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Revolution In Synthetic Organic Chemistry By H.C. Brown

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Abstract - Right from the beginning human being have been running for the best of everything. Many revolutions have been made in the field of synthesis of organic compounds. One such revolution was by made by American Chemist H.C. Brown who through his work on boron compounds revolutionized synthetic organic chemistry.

Herbert C. Brown (1912-2004) was one of the leading American chemists of the 20th century, his Nobel Prize-winning work with boron compounds revolutionized synthetic organic chemistry. His discoveries at Purdue opened entirely new avenues in both academic and industrial chemistry. Boranes are now used in the synthesis of many organic compounds, including medications such as the antidepressant Prozac and the cholesterol-lowering drug Lipitor. Brown came to Purdue in 1947. During the late-1950s, he and his students discovered that unsaturated organic molecules can be readily converted to organoboranes through hydroboration reactions, in which boron and hydrogen add to multiple bonds. He supervised a very large group of graduate students and post-doctoral researchers—most notably Ei. Chi. Negeshi and Akira Suzuki, 2010 Nobel laureates who studied with Brown in the 1960s. Brown retired in 1979 but continued to be an active researcher until his death in 2004.

Early Life and Education- Brown was born in a Jewish settlement camp in London, a temporary way station on his parents' migration from Ukraine to the US, where they settled with family members living in Chicago. He earned

a bachelor's (1936) and a doctorate (1938) from the University of Chicago, dissertation under the direction of Hermann Schlesinger, involved the reaction of diborane with aldehydes and ketones. This was indeed the beginning of his lifetime's devotion to organoborane chemistry. Postdoctoral study of the chlorosulfonation of alkanes (hydrocarbon compounds with only single molecular bonds) may likewise be seen as the genesis of his almost equally long devotion to physical organic chemistry.

Career - In 1939 Brown became Schlesinger's personal research assistant. Sodium borohydride is a relatively mild reducing agent, while lithium aluminium hydride is among the most powerful. A major portion of Brown's research at Chicago (1939–43), Wayne State University (1943–47) in Detroit, and Purdue University (1947–78) in West Lafayette, Ind., was devoted to the development of new reducing agents. As a result of his work, organic chemists obtained an unparalleled data collection of reducing agents carefully tailored to specific synthetic requirements. It was this work that was alluded to in the first part of the citation for his Nobel Prize. Incidental to this work, Brown and B.C. Subba Rao studied the reduction of ethyl oleate by sodium borohydride in the presence of aluminium chloride. While the expected reduction of the ester group did indeed take place, there was an additional uptake of active hydrogen. Rather than dismissing the anomalous result, Brown boldly speculated that the double bond in oleic acid had been "hydroborated" by the excess reagent. Further research showed that this hydroboration reaction was a general property of double bonds. At the time of this discovery (1956), hydro boranes were virtually unknown and thought not likely to be of synthetic use. Further work by Brown and his co-workers showed that organoboranes, produced by the hydroboration reaction, were in fact capable of an extraordinary range of synthetically important reactions. Brown embarked on a major new area of the development of organoborane-based carbon-carbon bond formation in the mid-1960s. Ironically, some of his most creative and original

investigations, such as those of carbonylation reactions (1972), have not yet been widely used by the synthetic community, perhaps in part because of their radically novel patterns of reactions that cannot be readily assimilated into the conventional organometallic carbon- H.C. BROWN carbon bond-formation methodology. This work was addressed in the second part of his Nobel Prize citation.

In the meantime, the Pd-catalysed cross-coupling of organometals containing boron, zinc, aluminium, and so on that A. Suzuki (2003) have discovered and developed as well as the asymmetric allyl- and crotylboration most extensively developed by Brown's group, all of which can readily fit into the patterns of conventional organometallic methods for carbon-carbon bond formation, have become widely accepted and used. At Purdue, H. C. Brown was promoted to R. B. Wetherill Professor in 1959 and R. B, Wetherill Research Professor in 1960. After his formal retirement in 1978, he was R. B. Wetherill Professor Emeritus.

All the awards and recognitions mentioned earlier were received by him while he was a Purdue faculty member. In recognition of his great accomplishments and contributions to Purdue University, one of the two main chemistry buildings was named the Brown Building, and the entire chemistry department has been renamed the Herbert C. Brown Laboratories of Chemistry. Besides being a premier scientist, H. C. Brown was a superb mentor to those who were sufficiently self-motivated and fundamentally well equipped to pursue research in a logical and rational manner. He himself possessed the kind of logical and rational mind reserved only for the very best scientists. One of the early projects suggested by Brown to this author dealt with the cyclic hydroboration of dienes and trienes (1972), which had been previously investigated by other well-known workers in the field. Primarily on rational grounds, Brown questioned several previous structural assignments. Detailed investigations eventually led us to correct them all (1972). Another lesson he instilled was to not only do research but also to live with eternal optimism, of course not in a quixotic manner but with well-calculated rationalism. This has easily

been the single most important lesson this author has learned from him. Brown officially retired shortly before receiving the Nobel Prize. He wrote Hydroboration (1962) and Organic Syntheses via Boranes (1975), among other works.

Recognitions -

1. Professor Brown was the Harrison Howe Lecturer in 1953, the Centenary Lecturer of The Chemical Society (London) in 1955, and the Baker Lecturer in 1968.
2. He was elected to the National Academy of Sciences in 1957, the America n Academy of Arts and Sciences in 1966, received an honorary Doctorate of Science degree from the University of Chicago in 1968 and was elected Honorary Fellow of The Chemical Society and Foreign Member of the Indian National Academy of Sciences in 1978.
3. He is the recipient of the Nichols Medal for 1959, the ACS Award for Creative Research in Synthetic Organic Chemistry for 1960, the Linus Pauling Medal for 1968, the National Medal of Science for 1969, the Roger Adams Medal for 1971, the Charles Frederick Chandler Medal for 1973, the Madison Marshall Award for 1975, the CCNY Scientific Achievement Award Medal for 1976, the Allied Award for 1978, the Ingold Memorial Lecturer and Medal for 1978, the Elliott Cresson Medal for 1978, and the Nobel Prize for 1979.

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