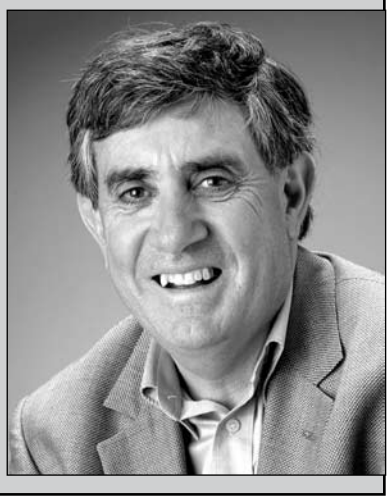
Obituary

Sir Paul Callaghan (1947–2012)



Sir Paul Callaghan, GNZM, FRS, FRSNZ, was arguably the greatest scientist ever to ply his trade in New Zealand. He led the world in his chosen field of science. He led a team of almost three hundred scientists who changed the way New Zealanders do science. He led the thinking behind the science and innovation policies that are embraced today by the major parties in New Zealand politics.

Paul was born in Whanganui in 1947 and often attributed his interest and aptitude for science to the adventurous, free-wheeling childhood he was able to enjoy there. He did not come from a wealthy family, and he was always grateful for the opportunities afforded to him through the New Zealand public education system. This no doubt helped cement Paul's strong sense of social justice and compassion for the less fortunate.

He studied physics at Victoria University of Wellington before winning a Commonwealth Scholarship to Oxford University to study for a Doctor of Philosophy in the Clarendon Laboratory. At Oxford, Paul was introduced to the phenomenon of nuclear magnetic

resonance (NMR), which he used to study atoms implanted in crystals that had been cooled to milli-Kelvin temperatures. Paul's first scientific article on 'Nuclear magnetic resonance of Sb^{124} and long-lived Sb^{120} oriented in Fe' appeared in 1972 in *Physics Letters B*.

Paul returned to New Zealand in 1974 with a freshly minted DPhil to take up a lectureship at Massey University in Palmerston North. He soon formed a partnership with chemist Ken Jolley and a JEOL FX-60 spectrometer that enabled him to strike out in a new direction: the use of the NMR effect to study the properties of complex liquids and materials at the molecular scale. This was the field in which Paul would become pre-eminent.

The sensitivity of the NMR effect to the strength of an applied magnetic field allows the use of magnetic field gradients to encode a spatial signature on the atomic nuclei in a sample. The decay of this spatial correlation over time can be measured, providing information about the movements of molecules within the sample. By developing several clever variants on this basic technique, and then designing and building the necessary hardware, Paul's team was able to non-destructively image the structure of soft materials under strain or shear. This mastery of technique and technology allowed Paul's team to be the first in the world to image the internal structure of a microporous material and the first to observe of the flow profile of a complex polymeric liquid during shear banding.

At Massey, Paul's natural talents for leadership soon began to shape his career. In 1984 he was made Professor of Physics and took over as head of the new physics department, a position which he held for more than a decade. This role involved many new responsibilities and Paul soon found he was busier than ever. Looking back on those years, Paul would often remark that the busier he became, the more success he had. This era saw a step change in his research productivity and impact, culminating in his first book, *Principles of Nuclear Magnetic Resonance Microscopy*, published in 1994.

Paul remained an active and energetic lecturer throughout this period. One of us (SCH) was lucky enough to have been taught by Paul as an undergraduate at Massey in the early 1990s and well remembers the panache and clarity of exposition that Paul brought to his lecturing. His sharpness of mind and his deep grasp of the subject matter made an impression on all those he taught.

In 2001, Paul was given the opportunity to return to his alma mater, taking up the Alan MacDiarmid Chair of Physical Sciences at Victoria University of Wellington. This was a great coup for Victoria, which had been struggling to maintain critical mass in its physics faculty in the EFTS (equivalent full-time student) era of university funding. The following year, he helped establish the multi-institutional MacDiarmid Institute for Advanced Materials and Nanotechnology, becoming its founding director.

With the MacDiarmid Institute, Paul hit on a new way of doing science in New Zealand. Having shown how a Kiwi scientist could do world-beating science from a lab in New Zealand, Paul now set out to build an institute of world-beating scientists. Slicing through the institutional barriers that had fragmented the science community in previous decades, he assembled a team of the best materials scientists from around the country. Within a few years, Paul had forged a truly national collaboration of scientists that was competing with the MITs and the Cornells. Many other research institutes and organisations in New Zealand have now followed Paul's model and there is evidence that this has lifted the performance of New Zealand science across the board.

International success opened up many opportunities for Paul. After he became the first scientist outside of Europe to win the AMPERE Prize for magnetic resonance in 2004, Paul was interviewed by Kim Hill on National Radio's *Saturday Morning* show about the science that had put him on the world stage. National Radio immediately realised that it had uncovered a sparkling new talent. Over the next three years, Paul and Kim discussed a diverse range of topics in science, from fatty foods to string theory to antibiotics. Paul became New Zealand's first celebrity scientist.

With the support of the communications staff at the Royal Society of New Zealand, Paul took science communication to a new level. From traditional forms of outreach, such as lecture tours, through to science classes for people in leadership roles in business and the media, Paul was tireless in his efforts to showcase the importance of science to the public. Anyone who was lucky enough to attend a Paul Callaghan talk will have a vivid recollection of his ability to captivate an audience with an unmatched eloquence and flare for storytelling.

At around the same time, Paul's career took yet another turn when he and several of his students and colleagues founded a company called Magritek. In order to take their imaging systems to the Antarctic, Paul and his team developed a portable NMR imaging system that utilised the Earth's magnetic field to control the NMR effect. Realising the value that could come from being able to perform NMR imaging outside the laboratory, Paul and his team started Magritek to commercialise this technology. Today, Magritek exports millions of dollars' worth of NMR instruments for use in teaching and as analytic tools for a number of industries.

This confluence of his new interest in the commercialisation of science and his growing role as a public figure in New Zealand now presented him with another intellectual challenge. Why had New Zealand's prosperity fallen behind that of the rest of the developed world over the preceding decades? Paul's response came in his book, *Wool to Weta: Transforming New Zealand's Culture and Economy*, where he outlined a powerful vision for New Zealand. Aspects of this are now embedded in the policies of all our major political parties.

Paul wrote a number of other books for the general public, including *As Far as We Know: Conversations about Science, Life and the Universe*, based on his interviews with Kim Hill. Of these, he regarded *Are Angels OK?*, which came out of a collaboration between physicists and artists, as the most important of his public works. Paul thought that this project in particular had broken the mould for scientists in New Zealand. Scientists had been unshackled from their laboratories.

Paul loved New Zealand and all things Kiwi with a passion. He was immensely proud of New Zealand's multicultural heritage and particularly valued the place of Maoritanga in contemporary New Zealand society. He prized New Zealand's unique landscape, flora and fauna, and played an active role as a patron of the mainland island, Zealandia, in Wellington. In recent

years, reflecting on how he had to use Skype to read his grandchildren in the UK their bedtime stories, he became particularly concerned with what he termed the 'Kiwi diaspora'. He became determined to reverse the outflow of talented young people from New Zealand and make the country 'a place where talent wants to live'.

Paul's exceptional achievements brought him many accolades. For his scientific advances, he was elected as a Fellow of the Royal Society in 2001. In 2005, he received the Rutherford Medal, New Zealand's top science honour, and in 2010, he received the Gunther Laukien Prize and the Prime Minister's Science Prize (together with his team at Magritek). For his achievements as a leader, he was appointed a Principal Companion of the New Zealand Order of Merit in 2005, awarded the 2007 Blake Medal, and named as the Kiwibank New Zealander of the Year in 2011.

Paul faced his battle with cancer with no less determination than he had shown in other spheres of his life. His descriptions of his journey through the health system and the people he met along the way, which appeared in his blog and occasionally the media, were infused with his characteristic humanity. Paul thoroughly researched his cancer and the treatments available, and as his options dwindled, he was prepared to test less credible alternatives such as high-dose vitamin C. These he eventually rejected as his prognosis worsened. He worked as hard as ever throughout his illness, completing yet another monograph, *Translational Dynamics and Magnetic Resonance*, in 2011.

From our own perspective, it has been an honour and a privilege to have worked with such a formidable scientist and human being. It is quite likely that neither of us would have remained in science in New Zealand were it not for the opportunities and support Paul lent us at critical moments in our careers. There are many other New Zealanders, young and old, and from all walks of life, who are similarly in his debt.

Paul passed away at home on Saturday, 24 March 2012, surrounded by his family. He will be mourned by all those whom he inspired, motivated and moulded during a career that was cut tragically short. We will all miss him greatly.

Shaun Hendy and Kathryn McGrath