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OBITUARY

Obituary: Lawrence Arthur Woolf (1934 to 2019)

Ken Harris[1] · **Will Price**[2]

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Lawrie Woolf died on the 9 March 2019, in Canberra, Australian Capital Territory, aged 85. He was born in Perth, Western Australia, on 21 January 1934. The family lived for a number of years in Wiluna on the edge of the Central Desert, later moving to the southern coastal town of Bunbury, where he developed a passion for chemistry at high school. An excellent scholar, he was able to enter the University of Western Australia (UWA) when only 16. On completion of his bachelor's degree, Lawrie began research in the laboratory of the legendary Robin Stokes, moving with Stokes in 1956 to the new Chemistry Department at the University of New England, Armidale, New South Wales, where he completed his MSc (1958) and Ph.D. (1959): both degrees were awarded by UWA. In Armidale he met his future wife, Kath, and they married in 1959 in Madison, Wisconsin, when he was a postdoctoral fellow with Lou Gosting at the University of Wisconsin (Madison). Later he held a lectureship at Sydney University and a senior lectureship at University College, Townsville, Queensland (later James Cook University), before moving to the Australian National University in Canberra in 1966.

A physical chemist, Lawrie's major contributions to solution chemistry were through experimental and theoretical studies of diffusion in liquids. Both his mentors, Stokes and Gosting, were superb experimentalists and builders of physical chemical apparatus of very high precision. In the 1950s diffusion studies required considerable analytical chemical skills to determine solution concentrations and his masters and doctoral work centred on the precise measurement of proton and ion diffusion coefficients to investigate the proton-jump model in electrolyte solutions. This led to a group of papers in *Analytical Chemistry*, the *Journal of Physical Chemistry* and the *Journal de Chimie Physique*. In Gosting's laboratory, he learnt Gouy and Rayleigh interferometry and together with Gosting, Peter Dunlop, Don Miller and Dick Wendt, provided the first thorough tests of the Onsager Reciprocal Relations as they applied to ternary diffusion, which contributed to the evidence supporting Lars Onsager's 1968 Nobel Prize in Chemistry.

The Australian National University was established in 1946 to be a research university of international standing. Under Marcus Oliphant (later Sir Mark), a nuclear physicist and former student of Rutherford, the Research School of Physical Sciences (RSPhysS) was

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Fig. 1 Lawrie Woolf with Peter Dunlop (centre) and Reg Mills (right), University House, Canberra, photograph taken in late 1980s

established in 1949. Reg Mills (1917–2001), a New Zealander, joined the Department of Radiochemistry in 1954. In 1964, he set up the Diffusion Research Unit where he was joined by Lawrie in 1966. Over a period of 32 years, the DRU was host to many distinguished visitors and young scientists from many countries who came to learn diffusion techniques. Many of the latter, now somewhat older, have kindly acknowledged Lawrie's mentoring and the passing on of his experimental skills and advice.

At Reg's suggestion, and with the excellent workshops and very skilled technical staff at RSPhysS, Lawrie undertook the development of a high-pressure version of the diaphragm cell. This provided the first accurate measurements of self- and tracer-diffusion in liquids under pressure. Lawrie's work on water at high pressures, both by this method and by NMR (with Ken Harris and Phil Back), is still the best available and has been very useful for theoreticians in understanding the structure and properties of water.

Lawrie, with the help of Lindsay Wilson, Jack Derlacki, Rakesh Malhotra, Will Price, John Dymond, John Isdale and Alan Easteal, went on to build other high-pressure equipment, including a self-centering falling body viscometer (which is still operating today in Ken Harris' laboratory) and a bellows volumometer for determining high pressure densities. Other instrumental innovations were diaphragm cells for tracer diffusion in liquid argon (with K. Srinivasan and Vernon Edge), with continuous concentration monitoring

(with Tony Collings and Reg Mills) and for high temperatures (with Will Price and Alan Easteal).

Not all his work was experimental, with Lawrie contributing to diaphragm cell theory (with Reg Mills and Bob Watts), multi-component diffusion, and refining and extending Gerhard Hertz's work on the statistical mechanical understanding of liquid solutions using velocity correlation coefficients.

On his retirement from ANU at the end of 1996, Lawrie joined the then School of Chemistry, University of New South Wales, ADFA, also in Canberra, as a Senior Visiting Fellow. He worked with Ken Harris on high-pressure transport property measurements for low temperature water and aqueous solutions and with Ken Harris and Mitsuhiro Kanakubo on ionic liquids, also at high pressure. His last paper was published in *Chemistry- A European Journal* in 2013. Figure 1 is photograph of Lawrie with two colleagues.

Lawrie had some 150 primary publications: his students included Bert Hoveling, Tony Collings, Mike McCool, K. Srinivasan and Bob Hurle. Alongside of his many scientific achievements and endeavours, and, with Kath, raising a large family, Lawrie somehow found the time to be the Chair of the Board of the former Canberra Credit Union and to run a small bush hobby farm near Tarago, NSW. He had a wry humour coupled with a keen mind and generosity of spirit, unpretentious and always ready to help others in his quiet way.

Our heartfelt sympathy goes to his family, including Kath, their five children and seven grandchildren.