

Professor Patrick Meares , MA, PhD, ScD, DSc, FRSC
1 July 1923 – 4 December 2014

Patrick's early education was at Trinity School of John Whitgift in Croydon, Surrey, and from there he went on to study chemistry at Queen's College Cambridge.

After only 2 years of undergraduate study (a consequence of wartime restrictions), he commenced his doctoral studies in the Colloid Science Laboratory under Sir Eric Rideal, subsequently relocating to the Royal Institution in London when the latter moved there. On completing his PhD Patrick was appointed to a lectureship in Physical Chemistry at the University of Aberdeen His research work was concerned initially with the properties of polyvinyl acetate membranes and the permeation and diffusion of gases and vapours through them. He authored many published papers on the structure and bulk properties of polymers, and a book published under the same title in 1965.

Patrick also developed a strong interest in the comparison of synthetic and biological membranes, and in 1955 he was awarded a Carnegie Research Fellowship to work with Hans Ussing in the Department of Zoo-physiology at the University of Copenhagen. Ussing had developed equations to differentiate between passive and active transport of ions across the membranes of living cells, and, building on this work, Meares and Ussing used a synthetic cation exchange membrane as a model of a passive membrane to test the validity of these equations.

Later, in the early 70s, he collaborated with K R. Page at the Biophysical Chemistry Unit in the Chemistry Department in the University of Aberdeen, studying what is called the Teorell Oscillator. This uses synthetic membranes to imitate the behaviour of excitable biological membranes. Teorell and some later workers used sintered glass membranes in their experiments whereas Meares and Page used Nuclepore filters which had a well-defined structure with parallel circular pores of known diameter. The experimental results obtained were qualitatively similar to those of other workers but by taking into account the structure of the membranes Meares and Page developed theoretical equations which gave predictions close to their observed results.

As his research interests broadened, Patrick studied the properties and uses of a wide variety of membranes. Practical uses of membranes depend on their physical and chemical properties, especially the chemical stability and strength of the material from which they are made, the size and structure of any pores, their thickness, and the presence or absence of chemical groups carrying positive or negative charges. He was interested not only in the manufacture, structure and properties of such membranes but also in their characterisation by the use of irreversible thermodynamics.

Commonly used membrane-dependent processes include ultrafiltration, reverse osmosis and electrodialysis. Ultrafiltration is used to separate molecules of different size especially in gases and vapours. In reverse osmosis a hydrostatic pressure greater than the osmotic pressure of the solution on one side of a suitable porous membrane drives the solvent through the membrane to the other side. Electrodialysis involves the use of electrical current to move ions through cells composed of alternate cationic and anionic selective membranes. One well established use of reverse osmosis and electrodialysis is the removal of salt from brackish water

Because of the importance of membrane-dependent processes in industry, Patrick became involved in some areas of chemical engineering. Examples include his work with the Harwell laboratory to study the possibility of finding membranes suitable for concentrating low level radioactive waste by electrodialysis or reverse osmosis, and his cooperation with Imperial Chemical Industries to study the properties of their sulphonated membranes.

In 1976 Patrick acted as editor of a book entitled *Membrane Separation Processes* in which he and more than a dozen other experts in the field discussed the uses and potential uses of various types of membrane. He was a strong proponent of international cooperation in research, and when the European Membrane Society was formed in 1982 he became an active member. He was keen to help younger generations of membrane researchers and was appointed chairman of the education committee.

While his research progressed, Patrick was promoted to Senior Lecturer, then to Reader, Professor, and, eventually, Head of the Chemistry Department at Aberdeen University. His post as

head of the department involved much administrative work which he did not enjoy, and in 1984 he decided to take early retirement to enable him to continue his research on the properties of membranes. He was offered research facilities and an Honorary Fellowship at the University of Exeter in the Chemical Engineering Department headed by Professor Robin Turner.

At Exeter, far from relaxing into semi retirement, Patrick continued to carry out research on membranes and published more articles and papers on this topic. He was also appointed by the UK Science and Engineering Research Council to coordinate membrane research projects in the UK, a post that he held from (1985-1992).

In recognition of his outstanding contributions to membrane research he was awarded the Castner Medal by the Society of Chemical Industry in 1990. Castner was one of the inventors of the Castner-Kellner process used on a large scale in industry to produce sodium hydroxide, chlorine and hydrogen by electrolysis of sodium chloride solution. Although a very efficient process it involved the use of a mercury cathode and traces of mercury have been found in the sodium hydroxide produced. This technique has now been largely replaced by the use of membranes in electrolytic cells

In August 2002 a special issue of the Journal of Membrane Science was published in Patrick's honour. Much of Patrick's work was carried out in collaboration with other researchers, research fellows and students. His encouragement and guidance was much appreciated as is clear from the short letters dedicated to him in that special issue. He was also made an honorary member of the European Membrane Society.

While working for his PhD at Cambridge, Patrick met his future wife Rhoda who was also studying there. They were married in York in 1947 and remained together for 61 years, until she died in 2008. They both enjoyed classical music, opera and ballet. They were members of the National Trust and after Patrick's semi-retirement in 1984, they travelled widely visiting historic buildings in England. They also visited many European countries and especially enjoyed river cruises. Both were keen environmentalists and supporters of the Royal Society for the Protection of Birds

Dr Dennis Mackay

Professor Patrick Meares , MA, PhD, ScD, DSc, FRSC. Born 1 July 1923. Elected FRSE 1967. Died 4 December 2014.