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Donald Ramsay
1922-2007



Donald Allan Ramsay, a distinguished molecular spectroscopist, died peacefully on October 25, 2007, in Ottawa, at the age of 85. Don had a productive career spanning more than 60 years in the Sussex Drive Laboratories of the National Research Council, remaining active to the last days of his life. He pioneered the study of the spectra of free radical molecules, short-lived species important in many areas of chemistry, biology, and astronomy. His achievements in the field of spectroscopy added greatly to the international reputation of the NRC and laid the groundwork for linkages to partner organizations around the globe.

Don Ramsay was born into a family of artisans on July 11, 1922 in Putney, London, England. He received schooling at Latymer Upper School before going up to Cambridge University where he studied as an undergraduate under Dr. (later Lord) Fred Dainton, and for his Ph.D. degree, awarded in 1947, under Dr. (later Sir) Gordon Sutherland. At Cambridge Don was an accomplished rower, taking part in the 1944 Boat Race against Oxford, a unique race held on the Great Ouse River rather than on the traditional Thames River due to wartime exigencies. At Cambridge Don met his future wife Nancy Brayshaw: they were married in June, 1946.

On completion of his doctorate, on Dainton's advice, Don took up an appointment as Junior Research Officer in the Organic Spectrochemistry group of the NRC Division of Chemistry under R. Norman Jones. In 1949, he transferred to the Division of Physics to work with Gerhard Herzberg. Although Don's early experience had been in infrared spectroscopy, he changed upon joining Herzberg's group to electronic spectroscopy in the visible and ultraviolet wavelength regions. Perhaps the most important event in his career was the advent of *flash photolysis* (now usually called kinetic spectroscopy). This technique, which originated with George Porter in the laboratory of Ronald Norrish in Cambridge, consisted of subjecting a sample to an intense flash of light, usually generated by discharging a capacitor bank through an array of mercury fluorescent lamps surrounding the sample cell. This photodissociated the sample into fragments (or *free radicals*), whose spectra could then be recorded with the aid of a weaker continuum flash at a timed delay after the photolysis flash. Continued repetition of this procedure using a fixed delay time gradually built up a spectrum on a photographic plate. The experiment could then be performed with different time delays, revealing the time dependence of the spectrum and the free radical lifetimes, typically in the microsecond to millisecond range.

Herzberg and Ramsay soon realised in 1950 that the sensitivity of this technique benefited by using gas phase samples and high spectral resolution, where the width of the lines in the spectrum was approximately matched by the instrumental resolution. Their first triumph with this approach was the observation of a detailed absorption spectrum of the NH_2 radical. This spectrum was known previously in emission from electrical discharges through ammonia, from flames, and from comets, but it had not been definitely identified. The observation of an absorption spectrum from the ground electronic state made it possible to definitively identify the carrier as NH_2 , and to assign quantum numbers to the levels involved. More detailed work by Kurt Dressler and Ramsay showed that this was the first established example of an effect predicted in 1934 by R. Renner, a student of Edward Teller, concerning electronic states that have equal energy for linear geometries, but separate for nonlinear geometries. NH_2 actually exemplified a larger Renner effect than was considered in Renner's original paper. Ramsay's subsequent observation of the NCO radical gave a case of the type originally considered by Renner. Nowadays, many examples of Renner effects of various sizes are known for different

molecules. Much of this information has been obtained using the flash photolysis technique, which proved to be extremely productive in generating spectra of free radicals.

Mention should be made of Ramsay's work with Ed Ballik in 1959 on the spectrum of the C_2 diatomic molecule. This cleared up the then-vexed question of the identity of the ground electronic state, which was shown to be a closed-shell singlet state, rather than the alternative triplet state. Their result had broad implications for the precise thermochemistry of carbon compounds.

One feature of Ramsay's work was his tendency to return to the same molecule on a number of occasions, to obtain further data and extend the analysis. For NH_2 this was done in an extended collaboration with Michel Vervloet; and at the time of his death Don was still working to glean further information from photographic plates taken with Dressler more than 50 years earlier. Other "Ramsay molecules" included HCO (important in combustion), formaldehyde (CH_2O), and glyoxal ($CHO-CHO$). He also published a number of papers on thioformaldehyde (CH_2S), where he was intrigued by perturbations of the excited electronic states, caused by high levels of the ground state, which could be probed by microwave-optical and radio-frequency-optical double-resonance techniques.

A continuing interest of Ramsay's was in the study of the effects of electric and magnetic fields on electronic spectra. In this he had long-standing collaborations with David Buckingham, John Brown, and Wolfgang Hüttner. These field effects were used in the determination of excited-state electric dipole moments, and in studies of the Kerr effect, magnetic optical activity, and magnetic rotation. Such measurements were all applied to formaldehyde, as well as to a number of other molecules.

Towards the end of his career Don had an extensive collaboration with Ewald Fink, who had devised methods for producing clean emission spectra by various techniques such as energy transfer from excited oxygen molecules. These were applied mainly to diatomic molecules isovalent with oxygen O_2 , such as SO, Se_2 , BiF, and others, but also produced valuable spectra of other molecules such as HO_2 , a molecule important in atmospheric studies.

In outreach activities, Don assisted D.K.C. McDonald in establishing the Department of Physics at the University of Ottawa in 1955, and lectured there until 1967. In 1956, he was a founder of the first International Symposium on Free Radicals held in Quebec City. Fifty-one years later, in August 2007, Don travelled to the 29th Symposium of this series, held in Big Sky, Montana. These Symposia, which he shaped and promoted steadfastly over 50 years, were a particular source of pride.

Don published over 200 papers in refereed journals, and a number of other articles. A strong promoter of Canadian science, he was proud of his 50 papers in the Canadian Journal of Physics. He was co-editor of The Selected Papers of the Nobel Laureate Robert S. Mulliken, published in 1975.

Following his election to the Royal Society of Canada in 1966, Don was strongly dedicated to its goals, serving as Vice-President of the Academy of Sciences, twice as Honorary Treasurer (for 6

years), and as Editor of The RSC Newsletter. He received the RSC Centenary Medal in 1982. From 1994 to 2007, he was active in the organization of two meetings a year for Fellows in the Ottawa region. He contributed generously to RSC Gender Studies, the Women in Scholarship lecture series, and to the Development Fund.

Don was elected Fellow of the Royal Society of London in 1978 and appointed to the Order of Canada in 1997. Other honours and awards include: The Queen Elizabeth II Silver Jubilee Medal in 1977; The Commemorative Medal for the 125th Anniversary of Confederation of Canada in 1992; and The Chemistry Institute of Canada Medal in 1992 (its highest award). Don was awarded honorary doctorates from the universities of Reims and Stockholm, and was named a Researcher Emeritus at NRC. As well he undertook visiting research appointments in many countries, including Israel, France, Sweden, USA, Brazil, Australia, Japan, Germany, China and New Zealand.

Don recognized that he owed much to the people around him. Quoting from reminiscences he wrote in the early 1990s: *“At the NRC I have benefited from the philosophies of Drs. E.W.R. Steacie and G. Herzberg, who believed that one should select persons carefully and give them the freedom and support to follow their own ideas. I have enjoyed the collaboration with numerous post doctoral fellows, research associates, summer students, and visiting research scientists. Finally, I wish to acknowledge the highly professional and loyal support of two technical officers, Werner Goetz and Mike Barnett, each of whom has assisted me for more than 25 years.”*

Don and Nancy were Charter Members of Kingsway United Church in Ottawa, where Don served as organist for 50 years. Don, Nancy and their four daughters (Shirley, Wendy, Catharine, and Linda) frequently hosted Don’s scientific colleagues, many from abroad, at their home. In the summers, many were also welcomed at North Star, their cottage near Deep River, Ontario. In Don’s eyes, the world of scientific research was closely interwoven with personal acquaintance.

Don was a kind-hearted and compassionate person. These qualities were very evident, particularly during the last years of his wife Nancy’s life when she entered a period of declining health. Sometime after her passing in 1998, Don met Dr. Marjorie Craven Findlay and they married in Edinburgh, Scotland.

In summary, Don Ramsay had a 60-year career at NRC, a very unusual achievement for anyone at any kind of scientific institution. Throughout this time he was one of the best-known figures in the field of molecular spectroscopy. He travelled widely, and had a number of productive collaborations with scientists from all around the world. He made many important contributions to molecular spectroscopy, of which his work on free radicals is particularly significant.

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(Author’s title given as of the time of writing)