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OBITUARY

Professor Robert JP Williams FRS (25/2/1926–21/3/2015)

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Professor Robert Williams
Photo Credit: Keith Waters 2006

Professor Robert Williams, known to all as Bob, was a pioneer in the study of the roles of metal ions in biology and a founding father of the subject we today call bioinorganic chemistry. A gifted man and true polymath, Bob was an inspirational teacher. His knowledge of chemistry, biochemistry and geochemistry was encyclopaedic. With a quick mind and fertile imagination he always sought to connect facts to discover the larger picture and underlying principles. It was these attributes that underpinned his wide-ranging research achievements.

As a teenager during the War working in agriculture, Bob first became curious about the functions of metal ions in biology when noticing the addition of lime, potassium phosphate and trace metals such as Fe and Mo, to ensure healthy plant growth. He won a place at Oxford University to study chemistry and where he was to teach and research for his entire career. As an undergraduate, he measured the thermodynamic stabilities of ligands, then used in analytical chemistry, showing the relative selectivity of binding. Published in 1948, it became known as the Irving–Williams series of transition metal stability constants. During the tenure of a fellowship with Professor A. Tiselius in Sweden developing chromatographic techniques for protein isolation, he wrote a seminal review "Metal ions in biological systems" that was published in 1953 in *Biological Reviews*. This led to contacts with biologists, in particular Bert Vallee, at Harvard Medical School, who was studying the role of Zn in red and white blood cells. A long collaboration ensued resulting in the isolation of Zn carboxypeptidase and the replacement of Zn(II) with the spectroscopic probe Co(II) ion, the first example of isomorphous replacement in proteins. His own laboratory explored the chemistry of vitamin B12 and the cobalamin ring and showed the correlation between the Fe spin states and optical properties of haems. Thus began an interest in the chemical processes of respiration and an examination of the possible roles of chains of catalysts within mitochondrial membranes. In his laboratory, his students were investigating electrical conductivity in organic materials and intensely coloured compounds, now known as mixed valence compounds, to model short- and long-range electron transfer in membranes. Bob examined the question of why is there a series of catalysts with functional groups at one end reducing oxygen and, at the other, oxidising hydrogen atoms? In 1960 he wrote papers describing a way of converting the energy of reaction of oxygen and hydrogen at long range into localised proton gradients and connecting that to ATP production. These ideas contrasted sharply with those of biochemists then hunting for so-called high-energy phosphorylated intermediates. After lengthy correspondence

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with Bob, Peter Mitchell took up the essence of these ideas to formulate his chemi-osmotic hypothesis.

Bob's research on the structures and functions of metalloproteins themselves began in earnest in 1970 with the formation of the Oxford Enzyme Group for the development of high-field NMR spectroscopy of proteins. This offered him the possibility of studying the dynamics of proteins, not available from protein crystallography, but critical to function. He applied new NMR methods to study electron transfer proteins, kinases, cytochromes, iron and calcium proteins to show the connection between mechanical movement and biological function. In the latter part of his career, Bob turned to study mechanisms of biomineralization and developed a deep interest in evolution.

Throughout his career, Bob wrote a number of highly original books setting out his insights into Inorganic Chemistry, the Inorganic Chemistry of Life and, latterly, Evolution. He was generous in sharing his insights sometimes before there was strong experimental evidence. Others were not slow to seize on his ideas.

Many honours and awards were bestowed on Professor Bob Williams during his career. These included Fellowship of the Royal Society and of four foreign national academies. He was awarded medals by the Chemical Society, the Biochemical Society, the Royal Society and the International Biochemical Society. He became the Napier Royal Society Research Professor at Oxford. He held honorary degrees from five universities and was elected a Foreign Member of the Swedish, Portuguese, Czechoslovakian and Belgian Science Academies. His students and co-workers, many in academic posts, are spread across the world.

Books by RJP Williams FRS

Inorganic Chemistry Vol. I and II
CSG Phillips and RJP Williams. OUP 1965

The biological chemistry of the elements: The inorganic chemistry of life
RJP Williams and JJR Fraustro da Silva. OUP 1991

The natural selection of the elements: The environment and life's chemistry
RJP Williams and JJR Fraustro da Silva. OUP 1996

Evolution's destiny: Co-evolving chemistry of the environment and life
RJP Williams and REM Rickaby. RSC Publishing 2012