British Journal of Nutrition (2024), 131, 1841–1843 doi:10.1017/S0007114524000539
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https://doi.org/10.1017/S0007114524000539 Published online by Cambridge University Press

British Journal of Nutrition

Obituary

Obituary: Professor Graham Burdge

(Submitted 13 February 2024 – Accepted 20 February 2024 – First published online 13 March 2024)

Graham Burdge, previous Editor-in-Chief of the British Journal of Nutrition and the Journal of Nutritional Science, passed away at home on the 1st February 2024 as the result of a brain tumour. He was 60 years old. The discipline of human nutrition lost a leader who had made a number of important contributions. Graham worked in the Faculty of Medicine at the University of Southampton almost continuously since November 1989, a tremendous record of service.

Graham Burdge completed a BSc (Hons) in Cell and Immunobiology at the University of Aberystwyth and then made his way to the University of Southampton to complete a PhD in Medical Oncology, studying the biochemical characteristics of proteolytic fragments from desmosomal glycoproteins. He followed this with a period working at Porton Down, and then in November 1989 Graham took up a post-doctoral research position in Child Health in the University of Southampton working alongside Alan Hunt in Tony Postle's group. The group was using mass spectrometry to determine phospholipid molecular species composition in different physiological and pathological states and to probe phospholipid metabolism. Graham found the technicality of this work to his liking, and he was able to carry out much novel research and publish a number of important papers focusing mainly on phospholipids in pregnancy and in fetal development. Through this research, Graham linked lipids, physiology, early life development and later disease, laying the groundwork for his future career. Perhaps Graham's most important contribution from this period was his identification of abnormalities of fetal

brain phospholipids following chronic maternal alcohol consumption, likely explaining some of the phenotype of fetal alcohol syndrome.

Towards the end of 1997, Graham moved to the Veterinary Laboratories Agency in Addlestone, Surrey where he spent a year. In October 1998, he returned to Southampton, joining Steve Wootton's group, working closely with Amanda Jones, Jane Murphy and others, and also with Keith Frayn's group at the University of Oxford. The focus of the group was on fatty acid handling in humans often probed using stable isotopes and analysed by mass spectrometry. Soon after arriving, Graham set up a technique for separation of different lipid classes from biological samples (serum, plasma, cells, tissues) that is still used in the nutrition group today, a remarkable technical contribution to the work of many others and to countless PhD theses and publications. At the time of Graham's arrival in the Wootton group, there was significant interest in how well the plant omega-3 fatty acid α-linolenic acid could be converted to the more bioactive omega-3s EPA and DHA. The general view at the time was that this conversion did not happen very efficiently in humans. Using carbon 13-labelled α-linolenic acid, Graham carried out landmark studies demonstrating that there are quite significant differences in the operation of this conversion pathway between young adult men and young adult women, with young women being much better at synthesising EPA and, more especially, DHA than young men. The biological rationale for this difference likely lies with the need for women of child-bearing age to be able to make DHA to supply the fetus and newborn infant in order to support brain and visual development. Graham's two papers reporting these findings are the most highly cited research papers published in the British Journal of Nutrition in 2002, with a total of over 1000 citations between them; in 2023, they received 54 citations evidencing the enduring impact of Graham's work in this area.

In 2001, Graham moved across to Philip Calder's group, working with Liz Miles, Sam Kew and later Caroline Childs and collaborating with Christine Williams and Parveen Yaqoob at the University of Reading. The group was working on metabolism and functionality of fatty acids, mainly conducting human-based research. Graham's first research in the group was on a BBSRC-funded project about conjugated linoleic acids (CLA), a 'hot' area in the early 2000s. He led a highly novel cross-over human trial comparing the physiological effects of naturally occurring CLA (the 9,11 isomer found in dairy products) and synthetic CLA (the 10,12 isomer found in supplements produced by hydrogenation of sunflower oil). The study showed opposing actions of the two CLA isomers with the natural form having effects associated with health and the synthetic form having effects considered to be unhealthy. This project involved a second human trial that Graham also led; it compared dairy products made from standard milk or from milk that had been enriched in 9,11-CLA through manipulating the diet of dairy cows, a novel approach at the time. Graham's leadership was instrumental in making this project a huge success, but he was extraordinarily generous in allowing more junior researchers to take lead positions on the several high quality publications that the project produced; Graham was always keen to see others do well. Following the CLA project, Graham led an industry-funded project on dietary fats and post-prandial inflammation. His close collaboration with Philip Calder and Liz Miles continued throughout the rest of his career. During this period, Graham also began working closely with Karen Lillycrop and Mark Hanson developing an interest in epigenetics as the link between dietary exposures in early life and longer-term outcomes, establishing a second long-term collaboration.

Graham was appointed as a Lecturer in Human Nutrition in 2007; he was serially promoted to Reader in Human Nutrition in 2009 and to a Personal Chair in Nutritional Biochemistry in 2015. Once Graham became a lecturer, he was able to further develop his dual research interests in nutritional epigenetics and in fatty acids, mainly omega-3s, although he often combined these interests. For example, in 2007 he received a grant from the British Heart Foundation to investigate the effect of maternal fatty acid intake on vascular function in the offspring. The following fruitful period involved research on protein, fatty acids and folate; Graham received grants from the World Cancer Research Fund and from industry to support this research and was involved in grants held by others including Mark Hanson, Keith Godfrey and Felino Cagampang. Karen Lillycrop became a key collaborator and Emma Garratt, Nikki Irvine, Sam Hoile and Charlie Sibbons were key researchers. In 2016, Graham was awarded a BBSRC grant to conduct first-in-human research on an oil from genetically modified *Camelina sativa*; as a result of the genetic modification, this oil contains the bioactive omega-3s EPA and DHA, unusual for a plant oil. Under Graham's supervision, Annette West was able to conduct highly novel studies and this research and its findings led to the award of a second BBSRC grant in 2021, involving collaborations with the Rothamsted Institute and the University of Reading, which aims to produce functional foods containing the novel plant oil and to test these in human trials. In between these two awards, Graham returned to his roots with another BBSRC grant to investigate the metabolism of α-linolenic acid in human T cells, this work again involving Karen Lillycrop, Liz Miles, Philip Calder, Annette West and Nikki Irvine and a collaboration with Barbara Fielding at the University of Surrey. This *in vitro* research combined use of stable-isotope labelled α-linolenic acid and state-of-the-art mass spectrometry-based lipidomics and uncovered previously unknown intricacies of metabolism of this fatty acid related to T cell function.

Graham was an excellent scientist; he embraced new technologies and he conducted important research. His work is well recognised within the nutrition community, and his papers are well cited by others. Graham was regularly listed as a Highly Cited Researcher, a clear recognition of the academic impact of his work. Beyond research, Graham held many roles in education, in administration and in management within the University of Southampton, many of these being behind the scenes. He had more visible external roles, for example, as a BBSRC Panel Member. Graham was a great supporter of the Nutrition Society which he joined in 1999. He published many papers in the British Journal of Nutrition and spoke at Society conferences on several occasions. He was one of the main organisers of the Nutrition Society Summer Conference hosted in Southampton in July 2021. Importantly, Graham was Editor-in-Chief of the Society's flagship journal, the British Journal of Nutrition, and of Journal of Nutritional Science from 2013 to 2018. He followed this with a

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period as Editor of Lipids, one of the journals of the American Oil Chemists' Society, from 2020 to 2023.

Graham was knowledgeable. He was innovative. He was a superb collaborator. He was generous to those who worked with him and he loved to see junior researchers find their feet and go on to flourish. He was meticulous. He was loyal. Above all, he was humble – Graham did not seek the limelight, preferring to let others do that. Many benefitted from his attributes.

Graham lived for many years with cancer and with its treatment. His condition worsened significantly in early 2023 and by May it became clear that he needed to stop working. He had continued leading his research programme and retained all his internal and external roles until then, which is quite remarkable. He submitted a paper for publication in May, also quite remarkable. Graham retired from the University of Southampton in August 2023.

Graham leaves behind his wife Ellie and his daughter Amelia.

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