Franklin Asbury Long

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Frank Long's research made fundamental, unique contributions to a surprising variety of important scientific subjects by applying his extensive background and deep intuition in physical chemistry to organic reactions, in combination with his creative instrumentation skills and keen awareness of new experimental techniques. These emerging research areas included basic reaction mechanisms of organic molecules in solution and unimolecular dissociation of gaseous ions. He was elected to the National Academy of Sciences in 1962. However, these broad interests also led him into leadership positions in academe, government, industry, and public affairs, especially his advocacy of international arms reductions. He served on the President's Science Advisory Committee for Presidents Eisenhower, Kennedy, and Johnson. Probably his most publicized appointment was the one that he did not receive as Director of the U.S. National Science Foundation when President Nixon learned at the last minute of Long's criticisms of the antiballistic missile system.

Professor Long, born in Great Falls, Montana, received B.A. and M.A. degrees from the University of Montana in 1931 and 1932. He did graduate work in physical chemistry at the University of California, Berkeley. After receiving his Ph.D. degree in Chemistry in 1935, he was an Instructor there, and at the University of Chicago, becoming an Instructor in the Chemistry Department at Cornell in 1937. He served as a research supervisor for the Explosive Research Laboratory of the National Defense Research Committee from 1942-45. He returned to Cornell as an Associate Professor and was promoted to full Professor in 1946. When Peter J.W. Debye stepped down as Department Chair in 1950, Long took over and served a record ten years. He was Faculty Trustee, 1956-57, and he served as Vice President of Research and Advanced Studies at Cornell, 1963-69. In 1969, he began a four-year tenure as Director of the new Cornell academic program, Science, Technology and Society, designed to study the impact of science and technology on the problems facing U.S. society. Between 1969-79, he was Henry R. Luce Professor of Science and Society, and between 1976-79, he was Director of the Peace Studies Program. He was a member of the corporate Board of Directors for the Carrier Corporation, United Technologies Corporation, and the Exxon Corporation, for which he was also a member of the Executive Committee. In 1985, he "retired" to serve as Adjunct Professor of Chemistry and Social Sciences at the University of California, Irvine, continuing to be active on national and international committees.

Frank Long was one of the pioneers who showed organic chemists that they had to think carefully about such physical chemistry concepts as nonideality, activity coefficients, and ion pairing if they were interested in the

mechanisms of aqueous reactions. These concepts formed the foundation of the worldwide interest in mechanisms of solvolysis reactions that began in the late 1940s and continued for nearly three decades. Because many aqueous organic reactions occur in media of high acidity, it soon became clear to mechanistic chemists that a supplement to the pH scale of dilute solutions would be necessary. When Louis Hammett proposed the H0 acidity function to accomplish this end, Frank immediately saw the power of the approach, and put it to good use in his studies of the hydrolyses of lactones, esters, and acetals. He extended the concept to mixed and nonaqueous solvents, and proposed alternative acidity functions for use under specialized conditions.

Many of the mechanistic descriptions that we teach our undergraduates can be traced back to Frank Long's work. Long and his coworkers used the then little-known technique of nonradioactive isotopic labeling to tackle these problems. Early isotope labeling studies relied on the use of radioactive tracers, with chemical degradation of reaction products being used to locate the labels. Avoiding the problems of radioactive labeling, Long was an early user of mass spectrometric techniques with stable isotopes to get the same information faster by degradation of the labeled molecule within the instrument.

Long also studied the change in kinetics that could accompany the introduction of such stable isotopes either into the molecule of interest or the solvent in which it was undergoing reaction. His work on H_2O/D_2O solvent isotope effects showed the way to generations of researchers studying the mechanisms of biologically relevant aqueous reactions. The important "proton inventory" techniques that have elucidated some essential enzymatic mechanisms can trace a good part of their ancestry to Long's work.

Mass spectrometry was previously used largely for the determination of accurate atomic weights and for quantitative analysis of hydrocarbons. Characterizing the products of Long's organic reactions involved vaporizing these into the mass spectrometer to form gaseous organic ions; Long was one of the early pioneers studying the unimolecular decompositions of these ions, particularly for lactones, alcohols, and esters. In a first for spectrometry, he and Friedman used this chemistry in 1953 to help define the molecular structure of ketene dimer, a highly publicized controversy of the time. His pioneering physical chemistry studies of these ions included appearance potentials, heats of formation, and the statistical theory of their dissociation. Notable was his classical example of the nonergodic dissociation of ionized fluroethylene that occurs before the input energy can be statistically randomized.

Frank Long's interests in arms control and other public issues began early, focused by his World War II research for which he was awarded the U.S. Medal of Merit. In 1949-52, he was member and Chairman, Advisory Committee for Chemistry, Office of Naval Research; and Trustee of Associate Universities that oversaw Brookhaven National

Laboratory. In 1953-59, he was Consultant, Ballistics Research Laboratory, Department of the Army, Aberdeen, Maryland. In 1956-60, he was a member, Science Advisory Board, Department of the Air Force. In 1957-60, he was a member, Ballistic Missiles Advisory Committee, Office of the Secretary of Defense; and in 1959-63, Chairman, Chemistry Advisory Committee, Air Force Office of Scientific Research.

He was a member of the President's Science Advisory Committee under Presidents Eisenhower, Kennedy, and Johnson. When the U.S. Arms Control and Disarmament Agency was formed in 1962, he was its first Assistant Director for science and technology. As a member of the U.S. group that went with Averell Harriman to the Soviet Union in 1963, he took a leading role in the effort of the U.S., the UK, and the Soviet Union to negotiate a comprehensive nuclear test ban treaty. Intense negotiations over an extended period resulted in agreements on almost everything except the number of on-site inspections; the Soviets insisted on three per year versus the U.S. demand of seven. The historical compromise, the Limited Test Ban Treaty, prohibited testing in the atmosphere, the oceans, and in space, but permitted underground testing. He was a Director of the Arms Control Association, 1971-77, and Co-Chair of the U.S. Pugwash Steering Committee, 1974-79. The 1995 Nobel Peace Prize was awarded to the Pugwash Conferences. He was a member of the Board of Directors of the Albert Einstein Peace Prize Foundation and a member of the Board of Trustees of the Fund for Peace.

His aggressiveness in arms control efforts is best illustrated in his opposition to the antiballistic missile project, as delineated in a 1968 publication stating that the ABM missile development would create "strong pressure toward acceleration of the arms race." In 1969, he was nominated by a board of scientists to be Director of the National Science Foundation. He went to Washington, D.C. one morning, presumably to receive the appointment from President Nixon in the White House Rose Garden that afternoon. However, upon arrival, he was told that the ceremony was cancelled. International publicity of the event produced an immediate outcry from a variety of concerned citizens as well as scientists. Later the White House relented but Long declined the President's offer.

Long also played a major role in science and technology transfer to underdeveloped nations, including India, South Korea, Latin America, Malaysia, and Indonesia, in part as a member of the National Academy of Sciences Board on Science and Technology for International Development. He was U.S. Co-Chairman for the Indo-U.S. Subcommission on Education and Culture; a member of the U.S. Overview Committee for Indo-U.S. Science and Technology Initiative of the U.S. National Research Council started in 1983 by Prime Minister Indira Gandhi and President Ronald Reagan; a member of the Council on Foreign Relations of the American Association for the Advancement of Science, 1964-89; and Co-Chairman, 1972-76, of the Joint U.S.-Korea Advisory Committee for

Science. In 1975, he received the Order of Civil Merit and Dongbaeg Medal from the President of the Republic of Korea for contributions toward the development of science and technology in Korea.

Only a few prizes are available to scientists for outstanding public service. Two of the most prestigious are the Charles Lathrop Parson Award from the American Chemical Society that Long received in 1985, and the Philip Haug Abelson Prize of the American Association for the Advancement of Science that he received in 1990. His wife, Marion Thomas Long, died in 1992. He is survived by a son, Franklin, a chemist, of Claremont, California; a daughter, Elizabeth, a Professor of Sociology at Rice University; a brother, George, of Portland, Oregon; and a grandson.

Barry K. Carpenter, Jerrold Meinwald, Fred W. McLafferty