NATIONAL ACADEMY OF SCIENCES

SAUL WINSTEIN

1912—1969

A Biographical Memoir by
WILLIAM G. YOUNG AND DONALD J. CRAM

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October 8, 1912–November 23, 1969

BY WILLIAM G. YOUNG AND
DONALD J. CRAM

SAUL WINSTEIN was born in Montreal, Canada, October 8, 1912, the son of Louis and Anne Winstein. His death came suddenly at his home in West Los Angeles on November 23, 1969, at the age of fifty-seven, at the height of his career. He leaves his wife, Sylvia, whom he married on September 3, 1937; a son, Bruce, a graduate student at the California Institute of Technology; and a daughter, Carolee, a student at UCLA. Dr. Winstein came to the United States in 1923 and became a naturalized citizen in 1929.

He graduated from Jefferson High School in Los Angeles in 1930, after which he received an A.B. degree in 1934 from the University of California at Los Angeles, followed by an M.A. degree in 1935 from the same institution. He received his Ph.D. degree in 1938 from the California Institute of Technology. After a postdoctoral fellowship at Cal-Tech, he spent 1939-1940 as a National Research Fellow at Harvard University, where he was associated with Professor Paul Bartlett. After a year as Instructor at the Illinois Institute of Technology in 1940-1941, he returned to his alma mater, UCLA, as an Instructor in 1941-1942, Assistant Professor from 1942 to 1945, Associate Professor from 1945 to 1947, and Professor from 1947 to 1969.

Dr. Winstein began his career after the notion of the chemical bond had been introduced by G. N. Lewis, and while this concept was being applied and elaborated by Linus Pauling and others. As an undergraduate he was introduced to research in physical organic chemistry by William G. Young. This association produced eight publications by the time Saul Winstein had his master's degree. His love of the field of physical organic chemistry deepened and broadened while he worked on the bromonium ion, and on silver and mercury olefin complexes with Howard Lucas for his doctorate. He often remarked in later years how as a young man he had studied and admired the research of Louis Hammett and Hans Meerwein. Clearly, many of the seeds of physical organic chemistry planted by these and other pioneers were carefully nurtured by Saul Winstein, and the species produced underwent mutations and selection under his critical care.

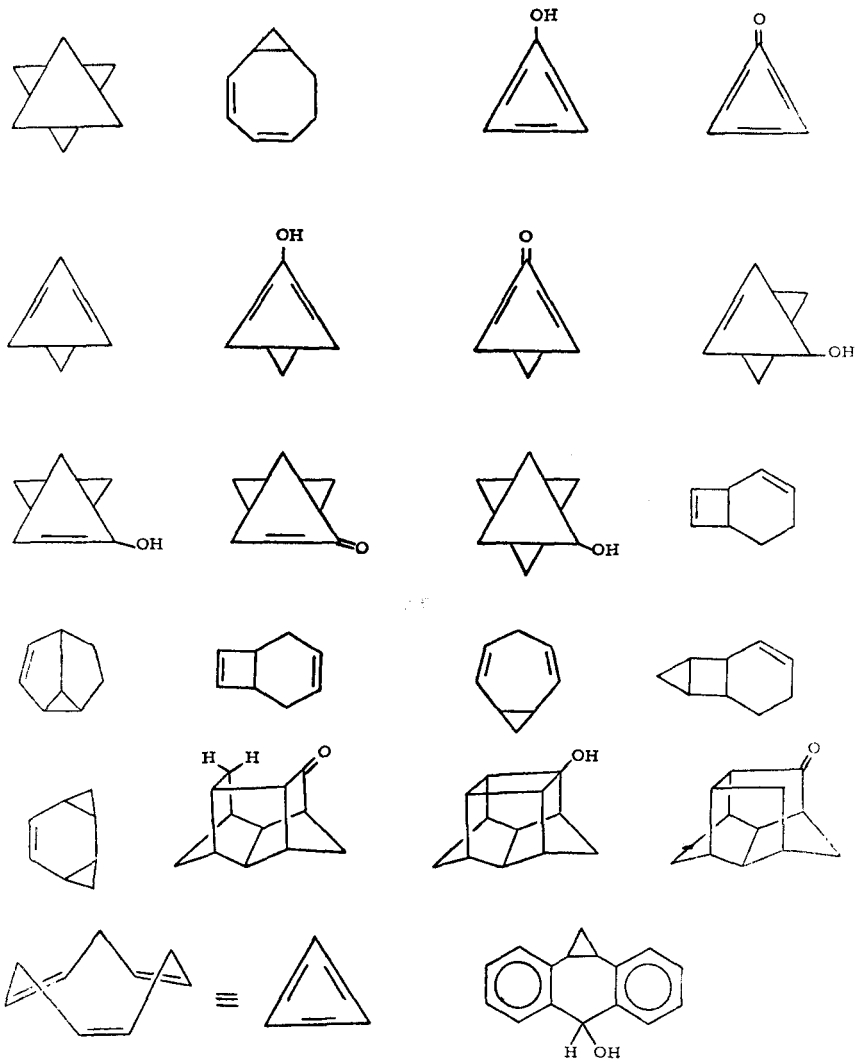
His life spanned what may turn out to be the maturing period for physical organic chemistry. He lived to see neighboring group involvement in cation formation grow from an idea, to a theory, to an integral part of the science, repeated over and over again in new structural contexts. His career was engaged centrally with research on this phenomenon. His research developed from pi-electrons of carbon-carbon double bonds as neighboring groups in his undergraduate research, to bromine as neighboring group in his graduate and postdoctoral work, and to methoxyl, acetoxyl, acetamido, pi-carbon, and sigma-bound carbon or hydrogen as neighboring groups during his middle years. This central theme matured in the form of the nonclassical cation, and found its most elegant expression in his concept and exemplification of homoconjugation and homoaromaticity. Although highly profitable excursions were undertaken into medium effects, radical reaction mechanisms, organometallic reaction mechanisms, ion-pair be-

havior, complex organic syntheses, and mechanisms of simple substitution and elimination reactions, throughout his scientific career he came back time and again to neighboring group participation in solvolytic reactions. From a program of research whose experiments were conceived on the basis of a superb central idea flowed a wealth of new molecular rearrangements, new stereochemical concepts, and new mechanistic insights. New instruments as they developed were put to work elucidating structures of compounds and of high-energy reaction intermediates alike, and were also used as kinetic probes. Molecular orbital theory served as a guide at many points. However, the new instruments and theory never were more than handmaidens to the major theme of organic reaction mechanisms and reaction intermediates.

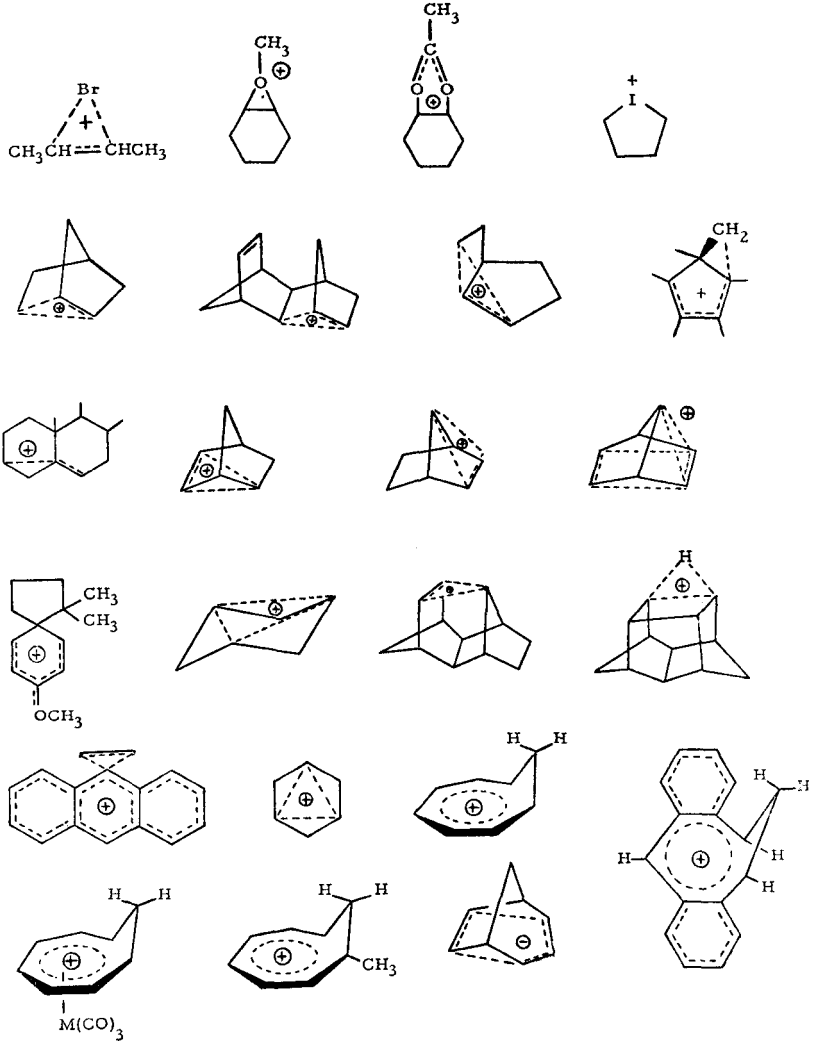
Professor Winstein's specific discoveries involved compounds and intermediates of considerable structural beauty. The structures of the compounds shown on page 324 provide graphic testimony to his thorough command of synthetic methods of organic chemistry. The structures of the reaction intermediates shown on page 325 summarize the fruits of his balanced application of the techniques of kinetics, stereochemistry, radioactive labels, spectra, molecular orbital calculations, and tailor-made starting materials to the difficult problem of elucidating the structure of often fleeting high-energy species.

As Dr. Winstein's career unfolded, his research results started whole trends which can be identified with vast bibliographies involving many distinguished investigators the world over. His research created a school of thought and investigation that reached far past his personal contacts. Many terms and phrases which highlighted the discovery and elaboration of new phenomena or concepts have become so common that their origins are unknown to the younger generation of investi-

Structures of Organic Compounds



Structures of Reaction Intermediates



gators. Textbooks now abound with such phrases of his as "neighboring group participation," "solvent participation," "internal return," "anchimeric assistance," "intimate ion pair," "ion-pair return," "bridged ions," "nonclassical ions," and "homoaromaticity."

In the area of ion pairs and salt effects in organic chemistry, he again led the way. He was the first to appreciate the importance of the distinction between ionization and dissociation, and to recognize the difference in behavior of intimate and solvent-separated ion pairs in ion-pair reorganization reactions in organic chemistry.

Recognition of Saul Winstein's research accomplishments came in many forms. He was a principal speaker at symposia held in almost every country that has a research program of any size in organic chemistry. His lectures took him to Great Britain, Ireland, Canada, Japan, Germany, Italy, Israel, The Netherlands, Australia, France, Rumania, Russia, Czechoslovakia, and Venezuela. His more formal honors are as follows: ACS Award in Pure Chemistry, 1948; election to the National Academy of Sciences, 1955; Dickson Achievement Award as UCLA Alumnus, 1958; Richards Medal of the ACS, 1962; Docteur Honoris Causa degree from the University of Montpellier, France, 1962; California Museum of Science and Industry's California Scientist of the Year Award, 1962; election to the American Academy of Arts and Sciences, 1966; McCoy Award, 1966; Alumni Distinguished Service Award of the California Institute of Technology, 1966; ACS Norris Award in Physical Organic Chemistry, 1967; Franklin Memorial Award for Outstanding Contributions to Chemistry, 1968; and the National Medal of Science awarded posthumously in 1971. Had he lived a few more years, he undoubtedly would have received the highest awards the world has to offer a scientist.

Professor Winstein's impact as a teacher was no less im-

pressive. A total of 72 students obtained their Ph.D. degrees under his supervision, and 86 postdoctoral fellows came from all parts of the world to collaborate with him. Of these, about 100 have joined the academic profession, and many are now noted investigators and teachers.

At the beginning, Saul Winstein taught the cultural course in chemistry at UCLA. At one time or another he taught almost every organic course offered there. His pedagogical impact was greatest perhaps in his advanced courses and contributions to seminars. Here his desire to "understand everything thoroughly" led him into cross-examinations of research ideas and results, which at one and the same time set standards and showed what can be known from the results of an experiment. His delivery of a seminar to the Thursday-night group at UCLA became an unforgettable experience for many students, colleagues, and investigators in physical organic chemistry from all parts of the world. His incisive insistence on clarity and his enthusiastic criticism were tempered as he grew older by perspective and, in instances, even by gentleness. What made his forthrightness always admirable was his visible interest in, and love of, the science, as well as his devotion to the idea of being correct. These qualities always enriched his questions and comments. He was a merciless worker who spent most of his daylight hours in personal contact with his co-workers. His long evenings were devoted to reading and writing. His outstanding qualities as a teacher were recognized by his being one of the first recipients of the Distinguished Teaching Award at UCLA. He was honored for his scholarship at the same institution by being elected Faculty Research Lecturer for 1955.

Professor Winstein contributed to the organizational aspects of his profession at several levels. He served for many years on the Editorial Board of the *Journal of the American Chemical*

Society, and was a charter member of the Editorial Board of the *International Journal of Chemical Kinetics.* He was also a member of the Honorary Editorial Advisory Board of *Tetrahedron.* He served on numerous committees of the Academic Senate of UCLA, and as faculty representative on the Executive Committee of the Alumni Association. In connection with the UCLA Fiftieth Anniversary celebration, he organized a symposium in physical organic chemistry dedicated to his first research supervisor, Professor William G. Young. His loyalty to the people, ideas, and institutions that contributed to his development was manifest.

In addition to his work with the alumni, he was active with other prominent members of the community in organizations such as the UCLA Art Council and Friends of Music. Irving S. Bengelsdorf, noted Los Angeles *Times* science writer, said of him: "Although single-mindedly devoted to science in general and chemistry in particular, Dr. Winstein was no ivory-tower recluse. He had an amazing ability to separate his professional world from his private life. Once out of the laboratory he loved to dance and entertain."

The noted author, Irving Stone, said of Saul Winstein at the memorial service: "I think this was a fortunate man, a man who realized his dream with nothing to go on but brains, character, integrity and self-discipline. . . . On three simple terms, fulfillment, a gentle man, and a man who gave himself both to love of his family and friends, and to his work, I can say how truly wonderful that he was born, that he grew up among us, that we had him for our co-worker and for our friend."

Dr. R. K. Lustgarten, a recent postdoctoral fellow of Saul Winstein, said of him: "My stay at UCLA probably represents as exciting a time as I will ever spend in chemistry, and a good part of the excitement came from simply being around Saul

Winstein. In my research report for Winstein, I included an epigram from the poet Cummings: 'Listen, there's a hell of a good universe next door—let's go!' Later, I reflected that this sentiment was superfluous—he'd known it all the time."

One cannot be a colleague of someone as dynamic as Saul Winstein for scores of years without gaining some knowledge of his character. Above all he was single-minded in all his enterprises. Whatever he did, he did intensely and effectively. He rejected sloppy reasoning, would not tolerate poorly designed undertakings, and grew restless when faced with ambiguity, arbitrary decisions, or amorphous arguments. He applied the same kind of reasoning and intensity to learning a new field of chemistry as to learning how to dance, and he applied the same standards of excellence to each endeavor. He dealt with matters either thoroughly or not at all. He applied his high standards to himself and those around him without discrimination. He was a tenacious competitor and was devoted to what his experiments and reasoning told him was correct. He never understood how others could be anything but reasonable. He lived as a real man in a real world on which he left a real impact.

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KEY TO ABBREVIATIONS

Chem. Ind. = Chemistry and Industry
J. Am. Chem. Soc. = Journal of the American Chemical Society
J. Org. Chem. = Journal of Organic Chemistry
Proc. Chem. Soc. = Proceedings of the Chemical Society

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