NATIONAL ACADEMY OF SCIENCES

ROGER ADAMS

1889—1971

A Biographical Memoir by

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Biographical Memoir

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ROGER ADAMS

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ROGER ADAMS was for a generation the leading organic chemist in the United States. In addition to publishing outstanding research in structural chemistry and stereochemistry and to training about 250 Ph.D.'s and postdoctorates at Illinois, he played a key role in the development of graduate education in science. His influence on the growth of industrial chemical research was great, both personally and through the students he trained. His services to the country in two world wars and to the scientific community brought him the role of scientific statesman on the world scene. He combined personal qualities of charm, strength, high intelligence, and extraordinary capacity for hard work.

Roger Adams was a direct descendant of the uncle of President John Adams; his ancestors had moved to southeastern New Hampshire, where Roger's father, Austin W. Adams (1845–1916), was born. Austin taught in a country school, then moved to Boston in 1872, where he was associated with the Old Colony and New Haven Railroads for the rest of his life. In 1880 he married Lydia Curtis from Jamaica Plain, likewise a school teacher, who was related to numerous business and literary figures in Boston and was descended from early colonial settlers.

The Adamses lived for twenty years on Worcester Street

in the then attractive residential section of South Boston. Austin Adams, a kind father and a man with scholarly avocations, supported his family on a comfortable but not luxurious scale. Roger was the last child in a family with three daughters, and he apparently had a happy boyhood. Two of Roger's sisters—tall, athletic, and gifted—graduated from Radcliffe and the third from Smith. The family moved to Cambridge in 1900, probably to be nearer the colleges.

After preparation at Boston Latin and Cambridge Latin, Roger entered Harvard in 1905. His first years were undistinguished academically, but he completed the requirements for his A.B. in chemistry in three years, earning high grades in his major courses in chemistry and in his minor of mining. His interest in chemistry may have been aroused by C. L. Jackson's course on "the chemistry of common life," which he took in his first year. He worked very hard at a series of demanding courses and had the satisfaction of receiving a John Harvard honorary scholarship for making four A's. In his last undergraduate year he took advanced courses and started research in organic chemistry with H. A. Torrey. After graduation in 1909, he worked for his Ph.D., aided by a teaching assistantship at Radcliffe. Torrey died prematurely in 1910, and Adams completed his thesis with the help of Jackson, Latham Clarke, and G. S. Forbes.

Among his fellow graduate students in 1911 and 1912 were E. K. Bolton ("Keis," a close friend), Farrington Daniels, Frank C. Whitmore, and James B. Sumner. James B. Conant was then an undergraduate.

As an outstanding Ph.D. of 1912, Adams was awarded a Parker Traveling Fellowship for 1912 and 1913, which he spent partly in the laboratory of Emil Fischer with Otto Diels at Berlin and partly with the brilliant Richard Willstätter in the latter's new laboratory in Dahlem, near Berlin. A ticket stub among Adams' papers shows that he took a Zeppelin

flight from Potsdam to Berlin; he also traveled in Finland, Russia, and Sweden.

Although it resulted in no scientific papers, Adams' European year was the beginning of his lifelong interest in European science and scientists. He clearly found the European university system distasteful; one professor in each department or institute controlled absolutely the activities of all research students and junior staff members. This attitude is reflected in Adams' leadership of the Illinois department along more democratic lines, which provided a model for other graduate science departments in American universities. Adams' policy of helping his junior colleagues develop independent research careers was emphasized further in 1954, when he designed the program for the Sloan Foundation that gave unrestricted grants to promising younger workers. As a result of his foresight, generations of young American scientists are in his debt.

Adams returned to Harvard in 1913 as research assistant to C. L. Jackson at $800 a year and shortly undertook the duties of instructor in chemistry. Along with other courses he taught elementary organic chemistry and initiated the first elementary laboratory in that subject at Harvard. He was a very successful teacher, so much so that James B. Conant, who succeeded him, did so with some trepidation about his own ability to interest an elementary class in organic chemistry. During his three years on the Harvard faculty, Adams not only carried a very heavy formal teaching load at Harvard and Radcliffe, but made a strong start on his own research program.

In 1916 Adams accepted an offer from William A. Noyes, head of the Illinois Chemistry Department, to become assistant professor at a salary of $2,800 per year. He was ambitious to accomplish something notable in science; he undoubtedly saw that the Illinois department, already well

known for its research and teaching under Noyes' leadership, offered greater opportunities than Harvard, as well as better laboratory facilities and the challenge of a position outside New England. He took the position at Illinois with no reservations and with the determination to develop his own research program and that of the department. Urbana remained his home for the rest of his life, in spite of many attractive offers to move to industry or university positions, including MIT and Harvard. It is indicative of his personal dedication to Illinois as his residence that he later joined the Rotary Club and served as its president in 1932.

At Illinois Adams took charge of the important "prep labs" started by his predecessor, C. G. Derick, for the synthesis of essential organic chemicals cut off by the blockade of Germany. This was expanded and, with the help of graduate students, particularly E. H. Volwiler and C. S. (Speed) Marvel, over 100 key compounds were made available for sale and for use in Illinois. Adams reorganized the operation, introduced strict cost accounting procedures, and made it a financial as well as scientific success. The tested procedures developed in "preps" (officially called Organic Chemical Manufactures) led to the indispensable annual publication, *Organic Syntheses,* of which fifty annual volumes were published under Adams' watchful eye. Conant later said that the publication should have been named "Adams Annual," because he was the moving spirit.

At Urbana Adams pursued research vigorously on the preparation of local anaesthetics with Oliver Kamm of the Illinois faculty and became a consultant to Abbott in 1917, a relationship that lasted on a formal basis until the 1960's. E. H. Volwiler, his first Ph.D., joined Abbott as a research chemist in 1918.

Adams was drawn into research for the army in 1917 and, with other chemists, worked on problems connected with war

gases at American University in Washington, D.C. Adams and Conant headed research groups, and E. P. Kohler, Adams' old faculty friend from Harvard, was in charge of the Offense Section. Adams spent the last few months of 1918 in uniform as a major. He was recognized by Conant as the leading figure in the group.

Adams was married to Lucile Wheeler on August 29, 1918 at White River Junction, Vermont. Mrs. Adams came from a well-known Vermont family; she was a Mount Holyoke graduate, had studied dietetics at Columbia, and had taught home economics at Illinois. They had one child, Lucile, and there are four grandchildren, in whom Adams delighted, particularly in his retirement years. The Adamses soon moved to a large house at 603 West Michigan, Urbana, where many guests, students and distinguished visitors alike, were graciously entertained by Mrs. Adams. This house was Adams' headquarters for the rest of his life. He wrote frequently to Mrs. Adams when he was away; he had a gift for light verse and sent a rhymed valentine to her and their daughter each year.

Adams' return to Urbana was followed by intensive research with a large number of Ph.D. students and by many outstanding scientific publications. From 1918 through 1926 he published seventy-three scientific papers and trained forty-five Ph.D.'s, including E. H. Volwiler, J. R. Johnson, A. W. Ingersoll, S. M. McElvain, W. H. Carothers, W. R. Brode, C. R. Noller, R. L. Shriner, C. F. Rassweiler, and many others who became well known in academic or industrial chemistry. This was in spite of a very serious illness in 1924, recovery from which required nearly a year. During this time he took up stamp collecting, a hobby he pursued for many years with characteristic thoroughness and enthusiasm.

The important problems he worked on during his research career included the development of platinum oxide

for catalytic hydrogenation (Adams catalyst—discovered by an excellent example of serendipity), local anaesthetics, synthesis of naturally occurring anthraquinones, structure and synthesis of chaulmoogric acid (used at that time in treating leprosy), stereochemistry of compounds with restricted rotation and of deuterium compounds, the structure of gossypol (the yellow material in cottonseed meal), compounds isolated from marihuana, and the structure of the Crotalaria and Senecio alkaloids and quinoneimines. The gossypol structure was perhaps the most difficult, but the voluminous correspondence related to his work on marihuana illustrates well the administrative and scientific ability and the boundless energy and enthusiasm with which he pursued his researches.

As a body, Adams' research represents the high point of structural organic chemistry, particularly on natural products, before the Instrumental Revolution and before the emergence of physical organic chemistry as a major field. He was elected to the National Academy of Sciences in 1929.

In 1926 Adams was chosen unanimously to succeed W. A. Noyes as head of the Chemistry Department at Illinois. By this date the department was recognized as one of the leaders in organic chemistry, and the characteristic features of Adams' conception of a graduate department were clear. The faculty should be of outstanding ability: Adams, Marvel, R. L. Shriner, R. C. Fuson, and, in the 1930's and later, H. R. Snyder, C. C. Price, N. J. Leonard, and their junior colleagues formed the organic group, with few changes. Equipment and facilities were to be kept up to date; graduate students and undergraduates were carefully selected and were caught up in the infectious enthusiasm and hard work of the faculty so that they, too, worked long hours. Research was carefully done, carefully and promptly prepared for publication, and great attention was paid to placing graduates

in suitable positions. Adams was actively interested in the progress of all Illinois graduates in chemistry after they left Urbana and recommended them for new positions as the occasion arose; his remarkable memory enabled him to call most of them by name, whoever had directed their research.

Adams developed a highly successful scheme for directing graduate student research. By starting a student on a problem that promised reasonable success and by publishing the work promptly, he built up the student's confidence to undertake more difficult experiments. Such problems as hindered rotation in biphenyls offered indispensable and excellent training in synthesis and physical measurements, and difficult investigations in natural products were usually given to experienced graduate students or to postdoctorates. Adams' personal magnetism made interesting even the drudgery encountered in research projects, and made good results exciting. His buoyant and forward-looking nature, his outgoing personality, his interest in people as individuals, and his breadth of knowledge and experience made conversation with him amusing and delightful, broadly educational in the best sense.

Adams' work on *Organic Syntheses,* his circulation of bound volumes of reprints to leading universities here and abroad, and his active participation in scientific societies increased the reputation of his department. What he had really accomplished by 1930 was the development of a graduate department of national stature that had strength in all significant fields of chemistry; it represented a novel addition to that characteristic American educational institution, the land-grant college. Although A. A. Noyes at MIT (later at Caltech) and G. N. Lewis at Berkeley had built up departments of physical chemistry with several outstanding colleagues, the Illinois department was larger and offered a broader range of research opportunities to students.

The growth and research output of the Illinois department are shown by a survey of papers in organic chemistry in the *Journal of the American Chemical Society.* In the twenty-five years from 1914 through 1939, Illinois was surpassed only four times in number of publications of organic research, advancing from four papers in 1914 to sixty-six papers in 1939, 11 percent of all organic papers published in this journal from all the nation's laboratories in 1939. The Illinois papers were scientifically of high quality. Although figures available do not give doctorates for organic chemistry as such, during the years 1920 through 1939 Illinois produced 346 Ph.D.'s in chemistry, 6 percent of all American Ph.D.'s in this field. Adams directed almost one-third of the Illinois total and accounted for about 2 percent of those in the whole country for the years 1920 through 1939, as shown in the following table; during the 1920's Adams trained 3 percent of the American Ph.D.'s in all fields of chemistry.

Doctorates Granted in All Fields of Chemistry, 1920–1939

Years	*Illinois*[a]	*Total US*
1920–1924	64 (30)	746
1925–1929	73 (26)	1,178
1930–1934	103 (25)	1,751
1935–1939	106 (22)	2,212

[a] Figures in parentheses represent Adams' own Ph.D.'s for these periods.

Of the 105 Ph.D.'s trained by Adams during the years 1918 through 1939 inclusive, seven were women; of the total, fifty-nine spent most or all of their careers in industrial research, twenty-six were in teaching, and nine worked in government laboratories. The remainder included a number of overseas students.

Where did all of these chemists find jobs? Consideration of this question leads to Roger Adams' interaction with the

industrial chemical research community, which grew strikingly between the two world wars. It is estimated that in 1920 there were 300 industrial research laboratories in the United States, and that in 1940 the number had grown to 2,200. In 1927 the chemical industry is believed to have had 3,300 research people, and in 1938, in spite of the depression, the number had increased to 9,542.

Adams had a natural inclination toward the business world; although he always regarded himself as a member of the academic profession, he understood finance and business and was liked and trusted by businessmen. He served as consultant for A. E. Staley Co., M. W. Kellogg Co., and Coca-Cola, as well as Abbott, and he and Marvel became consultants for DuPont in 1928. Industrial research was given a large boost by the spectacular success of Adams' brilliant student, Wallace H. Carothers, whose fundamental research on polymers at DuPont from 1928 to 1937 resulted in the discovery of nylon and neoprene rubber. Adams, always close to him, was deeply affected by his death in 1937.

Adams frequently wrote and spoke about what industry was entitled to expect from its research chemists, and the majority of Illinois Ph.D.'s who did go into industrial research were well informed as graduate students in this regard. Conversely, he was able to make clear to research management in industry how research chemists should be treated to maintain good morale and productivity. As the number of Illinois Ph.D.'s grew, it was a small educational or industrial laboratory that did not have one or more. Hence, the influence of the Illinois department and its graduates became very great, particularly when many of these graduates reached responsible administrative positions in research and teaching. Adams was constantly being asked for advice about academic and industrial positions everywhere, and he spent much effort in finding suitable positions for his students. In 1954 he

wrote that his "biggest contribution to chemical industry has been very indirect through many of the students who have been eminently successful in industry." It is clear, however, that this underestimates his personal contribution.

Although it is almost invidious to single out Adams' Ph.D.'s between 1927 and 1959, the following had outstanding careers: M. M. Brubaker, R. M. Joyce, T. L. Cairns, J. F. Hyde, W. M. Stanley (Nobel Laureate), W. E. Hanford, Byron Riegel, R. Clarke Morris, Allene R. Jeanes, B. R. Baker, Nathan Kornblum, R. S. Long, M. W. Miller, Jack Hine, W. H. Lycan, M. T. Leffler, E. E. Gruber, D. J. Butterbaugh, R. O. Sauer, and R. B. Wearn. An equally impressive list could be made of his postdoctorates.

Adams played a key role in the enlistment of unrestricted industrial support for university research, which became particularly significant after World War II; this was sometimes in the form of graduate fellowships, of which there were many at Illinois even before World War II, and sometimes as unrestricted grants to be used for equipment or stipends as needed. In addition, his service for the National Science Foundation, the Sloan Foundation, the Welch Foundation, and the Sloan-Kettering Institute for Cancer Research, among others, increased the influence of his ideas. His attitude in distributing research funds was the same as in his selection of faculty members or graduate students: pick the best people possible, give them what they need to work, and don't bother them unduly.

Several points previously mentioned bear on Adams as an international scientific figure. His acquaintance with European chemistry from his postdoctoral trip in 1912 and 1913 was maintained and increased by extensive correspondence. His papers contain a series of letters written in 1927 acknowledging copies of Illinois reprints from numerous distinguished European chemists and many Americans, and his

home guest book contains the names of eminent scientists from all around the world. He maintained a cordial correspondence with nearly all prominent foreign chemists, including numbers from South America, South Africa, and the Far East, and many of them visited Urbana. In 1936 he visited many countries in Europe and greatly increased his professional acquaintances, especially in Switzerland.

During his war years of work for the National Defense Research Committee, 1940 to 1945, Adams was in charge of many projects in chemistry and chemical engineering, requiring constant travel in this country to laboratories and proving grounds. In 1943 he visited Britain, where he renewed several old acquaintances and met many distinguished British scientists whom he had not seen before. He returned to Urbana when possible to talk with his students. One of his associates in Washington during those years wrote that if he was shipwrecked on a distant island, he would like to have Roger Adams with him. He was sure that Adams would figure out some way of getting off, and they "would have a whale of a good time doing it."*

After the war he was in Berlin, from November 1945 until February 1946, as scientific advisor to the U.S. Military Government under General Lucius D. Clay, where he exercised significant influence in reviving the German compendia, Beilstein and Gmelin. He also visited Japan twice with committees of scientists, and the ensuing plan for a complete reorganization of Japanese science resulted in its rebuilding along more democratic lines. His group had a long conference with General MacArthur who strongly commended their report and used it as a basis for scientific policy in Japan.

Although he retired as department head at Illinois in 1954, and as research professor in 1957, he continued his

* W. M. Latimer to N. A. Parkinson, 20 October 1949.

work with *Organic Syntheses* and *Organic Reactions,* which he had started about 1940, and as a consultant; he was on advisory boards for many groups, some mentioned above, and for the American Chemical Society, of which he had been president in 1935. He was president of the American Association for the Advancement of Science, served on the Natural Resources Board of the State of Illinois, and on the Board of Directors of Battelle Memorial Institute.

His retirement as head of chemistry in 1954 was celebrated by a symposium in Urbana, attended by over 300 former students, colleagues, and friends. The group showed its great affection for Adams, and some of his students wrote a suitably irreverent skit, poking fun at some of his foibles.

Adams made many overseas trips, partly for pleasure and partly to attend international scientific meetings; he visited most of the major countries of the world at least once, and enlarged his circle of acquaintances in every country. As a senior statesman of American science, his visits were major events everywhere. After Mrs. Adams' death in 1964, he continued an active schedule of attending meetings, serving on boards of directors, and traveling, even in his late seventies. One of his colleagues, asked if Adams was working less after his retirement, said he probably was; he was doing only three men's work instead of four.* He died on July 6, 1971 after a brief hospitalization, following a trip to Columbus for a directors' meeting at Battelle Memorial Institute.

Adams' accomplishments had been recognized by the respect and personal affection of his collaborators and associates. He was a member of the American Philosophical Society, the American Academy of Arts and Sciences, and an honorary member of more than a dozen foreign academies and chemical societies. He received honorary doctorates

*C. S. Marvel to E. H. Volwiler, 12 November 1958.

from ten institutions, including Illinois, Harvard, Yale, Rochester, Pennsylvania, and Michigan. He was the recipient of most of the medals and awards open to scientists, such as the Davy Medal of the Royal Society, the Gibbs, Nichols, Parsons, and Priestly medals, the Medal of the Franklin Institute, the National Medal of Science, Honorary Commander of the British Empire (C.B.E.), and the Medal for Merit of the United States, the last two recognizing his services in World War II. The list of his awards, offices, and honors covers three pages.

More than any other organic chemist of his time, Roger Adams epitomized the coming of age of organic research and advanced training in this country and the phenomenal growth of chemical research and production in industry. His influence on the development of American science rested partly on the period in which he lived, but to a greater extent on his own extraordinary personality and ability. Roger Adams is a good example of Dr. Samuel Johnson's definition of genius: "a mind of large general powers, accidentally determined to some particular direction."

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