

A Famous Irish Biochemist

By Professor William Reville, University College Cork.



Over the course of the twentieth century a number of Irish scientists carried out world-class research in Ireland, heroically overcoming local straitened circumstances so unpropitious to doing high class research. Usually the term 'great' is attributed to a scientist only after he/she is long dead and their contribution has stood the test of considerable time. Nevertheless, few could disagree that Professor Edward J. Conway (1894-1968) has now earned the title of 'great Irish scientist'.

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E.J. Conway, born in Nenagh, entered the medical school at UCD in 1912. He graduated in 1921, having also qualified with a BSc in Physiology, and joined the staff of the UCD Physiology Department. He was awarded the D.Sc. by the National University of Ireland in 1927 after which he spent a year studying muscle physiology in the laboratory of the great German biochemist Gustav Embden in Frankfurt. He was appointed to the new chair of Biochemistry and Pharmacology at UCD in 1932 where he started up a research laboratory that earned world-wide renown.

Conway's early research, an investigation of kidney function and the laws governing excretion by the kidney, stimulated wide international interest. Conway was forced to develop his own methods in order to cope with the analysis of endless tiny volumes of fluid demanded by this research. He developed a microburette/diffusion apparatus that was so successful it became widely adopted as a standard method of microanalysis.

The structural unit of biological organisation is the cell. It is surrounded by a membrane that partitions the internal contents of the cell from the external environment. The chemical composition of the cellular content (cytoplasm) is quite different to the composition of the outside environment and is finely regulated by various enzymes and hormones.

Conway is primarily remembered for establishing the significance of the asymmetric distribution of positively charged atoms (ions) of potassium and sodium across the cell membrane. Together with his student Boyle, Conway published a classic paper in 1941 explaining how the compositional differences between the fluids inside and outside the cell are established and maintained. The cell membrane is selectively permeable, restraining the movement of some electrically charged atoms and water-soluble molecules. Also, active transport, the movement of molecules or ions against a concentration gradient, maintains an asymmetric distribution of sodium and potassium ions across the cell membrane.

The agent of active ion transport, called the sodium-potassium pump, is powered by chemical energy in the form of adenosine triphosphate (ATP) generated by the metabolism of the cell. This pump was later discovered to be an enzyme that pumps 2 potassium ions into the cell for every 3 sodium ions it pumps out of the cell. The resulting asymmetric distribution of ions across the cell membrane causes an electrical polarisation or membrane potential, i.e. the intracellular side of the membrane is slightly negatively charged relative to the extracellular side. Alan Hodgkin and Andrew Huxley in Cambridge built on this work to explain the mechanism of conduction of the electrical signal along nerve axons, which won them the Nobel Prize in Physiology or Medicine in 1963.

Conway also carried out fundamental work on the biochemistry of gastric acid secretion, and on the chemical evolution of the oceans, and his papers on the ocean are still regarded as standard works in the area.

Conway's brilliance was widely acknowledged and he received many honours, e.g. Fellow of the Royal Society (1947), Fellow of the Royal Institute of Chemistry (1957), Member of New York Academy of Science (1960), and Boyle Medal of the RDS (1968). Conway was a devout Catholic and when attending international conferences he would always enquire as to the location of the nearest church lest he miss Sunday mass.

Conway's research laboratory at UCD attracted widespread financial support from granting agencies. Funding from the US Air Force allowed him to acquire the first electron microscope in Ireland.

Conway retired from the Chair of Biochemistry in 1964 but continued to direct the UCD Unit of Cell Metabolism for a few years. I did my degrees in Biochemistry at UCD and I remember seeing Conway in the Biochemistry Department when I was a third year student. I did my Ph.D. research on the Philips 100 Electron Microscope that he purchased for the Department.

My UCC colleague, Professor Jim Heffron, also did his degrees in Biochemistry at UCD and attended lectures by Conway in his third and fourth undergraduate years. He describes Conway's lectures on thermodynamics as 'models of clarity in both content and delivery'. Jim also told me a story about Conway driving his Mercedes to UCG to act as an external examiner. Next morning, forgetting he had driven over, he returned to Dublin on the train !

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