Obituary

Donald J. Cram (1919–2001)

Donald Cram, a gifted and creative organic chemist, died peacefully at his home in Palm Desert, California, on 17 June. He had been plagued periodically for 30 years by metastatic melanoma, a disease to which he succumbed rapidly in the end.

Cram was born in semi-rural Brattleboro, Vermont, on 22 April 1919. His father, a successful attorney, died when Cram was four years of age. He and his four sisters were raised by their mother, a woman of considerable resolve. When he was 16 years of age, the family dispersed and Cram became self-supporting, working first in Florida and then on Long Island, New York. This early independence, acquired while both working and attending high school, instilled the personal characteristics and standards that guided him so well throughout his life.

In 1937, Cram obtained a full four-year scholarship to Rollins College near Orlando, Florida, which enabled him to pursue chemistry as a major. There he began a lifelong love affair with organic chemistry, a subject that not only intrigued him intellectually but also offered an escape from the tedium of the low-paid, repetitive tasks that he had come to loathe. Cram's strongest desire was to become a university professor because no other profession offered the freedom to choose research problems and gamble that the choices were correct. He started by taking a master's degree in 1942, under Norman H. Cromwell at the University of Nebraska. The United States had just entered the Second World War, and Cram was then hired by the Merck pharmaceutical company to work on the development of penicillin, which he did until the war's end.

In 1945, Cram moved to Harvard University where, in a mere 18 months, he completed his PhD under Louis Fieser. He was then awarded an American Chemical Society fellowship, which allowed him to carry out independent postdoctoral research at an institution of his choice. Cram knew the eastern United States well, so he went for the unknown — the University of California at Los Angeles. The proximity of the Pacific Ocean on the one hand, and ski slopes on the other, no doubt played a part in this choice. UCLA was then only just beginning to develop as a research university, but a world-class organic chemistry group had already been established there by Saul Winstein, William G. Young and Thomas Jacobs. In 1948, Cram accepted UCLA's offer of an assistant professorship and he immediately began to realize his dream — that of setting up his own research group. UCLA was to be his scientific home for the next 50 years.

The last half of the twentieth century may prove to have been the golden age of organic chemistry, and Cram's research career flourished. Major topics in the earliest part of this period were the elucidation of organic reaction mechanisms, the development of new synthetic methods, and the construction of molecules designed to test ever-advancing concepts of structure and bonding. Cram's career touched on all of these subjects, and two themes pervade his chemistry: the application of stereochemistry and chirality as research tools, and the design of molecular architecture for particular functions. He was never without a satchel filled with molecular models, attesting to his single-minded dedication to this last theme.

There are six areas of chemistry to which Cram made seminal contributions or which he created outright. Each represents a change of interest, occurring at roughly ten-year intervals. These moves stemmed from Cram's view that more than a decade of intense work on any subject would exhaust his creativity in that area.

Those areas and his achievements, in chronological order, were the isolation and structural characterization of natural products; the discovery of phenonium ions and stereochemical study of the mechanism of the Wagner–Meerwein rearrangement, triggered by his investigation of the acid-catalysed racemization of a degradation product of the antibiotic citrinin; the design and synthesis of the cyclophane hydrocarbons and their derivatives, in which the π-electron systems of aromatic rings were forced into face-to-face contact, causing perturbations of their chemical and physical properties; the stereochemical and mechanistic study of electrophilic substitution reactions at saturated carbon centres, which later became identified with carbanion chemistry; the discovery and development of host–guest complexation chemistry and its relevance to biology, for which Cram was awarded the 1987 Nobel Prize in Chemistry along with Jean-Marie Lehn and Charles Pedersen; and, finally, the design and synthesis of carcerands, or 'molecular bottle' species, which encapsulate reactive molecules that can subsequently be converted within the carcerand to notoriously unstable species such as cyclobutadiene and *o*-benzyne. Entrapment in the molecular vessel allowed these and similar species to be studied as never before. Cram himself considered bottle molecules to be his finest scientific discovery.

Pioneer in organic chemistry, especially host–guest complexes

Cram's passion for chemistry was matched by his participation in sports requiring skill, physical exertion, and often courage. He could be found on the ski slopes of southern California during the winter, and surfing with his friends — a group known as 'the old guys' — at San Onofre beach in the summer. He had a lifelong penchant for singing ballads, accompanying himself on the guitar. He continued to take part in sporting activities until his eightieth year, and had recently taken up golf.

Above all, Donald Cram was a strong and realistic man who observed his own approaching death with calm and with gratitude for having had all of his dreams fulfilled. He is survived by his third wife, Caroline.

M. Frederick Hawthorne

M. Frederick Hawthorne is in the Department of Chemistry and Biochemistry, University of California at Los Angeles, California 90095-1569, USA.

e-mail: mfh@chem.ucla.edu

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