

Hans C. Freeman (1929–2008)

Australia's scientific community lost a leading figure when Hans Freeman, Emeritus Professor at the University of Sydney, his *alma mater*, died on 9 November 2008. He will be remembered as much for his influence in science policy as for his research and as a great teacher and mentor. Hans was born in Breslau, Germany and migrated to Australia at the age of nine in 1938. He topped his primary school after only one year speaking a new language in a new country, and then went on to complete his secondary education at Sydney Boys High, a school that selected pupils based solely on academic merit. At Sydney High, Hans was taught science by a legendary teacher, Len Bassler, who has numbered more than eight professors of science among his former pupils.

Hans then attended Sydney University where he graduated with first class Honours and the University Medal in Chemistry and proceeded to an MSc and then to a PhD. He commenced his research studying dipole moments with Professor Raymond LeFevre, but it was the award of a Rotary Foundation Fellowship that permitted Hans to spend a year at the California Institute of Technology that was to permanently change his research career. He was introduced to crystallography by Eddy Hughes and the environment of the laboratory focussed Hans' interest on molecules of biological relevance. A defining moment during his time at Cal. Tech. was the opportunity to attend two select meetings on the structure of proteins held in 1953. The attendees included Bragg, Crick, Kendrew, Pauling, Perutz, Watson and Wilkins among other notable figures of crystallography and structural biology. An article describing one of these meetings was authored by John Kendrew [Kendrew, J. C. (1954), *Nature (London)*, **4393**, 57–59].

Hans commenced work on biuret hydrate at Cal. Tech. and completed the structure for his doctorate at the University of Sydney. As part of this work he pioneered the use of digital computers for crystallography utilizing SILIAC, one of the first general purpose computers installed in Australia. He published several papers on the computer codes developed for the crystallographic calculations. From biuret hydrate he moved on to determine metal complexes firstly of biuret itself and then of amino acids and peptides. This work, which continued throughout the 1960s with a large group of graduate students and post-doctoral Fellows, culminated with the publication of two large reviews. These remained the definitive references in the field for many years.

Seeing that the future of structural bioinorganic chemistry lay not in model compounds but in the proteins themselves, Hans seized an opportunity offered by the University of Sydney to explore new areas of research and in 1970 formed what was to be the first protein crystallography group in Australia. Others in the crystallographic community feared that macromolecular research would drain funding from other aspects of the field. If one looks at the make-up of the crystallographic community in Australia today, one can see that these fears have in many ways been realised. There are now more than 15 flourishing protein crystallography groups in Australia and New Zealand. Hans' initial vision for his own protein crystallography research was directed to a single protein target, that of the 'blue' copper protein plastocyanin. Its intense blue colour and unusual redox chemistry had defied the creation of a small molecule mimic and the sure route to an understanding of the properties of the protein lay in its structure. In the days before recombinant protein expression, plastocyanin was purified from thirteen natural sources before crystals were finally grown from extracts of the leaves pruned from poplar trees on the University of Sydney campus. Visualization of the structural basis for the 'blueness' of 'blue' copper proteins was a significant achievement in the field of bioinorganic chemistry and is widely quoted in many texts to this day.

Hans was a regular and enthusiastic participant at casual meetings of the so-called 'bush crystallographers' in Australia. These meetings held every 18 months to two years at various locations around the country brought together all crystallographers regardless of their specialization. Despite an initial reluctance to formalize the organization, Hans was instrumental in the formation of the Society of Crystallographers in Australia (SCA, later to become SCANZ) and was elected its first president in 1976. He started the Society on a path that promoted and supported crystallographic science in Australia and internationally.

Hans was the programme Chair for the 1987 IUCr Congress and General Assembly held in Perth, Western Australia. In this role, he ensured that the meeting showcased outstanding science. The exceptional local organisation, led by Ted Maslen and Syd Hall, together with the strong programme resulted in a financial as well as scientific success. The income from the invested funds has been used very profitably since 1987 to fund travel by Australian and New Zealand students to IUCr, AsCA and SCANZ meetings and to bring a distinguished lecturer to each of the local meetings of the society.

Hans was a charismatic lecturer for whom teaching was a love and a privilege and never an obligation. He enthused generations of first year students with a love for chemistry. His lectures were always beautifully structured and informed by research. Hans continued teaching a special first year class long after his formal retirement and did so until not long before his passing. Hans was conscious of the fact that Australia suffered from a tyranny of distance that

meant senior students had fewer opportunities than those in the northern hemisphere to interact with leading researchers. In 1972, he was instrumental in the formation of the Foundation for Inorganic Chemistry at the University of Sydney, that each year since has brought one or two international scientists to the School for an extended visit and to deliver a series of lectures. Included among these visitors have been protein crystallographers, bioorganic chemists and X-ray spectroscopists. Many of the students have subsequently joined these scientists as post-graduate or post-doctoral students.

In total, Hans authored over 160 research papers, and received practically every honour available to a chemist in Australia including the Burrows and Leighton medals of the Royal Australian Chemical Institute and the Craig medal for chemistry from the Australian Academy of Science. He was elected as a Fellow of the Academy in 1984 and was recognised by the Australian Government for contributions to chemistry by being made a Member of the Order of Australia in 2005.

Once elected to the Academy, Hans used the opportunity to make a significant and lasting contribution to Australian science when he co-authored a report entitled 'Small Country, Big Science'. The 'small' referred of course to the population not the land area. The report highlighted the need for access to major research facilities not available in Australia at the time, including high intensity neutron and synchrotron X-ray sources. Following the report, the Australian government put in place easily accessible funds for travel by Australian scientists to overseas facilities. This funding has had a major impact on many different scientific disciplines in Australia. A further outcome of the report was the establishment of the Australian Synchrotron Research Programme (ASRP) of which Hans was a board member until its incorporation into the Australian Synchrotron in 2008. Access to synchrotron sources, first at the Photon Factory in Tsukuba, and later at the Advanced Photon Source, Argonne was a major boost to crystallography in Australia. The expertise gained from the support of scientists by the ASRP led eventually to the construction of the Australian synchrotron in Melbourne that is proving to be an outstanding success.

Hans listed his non-scientific interests as opera and travel and he indulged these whenever he had the chance. Hans Freeman leaves behind a legacy of significant research, institutional innovations and generations of students imbued with a love of science. He is survived by his wife, Edith, of more than 40 years, his loving children, Maeva and Philip, and his sister, Eva.

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