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JOHN RAVEN JOHNSON
1900–1983

A Biographical Memoir by

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AND KEITH R. JOHNSON

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John R. Johnson

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August 9, 1900–May 25, 1983

BY CHARLES F. WILCOX, JERROLD MEINWALD, AND KEITH R. JOHNSON

JOHN RAVEN JOHNSON WAS born in Chicago, Illinois, on August 9, 1900. He developed into a precocious science student and received his B.S. degree at the University of Illinois in 1919. He stayed on at Illinois to work with Roger Adams, under whose direction he earned his M.S. in 1920 and his Ph.D. in organic chemistry in 1922. His Ph.D. thesis work was concerned with the synthesis of pharmacologically active arsonic acid derivatives for treatment of trypanosomiasis, which resulted in two publications and a U.S. patent (1921, 1923, 1925). He spent two years abroad doing postdoctoral research in the laboratory of Charles Moreau at the Collège de France in Paris under a prestigious American Field Service Fellowship. There he developed a lifelong love of France and French wines. His research with C. Moreau and C. Dufraisse on the bromination of furylacrylic acid and its conversion to furyl acetylene was published (1923, 1927) along with other work on the reactions of furan derivatives (1928, 1929).

He returned to the University of Illinois, spent three further years there as an instructor, and made several contributions (1925, 1926, 1927) to the *Organic Syntheses* series introduced by R. Adams. At the time, chemical supply houses did not exist as they do now and the development of practical syntheses of organic starting materials on a large scale was

extremely valuable to the organic chemistry community. Johnson had a passion for organic laboratory work, and he coauthored with his teacher and friend, Roger Adams, a widely used laboratory textbook on organic chemistry (1928). That book in a metamorphosed form continues to be used today. He also used his time as an instructor to continue his work, started in Paris, on furan chemistry.

In 1926 Johnson was invited to give a lecture in Cornell's Department of Chemistry. It was so well received by both the students and the faculty that he was offered a job as an assistant professor, which he accepted. Although only 27 years old when he started teaching at Cornell, he had already developed a reputation as one of the nation's brilliant young chemists. He brought to Cornell the new organic chemistry for which Illinois had become famous. He quickly put into place a lively program of research and attracted large numbers of graduate students. He also restructured Cornell's courses in organic chemistry and developed a reputation as a superb teacher. At Cornell he continued his studies of furan reactions (1930). He also collaborated with Professor A. W. Browne on the photochemistry of alkyl and acyl derivatives of azidodithiocarbonic acid (1930).

Jack (as he was known to his friends) Johnson was a meticulous lecturer. His lectures were prepared on 5 × 8 note cards that he called "board cards." Not only did he know what he was going to say but he knew exactly where he was going to write each structure and equation on the board. This was difficult for his later junior colleagues whom he would, on rare occasions, ask to lecture for him. He would insist that they show him their own board cards before he would sign off on their lecturing.

In 1930 Johnson, even though he was only 30 years old, was promoted to full professor. His publications from this period show continued activity in furan chemistry, medicinal

chemistry, and what was somewhat unusual among organic chemists of the time, a budding concern about electronic properties and mechanisms of reaction. In 1931 he initiated research programs in boron chemistry and organometallic chemistry, which continued for many years.

The 1930s were not kind to Cornell or Johnson. A department brochure for 1933 shows that Johnson was the only faculty member of professorial rank teaching the organic lecture courses. His predecessor, Professor W. R. Orndorff, who had been at Cornell since 1887, had died. He had two instructors to run the laboratories and to teach one of the graduate courses, but he had to lecture in three courses for each semester.

Johnson had a long, professional connection as chemical consultant with the Du Pont Company, where his old Illinois friend W. H. Carothers was the research director of the newly established Central Research Experimental Station. Carothers, who was credited with the development of Nylon for Du Pont, had a nervous breakdown in 1937 and fled to somewhere in France to escape the pressure. Based on his familiarity with both France and Carothers, Johnson was engaged to go to France, find Carothers, and bring him home. This he did. Unfortunately, Carothers, despite treatment that appeared to be working, a little while later committed suicide.

In 1937 there was a chance encounter that had lasting consequences. At that time the 20-year-old R. B. Woodward had obtained his Ph.D. from the Massachusetts Institute of Technology and was teaching a summer course at the University of Illinois. Johnson, then 37 years of age, apparently met and befriended Woodward there; at least in later years he spoke of counseling the young instructor Woodward. However it happened, Woodward and Johnson developed a mutual respect that resulted in important later collaborations.

In 1938 Johnson wrote a 116-page chapter in Gilman's influential *Organic Chemistry, An Advanced Treatise* entitled "Modern Electronic Concepts of Valence." This major review apparently was inspired by Sidgwick's Baker Lecture series at Cornell in 1933 on "The Electronic Theory of Valency," but it went well beyond Sidgwick by including Robinson's and Ingold's discussions of reaction mechanisms, as well as Pauling's treatment of resonance. For many organic chemists of the time this chapter served as a roadmap to the newly emerging field of physical organic chemistry.

In 1938 Johnson and Van Campen discovered the nearly quantitative oxidation of organoboranes to alcohols by alkaline hydrogen peroxide. Although this new reaction was only an incidental part of Johnson's borane program, 20 years later H. C. Brown and S. Rao capitalized on it and employed it as an essential facet in their powerful development of hydroboration chemistry.

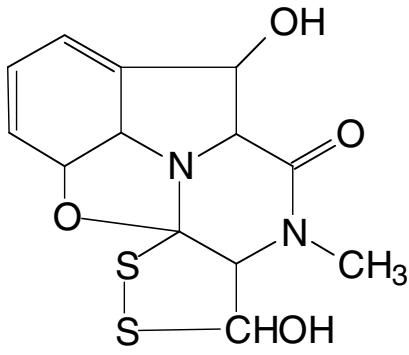
During the period 1941-1945 Johnson became deeply involved in the scientific aspects of several U.S. wartime research efforts. He was an early participant in studies on the synthesis of new chemical explosives and contributed to the vigorous U.S. search for new antimalarial agents. He also took part in the Alsos mission, a section of the Manhattan Project charged with trying to discover what progress, if any, Germany was making toward an atomic bomb.

In 1942 and 1943 he served in London, England, as the scientific officer for chemistry in the U.S. Office of Scientific Research and Development. One of the issues he dealt with concerned the new high explosive RDX (cyclonite) that the United States had developed. RDX has a nasty habit of crystallizing in different polymorphic forms, at least one of which is extremely shock sensitive, making the explosive unusable. Johnson, in collaboration with his Cornell colleagues A. T. Blomquist and W. C. McCrone, Jr., developed

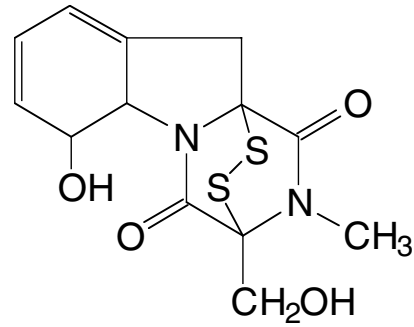
new crystallization solvents and procedures that eliminated the undesired polymorphs and made RDX an explosive of choice.

He participated in the Alsos mission in Italy in 1943 and 1944, following the Allied advance closely in order to interview Italian scientists who might know something of German nuclear research. Fortunately, the results were negative. He enjoyed telling of how he was accompanied near the battlefront by Lt. Col. Boris Pash, the chief of Alsos, who packed a .45 pistol. When Johnson observed that a .45 would be little use against an enemy attack, Pash said that wasn't the point: He had orders to shoot Johnson if necessary to make sure he did not fall into enemy hands. Johnson received the U.S. Medal of Merit for his wartime service, and in 1945 he was elected to the National Academy of Sciences.

Jack Johnson returned to Cornell after the war and resumed his career of supervising the research of graduate students, teaching large organic chemistry classes, and consulting with the Du Pont Company. In 1943 Johnson had published his first paper on the structure of the powerful antibiotic gliotoxin. In spite of the wartime hardships this work continued through a dozen publications until at last with the assistance of R. B. Woodward a final correct structure was published in 1958. Johnson was a classically trained organic chemist. The only instrument available to him for the bulk of the gliotoxin studies was an ultraviolet spectrometer that required separate point measurements at each desired wavelength. In spite of not having nuclear-magnetic-resonance spectroscopic evidence, he and his students managed to correctly identify all the structural pieces and most of the connectivities. It fell to his friend Woodward to put them together in the correct fashion. Woodward in later years credited Johnson as one of the pioneers in using physical methods for structure determination.



Johnson Structure



Corrected Structure

During World War II the chemistry and production of penicillin was treated as a war secret. The work of more than 20 U.S. industrial and academic research groups was coordinated with the similarly large British effort through the U.S. Office of Scientific Research and Development. In 1946 the massive joint effort was declassified and in 1949 Johnson collaborated with H. T. Clarke and R. Robinson to write and edit the monograph *Chemistry of Penicillin*, which described the knowledge about penicillin developed during the war.

Perhaps all chemists at some point in their life dream that their research might help save a human life. Few get to realize this dream, and fewer yet get to see it applied in such a personal way as did Jack Johnson. In the summer of 1945, just after the war in Europe had ended, Jack's 10-year-old son had to have an emergency appendectomy, which was successful but led to a serious case of peritonitis, a commonly fatal condition at the time. Johnson was able to

arrange for penicillin treatment and after a month of regular penicillin injections, his son made a full recovery.

During the spring semester of 1951 Johnson served in West Germany as special consultant on scientific matters for the U.S. Department of State. In 1952 he became the Todd Professor of Chemistry at Cornell, occupying the only named chair then available to the Cornell Department of Chemistry. Johnson's research continued to bridge the old and the new in organic chemistry. He and his students gave much effort to devising syntheses and determining structures of important molecules in the best tradition of organic chemistry. In 1963 he was joined in the authorship of the venerable Adams and Johnson *Laboratory Experiments in Organic Chemistry* by his Cornell colleague C. F. Wilcox.

In 1965 Johnson retired from Cornell and he and Hope, his wife of 36 years, moved permanently to their beloved farm in Townshend, Vermont. For several years after leaving Ithaca he spent six months at a time in Wilmington as a consultant in residence at the Du Pont Experimental Station. Although he was cut off from formal research, he also kept busy with one of his original loves, organic laboratory instruction. Johnson drew on his encyclopedic knowledge of organic chemistry and his treasured personal copy of Beilstein to suggest interesting new experiments that were then perfected at a practical level back at Cornell. The sixth and seventh editions of the laboratory manual were developed in this long-distance fashion. The seventh edition appeared in 1979, 51 years after the first: an extraordinary run for a manual in any field of science.

Johnson had been a heavy smoker for most of his life, and he eventually developed emphysema. His life became increasingly restricted, but he remained engaging and intellectually lively up to his death in May 1983. He was survived by his wife; two sons, Keith and Leonard; and three

grandchildren. Jack Johnson's Cornell colleagues and his many students and other friends remember him with admiration and affection as one of the important players in the development of Cornell into a great research university.

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