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EDITORIAL

George A. Olah (1927–2017): An Introduction

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George A. Olah in the author's office in 1995 at the Budapest University of Technology and Economics (photo by I. Hargittai)

Abstract

This contribution introduces a special collection of papers honoring the American-Hungarian chemistry Nobel laureate George A. Olah, a graduate and former instructor of the Faculty of Chemical and Bioengineering of the Budapest University of Technology and Economics.

Keywords

Budapest University of Technology and Economics, Carbocations, Hydrocarbon Chemistry, Nobel Prize, Methanol Economy

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George A. Olah's life and oeuvre make an exciting and uplifting story in twentieth-century science history [1, 2]. He enrolled in chemical engineering studies in 1945 and graduated as a chemical engineer in 1949 from the Budapest Technical University (as it was then), what is today the Budapest University of Technology and Economics. Olah studied under the mentorship of Geza Zemplen—a former postdoc of Emil Fischer. Upon graduation Zemplen invited Olah to stay on in a university position. Zemplen's field of research was carbohydrate chemistry, but he urged Olah to pursue an independent research career. Olah chose organic fluorine chemistry that had not been cultivated in Hungary. His research was supported by a fellowship for his post-graduate studies by the Hungarian Academy of Sciences. Thus, Olah was both an instructor in organic chemistry at the Technical University and a researcher for the Science Academy. In addition, he enrolled and completed three years of study at the Medical School (as it was then, now it is the Semmelweis University) for becoming better prepared in his joint research with physicians concerning

oncological aspects of fluorine organic compounds. Olah built a Freon reactor as part of his dissertation work. He published his papers in Hungarian and in English in journals published in Hungary. He submitted his thesis in 1953 and defended it in 1954, thus earning his PhD-equivalent degree.

He continued his research of the mechanism of electrophilic aromatic substitution reactions and embarked on writing a textbook of theoretical organic chemistry. It was also in 1954, when he was appointed deputy director of the recently organized Central Research Institute of Chemistry of the Hungarian Academy of Sciences. Olah published his papers about his new research activities in Nature, the Journal of the Chemical Society, Chemische Berichte, and Naturwissenschaften. He submitted his dissertation for a higher doctorate, the DSc degree—a prerequisite for a professorial appointment—in 1956. The title of this thesis in English translation was "Data for the mechanism of electrophilic reactions of aromatic substitution." He did not defend this dissertation because in the aftermath of the anti-Soviet revolution and its tragic suppression in 1956, Olah and his family left Hungary.

First they stopped in London, then, continued to Canada. There, Olah started working at a Dow industrial laboratory where, after hours, he could pursue his own research. At this laboratory, he applied superacids to prolong the lifetime of some reaction intermediates, discovered carbocations, and ultimately, decided a long-time debate about the mechanism of the hydrolysis of 2-norbornyl esters. His role in resolving the long-time debate on this controversy catapulted Olah to great visibility, but his contribution was greater than merely determining the nature of the intermediates in the hydrolysis of 2-norbornyl esters.

He gave longer life to carbocations and this would become the motivation for his unshared Nobel Prize in Chemistry in 1994: "for his contribution to carbocation chemistry." Even more than that, he transformed the rather uninteresting hydrocarbon chemistry into a vibrant field of research. He enabled the rather inert C–C and C–H sigma bonds to become reactive and thereby opened a whole new chemistry. Olah formulated his discovery as "The realization of the electron donor ability of shared electron pairs that could one day rank equal in importance with G. N. Lewis's realization of the electron donor unshared pairs." [3] Olah's discovery did not happen in a Eureka moment; rather, it was the result of long, painstaking experiments and deliberations. He utilized chemical syntheses, physical techniques of structure elucidation, and quantum chemical computations. The culmination of his communications about his discovery was his seminal paper in 1972. [4]

Olah worked for Dow from 1957 till 1965 when he returned to academia and became professor and chairman of chemistry at the Western Reserve University in Cleveland. There, he initiated the unification of his department with the Department of Chemistry of the neighboring Case Institute of Technology, and eventually the unification of the two institutions. Today, it is the Case Western Reserve University.

In 1977, Olah and his group moved to the University of Southern California, Los Angeles. There, soon the Loker Hydrocarbon Institute was built for him, a rather unprecedented institution in an American university setting. It is a physical realization of the highly focused laboratory for target oriented research work. Following the Nobel Prize in 1994, Olah's research activities did not slow down. Even before, his interest was always strong in the industrial applications of his hydrocarbon chemistry. This interest even intensified during the last two decades of his life. Suffice it to mention the progress he achieved in the area he called the methanol economy. His Loker Hydrocarbon Institute is expected to carry on in Olah's spirit for the foreseeable future.

Olah was not only a prolific researcher, but also a prolific author. His research career can be followed by looking up his authored and edited monographs, including the following titles: Friedel–Crafts and Related Reactions (edited, in four volumes, 1963–1965); Carbonium Ions (edited in four volumes, 1968–1973); Carbocations and Electrophilic Reactions (1973); Friedel–Crafts Chemistry (1973); Halonium Ions (1975); Superacids (1985); Hypercarbon Chemistry (1987, updated 2011); Nitration: Methods and Mechanisms (1989); Cage Hydrocarbons (edited, 1990); Electron Deficient Boron and Carbon Clusters (edited, 1991); Chemistry of Energetic Materials (edited, 1991); Synthetic Fluorine Chemistry (edited, 1992); Hydrocarbon Chemistry (1994; 2004); Onium Ions (1998); A Life of Magic Chemistry (2000, updated 2015); Across Conventional Lines (edited, selected papers, two volumes, 2003); Carbocation Chemistry (2004); Beyond Oil and Gas: The Methanol Economy (2006, updated 2009); Superelectrophiles and Their Chemistry (2008); Superacid Chemistry (2009); Across Conventional Lines (edited, selected papers, third volume, 2014). There are still further volumes in production, expected to appear later in 2017 or early 2018.

George Olah's scientific oeuvre, his humanity, and his example have enriched chemistry and the lives of a growing circle of chemists.

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