ChemNEWS

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Newsletter of the University of Sydney Chemistry Alumni

Professor Trevor Hambley
Head of School

From the Head of School

How often do you hear or read in the news media that interest in and enrolments in science are falling? Well, this certainly doesn't apply to the University of Sydney! Every year for the past six, we have had increased interest in science and consequently the Universities Admission Index (UAI) cutoffs for our various science courses have continued to climb. The cutoff for entry into the BSc has risen from 81 in 2002, to 82 in 2003 and now to 85 in 2004. Even this doesn't give the full picture because the median intake is now in the mid-90s. Still more pronounced has been the growth in our top end courses: Advanced Science now has a cutoff of 96.7 and the enrolment in our highly successful Talented Students Program, with a cutoff of 98.7, has risen to be in excess of 130. The top 10% of our intake into science has an average UAI of an astounding 99.8! Does this renewed interest in science from the very best students translate to chemistry? Absolutely! Our own programs for talented students also continue to grow. The First Year Special Studies Program, also with a cutoff of 98.7, has grown from 16 students in its inception ten years ago to 48 now, and our higher year advanced programs have grown in parallel. Enrolments into our mainstream chemistry courses are also showing healthy growth, despite an enforced 16% cut in enrolments in the Science Faculty resulting from the Nelson Review and the consequent changes to higher education funding.

What is responsible for this increased interest in science? The new high school syllabuses seem to have helped (see Issue 1), but the upward trend began before that. A major factor has been an increased emphasis and professionalism in the marketing of our courses and activities. The Faculty of Science appointed a Marketing Manager, Ms Jas Chambers, six years ago and the School of Chemistry appointed a High School Liaison Officer, Dr Jeanette Hurst, at about the same time. Some of Jeanette's activities are reported on elsewhere in the newsletter, but it is worth noting here that up to half of the HSC Chemistry cohort visit the School of Chemistry at some time during their high school education. Another factor has been a renewed interest in science generally, brought about by the new career opportunities in science such as biotechnology and materials science. Of course, both of these growth areas have their roots in chemistry and many of our graduates now find employment in these fields.

As a result of a number of recent appointments and a change in interests of some established staff, the School of Chemistry has developed major strengths in both the biological/medicinal and the materials areas. These strengths fit well with the interests of today's students and are contributing to chemistry continuing to be seen as a highly relevant subject.

Professor Trevor Hambley
Head of School

General queries to:

Chemistry Alumni
School of Chemistry, Bldg F11
The University of Sydney
NSW 2006 Australia

Email
alumni@chem.usyd.edu.au
Phone
+61 2 9351 4504
Fax
+61 2 9351 3329
Web sites
http://www.chem.usyd.edu.au
http://alumni.chem.usyd.edu.au/

The University of Sydney
AUSTRALIA

Science Teachers' Workshop

The School of Chemistry has an established tradition of providing workshops for teachers of high school chemistry that goes back nearly ten years. Over most of this time, the workshops have been directed toward the provision of information and resources to teachers to assist them in teaching the core syllabus and, more particularly, those optional areas of the syllabus that had the greatest demand for resources. When the new HSC Chemistry syllabus was being introduced we provided workshops to help resource this syllabus and, more recently, we introduced a consultative element to the workshops to establish where the teachers' needs lay. This led to the School mounting a series of workshops for students that address aspects of the new syllabus that cannot be dealt with in the high schools. For instance, in the Chemical Monitoring and Management module of the new syllabus, Atomic Absorption Spectroscopy (AAS) is quite logically an important aspect, but is not available in high schools. Therefore, our workshop on this topic provides students with the opportunity to experience our AAS facilities.

The series of workshops for the new HSC syllabus has been formalised as the Kick Start Science program run within the School of Chemistry by Dr Jeanette Hurst, our High Schools Liaison Officer. Jeanette has developed each of these workshops and presents them with the assistance of selected postgraduate students and our technical staff. The workshops are all very well received and last year, nearly 2 000 of the current HSC cohort visited the School to take part in one or more of them.

The outstanding success of these workshops for students and the comments from their teachers has led to a rethinking of the workshops we present for the teachers. In our most recent teachers' workshop, held in November 2003, we presented a series of hands-on practical experiences, many of which were related to the workshops presented for students and others of which were related to other aspects of the syllabus. As a consequence, the teachers are able to describe to students how the equipment operates and what it achieves based on first-hand experience. Based on the feed back received, this workshop was a great success and will be repeated and expanded late in 2004. ♦

2004 Graduation Ceremony

Friday, 4 June

Most of the 2003 Honour students and some postgraduates will receive their degrees at this ceremony. You are invited to a reception following the ceremony to honour these new graduates and meet with many of their academic supervisors from 4:00pm in the Holme & Sutherland Rooms at the University of Sydney.

RSVP by Wednesday 19 May to
Mr Philip Penwright
Telephone: 02 9351 4504
Email: philip@chem.usyd.edu.au

Dr Jeanette Hurst

High School Liaison Activities in the School of Chemistry

The School of Chemistry conducts a wide variety of activities for high school students all the way through from years 7-12. These include the Kick Start program that is aimed at HSC students, a Gifted and Talented Discovery students program for years 8-10, Workshops at Science in the City for years 7-12, school visits and the Olympiad Training program for years 10-12. Most of these can be booked through the Science Faculty website (http://www.scifac.usyd.edu.au/school/).

In the School of Chemistry, all of these activities are supervised by Dr Jeanette Hurst, our High School Liaison Officer. Jeanette has a PhD in chemistry, specialising in spectroscopy, and has nearly 10 years experience in conducting programs and activities for high school students. If you want to find out about any of the programs or how to get your child involved, Jeanette can be contacted by email at j.hurst@chem.usyd.edu.au. ♦

Lou Rendina

Lou Rendina joined the School in September 2003 as a Senior Lecturer from the University of Adelaide in South Australia.

Lou received his BSc with First-Class Honours in Chemistry from the Australian National University (ANU) in 1988. From 1988-1991 he was the recipient of a Commonwealth Postgraduate Research Award, and he obtained his PhD in Bio-inorganic Chemistry (under the supervision of Dr John A. Broomhead) in 1991. He was then awarded an ANU-IAS Postdoctoral Fellowship to work with Professor Martin A. Bennett, FRS, at the Research School of Chemistry, Institute of Advanced Studies, ANU. In 1993 he was awarded a prestigious NSERC Canada International Fellowship to work with Professor Richard J. Puddephatt, FRS, at the University of Western Ontario, Canada. In late 1995 he returned to the ANU as a Visiting Fellow, and in 1996 he was appointed as Lecturer at the University of Adelaide. He was promoted to the position of Senior Lecturer in 2000.

His areas of research interest cover synthetic chemistry of the platinum group metals; metal-based pharmaceuticals for Boron Neutron Capture Therapy and Synovectomy; supramolecular construction of metal-containing receptors, polygons and polyhedra, and metal-DNA chemistry.

We welcome Lou to the School.

News in Brief

Cameron Cleans Up!
Double congratulations to Dr Cameron Kepert, Senior Lecturer in the School of Chemistry. Cameron has been awarded the 2003 Le Fèvre Memorial Prize by the Australian Academy of Science. The purpose of this award is to recognise outstanding research in chemistry by scientists under the age of 40. Furthermore, Cameron has been awarded the 2003 Rennie Medal by the Royal Australian Chemical Institute. The Rennie is the Institute's premier medal for young chemists.

Selby Research Award
Our heartiest congratulations to Dr Rachel Codd, Lecturer in the School of Chemistry, who was awarded the 2003 Selby Research Award. This award is for research performance by a member of academic staff within their first five years of appointment. Well done Rachel!

A Very Good Year!
2003 was a rewarding year for our very own Greg Warr. Greg was promoted to Professor in recognition of his many contributions across all fronts including teaching, research, administration and professional service, both locally and internationally. The good news doesn't stop there, Greg was awarded one of only three International Joint Research Grants offered by NEDO, a Japanese Government organisation. Greg heads a team from Japan, France and Australia that has been awarded nearly $300 000 per year for three years to study New Strategies for Developing Ultrathin Nanostructure Polymer Films.

Sesqui Success!
The School of Chemistry has just been awarded a Sesqui Lectureship in the area of Theoretical Materials Chemistry. This appointment in the computational chemistry area will be made with the aim of increasing interactions with the materials science groups in Physics. Congratulations to Peter Harrowell, Associate Professor in the School of Chemistry who prepared this application.

Jim Eckert writes about

Chemistry Prac 100 Years Ago

In the box on the next page, the prac courses for Junior and Senior Chemistry are reproduced as they appeared in the University Calendar of 1898. The course for Junior and Medical students, time-tabled for thirty 3-hour sessions, included exercises on the common gases and acids (one of them HF, not something we would leave around in a first year lab these days). They also did a set of organic exercises and so, too, did the Senior students. But in both courses, the emphasis was heavily on chemical analysis, with first years learning how to identify the elements and second and third years how to measure them.

The photo below, from the University Archives, shows a prac class in progress. The year is 1893 and a Med I group is at work in the Junior lab. I can see wash bottles on every bench, made earlier as a glass-working exercise, and precipitates being filtered and washed. There are test tubes in racks and kits of reagent bottles. Light globes hang from the ceiling. The building, opened not long before, was "provided with the electric light".

"Wet" processes are being studied here. Elsewhere, the Junior course amounted to a canter through 50 years of "dry" qualitative analysis. By the mid-1800s, no analytical chemist would have been without a blowpipe. Developed originally by goldsmiths and glass blowers, this simple device consisted of a narrow-bore tube and a mouthpiece for blowing a fine jet of air into a flame. And I mean blowing, although sometimes there was a hand- or foot-operated mechanical blower, "to relieve the cheek muscles".

A skilled analyst used the blowpipe to direct a pointed oxidising or reducing flame onto a sample and was able to work out much about the composition of the sample by noting the volatility or fusibility of the material, the colour of the flame, the odour of the gas evolved ("the odour of rotten horse-radish" for example "indicates Se") and the nature of the residue.

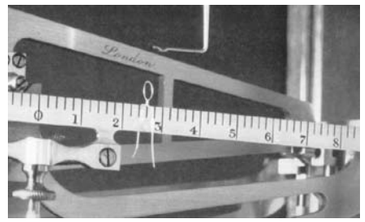
Two events, however, marked the beginning of the end for the blowpipe as an analytical tool - the invention of the Bunsen burner which was almost as versatile as the blowpipe and easier to use; and, soon after, the publication of papers by Bunsen and Kirchhoff that took qualitative analysis to a new level.

Others before them had observed line emission by metal salts in a flame and also the black lines known as Fraunhofer lines in the otherwise continuous spectrum of sunlight. Bunsen and Kirchhoff, using a spectroscope of their own design, systematically recorded the emission lines of individual elements. They were then able to identify the elements in a sample with previously unimagined sensitivity; and, the clincher, to discover new elements (Rb and Cs in mineral spring waters). Meanwhile, Kirchhoff explained Fraunhofer lines as "reversed spectra", caused by atomic absorption in the sun's outer layers, and was busy drawing conclusions about the composition of the sun. Their "spectrum analysis" was a wonder of the age.

Junior and Medical students re-traced these steps in the prac course. For those going on to Senior Chemistry, prac turned largely quantitative. Second and third years were "required to make correct determinations" of a long list of salts and minerals and "certain of the following" which included ores, cements, coal, steel and manure.

The biggest shock for anyone today who had to do the Senior Prac in Liversidge's laboratory would be, I think, the analytical weighings. The lab was "well provided with balances for different purposes" and it needed to be. Most of the determinations were gravimetric and each involved a number of accurate weighings, perhaps 10 or 15, as replicates were taken to constant weight.

This would be no great chore using a present-day electronic analytical balance, with its single cushioned pan and in-built electromagnet. But the traditional analytical balance was a very different instrument. With two pans, light-weight beam, knife edge and set of reference masses, it was sensitive and accurate - and so tedious to use! In Fresenius' *Quantitative Chemical Analysis*, a prescribed textbook for prac in 1898, it took 4 closely packed pages to set down the rules for weighing and the tricks-of-the-trade. Shown above is a set of 19th Century weights and below, the use of a "rider" to determine fractions of a mg.



Fresenius, in the introduction of his book, had this to say about analytical chemistry: "The satisfaction enjoyed at the success of our efforts is surely in itself a sufficient motive for the necessary expenditure of time and labour, even without looking to the practical benefits which we may derive from our operations." I can hear our second years: "Yeah, right".

I am grateful for the help of Reference Archivist Nyree Morrison.

In addition to the University Calendar of 1898 and the Fresenius book, I used the following:

H.E. Roscoe and A. Schuster, *Spectrum Analysis*, Macmillan, 4th edn. (1885).

J. Landauer, *Blowpipe Analysis*, Macmillan, 2nd edn. (1892).

J.T. Stock, *Development of the Chemical Balance*, HM's Stationery Office (1969). ♦

Sydney University Calendar.

1898-9.

28.—PRACTICAL COURSES.

A.—INTRODUCTORY COURSE FOR JUNIOR AND MEDICAL STUDENTS.

1. Glass working.—Rounding the ends of rods and tubes, drawing, bending and joining tubes, blowing bulbs, mending test tubes.

2. The preparation and properties of gases, *e.g.*, hydrogen, oxygen, carbon, monoxide, carbon dioxide, the oxides of nitrogen and sulphur, chlorine, hydrochloric acid, hydrofluoric acid, ammonia, &c.

3. The structure of flame, flame re-actions, use of blowpipe, reduction of metals on charcoal, residues coloured by cobalt nitrate, incrustations, films, &c., borax and microcosmic salt beads.

4. Spectroscopic reactions.

5. Reactions of Reagents.

6. Qualitative Analysis by wet and dry processes.

7. Reactions and processes for the detection of the alkaloids, sugars, starch, glycerine, alcohol, fusil oil, carbolic acid and similar common substances.

B.—QUANTITATIVE COURSES.

Candidates for the B.Sc. degree in Chemistry, and B.E. degree in Mining and Metallurgy, are required to make correct determinations of the following substances :—

1. Verification of weights. 2. Determination of ash in filter paper. 3. Copper Sulphate. 4. Potassium dichromate. 5. Calcite. 6. Sodium chloride. 7. Rochelle Salt. 8. Ammonio-ferrous sulphate. 9. Lead Nitrate. 10. Siderite. 11. Dolomite. 12. Apatite. 13. Orthoclase. 14. Niccolite (kupfernickel). 15. Smaltite (Co. Ni. and As.). 16. Copper pyrites. 17. Topaz.

And certain of the following :—

18. Blende. 19. Zinc silicate. 20. Pyrolusite. 21. Chromite. 22. Wolfram. 23. Mispickel. 24. Fahlore. 25. Petalite. 26. Beryl. 27. Strontianite. 28. Cinnabar. 29. Coinage—bronze. 30. Lead, tin, bismuth, cadmium alloy. 31. Ilmenite. White lead and pigments. Cements. Iron Ores. Iron and Steel. Fireclay. Oils. Mineral Oils—including flashing points. Coal Gas. Furnace Gases. Coal, including ash and calorific power. Coke. Water for domestic and manufacturing purposes Manures.

Also the following volumetric estimations :—

1. Chlorine. 2. Silver. 3. Potassium and sodium. 4. Sodium hydrate 5. Iron by permanganate and dichromate solutions. 6. Bleaching powder. 7. Nitric acid. 8. Chloric acid. 9. Ammonia.

And the following determinations of organic substances :—
1. Exercises in the purification of substances, including fractional crystallisation and distillation. 2. Boiling and melting points; specific gravity. 3. Ultimate analyses. 4. Vapour density. 5. Molecular weights of acids. 6. Use of polariscope. 7. Preparation of carbon compounds.

Physical Chemistry in Sydney

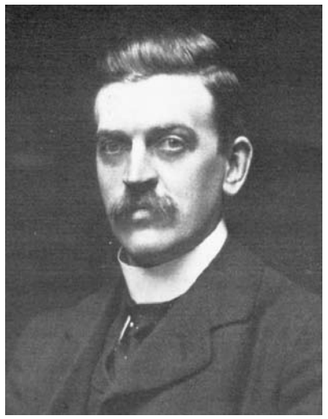
The Early Years

by

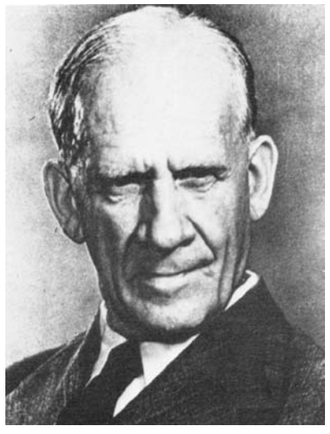
Bob Hunter

The roots of the important areas of Australian physical chemistry (spectroscopy, thermodynamics, kinetics, electrochemistry and colloid science) were laid down in the nineteenth century but it was not until the appointment of David Craig to the Foundation Chair of Physical Chemistry in 1952 that the subject was acknowledged in Sydney as distinct. There had, however, been much earlier activity which would now be included under that rubric. At the turn of the twentieth century the study of chemistry in Sydney had a heavy bias towards the needs of the local mining industry and was mainly in inorganic and analytical chemistry. Research in other areas would not begin until the appointment of Robert Robinson to a Chair in Organic Chemistry (Pure and Applied) in 1913. Nevertheless, there were a couple of well known names: Douglas Mawson, and T.H. Laby (of Kaye and Laby fame) were employed as junior staffers in the department in the early 1900s and each went on to becomes FRSs for their work in geophysical exploration and physics respectively.

When Charles Fawsitt was appointed to the Chair of Chemistry in 1909 he quickly set about the introduction of undergraduate studies in physical chemistry. Although he could boast a strong academic pedigree in that area, having studied with Wilhelm Ostwald and Alexander Crum-Brown (one of the founders of valency theory), Fawsitt seems to have been much more interested in teaching and administration than in research. According to David Craig it was Fawsitt who was responsible for the general admonition to all junior staffers: "When interviewing young female students, always keep your door open." He remained until the end of World War II when RJW Le Fèvre took over as Head of School in 1946.



Charles Fawsitt



Robert Robinson

It was not until the late twenties that the research side of the School's activities in physical chemistry began to develop with the appointment of Tom Iredale to a lectureship in 1927 and David Mellor in 1929. Mellor was at that time an X-ray crystallographer and he teamed up with a more senior staffer, George Burrows, in some of the earliest studies in the field in Australia. (Although the Braggs, father and son, had an Adelaide connection, they didn't start their studies of X-ray crystallography until Bragg senior return to England.) Mellor subsequently moved out of the X-ray area to become a pioneer in the study of magneto-chemistry. Although his researches were strongly based in physical chemistry, he was later more usually thought of as an inorganic chemist because he had made some profound contributions to the understanding of coordination chemistry. He was appointed Professor and Head of the School of Chemistry at the University of NSW in 1955 and was to become one of Australia's most respected academics.

Iredale was a Sydney graduate who won the Caird Scholarship in 1917 which took him to University College London to continue his studies on colloid science with Frederick Donnan. On his return to Sydney he developed an interest in the physical properties of bromine and iodine substituted organic compounds, particularly their thermal and photo-decomposition and over the years he subjected such compounds to a range of spectroscopic and other techniques culminating in some of the first applications of the very new technique of NQR spectroscopy in the 1950s. Former graduate student, David Alderdice, says: "In the early 1950s Tom Iredale's interest in NQR was aroused when on sabbatical leave, during which he visited Hatton and Rollin's NQR activities at the Clarendon Lab, in Oxford. After a fruitless start-up attempt ... Tom struck the jackpot in 1957 when he gained the services of Julian Brown, a disillusioned physics graduate. Joined that year by Honours student Alderdice, Julian soon had the group fabricating from scratch quite sophisticated electronic equipment, and during that year they observed their first NQR signals, for both chlorine and iodine compounds. Their first NQR publication appeared early in 1959."

David Mellor

One of Iredale's most successful early students was Alan ("Sandy") Maccoll who took his MSc in 1937 for work on the rates of vapour phase reactions. He was later to develop the use of spectroscopic techniques for determining the details of molecular geometry, a field which he pursued after WW II in University College London, along with a number of other distinguished Australians.

David Craig, who began his research career with Mellor in magneto-chemistry, was appointed to a lectureship in Sydney after his discharge from the Army in 1946 but soon left for UC London, to return in 1952 to take up the Foundation Chair of Physical Chemistry. He recently recalled the rather primitive conditions at the time. One of his students, Max Redies was measuring the IR spectrum of naphthalene. The only way they could get sufficient vapour pressure to record the spectrum was to heat the whole room to a temperature which was almost unbearable for the poor benighted student. "Max was almost perfectly spherical in shape and the temperature had him sweating profusely for the whole time it took to collect the data we needed." After only a few years away from the centre of things, David returned to UC as Professor of Theoretical Chemistry in 1956 and remained there until 1967 when he was called back to take up the Chair of Physical Chemistry in the Research School at ANU.

"Max was almost perfectly spherical in shape and the temperature had him sweating profusely for the whole time it took to collect the data we

Calculation methods were very crude in those early days. David recalls that Tom Iredale had possession of one of the School's premier calculators: a Fuller slide rule. This was a cylindrical device about 40 cm long and 10 cm in diameter with the scale wrapped around it, so that it was about ten times longer than the usual slide rule. (I also had one in my CSIRO lab in 1955.) Although Tom was happy to lend it to knowledgeable users he kept a close watch to prevent its going astray. Le Fèvre preferred the Swedish Facit calculator, a mechanical gadget which he still used to calculate student exam averages in the late 1960s. (Division was done by rotating the handle until the bell rang and then racking back a notch, as I recall.)

Raymond J.W. Le Fèvre

The distinction between inorganic and physical chemistry has always been a rather arbitrary one in this University. When Le Fèvre was appointed Head of School in 1946 he was also Professor of Chemistry and he was adamant that these 'adjectival' brands of chemistry were an impediment to progress. No one else had the slightest doubt that his research interest was in physical organic chemistry and he produced a multitude of graduate students, many of whom continued in their academic careers in that same area: applying physical methods to the solution of various problems involving most of the elements of the periodic table. Ian Ross moved quickly from Le Fèvre's group into physical chemistry, continuing Craig's work in spectroscopy, greatly assisted by the introduction of the first crude computing system in the late 1950s. He subsequently went off to the Chair of Chemistry in the Faculties at ANU. The line of Le Fèvre's students came full circle when, in the early '70s, crystallographer Hans Freeman succeeded him in the Chair as Professor of Inorganic Chemistry. Another of his students, Geoff Ritchie, moved to the physical chemistry department on Le Fèvre's retirement in 1970, and subsequently took up the Chair in the University of New England.

The other prominent contributor in physical chemistry in those years was Lawrie Lyons who studied the physico-chemical properties of solids, a field which was to become so significant in the development of solid state electronic devices. He was to continue his career as Professor in the University of Queensland.

I am indebted to the text "Ever Reaping Something New" edited by David Branagan and Graham Holland for the more reliable facts recorded here. ♦

A Great Response!

We would like to extend our thanks to the following people for their generous donations during 2003.

Alumni Fund

Dr John Phillip Connell
Mr Arthur Dimitrious
Dr Joyce Fildes
Dr Steven Hacobian
Mr Alfred John Harle
Dr Phillip King
Dr Michael F. O'Dwyer
Dr Diana Temple
Ms Lo-Chia Wang

Inorganic Foundation

Dr Manuel Aroney
Professor Hans Freeman
Professor Len Lindoy
Mr Thomas Savage
Mr Paul Slade
Ms Thida Swe
Dr William Tulip
Ms Lo-Chia Wang

Cornforth Foundation

Ms Carol Bae
Mrs Kim Eunho (Dentonhall P/L)
Dr Joyce Fildes
Mr Ronald Hinde
Mr Roberto Pavan
Mr Leo Wang
Ms Lo-Chia Wang

We would also like to thank Alumni who responded to our request for details of alumni career histories since leaving Chemistry. We hope this will prove a valuable careers resource for students. Visit our Careers page at http://alumni.chem.usyd.edu.au/ and read about your fellow Alumni.

If you would like to contribute to either *Your Story* or Snapshots or to make a donation, please contact Anne at a.woods@chem.usyd.edu.au or telephone her on (02) 9351 2755.

Visit our new Chemistry Alumni website at http://alumni.chem.usyd.edu.au/

Stop press!

Chemistry Alumni Scholarship

The generous donations to the Chemistry Alumni Fund have been used to provide scholarship support for one of the School's postgraduate students. Christopher Mitchell, PhD student working in the area of bioactive natural product synthesis, is the first recipient of the Chemistry Alumni Scholarship. Full details in Issue 5 of ChemNEWS due out in October.

Snapshots!

Robert Geyer (BSc Hons 1976)
I have been employed in laboratories for over 26 years, of which the first 10 were spent on the bench and the last 16 were spent managing a small laboratory and a staff of 13 people. I have done two graduate diplomas in clinical biochemistry and occupational hygiene since my Chemistry School days and have been a member of numerous professional organizations like RACI, AIOH and QSA for many years.

Graham Brophy (BSc 1967, MSc 1973)
After graduating with a degree in science, majoring in Chemistry & Biochemistry in 1967, I went on to work in both the private and public sector, including the School of Chemistry at the University of Sydney where I worked in the field of nuclear magnetic resonance. In 1973, I completed an MSc in Chemistry while working with Professor Sev Sternhell. From there my interests turned more to teaching than research and later into the area of education policy. I am currently working for TAFE NSW Strategic Services Unit, but I have been associated with TAFE NSW and the Department of Education and Training in various capacities since 1980. I have completed a Diploma of Education teaching qualification in 1983 from Sydney College of Advanced Education (now part of UTS) where I received an award for excellence in teaching. I have also completed a number of Graduate Certificates, the most recent being a Graduate Certificate in Management from the University of Western Sydney which was conferred in December 2003.

Send your contribution to Anne Woods at a.woods@chem.usyd.edu.au or the contact details listed at the front of ChemNEWS.