Japanese collaboration a fillip for drug and high tech development

ANU effort boosts Australian access to "Big Science"

BY LIZ TYNAN

AUSTRALIA has entered a new era of "big science" with major implications for drug development and high technology following its establishment of a permanent presence at one of Japan's foremost research establishments, the Photon Factory at Tsukuba Science City.

The collaboration with the Japanese is the work of a consortium in which ANU is a major partner.

While the centrepiece at the Photon Factory is a synchrotron worth hundreds of millions of dollars, the Australian consortium is spending only $3 million on the experimental station for the Australian Beamline. Our beamline is one of 22 operated by the Japanese Government and industry. A synchrotron is a type of particle accelerator used to impart high energy to electrons by accelerating the particles in closed orbits. The accelerating particles give off an intense beam of X-rays which is channelled down the beamline to the experimental station. These X-rays are used to obtain structural information on a wide range of materials, from silicon chips to proteins.

This unique collaboration with the Japanese gives Australia access to a major international research effort using the big science of synchrotron radiation.

Already, scientists from the ANU's Research School of Chemistry (RSC) working at the Science City have obtained striking early results from the yet-to-be-commissioned Australian Beamline. Their work looks set to offer unprecedented research potential in many areas, ranging from drug design to high tech electronics.

Dr David Ollis and Dr Paul Carr of the protein crystallography group, part of the ANU's new Centre for Molecular Structure and Function, produced the Beamline's first 'Laue' photos of the diffraction pattern of an enzyme, allowing them to elucidate its structure.

"We went to the synchrotron for two purposes," Dr Ollis said, "to see if it were possible to collect Laue data and secondly and more importantly, we had several crystals on which we couldn't really collect data here. The crystals are proteins that have very important biological functions.

"One is a DNA binding protein and the other a bacterial protein important to the construction of the bacterial cell wall. That protein was a good target for rational drug design, because if we could knock it out we could kill bacteria selectively," he said.

Other big users of the equipment at Tsukuba Science City will be solid state chemists and physicists. Dr Ollis said solid state work was the reason for the development of the Japanese synchrotron in the first place, "to satisfy the solid state physicists who do research for the big electronic companies".

"Japan is building another 12 synchrotrons, and the next generation instruments will be an order of magnitude more powerful," he said.

Although Australia could never afford this big ticket science, by linking with Japan our researchers are assured constant access to the beam power of the Photon Factory synchrotron.

RSC has been heavily involved from the start in the move to the Photon Factory. Professor John White, a group leader at RSC and Chairman of the Board of the Institute of Advanced Studies, serves on several committees connected with the Australian Beamline, and he and his research group will be among its biggest users, along with

– Continued on Page 10

"Big Science"

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two other groups at RSC, protein crystallography and solid state inorganic chemistry.

Professor White said this move, apart from cementing research links with Japan, showed that different organisations in Australia, operating independently with their own agendas, could come together to collaborate on an important venture for Australia.

This collaboration flowed from an Australian Academy of Science report, *Small Country, Big Science*, which spelled out the steps that had to be taken to ensure a place for Australia in the world of high energy physics, neutron scattering and X-ray crystallography.

According to Professor White, the story started about six years ago when a need was identified for access by Australian scientists in universities, CSIRO and industry to big science facilities.

Big science is research that requires large and expensive instruments, although often lots of small science also is made possible.

"Australia had just one facility of this kind, the Lucas Heights Nuclear Reactor," Professor White said. "This has served the country in very good stead for 30 years, and in some areas is still first class, but in many areas it has been superceded by advances overseas."

A 1989 enquiry by the Australian Science and Technology Council (ASTEC) recommended, among other things, that Australia should seek immediate access to synchrotron radiation facilities.

According to Professor White, Australia would become a "third world science nation" if it didn't have access to a synchrotron.

A hard decision had to be made. The National Committee on Crystallography decided to set aside the idea of neutron scattering and high energy physics to concentrate on what was immediately feasible – X-ray crystallography.

The Department of Industry, Technology and Commerce came up with some funding, and this was boosted with pledges from the Australian Research Council, the Australian Nuclear Science and Technology Organisation, CSIRO, the ANU and the University of New South Wales, and a consortium was formed.

Professor White elected to Royal Society

PROFESSOR John White of the Research School of Chemistry has joined an elite group of scientists with his election as a Fellow of the Royal Society in London.

He becomes part of a group of only 1100 scientists worldwide, and a handful in Australia, who have been recognised for their long-standing commitment to research excellence. RSC has a disproportionately large number of Australian Fellows of the Royal Society, with Professor White bringing their number to four.

The others at RSC are the Dean, Professor Lew Mander, Professors Athel Beckwith and Alan Sargeson. Two retired RSC members, Professors Arthur Birch and David Craig, also hold the title of FRS.

The Royal Society, founded in 1660, is a prestigious national academy of science, set up to promote and advance science, its applications and its place in society.

Its Fellows embrace all fields of physical and biological sciences, mathematics and engineering, medical and agricultural science.

Professor White heads the Physical and Theoretical Chemistry group at RSC and also is Chairman of the Board of the Institute of Advanced Studies.

Prof John White elected to the Royal Society

The ANU's six chemistry Fellows of the Royal Society. Left to right: Professor David Craig (retired), Professor Alan Sargeson, Professor Athel Beckwith, Professor John White, Professor Lew Mander, and Professor Arthur Birch.

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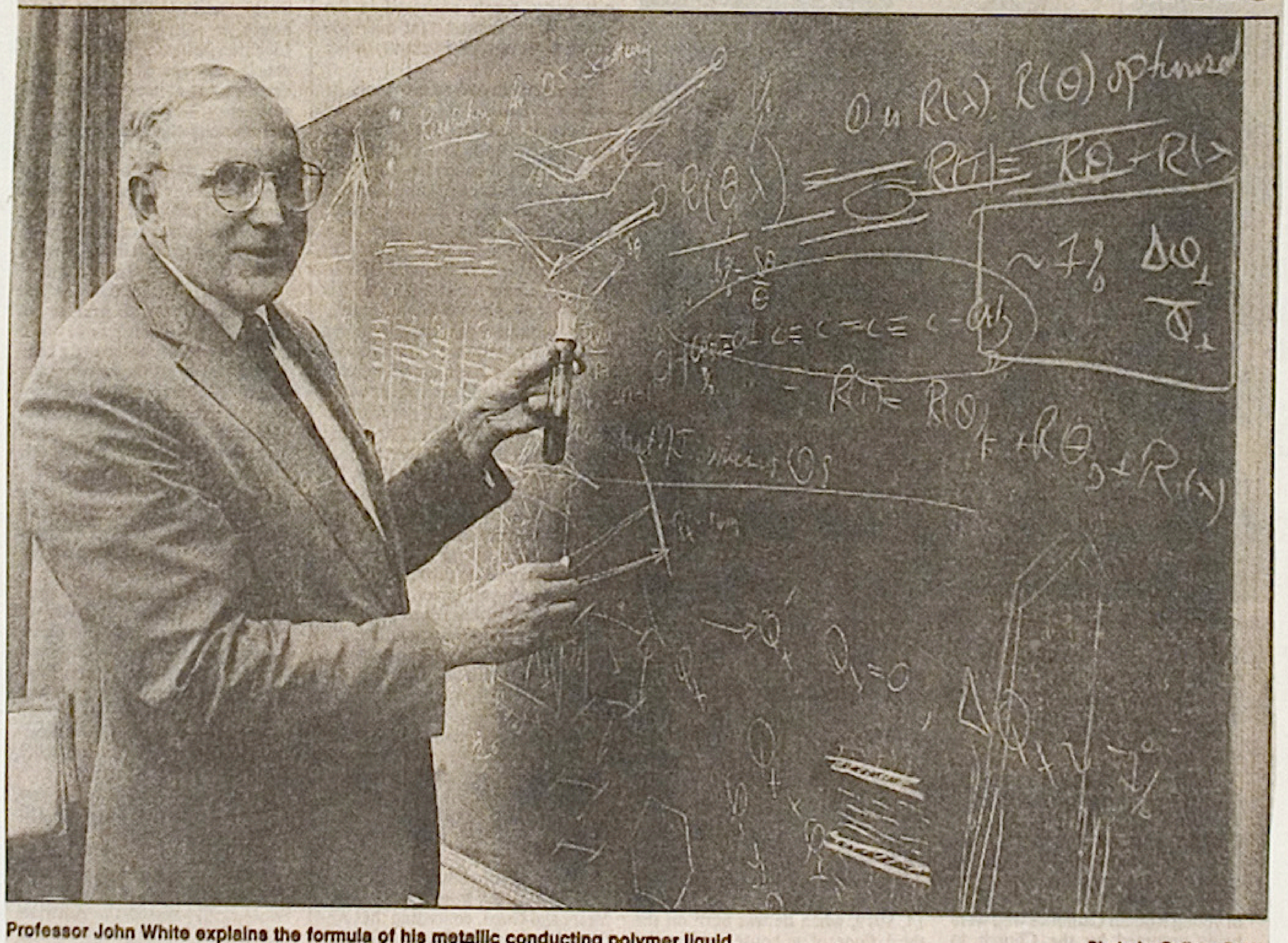
Professor excels in uncharted waters



Professor John White explains the formula of his metallic conducting polymer liquid. *Photo by Colleen Petch*

By REBECCA LANG

Professor John White is a man who relishes a challenge.

The active professor, who can be found most days haunting the labs and corridors of the ANU School of Chemistry, prides himself on inspiring his students to investigate new and uncharted waters in the field of chemistry.

It is this sense of intrepid scientific adventure and longstanding commitment to research that has earned him a Fellowship of the Royal Society of London, the most prestigious award available in scientific circles.

The society has been in existence since 1660, and its many high-profile former members include Sir Isaac Newton, Captain James Cook, and naturalist Joseph Banks.

"Basically it's something you get for your life's work, very few people get it," Professor White said.

"It is a great honour and I hope it is an honour to the work I have been doing with my colleagues here in Canberra, and an honour to the Institute of Advanced Studies. It's a privilege and it's good for Australia."

The professor's work has involved the use of neutron-scattering methods for the study of the structure of crystals and liquids, a relatively new field of research, and one that will have a big impact on the way materials can be utilised in the future.

A number of experiments have helped in his research to better understand the make-up of matter. One such experiment involved aligning polymers, the long stringy components of plastic, into perfect lines thereby strengthening the experimental plastic, giving it almost as much strength as steel in certain directions.

"One of the reasons this is important for Australia is that not only can we understand the things we commonly use, but we can begin to design new materials . . . we have made this polymer into a extremely high-strength material."

Another pet project was the development of a soluble electrically-conducting polymer, a plastic liquid endowed with the qualities of a metal and capable of conducting electricity, that can be painted on to surfaces.

"Here we've been able to make not only something which conducts electricity nearly as well as copper, but we're able to dissolve it and paint it on to things."

Professor White, 55, recalls his Oxford university days, when graduates were not allowed to study the same area they had worked on during their thesis, challenging them to find new areas to expand into.

"I decided to take a chance. I started this completely new area [of scattering methods] . . . it was a challenge." Professor White is optimistic about Australia's scientific standing, saying that we are in a position to compete with the best in the field of chemistry.

No case too hard for "Crystal detective"

BY LIZ TYNAN

A "crystal detective" who takes on the cases which have hit other scientists' too-hard basket has been appointed to boost the Research School of Chemistry's strategic initiative in new generation crystallography.

Professor David Rae is one of Australia's leading crystallographers and is recognised for his ability to solve the structures that other scientists have given up on. He has been enticed from his long-time position at the University of New South Wales to join RSC at a crucial stage in its development of an advanced crystallography capability.

His appointment stems from RSC's success in securing support from the Institute of Advanced Studies under its Strategic Development Scheme for the new generation crystallography initiative.

"A lot of what I am doing is mistake identification," Professor Rae said. "Many times difficulties in solving crystal structure stem from a foul-up in the computer model itself," he said. "You certainly get structures which can appear to be reasonable according to the statistics, but not according to chemistry."

Analysis of crystal structure has only been going on for about 100 years, and the Australian scientist Lawrence Bragg is credited with solving the first structure, that of common salt, or sodium chloride, around 1911. Since then, the field has grown considerably, and now easy structures can be solved fairly quickly. But more complex structures, and especially those of novel high-technology materials, are still very difficult.

It is the difficult ones that interest Professor Rae most. "I have spent most of my crystallography life doing structures other people have thrown away because they have come to grief on them," he said. "A lot of the time it is just a matter of pinpointing where they have made the one crucial mistake. Usually most of the structure is correct, and it is a question of fine-tuning a model completely enough to be convinced you know precisely what is going on."

Often Professor Rae finds that by embarking on one problem, the answer to another will become evident. His "suck it and see" approach pays many dividends – "you do things just to find out what happens," he said. "You certainly gain a considerable amount of knowledge about what can occur, and you store that in your brain for the next problem."

RSC already has an international reputation for its expertise in various aspects of the field, particularly disordered materials and solid-state inorganic crystallography, in groups led by Dr Richard Welberry and Dr Ray Withers respectively.

Crystallography is the science of uncovering the ordered arrangement of atoms in crystals. Because crystals are found everywhere – indeed, they are the solid-state purified form of many diverse substances – they have enormous implications in many branches of science. Solving a structure means working out what atoms are there and refining means accurately locating them.

Synthetic chemists and biochemists rely heavily on crystallographers to tell them the exact nature of the substances they have created in their laboratories, enabling them to assess the usefulness of the substances.

Professor Rae's current challenge centres on non-standard crystal structures known as modulated structures, which demonstrate regular, wave-like distortions or perturbations from the normal, parent structure. Although they have always existed, they came to prominence in the 1980s with the dramatic discoveries of high temperature superconductors and of quasicrystals.

Some commercially-important electronic and optical materials, like ferroelectrics, have modulated structures.

"The sort of things we are looking at require sophisticated computer modelling," said Professor Rae. "A lot of these have fairly important physical properties. They aren't perfect structures, but have been 'messed up' by the addition of other types of ions. We need to sort out just what is going on in them, so that they can be manipulated for all sorts of purposes," he said.

"If you want to start manipulating properties and know what is going on, it is necessary to understand the structures very accurately," he said.

– Continued on Page 11

New EEO committee rep for staff from non-English speaking backgrounds

Mrs Reet Bergman has recently been appointed to the Equal Employment Opportunity Committee as a representative of non-English speaking background (NESB) employees.

To help her address issues of concern and relevance, she would like to hear from employees of non-English speaking backgrounds who have specific problems, approaches and/or solutions they would like to be brought to the Committee's attention.

Reet Bergman

Mrs Bergman brings to the committee extensive experience as a volunteer worker in the area of migrant and multicultural concerns.

Supervisors who supervise employees of non-English speaking background should also feel free to approach Mrs Bergman as a resource or to refer questions to her. She can be reached on extension 3730 or through campus mail at RSC.

The EEO Committee provides advice to Council on equal opportunity matters and oversees the implementation of the University's EEO program.

Previous initiatives from this Committee include the *Policy for People with Disabilities, Equal Opportunity Plan: New Steps,* and the distribution of an employee survey in 1991.

Crystal detective

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"With high-tech electronic de-
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nperature, and you do that by
ering a prototype structure to
ne extent. Having some idea of
at is happening in such a process is useful knowledge and helps you to understand what you are doing," he said.

There are many types of problems to be examined in crystallography.

Protein crystallography, now also a major initiative for the ANU through the new Centre for Molecular Structure and Function, examines very large protein molecules and is quite different from crystallography of minerals and different again from crystallography of simple inorganic complexes.

Each has a different method of structure solution requiring different methods of approach. The field is vast.

One of the contributions Professor Rae is continuing to make is in developing computer programs which will enable them to refine various types of modulated structures.

Professor Rae is no stranger to RSC, having first visited in 1971 for a Summer School, and more recently having spent six months in 1989 on study leave, working closely with Drs Ray Withers and John Thompson. Since then, he has published a number of papers with RSC researchers.

With the recent purchase of another X-ray diffractometer coinciding with Professor Rae's appointment, the School is now well placed to provide an effective structure-solving service to the ANU's synthetic chemists and biochemists.

With the upgraded facilities and the expertise brought by Professor Rae, it is envisaged that RSC's crystallography capability increasingly will provide assistance to colleagues throughout Australia, particularly those stumped by the problem structures.

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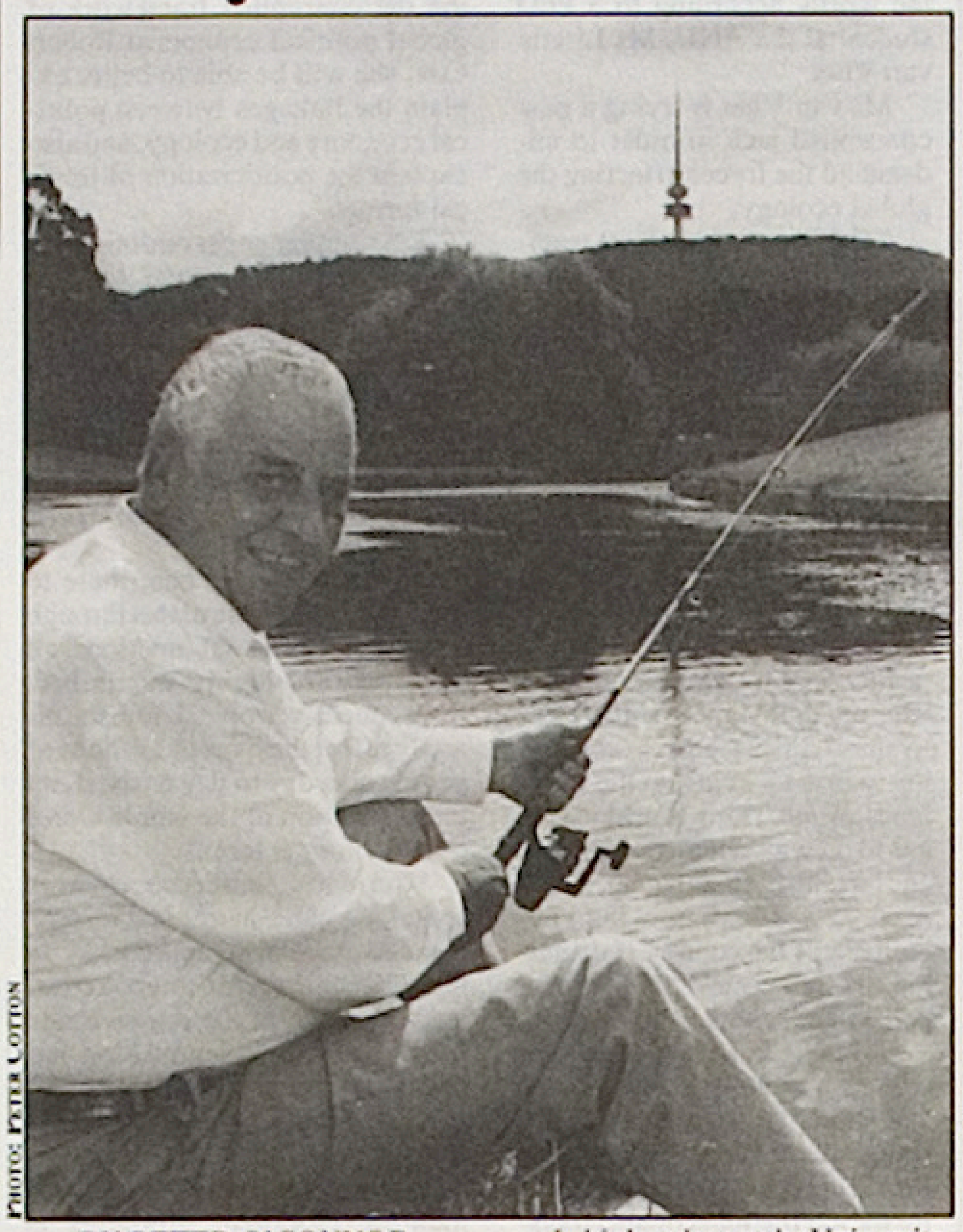
John's three year stay blew out to 38



BY PETER O'CONNOR

WHEN John Harper left England in 1955 for Australia, his plan was to stay three years working at the ANU's John Curtin School of Medical Research (JCSMR). Mr Harper leaves at the end of this month as the University's longest serving employee, with 38 years notched up.

In his last days at the University, he has been thinking about the fishing, boating, golf or "just doing whatever I want" that will soon occupy his time.

He also thinks back on one of the most interesting and distinguished careers of any general staff member

– Continued on Page 7

As for physical exercise, 68 per cent of the younger group and 60 per cent of the older students undertook moderate exercise for half an hour or so three or more times a week.

Most senior students (93 per cent) said that they always ate breakfast, while 73 per cent of the younger students were breakfast eaters.

Dr Furnass said it appeared that the majority of older students were happy with their university experience, both in terms of personal development and academic achievement.

After 38 years...

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at the ANU, a career which includes the honour of an MBE for services to university administration.

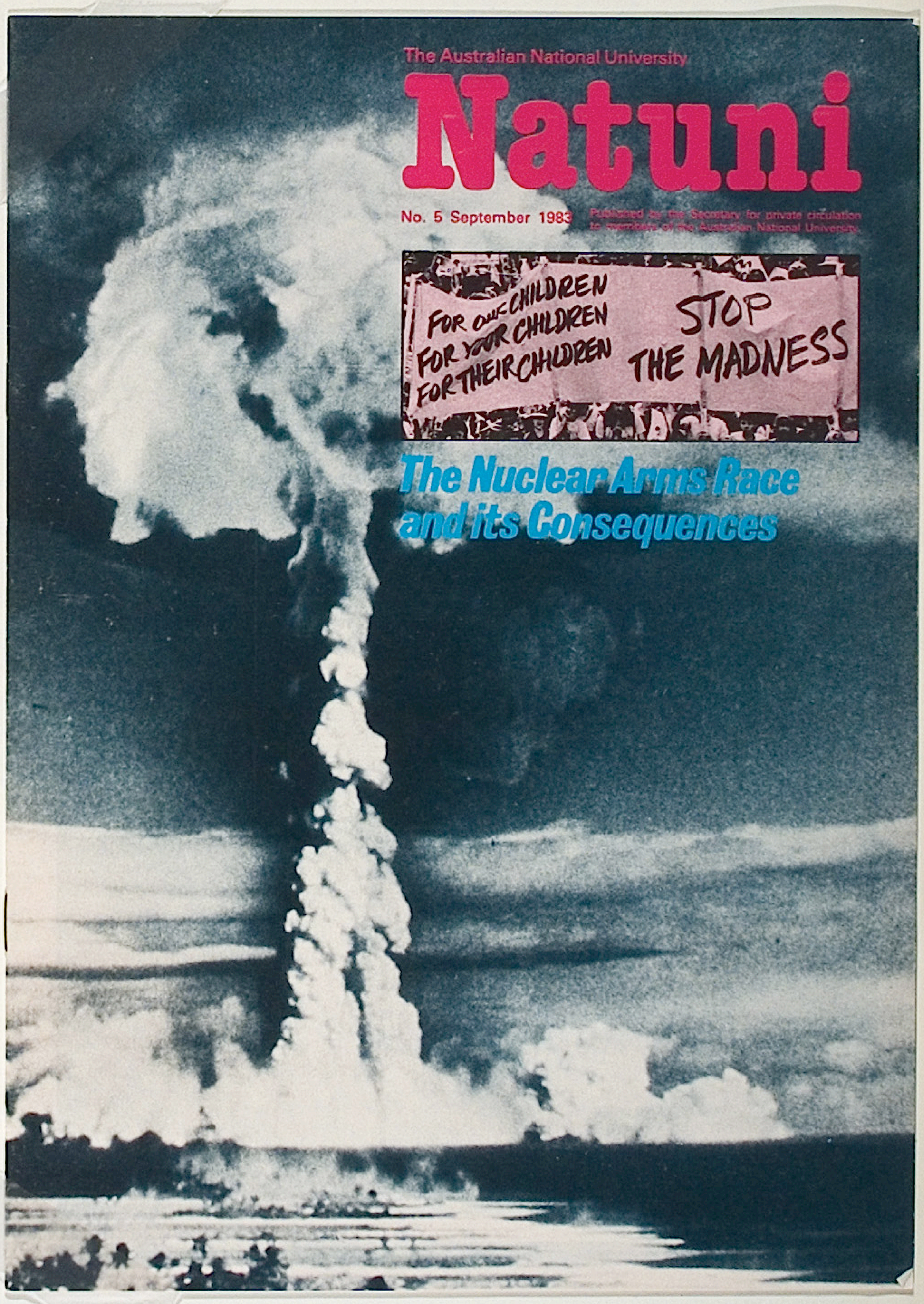
A chemist, with a strong technical grounding, John Harper was recruited in England as part of the small team charged with transforming an empty building into one of the country's leading medical research institutes, the JCSMR.

He was later foundation laboratory and technical manager of the ANU's Research School of Chemistry.

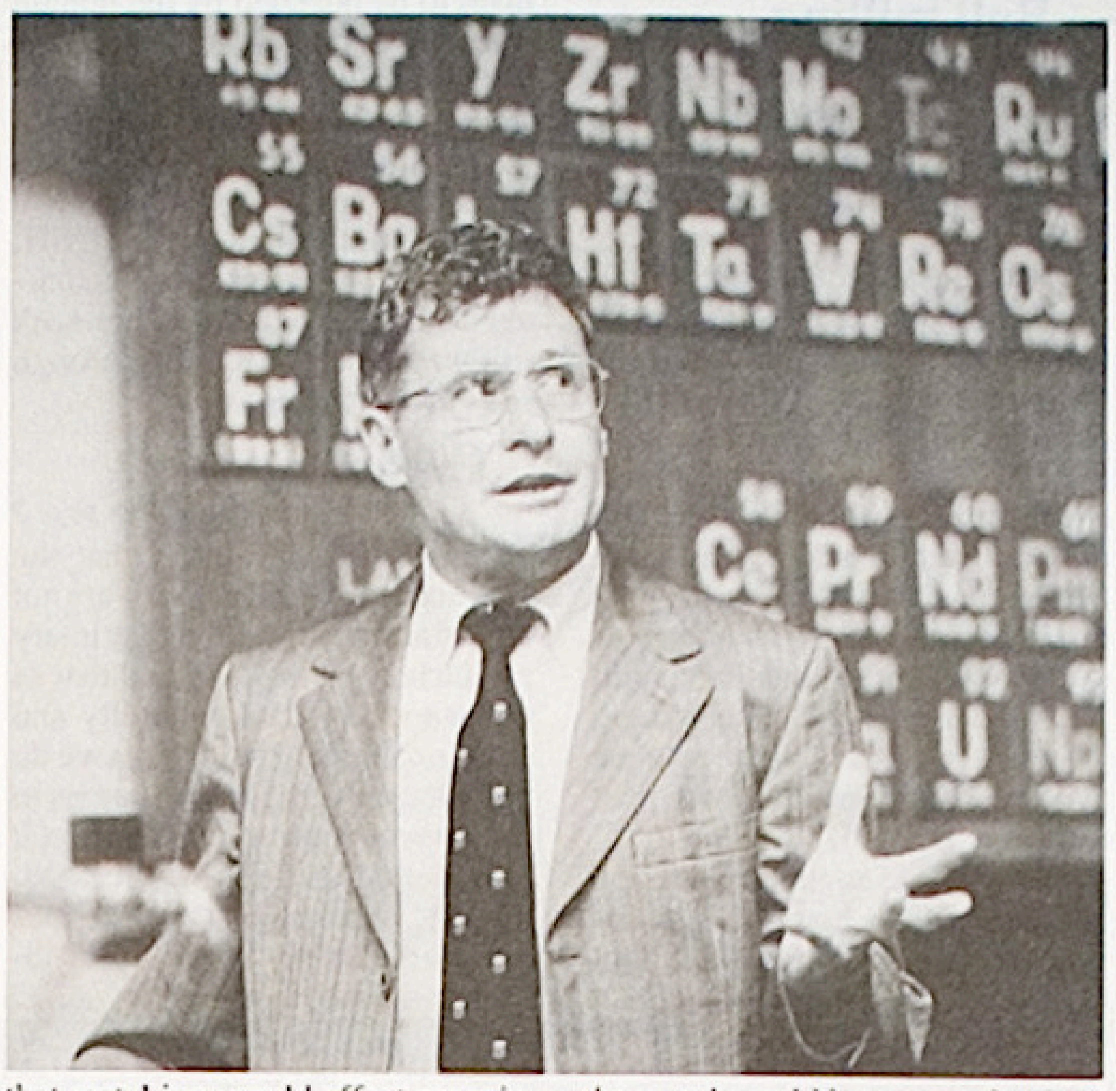
In 1982 John was one of a small UNESCO team invited to China to advise Beijing on the rebuilding of its higher education system following the Cultural Revolution.

Over the past eight years he has worked as assistant secretary setting up the occupational health and safety office, planning and overseeing the difficult task of removing asbestos from University buildings. He is presently assistant secretary and Head of the Personnel Office.

10.9.93
25yrs at R.S.C
Lorraine Scorr



Alan Sargeson and the chemistry of 'cages'



PROFILE

BY LIZ TYNAN

CHEMICAL reactions simply involve the shuffling of electrons between atoms, but they lead to the creation of an almost endless variety and complexity of substances. Exploring the nature and potential of these reactions has long captured the imagination of enquiring scientific minds.

One ANU scientist who has spent his career investigating chemical reactions, and has gained a worldwide reputation for his achievements, is Professor Alan Sargeson at the Research School of Chemistry (RSC). He is among the many RSC scientists who have enhanced the international prestige of the School. He is in demand overseas as a lecturer and visitor and has received numerous international awards and medals.

Imaginative research by Professor Sargeson and his colleagues over many years at ANU has led to the creation and further development of special molecules, now known throughout the chemistry world as "sarcophagine cages", in which a metal atom has been trapped (using a simple chemical process) inside an organic sarcophagus. This organic structure presents many possibilities, including the potential to "scavenge" toxic waste from contaminated water. This work is continuing along a number of different tracks at RSC, years after Professor Sargeson first developed an interest in the molecules and their possibilities.

Alan Sargeson was born in the New South Wales town of Armidale, although the family moved away when he was only six months old. His father was a magistrate who was posted at regular intervals to different towns and cities. While growing up, Alan Sargeson lived in Cessnock, Taree, Sydney, Cootamundra and Maitland.

His father was a highly intelligent man who was well aware of science in a general sense, according to Professor Sargeson. "He was extraordinarily perceptive in some ways, for example about diet and infectious diseases," he said. "In the pre-war era this was not common, and we had a very healthy childhood."

Alan Sargeson's mother came from pioneering stock who lived an isolated life in the Mildura/Wentworth area. Her family name was Macleod, and they had the trademark Scottish pluck and ability to deal with adversity. Her schooling was sporadic, dictated by isolation and the fluctuating fortunes of a grazier's family in a dry area.

"She was determined that her children would have a good education," said Professor Sargeson. "She was very supportive."

One of his older brothers had gone to Sydney University where he had majored in chemistry and geography, on his way to becoming a teacher. This had some effect on the budding young chemist Alan Sargeson, but a bigger influence during his school years was a series of excellent science teachers. In particular, a Mrs Sherringham at Cootamundra High School "made it interesting".

"But I would have to say that my father made me aware of the nature of natural phenomena. He didn't have a special interest in a particular subject but he knew about things in general. He had read a lot and knew about plants, minerals and animals."

By the end of school there was no question that Alan Sargeson wanted to be a scientist, so he went to Sydney University on a Teachers College scholarship. At that time the Commonwealth Scholarship Scheme had not yet started and tuition fees were high.

In 1948, at the age of 17, he began his studies, tackling physics, mathematics and geography as well as chemistry. The geography component was the result of his brother's influence, but it wasn't his forte. It soon became clear that he was going to be a chemist.

Among the many excellent teachers encountered by Alan Sargeson at Sydney University, one was to have a profound effect on his subsequent career. Francis Dwyer was one of Australia's foremost chemists, and he was to became Sargeson's postgraduate supervisor.

Although Alan Sargeson had completed his Honours degree in organic chemistry (the branch of chemistry which deals with carbon-based compounds), Dwyer was an inorganic (non-carbon) chemist. These two branches of chemistry had traditionally been separate, but had started to come together in interesting ways earlier this century. Inorganic chemistry deals largely with metals and their derivatives. Carbon is closely allied with biological chemistry and carbon-based molecules are present in every living thing on Earth (as well as many non-biological substances).

Dwyer was interested in co-ordination complexes and especially the combination of organic and inorganic substances. It already had been discovered by researchers that metal ions were important in biology; such things as iron (a metallic, therefore inorganic, element) in the haemoglobin in red blood cells, cobalt in vitamin B12, and various other trace elements were found to be necessary for functioning organisms.

Dwyer's work with W P Rogers at the CSIRO McMaster Laboratories was part of the evolution of chemistry into biology. Discoveries that trace elements were required by both animals and plants led to the opening of new areas for agriculture, especially in South Australia. The CSIRO identification of cobalt deficiency in sheep influenced Australia's wool and sheep meat industries. Also, zinc, manganese and cobalt deficiencies in soil were remedied and crops and animal production improved markedly as a direct result of these discoveries.

In this climate of the development of biological co-ordination chemistry, the young organic chemist Alan Sargeson became Dwyer's postgraduate student and realised he wanted to remain in research. Once he had finished his doctorate, in 1956, he went to the University of Adelaide as a lecturer and researcher.

In the meantime, Dwyer, who had continued his research at the University of Sydney, had accepted the Chair of Chemistry at Pennsylvania State University in the United States and was about to move, when the Australian chemists became concerned about losing such an important researcher. The ANU and CSIRO came up with a deal to encourage him to stay in Australia. He was offered his own unit at the John Curtin School of Medical Research, and he accepted it.

Then he asked Alan Sargeson to join him in helping to set up the group. So in 1958, Sargeson moved from Adelaide to Canberra to the new Unit of Biological Inorganic Chemistry.

One of the Unit's activities included the development of metallo-organic molecular complexes which proved very active against bacteria. The chemical company Monsanto also was involved in trying to interest pharmaceutical firms in this work, but in the end another drug, hexachlorophene, preferred by the companies for the same purposes. Subsequently, hexachlorophene proved to have major neurotoxic side effects and has virtually vanished from use. Professor Sargeson still uses the iron/nickel compounds he made at JCSMR back then for topical application on minor bacterial infections, and he has not suffered any ill effects in over 30 years. Eventually, the mode of action of these molecules was unravelled by a researcher in the US, Jacqueline Barton, who showed that they interfered with DNA replication, preventing the development of the second generation of bacteria. But that wasn't known at the time, and a commercial opportunity for Australia went begging.

The new Unit was "going great guns" when suddenly, in 1962, Francis Dwyer died of a massive coronary at the age of 51. It was an unexpected and shocking loss, and it left Alan Sargeson in charge of the group. At that time he had been on the verge of going to Chicago to work with Professor Henry Taube (who later won a Nobel Prize), but Sargeson put this off for a year to get the Unit in order. In the interval Taube moved to Stanford University and this sabbatical year proved to be enormously influential.

"It was a very important year in my life because I learned a lot more about reactivity matters. Even at that time, Taube was a very important figure in reactivity of these co-ordination complex molecules," said Professor Sargeson. This was vital knowledge for the work which was to come.

When he came back he had to rebuild the group as many of the members had dispersed. Work picked up again in collaboration with a Research Fellow Dr David Buckingham and students, with new research on the reactivity of amino acids bound to metal ions which led to new methods for synthesising and degrading peptides.

In 1967 the Research School of Chemistry was founded, and Sargeson's group was moved there, while still maintaining biological interests but also taking up opportunities that the new School provided.

In 1975 came the discovery with which the name Sargeson is most associated, although he and his group didn't recognise that they had created "sarcophagine cages" until three months after the event.

"It arose as a result of our work at JCSMR, where it became evident that metal ions could affect organic reactivity in a very profound way," said Professor Sargeson. This work was preceded by the discovery in America by a scientist called Pedersen of Dupont of large-ring structures containing oxygen atoms which could bind around metal ions. They were dubbed "crown ethers", and they led directly to the development of "phase transfer catalysts" which catalysed reactions at solvent interfaces. These synthetic metallo-organic structures gave chemistry a glimpse of the future. They were quickly supplemented by other cages called cryptands and spherands.

"Then it began to be recognised that there were naturally occurring molecules that would carry metal ions in biological systems, and that these carriers were important in maintaining the sodium-potassium balance in organisms," said Professor Sargeson. "It became evident that these cages and encapsulating molecules had very interesting properties and that new cages which trapped the so-called transition metals (including iron, copper and manganese) would be just as interesting. For this purpose nitrogen atoms binding to the metal would be more suitable."

Sargeson and his group reasoned that this should not require dozens of reactions, but rather a straightforward one- or two-stage process using a simple template reagent. But the first attempts didn't work at all well.

Then Alan Sargeson set up another experiment before going to Perth in September 1975 for some lectures. The new experiment would use simple reagents formaldehyde and ammonia and a metal template complex containing nitrogen atoms bound to the metal. It was carried out by the group's research fellow Jack Harrowfield and research assistant Tony Herlt.

"I went to Perth for a month and forgot all about the experiment, and it wasn't until after the Christmas holidays that I remembered to ask Tony about it," said Professor Sargeson. "Tony commented that there appeared to be many products but when I looked at the NMR [nuclear magnetic resonance] spectra, I said 'that's it'. I could see immediately that it was the right stuff."

The simple strategy uncovered by this experiment for making

-Continued on page 10

Chemical reactions

Profile of Professor Alan Sargeson, an ANU chemistry researcher who devised chemical "cages" that can clean up toxic waste

9

Alan Sargeson

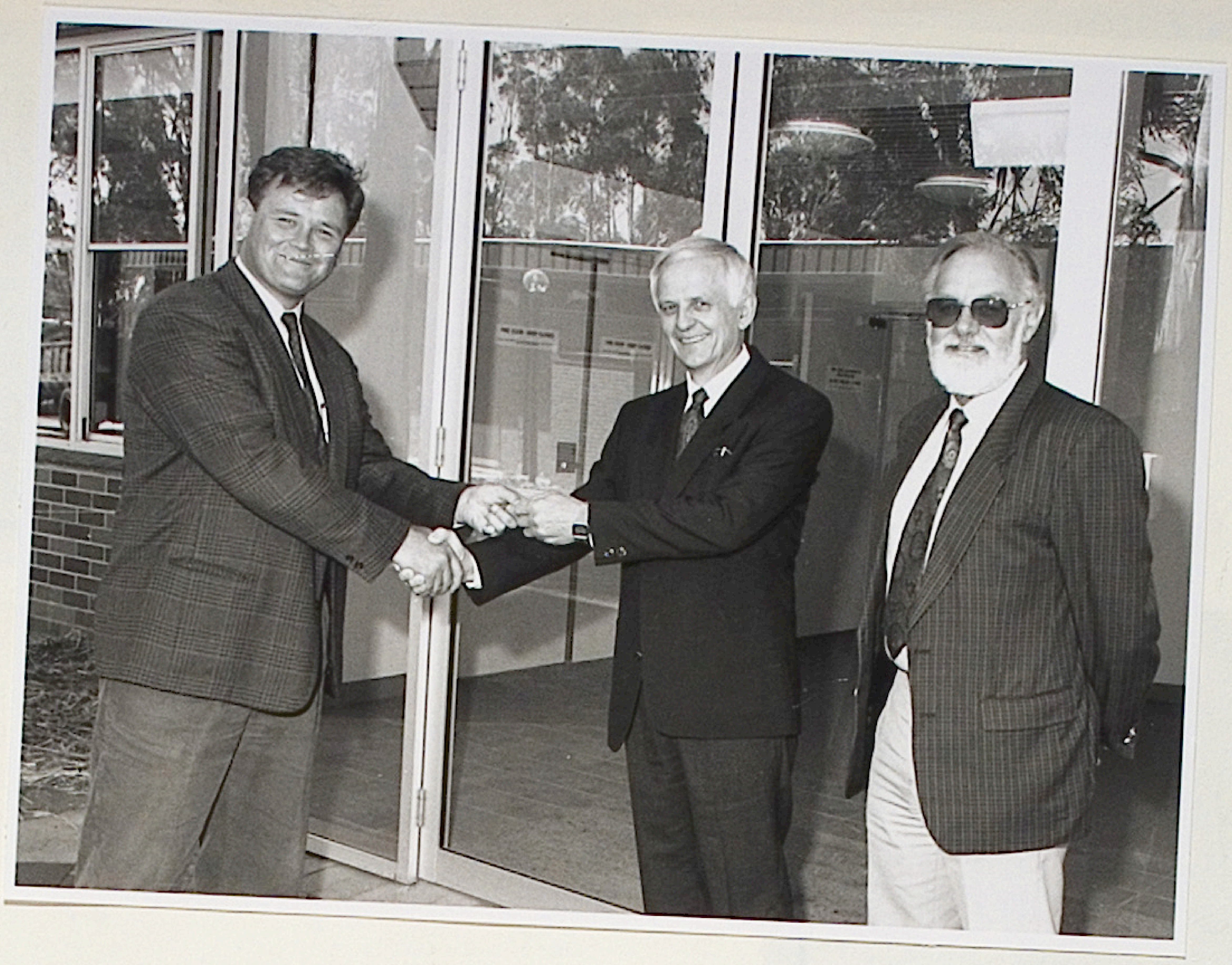
-Continued from page 9

metallo-organic cages using the transition elements has led to many possibilities. For instance, the group has made a new class of detergents and a nylon-like polymer which has been found to remove just about every trace of copper, zinc, cadmium, mercury or lead from water. Apart from potential applications in removing contaminants from water, it could also be used to remove trace metals from biological sera.

Also, Professor Sargeson and his group have been involved in work with a chemical company on biological imaging. By inserting a "paramagnetic" metal ion into an organic cage, it is possible to use NMR to image internal organs instead of X-rays.

"None of this work has come about just because of me," said Professor Sargeson. "It is a mixture of serendipity, effective collaboration, hard work and very talented people I have had and still have in my group. They have contributed very extensively to this program and continue to do so."

(His current group comprises Research Officer Rodney Geue, Research Fellow Peter Osvhath, Postdoctoral Fellows Paul Bernhardt (ARC), Patricia Angus (ARC) and Christopher Crane and students Alexia Bygott, Kylie Brown, Dierdre Pierce, Glen Walker, Tony Elliot and Qin Chang Jin.)



John Arthur, L.Mander (Dean) Dan Hardman, Handing over of the "KEY"

HANDING OVER OF THE KEYS
CRAIG BUILDING

28 FEBRUARY 1994

Rob NOAK (Foreman) John Arthur (Project Manager) ED Bulley (B & G)

John Mush, John Eichholzer, Prof L Mander, Dan Hardman (Head B & G)

Denis EVANS
elected to Aust. Academy of Science

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Breakthrough in plant growth control could see mowing costs slashed

BY LIZ TYNAN

A substance which inhibits plant growth and could be used on golf courses and other tracts of turf to drastically reduce the time and cost of mowing has been created as part of a long-term research project at the ANU's Research School of Chemistry (RSC).

Dean of RSC, Professor Lew Mander, said that the substance, a synthetically-produced version of a natural plant hormone called gibberellic acid (GA), is undergoing trials now and commercial production is likely in the future.

The work is the result of wide ranging research on gibberellins, hormones which regulate plant growth and development (see Centrifuge feature on the importance of fundamental research, pp. 6&7). Professor Mander has been researching gibberellins for many years, and has established collaborations with up to 40 other research groups around the world and in Australia. This latest breakthrough has arisen directly from his collaboration with Drs Rod King and Lloyd Evans at the CSIRO Division of Plant Industry and Dr Richard Pharis at the University of Calgary in Canada.

The researchers were attempting to produce a gibberellin variant that would induce flowering but not the unwanted excessive growth known to be caused by GA. In doing so, the scientists produced a substance which slows down growth while making the plants, including grass, thicker and lusher.

"This compound was very exciting because not only was it more effective at inducing flowering, it actually inhibited growth. So for ornamental flowers, for example, it looked ideal," said Professor Mander.

Further refinements have produced second generation materials which are even more effective, slowing growth to 30 per cent of the normal rate, with one application lasting for about five weeks.

"One of the potential uses for this would be in, for example, golf courses and other amenity plantings, because it has the potential to reduce the frequency of mowing, watering and fertilising," said Professor Mander.

At present, the substance is being tested on grass plots at the CSIRO Plant Industry laboratories at Black Mountain, and at the Canturf farm at Bungendore.

The compound is a synthetically modified form of a naturally-occurring hormone and is very similar to the natural substance. There-

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Plant growth

-Continued from page 1

fore the potential for environmental problems is minimal, according to Professor Mander.

Professor Mander and his colleagues are investigating ways to commercialise the substance. At least in the short term, it is likely that the CSIRO Division of Chemicals and Polymers' pilot plant operation in Melbourne will be used to produce commerical quantities. Eventually it is hoped that a transnational chemical company, perhaps one with an Australian manufacturing operation, will become involved.

Fruits of fundamental research 1: gibberellins

BY LIZ TYNAN

GIBBERELLINS have fascinated chemists and biologists for half a century. These naturally-occurring plant hormones have many variations and possess complex structures and chemistry. The curiosity that they have aroused over the years among scientists such as Professor Lew Mander, Dean of the ANU Research School of Chemistry (RSC), has resulted in some commercially important applications.

"For about 10 years we had worked on what can be described as fairly fundamental explorations of the way one might construct complex molecules," said Professor Mander. "On a not wholly arbitrary basis we had chosen to work in this field of gibberellin chemistry because it presented a combination of challenging science and biological potential."

Work on elucidating methods for the construction of the gibberellic acid (GA) molecule proceeded successfully, and when Professor Mander published his results, there was an immediate response from biologists around the world. They wrote to him, phoned him and came to visit, presenting a whole range of problems they were grappling with concerning GA, in the hope that he might be able to assist them. From that process, Professor Mander developed a worldwide collaborative network of close to 40 research groups working in the general area of plant physiology and horticulture. Within that network, Professor Mander works closely with half a dozen groups.

One of these collaborations, as part of the Cooperative Research Centre for Plant Science, involves scientists at CSIRO's Division of Plant Industry and one from the University of Calgary in Canada. It is this collaborative group which has come up with the growth-slowing GA (see story on page one).

Gibberellins are involved in many phases of plant growth and development. For instance, they initiate germination, promote flowering and inhibit senescence (the yellowing and ripening of fruit or the yellowing and dying of leaves). Also, they cause the spurt of growth in plants just before flowering, commonly seen in lettuce and radish plants at the end of the season. Promoting taller plants would be extremely undesirable in most agricultural plant production, and in fact commercial preparations are available to inhibit the gibberellins from doing this.

Currently there are more than 100 known naturally occurring variations of the gibberellin structure. "One of the things we are trying to work out is why there should be such a variety," said Professor Mander. An enormous amount of effort has gone into unravelling this and other questions, such as how the enzymes already in the plant are able to modify GA which is applied to the plant. Much work on these questions has been undertaken on mutants of barley by Dr Peter Chandler at CSIRO, and on maize at the University of California at Los Angeles by Dr Bernard Phinney.

Commercially available compounds based on GA are used in several agricultural industries. For instance, it is used to produce plump, sweet, seedless grapes. Naturally occurring Thompson seedless grapes are small and deficient in flavour, while seeded grapes are much bigger and tastier. This is because the GA which initiates the flow of sugar and sap into the berry is produced in the seeds, and if seeds aren't there it doesn't occur. By treating Thompson seedless grapes with GA at the time of flowering, then again as the fruit matures, it is possible to produce grapes which match consumer demand more closely.

The GAs which are used to treat grapes are manufactured by the large US chemical company Abbott in North Chicago, for which Professor Mander consults. This company has supported GA research at RSC for some time.

Other GA products which are commercially available include a substance used to keep lemons and oranges in better condition and one to prevent the development of a harmless but unsightly scab on Golden Delicious apples.

"Obviously the companies producing GA products would be very interested if we could develop an expanded market for them, but preferably a different market. I don't think they would be interested if we simply came up with a gibberellin that was 10 times as effective for the uses they already have," said Professor Mander, "but a new application would be a different matter."

And this is what Professor Mander and his colleagues have done. While on the lookout for a promising compound, the researchers have come up with something far better than they had expected.

A range of natural and synthetic variants of GA were made by the scientists for testing, and supplies of one of these, made in Calgary, ran out. Prompted by their CSIRO partners, Professor Mander's group set out to make some more of this particular compound. This they did but when it was assayed it was found to be not nearly as active as the original material produced at Calgary.

-Continued on page 11

Gibberellins

-Continued from page 7

"We went back to the empty bottles and by running a trace of the residual material through a mass spectrometer we were able to determine that there was an impurity in the original material. Moreover we were able to work out the structure of the impurity and prepare good quantities for further testing. We found that it was significantly more active than the main material," said Professor Mander.

What they had was a modified form of a natural gibberellin which had been accidentally produced by a biologist in Calgary, as an impurity in the main substance.

"I don't think we would have ever set out to make that compound or to test it for this purpose," said Professor Mander. "It was in a sense in the opposite direction from where the systematic, logical approach was taking us."

Having produced the first generation of this compound, the scientists undertook an exercise designed to protect their patent, by identifying a dozen variants on the substance that a competitor might try to produce. Although these products proved to be no more effective and therefore commercially uninteresting, an "intermediate" substance made during the process unexpectedly turned out to be 10 times as active as the original compound. It is this substance which is being investigated as a growth inhibitor.

"So many discoveries in science do not come about through a linear progression," said Professor Mander. "They come about because we keep our eyes and our ears open, and because we are thorough about what we do and from time to time we stumble across a chance discovery.

"What is important is being able to recognise the possibilities and run with them. That occurs not only with our own work but with work being done by people in other groups and other disciplines.

"Serendipity is a somewhat debased term, being taken by many to mean a fortuitous discovery. But according to the correct definition, it involves a capacity to recognise the significance of the discovery.

"It requires a prepared mind to recognise the potential – that is an essential and integral part of what serendipity is about."

12 – Wednesday 8 June 1994 ANU Reporter

Leo Radom first Australian to win Schrödinger Medal

Photo: Darren Boyd, Coombs Photography

A scientist at the ANU's Research School of Chemistry (RSC) has become the first Australian to win the Schrödinger Medal, a major international award in theoretical chemistry. Among the previous 17 recipients of the Medal, there have been three Nobel Prize winners – Kenichi Fukui, William Lipscomb and Roald Hoffman.

Professor Leo Radom has received the 1994 Schrödinger Medal from the France-based World Association of Theoretical Organic Chemists (WATOC) for his "outstanding contributions to theoretical and computational chemistry" over a 25-year career. Professor Radom's field of research is computational quantum chemistry. He uses computer calculations to make predictions of molecular structures and reactions.

ANU Reporter Wednesday 11 May 1994 – 3

11 MAY 1994

Prof Athel Beckwith, Prof L Mander, Dr Mick Collins

Dr R. Bramley

Prof Sargeson Prof Bennett Prof Rickards

PROF BIRCH.

Dr Bruce Wild & Peter Osvath.

Prof BIRCH.

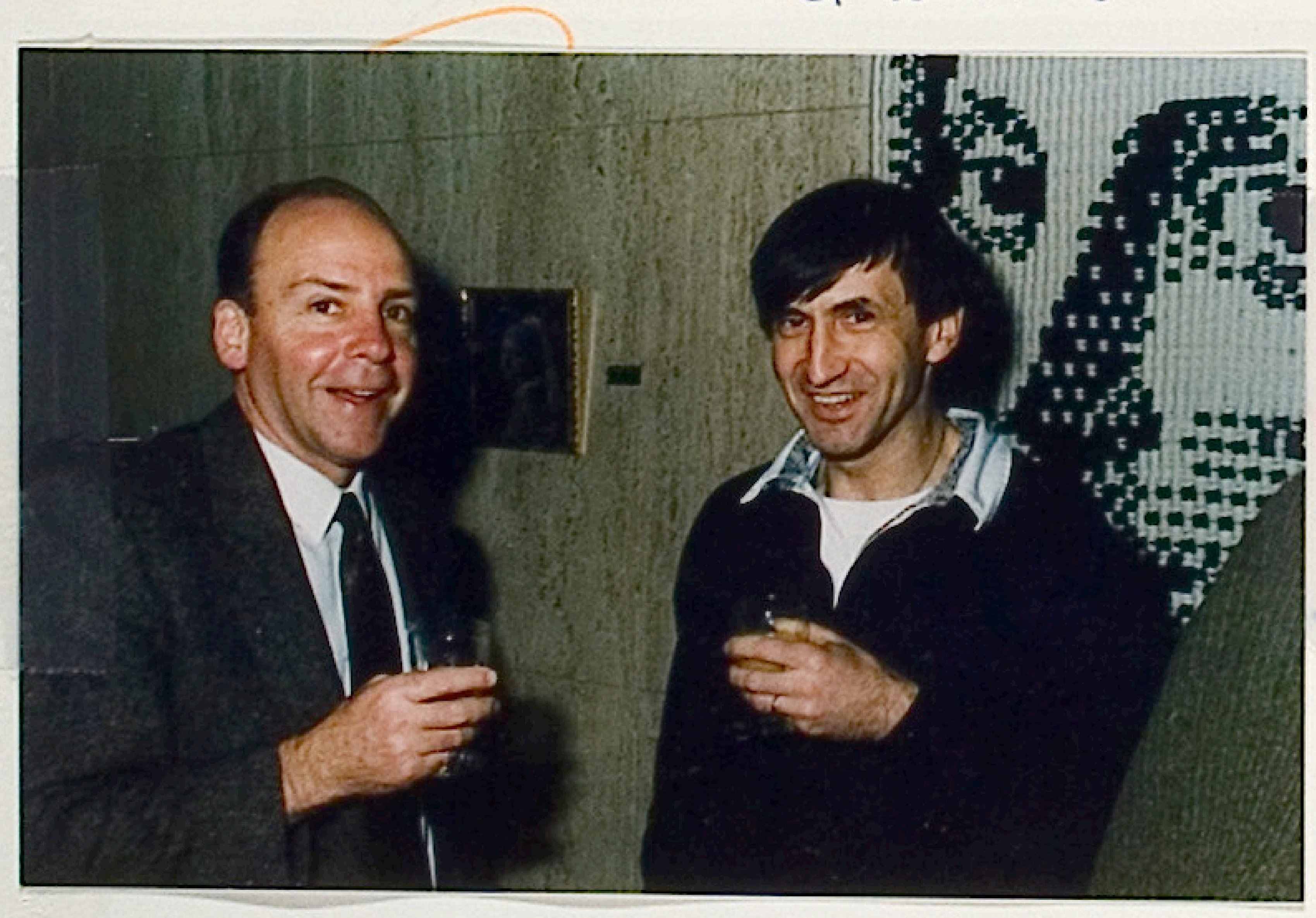
BIRCH LECTURE

Dr Elmars Krausz Dr G. Heath

Dr M. Perkins Chris Love

Dr John Lambert

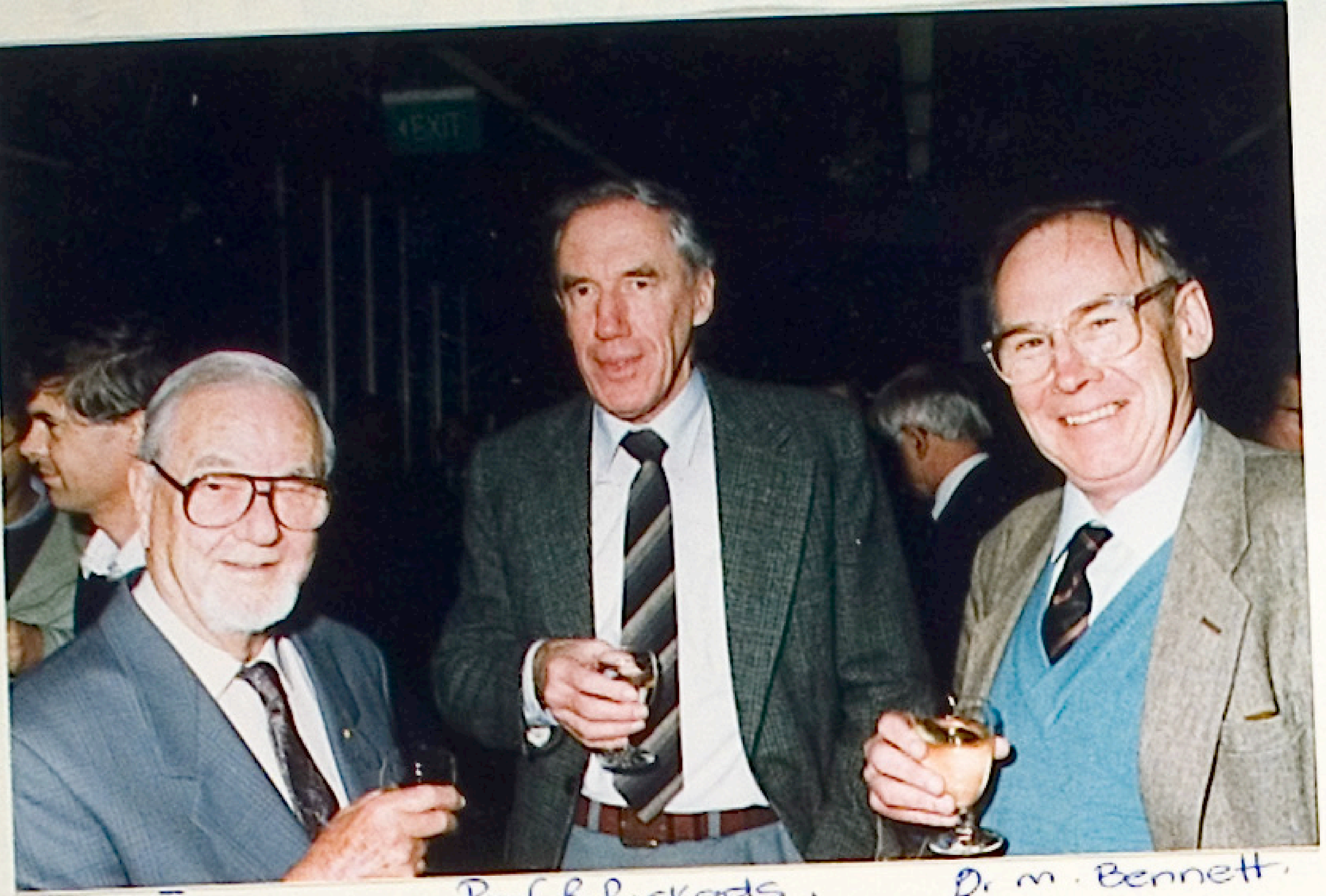
Prof Williams



Prof Beckwith & Prof L. Mander.

Prof White

Prof Sargeson



Prof Birch   Prof R. Rickards.   Dr M. Bennett.

Dr Macleod.   Dr Welberry   Dr Keniry

BIRCH LECTURE

11 MAY 1994

RACI Fellowship for Arthur Birch

EMERITUS Professor Arthur Birch, one of the founders of the ANU's Research School of Chemistry and now a Visiting Fellow in the Chemistry Department, is to receive an Honorary Fellowship of the Royal Australian Chemical Institute, only the eighth such Fellowship ever awarded by the Institute.

According to the Institute, Professor Birch was recommended for the award because of his "immensely distinguished contributions to chemistry".

ANU Reporter Wednesday 24 August 1994 — 13

Canberra Times 10/8/94

Professor Andrew Cockburn and Dr Rosemary Martin, a lecturer in neuroscience, in a crowded lecture room.

Facilities crowded and unsafe

By JANE DARGAVILLE

THE FOUNDATION head of the Division of Botany and Zoology at the Australian National University, Andrew Cockburn, has threatened to resign over the condition of the buildings which have housed his staff and students for the past three and half years.

Professor Cockburn says that all the staff and students in the division, including about 50 PhD students, are working in either severely over-crowded, unsafe or illegal environments.

"Nearly everything we do here is blatantly illegal," a disappointed Professor Cockburn told *The Canberra Times* this week.

He claims the ANU council, at its regular meeting last month, voted to halt the commencement of construction of a new building, which was to have eased the situation in his own division, in response to complaints from a senior academic in another department that the new building would ruin the view from his window.

According to Professor Cockburn, this decision, which was taken "just as the bulldozers were about to move in", cost the university $330,000 in funds committed to contractors.

"Even if council were to reverse that decision at its meeting this Friday, that sum would still be lost," said Professor Cockburn.

"Beyond that, it means that the time tabling of a whole series of moves, which were to have taken place to enable my division to be adequately accommodated, have been destroyed."

The Division of Botany and Zoology, responsible for about 1000 undergraduate students, is housed across several buildings on the west side of the campus.

Some of the temporary buildings, converted into laboratories, were bought from Parliament House construction site.

"This is an office building ... it has got carpet and yet we're using highly toxic chemicals. As well, we're trying to do microscopy and create sterile cultures in an unstable and filthy environment."

When it was set up in 1991, says Professor Cockburn, he was promised that suitable, permanent accommodation would be provided by the middle of 1994.

However, in the ANU's "desperation" to get an engineering faculty up and running, a series of ill-judged decisions were made, he said. In domino style, engineering was moved into the geology building, geology was moved into the botany building and botany was moved into the psychology building.

"The new building was to have been for the physicists, so the psychologists could move to where the physicists are now and we could have moved into the psychology building."

Professor Cockburn says that because of council's decision, the earliest his division is likely to be move into its new accommodation is 1996.

"This was something people put up with in good faith ... but if they don't come to some sort of solution, I guess I'll have to quit as head."

OPENING OF THE NEW

BRAMLEY'S BAR

1994


Bramleys Bar


EXIT
Bramleys Bar


Bramleys Bar

RSC Reactions

Newsletter to the alumni and friends of the Research School of Chemistry

Research School of Chemistry
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Extension Nearing Completion

The Dean, Lew Mander, checking on progress with the School's Technical and Business Manager, John Eichholzer - behind them the link is taking shape.

Construction of the School's new wing is on target for completion in March next year. Where once the Corin Dam Huts housed theoretical chemists, computer terminals and Byam's studio has risen a modern three-storey structure which will increase floor space by about one third.

As reported in the previous issue of *RSC Reactions* the 36 by 18 metre extension commenced in June of this year. The project has progressed at a remarkable pace, providing an insight into 1990s construction techniques. The Wild and Mander group labs on the eastern corner of the main building have provided the best vantage points, tempting residents of those labs to charge an entrance fee to the throngs of sightseers.

The link between the new wing and the main building is completely glassed-in and incorporates bridges on the second and first floors above a ground floor entrance way. The construction of this all-glass link is proving most challenging for the engineers but, when complete, will be the most striking architectural feature of the extension.

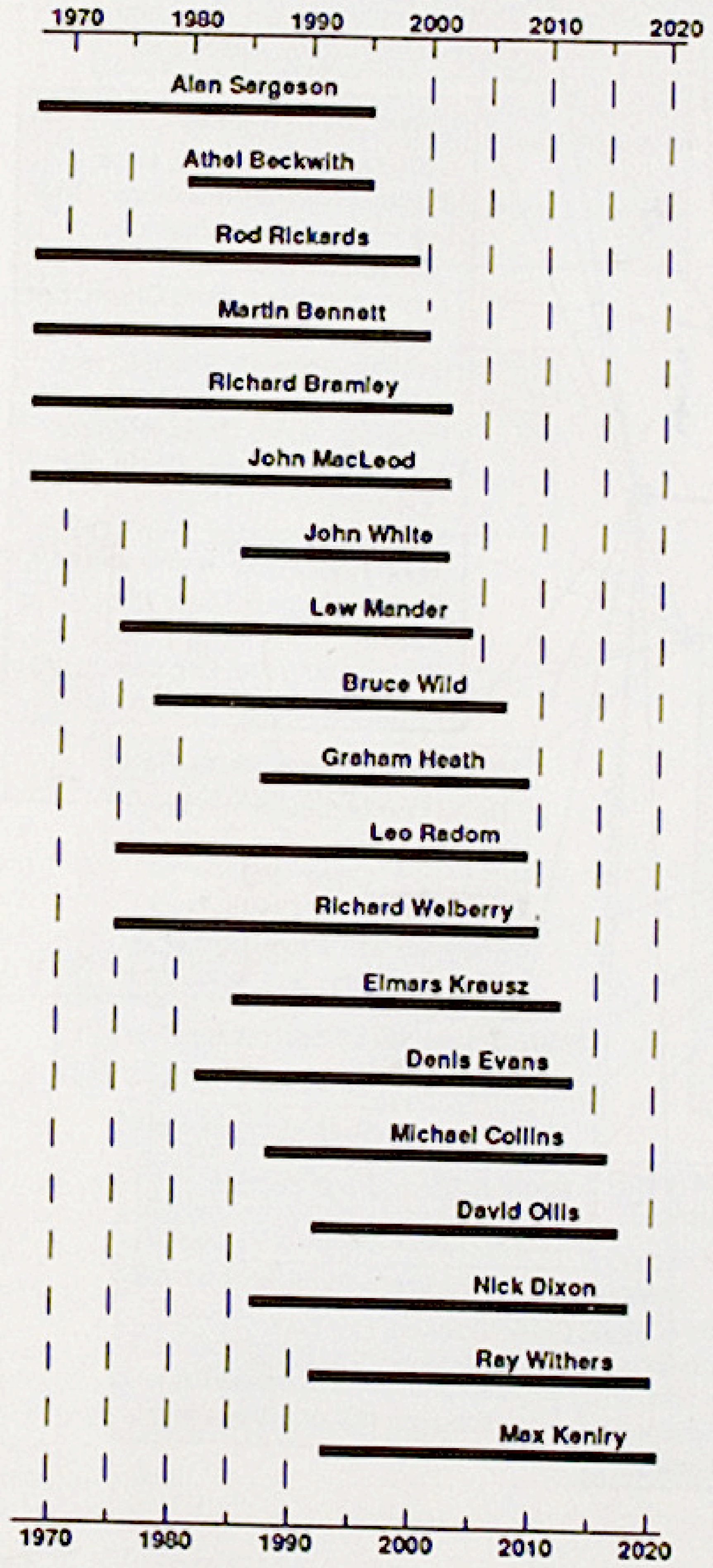
The north-facing area bounded by the new wing, the glassed-in link and the main building is to be landscaped. As the new tearoom on the ground floor of the extension overlooks this area it is likely to become the new focus of social activity in the School.

Construction will reach "lock-up" stage by Christmas allowing just over two months for fitting out. Due to a shortfall in capital funds the ground floor will not be seen in its final form until 1995.

The official opening of the new wing will take place in April or May, though the exact date is yet to be finalised. Alumni who would like to join present RSC staff at the opening celebrations should contact the School early in the New Year for details.

The Corin Dam Huts - the Australian Heritage Commission did not stand in the way of their removal!

Lifetime of the School's Research Groups



The Changing Face of RSC

New Academic Appointments since 1990

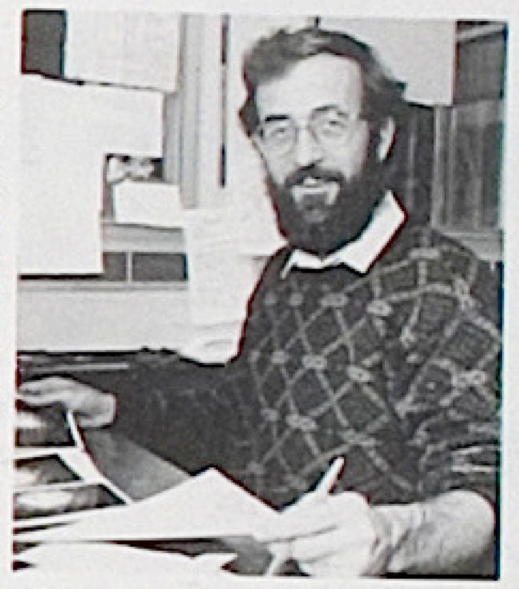
Outside the ANU few realise that only about one third of academics employed at RSC have tenure. Of course it will come as no surprise to RSC's alumni, as many of you made up the two thirds who did not.

To say that throughout the life of RSC there has been a healthy flow of new blood through its arteries would be an understatement. However, the large number of post-doctoral and research fellows coming and going each year tends to overshadow the turnover in tenured academic staff.

A rough calculation of this turnover can be made by dividing the number of group leaders (~ 20) by the duration of tenure (~ 30 years). To maintain the *status quo* a new group leader must be appointed about every eighteen months. The chart (left) juxtaposes the timelines for the School's tenured group leaders.

To bring you up to date with the tenured new blood, brief profiles of such appointees since 1990 appear below.

Ray Withers BSc, PhD *Melb.*



Ray, 38, was born and bred in Aussie Rules territory, in Wangaratta, Victoria. He received his tertiary education at Melbourne University, and in 1981 completed his PhD in the Physics Department under the supervision of Dr Les Bursill. After post-doctoral stints in Toronto, Canada, and Bristol in the UK, he joined Professor Bruce Hyde's Solid-state Inorganic Chemistry group in January 1986 as a Research Fellow. In 1989 he was promoted to Senior Research Fellow.

On the retirement of Bruce Hyde at the end of 1990, the School decided to maintain a research group in solid-state inorganic chemistry and Ray was successful in competing for the job. In December 1991 he was appointed as Fellow and group leader.

Ray concedes that he is a latter-day convert to chemistry, his background being in electron microscopy, solid-state physics, group theory and modulated structures. His apprenticeship with Bruce Hyde allowed him to apply his considerable physics and mathematics expertise to the wealth of crystal structure problems available to crystal chemists.

A major focus of his work has been non-molecular solids which have modulated crystal structures, the description and refinement of which is at the leading edge of crystallography.

Put simply, a modulated structure can be envisaged as one which has a simple average structure with 3-D periodicity. This average structure is then perturbed periodically, with a longer wavelength. The elegant way of dealing with modulated structures is in 4-, 5- or even 6-dimensional space. As a solid-state chemist with a physics upbringing Ray has no problems imagining such higher-dimensional crystals.

Ray is recognised internationally for his work in observing and characterising modulated structures in a wide range of systems, from refractory oxide ceramics to high-Tc superconductors, from silicate minerals to chalcogenide semiconductors. He publishes prolifically and has

Laser chemistry right on target

BY MARITA BLACK

AN "optical" computer able to operate at ultra high speeds and a "chemical" solar cell are just two of the technologies which could arise from powerful advances in spectroscopic techniques. Scientists in the ANU Research School of Chemistry (RSC) are at the forefront of the relatively new field of laser spectroscopy, which has the potential to leap-frog from being a tool of fundamental research to be the cornerstone of a set of applied technologies.

Spectroscopy allows chemists and physicists to peer into the atomic structure of molecules. Electronic transformations which occur by interaction with visible wavelengths of the spectrum can be studied using a conventional light source such as a lamp, or, in the case of laser spectroscopy, a laser light source.

Dr Elmars Krausz and Dr Hans Riesen of the Laser and Optical Spectroscopy group at RSC are making revolutionary studies of the electron transfer processes which occur in coordination compounds. Such compounds comprise a central metal ion surrounded by a number of organic molecules. When stimulated by light, electrons travel between the metal ion and surrounding molecules, in a transfer of energy likened to an electronic "switch".

If harnessed, this electronic switching could be used for the storage of visible light in a "chemical" solar cell, or for stimulating electronic circuits. Dr Krausz said that "optical" computing using coordination compounds to store and retrieve vast amounts of electronic information at ultra high speeds could be possible.

Laser spectroscopy enables single molecule units in a crystal to be studied, said Dr Krausz. With conventional spectroscopy, the wavelength range of the light source is too broad and not powerful enough to examine single units.

In a so-called "perfect" crystal, the units are arranged in an identical manner, but this is not the case for a real crystal, where each unit has a slightly different environment. Measurements made with conventional light sources are average readings from many units, and may be significantly distorted. Laser beams, in comparison, are incredibly intense and finely tuned and can resolve such distortions to give a clear picture of the electronic structure of individual units.

According to Dr Krausz, one of the real strengths of laser spectroscopy is that it provides a valuable bridge between the fields of physics and chemistry, allowing a stimulating exchange of ideas and information which benefits both disciplines.

Next *Reporter*

All material for the next issue of *ANU Reporter* should reach our office by 5pm on Monday 31 October, for publication in the issue of 9 November.

SYMPOSIUM DE CHIMIE SUPRAMOLÉCULAIRE DES MÉTAUX DE TRANSITION

Professeur Alain M. Sargeson
Australian National University
Camberra Australie
Illustre Conférencier

dédié à Françoise Moulines
sous la présidence
de Jacques Joussot-Dubien

Les 10 et 11 octobre se tiendra, à l'Université Bordeaux 1 (amphi Kastler) le Symposium de Chimie Supramoléculaire des Métaux de Transition qui regroupera plus de 200 participants. Six conférences seront prononcées par six chimistes de très grande réputation internationale. Il débutera le lundi 10 octobre à 14h par la conférence extraordinaire du Professeur Harry B. Gray et se terminera le mardi 11, de 11h à 12h, par le non moins remarquable exposé du Professeur Jean-Pierre Sauvage, premier élève de Jean-Marie Lehn. **Le Symposium est ouvert à tous, enseignants-chercheurs et étudiants même non-inscrits.**

PROGRAMME

LUNDI 10 OCTOBRE

14h

Présentateur-Modérateur : Jacques Joussot-Dubien (Bordeaux)
Harry B. Gray (Caltech, Pasadena, Californie, USA)
Membre de l'Académie des Sciences USA, Médaille Priesley
«Electron Transfer in Proteins»

Présentateur-Modérateur : Jean-Pierre Launay (Toulouse)
Alan M. Sargeson (Camberra, Australie)
Fellow of the Roayl Society, Fellow of the Australian Academy, Dr HC
«Metal Ions in Organic Cages : A Confluence of Organic and Inorganic Chemistry»

16h
Pause

16h30

Présentateur-Modérateur : Henri Bouas-Laurent (Bordeaux)
Vincenzo Balzani (Bologne, Italie)
Médaille d'Or Cannizzaro, Franqui Chair (Leuven), Dr HC
«Photochemistry and Photophysics of Supramolecular Systems Involving Inforganic Complexes of Transition Metals»

MARDI 11 OCTOBRE

8h30

Présentateur-Modérateur : Gilbert Balavoine (Toulouse)
Henri Kagan (Orsay, France)
Institut Universitaire de France, Académie des Sciences
«Les Composés Ferrocéniques à Chiralité Plane : Synthèse Asymétrique et Utilisation pour la Préparation de Ligands Chiraux»

Présentateur-Modérateur : Michel Pereyre (Bordeaux)
Henri Brunner (Regensbourg, RFA)
Prix Humboldt
«Right of Left in Chemistry - Enantioselective Catalysis with Transition-Metal Complexes»

10h30
Pause

11h

Présentateur-Modérateur : Didier Astruc (Bordeaux)
Jean-Pierre Sauvage (Strasbourg, France)
Médaille d'Or Prelog, Académie des Sciences
«Objets Moléculaires Impossibles : des Nœuds Moléculaires aux Caténanes Doublement Entrelacés».

Opening of David Craig Building

February 27, 1995

Number 4 1995

Staff News

The Australian National University

Wednesday 8 March

School of Chemistry opens wing and honours founder

The Research School of Chemistry has opened a new $2.75 million wing, which is designed to meet the expanded needs of the School in biological, theoretical and physical chemistry, areas in which the School has achieved international recognition.

Opened on 27 February by Mr Ted Lindsay, Parliamentary Secretary to the Minister for Industry Technology and Commerce, the new wing is named after Professor David Craig who co-founded the School with Professor Arthur Birch and was later, twice Dean between 1970-73 and 1977-81.

Professor Craig was also the first Professor of Physical Chemistry at the University of Sydney between 1952-56 and President of the Australian Academy of Science between 1990-'94.

In his speech at the opening Mr Lindsay thanked Professor Craig for his contributions to public policy as Chairman of the Bilateral Programs Committee of the former Department of Science between 1985-88 and as a member of the Prime Minister's Science and Engineering Council between 1992-94.

"His advisory role have been symbolic of the important service rendered to the nation by the Research School of Chemistry," Mr Lindsay said.

ANU Vice-Chancellor, Professor Deane Terrell said at the opening that the basis of the strength in the Research School of Chemistry was set in place by Professor Craig and Professor Birch.

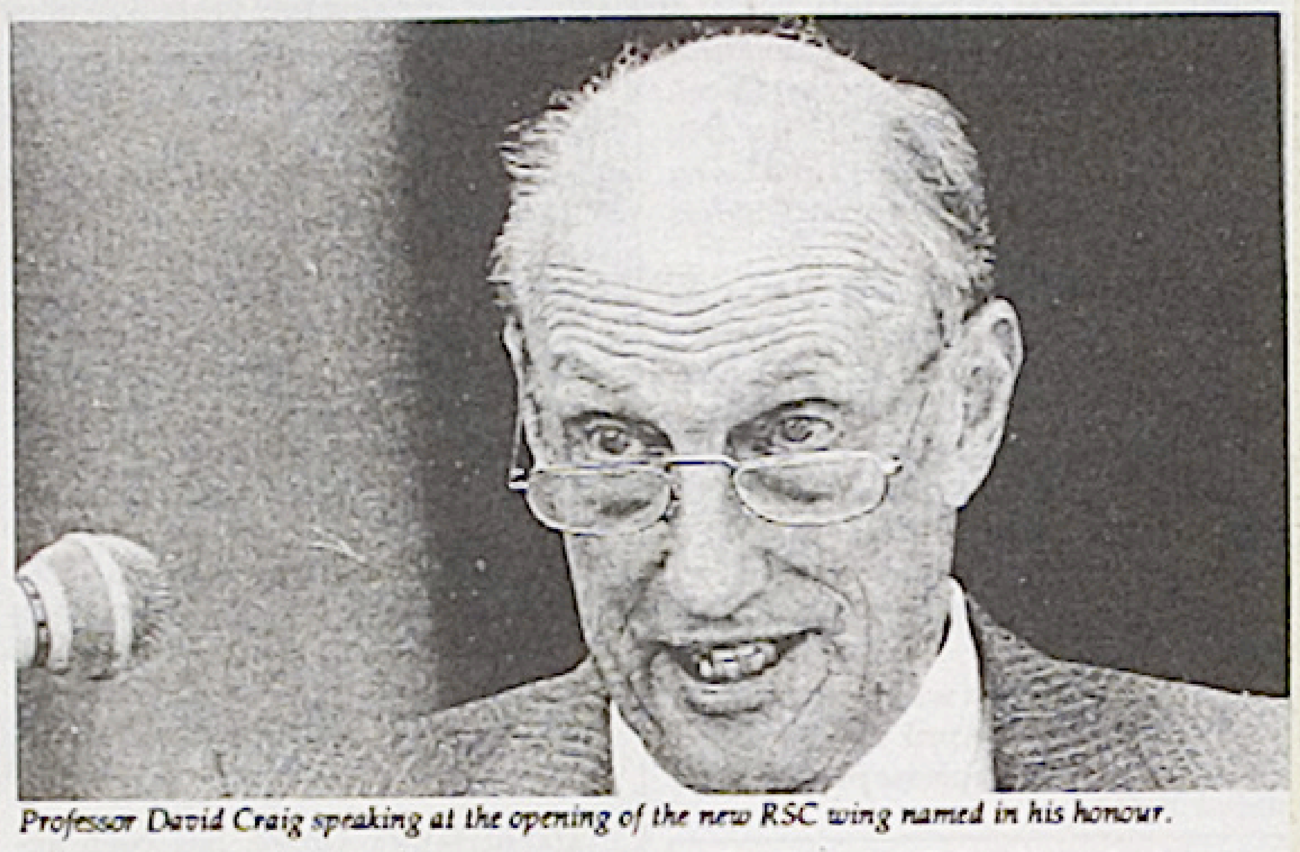
"Today is the occasion on which we honour the part Professor David Craig has played," he said.

"Since its foundation in 1967 the Research School has played a lively part in the development of the University. Distinctive styles of governance were set by the Founding Fathers; the School has a Dean rather than Director, this, we are assured, to embody the longstanding academic principle of first amongst equals. The non-departmental structure of the School, and its modus operandi, with competitive allocation of funding in all categories on an annual basis, place the onus of quality and competitiveness upon each tenured staff member.

"The School feels in this that it set a good example, and such ideas have over the years been adopted in other parts of the University.

"The School is very proud of the measures which have provided its flexibility of funding and governance, and attributes to these some of the national and international success that it has attained.

"They have allowed the School to make strategic shifts in its research profile which complement those in other universities," Professor Terrell said.



Professor David Craig speaking at the opening of the new RSC wing named in his honour.

The Research School is at the forefront in Australia of core research in organometallic chemistry in the synthesis of catalyst materials, electrochemistry and solid state chemistry.

Two strategic development proposals on new generation crystallography and polymer physical chemistry have started in the last three years and a new one on molecular recognition will start in 1995/96.

The fundamental Research work in RSC has led to the development of commercial applications such as new product for environmental clean-up and industrial processes. The new absorbent material is readily made from kaolonite, an abundant mineral found in high purity in Queensland. A pilot production plant will soon be operating in the School as part of a venture which will add value to an important Australian mineral source.

INSIDE: ANU merges main purchasing operations p3; Noticeboard p4; Staff Services p5; Grants Awards p6.

Research School of Chemistry
THE AUSTRALIAN NATIONAL UNIVERSITY

The Dean, Professor John W. White

invites

....

to attend the Opening of the

Research School of Chemistry
David Craig Building

by

Senator the Hon. Peter Cook
Minister for Industry, Science and Technology

Monday 27 February 1995, 10.30 am

Venue: Research School of Chemistry
Science Road, Acton

Light Refreshments will be served after the Opening
11.30 am - 12.00 noon

RSVP - Mrs Heather Jauncey 249 3578 - 17 February 1995

...dial invitation to attend the Opening of the David Craig Building at ... 27 February. Would you please assemble in the Courtyard outside ...he Extension *no later than 10.55am*.

...Minister for Industry, Science and Technology, will officially declare ...here will be four five minute speeches by Senator Cook, the Vice- ... Craig and myself.

...sion you are also invited to join the rest of the RSC staff in a Sausage ... School in the Courtyard from 12.30 - 2.00pm.

...ting with you on this memorable occasion.

Opening of David Craig Building

February 27, 1995

The Australian National University

Opening of David Craig Building
Monday 27 February 1995
PROGRAM

10:30am Arrival of Hon Ted Lindsay at main entrance of the School. Met by Dean and taken on Tour of the David Craig Building accompanied by Professor Deane Terrell, Miss Pauline Griffin, Professor Sue Serjeantson, Professor David Craig. Official Guests not going on the Tour or arriving late to be entertained in the Foyer - Morning Tea.

10:55am Official Party assembles in the Foyer leading to the David Craig Building at ground level.

11:00am Introduction by Professor White - 5 mins

Opening speech by Hon Ted Lindsay - 5 mins

Speech by Professor Terrell - 5 mins

Response by Professor Craig - 5 mins

11:20am Professor White - Invitation to Official Guests to move into Board Room for refreshments and any of these Guests who desire a Tour of the building are escorted in groups of up to 6 (?post Mr Lindsay's departure).

11:30am Mr Lindsay departs.

12:30pm School staff, students and visitors assemble in the Courtyard for barbecue.

Professor White addresses the assembly, introducing Professor Craig, and any other Official Guests still present.

Research School of Chemistry
THE AUSTRALIAN NATIONAL UNIVERSITY

The Dean, Professor John W. White

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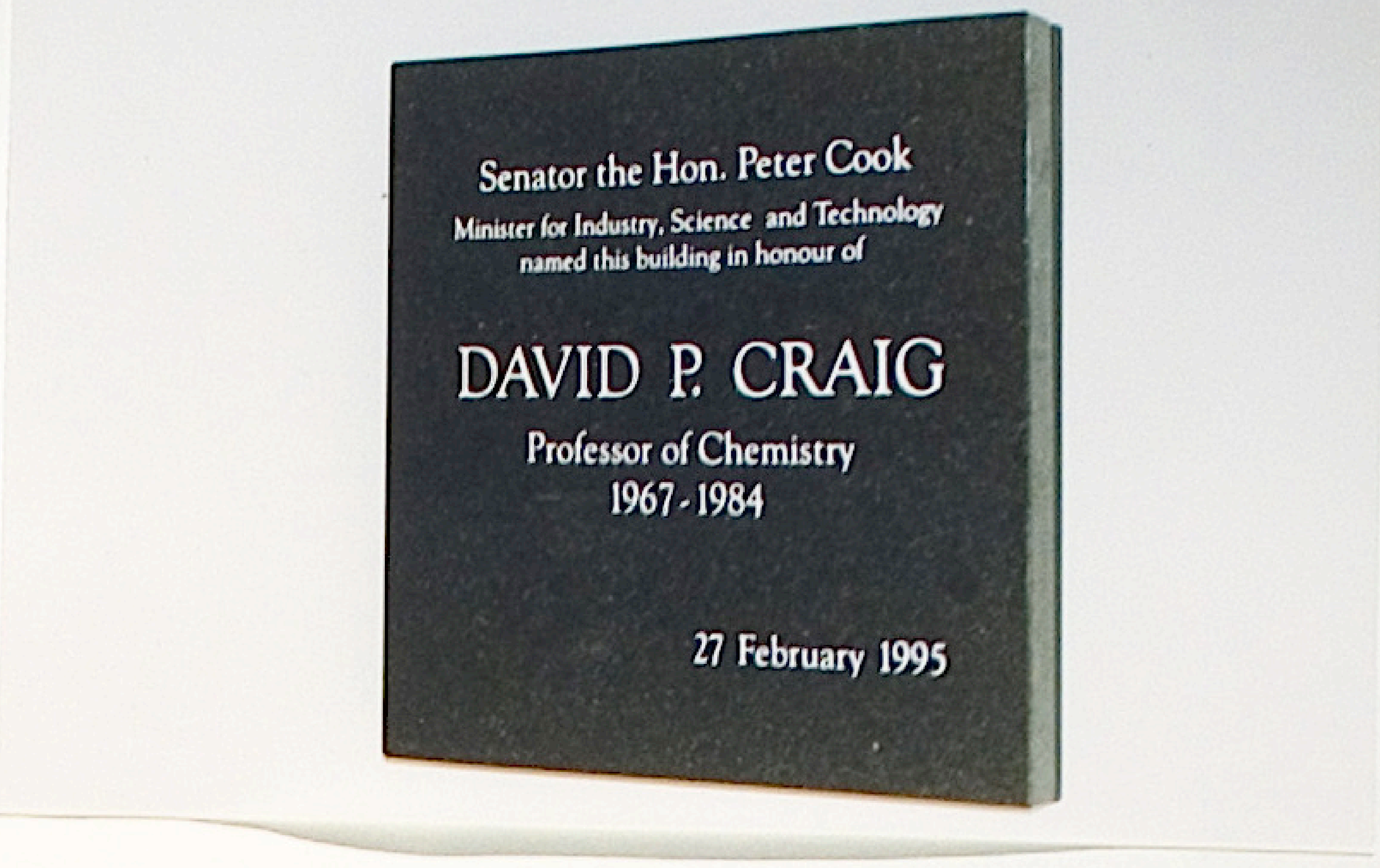
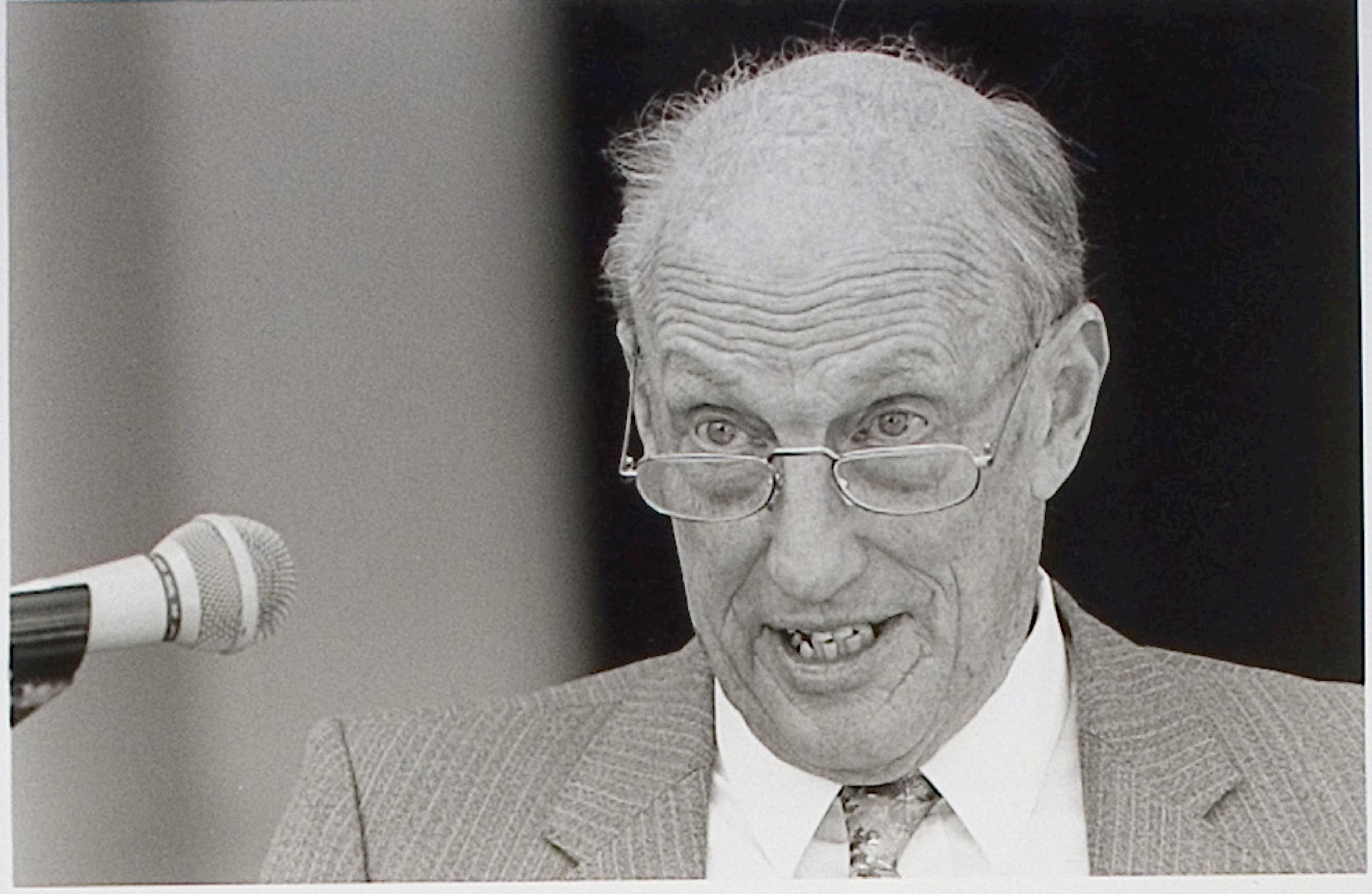
RESEARCH SCHOOL
OF
CHEMISTRY
DAVID CRAIG
BUILDING


Senator the Hon. Peter Cook
Minister for Industry, Science and Technology
named this building in honour of
DAVID P. CRAIG
Professor of Chemistry
1967 - 1984
27 February 1995


ANU

Extras



Extras

Johann Wolfgang Goethe-Universität
Frankfurt am Main

Our University Newspaper

Nr. 5
10. Mai 1995
Jahrgang 28

Uni-Report

D 30699 D

Rolf-Sammet-Gastprofessur

Interdisziplinärer Brückenschlag

Eine Lücke im Vorlesungsangebot der Chemiker und Biologen schließt der diesjährige Inhaber der Rolf-Sammet-Professur, Professor Dr. Alan M. Sargeson. In einer gemeinsamen Gastprofessur von Chemischen Instituten und Biozentrum wird Alan M. Sargeson in zwölf Vorlesungen zum Thema „Topics of Complex Chemistry and Bioorganic Chemistry" sprechen. Damit ergänzt der Komplex-Chemiker nicht nur das Lehrangebot der Anorganischen Chemie, sondern bereichert auch die stark biologisch ausgerichtete Organische Chemie mit ihrem Graduierten-Kolleg sowie die Arbeitskreise des Biozentrums.

Der 1930 in Australien geborene Alan M. Sargeson studierte an der Universität Sydney Chemie, seit 1978 lehrt er als Professor für Anorganische Chemie an der australischen National-Universität des Regierungshauptsitzes Canberra. Sein Hauptinteresse gilt der Koordinationschemie von Metallionen und deren Rolle in der Synthese, der Stereochemie und den Mechanismen von Reaktionen. Besonderer Schwerpunkt ist die durch Metallionen geförderte Organische Chemie und die Rolle von Metallionen in Biologie und Medizin.

Alan M. Sargeson wurde vielfach ausgezeichnet; er ist Mitglied zahlreicher Akademien, so seit 1983 Fellow of the Royal Society, und hat, wie vergangenes Jahr am Massachussetts Institut of Technology oder am CALTECH in Pasadena, Gastprofessuren wahrgenommen. UR

nung heute zu diskutieren.

Beitrag für politische Praxis

Kants Friedensschrift, seine Idee eines Friedensbundes zwischen den Staaten und einige unverzichtbare Rechtsprinzipien auch im zwischenstaatlichen Verhältnis haben mehrmals beim Versuch der Staatsmänner, eine friedvolle Weltordnung zu bauen, Pate gestanden: einmal zu Beginn des 20. Jahrhunderts bei der Gründung eines Völkerbundes und nach dessen politischem Scheitern bei der Proklamation der Charta der Vereinten Nationen.

Doch gerade angesichts der dramatischen Veränderungen der internationalen Politik nach dem Ende des kalten Krieges und der neuen Herausforderungen, mit denen sich die UNO konfrontiert sieht, ist es Absicht der Konferenz, die überlieferten Konzepte wie auch Kants Friedensidee zu überprüfen. Das Konzept von Recht und Frieden zwischen den Staaten steht dabei ebenso auf

die (Frankfurt), Hauke Brunkhorst, Ernst-Otto Czempiel (beide Frankfurt), Thomas McCarthy (Chicago), Richark Falk (Princeton), Jürgen Habermas, Axel Honneth, Friedrich Kambartel (alle Frankfurt) und andere.

Die Arbeit der Konferenz soll im kommenden Jahr durch eine internationale Tagung zum Thema „Kosmopolitismus" in St. Louis fortgesetzt werden. UR

Neu: „Stellen aktuell"

Die Stellenanzeigen erscheinen ab sofort nicht mehr im Uni-Report, sondern erhalten eine eigene Publikation, die von der Personalabteilung betreut wird. „Stellen aktuell" erscheint alle zwei bis drei Wochen und wird wie „Uni-Report aktuell" an den zentralen Infostellen ausgelegt.

Rückfragen bitte an Hans-Peter Glück, Telefon 798-23229, oder Karl-Heinz Böff, 798-23939 (Personalabteilung). UR

und Michael Göbel, beide vom Institut für Organische Chemie, sowie Verena Lobsien, Anglistin am Institut für England- und Amerikastudien, wurden für das „nach besonders strengen Maßstäben" vergebene Programm ausersehen. Heisenberg-Kandidaten hätten erfahrungsgemäß gute Chancen, auf Professorenstellen berufen zu werden, heißt es in der Mitteilung der DFG. UR

Schon gewußt, daß im Sommersemester 1995

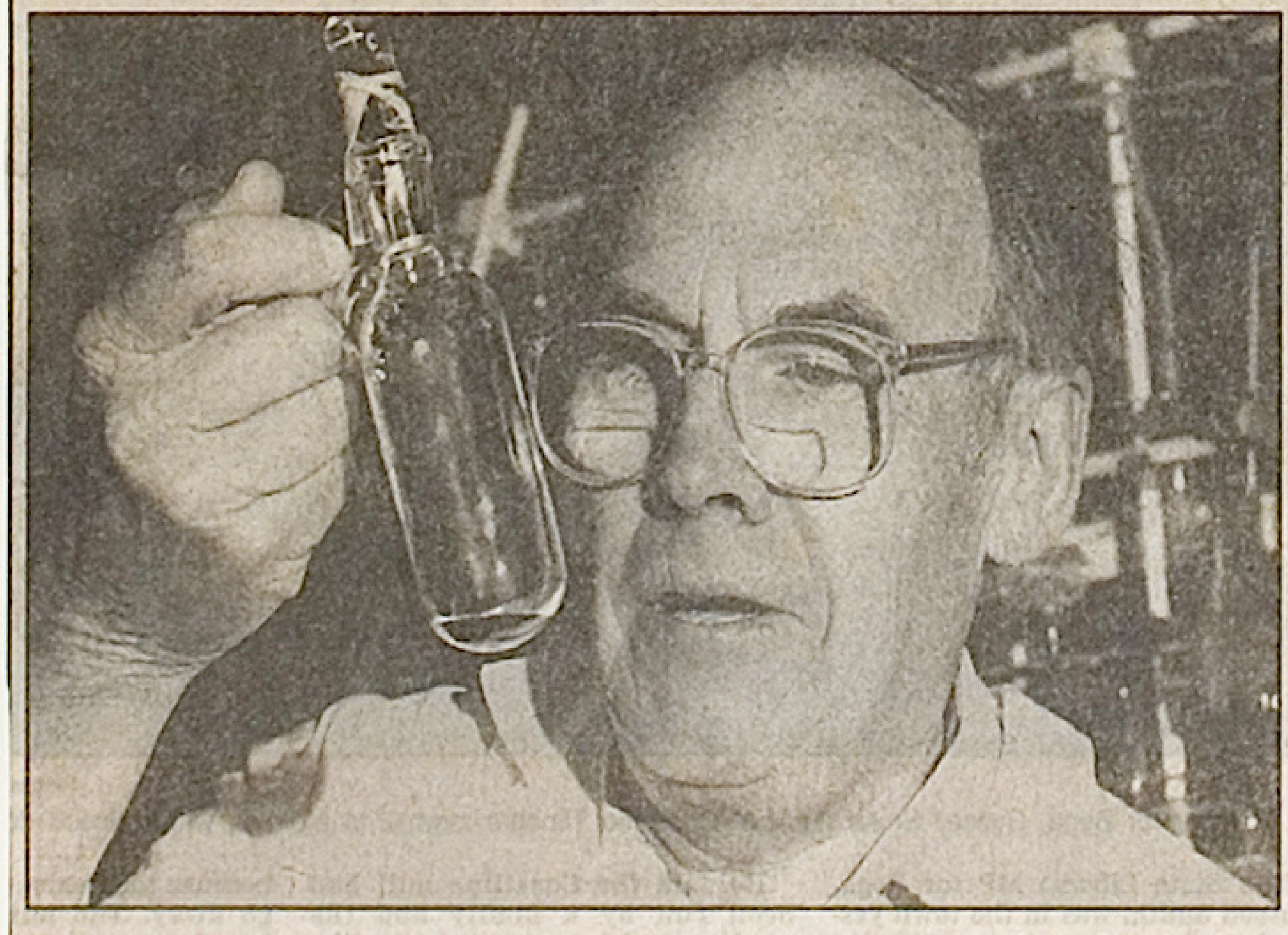
... an der Universität Frankfurt ca. 36 500 Studierende, also rund 1000 weniger als im vergangenen Semester, ihren Geschäften nachgehen,

... 2536 Studierende (inklusive Fachwechsler) in ihrem Studentenausweis die Notiz „1. Fachsemester" tragen,

... 2281 Studierende erstmals ihren Fuß in die Uni Frankfurt setzen, davon 1780 Erstsemestler

... und in den Numerus-clausus-Fächern VWL und BWL jeweils rund 100 Plätze unbesetzt blieben?

Honour for scientist



Picture: RICHARD BRIGGS

Martin Bennett — now a fellow of the Royal Society for his work with organo-metallic chemistry.

By SIMON GROSE

"It always seems to be regarded as more prestigious than being elected to the Australian Academy, and that sort of worries me a bit," was one way Professor Martin Bennett reacted to his election as a Fellow of the Royal Society.

Professor Bennett, of the ANU's Research School of Chemistry, also thanked his lucky stars.

"It's a once in a lifetime thing. For a guy in my position, it's among the top things you can get. But it's a lucky thing. There are some good people that I know who are not in it. A lot of luck goes into these things."

Along with Professor Graham Farquhar, of the ANU's Research School of Biological Sciences, and Professor Jeremy Pickett-Heaps, of the University of Melbourne, Professor Bennett joined about 1100 Royal Society fellows around the world, 70 of whom are based in Australia.

He still does not know who nominated him or why, but he believes it was for 28 years of organo-metallic chemistry at the ANU. He is expert in using metallic catalysts to convert carbon-based organic materials into new forms, a branch of chemistry which provides many things we take for granted, like plastic bags and bottles.

He will return to London, where he was born and educated, to accept his new honour. But he will keep his qualms about our "cultural cringe" over gongs from the old country, and thank his lucky stars again for bringing him to Australia 28 years ago.

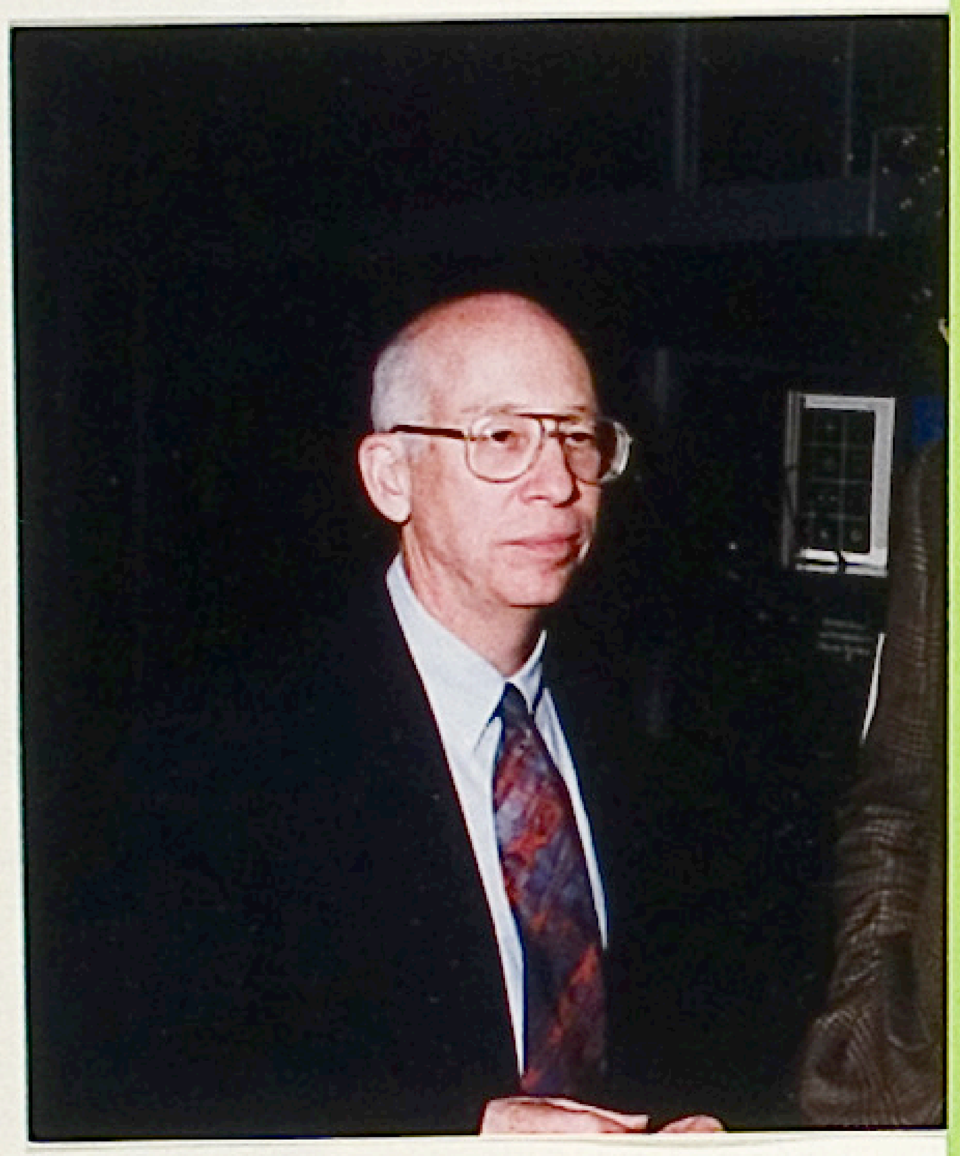
from:

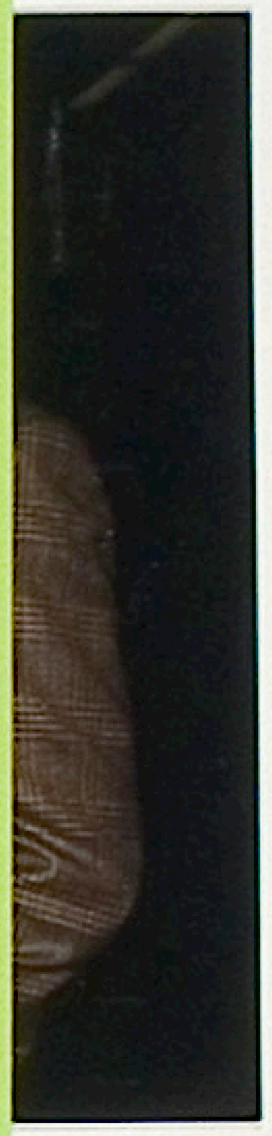
The Canberra Times

March 11, 1995

March 29, 1995

The A. J. Birch Lecture





THE ANU PUBLIC LECTURE SERIES

THE AUSTRALIAN NATIONAL UNIVERSITY

RESEARCH SCHOOL OF CHEMISTRY

The A J Birch Lecture

Activation of Hydrocarbons with Transition Metal Compounds

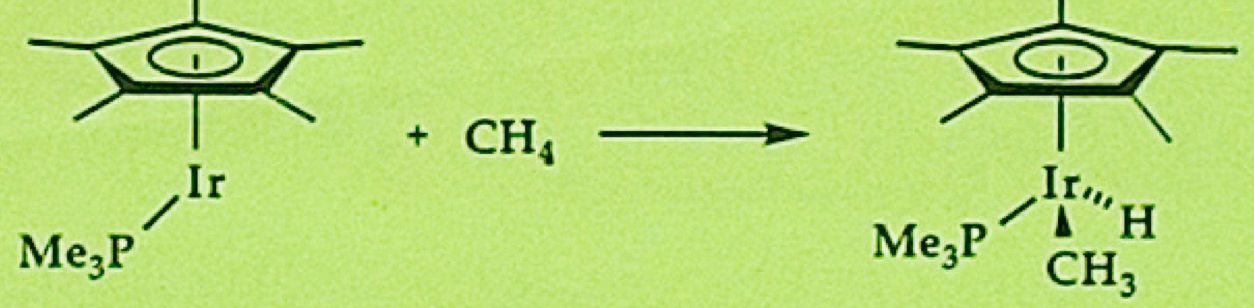
by

Professor Robert Bergman

Professor of Chemistry at the University of California, Berkeley

Monday 29 May 1995 at 8.00 pm

Research School of Chemistry Lecture Theatre, Daley Road ANU
Science



Paraffins (saturated hydrocarbons), the main constituent of petroleum, are very inert materials and cannot be used routinely for chemical synthesis. Professor Bergman will describe a new approach to the activation of paraffins that employs compounds of transition metals

This lecture is free and interested members of the public are invited to attend.
Inquiries to University Public Affairs, tel: (06) 249 2229/ 249 4144
or to the Dean, Research School of Chemistry (06) 249 3578

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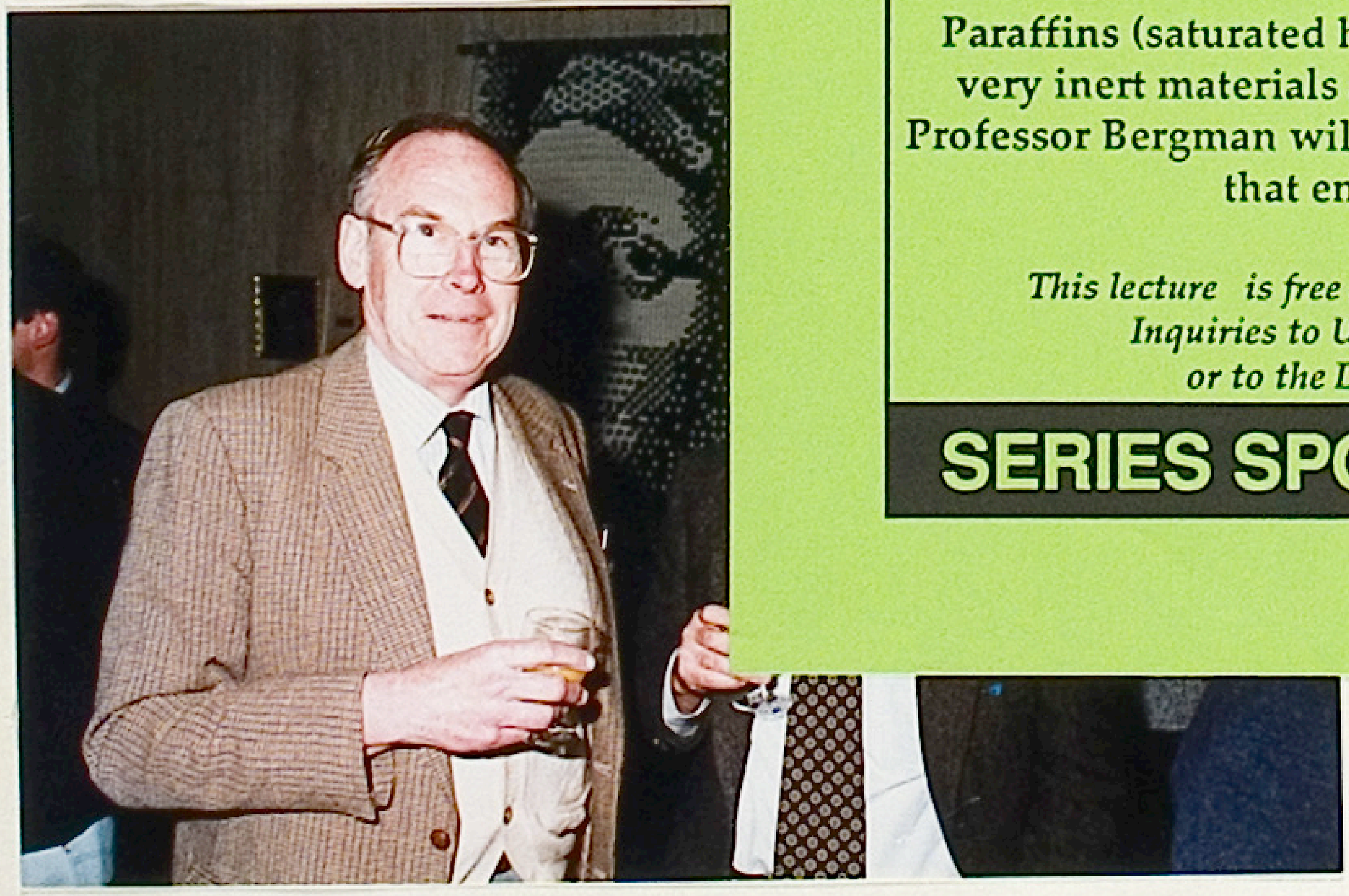
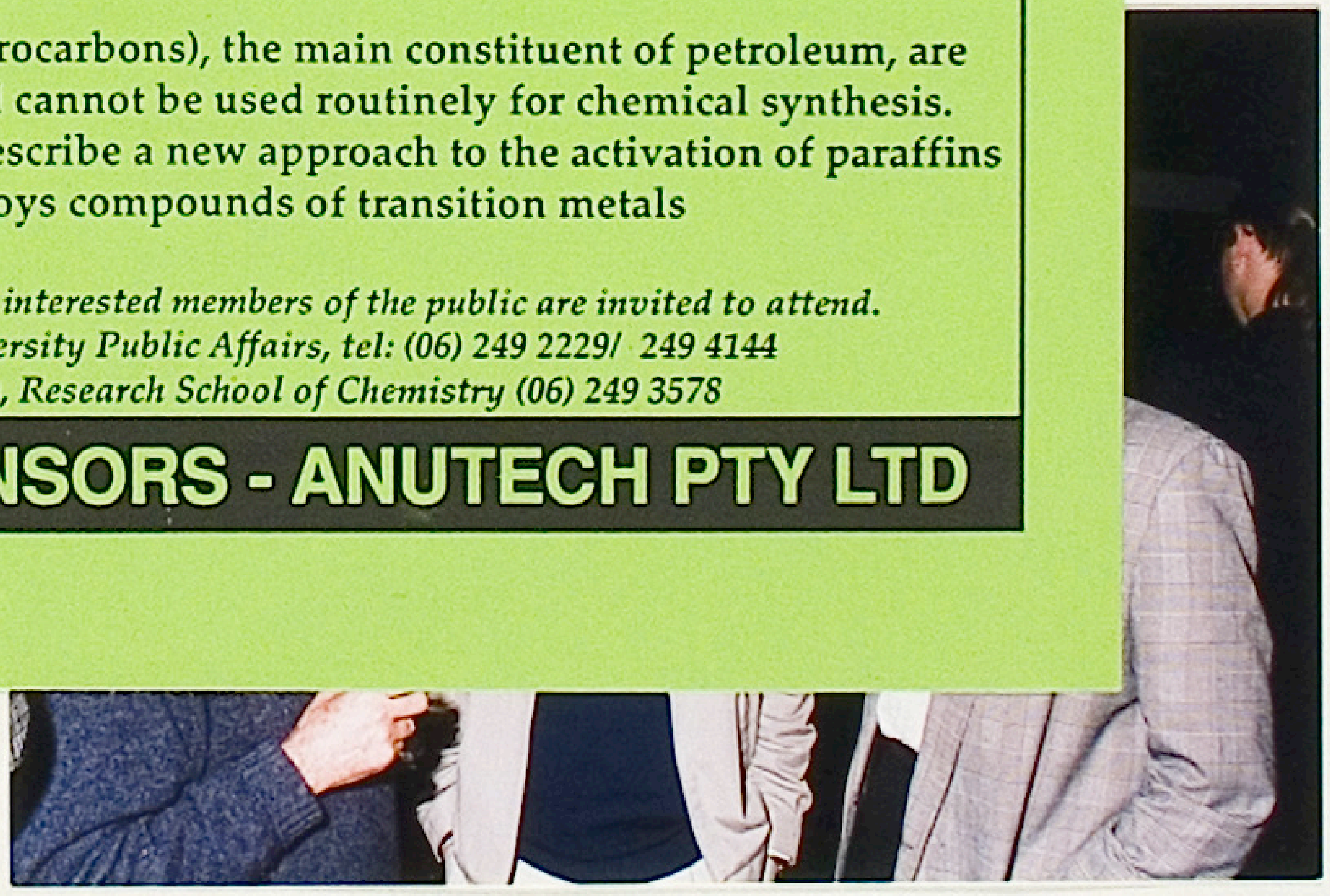




The A. J

EDITED BY JULIAN CRIBB

Slow growth chemical cuts lawn mowing

By ADAM FRIEDERICH

MOWING the lawn may soon become a rare chore following the development of a revolutionary natural substance that slows grass growth.

Professor Lewis Mander, of the Research School of Chemistry at the Australian National University, led the research conducted jointly by the ANU, the CSIRO and the University of Calgary in Canada.

"Grass treated with the chemical grows only about one third as fast as normal grass," he said.

"It also tends to grow more sideshoots, resulting in a dense, low mat of grass."

The slower growth means not only less mowing but also less need for water and fertiliser. The substance is based on a class of plant hormones known as gibberellins.

"These are found in tiny amounts in all plants, and are responsible for controlling all aspects of the plant's growth and development," he said.

By slightly modifying this natural slightly the team found the growth of grasses could be slowed dramatically.

Trials are being held at the Canturf lawn farm near Canberra where grass plots are sprayed with varying concentrations of the hormone to measure the reduction in yield.

Although not directly involved in the trials, Canturf's Mr James Davy says he can see plenty of promise in the results. He considers the biggest potential customers will be parks, sports grounds and golf courses, where grass maintenance is laborious and costly.

This work has more to offer than saving time and effort in the backyard or on the oval.

"It works on all grass-like plants so there are many applications, including in agriculture" Professor Mander said.

Large-scale trials are being held in Europe and North America, on the use of gibberellic acid to stunt growth in cereal crops.

Inhibiting crop growth is not as odd as it sounds.

"Tall growing plants are not necessarily good. If the stems become too long it weakens the plant," Professor Mander said.

Much effort has been devoted in recent years, both in chemistry and genetics, to developing shorter, more compact crops, which put energy into producing grain rather than straw.

There are plenty of synthetic crop growth regulators already available but Professor Mander believes the environmental appeal of gibberellic acid is that it is a naturally occurring compound, already present in our fruit and vegetables.

While Professor Mander said further testing of gibberellic acid was needed before it could be released commercially, he was confident that there would be no problems.

"A number of international companies are interested in producing it," he said.

INNOVATION

Early data

THE Australian Geological Survey will launch a prototype version of @ngis, the Australian National Geoscience Information System, in February, well ahead of schedule.

@ngis aims to provide access to geoscientific information now held in paper and data archives of federal and State government, industry and the research community.

The degree of detail available and the price to be charged will be up to the organisation or company holding the data.

The Federal Government has allocated $500,000 a year for three years, with a requirement that @ngis should be running by July 1997.

Contact: David Berman dberman@agso.gov.au or info@@ngis-.gov.au; http://www.agso.gov.au.

On the tiles

A RANGE of designer tiles handmade from industrial glass by Monash University ceramicists will be featured at a design fair in Paris in September and be released on the Australian market later this year.

Johnson Tiles Australia took the tiles to its product development conference in Italy earlier this year.

The tiles evolved from research into new uses for common types of glass, concrete and ceramics: among the materials is a glass originally used to line hot-water tanks.

Senior ceramic design lecturer Mr Chris Selwood said the Monash tiles were the only patterns with relief and texture at the Italian conference.

The tiles will carry the Monash name. The university's commercial arm, Montech, has joined the project as business adviser.

The Monash group will handle initial production, but will develop a separate manufacturing company when demand warrants it. Apart from the income, a plus for the university is that students will be able to work as practising artisans while completing their studies.

ANU cleans up

LICENSING agreements between the Australian National University and Western Australian resource company Venture Exploration Ltd will see a family of new materials developed to soak up metallic toxic waste from ground water and effluent.

XAM inventor Dr John Thompson is working on scaling up production of the kaolin-based material at a pilot plant in Cairns. Dr Thompson, a fellow at ANU's research school of chemistry, has assembled a kilogram-scale production line at the university.

The university's commercial arm, Anutech, is having further applications for the material tested and is likely to be seeking a commercial partner.

Other applications could include an environmentally safe, cheap additive to laundry detergents.

Chemistry academic goes against the stream

EMERITUS Professor Arthur Birch, who will be 80 in August, owns a delicate white porcelain figure of an old man, a gift from the Chinese Government during the 1980s.

The old man is carrying a staff, and from the top of the staff fresh new leaves are sprouting.

"That's me," he says with a chuckle.

Professor Birch, a co-founder with Professor David Craig of the ANU's Research School of Chemistry, has a curriculum vitae that is five pages long. Every undergraduate chemistry student has learned the "Birch Reduction", and, for decades, they have been staggered to discover he is still alive and not a relic from scientific antiquity.

Dubbed "the father of the pill" because of his work which followed at Manchester University, Professor Birch brought the fight for science home when he returned to found the RSC, and has been doing battle with governments in Australia and abroad ever since.

He has won every conceivable international award for organic chemistry, other than a Nobel Prize, though he has even been nominated for that on many occasions, including this year.

"The only reason I'd like to get one is not the honour but the money, so I might be able to still continue doing some research, even now," he says.

In fact, he is still conducting research in India, via a fax machine at the Institute of Bangalore, but he is too frail to travel at the moment. "I was supposed to die last week, but I'm still here," he says with another wicked chuckle.

He says he would certainly not have retired at the age of 65, in 1980, if he had had the choice. "I was retired at the height of my powers. I got the Tetrahedron Award in 1988 which is the world's top award for creativity in chemistry — at the time when I was told that I was too old to apply for grants to the Australian Research Council.

"I was very regretful [about retiring]. In fact I gave up two years of active life by coming here from Manchester [to found the RSC] because the retirement age was 67. That, in the end, I rather regretted. In many ways I regret returning to Australia.

"I did continue working to about 1985 because I did get some ARC money, and I was appointed an honorary Fellow at the ANU's Department of Chemistry, which gave me at least access to a laboratory. I left the RSC quite deliberately because I thought I might interfere and, if I did, even if I was right, it would be a bad thing. And there would be a lot of things I would interfere with!"

He's delighted with the recent review of the RSC. "It's absolutely brilliant, the most complimentary thing I've ever seen. I'm very happy".

He must feel proud. "Well, I acknowledge the work in the school is due to the people in it. But most of them wouldn't be there and the facilities wouldn't be there and the organisation wouldn't be there apart from David Craig and me. So I do feel we're responsible and that makes me happy."

When the research money ran out, he turned to writing. He has two autobiographies — one scientific and one personal. The scientific one, *To See the Obvious*, is being published, but his general one is not yet complete. "It's called *Against the Stream* which is a quote from John Philip [an eminent soils physicist, officially retired from the CSIRO] who said to me, 'You're always against the stream.'"

He's also written heaps of scientific papers and has never stopped receiving awards. "Last December, I spent the whole month in India for two major conferences and industrial consulting which I don't get in Australia. I'm very impressed with India at the moment. It's going ahead enormously, it's going to be the powerhouse of Asia, even more than China. I've also just been invited by the International Science Academy, of which I am a Fellow, to provide a major review on chemical synthesis for their 60th anniversary. So they don't think I'm dead from the neck-up."

Does he think academics would self-select out if they were no longer productive?

"I think a lot would. I cannot guarantee it, because there are still some stupid buggers who cannot assess themselves correctly anyway, so I don't say that should be the sole criterion. My suggestion very early on, which has also been suggested by other people, is that people should be appointed to some level, say senior lecturer, and then be promoted to professor or God knows what on a temporary basis. Then, when they retire, they would revert to their basic level of appointment and the appurtenances thereof."

As for superannuation, he thinks if they have adequate superannuation they should not receive a salary.

"My superannuation is frankly about two-thirds the level of a bus driver but, as far as I'm concerned, it's adequate because I own two houses ... I would have been happy to have a salary ... but what I needed was research support. You see some people can work entirely with their hands and their brain but the sort of work I do, as a synthetic organic chemist or a biochemist, needs hands in a laboratory.

"So I reckon I need $50-100,000 a year which I've absolutely no hope of getting. So I think it's not a question of personal support, so much as work support. I think many people would be happy to live on superannuation — God, I've missed being a multi-millionaire twice over and I don't care much about it."

— VERONA BURGESS

Picture: GRAHAM TIDY

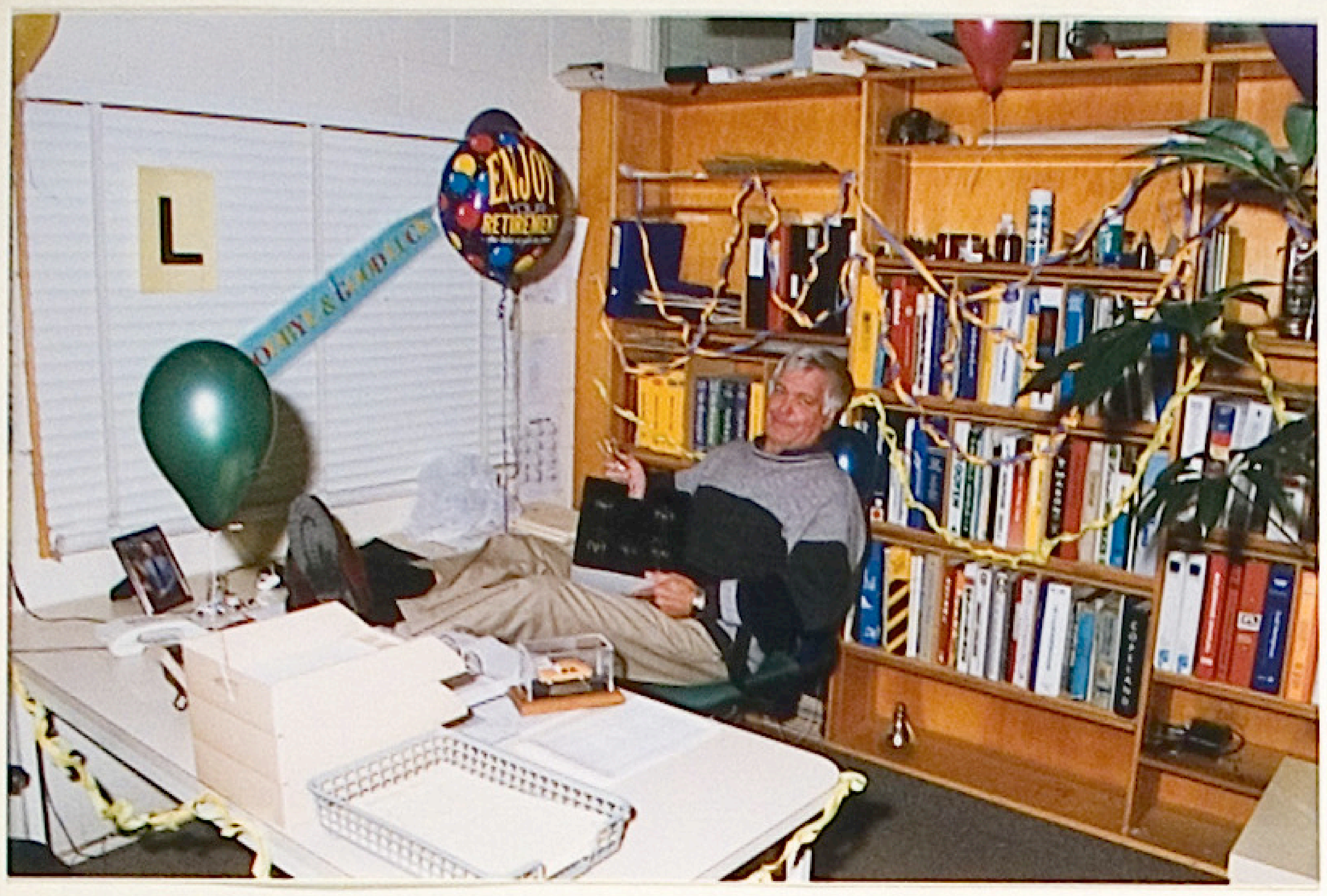
Professor Arthur Birch with a figure symbolic of his link with China.

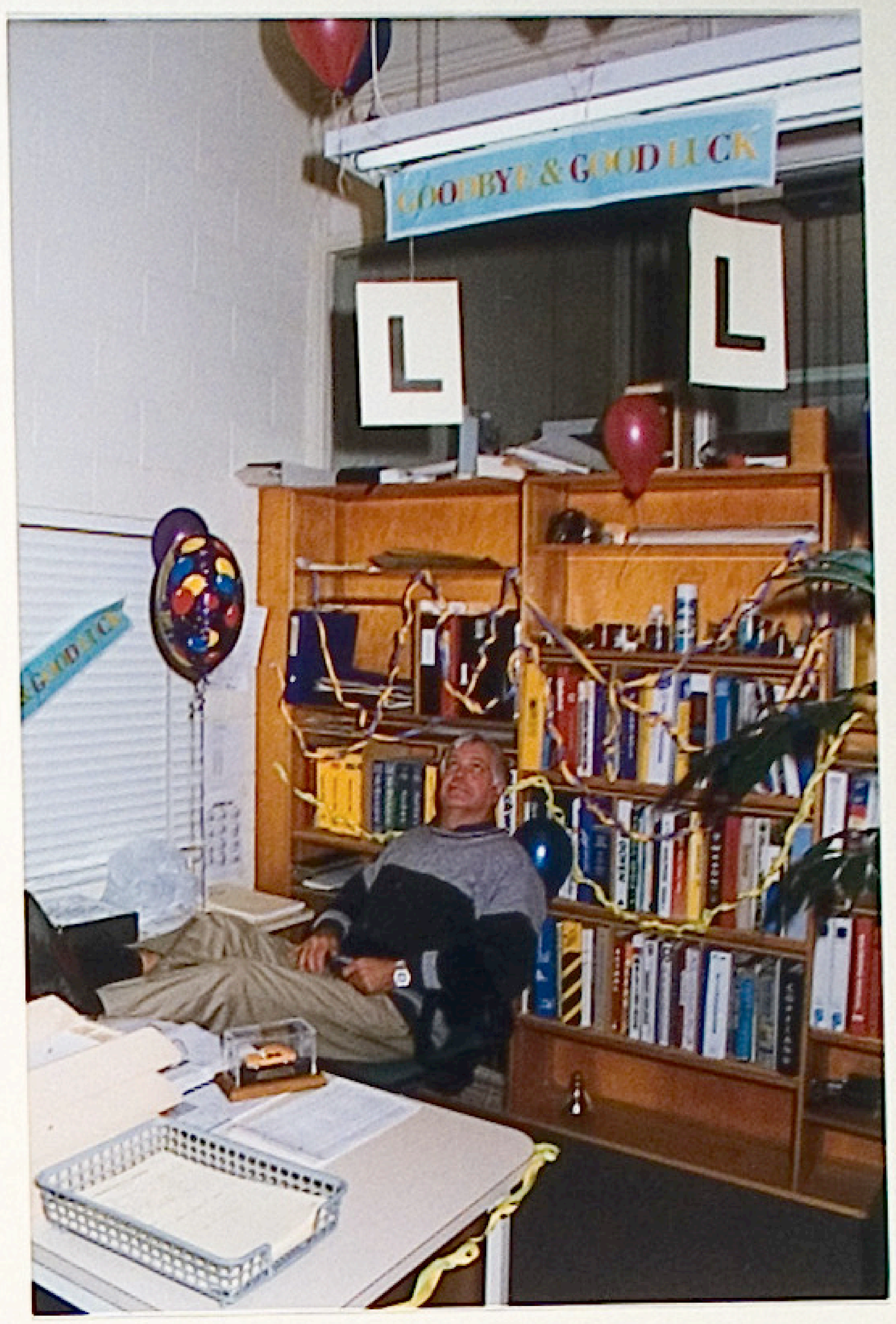
Canberra Times June 17, 1995

Building Bridges Between Organic and Inorganic Chemistry


TASMANIA
benetton

June 28, 1995





John Hush Farewell

JOHN HUSH DIED
7.9.99.

Professor Arthur J. Birch, CMG, FAA, FRS

In a recent interview Arthur Birch said that his motto was "Trust the scientists, but not too much ....". This gives us just a glimpse of the salty flavour of Arthur's comments from time to time on Australian science, industry, education and matters in general. He was one of the country's most valuable commentators and never afraid to speak his mind and to point to directions which he perceived would be beneficial for the general interest. His passing in Canberra on the morning of Friday 8 December 1995 leaves Australian science and, in particular, chemistry in Australia, the less.

A recent biography by Professor Rod Rickards of the Research School of Chemistry, The Australian National University, spoke with deep knowledge of Arthur's scientific contributions. Arthur Birch was born in Sydney in 1915 and graduated from the University of Sydney with First Class Honours and the University Medal in Organic Chemistry in 1936. His 1851 Scholarship to Oxford University allowed him to work with one of the most distinguished chemists, Sir Robert Robinson, and it was there that his ever creative mind led him to the discovery of the famous "Birch Reduction" still widely used throughout organic chemistry. On leaving Oxford he held chairs of chemistry at Sydney University, the University of Manchester and finally, the Australian National University. In addition to being a Fellow of the Australian Academy of Science and of the Royal Society, he was a Full Foreign Academician of the USSR Academy of Science and a Foreign Fellow of the Indian National Science Academy.

His remarkable career spanned five decades, and encompassed seminal contributions to our understanding of the structures and origins of natural products, and to the present state of the art of organic and organometallic synthesis.

On the organisational level, one of Arthur Birch's greatest achievements was the founding of the Research School of Chemistry at the Australian National University with Professor D.P. Craig and Professor R. Nyholm. He was the first Dean. His conception of the School as a community of scholars, all equal but with a Dean *primes inter pares,* has been the key note of its success, so recently acclaimed in the 1995 Review of the School by a most distinguished panel of international referees. The Research School of Chemistry is a lasting tribute to Arthur's vision and energy.

He is survived by his wife, Jessie, and five children.

Professor J.W. White
Dean, Research School of Chemistry
8 December 1995

ANU Reporter Wednesday 13 December 1995 – 3

Death of Professor Arthur Birch

ONE of the founding fathers of the ANU's Research School of Chemistry, Emeritus Professor Arthur Birch, died early last Friday morning (8 December).

Professor Birch, who had turned 80 in October, set up the School 28 years ago, in association with Professor David Craig.

An obituary for Professor Birch will be prepared for the 31 January issue of *ANU Reporter*.

To See the Obvious

by Arthur J. Birch*

in *Profiles, Pathways, and Dreams,* Ed. J.I. Seeman, Am. Chem. Soc., Washington, DC, 1995.

Organic chemistry became the leading branch of chemistry in the 1930s and 1940s because of the isolation, determination of structure and synthesis of the vitamins and steroidal hormones. The importance of these compounds was self-evident and their partial or total synthesis became major industrial activities. Amongst the great names (in alphabetical order) we find Butenandt, Karrer, Kühn, Reichstein, Robinson, Ruzicka, Wieland and Windaus. All of these gentlemen were recipients of Nobel Prizes. Seven of them were of German or Swiss nationality. Only one was not in this group - Robert Robinson. We have discussed the tempestuous relationship between Robinson and Ingold before ("Ingold, Robinson, Winstein, Woodward and I", book review published in *Tetrahedron News* No. 3, June 1994, Elsevier Science Ltd, Oxford). Their contributions to theory were not generally appreciated at the time in question and Ingold, although very deserving, did not receive a Nobel Prize.

World War II gravely damaged organic chemistry in Europe, but it had a profoundly stimulating effect on American Industry. Organic chemistry benefited from penicillin research, which heralded the development of all the antibiotics.

At this time, three men of genius appeared discretely upon the American scene (in alphabetical order): H.C. Brown, Saul Winstein and R.B. Woodward. Of course, Brown and Woodward received Nobel Prizes later and Winstein died too young to be a serious candidate for this honor.

On the post-war British scene, the fundamental work of A.R. (now Lord) Todd also produced a Nobel Prize. His influence on the synthesis of organic phosphates lead Khorana, in due course, to DNA synthesis and another well-deserved Nobel Prize. However, there were three other players on the British scene all influenced by Robert Robinson and each to make major contributions to organic chemistry.

One of these was the present author and the other two were A.J. Birch and M.J.S. Dewar. The fascinating biography of Michael Dewar has already been reviewed ("A Semiempirical Life", book review published in *Tetrahedron News* No. 2, December 1993, Elsevier Science Ltd, Oxford). The present article concentrates on the biography of Arthur Birch. This is almost the last in the series and possibly the best.

The title of Birch's book, *To See the Obvious* is in fact very similar in philosophy to the present writer's title, *Some Recollections of Gap Jumping*. It is important to identify the way in which original thinkers think because most people, including chemists, never think! This is probably a result of the educational system which rewards those who can recapitulate accurately what they have been taught. There are no immediate rewards for those who question the taught 'dogma of the day'. However, the later rewards are evident as in the story of Arthur Birch's life.

He was an only child born into a poor family. His father was eventually a pastry chef, but became terminally ill when Arthur was 14. His mother clearly understood and supported her son's obvious intelligence and natural interest in scientific phenomena. He taught himself about organic chemistry from the age of 12, much like R.B. Woodward.

Birch arrived in the highly selective Sydney Technical High School and found every academic subject interesting. Chemistry fascinated him by its aesthetic rather than its intellectual appeal. He was clearly a natural intellectual with a tendency to question all that he was taught.

He entered Sydney University in 1933 without a scholarship in spite of his ranking third in about 3,000 would-be students of chemistry in New South Wales. He had to support himself by all kinds of menial tasks, as well as, by tutorial work. But he did survive. The Professor of Organic Chemistry in Sydney was J.C. Earl - famous for the discovery of 'sydnones'. He recognized Arthur's independent spirit and gave him a bottle of *Eucalyptus dives* leaf oil to investigate for his M.Sc. and then left him alone.

The next stage in his career was the Ph.D., not then offered in Australia. A generous scholarship from the 'Royal Commission for the Exhibition of 1851' took him from Sydney to the dreaming spires of Oxford and his destiny with Robert Robinson. Two other brilliant Sydney students, Kappa (later Sir John) Cornforth and Rita Harradence (later Lady Cornforth) also gained scholarships to work with Robinson in Oxford at about the same time. Cornforth was awarded a Nobel Prize some thirty years later for his brilliant work on the biosynthesis of cholesterol.

Robinson was a bad supervisor for the majority of graduate students because, for most of the time, he was not there. He had innumerable Committee Meetings and was a frequent Consultant to British Industry. For Arthur, Robinson was an excellent Supervisor because of the very fact that he was not there. Arthur had to think for himself, for which he was well-gifted even at the age of 21.

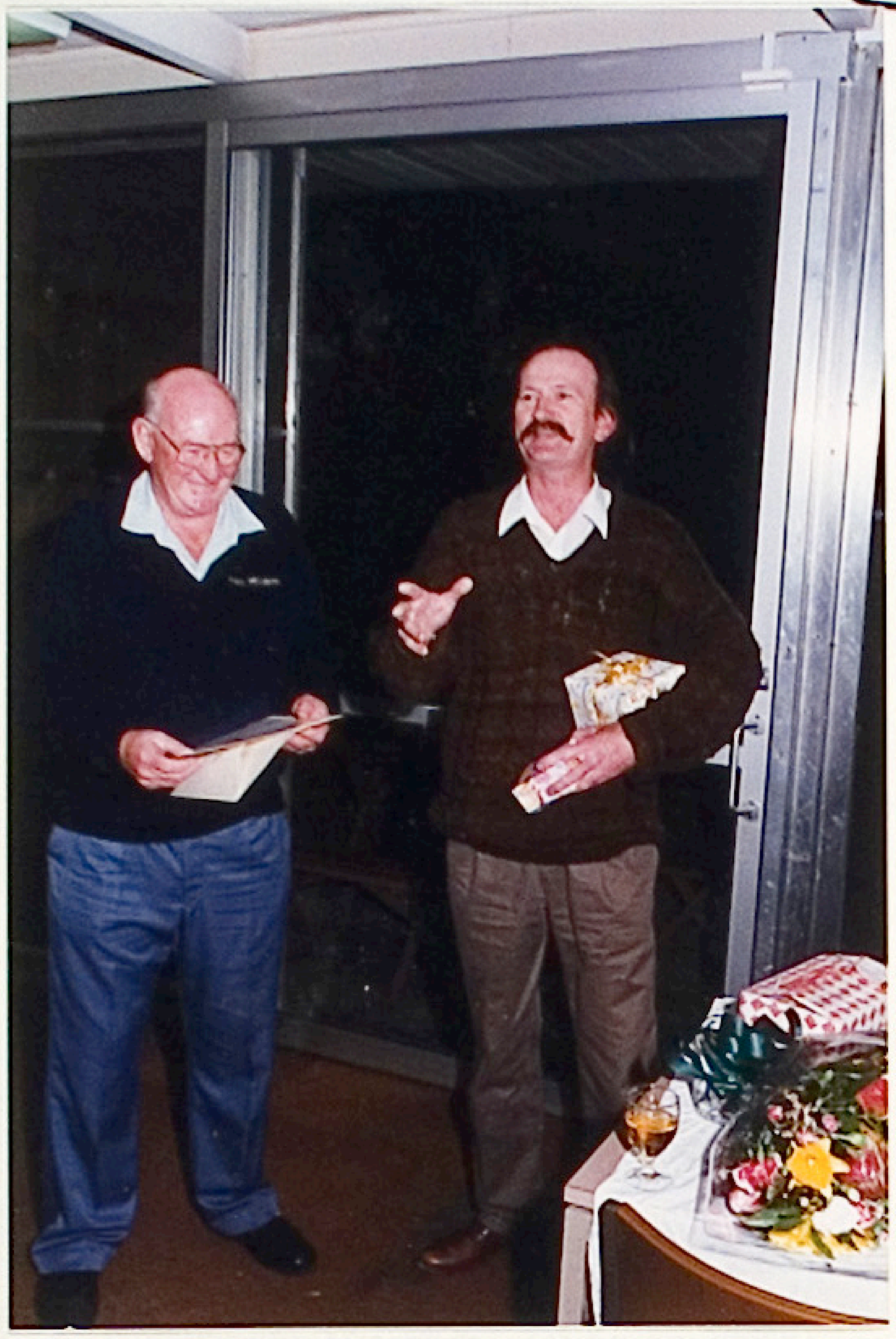
Robinson was not interested in laboratory administration, so the Dyson-Perrins Laboratory for Organic Chemistry was noted for its disorganization and disregard for safety measures. Nevertheless, there were many outstanding young people from all over the world including M.J.S. Dewar, Martin (later professor in Bruxelles), Barltrop and Openshaw (from the U.K.) and Edward (from Canada). Robinson's files were totally disorganized and he wrote many letters by hand without keeping copies. As Birch comments, "where can we find today the like. There was an air of stimulating uncertainty in the Dyson-Perrins Laboratory, where almost anything could happen including revolutionary ideas crystallizing out of chaos". Birch and Dewar within a few years provided two examples of revolutionary ideas.

At first, Arthur was asked to work on a dull problem - the synthesis of

continued on page 4

**This review is dedicated with admiration and fond memories to Arthur Birch. He died just as this manuscript was being completed. It is planned to have a special memorial issue of Tetrahedron with articles by his former collaborators and colleagues in honor of his memory.*

Norm Gehrig - Farewell 12·7·95



RON BANNERMAN
DIED 14/1/2004

Norm Gehrig - Farewell 12.7.95

RON BANNERMAN
DIED 14/1/2004

Opening of Birch Building - 23 August 95

Opening of Birch Building - 23 August 95









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