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Stephen Harrop (1966–2024)

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Stephen Harrop, who died on 17 November 2024, was a respected macromolecular crystallographer whose research career spanned three distinct periods: his PhD at the University of Manchester Chemistry Department following his graduation in physics from the University of York, his time as a postdoctoral researcher at the University of New South Wales and, finally, his time at the Australian Synchrotron as a beamline scientist. Stephen was born in Leigh, Lancashire, UK and is survived by his mother.

Stephen graduated with a first-class honours degree in physics and joined John R. Helliwell as a PhD student in the Department of Physics at the University of York and then from January 1989 in the Department of Chemistry at the University of Manchester when John became Professor of Structural Chemistry. John continued his joint appointment at the UK Synchrotron Radiation Source (SRS) at Daresbury Laboratory just 25 miles from Manchester. The link with, and proximity of, the SRS laid a foundation for Stephen's future as he developed strengths in macromolecular crystallography data collection and processing, and important experience with the equipment and software. Stephen was an outstanding PhD student, an excellent problem solver, curious with wide

ranging interests and although he could be reserved, he was a natural collaborator and mentor. His PhD thesis involved the development of the synchrotron Laue method for protein crystallography (Lindahl *et al.*, 1992) and the assessment of the method's specific domains of application, notably microcrystal diffraction and time-resolved structure determination. Secondly, his research developed MAD phasing strategies (Peterson *et al.*, 1996) and trying to simplify them, along with his pivotal participation in protein crystal structure analyses of concanavalin A (Harrop *et al.*, 1996) and also hydroxymethylbilane synthase (Hädener *et al.*, 1999). He was popular with his colleagues, highly respected and played an important role in supporting everyone and every project in the laboratory. Notably, Stephen was central to the crystallographic development of many future leaders with undergraduate backgrounds in chemistry, physics and biochemistry, including fellow PhD students Jim Naismith, Ashley Deacon, Cristina Nonato, Eddie Snell, Gail Bradbrook, Mark Peterson and Charlie Bond. There were many late nights utilizing short-notice shifts at the SRS and where Stephen would quite happily roll up to help on any project. A photograph from the time of his PhD is shown in Fig. 1.

In 1995, Stephen moved to the University of New South Wales in Sydney to join Paul Curmi's laboratory, which was just being established. During the next two years, Stephen played a critical role in creating a state-of-the-art protein crystallography facility. Soon after, he solved the first four structures from the group: the serpin PAI2 in the stressed and relaxed (or inserted) states (Harrop *et al.*, 1999; Jankova *et al.*, 2001), the cryptophyte light-harvesting protein PE545 (Wilk *et al.*, 1999) and CLIC1 (Harrop *et al.*, 2001). Stephen was a master at collecting and processing the best crystallographic data at the highest resolution by scrutinizing raw diffraction images. He solved multiple structures of CLIC proteins and light-harvesting proteins around the 1.0 Å resolution mark (Michie *et al.*, 2023; Doust *et al.*, 2004). At the same time Stephen was generously assisting other groups in Sydney to solve long-standing difficult crystallographic targets (see, for example, Bond *et al.*, 1997).

Stephen was an excellent teacher, training numerous doctoral students in Paul Curmi's group and collaborators. He was patient and sensitive, allowing the students to solve their own structures under his guidance and tutelage. As a result, he has trained many graduates who have gone on to careers in structural biology (Phang *et al.*, 2016; Shah *et al.*, 2014; Sureshan *et al.*, 2013; Lee *et al.*, 2013; Pilak *et al.*, 2011; Deshpande *et al.*, 2011; Lampl *et al.*, 2010; Naidoo *et al.*, 2008; Robinson *et al.*, 2005; Littler *et al.*, 2004; Collins *et al.*, 2001).

During his years in Sydney Stephen enjoyed the change from the UK, which ultimately resulted in him taking dual citizenship: cheering on the Sydney Swans Australian Rules Football team at Sydney Cricket Ground, exchanging dark old pubs with dark beers for sunny pubs with sea views, and making extended camping trips with friends and colleagues up the New South Wales coast. A photograph of Stephen at an Australian conference in 1996 is shown in Fig. 2.

A position at the Australian Synchrotron was the next destination and the synchrotron's collaborative and interdisciplinary nature provided the perfect environment for Stephen to apply his unique combination of skills and to flourish. Here he was able to integrate his scientific experience and technological skills to make contributions to his personal research and the ongoing evolution of beamline capabilities.

Figure 1
Stephen Harrop as a PhD student.

Figure 2
Stephen enjoying the conference dinner at the 1996 Lorne Conference on Protein Structure and Function.

His deep understanding of crystallography shone bright, matched by his self-taught prowess in programming and software development, and he played a key role in the Macromolecular Crystallography (MX) beamlines at the Australian Synchrotron. As a self-taught Python programmer, Stephen became instrumental in writing and modifying much of the software that powers the MX beamlines and significantly enhanced their efficiency and effectiveness, allowing scientists from across Australia and Asia to make groundbreaking discoveries in the study of proteins and other biomolecules.

His work ethic, creativity and enthusiasm were an inspiration to his colleagues, and he has left a lasting mark on the Australian Synchrotron and the global crystallographic community.

Stephen understood the importance of 'every photon' to the user community, as both a user and beamline scientist, and when the equipment did not perform as expected he approached the fixes with a deep intellectual rigour. He was able to communicate complex issues and concepts in simple, understandable terms and this made him an exceptional mentor. He was eager to share his knowledge with younger generations of crystallographers (both members of the MX team and the user community), guiding them not only in the technical aspects of their research but also in the computational tools that are essential for modern structural biology. Whether he was helping a colleague debug a line of code, offering advice on experimental design or explaining a new programming technique, Stephen was always willing to lend a hand. He believed in empowering others and delighted in assisting others to achieve their scientific goals.

Stephen's contributions to the field were not limited to his technical expertise. He was calm and measured, broad-minded, kind and compassionate. He also had a dry sense of humour and a unique and brilliant turn of phrase, that he deployed with excellent comic timing, especially when he felt spirits should be lifted. He had an innate ability to make those around him feel valued, whether they were seasoned scientists or newcomers to the field. His humility, coupled with his deep passion for science, made him a mentor and dear friend to many.

Stephen leaves behind a legacy of scientific excellence, collaboration and mentorship. He is survived by his colleagues, the many crystallographers whose careers he supported or shaped, and the broader community whose work he enriched. Stephen will be deeply missed by all who had the privilege of knowing him.

A memorial service to Stephen was held by his colleagues and family at the Australian Synchrotron on Tuesday 26 November: https://app.memories.net/memorials/stephen-harrop-422708/tributes.

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References

Bond, C. S., Clements, P. R., Ashby, S. J., Collyer, C. A., Harrop, S. J., Hopwood, J. J. & Guss, J. M. (1997). *Structure*, **5**, 277–289.
Collins, B. M., Harrop, S. J., Kornfeld, G. D., Dawes, I. W., Curmi, P. M. & Mabbutt, B. C. (2001). *J. Mol. Biol.* **309**, 915–923.
Deshpande, C. N., Harrop, S. J., Boucher, Y., Hassan, K. A., Leo, R. D., Xu, X., Cui, H., Savchenko, A., Chang, C., Labbate, M., Paulsen, I. T., Stokes, H. W., Curmi, P. M. & Mabbutt, B. C. (2011). *PLoS One*, **6**, e16934.
Doust, A. B., Marai, C. N., Harrop, S. J., Wilk, K. E., Curmi, P. M. & Scholes, G. D. (2004). *J. Mol. Biol.* **344**, 135–153.
Hädener, A., Matzinger, P. K., Battersby, A. R., McSweeney, S., Thompson, A. W., Hammersley, A. P., Harrop, S. J., Cassetta, A., Deacon, A., Hunter, W. N., Nieh, Y. P., Raftery, J., Hunter, N. & Helliwell, J. R. (1999). *Acta Cryst.* D**55**, 631–643.
Harrop, S. J., DeMaere, M. Z., Fairlie, W. D., Reztsova, T., Valenzuela, S. M., Mazzanti, M., Tonini, R., Qiu, M. R., Jankova, L., Warton, K., Bauskin, A. R., Wu, W. M., Pankhurst, S., Campbell, T. J., Breit, S. N. & Curmi, P. M. (2001). *J. Biol. Chem.* **276**, 44993–45000.
Harrop, S. J., Helliwell, J. R., Wan, T. C. M., Kalb (Gilboa), A. J., Tong, L. & Yariv, J. (1996). *Acta Cryst.* D**52**, 143–155.
Harrop, S. J., Jankova, L., Coles, M., Jardine, D., Whittaker, J. S., Gould, A. R., Meister, A., King, G. C., Mabbutt, B. C. & Curmi, P. M. (1999). *Structure*, **7**, 43–54.
Jankova, L., Harrop, S. J., Saunders, D. N., Andrews, J. L., Bertram, K. C., Gould, A. R., Baker, M. S. & Curmi, P. M. (2001). *J. Biol. Chem.* **276**, 43374–43382.
Lampl, N., Budai-Hadrian, O., Davydov, O., Joss, T. V., Harrop, S. J., Curmi, P. M., Roberts, T. H. & Fluhr, R. (2010). *J. Biol. Chem.* **285**, 13550–13560.
Lee, L. K., Bryant, K. J., Bouveret, R., Lei, P. W., Duff, A. P., Harrop, S. J., Huang, E. P., Harvey, R. P., Gelb, M. H., Gray, P. P., Curmi, P. M., Cunningham, A. M., Church, W. B. & Scott, K. F. (2013). *J. Biol. Chem.* **288**, 15269–15279.
Lindahl, M., Liljas, A., Habash, J., Harrop, S. & Helliwell, J. R. (1992). *Acta Cryst.* B**48**, 281–285.
Littler, D. R., Harrop, S. J., Fairlie, W. D., Brown, L. J., Pankhurst, G. J., Pankhurst, S., DeMaere, M. Z., Campbell, T. J., Bauskin, A. R., Tonini, R., Mazzanti, M., Breit, S. N. & Curmi, P. M. (2004). *J. Biol. Chem.* **279**, 9298–9305.
Michie, K. A., Harrop, S. J., Rathbone, H. W., Wilk, K. E., Teng, C. Y., Hoef-Emden, K., Hiller, R. G., Green, B. R. & Curmi, P. M. G. (2023). *Protein Sci.* **32**, e4586.
Naidoo, N., Harrop, S. J., Sobti, M., Haynes, P. A., Szymczyna, B. R., Williamson, J. R., Curmi, P. M. & Mabbutt, B. C. (2008). *J. Mol. Biol.* **377**, 1357–1371.
Peterson, M. R., Harrop, S. J., McSweeney, S. M., Leonard, G. A., Thompson, A. W., Hunter, W. N. & Helliwell, J. R. (1996). *J. Synchrotron Rad.* **3**, 24–34.
Phang, J. M., Harrop, S. J., Duff, A. P., Sokolova, A. V., Crossett, B., Walsh, J. C., Beckham, S. A., Nguyen, C. D., Davies, R. B., Glöckner, C., Bromley, E. H., Wilk, K. E. & Curmi, P. M. (2016). *Biochem. J.* **473**, 2763–2782.
Pilak, O., Harrop, S. J., Siddiqui, K. S., Chong, K., De Francisci, D., Burg, D., Williams, T. J., Cavicchioli, R. & Curmi, P. M. (2011). *Environ. Microbiol.* **13**, 2232–2249.
Robinson, A., Wu, P. S., Harrop, S. J., Schaeffer, P. M., Dosztányi, Z., Gillings, M. R., Holmes, A. J., Nevalainen, K. M. H., Stokes, H. W., Otting, G., Dixon, N. E., Curmi, P. M. & Mabbutt, B. C. (2005). *J. Mol. Biol.* **346**, 1229–1241.

Shah, B. S., Tetu, S. G., Harrop, S. J., Paulsen, I. T. & Mabbutt, B. C. (2014). *Acta Cryst.* F**70**, 1318–1323.
Sureshan, V., Deshpande, C. N., Boucher, Y., Koenig, J. E., Midwest Center for Structural Genomics, Stokes, H. W., Harrop, S. J., Curmi, P. M. & Mabbutt, B. C. (2013). *PLoS One*, **8**, e52934.
Wilk, K. E., Harrop, S. J., Jankova, L., Edler, D., Keenan, G., Sharples, F., Hiller, R. G. & Curmi, P. M. (1999). *Proc. Natl Acad. Sci. USA*, **96**, 8901–8906.