



In Memoriam Philip John White (1960–2023)

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It is an honour to write this *In Memoriam* for Professor Philip J. White. I shall be forever indebted to Philip as a colleague and a friend for more than 25 years. I thank his beloved wife, Jacqueline (Jacqui), for fact-checking, and to his former colleagues who have been kind enough to share their memories in recent weeks.

Philip was born in Preston, Lancashire, on April 8th, 1960. The son of teachers, Edmund (Eddie) and Eveline, and elder brother to Catherine, his childhood years were spent in Preston, Nottingham, and then Bury—an industrial market-town approximately 15 km north of Manchester.

Philip excelled in school, both academically and on the football (soccer) field. His talents were recognised early as he secured a prestigious scholarship to attend Manchester Grammar School. He subsequently graduated from the University of Oxford (New College) with a BA in Biochemistry in 1983, where he was awarded an Exhibition for his academic performance.

Encouraged by Brian Loughman, an academic in the Department of Agricultural and Forest Sciences at Oxford, whom Philip remembered fondly as an inspiring mentor during periods of summer work in his group (Adu 2016), Philip decided to pursue a PhD in plant physiology. He studied the effects of temperature on ion transport and membrane properties in the roots of rye (*Secale cereale* L.). Philip's lead supervisor was Mike Earnshaw at the University of Manchester. However, Philip spent most of his time working in a research institute environment, under the co-supervision of the pioneering plant mineral nutritionist, David Clarkson (Lambers 2022). First, at the Letcombe Laboratory, Oxfordshire, then, at the Long Ashton Research Station near Bristol when David relocated his laboratory in the mid-1980s. Philip remained proud of the research arising from his PhD years (e.g., White et al. 1987, 1988).

Philip took up his first post-doctoral position in the laboratory of J. Andrew C. Smith, at the University of Edinburgh, in 1987. They gained several new insights into biochemical mechanisms of ion transport across plant vacuolar membranes, including identifying linkages between malate-specific transport processes and crassulacean acid metabolism (CAM) in succulents (White and Smith 1989) and orchids (White and Smith 1992). Philip always recalled with great fondness the intellectual stimulation and scientific advances from his time in Andrew's lab. Similarly, Andrew recalls that Philip, “produced two of my all-time favourite papers” during the period. Jacqui first

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met Philip in Edinburgh; Philip bet Jacqui a bottle of gin that one of her experimental ideas wouldn't work (it did!) and they subsequently published their only jointly-authored paper (White et al. 1990). A lack of further joint papers was compensated by a life-long, far more important, chemistry beyond the scope of science.

Philip's desire to gain a deeper understanding of ion transport processes, combined with his immense capacity to focus on fundamental research questions, led him to take up a post-doctoral position in the pioneering electrophysiology group of Enid MacRobbie, at the University of Cambridge, in 1990. The period saw Philip characterising the membrane transport of potassium (K^+), calcium (Ca^{2+}) and other cations through ion channels using planar lipid bilayers. Papers from this highly-productive period of research provided the conceptual groundwork for many subsequent studies in plant mineral nutrition in the post-genomic era. For example, novel observations from early electrophysiological work on rye protoplasts included the prescient note on the "remarkable diversity of potassium channels" to be found in plants (White and Tester 1992). Observational and modelling evidence of Ca^{2+} channel transport kinetics was also consistent with in vivo cell signalling roles in plants for these channels, yet to be elucidated (White 1993). Seminal outputs from this period include ~16 sole-author primary papers and reviews in the 1990s and early 2000s. During this period, Philip became an active member, and then convener (2000–2011), of the Plant Transport Group (PTG) of the Society of Experimental Biology. Through this forum, Philip helped organise many meetings and symposia that were widely appreciated by the Plant Sciences community.

Philip moved back to his preferred research institute environment in 1992, at the East Malling Research Station in Kent, which by then was part of Horticulture Research International (HRI). In 1995, and coinciding with the birth of their son (and "proudest achievement"), Christopher, Philip and Jacqui relocated to HRI's Wellesbourne site near Stratford-upon-Avon, where Philip would work for the next 11 years. During this period, he continued to pursue his electrophysiological experimental and modelling work whilst beginning to take advantage of new tools in molecular biology, supported by the technical skills and dedication of colleagues

including Helen Bowen (née Moore), and by wider collaborations with several universities that supported joint PhD students. For example, John Hammond, co-supervised by Malcolm Bennett at the University of Nottingham (e.g., Hammond et al. 2003), and Corrina Hampton, co-supervised by Jeremy Pritchard at the University of Birmingham (e.g., Hampton et al. 2004). At HRI, Philip also enjoyed the opportunities and intellectual stimulation of diversifying into more applied areas of plant mineral nutrition, spanning field agronomy and genetics of phosphorus use efficiency (e.g., Hammond et al. 2009), through to linkages between micronutrient fertiliser applications and human nutrition (e.g., Broadley et al. 2010).

In 2006, Philip moved to the Scottish Crop Research Institute (SCRI) in Invergowrie, near to Dundee. Instrumental in his decision to move north was the leadership and vision of his former PhD examiner, and then-Director of SCRI, Peter Gregory, who asked Philip to lead the Environment-Plant Interactions Programme. This opportunity provided Philip with a major role to represent the research interests of more than 40 researchers. For Jacqui, the opportunity for the family to return to her home in Scotland was attractive. Philip has previously recollected how much he enjoyed this period of his career, "*[managing] a group of exceptional, hardworking, honest, gifted, unselfish, and optimistic colleagues, who not only were excellent and innovative scientists but also published well, engaged wholly in the public understanding of science, and generated sufficient income to support their research*" (Adu 2016). He continued to work at SCRI, which subsequently merged with the Macaulay Land Use Research Institute to become the James Hutton Institute in 2011, for the remainder of his life. In recognition of his contributions to Plant Ecophysiology, Philip was elected to become a Fellow of Scotland's national academy, the Royal Society of Edinburgh (RSE), in 2021.

Philip's scientific outputs throughout his career have been immense. By June 2023, he had co-authored ~300 papers, accruing ~25,000 citations and an *h*-index of 73 (Web of Science ResearcherID: C-5860-2008). Philip was a highly cited researcher in the subject field of Animal and Plant Sciences from 2014–2018. A word cloud to illustrate the scope of Philip's research papers is shown in Fig. 1.

Philip's enthusiasm for writing can be further seen in his varied roles as a commissioned contributor



Photograph 2 Philip (right) with Konrad Neugebauer (left) observing the effects of combinations of N, P & water stresses on potato crop in a polytunnel at the James Hutton Institute, Invergowrie, Scotland (Photograph Courtesy of Jacqueline Marshall, July 2019)

by his appointments as a Full Professor in Biology at King Saud University (Saudi Arabia), as a Guest Professor at Huazhong Agricultural University (China), as an Honorary Professor at the University of Nottingham (UK), and as a Visiting Associate Professor at the Comenius University (Slovakia). Philip sat on the Science Boards of The Centre for Fertilization and Plant Nutrition (Israel) and The International Magnesium Institute (China) and was a member of the International Plant Nutrition Council (IPNC). Philip co-convoked the Soil Management for Sustainable Agro-Food Systems group, at the European Geoscience Union General Assembly (2010–2014), and he served on the 2014 Research Evaluation Framework (REF) to assess the quality of research in UK Higher Education Institutions.

Outside of work, Philip loved visiting botanical gardens, watching films, travelling with Jacqui, and watching football (Manchester United and—alas—Preston North End). In an earlier phase of his life, he was an enthusiastic amateur poet, including a performance poet. Unfortunately, evidence for the quality of this earlier body of work remains elusive! I like to imagine Philip fixing the audience with his characteristic intense and uncompromising stare, ready to be challenged artistically and intellectually, ready to respond accordingly. Although he retained elements of this persona throughout his science career, his approach to collaboration was open and generous,

provided that colleagues were willing, “to collaborate and not compete, to be honest, to keep to any agreements whether spoken or written, to give credit where credit is due, and to tolerate my idiosyncrasies” (Adu 2016).

As a friend, Philip was kind, fun, and fiercely loyal; sentiments that have been shared by many from the plant nutrition community. Philip was also a very private person, including during the many months of illness that he and his family had to navigate before his passing. Philip passed away on 11th April 2023, in Dundee, supported by Jacqui, Christopher, and his close family.

Philip has left the scientific stage early, but he leaves us with a substantial legacy of written and spoken ideas, and immeasurable influence on the lives of many people working in the field of plant nutrition and beyond.

Declarations

Competing interests No competing interests.

References

- Adu MO (2016) Luminaries: Philip J. White. *ASPB News* March/April 2016 43(2): 9–11. Available Online. <https://aspb.org/newsletter/archive/2016/MarApr16.pdf#page=9>. Accessed 1 Sept 2023
- Bokor B, Soukup M, Vaculík M, Vd’áčný P, Weidinger M, Lichtscheidl I, Vávrová S, Šoltys K, Sonah H, Deshmukh R, Bélanger RR, White PJ, El-Serehy HA, Lux A (2019) Silicon uptake and localisation in date palm (*Phoenix dactylifera*) – a unique association with sclerenchyma. *Front Plant Sci* 10:988. <https://doi.org/10.3389/fpls.2019.00988>
- Broadley MR, Alcock J, Alford J, Cartwright P, Fairweather-Tait SJ, Foot I, Hart DJ, Hurst R, Knott P, McGrath SP, Meacham MC, Norman K, Mowat H, Scott P, Stroud JL, Tovey M, Tucker M, White PJ, Young SD, Zhao FJ (2010) Selenium biofortification of high-yielding winter wheat (*Triticum aestivum* L.) by liquid or granular Se fertilisation. *Plant Soil* 332:5–18. <https://doi.org/10.1007/s11104-009-0234-4>
- Broadley MR, Bowen HC, Cotterill HL, Hammond JP, Meacham MC, Mead A, White PJ (2004) Phylogenetic variation in the shoot mineral concentration of angiosperms. *J Exp Bot* 55:321–336. <https://doi.org/10.1093/jxb/erh002>
- Broadley MR, Bowen HC, Cotterill HL, Hammond JP, Meacham MC, Mead A, White PJ (2003) Variation in the shoot calcium content of angiosperms. *J Exp Bot* 54:1431–1446. <https://doi.org/10.1093/jxb/erg143>

- Broadley MR, White PJ (2005) Plant nutritional genomics. Blackwell, London
- Broadley MR, White PJ, Hammond JP, Zelko I, Lux A (2007) Zinc in plants. *New Phytol* 173:677–702. <https://doi.org/10.1111/j.1469-8137.2007.01996.x>
- Hammond JP, Bennett MJ, Bowen HC, Broadley MR, Eastwood DC, May ST, Rahn C, Swarup R, Woolaway KE, White PJ (2003) Changes in gene expression in Arabidopsis shoots during phosphate starvation and the potential for developing smart plants. *Plant Physiol* 132:578–596. <https://doi.org/10.1104/pp.103.020941>
- Hammond JP, Broadley MR, White PJ, King GJ, Bowen HC, Hayden R, Meacham MC, Mead A, Overs T, Spracklen WP, Greenwood DJ (2009) Shoot yield drives phosphorus use efficiency in *Brassica oleracea* and correlates with root architecture traits. *J Exp Bot* 60:1953–1968. <https://doi.org/10.1093/jxb/erp083>
- Hampton CR, Bowen HC, Broadley MR, Hammond JP, Mead A, Payne KA, Pritchard J, White PJ (2004) Cesium toxicity in Arabidopsis. *Plant Physiol* 136:3824–3837. <https://doi.org/10.1104/pp.104.046672>
- Hodson MJ, White PJ, Mead A, Broadley MR (2005) Phylogenetic variation in the silicon composition of plants. *Ann Bot* 96:1027–1046. <https://doi.org/10.1093/aob/mci255>
- Lambers H (2022) In Memoriam David Thomas Clarkson (1938–2021). *Plant Soil* 476:25–29. <https://doi.org/10.1007/s11104-021-05275-3>
- Neugebauer K, Broadley MR, El-Serehy HA, George TS, McNicol JW, Moraes MF, White PJ (2018) Variation in the angiosperm ionome. *Physiol Plant* 163:306–322. <https://doi.org/10.1111/pl.12700>
- Rengel Z, Cakmak I, White PJ (eds) (2022) Marschner's mineral nutrition of higher plants, 4th edn. Academic Press, London. <https://doi.org/10.1016/C2019-0-00491-8>
- White PJ (1993) Characterization of a high-conductance, voltage-dependent cation channel from the plasma membrane of rye roots in planar lipid bilayers. *Planta* 191:541–551. <https://doi.org/10.1007/BF00195756>
- White PJ (2002) Recent advances in fruit development and ripening: an overview. *J Exp Bot* 53:1995–2000. <https://doi.org/10.1093/jxb/erf105>
- White PJ (2019) Can Early Career Researchers write reviews? The case of zinc. *Botany One*. Available Online. <https://botany.one/2019/02/can-early-career-researchers-write-reviews-the-case-of-zinc/>. Accessed 1 Sept 2023
- White PJ, Broadley MR (2000) Mechanisms of caesium uptake by plants. *New Phytol* 147:241–256. <https://doi.org/10.1046/j.1469-8137.2000.00704.x>
- White PJ, Broadley MR (2003) Calcium in plants. *Ann Bot* 92:487–511. <https://doi.org/10.1093/aob/mcg164>
- White PJ, Clarkson DT, Earnshaw MJ (1987) Acclimation of potassium influx in rye (*Secale cereale*) to low root temperatures. *Planta* 171:377–385. <https://doi.org/10.1007/BF00398683>
- White PJ, Earnshaw MJ, Clarkson DT (1988) The effect of shoot-root ratio and temperature on K⁺ influx in rye. *Plant Soil* 111:245–248. <https://doi.org/10.1007/BF02139947>
- White PJ, Hammond JP (eds) (2008) The ecophysiology of plant-phosphorus interactions. Springer, Dordrecht. <https://doi.org/10.1007/978-1-4020-8435-5>
- White PJ, Marshall JM, Smith JAC (1990) Substrate kinetics of the tonoplast H⁺-translocating inorganic pyrophosphatase and its activation by free Mg²⁺. *Plant Physiol* 93:1063–1070. <https://doi.org/10.1104/pp.93.3.1063>
- White PJ, Smith JAC (1989) Proton and anion transport at the tonoplast in crassulacean-acid-metabolism plants: specificity of the malate-influx system in *Kalanchoë daigremontiana*. *Planta* 179:265–274. <https://doi.org/10.1007/BF00393698>
- White PJ, Smith JAC (1992) Malate-dependent proton transport in tonoplast vesicles isolated from orchid leaves correlates with the expression of Crassulacean Acid Metabolism. *J Plant Physiol* 139:533–538. [https://doi.org/10.1016/S0176-1617\(11\)80365-2](https://doi.org/10.1016/S0176-1617(11)80365-2)
- White PJ, Tester MA (1992) Potassium channels from the plasma membrane of rye roots characterized following incorporation into planar lipid bilayers. *Planta* 186:188–202. <https://doi.org/10.1007/BF00196248>

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