The Diffusion Research Unit, The Australian National University, Canberra: A contribution to physical chemistry and beyond

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The Australian National University was established in Canberra in 1946-48 to be a research university of international standing under the post-war Chifley federal government. At that time Australia had only six universities, all in the main population centres, the state capitals. Canberra, as the country's capital housed the national Parliament, but had yet to be developed as a true city. Under Adelaide-born Marcus Oliphant (later Sir Mark), a nuclear physicist and former student of Rutherford who had contributed to the Manhattan Project, the Research School of Physical Sciences was established in 1949. Reg Mills (1917-2001), a New Zealander, joined the Department of Radiochemistry in 1954, bringing skills in using radio-tracer methods to make precise measurements of the diffusion of ions in electrolyte solutions to test theoretical predictions. In 1964 he set up the Diffusion Research Unit which he led until his retirement in 1982. He was succeeded by Lawrie Woolf (1934-2019), a West Australian who, having joined DRU in 1966, continued the outstanding work of the unit until his retirement in 1998. During this period of 32 years, DRU was host to many distinguished visitors and young scientists from many countries who came to learn diffusion techniques. Mills and Woolf adapted the Stokes diaphragm cell for radiotracer measurements and McCool, Collings and Woolf developed a high-pressure cell for self-diffusion measurements. Mills established the first accurate values for self-diffusion coefficient of water over a range of temperature [1]. These are now the basis for calibration of all NMR apparatus used in diffusion measurements and certain applications of Magnetic Resonance Imaging in medicine. In addition, Harris and Woolf determined the self-diffusion of water and 18-oxygen water over a wide range of pressures and temperatures [2]. DRU carried out extensive studies of isotope effects, i.e. the effect of molecular mass, on molecular and ion diffusion. These are used extensively by hydrologists and soil sciences in understanding the age and flow of water in artesian water supplies.

Here we detail these and other contributions made by DRU in fields such as molten salts, liquid state physics, refrigerants, cryogenic liquids, food chemistry, electrolyte and non-electrolyte solutions, and the theory of mass and charge transport processes in solutions. These illustrate the wide use and fundamental importance of diffusion processes in diverse areas of Science and Technology.

References

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