

## Professor Brice Bosnich, FRS (1936–2015)

James D. Crowley,<sup>A,D</sup> W. Gregory Jackson,<sup>B</sup> and S. Bruce Wild<sup>C</sup>

<sup>A</sup>Department of Chemistry, University of Otago, PO Box 56, Dunedin, New Zealand.

<sup>B</sup>School of Physical, Environmental and Mathematical Sciences, Chemistry,  
The University of New South Wales, Australian Defence Force Academy  
(UNSW@ADFA), Northcott Drive, Canberra, ACT 2600, Australia.

<sup>C</sup>Research School of Chemistry, College of Physical and Mathematical Sciences,  
Australian National University, Canberra, ACT 2601, Australia.

<sup>D</sup>Corresponding author. Email: [jcrowley@chemistry.otago.ac.nz](mailto:jcrowley@chemistry.otago.ac.nz)

This special issue of the *Australian Journal of Chemistry* is dedicated to Professor Brice Bosnich, FRS (1936–2015) (Fig. 1). While Bos, as he was universally known, spent most of his career at University College London, University of Toronto, and The University of Chicago, he remained an authentic Australian. He often returned to Australia and spent time at the Australian National University (ANU), the University of Sydney, the University of Western Australia, and the Central Queensland University, Rockhampton. Perhaps more importantly, he mentored several antipodean students and post-doctoral fellows who went on to become academics in Australia (Harrowfield, Wild, Jackson, Roberts) and New Zealand (McMorran and Crowley). Here ex-students (Fryzuk, Bergens,

Hollis, Fraser, and Crowley) and post-docs (Harrowfield, Wild, Jackson, Leung, and McMorran) and colleagues (Lindoy) from around the globe come together to pay tribute to a superb scientist, mentor, and mate who died in Canberra on 13 April 2015.

Bos was born in 1936 in the Queensland country town of Tully, the son of Croatian parents who had emigrated to Australia in 1928 after the devastation of their country during World War I. Bos's mother died when he was three years old. He lived with his mother's sister in nearby Mossman, Qld, about 200 km from Tully, until he was ten and then with his cousin George's family in West Hoxton near Liverpool, NSW, until he began high school as a boarder at St Gregory's College, Campbelltown. Bos enjoyed cricket and was a good fast bowler. He was also a good tennis player.

Bos graduated in chemistry from the University of Sydney in 1958 and completed his Ph.D. at the ANU in 1962 under the supervision of Francis Dwyer in the John Curtin School of Medical Research. Frankie Dwyer held a Personal Chair in the Biological Inorganic Chemistry Unit of the JCSMR and had a formidable reputation for his insights into transition metal coordination chemistry, especially stereochemistry and optical activity. Alan Sargeson (Sargo) was a junior colleague of Dwyer at that time and the influence of these two leaders remained with Bos throughout his career. Sargo and Bos maintained a lifelong friendship.<sup>[1]</sup> It was clear from an early stage that Bos was an extremely talented scientist, his first (with Dwyer and Sargeson)<sup>[2]</sup> and second<sup>[3]</sup> papers being published in *Nature*. Most of Bos's Ph.D. work, however, was published<sup>[4]</sup> in the *Australian Journal of Chemistry* after Dwyer's untimely death in 1962.

After completing his Ph.D., Bos moved to University College London (UCL) as a post-doctoral fellow, initially as a DSIR Postdoctoral Fellow (1962–63) and then as an ICI Fellow (1963–66). As a post-doc, he carried out early work on the coordination chemistry of 1,4,8,11-tetraazacyclotetradecane (cyclam).<sup>[5]</sup> In 1966, Bos was appointed to a lectureship in UCL, where he shared a small laboratory with Martin Tobe next to Sir Ronald Nyholm's office. Here, he began to examine the use of circular dichroism spectroscopy to determine the absolute configurations of coordination complexes.<sup>[6]</sup> Bruce Wild and Jack Harrowfield joined his group in 1968 and then moved with him the following year to the Lash Miller Chemical Laboratories of the University of Toronto. Greg Jackson followed shortly thereafter. Bos and these early Australian post-doctoral fellows carried out pioneering work on the resolution and coordination chemistry of chiral tertiary arsines and investigations into the circular dichroism spectra of octahedral cobalt(III) complexes.<sup>[7]</sup>



**Fig. 1.** Bos in his office at The University of Chicago ca. 2002 (reproduced with the permission of the Department of Chemistry, The University of Chicago).

Building from his expertise in topological and conformational stereochemistry, Bos became interested in asymmetric synthesis (catalysis) and developed a rational approach to the design of chiral diphosphine ligands, the premier member being Chiraphos.<sup>[8]</sup> Unlike other ligands of this type, the chirality of Chiraphos resides in the organic backbone linking the two phosphine donors. This concept underpins the design of most of the  $C_2$ -dissymmetrical ligands subsequently developed for use in metal-catalysed asymmetric synthesis. Michael Fryzuk was among Bos's first Ph.D. graduate students at the University of Toronto and carried out the pioneering experimental work on the rhodium-catalysed asymmetric hydrogenation of prochiral enamides.<sup>[8,9]</sup> In later work, in association with David Fairlie and Steve Bergens, Bos discovered that the rhodium–diphosphine catalyst was highly efficient for intramolecular enantioselective hydroacylation.<sup>[10]</sup> Also, while in Toronto, Bos developed with Peter Mackenzie and John Whelan highly enantioselective palladium-catalysed allyl–alkylation reactions and investigated the origins of the enantioselectivity.<sup>[11]</sup> This beautiful chemistry, along with penetrating investigations into the origins of catalytic enantioselection, helped lay the foundations for the multitude of metal-catalysed asymmetric syntheses employed by the pharmaceutical industry. While in Toronto, Bos and co-workers also developed a series of ligands that mimicked the spectroscopic properties of the blue copper proteins.<sup>[12]</sup> As part of this work, Bos spent time with crystallographer Hans Freeman in the University of Sydney working on plastocyanin.

In 1987, at the invitation of Jack Halpern, Bos was appointed to a professorship in the University of Chicago, and, in 2004, to the Gustavus F. and Ann M. Swift Distinguished Service Professorship in Chemistry. Pak-Hing Leung and John Whelan moved with Bos from Toronto to Chicago as post-doctoral fellows. Chicago is one of the ten most senior universities in the USA and one could say that Bos by then had really made it – a long way from Tully! While in Chicago, Bos continued to work on asymmetric catalysis; in particular, hydroacylation, hydrosilylation, and chiral transition-metal Lewis acid catalysis,<sup>[13]</sup> with Bergens,<sup>[10,14]</sup> Hollis,<sup>[15]</sup> Leung,<sup>[16]</sup> and McMorran<sup>[17]</sup> making contributions. A major achievement for Bos (with Steve Bergens) in Chicago was the catalytic isomerization of allylic alcohols into the corresponding enols.<sup>[14a]</sup> The isomerization allowed for the preparation of simple enols, through kinetically controlled conditions, leading to high yields free from the corresponding keto isomers. Remarkably, the simple enols were kinetically stable for up to two weeks at room temperature in the rigorous absence of acid or base. The demonstrated stability of an enol was unprecedented and is a fine example of the ground-breaking chemistry achieved in Bos's group over a distinguished career in transition metal-catalysed organic synthesis. Additionally, inspired by the oxygen binding protein hemerythrin, Bos, along with Cassandra Fraser and others,<sup>[18]</sup> worked on the development of bimetallic complexes that were capable of one-site addition two-metal oxidation<sup>[19]</sup> as observed in hemerythrin. In the last ten years of his career, Bos became interested in the field of supramolecular chemistry<sup>[20]</sup> and, with James Crowley (his last Ph.D. student) and others, published a series of papers on self-assembly,<sup>[21]</sup> molecular recognition,<sup>[22]</sup> and molecular machines.<sup>[23]</sup> Bos's contributions to coordination/organometallic chemistry and asymmetric synthesis were wide-ranging, with his work being an elegant intellectual blend of organic and inorganic synthesis along with insightful mechanistic analysis to solve the problem at hand.

Bos remained in Chicago until his retirement at 70, when he moved to Canberra and was appointed to a Visiting Fellowship

in the Research School of Chemistry at the ANU. Bos was happy to be living in Canberra near to his close friends Malcolm and Gwyneth Gerloch and the late Glen Robertson. He had met and married Jayne in Chicago in 1992. Jayne died in Canberra in November 2014 from the rare Creutzfeldt–Jacob disease.

Bos received many academic awards throughout his career. These include the Canadian Society for Chemistry Noranda Lecture Award in Inorganic Chemistry (1978), the Royal Society of Chemistry Organometallic Chemistry Award in 1994, the Nyholm Lectureship of the Royal Society of Chemistry for 1995/6, and the American Chemical Society Award in Inorganic Chemistry in 1998. In 2004, he presented the Francis Lyons Memorial Lecture at the University of Sydney. Bos was elected Fellow of the Royal Society of London in 2000.

Bos had a blend of idiosyncratic traits like no other colleague we have known. He delighted in getting a rise out of people, often smiling while providing well-directed abuse. He loved a joke, enjoyed a smoke, and the best of red wine. He could be cantankerous. Bos always dressed well, claimed he was a fine cook, and patronized fine restaurants. While in Ontario, he used his students to till land at the country property of his good friend, Doug Butler, an Australian who was professor of organic chemistry at York University, Toronto. He then planted grapes in the belief that he could make better wine than the Canadians. Bos also imported French red wines through Buffalo, USA, again using his students' assistance to avoid problems with border customs, and kept the wines in an expensive thermostatted cabinet in his apartment. To Bos's great chagrin, Sargo sampled much of this wine while staying in his apartment during Bos's brief visit to Australia. Another close friend of Bos's in Toronto was Australian carpet-dealer Peter Templeton. Peter's daughter Clio attended Bos's funeral in Canberra.

Over the years, colleagues learnt a whole new language from Bos: neither Italian nor Croatian (both of which he was fluent in), nor classic English. Expressions like 'Rat up a drain pipe', 'As the actress said to the bishop', and 'Here's to looking up your kilt' come to mind.

Bos was a gifted academic who emerged through difficult times as a youngster to make it to the top (Fig. 2). More importantly, he was a great friend and mentor to us and we will miss him – RIP Bos.



**Fig. 2.** Bos in full swing at the dinner following the Singapore International Chemistry Conference 2 (SICC-2), Singapore, 18–20 December 2001 (photograph taken by Pak-Hing Leung).

## Acknowledgements

The authors wish to thank 'Cousin George' Bosnich and Malcolm Gerloch for providing us with many interesting details of Bos's life. We would also like to thank Steve Bergens and Michael Fryzuk for providing additional details on Bos's chemistry and for proofreading the document.

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