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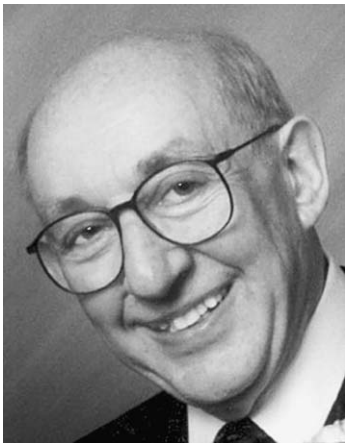
Preface

Asymmetric catalysis



Professor Jack Halpern

It is a great pleasure for us to co-edit this special issue of Tetrahedron: *Asymmetry* to honor Jack Halpern, a giant of science of our time. Both of us have known Jack for more than 30 years. ASC entered Jack's laboratory as a first-year graduate student at the University of Chicago in 1975 and TH learned from Jack at an even earlier time both through the literature and through his former mentor Makoto Kumada, a good friend of Jack. Through the years many of us organometallic chemists have benefited a great deal from Jack's teaching both from his seminal publications and from his stimulating questions and comments at conferences. There is no doubt that Jack has had a significant influence on the way of thinking and solving problems for our generation of scientists.

Jack was born in Poland and moved to Canada at the age of four. He received his B.S. in 1946 and his Ph.D. in 1949 from McGill University in Montreal. After a year of postdoctoral training as an NRC Postdoctoral Overseas Fellow with A. G. Evans at the University of Manchester, he joined the faculty of the University of British Columbia and started his academic career in the metallurgy department. His early work was on the leaching of metal ores. However, his strong interest in the mechanisms of reactions of dissolved metal species soon led him to fame in chemistry. In 1954 Jack published his first paper on the homogeneous activation of H_2 by metal ions. His careful kinetic study of the reaction of copper(II) with H_2 implicated the presence of a copper hydride intermediate. In 1959 he showed for the first time that homogeneous Rh(III) species, among several transition-metal ions, can activate H_2 in solution via electrophilic attack, leading to the heterolytic splitting of H_2. These studies clearly showed the earliest recognition of the roles of transition-metal hydrides as catalytic intermediates and formed the important landmarks for the field of homogeneous catalysis. In 1961 Jack developed the first homogeneous catalyst (a ruthenium species) for the hydrogenation of olefins. There is no doubt that many important scientific discoveries and technological developments in the important field of homogeneous catalysis can be traced to Jack's pioneering work.

After 12 years of successful career at UBC, Jack moved to the University of Chicago in 1962 and continued his pioneering work on the understanding of homogeneous catalytic reactions. He was named Louis Block Professor in 1971 and Distinguished Service Professor in 1984. Jack's persistent study of complex, multi-step catalytic reactions established him as a world leader in the understanding of the mechanisms of homogeneous catalytic reactions. One of the characteristics of Jack's seminal studies is that when the work was first published, it was so awakening that it seemed quite 'surprising'. Yet, after his explanation with the support of strong and detailed evidences, it became

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so 'natural'. This characteristic is reflected by his elegant elucidation of the mechanism of the rhodium-catalyzed asymmetric hydrogenation of olefins (including the Monsanto L-Dopa Process). The revelation that the major hydrogenation product came from the minor but much more reactive intermediate not only amazed chemists but also raised questions on the validity of the generally accepted 'lock-and-key' concept of enzymatic reactions.

In 1966 Jack recognized the parallels between the patterns of reactivity of certain low-spin transition-metal complexes and those of reactive organic species of related configurations. This analogy was subsequently embodied in the currently widely used 'isolobal analogy' concept. The utility of this analogy for the interpretation and prediction of inorganic and organometallic reactions has significantly helped the advancement of modern inorganic and organometallic chemistry. In contrast to the large thermodynamic data bank for organic compounds, the bond energy data for organometallic species were rather limited. This had constrained our understanding of the reactivity patterns of organometallic chemistry. Jack recognized this problem and developed two methods for the measurement of transition metal-alkyl bond energies, one based on thermodynamic measurement and the other based on kinetic measurement. This work clearly elevated our understanding of the basic parameters of organometallic complexes and the influence of steric and electronic factors on the metal-alkyl bond dissociation energies.

Jack's interest cut across the boundaries of chemistry while maintaining a central theme of pursuing the understanding of chemical reactions at a detailed molecular level. In this regard, his contributions to bioinorganic chemistry are also remarkable. In an attempt to understand the mechanisms of reactions related to co-enzyme B_{12}, he prepared relevant organocobalt complexes and studied their roles as co-enzyme B_{12} models. This is by far the most fundamental understanding of the cobalt–carbon bond homolysis in co-enzyme B_{12} dependent rearrangements. He also extended his studies on the H_2 activation by ruthenium complexes to explain the roles of enzyme hydrogenase. This work gave important insight of the mechanism of action of the enzyme.

In addition to devoting himself to fundamental studies, Jack also emphasized the importance of the practice of chemical science in the real world. He has been a long-term consultant for Monsanto Company and Argonne National Laboratory. His scientific insight has helped shape the advancement of many important areas in the chemical industry.

Over the years Jack has received many prestigious academic awards. He received the Ann Molson Prize while at McGill University, the Young Author's Prize of the Electrochemical Society, an Alfred P. Sloan Fellowship, the Royal Society of Chemistry Award in Catalysis by the Noble Metals and their Compounds, an Alexander von Humboldt Foundation US Senior Scientist Award, the Richard Kokes Award from Johns Hopkins University, the Karcher Medal from the University of Oklahoma, the Willard Gibbs Medal, the Bailar Medal, the August Wilhelm von Hofmann Medal of the German Chemical Society, a Merit Award from the National Institutes of Health, the Chemical Pioneer Award from the American Institute of Chemists, the Paracelsus Prize of the Swiss Chemical Society, the Basolo Medal from Northwestern University, the Henry J. Albert Award of the International Precious Metals Institute and a Cross of Merit of the Federal Republic of Germany, conferred in recognition of his contribution as the Founding Chairman of the German–American Academic Council. He has received three prestigious awards from the American Chemical Society: the ACS Award in Inorganic Chemistry, the ACS Award for Distinguished Service in the Advancement of Inorganic Chemistry and the ACS Award in Organometallic Chemistry. He was elected a Scientific Member of the Max-Planck Society and a Foreign Associate of the National Academy of Sciences of the USA in 1984, before transferring to regular membership when he became a US citizen a year later. He also is a Fellow of the Royal Society of London, of the American Academy of Arts and Sciences, of the Royal Society of Canada, and an Honorary Fellow of the Royal Society of Chemistry. Jack holds honorary D.Sc. degrees from the University of British Columbia and McGill University. In 1994 Jack shared the Welch Prize in Chemistry with F. Albert Cotton.

Jack is certainly a world-class scientist by any definition. Aside from the tremendous accomplishments in his own research, his devotion to the service of the scientific community and the promotion of scientific research and education worldwide is greatly appreciated by his colleagues and peers. He served as an editor for *the Journal of the American Chemical Society* for 25 years and set a legendary high standard for the publication. Since 1990 he has assumed several major responsibilities in the US National Academy of Sciences, serving as Vice President of the Academy from 1993 to 2001 and, since 2001, as Associate Editor of the Proceedings of the National Academy of Sciences. He became the Louis Block Distinguished Professor *Emeritus* at the University of Chicago in 1998. To all of us who know Jack well, Jack has never retired from scientific endeavors; he is just working harder for a bigger community.

This special issue is the product of a long list of distinguished contributors. We all admire Jack's accomplishments and wish him and his family continued success, good health, and happiness.

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