F. Sherwood Rowland: A man of science, vision, integrity, and kindness

Barbara J. Finlayson-Pitts

Department of Chemistry, University of California, Irvine, CA 92697-2025

A man does what he must—in spite of personal consequences, in spite of obstacles and dangers and pressures—and that is the basis of all human morality.

—Sir Winston Churchill, British politician (1874–1965)

F. Sherwood (Sherry) Rowland was best known for his ground-breaking work on the impact of chlorofluorocarbons (CFCs) on stratospheric ozone. Although this topic was controversial at the time, Sherry courageously persevered in the face of “obstacles, dangers and pressures.” His research was ultimately proven correct and was recognized by sharing the 1995 Nobel Prize in Chemistry. Sherry was also a giant in the broader chemical community, with studies running from hot atom reactions to atmospheric concentrations of trace gases, including greenhouse gases, and more recently the use of breath analysis as a marker of disease and drug efficacy. Sherry served as Foreign Secretary of the National Academy of Sciences from 1994 to 2002 and President of the American Association for the Advancement of Science in 1992. However, in addition to his science, Sherry was well known for his vision, integrity, and kindness, attributes that encompassed his entire life and career.

Sherry passed away peacefully at home on March 10, 2012 at age 84 from complications associated with Parkinson’s disease. He is survived by his wife Joan, daughter Ingrid, son Jeff, daughter-in-law Christie, and two grandchildren, Taylor and Lindsay.

Sherry was born in Delaware, OH in 1927 and entered Ohio Wesleyan as an undergraduate at the age of 15, from which he graduated (after time out in the Navy during the war) with majors in chemistry, physics, and mathematics. He completed his PhD at the University of Chicago under Willard Libby and then joined Princeton University as an instructor for 4 y. He moved to the University of Kansas in 1956 as an assistant professor, where he earned tenure after only 2 y. In 1964 he accepted the challenge of becoming the founding chair of the department of chemistry at the University of California at Irvine (UCI), which opened its doors to students in 1965.

I first met Sherry when I was a young graduate student in the early 1970s. There was a very active group of researchers in physical and photo-chemistry in Southern California and the field that became atmospheric chemistry was just emerging. There were a number of photochemistry conferences held during that time, at which “beginners” such as I had unique opportunities to interact with the leaders in the field: this included Sherry. My fond memories of those interactions are of a patient, interested, and supportive senior scientist who went out of his way to encourage us youngsters in the field.

This perception was borne out over many subsequent decades of interactions with Sherry, including over recent years at UCI, where I was most fortunate to count myself as his friend and colleague.

The 1970s were an exciting time in chemistry and especially in Southern California, which was then known as the smog capital of the world. Coming out of the 1960s, environmental issues had risen to the forefront of public concern, and the role that chemistry played in both the causes and the cures of many environmental problems was becoming apparent. Arie Haagen-Smit’s research at the California Institute of Technology, beginning in the 1950s, had set the stage for understanding the importance of chemistry in the lower atmosphere (troposphere), but it was not until 1970 that the central role of the OH radical was recognized. This finding sparked an explosion of research activity on the chemistry of the plethora of reactive gas-phase organics in tropospheric air.

There had been relatively little work on stratospheric chemistry since the seminal studies of Sydney Chapman, who elucidated the natural odd oxygen cycles that form and destroy ozone in the upper atmosphere. In 1970–1971, Paul Crutzen (1, 2) elucidated important additional cycles involving oxides of nitrogen in the stratosphere that could lead to ozone destruction, and the impact of direct emissions of NOx into the stratosphere was discussed by Harold Johnston in 1971 (3). In 1974, Richard Stolarski and Ralph Cicerone (4) proposed new ozone-destroying cycles involving chlorine that could be important if there were sufficient sources of chlorine into the stratosphere.

James Lovelock, inventor of the electron capture detector, which is widely used in gas chromatography, had applied this technique to measure CFCs in air parts-per-trillion concentrations. At that time, Sherry’s research on hot atom chemistry was funded by the Atomic Energy Commission (AEC) who, thankfully,

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1 E-mail: bfjinlay@uci.edu.
understood and encouraged curiosity-driven research by their grantees. On a train from Salzburg, Austria after a conference, an AEC program manager invited Sherry to attend a meeting in Florida at which the Lovelock work was discussed. In these early days, the idea that nonreactive organics, such as CFCs released into the troposphere at the earth’s surface, could impact the stratosphere and ultimately have global impacts would have been regarded as absurd, at best. However, Sherry was not one to gloss over “accepted wisdom” (or lack thereof), and with the AEC’s blessing and support, decided to trace the atmospheric fate of CFCs in his characteristic quantitative scientific approach.

In 1973, Mario Molina joined Sherry’s group as a postdoctoral fellow and began working on the CFC issue. Sherry and Molina quite rapidly came to the conclusion that, given the lack of reactivity in the troposphere (which had been regarded as a plus), CFCs would be transported into the stratosphere. At sufficient high altitudes, CFCs would be exposed to UV that was energetic enough to dissociate and form chlorine atoms. Based on the known chemistry at the time, this exposure would set off chain reactions leading to increased chemistry at the time, this exposure would set off chain reactions leading to increased steady-state ozone concentrations in the stratosphere. Given the key role of ozone in filtering UV before it reaches the troposphere, the global impacts were likely to be significant. This work was published in Nature (5) in 1974, forming the basis of the joint award of the Nobel Prize in Chemistry to Sherry, Mario Molina, and Paul Crutzen in 1995.

Sir Winston Churchill is quoted as saying “We shall not always win, we shall not always stumble over the truth, but usually manages to pick himself up, walk over or around it, and carry on.” Fortunately for the world and science in general, Sherry and Mario, having discovered the truth, along with others, such as Ralph Cicerone, dedicated themselves to not only furthering the science but also to making the public aware of its implications. This dedication lead to regulatory action on CFCs in aerosol cans by the US Congress in 1978 which, in retrospect, was an incredibly fast response. Such action would never have been the case were it not for Sherry’s courage and steadfastness in speaking the scientific truth and translating the implications for public health and welfare.

It was certainly not an easy time, with many attacks on his science and personal integrity coming from many different quarters. However, with the first reports of the Antarctic “ozone hole” in 1985 and the subsequent inescapable conclusion after some intense field and laboratory studies that this ozone hole was caused by CFCs, the work was completely vindicated. In 1987, the first international agreement on CFCs took shape in the form of the Montreal Protocol, which continues to serve today as a model for international collaboration to address a global problem.

Although much of the recognition of Sherry’s research has focused on the CFC work that led to the Nobel Prize, there were many other important contributions over his scientific career. These contributions include his early work on hot atom chemistry and, after the CFC discovery, his measurements of trace atmospheric gases and their trends with time, which began in the mid-1970s when Don Blake joined his group as a PhD student. The research carried out during their very productive collaboration over many years since continues at UCI, where Don is a full professor. This research includes measurements of the CFCs, which showed a turnover in their previous rates of increase as the Montreal Protocol and subsequent agreements came into play, which must have given Sherry great satisfaction. These measurements also include a number of important species, such as methane, an important greenhouse gas, and reactive impurities in propane that are important in generating air pollution in Mexico City. Sherry was also very excited over recent years by a new direction in which his atmospheric measurement techniques were applied to breath analysis as markers of disease and the efficacy of various medications.

However, there was much more to Sherry than superb science. He loved both opera and athletics (an interesting combination). When he was a graduate student at Chicago, Sherry was on a semi-professional baseball team in Oshawa, ON, Canada, and was managing this team when it won the championship in 1950. His athletic abilities, honed in baseball, basketball, and tennis, were often demonstrated during spontaneous games of various sorts at conferences.

Sherry had tremendous vision that was apparent not just in his science, but in the leadership he brought to everything in his life. He came to Irvine in 1964 when it was not much more than a series of ranches. He played a major role in the development not only of the Department of Chemistry, but also the campus as a whole. Institutions and departments can neither be propelled forward or held back for a long time by the initial leadership and vision; Sherry’s impact, particularly for the Department of Chemistry, was most certainly in the former category. Sherry also led in the founding of the Earth System Science Department at UCI, which within a few short years became internationally recognized.

Sherry was a man of enormous integrity. Not many could have withstood the onslaught of both scientific and personal attacks to which he was subjected over a decade before the Rowland/Molina hypothesis on CFCs was accepted. However, Sherry continued to speak his truth quietly and clearly, without demonizing his critics, but remaining steadfast in his science.

A characteristic of Sherry that is not as often acknowledged is his kindness. I saw this first as the young graduate student with whom he generously shared his time and knowledge, remarkably making me feel as if I were his equal (which could not have been further from the truth!). However, Sherry treated everyone with the same respect and interest, from undergraduates to fellow scientists to politicians to the Pope. He was the epitome of the lines in Rudyard Kipling’s poem “If”:

“If you can talk with crowds and keep your virtue, or walk with Kings—or lose the common touch...”

Finally, a retrospective on Sherry would not be complete without recognizing the key role played by Joan, his wife and life partner in all things. Sherry simply would not have been Sherry without her support, advice, and full partnership in all their endeavors. In a US Senate hearing in 1986, Sherry was asked what he would do “if he were king.” His response? “I would ask the queen.” Their 60th wedding anniversary would have been on June 28 of this year.