NATIONAL ACADEMY OF SCIENCES

WILLIAM ALBERT NOYES

1857—1941

A Biographical Memoir by

ROGER ADAMS

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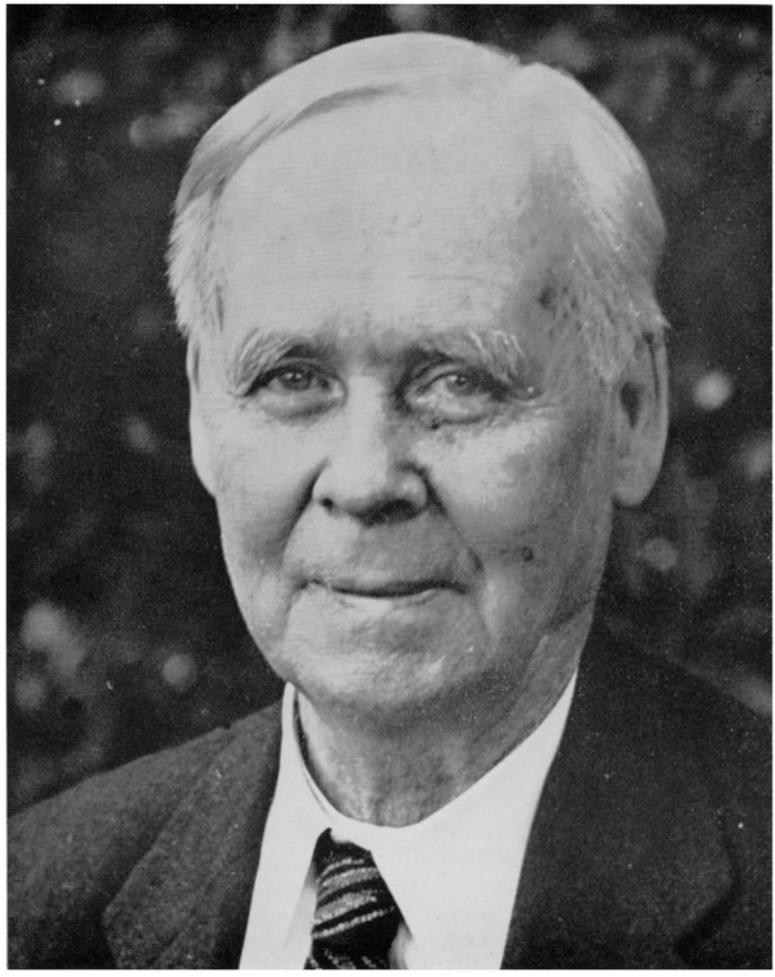

William Albert Noyes

WILLIAM ALBERT NOYES[1]

1857–1941

BY ROGER ADAMS

William Albert Noyes was born November 6, 1857 on a farm near Independence, Iowa. He was the seventh generation of the Noyes family in America, being descended from Nicholas Noyes who came with his elder brother, James, from Choulderton, Wiltshire, in 1633. Their father had been a clergyman but had died before the sons left England. The two brothers settled first in Medford, Massachusetts but in 1655 moved to Newbury. Samuel, of the third generation in this direct line, moved to Abington about 1712 and there he and the succeeding generations lived for over one hundred and forty years.

Spencer W. Noyes, the great grandson of Samuel, was admitted as a student to Phillips Academy at Andover, Massachusetts, March 21, 1837. He married Mary Packard—related to the famous family of shoe manufacturers—and they had three children when they left Abington and migrated to Iowa in 1855. When the father with his family went west to open up a homestead, he found conditions typical of the prairies and life was necessarily primitive. In the east he had been a cobbler by trade so had had little experience working the land. The early years were difficult ones because of the hard work in establishing a farm home, getting land into cultivation, raising food and storing sufficient for winter needs. This had to be accomplished by much manual labor with only the simplest tools and equipment. Frontier living had the usual monotony of daily routine, broken by Sunday observances, by the only big family festival at Christmas, and by the not infrequent excitement when prairie fires threatened.

The family life was an especially happy one even with the strict financial limitations, for there was the wholehearted cooperation of all; the girls helping the mother with household tasks and the boys learning by working with the father. It was

[1] Grateful acknowledgment is made to the sons of Dr. W. A. Noyes for help with historical material and to his wife, Katharine Macy Noyes, for reading the manuscript before publication.

necessary to fashion and repair many articles for farm and home use, and William Albert became skillful with his hands. Not only tools, but the toys of the home were often home-made, for playthings purchased at distant stores were few. In later years William Albert Noyes recalled as one of the vivid incidents of his youth his longing for a sled at Christmas, but which didn't arrive until months later, due probably to his father's limited funds at the holiday time. He also remembered spending a whole season digging potatoes to earn enough money for a pair of skates. He was an active youth and enjoyed the outdoor sports of the normal boy.

The intellectual life in the home was also one of cooperation. Mother Noyes was a cultured woman, never really at home on the prairie. She was the driving force in the family and created the intellectual atmosphere which inspired all four children to go to college and enter professional life. She taught the older children and they, always having shown great interest in the younger brother, helped in the instruction of young William; the boys with farm practices and elder sister Hannah with his books, especially Latin. He, from the beginning able to concentrate, learned the Greek alphabet one day while plowing corn in the fields. Although he walked miles to and from the country school a few months each year, he was self-taught to a great degree. All New England families on migrating to the west carried among their precious possessions the Bible and a few books. In the scanty library of the father was a copy of "Elements of Chemistry" by J. L. Comstock, M.D., published in 1831 at Hartford, Connecticut. Young Noyes acquired an early interest in science by reading this and began experimenting for himself with materials purchased in the village apothecary's store.

To fully appreciate the cultural influences of the frontier home it is of interest to mention the careers of the three older children. Edmund, the oldest son, was too young to be in the Civil War. After studying as a dentist's apprentice in Dubuque, he went to Chicago prior to 1870 and practiced dentistry in an office not far from the present Marshall Field Building. Burned out in the Chicago fire, he revived his practice and accepted

along with it an appointment as Professor at Northwestern University which he held for nearly fifty years.

The older girl, Hannah, later fondly known by the boys in the W. A. Noyes family as "Aunt Nannie" was graduated from Iowa College in 1875 and had a long and distinguished career as a teacher, author and lecturer. She married one of her college classmates, Charles Davidson, who subsequently received the Doctor of Philosophy degree in English at Yale University. Hannah Noyes Davidson's best known works were the editing of the Autobiography of Benjamin Franklin and her Study Guides on Literary Works. The other sister, Mary, was one of the first women to receive the degree of Doctor of Philosophy in Physics from an American university. This was conferred by the State University of Iowa in 1892. Her teaching career at Oxford College for Women was terminated by ill health in the early 1900's.

The real turning point in Noyes' life came when he went to Grinnell, Iowa, and enrolled for one semester in the Academy before entering Iowa College in 1875. This college, founded in 1847 by three pioneer settlers, Congregationalists and graduates of Yale, and twelve graduates of Andover Theological Seminary, became in 1909 Grinnell College. Here was provided a religious background, a follow-up of the home training which influenced Noyes throughout his lifetime. It was also at Grinnell that he had his thorough study in the classics and awoke to a real interest in science. At that time Grinnell had a three-term system, fall, winter and spring. It was necessary for Noyes to absent himself from the winter terms in order to earn money for his expenses for the other two sessions by teaching in nearby country schools. This did not deter him from graduating in the normal period of time, for by night study he covered the subjects missed in the regular classes of the winter terms. During his senior year the financial stringency was somewhat relieved, as he was honored by receiving one of the four coveted Grimes Foundation Scholarships "awarded to the best scholars and the most promising in any department . . . without regard to religious tenets or opinions entertained by any person seeking said scholarships." Perhaps

this absence of bigotry in a denominational college was reflected in Noyes' characteristics of tolerance and love of justice. During the college course he was registered as a "classical student," and specialized particularly in Greek. He also had political science under the distinguished Professor Jesse Macy. No doubt these subjects formed the foundation of his interest later in life in philosophical discussions and international issues. As an extra-curricular activity he was an enthusiastic member of the Chrestomathia Literary Society. This classical training and ability to express his thoughts in words gave to his work and writing all through his life profound depth and clarity.

While studying at Grinnell, he became interested in natural philosophy. He took such scientific courses as were available in those days to a classical student, but these were confined chiefly to his junior year. However, driven by a consuming interest, he worked regularly at night in the chemical laboratory for recreation while other students sought diversion in other ways. He thus completed the study of qualitative and quantitative analysis by himself. When time came for graduation, Noyes pointed out to the faculty that he had not only finished all of the work required for the Bachelor of Arts degree, but he had also met the requirements for the Bachelor of Science degree, and he claimed the right to have both degrees awarded simultaneously. After some debate, the faculty was forced to admit his contention and he was granted the A.B. and B.S. degrees in 1879. The faculty passed a rule, however, which prevented any simultaneous awarding of two degrees thereafter.

During the year following graduation he taught Greek and chemistry thirty hours a week in the Academy of the College, and during his spare time did advanced work in analytical chemistry. He studied blowpipe analysis and built himself a small assay furnace so that he was able to eke out a small income by performing analyses. In the fall of 1880, the second year after graduation, he was given charge of the Department of Chemistry for one term while Professor W. H. Herrick was absent on leave. In 1880 he was awarded the Master of Arts degree by Grinnell College.

With what savings he had he went to Johns Hopkins Univer-

sity during the academic year 1880-1881, but did not arrive in time for the opening of the fall term. While there he worked under Professor Ira Remsen, and performed water analyses on the side to pay his expenses. His life at Johns Hopkins was one mainly of work for he received the Doctor of Philosophy degree in 1882 after one year and a half. When Dean K. C. Babcock of the University of Illinois later asked Dr. Remsen whether he was not somewhat regretful at letting a student finish work for the degree in such a short time, Remsen merely asked, "Has anyone ever objected?" This was indicative of the high esteem which he had for Noyes. During the summer of 1881, Noyes made four-hundred water analyses for Professor G. W. Mallet of the University of Virginia, who was studying the connection between water supply and disease for the then-existent National Board of Health.

The first independent position Dr. Noyes held was that of instructor in chemistry at the University of Minnesota during 1882-1883 at a salary of $700. Much of his time that year he spent in analytical work for the Minnesota Geological Survey. In the fall of 1883 he became Professor of Chemistry at the University of Tennessee at Knoxville. While Noyes was at the University of Tennessee, professorial appointments had to be approved annually by the State Legislature. The other professor in the Department was a southerner, and there still existed considerable feeling because of the Civil War so that Noyes considered his position to be insecure. Consequently in 1886 he accepted a professorship at the Rose Polytechnic Institute in Terre Haute, Indiana.

No chemist worthy of the name in the United States during that period considered his training complete until he had spent some time in Europe. Consequently, Dr. Noyes went on leave during the second semester of 1888-1889 and worked with Professor Adolf von Baeyer, the distinguished organic chemist at the University of Munich. The months with von Baeyer exerted a profound influence on him and the subsequent travels around Europe, particularly in England, widened his acquaintances and cemented friendships which lasted throughout his life. Alexander Smith was a student at Munich at the same

time and, on returning home, Noyes was instrumental in getting him his first position in the United States at Wabash College. J. Bishop Tingle, later a professor at McMaster University, Hamilton, Ontario, was another intimate friend.

At Rose Polytechnic Institute, Professor Noyes' salary was $1850 per year, later raised to $2250, and his starting salary was the highest paid to any professor of chemistry west of the Alleghenies at that time. Nevertheless, it proved insufficient to support a family, and he always did some work for the State Water Survey and a certain amount of analytical work. Professor Noyes *was* the Chemistry Department at Rose Polytechnic Institute, and for many years he taught all of the courses of the chemistry curriculum. The seniors in the curriculum were required to present theses based on original research. Several of these were published in the *American Chemical Journal,* and Noyes' early scientific reputation was based on this work. Some students from those days, particularly George W. Morey, later attained eminence.

In 1901 Professor Noyes became Editor of the *Journal of the American Chemical Society.* In 1907 he founded *Chemical Abstracts.* It was an enormous undertaking to get this latter project under way since he even had to correct proof because of lack of assistants. But two years later when he was relieved of this additional burden, *Chemical Abstracts* was on a sound basis and has become one of the outstanding publications in science. From 1904 to 1907 he was also secretary of the American Chemical Society. In 1909 he was a member of the committee which recommended publication of the *Journal of Industrial and Engineering Chemistry.* Later Professor Noyes took an active part in the establishment of *Chemical Monographs* (1919) and *Chemical Reviews* (1924). He contributed more than any other individual to the publications of the American Chemical Society and largely to his influence may be attributed the healthy start and growth of these publications which today hold a preeminent position among the scientific journals of the world.

It had become evident to Professor Noyes by 1902 that the Rose Polytechnic Institute would be surpassed by many other

institutions in that area, and when he was asked to become the first Chief Chemist of the newly established Bureau of Standards, he took the necessary Civil Service examinations and obtained the appointment. He left Terre Haute during the summer of 1903, but since the new buildings for the National Bureau of Standards were not complete, he returned to Johns Hopkins University to do research during the academic year 1903-1904. This location was chosen because of the proximity of Baltimore to Washington which permitted him to participate in the plans and construction of the new buildings.

It was during the period in Washington from 1904 to 1907 that Noyes' reputation became truly international. He was relieved of teaching duties and his researches prospered. His development of standard methods of analysis and standard specifications for chemicals established the base upon which the Bureau of Standards expanded to its present position of influence and prestige. Famous foreign and American visitors frequented his home during that period: Ostwald, van't Hoff, Harvey Wiley, W. F. Hillebrand, not to mention many other chemists.

After the death of Professor A. W. Palmer, Head of the Chemistry Department at the University of Illinois, a search was made for a new Department Chairman and the position was offered to Dr. Noyes. He declined, but the following year when the University, intent on securing him, made a new offer he accepted. President Edmund J. James assigned to him the task of "building a strong graduate Department of Chemistry." For the next nineteen years, Dr. Noyes' major effort was to strengthen the department by expanding the staff with promising young men, reorganizing the courses of study, and systematizing the plan of instruction. By his own interest in research he stimulated his colleagues in original work and with staff cooperation he laid the foundation for one of the eminent chemistry departments of the country. The reputation of Illinois chemistry, the vigorous atmosphere for progress which he inspired, and his traditionally friendly attitude toward the growing staff will always remain as his lasting contribution to the University of Illinois and American chemistry.

In 1907 the entire teaching staff of the department numbered eleven and there were seventeen graduate students. At the time of his retirement in 1926, the staff had increased to twenty-five and the graduate students to one hundred fourteen. But of more importance may be cited the scholarly work achieved. During the period 1870-1903, there was an average of one paper a year from the department; from 1904-1906, an average of fifteen papers annually; during the period Dr. Noyes was director of the laboratories, 1907-1926, the number of publications averaged forty-four a year. His personality and great interest in research will always be remembered by the members of his staff.

His breadth of knowledge in various fields of chemistry profoundly impressed his younger colleagues whose training had been far more specialized. He initiated weekly journal meetings, monthly faculty luncheons and the Chemistry Club which served to build up friendship and cooperation among students and faculty.

Dr. Noyes received many honors and deserved recognition for his achievements. He was awarded the honorary degrees of LL.D. from Clark University in 1909, Chem. D. from the University of Pittsburgh in 1920 and Sc. D. from Grinnell in 1929, the fiftieth anniversary of his graduation. He was elected in 1908 an Honorary Member of the Philadelphia College of Pharmacy. He was a fellow of the American Academy of Arts and Sciences, a member of the National Academy of Sciences and the American Philosophical Society. He served the American Chemical Society as Editor, Secretary, and in 1920 as President. He was Secretary of Section C of the American Association for the Advancement of Science and in 1896 Vice-President. He was a charter member of the Indiana Academy of Science and its President in 1912. He was also a member of the Illinois Academy of Science, the Society of Chemical Industry, the Deutsche Chemische Gesellschaft and the Société Chimie Industrielle. Dr. Noyes served on the Illinois State Board of Natural Resources and Conservation as member and Secretary from 1917 until his death.

In 1908 Dr. Noyes and Dr. H. C. P. Weber were awarded

the Nichols Medal for their work on the atomic weight of chlorine. He received the Willard Gibbs Medal in 1920 for his distinguished attainments in organic chemistry and the Priestley Medal, the highest award of the American Chemical Society, in 1935, for his general contributions to chemists and chemistry.

On November 5, 1937 the staff of the Chemistry Department at the University of Illinois united in celebrating Professor Noyes' eightieth birthday and presented to him a parchment scroll signed by his colleagues of the teaching staff. The inscription reads:

"The celebration of your eightieth birthday is an event which we, your colleagues, are happy and proud to share. We realize that our privilege on this occasion is one which belongs not to us alone, but rather to the entire chemical world. Chemists everywhere—of every persuasion and of every nation—share the feeling of gratitude and high esteem which we would express.

"Your numerous scientific discoveries, your sucessful promotion of chemical societies and journals, and your inspiring guidance of students and colleagues have made your name immortal among men of science. We take this opportunity to congratulate you upon your achievements and to wish you continued success and happiness."

On May 13, 1939 at a University Convocation at the University of Illinois, the Chemical Laboratory was rededicated and named "The William Albert Noyes Laboratory of Chemistry". Dean M. T. McClure on this occasion remarked "Professor Noyes, through his long and distinguished connection with this Laboratory, has brought honor to the University of Illinois. In return the University seeks to honor Professor Noyes. This is no casual recognition. Only one other building on the campus has been named in honor of one of its living scholars. So long as the University stands, the name of Professor Noyes will remain among its immortals, among those who have devoted themselves to the mystery of the mechanism of Nature. Any sound philosophy must look to science for its facts and to the lives of men for its ideals."

While Professor Noyes was at Knoxville, Tennessee, in 1883 he married Flora Collier, a former student in the Conservatory

at Grinnell College, whom he had met while an undergraduate there. A daughter, Helen, was born in Knoxville. During the Noyes' trip to Europe in 1889 she contracted spinal meningitis and died. A second daughter who was born in 1892 died from typhoid fever in 1899. A third child, William Albert, Jr., was born in 1898. He has now become one of America's most distinguished chemists. He is head of the Chemistry Department at the University of Rochester, Past-President of the American Chemical Society. He was Editor of *Chemical Reviews* for many years, and is now Editor of the *Journal of the American Chemical Society*. He is a member of the National Academy of Sciences and the American Philosophical Society. Flora Collier Noyes died in 1900.

On June 18, 1902 Professor Noyes married Mattie Elwell whom he had met while in Minnesota. In 1904 a son, Charles Edmund Noyes, was born. He followed a literary career and is now Publicity Director of the American Institute of Accountants. The second Mrs. Noyes died in 1914.

In November 1915, he married Katharine Haworth Macy, daughter of Professor Jesse Macy, an internationally known scholar in political science at Grinnell College who had been one of Dr. Noyes' teachers. At the time of her marriage Katharine Macy was teaching English at the institution. They had two sons; Richard Macy Noyes, now Assistant Professor of Chemistry at Columbia University, was born in April, 1919, and Henry Pierre Noyes, now a graduate student in physics at the University of California, was born in Paris in December, 1923.

After the close of World War I Professor Noyes, at the invitation of Professor Ernest Cohen of Utrecht, visited Europe to attend the meeting of Allied and Central Power chemists. The following year, in 1923, he was a delegate to the International Union of Chemistry meeting at Cambridge, England and on this trip spent much time on the Continent trying to allay some of the hatreds between the French and Germans resulting from the war. His last trip to Europe was in 1931 in order to give his two young boys a chance to become familiar with foreign languages.

Before the first World War in the peaceful year of 1910, he built a family cottage near Frankfort, Michigan which was to be his summer home nearly every year from then until he died. As an ardent churchman, a Deacon for many years of his life, it was perhaps natural that this cottage should have been built on the grounds of the Congregational Summer Assembly. While he did considerable writing in the summer, it was in Michigan he indulged in chopping wood, rowing a boat and strolling about the country.

Anecdotes about Professor Noyes and his family life furnish a little more intimate knowledge of him in matters outside of his scientific career.

In 1902 his second wife received as a wedding gift from her brother, who had a real interest in horses, a small pony which was named "Teddy" after the first Roosevelt. This pony was with the family, in Terre Haute, in Baltimore, in Washington and finally in Urbana, until he was put out to pasture by arrangement with a local farmer in 1917 when an automobile finally took his place. *The Daily Illini,* University of Illinois student newspaper, referred to "Little Willie and his coach and four" since the family was often seen driving around Urbana in a little two-seated buggy behind this pony.

Professor Noyes always believed in close family ties and these included the relatives of his three wives. During the last years of his life he wrote a "family letter" every week and carbon copies were distributed widely among the members of the family. Sunday was observed strictly in the New England tradition, Sunday School, church and a formal dinner at one. Reading out loud or being read to were among his greatest enjoyments. This he often did with his wife and children. Novels and sometimes more serious philosophical books were read but seldom anything too light and flippant.

At home his meals were fairly formal affairs in the dining room, for breakfast nooks had not come into existence and his memory went back to eating in the kitchen of the early farm home. Grace was always said and conversation was usually serious and intellectual. The days' activities were recounted with the family and he liked to discuss important matters with

his wife. He did not unbend easily and indulge in banter, but he did appreciate a good joke. Entertaining was infrequent and formal. Once a year there was a formal reception for the department at which evening dress was in order. Dinners when the President or the Dean was invited were given in Victorian style.

Professor Noyes usually worked in his study at home after supper. His duties for the American Chemical Society and the books he wrote occupied many of his evenings. He had a very complete library which included not merely scientific books but those by the best literary authors. Although he gave the impression of never relaxing completely, he was truly absent-minded at times and had powers of concentration which were remarkable. Noise and confusion were not tolerated about the home, and he never permitted a rough house since they interfered with his concentration and proofreading. He was busy all day whether he was in Urbana or at his cottage in Michigan.

Professor Noyes was meticulous in his personal affairs. His accounts were carefully kept, personal correspondence was retained, and his desk at home was covered with papers more than his desk at the laboratory. His habit of doing everything on an "urgent" basis was characteristic of the man and persisted after he retired and until his death. He was too active too long to enjoy fully the years of much deserved leisure.

He took little interest in menial tasks about the home or outdoor work in the yard. Such things seemed to bore him, perhaps as a result of his many years of hard work on a farm while a youngster or because of his need for every minute for intellectual pursuits. Nevertheless, he was ingenious and could make repairs of household appliances and get them in working order. When he found the two older sons trying to learn chess from the Encyclopaedia Britannica he revived his early skill and made a set of chessmen for them. His health was excellent, but he rarely took any exercise in Urbana after his five minute setting-up exercises each morning, other than walking to and from the laboratory. It was consequently surprising that he was always in good shape when it came to a hike whether in Glacier Park or in Europe.

Professor Noyes attended many lectures and rarely missed an important lecture or concert given on the University campus. His interests were catholic particularly as regards world affairs and politics. He also thoroughly enjoyed the legitimate theatre and went to everything offered locally in the days when good companies played in Champaign. When in the larger cities either in the United States or abroad he always went to plays. While he did not care much for music himself, he did go to hear outstanding artists and saw that his children had musical opportunities.

In spite of his mild manner of speech, Professor Noyes left no uncertainty as to his meaning and would defend his viewpoint with skill, courage and fearlessness. He was unafraid of an adversary in debate, so long as he believed that truth and right were on his side. This quality of stubbornness served him well, for it made possible the attainment of adequate support for his department and of success in many activities in and out of science for which he had been given responsibility.

He was particularly sympathetic and helpful to his students and colleagues. He had the faculty of overlooking in an individual any idiosyncracies which might prejudice most people, and always gave sound advice. He was profoundly respected by all scientists, and was looked upon with real affection by the younger men who had the good fortune to come under his guidance. He maintained a remarkable degree of interest in persons he had known and worked with. His colleagues will remember his untiring devotion to his tasks, his simplicity of life, his fairness to all, and his devotion to the cause of peace.

During his life, Professor Noyes had more than his share of sorrow in the loss of loved ones, and he always carried a heavy load because of being a pioneer in chemistry and lacking facilities everyone now expects and takes for granted. Through it all he kept the same outward calm. He thought everything out carefully and lived a carefully planned life. He could make decisions rapidly, but he never made them "hastily".

After his retirement in 1926, Noyes' study of chemistry never ceased. He was as alert and excited by all new developments as his younger colleagues and continued his researches until the

time of his death. His attendance at scientific lectures and meetings of the American Chemical Society and National Academy of Sciences was as faithful as in his more active years. Retired from his administrative duties, he had more time for reading and writing. He enlarged his interest in religious, philosophical and political problems. Always deeply religious, he devoted even greater service to the Congregational Church. While still in active service he took an active part in planning the building of the present church edifice which serves both Urbana and Champaign as well as the student body of the University.

He increased his efforts toward the creation of world peace and avoidance of future wars. He had many warm friends in both France and Germany and he was deeply distressed because of the bitterness which had grown up between these countries. He carried on an extensive correspondence with the scientific leaders of many nations and the publications of many of these letters show the increasing determination and earnestness with which he approached the involved international situation. He was convinced that scientists, accustomed to the recognition of truth and the appreciation of honest effort, ought to find a common ground for mutual understanding. He spoke earnestly for peace, disarmament and good will. Some of the topics of his pamphlets indicate his breadth of understanding and his sincere effort to abolish war: "Building for Peace", "International Understanding", "War or Peace", "Laissez Faire or Cooperation", "International Backgrounds", "Who Have Paid the Cost of War?", "Science in Place of War", and many others were written between 1920 and 1937. Dr. Noyes was a charter member of the American Committee for Democracy and Intellectual Freedom and even to the last few days of his life took an active part in the work of this organization. He believed in evolutionary progress almost as an act of faith. He maintained that he had lived to see substantial improvement in relations between people on both the domestic and international level, and was convinced, in spite of setbacks, in the ultimate triumph of cooperation and understanding among peoples. In his great zeal and striving for international peace and his participation in religious activities his wife, Katharine Macy Noyes,

was his devoted coworker and helpmate. Their common interests in the four sons and similarity of tastes in intellectual life made for a companionship of affection and loyalty.

In October 1941 Professor and Mrs. Noyes motored to Madison, Wisconsin to be present at the fall meeting of the National Academy of Sciences. The following week at home he attended the all-day meeting of the Illinois Board of Natural Resources. Just two weeks before his eighty-fourth birthday William Albert Noyes passed away after a brief illness of five days. Funeral services were held in the First Congregational Church in Champaign and, after cremation in Chicago, the ashes were interred in the Macy family lot in Grinnell, Iowa.

The *"Illio of 1942"*, the Senior Class Book at the University of Illinois, was dedicated to Dr. Noyes. His successor as Head of the Chemistry Department was asked to write the dedicatory words. The following tribute to him from the *Illio* characterizes briefly the place of this distinguished man on the campus, in the community, and in the professional world.

"William Albert Noyes

1857–1941

"William Albert Noyes, Professor and Head of the Department of Chemistry, came to the University of Illinois in 1907, and for thirty-four years devoted himself to the utmost in the furtherance of its interest.

"Coming at a time when the science of chemistry in this country was entering a new era, he brought to the department a background of culture, a training in investigational science, editorial and executive experience. With his inquiring mind and tireless vigor he laid the foundation of a department in which fundamental courses were nurtured and research became a vital interest.

"Patient, helpful, sincere to student and colleague; tenacious and undiscouraged in attaining a goal; zealous in working for the right in a world so apparently athwart his ideals, he was an influence throughout the life of the whole University.

"To few are given such outstanding achievements of scholarly research, of developing a department whose building now honors

his name, of authorship of many books and scientific papers, of fostering new journals which have become leaders in the fields of chemistry, of giving strength and vision to many chemical organizations from their modest beginnings until they attained national prestige. With all of this he was a lover of home and friends. Of him it can be truly said he was a faithful servant of the Church and the State."

Publications

The scientific achievements of Dr. Noyes were characterized by their diversity and by the care and skill with which they were performed. He completed investigations in the fields of analytical and inorganic chemistry as well as in his specialty, organic chemistry.

His work as a student with Remsen aroused his interest in the variable activity of different oxidizing agents upon alkylated benzenes. As a consequence he pursued this field further and in his first independent series of papers demonstrated the effectiveness of the previously unstudied ferricyanides for converting certain alkyl benzenes to the corresponding benzoic acids.

Dr. Noyes had been engaged in much analytical work in his early days partly through interest and partly by necessity. It is not surprising therefore that he undertook to improve various accepted procedures. His contributions in this field were numerous and included the detection and estimation of titanium, the determination of magnesium, sulphur and phosphorus in iron and steel, a means of estimating the amount of benzene in illuminating gas, and the detection of strychnine in the human body.

The elucidation of the structure of camphor was being explored in many laboratories in different parts of the world during the period 1880-1900. Dr. Noyes was one who became attracted to this problem and whose subsequent researches served as a major contribution toward its final solution. His early work was confined to a study of camphoric acid, the major oxidation product of camphor, and to related compounds. Fifteen papers were published on this subject. He turned his attention next to the molecular rearrangements in the camphor

series and achieved much in the clarification of these complicated reactions. The results appeared in about twenty articles. Dr. Noyes never lost his interest in camphor and he continued some phase of investigation in this field over a period of forty years.

His exploits in inorganic chemistry resulted in 1889-1890 in the determination of the atomic weight of oxygen with more accuracy than had been attained hitherto.

Dr. Noyes was one of the first organic chemists to become interested in the electronic theory of valence, and as early as 1912 gave a presidential address before the Illinois State Academy of Sciences on this subject. That same year he published two articles attempting to explain certain phenomena of ionization by the electron theory and the connection between electronic conductivity and loss of electrons by metals. Each year thereafter one or more papers on the application of the electron theory to organic and inorganic compounds appeared, especially as applied to polarity of valences and in relation to ionization. He was particularly interested in the valence and character of the nitrogen atom in ammonium salts, in nitrogen trichloride and other nitrogen compounds.

KEY TO ABBREVIATIONS

Am. Chem. J.=American Chemical Journal
Ber.=Berichte der Deutschen Chemische Gesellschaft
Bull. soc. chim.=Bulletin, Société de Chimie
Chem. Revs.=Chemical Reviews
Ind. Eng. Chem.=Industrial and Engineering Chemistry
J. Am. Chem. Soc.=Journal of the American Chemical Society
J. Anal. Appl. Chem.=Journal of Analytical and Applied Chemistry
J. Chem. Ed.=Journal of Chemical Education
J. Franklin Inst.=Journal of the Franklin Institute
Nat. Acad. Sci. Biogr. Mem.=National Academy of Sciences Biographical Memoirs
Proc. Am. Acad. Arts Sci.=Proceedings, American Academy of Arts and Sciences
Proc. Am. Assoc. Adv. Sci.=Proceedings, American Association for the Advancement of Science
Proc. Am. Phil. Soc.=Proceedings, American Philosophical Society
Proc. Am. Soc. Test. Mat.=Proceedings, American Society for Testing Materials
Proc. Ill. Acad. Sci.=Proceedings, Illinois Academy of Science
Proc. Ind. Acad. Sci.=Proceedings, Indiana Academy of Science
Proc. Nat. Acad. Sci.=Proceedings, National Academy of Sciences
Rec. trav. chim.=*Recueil des travaux chimiques des Pays-bas*
Sci. Mo.=Scientific Monthly
Trans. Faraday Soc.=Transactions, Faraday Society
Trans. Ill. State Acad. Sci.=Transactions, Illinois State Academy of Science
Zeit. anal. Chem.=Zeitschrift für analytische chemie
Zeit. angew. Chem.=Zeitschrift für angewandte chemie
Zeit. anorg. Chem.=Zeitschrift für anorganische chemie
Zeit. Elektrochemie=Zeitschrift für Elektrochemie
Zeit. physik. Chem.=Zeitschrift für physikalische chemie

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