

## Iain Campbell — A Personal Recollection

Iain Campbell played a pioneering role in demonstrating how nuclear magnetic resonance (NMR) spectroscopy can inform our understanding of complex cellular mechanisms. In particular, he showed that NMR could provide structural and mechanistic insights into cellular receptors and their interactions with both extracellular and intracellular proteins. Iain was a first-rate scientist and an inspiring supervisor and mentor to many researchers in his field.

Iain died on March 5, 2014, from bone cancer. Right up to his last few weeks, Iain remained actively engaged in research and in the academic life of the Biochemistry Department in Oxford. Such a level of commitment was typical of Iain. His combination of stoicism and cheerfulness at this time was an inspiration to all those who knew and worked with him. His death is a tremendous loss to us all.

Iain Campbell was born near Perth (Scotland) and attended school at Perth Academy. In 1959, he went to study physics at the University of St Andrews. He remained in St Andrews for a Ph.D. in ESR studies of optically excited states. Following a year in the Physics Department of the University of Bradford, Iain moved to Oxford in 1967. He was initially in the Physical Chemistry laboratory. In 1970, he moved to the Biochemistry Department, where he stayed for remainder of his career. He was appointed a lecturer in Biochemistry 1976, and was made Professor of Structural Biology in 1992. He was a fellow of St Johns College in Oxford. Although he officially retired in 2009, Iain remained a highly active member of the department, both via his ongoing research and also through his enthusiastic and energetic support for undergraduate teaching and for the wider life of the department.

In his initial research, Iain built on his background in physics to make significant contributions to methods for NMR of biological systems, ranging from studies of collagen (Chapman et al., 1970) to the interactions of Mn<sup>2+</sup> ions with ATP (Brown et al., 1973). He subsequently made major contributions to pioneering NMR studies of proteins including lysozyme (Campbell et al., 1975), carbonic anhydrase (Camp-

bell et al., 1974), and triose phosphate isomerase (Browne et al., 1976).

On establishing his own research group within the Biochemistry Department, Iain explored the use of NMR to study metabolites within cells (Brown and Campbell, 1980). It was at this stage that I first encountered Iain. I was an undergraduate biochemist looking for a possible final year project. He persuaded me that structural biology was the most interesting field in which to work. (I am embarrassed to say I abandoned my nascent interests in NMR, switching to protein crystallography.) This was the time when Iain's main direction of research was returning to protein structure.

Iain's greatest achievements resulted from applying NMR to the structures of cellular receptors and their interactions with proteins outside and within cells. His landmark achievement was the determination of the solution structure of EGF (Cooke et al., 1987). This was followed by pioneering NMR studies of the transmembrane domains of several proteins, including the TM domain of *neu* (a rodent homolog of the EGF receptor (Gullick et al., 1992)). It was at this time that Iain developed the proteins modules approach to dissection of complex cell surface proteins (Baron et al., 1991), in

particular, those involved in cell adhesion, migration, and signaling. This development lead to NMR structure determinations of a whole host of such modules, including EGF-like domains in a number of proteins and SH3 domains and their ligand interactions. More recently, Iain worked on the structural biology of the integrins and their interactions with cytosolic proteins such as talin (Wegener et al., 2007).

It is inspiring to review Iain's many contributions to the research literature. His most highly cited papers range through all the phases of his scientific career. They document the continued impact of his work as he moved from NMR methodology (Campbell et al., 1973) to protein structure determination (Cooke et al., 1987) and on to protein/protein interactions underlying signaling (Wegener et al., 2007).

In addition to his many structural and mechanistic discoveries, Iain's work had a larger scale impact in establishing the importance of NMR in biochemistry and structural biology. He established world leading protein NMR facilities in Oxford and helped to foster the development of this subject within the UK and elsewhere. It is now inconceivable to have a major biochemistry or structural biology research effort without including protein NMR. Iain served on the editorial boards of a number of journals, including *Structure*. Iain was elected a member of EMBO in 1990 and a Fellow of the Royal Society in 1995. In his 2006 Croonian Lecture, he summarized his view of the continued relevance of structural biology to informing our understanding of cellular function (Campbell, 2008).

In addition to research, Iain was wholeheartedly committed to educating the next generation of structural biologists, both at the undergraduate and graduate levels. Indeed, one of his recent publications was a textbook providing a lucid survey of the range of biophysical and structural techniques available to modern biology (Campbell, 2012).

How should we remember Iain? First and foremost, as a rigorous, enthusiastic, and inspiring researcher. At a personal level, he was a wonderful colleague to



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work with. I failed to join Iain's research group as an undergraduate, but 30 years later I had the privilege to collaborate with him on the interactions of the talin/integrin complex with lipid bilayers. I still recall emailing Iain a draft manuscript for his comments, thinking that I could then return to the task in a few days. Within the hour, Iain had returned the manuscript, fully commented and much improved (Kalli et al., 2010). This exemplified his focus and energy. We will miss him.

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