MEMORIAL RESOLUTION
WILLIAM SUMMER JOHNSON

(1913-1995)

William Summer Johnson, widely regarded as among the world's leading practitioners of synthetic organic chemistry of the last century, died in his home in Portola Valley on August 19, 1995 of circulatory and heart problems. He was born in New Rochelle, NY on February 24, 1913. He attended high school there through the sophomore year, his school record not foreshadowing his future success. At the age of 13 he began piano lessons and became proficient in the instrument. Though he began with classical music, he was more interested in jazz, which he undertook to learn on his own. In pursuing this interest he became proficient also in the tenor saxophone, enough so that in 1934, he paid for a trip to Europe, by playing for dances on an ocean liner. His passion for the music of his choice was almost as great as it proved to be for research in organic chemistry and continued for the rest of his life. His remaining year of high school was spent at the Governor Dummer Academy, a preparatory school for Harvard, where apparently a spark was struck. On the strength of his academic record there he transferred to Amherst College in 1932, receiving the B.A. degree, magna cum laude, in 1936. Here he experienced his first exposure to organic chemistry, where according to his own words[1] he "became hooked" on reading a textbook on the subject written by James B. Conant, an eminent chemist who served a number of years as President of Harvard University. Following a year at Amherst as Instructor he was admitted to Harvard in 1937, where he chose as his mentor for the Ph.D. degree Louis Fieser, a highly regarded organic chemist. Although the research supporting his degree did not involve steroids, his interest in what was to become the focus of his later research developed as a result of reading a book by Fieser which dealt with a facet of this subject, followed by a course given by him on the subject. Johnson was awarded the Ph.D. degree in 1940, a year made notable also as that in which his marriage to Barbara Allen took place, who continued as a most highly regarded companion for the remainder of his life.

Also in 1940 Johnson accepted a position as Instructor in the Department of Chemistry, University of Wisconsin (Madison). Here he began his investigations of the chemistry of steroids, his first paper in the Communication form – a category reserved for items of unusual interest and urgency – appearing in the Journal of the American Chemical Society, followed by two later papers still based on research performed by himself, and it was not until 1944 that the first publication reporting the results of research efforts by coworkers was published. Despite the relatively small contribution by coworkers to his early research, he rose through the intermediate ranks to that of Professor in 1946. Outside recognition of his prowess in research came rather early, in his being elected to the National Academy of Sciences in 1954, this followed by two other major awards while he was still at the University of Wisconsin.

His connection with Stanford began in 1958 when he was invited by the Provost of Stanford, to become Executive Head of the Department of Chemistry. This was part of a program of upgrading a number of the departments of the University, welcomed, in the

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[1] William S. Johnson, "A Fifty Year Love Affair with Organic Chemistry" in Autobiographies of Eminent Chemists, Jeffrey I. Seeman, Editor, 1992, A.C.S. Publication.

instance of which we have knowledge, by the existing faculty. Johnson made his acceptance contingent on major requirements benefiting the department relating to faculty, laboratories, equipment, and library being met. These were promptly agreed to by the Administration, and a program for improvement was well underway when in 1960, Johnson assumed the position he had been offered. An early success, which involved Johnson's personal offices, was in attracting well established faculty members – namely Djerassi, Flory, McConnell, Taube, and van Tamelen, – to the department. As a result of these additions, there was an improvement in the quality of junior faculty and graduate students who were recruited to the department. Also as a result of these additions, in a few years the departmental ranking rose from 15th in the nation to fifth according to a report in 1966 by the American Council on Education. While many predicted that the rapid and major infusion of senior faculty would prove to be a disaster, the department proved to be durable, in large part because of Johnson's tact and good sense.

Johnson relinquished his administrative duties at the end of 1969. Despite their heavy burden, he had lost no momentum in research, as attested to by five major awards in the period 1963-1970, culminating in his being the first recipient of the Roussel Prize in 1970, in recognition of his research on the chemistry of steroids. His passion for and heavy involvement in research continued to the end of his life, outside recognition continuing in the way of two major awards by the American Chemical Society (1977, 1989), the National Medal of Science (1987), the Tetrahedron Prize (1991). Recognition by the University of his contributions to its welfare came in the way of his appointment in 1975 as Jackson-Wood Professor of Chemistry, and the establishment in 1986 of the annual Johnson Symposium which attracts participation by the most eminent contributors to the advancement of Organic Chemistry world-wide.

Johnson, in devising strategies for the high yield syntheses of steroids, is credited with opening up an entire area of synthetic chemistry. Steroid molecules are fused ring systems, the rings made of carbon to carbon bonds, a common variation consisting of four rings, three six-membered and a terminal ring, five-membered. Steroids include synthetic molecules used as pharmaceuticals, and natural steroid hormones, together with the well-known component of cell membranes, cholesterol. Although the molecules have simple chemical compositions, being composed of carbon, hydrogen and oxygen, they have enormously complex three-dimensional shapes. Cholesterol itself has hundreds of chemically stable stereoisomers, all with the same atom-to-atom connectivity. The difficulty in synthesizing steroids is apparent from the field of biochemistry. In contrast to the usual parsimony of cellular biosynthetic chemistry, the synthesis of cholesterol requires 30 different enzymes. For the synthetic chemist, the basic problem boils down to forming carbon-carbon bonds between the desired pairs of carbon atoms, and forming these bonds in the desired three-dimensional directions. With proper activation a linear chain with double bonds strategically placed can yield a steroid. When this is done without proper safeguards a very large number of isomers are formed, only one among them the desired product. Johnson's genius lay in applying reaction principles to the problem, taking account of steric and electronic effects, to modify the composition so that in the process of bond formation the stereochemistry and chirality of the desired product is optimized, the special groups needed for control later being replaced.

A thirty-five year focussed research effort culminated in Johnson's success in using a positively charged polyene to undergo a seeming miraculous "zipper reaction", a process in which several specific carbon-carbon bonds are formed almost simultaneously, with the proper conformation. He thereby developed a chemical laboratory method that mimics an enzymatic reaction converting squalene to lanosterol, the immediate biosynthetic precursor of cholesterol. In fact Johnson's work anticipated the biochemical discovery of the role of 2,3-oxidosqualene in the enzymatic catalysis of the zipper reaction. Many regard his approach to synthesis of steroids as the most innovative ever in this field. It is important to note that the strategies he introduced have benefited polyolefin cyclization practiced in other contexts.

If the loyalty of former coworkers is a valid criterion to judge the performance of a teacher, Johnson was a genuine success. More than 300 enjoyed the advantage of association with him in research, many in their independent careers having become prominent in industry and in academia. On his part, Johnson was generous in acknowledging the contributions his coworkers made to the research done under his supervision.

Johnson's good judgment and scientific insights were highly valued also outside of academia. He served as consultant of the Winthrop Chemical Company beginning in 1945 and continuing to its transformation to the Sterling-Winthrop Research Institute, an association that lasted for 24 years. They valued not only his scientific advice, but also the results of his program of research in academia. Joint projects developed from this interaction, which provided a direct benefit to the academic scientific effort and a financial benefit in the way of an annual unrestricted grant which continued for 15 years. Several years later he became a consultant for Dupont in their plastics division, and greatly valued the experience of learning about polymers, a subject outside the area of his major research interest.

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