Wells, the grandfather of the subject of our memoir, having married Pamela Sedgwick, of West Hartford, whose grandmother was Miriam Webster. Levi Sedgwick Wells, the father of Horace Lemuel, married Harriet Francis, whose mother was Mary Tobey, a direct descendant of Thomas Tobey of Sandwich, Cape Cod, one of the original grantees of this first settlement on the Cape in 1637. Consequently from both sides of his ancestral line Horace Lemuel Wells, if heredity and environment exercise the influence we assume on character and ability, was fully endowed with traits that contribute to the development of courage, self-reliance and industry.

The boyhood of Horace Lemuel was spent on his father's farm near New Britain, where he enjoyed the blessings of outdoor life and early acquired that love of nature that characterized his mature years. For associates and playmates he had an older brother and a younger sister, but the woods and the fields near his home had for him a special attraction and he found much to satisfy the desires of his inquisitive mind in the trees, wild flowers, fungi, and song birds that he met with in his daily rambles. During his school days, spent in the public schools of New Britain, he began to think of botany as a career, and with his analytical mind and habits of close observation he would have made undoubtedly a success in that field of scientific work. The home influences, however, tended to draw his youthful mind toward a business career, for his father, though living on a farm, was president of the local bank, public-spirited and active in many movements for the betterment of local conditions. These matters while interesting to the young lad did not appeal to his imagination sufficiently to draw him away from thoughts of a scientific career, vague though they must have been, for he had an instinctive love of the mysteries of nature and a keen desire to peer beneath the surface. Both his father and mother in their younger days had taught school, the one in the typical red school house of New England and the other in a more dignified Academy, and it is quite likely that the son had acquired from some near or remote ancestor not only his scholarly in-

stinct, but also a desire to impart to others knowledge which he had gained by careful thought and study. However that may be, it was decided that he should go to college, and having finished his course at the New Britain High School he entered the Sheffield Scientific School at Yale in September, 1874, when he was nineteen years of age.

His college life brought to him new experiences and opened up new thoughts and aspirations. Closer acquaintance with the experimental methods in chemistry and physics awakened his profound interest in these sciences and he seems to have debated whether he might not find here a special field for his future work. Further, he was attracted by the sciences of geology and mineralogy and he saw in his thoughtful way how closely chemistry was related to physical geology and to mineralogy. The applications of chemistry to these two latter sciences as well as to many other sciences and to problems in industrial life led him to magnify, perhaps unduly, the significance and importance of analytical chemistry. Again, Wells was naturally a very careful, painstaking worker, and consequently he was greatly attracted by these requirements in chemical analysis as well as by the exactness so necessary in analytical work. Further, I have heard him say that the *difficulties* in the way of exact chemical analysis always had for him a great attraction, and this fact perhaps added some weight to the other reasons which finally led him, while still in college, to choose analytical chemistry as his life work.

Wells was fortunate in his undergraduate life in having three classmates and close friends, who like himself were thoughtful, serious-minded students intent on gaining from their college experience all the advantages possible not only from class room and laboratory, but by association and discussion with professors and instructors and with each other. All four of these young men had decided on their life work early in their college course, and their many serious discussions regarding the advantages and disadvantages of a career in a given science undoubtedly helped each one in the crystallizing of his ideas into definite shape. These classmates were Joseph P. Iddings, later Professor of Petrology, University of Chicago, and a member of the National Academy; Samuel L. Penfield, later Professor of Mineralogy at Yale, also a member of

the Academy; and William T. Sedgwick, later Professor of Biology at the Massachusetts Institute of Technology. This was a rare group of young men, each destined to become a recognized leader in his chosen field of work and each no doubt contributing much during the years of close association in their undergraduate life to broaden the mental outlook of the others. It is interesting to note that of these four men, three were fitting themselves for closely allied fields of work.

At the end of his junior year, Wells received the prize for excellence in chemistry, and on his graduation in June, 1877, with the degree of Bachelor of Philosophy, he was chosen on the basis of merit to read a portion of his thesis at the Anniversary Exercises. This thesis was entitled "Determination of Titanic Acid in Iron Ores Containing Phosphoric Acid." After graduation, he spent the following year as a graduate student in the Sheffield Scientific School, carrying on advanced work in chemistry and mineralogy under Professors Samuel W. Johnson, Oscar D. Allen, and George J. Brush. During the next two years he served as an assistant chemist at the Connecticut Agricultural Experiment Station, devoting such spare time as he could obtain to furthering his advanced studies in the Sheffield Scientific School. For a short period, he was assistant chemist under Dr. Charles B. Dudley at Altoona in the laboratory of the Pennsylvania Railroad. In the latter part of 1880 he went to South Pueblo, Colorado, as chemist to the Colorado Coal and Iron Company, where he remained for four years, gaining much practical knowledge in both chemistry and metallurgy.

Wells had now reached the turning point in his career. For six years he had been occupied mainly with work in practical chemistry and metallurgy. This experience had broadened his vision and given him a clearer knowledge of the applications of chemistry to industrial operations, but he realized fully that this was not the line of work for which he was best fitted, neither did it give him opportunity for the scientific study and research he longed to carry on. The time had not been wasted. He had learned much, but he realized that the future of which he had dreamed and for which he had struggled to prepare himself was not to be attained by continuance in the path he was following. Providentially just then there came a call to

return to Yale, as instructor in analytical chemistry in the Sheffield Scientific School. This he accepted at once, and the fall of 1884 found him back in New Haven engaged in work that was in every sense congenial. Here he was associated with Professors George J. Brush and Edward S. Dana in mineralogy, and what was of almost equal importance to him, with his classmate, Samuel L. Penfield, then instructor in mineralogy. In chemistry proper he had the advantage of association with Professors Samuel W. Johnson, Oscar D. Allen, and especially with the younger men, Louis V. Pirsson and Thomas B. Osborne, both later members of the Academy. The way was now open for him to make progress in the direction where his chief interests lay, and under most satisfactory conditions. To undergraduate students he gave instruction in qualitative analysis and later in quantitative analysis, but he had ample time to carry on the research work he longed to do. His first published paper on "Gerhardtite and artificial basic cupric nitrates" appeared in the American Journal of Science in 1885, in cooperation with Samuel L. Penfield, and from that date until the year prior to his death there was a steady output of contributions giving the results of his investigations.

At the time when he began his research work, there was great activity in the field of mineralogy at New Haven. Professors E. S. Dana and George J. Brush had found a wealth of new material in the mineral deposits at Branchville, Connecticut, and it was quite natural that Wells, with his marked ability as an analyst, should be drawn into the study of these new minerals which Dana and Brush were investigating. Consequently, some of his earlier papers dealt with the composition of a number of these new minerals. With E. S. Dana he described the new mineral Beryllonite, he determined the composition of a new platinum mineral which he named Sperrylite, and with Brush and Dana he analyzed and described several manganesian phosphate minerals from the Branchville locality. He also studied and described with Dana some selenium and tellurium minerals from Honduras. He was likewise occupied for some time with a study of various basic salts, notably basic lead nitrates, and basic zinc and cadmium nitrates, the results of which were published in the American Chemical Journal. During 1889 he broadened his experience by work-

ing for one semester at the University of Munich, where he absorbed much that was useful to him in his later life.

Wells was gradually making for himself a definite and well-recognized position at Yale, and in 1888 this position was stabilized by his appointment as assistant professor, followed five years later, in 1893, by his appointment as professor of analytical chemistry and metallurgy and a member of the Governing Board of the Sheffield Scientific School. Graduate students in chemistry were beginning to turn to him for their thesis work and many important investigations were carried on jointly by Wells with these advanced students. He was not only a good teacher, training the men in exact methods of chemical research and leading them on to independence of thought and action, but in addition he was endowed with that rare quality of inspiring those with whom he came in contact with the true spirit of sound scientific research. He was a man of clear intelligence and strong will, with a whole-hearted devotion to his chosen field of work, which impressed his students and gave them a feeling of respect and admiration both for his ability and his quiet but persistent efforts for their development. He had a firmness of conviction that was not easily shaken regarding the proper course to be pursued in carrying on an investigation. No halfway methods were allowed in his laboratory. Nothing short of the greatest possible accuracy would satisfy his mind and no effort was spared to insure that exactness which the conscientious and careful analyst aims to attain. He was truly a brilliant analytical chemist.

His whole life was given to the one purpose of upbuilding the science of chemistry in the Sheffield Scientific School and no work was too arduous for him to undertake. He was more or less responsible for all the undergraduate instruction in chemistry given in the Scientific School, except in the field of organic chemistry and in the elementary courses pursued by the Freshman class, for a period of thirty-five years. He assumed the duty of general oversight and upon him rested largely the selection of the younger instructors and assistants needed to carry on the courses of instruction. But it was his plan of work that was followed and over it all he kept a careful supervision. In this, however, he did not interfere unduly

with the younger men, but left them free to pursue their own methods, so long as results were satisfactory. He also had charge of the instruction in metallurgy and assaying during a long period of years, and for this work he was admirably equipped by his earlier experience in South Pueblo. Further, he was called upon to plan the new Sheffield Chemical Laboratory, which in 1893 was erected to supplant the old laboratory in Sheffield Hall, then wholly inadequate to care for the many students applying for admission. This work he undertook with his customary enthusiasm, with the result that the new laboratory planned wholly by Professor William G. Mixter and himself was without question one of the most convenient and satisfactory laboratories of chemistry in the country at that date. All the time and thought required by this work he gave willingly and unselfishly, seeing in it merely another opportunity to aid in placing chemistry in the Sheffield Scientific School on a higher and more fruitful plane.

In 1891, Professor Wells began a series of studies on double salt formation, especially compounds of cæsium, extending over a period of thirty years, upon which his reputation as a scientific investigator largely rests. Up to the time he began this work the element cæsium was exceedingly rare, having been found only in extremely small quantities, and consequently little was known concerning its salts. Fortunately, in 1891, he obtained a large amount of the rare mineral *pollucite*, rich in cæsium, and from this he was able to obtain several kilograms of pure cæsium salts with which he began his studies on double salt formation. At first, he prepared a variety of perhalides of cæsium, salts having a beautiful crystallized form, and later he made a great variety of entirely new double salts, the crystallographic forms of many of which were studied by Professor Penfield. This work led to a systematic study of double salts containing cæsium, reinforced later by a study of the halides of rubidium and potassium, both of which elements are closely related to cæsium. His investigations were in many respects remarkable and led to an accumulation of data of great value in throwing light on double salt formation in general. His study of the trihalides was also especially important. A glance at the bibliography will give some indication of the great variety of the compounds pre-

pared and studied in this long-continued investigation of double salt formation, largely compounds of cæsium.

In 1902, he published in the American Chemical Journal a long and important article dealing with the discovery of a remarkable series of triple salts containing cæsium, notably triple thiocyanates. The discovery of these compounds opened up a new and important chapter in inorganic chemistry. Twenty-three double thiocyanates, all but one of which were new, and fourteen triple salts were prepared and studied, all well crystallized. He came to the conclusion that the triple compounds and the double salts are governed by the same laws, but the thiocyanates generally form double salts in smaller variety than the halides. These triple salts continued to occupy his attention for many years, and the last paper he published was "on a cæsium-cupric-mercuric triple chloride" in 1923.

During these thirty years or more of active research he was aided by a large number of graduate students, who looked upon the privilege of working with Wells as a golden opportunity to acquire from a master mind the method and spirit of the chemical investigator. He demanded much in the way of steady and earnest effort, scrupulous care and exactness of result, but he in turn gave much. He was intensely interested in all the men who studied under him and worked with him and their welfare and success were always close to his heart. To them he gave generously of his knowledge and experience, and he was a friend to whom they could go freely for advice and help. Wells was a man of strong likes and dislikes, with an intense love for inorganic chemistry, and for all those who showed an interest in his chosen field of work he had a strong feeling of respect and a desire to encourage and help them forward. But for the man who was not thoroughly honest and sincere in his endeavors and who was not willing to give his whole mind to his work he had an equally strong feeling of dislike and distrust. To such a one he had nothing to give.

Professor Wells was widely read in chemistry. While his chief interest naturally lay in the field of analytical and inorganic chemistry he had a deep interest in all that related to chemistry in general and his knowledge was profound and extensive. For more than twenty years he was an associate

editor of the American Journal of Science and he contributed a large number of reviews and scholarly criticisms of books and scientific articles to that journal. To facilitate the use of the best analytical methods he translated in 1897 the last German edition of Fresenius' Manual of Qualitative Analysis, and the following year he wrote and published a smaller text book dealing with analytical methods which is widely used. He likewise prepared and published a book entitled "Chemical Calculations," designed primarily to facilitate calculations in analytical chemistry. This book, together with a later textbook of "Chemical Arithmetic," has proved of great service to students of chemistry at Yale and elsewhere. In 1901, when Yale University celebrated her two hundredth anniversary, he edited two large volumes of researches from the Sheffield Chemical Laboratory published under the title of "Studies from the Chemical Laboratory of the Sheffield Scientific School."

The work Wells accomplished gained for him well-deserved recognition. Yale, in 1896, conferred upon him the honorary degree of Master of Arts. The University of Pennsylvania in 1907 gave him the honorary degree of Doctor of Science, and in 1903 he was made a member of the National Academy of Sciences. On his retirement from active service in 1923, as professor Emeritus, the President of the University in his annual report made the following statement: "The close of the college year marks the retirement to the 'Emeritus' group of Horace L. Wells, Professor of Analytical Chemistry and Metallurgy, after a long and distinguished career in the service of the (Scientific) School. He was responsible to a very large degree for the excellence of the instruction in Chemistry, which has always characterized the School's work and for the development of the work of the Department in all branches of chemical science. Actively engaged in research himself, he was indefatigable in inspiring and helping others in their investigations."

Amid all his duties in the University and his devotion to his research work, Wells found time for social intercourse with his many friends, both inside and outside the academic circle. He made friends readily, his receptiveness, his unfailing courtesy and kindliness and his intellectual honesty all combined to render him a very lovable companion. In his home

circle he was extremely fortunate. In 1896 he married Sarah Lord Griffin, of Lyme, Connecticut. They had two daughters who grew to be the close companions of their father, deeming it their greatest privilege to accompany him on his walks into the woods and fields about New Haven to study the plants and fungi which Wells delighted in. He taught the children the names of the flowers, the localities where the rarer species grew and found pleasure and relaxation in training them in habits of close observation of nature's ways. For young children their knowledge under his tutelage became quite profound and it was a delight to see them with their hands full of various specimens, the Latin names of which they rattled off as fluently as any mature botanist. Wells all through his life maintained his early interest in botany, especially the fungi. Of mushrooms he had a profound knowledge and the haunts of the edible forms he knew thoroughly. He delighted in bringing home some specially toothsome variety and having a chafing dish party with his family and friends about him.

Wells died at his home in New Haven on December 19, 1924, in his seventieth year, being survived by his wife and two daughters. One daughter, Gertrude Griffin, is married to Danford N. Barney, Jr., and the other, Evelyn Salisbury, is the wife of General Charles H. McKinstry. But he left others to mourn his loss aside from the members of his family. Friends and colleagues there are who miss his genial presence, and a large group of those who may claim intellectual inheritance, former students to whom he had transmitted, in part at least, his enthusiasm, sterling honesty, and love of truth.

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