



First Theo Murphy High Flyers Think Tank

Some of Australia's and a few of New Zealand's brightest early- and mid-career researchers met at the University of Sydney on 6 November to engage in vigorous discussion on a topic of national importance, *Preventative health: Science and technology in the prevention and early detection of disease*.

With around 90 participants, this High Flyers Think Tank – the first to be supported by the Royal Society of London through the Theo Murphy (Australia) Fund – was the largest gathering since the Think Tanks began in 2002. It also represented the culmination of many months of work, especially by Professors Bruce Armstrong FAA, John Chalmers FAA and Philip Kuchel FAA. They not only applied their expertise and experience behind the scenes in developing and refining the areas for discussion, but were themselves active participants.

Preventative health aims to improve the health and wellbeing of Australians through early implementation of health measures to tackle health challenges caused by such things as tobacco, alcohol, obesity, genetic predisposition and inaccessibility to health services. While socioeconomic status is a key determinant, science too has a role to play and this was the main focus for the Think Tank.

Academy President Professor Kurt Lambeck encouraged participants to identify 'new approaches that can be brought to bear on the problem under consideration...to apply [their] rich diversity of knowledge and experience to think about novel applications of existing sciences and technology and to identify gaps in knowledge that is required to tackle the problem.' He noted that there are many diseases, injuries and illnesses that can be prevented by analysis of risk factors, early detection, lifestyle changes and other measures.

Government efforts to improve Australia's health outcomes include a range of initiatives, one of which is the National Preventative Health Taskforce set up in April this year to provide evidence-based advice to government on preventative health programs. Their initial focus is to develop strategies for obesity, tobacco and alcohol related disorders by June 2009.



Photo: Joe Hiburcek

Focus on preventative health: Speakers and chairs for the Think Tank

Professor Paul Zimmet, who is on the Taskforce's obesity working group, provided an overview of the work of the Taskforce. He spoke of the 'diabetes' epidemic in Australia, noting an almost 300 per cent increase in obesity prevalence and a similar increase in diabetes in a twenty year period between the early 1980s and 2000s.

After a stimulating presentation from Professor Chris Goodnow FAA on the topic of genes and the environment, four other expert speakers spoke on their specialist health areas:

- Professor Bruce Armstrong on the process of carcinogenesis;
- Professor Ian Hickie on mental health and the dominance of neurological and psychiatric disorders in disability;
- Professor Kerin O'Dea on the metabolic syndrome in the context of metabolically healthy obesity and the role of diet and lifestyle, concentrating on social disadvantage and using the indigenous Australians as a small case study; and
- Professor Graham Brown on some of the threats in infectious diseases, including emerging infectious diseases and what we have learned from the past, mistakes made and where technology could possibly help us to do a little better in the future.

Participants then divided into four breakout

groups for detailed discussions on potential applications of science in prevention, such as the use of bioinformatics, diagnostic screening and vaccination.

Summarising the discussions following a reporting back session, John Chalmers noted the commonality of risk factors across the different diseases, the need for better data linkages (for example electronic support systems and bioinformatics) and the importance of better facilitation of cross disciplinary research. These needs are also common to other diseases that have been identified as national health priorities including, for example, asthma.

Professor Mike Daube, deputy chair of the Preventative Health Taskforce, gave the closing address in which he welcomed the Academy's initiative to bring 'fresh thinking' and reiterated Paul Zimmet's call for participants to contribute to the Taskforce's agenda. He concluded that 'prevention is about implementation', and the challenge is to bring about action, including an advocacy role for scientists both at the public and private level.

Audio files from the presentations are available from www.science.org.au/events/thinktank2008 and the full proceedings will be published at a later date. ■

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Honours to Fellows

The Australian Academy of Technological Sciences and Engineering announced 34 new Fellows at their annual general meeting. Included in the list is **Professor Antony Wilks Burgess**, director of the Ludwig Institute for Cancer Research at Royal Melbourne Hospital, who was recognised for his work over nearly three decades and his reputation as Australia's leading scientist and technologist in cancer research.

Other honours

Professor Bob Clark was appointed chief defence scientist for the Defence Science and Technology Organisation.

Professor Ian Frazer was awarded the Balzan Prize 2008 for preventive medicine, including vaccination.

Professor Martin Green is the inaugural NSW Scientist of the Year. He also won the Environment, Water and Climate Change Sciences category.

Professor John Hopwood is 2008 South Australian Scientist of the Year.

Professor Ross Taylor was made a Companion of the Order of Australia for



New chief defence scientist, Bob Clark

outstanding service to science, particularly in the fields of geochemistry and cosmochemistry as a researcher, writer and educator.

Professor Gordon Wallace was a winner in the NSW Scientist of the Year Awards 2008 in the chemistry category.

The Australian National University has named their new animal facility the Wes Whitten Building, in honour of the contribution of **Dr Wes Whitten**.

Important dates

2 December 2008: Public lecture on the theme of geothermal energy by Dr Anthony Budd, project leader for the Geothermal Energy Project, Onshore Energy and Minerals Division, Geoscience Australia.

31 January – 4 February 2009: Sir Mark Oliphant Conferences – International Frontiers of Science and Technology. *Asia-Pacific Congress on Electron Tomography*. Brisbane, Queensland.

10–12 March 2009: Fenner Conference on the Environment, *The art and science of good environmental decision making*. Shine Dome, Canberra. www.conferenceplus.com.au/fennerconf/2009/

3 February 2009: Public lecture on the theme of fuel cells. Mr Brendan Dow, managing director of Ceramic Fuel Cells Ltd. Shine Dome, Canberra. www.science.org.au/events/publiclectures/re

3 March 2009: Public lecture on the theme of energy from biomass. Dr Steve Schuck, manager of Bioenergy Australia. Shine Dome, Canberra.

6–8 May 2009: Science at the Shine Dome and Annual General Meeting. *Evolution of the universe, the planet, life and thought: The inspiration of Galileo and Darwin*. Shine Dome, Canberra.

7 April 2009: Public lecture, *Solar thermal concentrators: Capturing the sun for large scale power generation and energy export*. Professor Keith Lovegrove, Solar Thermal Group leader at the Department of Engineering, Australian National University College of Engineering and Computer Science.

21–24 June 2009: Sir Mark Oliphant Conferences – International Frontiers of Science and Technology, *Nanophotonics down under: Devices and applications*. Melbourne Convention Centre. www.smonp2009.com/

China–Australia symposium on remote sensing technologies and sustainability

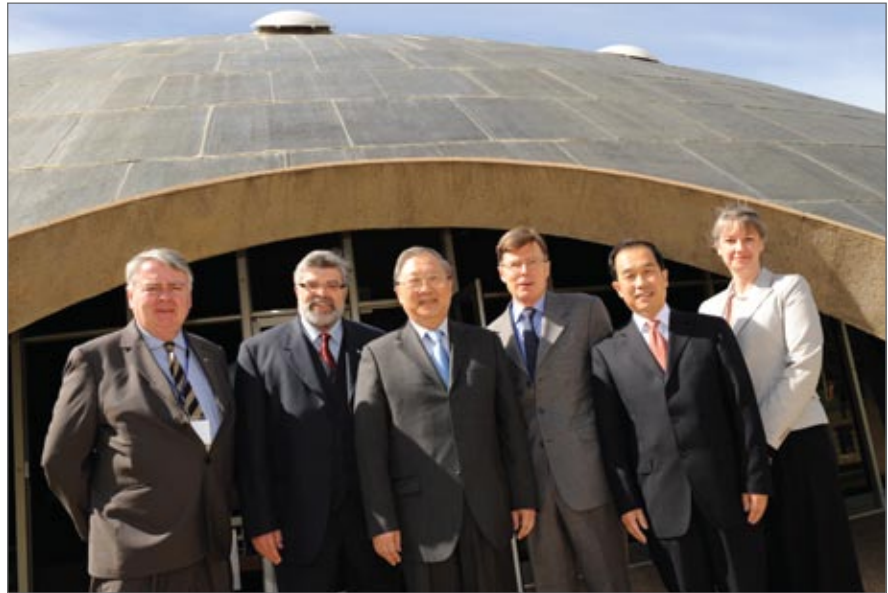
The Academy and the Australian Academy of Technological Sciences and Engineering (ATSE), on behalf of the Australian Department of Innovation, Industry, Science and Research (DIISR) organised the *China–Australia symposium on remote sensing technologies and sustainability* in Canberra on 24 and 25 November 2008.

This symposium is the fifth in a series of high-level annual symposia to be conducted with the Chinese Academy of Sciences (CAS). In addition to bringing together leading scientists from both economies to increase research linkages, strategic partnerships formed through participation in these symposia have provided a valuable avenue for the training and exchange of young scientists, and the sharing of expertise and facilities between the two countries.

Approximately fifty Chinese and Australian invited participants explored collaborative opportunities during plenary discussions and in four breakout workshops in the areas of:

- energy and mineral exploration;
- land management and agriculture;
- water resources; and
- natural disaster and environmental change.

The Chinese delegation was led by Professor Yongxiang Lu, President of the Chinese Academy of Sciences and also vice-chairman of the standing committee



Convenors and guest speakers at the symposium

of the National People's Congress.

Senator the Hon Kim Carr, Minister for Innovation, Industry, Science and Research spoke at the opening of the symposium saying, 'Australian researchers have shown a keen appetite for bilateral collaboration with the People's Republic of China. China is now our third largest partner for joint scientific publications, up from seventh place just seven years ago ... This year we established two joint biotechnology research centres – one for phenomics

and one for stem cells. They are located in Australia, and receive funding from governments, universities, industry and not-for-profit medical research institutes in both countries.'

Professor Penny Sackett, Australia's chief scientist, was the dinner speaker on the first evening of the event.

The Chinese delegation undertook a program of site visits on 26 November following the symposium. ■

More international news

InterAcademy Panel on International Issues

Professor Kurt Lambeck attended the InterAcademy Panel (IAP) Executive Committee meeting hosted by RSC: The Academies of Arts, Humanities and Sciences of Canada, in Ottawa on 8 and 9 September. IAP programs involve interdisciplinary activities and studies on critical issues related to science and technology. IAP hopes to broaden its agenda by serving as a hub of activities for science academies interested in gaining a greater public presence within their nations and regions.

Following a competitive process, IAP has awarded funding to the Academy for *Primary Connections* activities in Asia in 2010.

Australian–European Commission Joint Science and Technology Cooperation Committee (JSTCC) meeting

Dr Sue Meek, the Academy's chief executive, was part of the Australian delegation that participated in the Australian–European Commission JSTCC meeting held in Brussels on 29 and 30 September. The Australian delegation was led by Mark Paterson, secretary of DSIR. Other delegates included the heads of the Australian Research Council and the National Health and Medical Research Council. Discussions focused on current Australian participation in a wide range of European Commission (EC) programs,

including the Academy COST Actions and International Research Staff Exchange Scheme, as well as potential future programs between the EC and Australia.

Science and Technology in Society forum, Kyoto

The 5th annual meeting of the Science and Technology in Society forum was held in Kyoto from 5 to 7 October and attended by Professor Kurt Lambeck. Over 750 leading scientists, policy makers, business executives and media leaders gathered from 91 countries to discuss science and technology issues of the 21st century. The forum is an important venue for

(Continued page 4...)

International news continued

learning about and discussing the latest developments in science and technology, and how they affect human society.

Federation of Asian Scientific Academies and Societies (FASAS)

Professor Jenny Graves FAA attended the 2008 FASAS council meeting on 15 October and the *2nd International Conference on Science Education in Asia and Pacific* on 16 October hosted in Ankara by the Turkish Academy of Sciences. Professor Graves gave a presentation on the Academy's primary science education program *Primary Connections*. Representatives from seven other academies also presented on science education activities in their respective countries, ranging from pre-school to tertiary level programs.

During these events, FASAS and the Association of Academies of Sciences in Asia took the opportunity to sign a memorandum of understanding to undertake joint activities in areas such as science education.

China

Professor Lambeck was invited by the Chinese Academy of Sciences to attend *The Academy, research institution and national innovation system symposium* in Beijing from 12 to 14 November. Professor Lambeck

gave a presentation, *Role of the Australian Academy of Science in development of a national innovation policy*, in which he spoke of the role that academies can play in developing and implementing a national innovation system.

Australia-China exchange program

Dr Jian Wu, a research fellow in the Intelligent Polymer Research Institute, at the University of Wollongong, was a participant in the 2007–08 Scientific Visits to China exchange program. Dr Wu visited Professors Yongfang Li and Daoben Zhu at the CAS Institute of Chemistry in Beijing, and attended several meetings and presented her research at the Institute of Chemistry at Tsinghua University, Beijing. She also visited the School of Materials Science and Engineering at the Beijing University of Science and Technology. Dr Wu's 21 day exchange (14 April to 14 May 2008) was for her project which aims to develop new materials and technologies based on conducting polymers and carbon nanotubes. She is preparing and testing a range of polymers and their composites including polypyrrole and polyaniline with carbon nanotubes on different textile materials, and investigating the effect of reaction conditions and characterisation

on these materials. The proposed applications of conductive polymer-coated fabrics include static dissipation, military applications, strain gauge performance and energy storing fabrics.

Dr Wu's visits to the Chinese institutes and universities has helped to establish a relationship between the ARC Centre of Excellence for Electromaterials Science at the University of Wollongong and Professor Li and his group of the CAS Institute of Chemistry. This collaboration will allow Dr Wu to establish contacts and provide a market in China for 'wearable strain gauges'. Professor Li believes that the collaboration will improve the capacity to exploit new technologies in China and build productive industry, science and technology alliances between China and Australia.

Taiwan

The Academia Sinica extended an invitation to Professor Lambeck to participate in an Academy Presidents' Forum about how national science academies can drive knowledge-based development. The meeting was held in Taipei from 6 to 8 December. At the forum, Professor Lambeck gave a presentation, *How should modern science academies be structured to best drive knowledge-based development?* ■

Renewable energy lecture series hits the mark

The Academy's new public lecture series *Australia's renewable energy future* has been a great success with record numbers attending.

The series has also attracted a diverse crowd including ACT politicians and representatives from Questacon, the National Solar Schools program, CO2CRC, architecture bodies and a Chinese energy company. Representatives from Australian Government departments have also attended.

Dr Tom Denniss from Oceanlinx discussed the state of play in wave energy at his lecture on 5 November saying, 'Australia is well placed to be a large utiliser of wave energy, with possibly five per cent of our needs coming from wave energy within 20 years'. However, he said 'It would be much faster, and we would have more, if there were feed-in tariffs introduced to motivate investors to get into the industry.'



Photo: Stockport

Wave energy: One of the renewable energy sources of the future

The October lecture by Professor Martin Green FAA on solar photovoltaics examined incentives used overseas to grow the solar industry as well as discussing first, second and third generation solar technologies. He said photovoltaics can

provide a solution to the carbon problem, provided volumes are increased while costs are kept down dramatically. He stressed that high-conversion efficiency in third generation technologies was crucial to this occurring: 'I believe that improving the

Presentation of the Ian Wark Medal and Lecture

The Ian Wark Medal was presented to Dr Alan Reid FAA at a dinner held at the Adelaide Hyatt on Friday 7 November. The Ian Wark Medal and Lecture recognises the contributions to Australian science and industry by the late Sir Ian Wark CMG, CBE, FAA, FTSE. The award recognises contributions to the prosperity of Australia where such prosperity is attained through the advancement of scientific knowledge or its application, or both. The award is normally made every two years.

Dr Reid achieved international recognition in the areas of solid state chemistry, high pressure minerals, mineral processing, solar energy, and automated mineralogy. His most significant commercial contributions include understanding of and improvements to heavy minerals processing, the invention of the stable and highly efficient AMCRO solar energy absorber surface now widely used across Australia, and the early development of an automated mineral analysis system, QEMSCAN.

The QEMSCAN system is now the basis of a highly successful new company, Intellection Pty Ltd, and of a new industry – automated mineralogy. It has had a revolutionary and financially beneficial effect on the use of mineralogical data in

geology, mining, mineral processing and oil and gas exploration, and lately, cosmology and forensics. Dr Reid's innovation and development of the technology brought together a number of emerging advances in mathematics, statistics, physics, chemistry and engineering.

As a senior CSIRO research manager and leader, Dr Reid established and mentored a number of successful research groups, and played a major role in developing and directing collaborative research between CSIRO and Australian industry. As a CSIRO executive he helped to establish major research facilities in the mining states of Queensland and Western Australia.

Dr Reid's work has been recognised through many awards including the Rivett Medal in 1970 for 'a decade of outstanding contribution to physical science', and a DSc from the Australian National University for contributions to solid state chemistry. He was elected to the fellowship of the Academy of Science in 1982, and the Australian Academy of Technological Sciences and Engineering (ATSE) in 1988, and made a Member of the Order of Australia in 1993. In 2003 the high pressure mineral reidite was



Ian Wark Medalist, Alan Reid

named after him.

He was for twelve years the chairman of the Australian Petroleum Cooperative Research Centre, and was a member of the council of Macquarie University. In 1997 he led an extensive study into national urban air pollution, published by ATSE for the Australian Government, and recently co-authored a paper on the geological history of the Murray Basin.

For the last four years Dr Reid has studied painting and drawing at the Adelaide Central School of Art, where he is a member of the board. ■

efficiency of a thin-film product is the key to reaching the ultimate potential of the technology. ...high-efficiency thin-film technology is the key to the post-2020 era'. He also said nanomaterials could be used to engineer new properties for use in third generation technology.

Feedback was collected from attendees at the most recent lecture to evaluate the series so far, as well as seeking suggestions for improvement and future lecture topics. The response to the series was very positive showing it was hitting the mark.

The next public lecture will be by Dr Anthony Budd from Geoscience Australia on 2 December on geothermal energy. There will be no lecture in January with the series to resume on Tuesday 3 February 2009.

The lecture program is available at: www.science.org.au/events/publiclectures/re Follow the 'Past lectures' link to find audio or transcripts for each lecture. ■

Fellow turns 90

Birthday greetings to Robert (Robin) Stokes, who turns 90 on 24 December. Robin was born in Southsea, England, and educated at Auckland University College, where he received both a BSc and MSc and which later awarded him a DSc, and University of Cambridge, where he completed a PhD. After a few years as chemist and chief chemist at the Colonial Ammunition Company in New Zealand, he moved to Perth as a lecturer in chemistry, being promoted to senior lecturer and reader. In 1955 he moved to Armidale as foundation professor of chemistry at the University of New England, from where he retired in 1979.

His research interests centred on solution thermodynamics and electrolytes. One aspect of his work that he particularly enjoyed was making his own equipment, often out of materials no longer needed by others.

Professor Stokes was elected as a Fellow in 1957. He has been honoured by the Royal Australian Chemical Institute's Electrochemistry Division, which established the RH Stokes Medal in 1981. In April next year the School of Science and Technology at the University of New England will hold a series of events to celebrate his career and 90th birthday.

News from national committees

Crystallography

The National Committee for Crystallography met in Osaka on 27 August, during the 21st General Assembly of the International Union of Crystallography (IUCr). The OPAL Reactor decadal plan, Australian Synchrotron, national and regional conferences and Australia's role in the IUCr were discussed. Planning commenced for a special symposium on the 'history of crystallography' to honour the ground-breaking research of the Braggs that established the field of crystallography. Professor Peter Colman FAA was elected vice-president at the IUCr General Assembly.

The national committee also raised concerns with Council regarding the continuity of funds for the Access to Major Research Facilities Program.

Nutrition

The National Committee for Nutrition met at Ian Potter House on 23 September. The symposium on iodine deficiency held in May resulted in much publicity. Food Standards Australia and New Zealand has now mandated replacement of non-iodised salt with iodised salt in bread. See www.foodstandards.gov.au/standardsdevelopment/proposals/proposalp1003mandato3882.cfm

The committee is now considering running one conference per year on priority and rising issues such as food allergies, salt reduction in the food supply and vitamin D deficiency.

Registration of nutritionists is now underway through the Nutrition Society of Australia. Planning of a nutrition leadership program, to encourage more people to the profession, is being undertaken by a subcommittee.

Earth system science

Funding has been secured for the National Committee for Earth System Science to undertake a decadal strategic review, and meetings were held on 25 September and 10 November to progress the plan.

The synthesis report and recommendations that have come out of the *Vegetation dynamics and climate change decadal research planning workshop*, held in the Shine Dome in August 2007, will be published with the assistance of the Department of Climate Change. This will form part of the decadal strategic plan.



Members of the National Committee for Geography October 2008

Photo: Jeannette Mill

History and philosophy of science

The National Committee for History and Philosophy of Science held their annual meeting at Ian Potter House on 3 October. The National Museum of Australia student essay prizes, a proposed postgraduate student prize, the impact of university and faculty re-structuring, and the upcoming 60th anniversary of the Academy of Science were all discussed.

Geography

Ian Potter House was also the venue for the National Committee for Geography to meet on 17 October. The chair reported on the election of Australian geographer Professor Ruth Fincher as vice-president of the International Geographical Union, at the 2008 General Assembly, held in Tunisia. The development of a national curriculum for geography was also a major topic for discussion.

Physics

A teleconference was held by the National Committee for Physics on 30 October, to progress preliminary work on strategic planning for the discipline. The draft title is *Investing in the future of physics*, and a presentation at the Australian Institute of Physics congress in December is being planned. Funding is yet to be secured for this undertaking. The chair, Professor Michelle Simmons FAA, reported on attendance at the International Union of

Pure and Applied Physics (IUPAP) 2008 General Assembly, held in Japan. Ten Australian nominations were made to the 20 commissions of IUPAP. Of these, six were successful.

Plant and animal sciences

The National Committee for Plant and Animal Sciences held its second meeting for the year by teleconference on 31 October. Developing research capacity in multi-discipline areas of national priority was discussed, along with possible Academy support for a future biological map of Australia research theme at the national level.

New national committees web pages

The national committees section of the Academy web site has been restructured. In addition to a cover page, each committee now has its own web page. See www.science.org.au/natcoms

International unions

Australia hosted the General Assembly of the International Union of Theoretical and Applied Mechanics in Adelaide from 24 to 30 August.

A recent update of records has shown that 26 Australian scientists are currently elected to the executive councils of the 31 international unions to which the Academy subscribes. This includes five presidents and

eight vice-presidents. The presidents are:

Professor Allan Chivas, International Union of Quaternary Research

Professor John Buckeridge, International Union of Biological Sciences

Dr Tom Beer, International Union of Geodesy and Geophysics

Professor Peter Doherty FAA, International Union of Immunological Societies

Professor Bob Vincent FAA, Scientific Committee on Solar-Terrestrial Physics

Professor Bruce McKellar FAA represented the Academy at the 29th General Assembly of the International Council for Science in Mozambique in October. Eight Australians attended the meeting, four of whom are Fellows of the Academy.

Academy-approved voting delegates also recently attended the general assemblies of the following international scientific unions:

International Union of Crystallography, Osaka, August

Committee on Data for Science and Technology, Kyiv, October

Scientific Committee on Oceanic Research, Massachusetts, October

International Union of Theoretical and Applied Mechanics, Adelaide, August

International Union of Pure and Applied Physics, Tsukuba, October

Radio science

The XXIX General Assembly of the International Union of Radio Science was held in Chicago, USA, from 7 to 16 August. The general assemblies of the International Union of Radio Science (URSI) are held at intervals of three years. Their main objective is to review current trends in research, present new discoveries and make plans for future research work or for specific projects, especially where it seems desirable to arrange for cooperation on an international scale. Symposia on selected topics are usually organised by two or more commissions. Most radio scientists attend the general assembly solely for these scientific activities, which are open to anyone interested in radio science, whether or not connected with a member committee of the union.

Radio science is an enabling science for many activities, including telecommunications, imaging, remote sensing and radio astronomy. The National

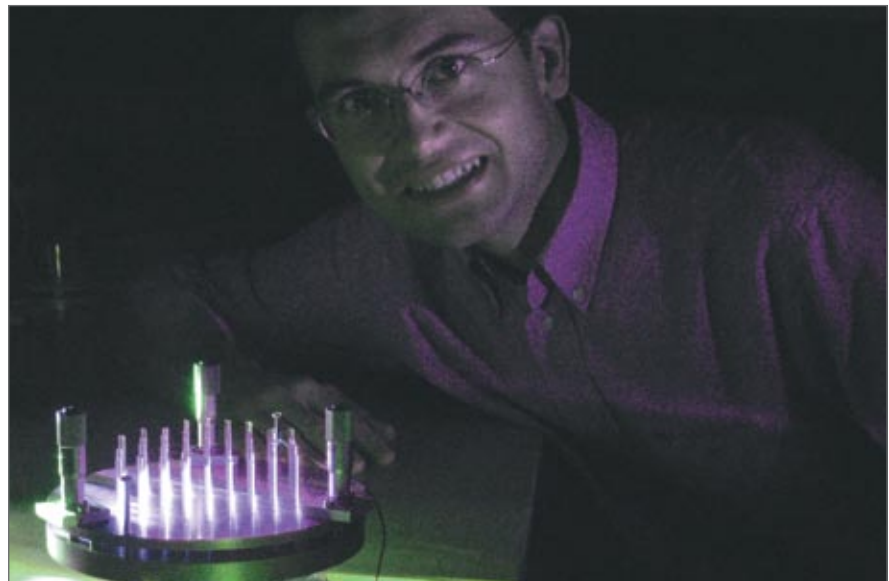


Photo: Courtesy of Jean-Michel Le Floch

Jean-Michel Le Floch, Young Scientist Awardee

Committee for Radio Science, chaired by Professor Andrew Parfitt from the University of South Australia, is the Australian member committee to URSI and was represented at the general assembly, particularly in areas relating to electromagnetic metrology, fields and waves, radiowave and ionospheric propagation, interaction of electromagnetic waves with biological media and radio astronomy.

Of particular note for Australia was the re-election of Dr Phil Wilkinson, of IPS Radio and Space Services in the Australian Bureau of Meteorology, to the position of vice-president of URSI.

A feature of the general assemblies is a commitment to providing opportunities for young scientists. Two Australians were Young Scientist Awardees in 2008: Dr Jean-Michel Le Floch from the University of Western Australia and Dr Maxim Voronkov from CSIRO.

Dr Le Floch attended the URSI General Assembly in Chicago. Dr Le Floch is an ARC Australian Postdoctoral Fellow; his research aims to generate the most precise frequencies in the extremely high frequency band. The topic of his work presented at the assembly was a new way to realise high selective resonators using multi-layered Bragg reflection techniques. The award gave him a great opportunity to meet both young and established scientists to exchange ideas and to start collaborations on topics of mutual interest. As the conference has a

broad domain of interest, which crosses all domains of radio science, he attended sessions across a variety of commissions to understand how his research may have a broader impact across other domains of radio science and to search for new ideas in other domains that may impact on his research. Dr Le Floch was part of the commission A, electromagnetic metrology, electromagnetic measurements and standards. He also took part in the commission A business meetings and gained an idea on how the union runs on an international level. ■

Did you know?

During Stage 3 (2006–08) of *Primary Connections*:

- 120 tertiary facilitators have been trained (2 days of training);
- 400 professional learning facilitators have been trained (3 days of training) who have in turn conducted more than 2,360 workshops;
- 880 curriculum leaders have been trained (2 days of training); and
- more than 110,000 units have been distributed throughout Australia and overseas.

Nova: Science in the news

Two new topics have recently been posted on the Academy's educational website, *Nova: Science in the news* (www.science.org.au/nova):

The quest to make hydrogen the fuel of the future

Australia and many other countries around the world are preparing for hydrogen to take over from fossil fuels and move to what's being called the 'hydrogen economy'. But there are some big hurdles to overcome before it can happen.

You may not realise it, but scientists, the energy industry, governments and climate change experts around the world have joined forces and are on a global quest – and a race against time. Their goal is to find an economical, practical and safe form of energy to replace our reliance on fossil fuels.

Hydrogen, the most abundant element in the Universe, is one potential candidate. Many regard it as the ultimate 'clean, green' fuel.

But a major obstacle to overcome is finding a cheap, efficient way of producing large supplies of hydrogen as it does not occur freely in nature. There are several competing technologies to produce hydrogen. Currently, the cheapest method uses natural gas – a method that also creates carbon dioxide, increasing our greenhouse gas emissions. The way to the

future might be uncertain, but already there is general agreement that using fossil fuels to produce hydrogen is not a long-term solution.

So the search is also focusing on finding 'greener' methods of producing hydrogen that rely on renewable sources of energy, such as solar, wind or geothermal energy. That's a tough challenge in itself. But there are two other significant hurdles to overcome. Storing hydrogen is problematic and there is no infrastructure yet to ensure that it can be supplied cheaply, conveniently and safely.

Converting Australia to a hydrogen economy has been talked about for more than two decades. What's different now is that all the years of research and collaboration on the various technologies are coming together. Conversion to a hydrogen economy won't happen overnight but the quest to make hydrogen the fuel of the future is well underway.

This topic is sponsored by the Australian Research Council Linkage Learned Academies Special Projects Grant (www.arc.gov.au/ncgp/lasp/lasp_default.htm).

Cancer immunotherapy – redefining vaccines

As the leading cause of death in Australia, scientists are giving cancer a shot. But making a vaccine for many cancers is not an easy task.

Vaccines are taken for granted in developed countries; since mass immunisation was introduced in Australia in 1924, deaths from infectious diseases have now become a rare event. Unfortunately though, these traditional types of vaccines can only be developed to prevent diseases that are caused by bacteria or viruses.

Less than 20 per cent of cancers are caused by viruses. Fortunately, cancer cells often have substances on their surface that are not present on other body cells. These antigenic substances can be used in vaccines to stimulate our immune system to attack cancer cells. Broadly known as immunotherapy, this type of treatment is redefining our understanding of vaccines by targeting existing disease.

Cancer immunotherapy can be divided into two categories: active immunotherapy and passive immunotherapy. Active immunotherapy stimulates the body's own immune response to cancer cells. However, it can be expensive and time consuming and become less effective with time. Passive immunotherapy uses parts of the immune system created outside the body to fight cancer. Monoclonal antibodies – the guided missiles of medicine – are produced in the laboratory to home in on and destroy cancer cells. They are created to target a specific antigen in or on cancer cells, and can be made more lethal by being loaded with toxins, chemotherapy drugs or radioactive material.

Vaccines are no longer a simple injection of inactive bacteria or viruses to prevent disease. Scientists are constantly finding new ways to train the immune system to target already diseased cells.

This topic is sponsored by the Sir Mark Oliphant International Frontiers of Science and Technology Conference Series (www.oliphant.org.au).

Information on both these topics is available on the Australian Academy of Science's *Nova: Science in the news* website at www.science.org.au/nova. A glossary, student activities, further reading and annotated links to relevant websites are also available for each topic.

The Australian Foundation for Science is a supporter of *Nova*. ■



Photo: Stockxpert

Vaccines are now being developed to treat existing diseases like cancer


 interviews
with **Australian**
scientists

What do a medical scientist, a zoologist, an endocrinologist, a plant molecular biologist and a couple of biochemists have in common? They have all recently been interviewed for the *Interviews with Australian scientists* project.

Professor Paul Korner FAA was interviewed in August by Professor John Chalmers FAA. Professor Korner has had an exceptional career as a medical scientist in the field of human physiology heading a number of key departments over his career. Professor Korner says his ultimate career achievement was the publication of *Essential hypertension and its causes: Neural and non-neural mechanisms*.

In September three interviews were filmed. Professor Charles Birch FAA was interviewed by Professor Rick Shine FAA in Sydney. Professor Birch spent his early research career studying insects; primarily the Australian plague grasshopper and the Queensland fruit fly. In the latter years of his career, his focus has been on his abiding interest in the relationship between science and religion, leading him to publish prolifically on the topic.

Professor David de Kretser FAA, the current Governor of Victoria, was interviewed by Professor Sir Gustav Nossal FAA at Government House in Melbourne. Professor de Kretser is distinguished in the field of male reproductive health. A particular highlight of his research was the discovery of the hormone inhibin in 1984, which had been postulated to exist since 1932. Professor de Kretser is also passionate about climate change and feels it is a great privilege to be able to use his position



Photo: Maggie Percival

Reflecting on a career in human physiology: Paul Korner (left) and John Chalmers (right)

as Governor of Victoria to champion this cause.

Dr Jim Peacock FAA was interviewed by Dr Liz Dennis FAA in Canberra. Dr Peacock remains in the thick of his career, having recently completed his term as chief scientist of Australia. Dr Peacock has contributed enormously to the growth and development of molecular biology in plant science and is emphatic about the need for governments to be involved in attracting top scientists to work in Australia across the whole science fabric.

Professor Bruce Fraser FAA and Professor George Rogers FAA interviewed each other in October in the idyllic location of Noosa, where Professor Fraser lives. Professor Fraser has enjoyed a long and rewarding career using X-ray diffraction to research wool keratin, collagen and other fibrous proteins. In his early career, he was also involved in the work that led to the discovery of the

molecular structure of DNA. Most recently Professor Fraser has published on the topic of a proposed tertiary structure for the filaments of feather keratin.

Professor George Rogers has also pursued a career researching wool and keratin and he collaborated during his earlier career with Professor Fraser. Professor Rogers was able to capitalise on the advent of electron microscopy and its applications to study protein chemistry of wool and feathers in the 1950s. He also believes that he made an important contribution to science in 1957, when he recognised that citrulline was a component of the protein trichohyalin and determined the mechanism of its formation.

The interviews of Professors Brian Anderson, Robert Street and Richard Stanton have been published on the *Interviews* web site www.science.org.au/scientists. ■

Recent acquisitions for the Basser Library

Some of the people who use the library are doing research with the intention of writing a book on some particular aspect of the history of Australian science. Generally they will have accessed many other sources of information and in most cases their recognition of our assistance will be no more than a mention in the list of acknowledgements. However, in some

cases they are extremely generous and send the library a complimentary copy of their book. Two such books have come into the library recently. They are:

Racing with death: Douglas Mawson – Antarctic explorer by Beau Riffenburgh

Pasteur's gambit: Louis Pasteur, the Australasian rabbit plague and a ten million dollar prize by Stephen Dando-Collins ■



The 2008 Lloyd Rees Lecture

by Peter Hannaford

The Lloyd Rees Lecture for 2008 was delivered by Professor Michelle Simmons FAA in Melbourne on 25 September on *Atomic electronics: When will scaling reach its limit?*

This was the ninth in the series of biennial lectures to commemorate the life and work of Dr Lloyd Rees FAA, foundation chief of the CSIRO Division of Chemical Physics from 1958 to 1978. The Rees lectures are given by scientists who have made distinguished contributions to chemical physics in Australia.

The microelectronics industry continues to pack more and more features onto a silicon chip by continually miniaturising its components. Professor Simmons began by raising the question, when will scaling reach its limit? She went on to demonstrate a complete fabrication strategy on the atomic scale using phosphorus as a doping agent in combination with scanning probe lithography.

Professor Simmons described how she can identify and control the incorporation of individual phosphorus atoms into silicon, using phosphine as a dopant source. She presented measurements of the electrical transport characteristics of highly doped planar sheets of phosphorus in silicon, and showed how these planar dopant layers can be patterned down to the atomic scale using a scanning tunnelling microscope. She went on to describe how she and her group have developed a patented method to electrically contact devices



Michelle Simmons with Lloyd Rees' daughters, Sally (left) and Amanda (right), after the Rees Lecture.

patterned by the scanning tunnelling microscope and how they use electrical device characteristics at low temperatures to confirm the presence of the lithographic patterning as they cross over from two-dimensional to one-dimensional transport. Using this process they have been able to fabricate the narrowest conducting wires in silicon with widths down to about two nanometres, tunnel junctions, single electron transistors and arrays of quantum dots. Professor Simmons discussed the significance of these results for the successful realisation of truly atomic-scale device architectures in pushing silicon miniaturisation to its limit. The work also has

potential application in the realisation of a silicon-based quantum computer.

Professor Simmons is a Federation Fellow, professor of physics, and director of the Atomic Fabrication Facility at the University of New South Wales. She graduated with a double degree in physics and chemistry and a PhD in physics from Durham University, UK. She spent six years working at the Cavendish Laboratory in Cambridge, UK, in quantum electronics, before coming to Australia on a Queen Elizabeth II Fellowship as a founding member of the ARC Centre of Excellence for Quantum Computer Technology. ■

Biographies of Academy Fellows

Biographers (*) have been appointed for the following Fellows:

Sir Geoffrey Badger

*Professor Ian Rae

Professor Howard Wornor

*Professor Greg Tegart

Professor Anton Hales

*Professor Kurt Lambeck

Professor Max Kelly

*Professor Ross Street

Professor John Anderson

*Professor Roy Jackson and
Dr Neil Avery

Professor Chris Christiansen

*Dr Bob Frater

Professor Rod Rickards

*Professor Lew Mander and
Professor Martin Bennett

Professor Richard Meyer

*Professor Ray Stalker

Professor Chris Heyde

*Professor Joe Gani and
Professor Eugene Seneta

Professor Frank Gibson

*Professor Jim Pittard and
Professor Graeme Cox

Biographers would be grateful to readers who could provide assistance on the basis of their personal knowledge of the individual or their work. ■

Memoirs of deceased Fellows are published in *Historical Records of Australian Science* and are also available from www.science.org.au/academy/memoirs

Ron Brown



Ron Brown

Ronald Drayton Brown was born on 10 October 1927 in Melbourne, where he died on 31 October 2008. He was educated at the University of Melbourne (BSc) and University of London (PhD), where he continued to work as an assistant lecturer in the Chemistry Department for a year.

In 1953 he returned to the University of Melbourne as a senior lecturer in general chemistry, with a promotion to reader in theoretical chemistry in 1959. That year he became foundation professor of chemistry at Monash University and remained in this position until his retirement in 1992. He felt that creating a chemistry department out of nothing was the major achievement of his professional life.

The first few years of Ron's career were mainly spent studying the electronic structure of molecules in an attempt to understand their chemical properties. He was one of the earliest people to use quantum mechanics to understand chemical reactions. He then moved on to studying the fundamental properties of molecules using microwave spectroscopy and later used this technique to search for interstellar molecules. Among other things he discovered the tricarbon monoxide molecule and another called propadienone, which was kinked when it had been predicted to be straight. This led to an abiding interest in kinky molecules, which were the subject of his Matthew Flinders Lecture to the Academy in 1988.

Ron's many awards included three medals from the Royal Australian Chemical Institute: Masson (1948), Rennie (1951) and HG Smith (1959). In 1959 he also received the David Syme Prize for Research from the University of Melbourne. He was elected to the fellowship of the Australian Academy of Science in 1965, received

both the Edgeworth David Medal of the Royal Society of New South Wales and the Royal Society Medal of Victoria in 1977, and was appointed a Member of the Order of Australia in 2002.

During his time in England Ron played county badminton for Surrey. He continued playing on his return to Australia and was president of the Victorian Badminton Association in 1960 and 61. He was Secretary (Physical Sciences) of the Academy from 1976 to 1980 and served on several Academy committees. He was also active in international science. His involvement with the International Union of Pure and Applied Chemistry included leading the Australian delegation to its general assemblies for a number of years, and he was president of commission 51 (Bioastronomy: Life in space) of the International Astronomical Union, and a member of the International Halley Watch.

He is survived by his wife Mary, his children Ron, David and Penny and their families.

Hans Freeman



Hans Freeman

Hans Freeman, who died in Sydney on 9 November 2008, was born in Breslau, Germany, on 26 May 1929 and came to Australia with his family in 1938. He was educated at the University of Sydney (BSc with 1st Class Honours and the University Medal in Chemistry in 1949), MSc (1952) and PhD (1957).

In 1952 and 1953 Hans went to the California Institute of Technology as a Rotary Foundation Fellow. There he learnt a new technique which led to his lifelong enthusiasm for crystallography. He returned to the University of Sydney in

1954 as lecturer, rising through the ranks to professor (of the newly created chair of inorganic chemistry) in 1971. He was made a professor emeritus in 1998.

Hans studied crystal structures of biological coordination compounds including metal-peptide complexes and metalloproteins, using X-ray crystallography and, more recently, EXAFS (extended X-ray absorption fine structure). He introduced the use of computers for crystallographic calculations to Australia, writing programs that ran on the SILLIAC, Australia's second computer. His laboratory was the first in the southern hemisphere to determine the crystal structure of a protein, plastocyanin. He listed his particular research areas as 'blue copper proteins', copper amine oxidases and enzymes with dinuclear metal sites.

Awards and honours received by Hans include being made a Fellow of the Royal Australian Chemical Institute in 1968 and the Royal Society of Chemistry in 1984, the year he was also elected as a Fellow of the Academy. He was the Liversidge Lecturer of the Royal Society of New South Wales in 1979, and was awarded the Burrows Medal of the Royal Australian Chemical Institute in 1980. In 2005 he was appointed a Member of the Order of Australia and in 2007 won the Academy's Craig Medal.

Hans's contribution to the administration of science include serving as foundation president of the Australian Society of Crystallographers in Australia in 1966 and 1967 (he was also a founder member of its precursor, the Bush Crystallographers), chair of the Coordination and Metal Organic Chemistry Division of the Royal Australian Chemical Institute from 1971 to 1973, and as chair of the Australian National Committee for Crystallography from 1984 to 1993. He served on the organising committees of several international crystallography congresses and from 1989 to 1992 was a member of the International Science and Technology Advisory Committee of the Department of Industry, Technology and Commerce. He also made major contributions to three reports on the need for Australian scientists to have access to 'big science' facilities.

Hans is survived by his wife Edith, a son and a daughter. ■

The Royal Society of Victoria's centennial flyover of the south magnetic pole, Antarctica, January 2009

by David M Dodd, Charles Barton, Patrick Quilty and Ian Allison

On 16 January 1909, two Australian academics, Professor TW Edgeworth David and Douglas Mawson, with Scottish doctor, Alistair Forbes Mackay arrived at the vicinity of the south magnetic pole, so becoming the first persons to accomplish this feat, and realising the dream of James Clark Ross who reached the north magnetic pole on 1 June 1831. The 2000 kilometre man-hauled sledge journey undertaken by this three-man northern party of Shackleton's British Antarctic expedition remains one of the most remarkable epics of the heroic era of Antarctic exploration and discovery.

Shackleton's expedition was notable for two other outstanding accomplishments: the first ascent of the continent's only active volcano, Mount Erebus on 10 March 2008, and penetrating further south than anyone had managed before – to within 97 miles of the south geographic pole on 9 January 1909. Alas, the successes of the expedition were to be overshadowed by the subsequent Amundsen/Scott 'race to the south pole' 1911–12.

It is fitting that the first 'discovery' and location of the south magnetic pole should be recognised 100 years on. On Saturday 17 January 2009, the Royal Society of Victoria is chartering a Qantas aircraft that will fly over the current location of the south magnetic pole, now 250 kilometres out to sea off the French Antarctic Territory of Adelie Land, then along the 1300 kilometre path traveled by the pole back to the observed 1909 position deep inland and, possibly, the position estimated by Ross in 1841.

The historic anniversary flight will feature an in-flight scientific program arranged by Dr Charles Barton (Australian National University), Professor Patrick Quilty (University of Tasmania), Dr Ian Allison (Australian Antarctic Division and International Polar Year joint committee co-chair), and Dr Larry Newitt (Canada).

Guests will include HRH Duke of Gloucester and the Governor of Victoria, Professor David de Kretser FAA (the society's patron). Sixty 'young science ambassadors' from secondary schools in New Zealand, Canada, France, Finland, the UK, and all states and territories of Australia will also participate.

The anniversary flight is part of



Photo: Courtesy of the David family

TW Edgeworth David, Douglas Mawson and Alistair Forbes Mackay at the vicinity of the south magnetic pole, 16 January 1909. The home-made flag has come down through the David family and is now the property of the Australian Academy of Science.

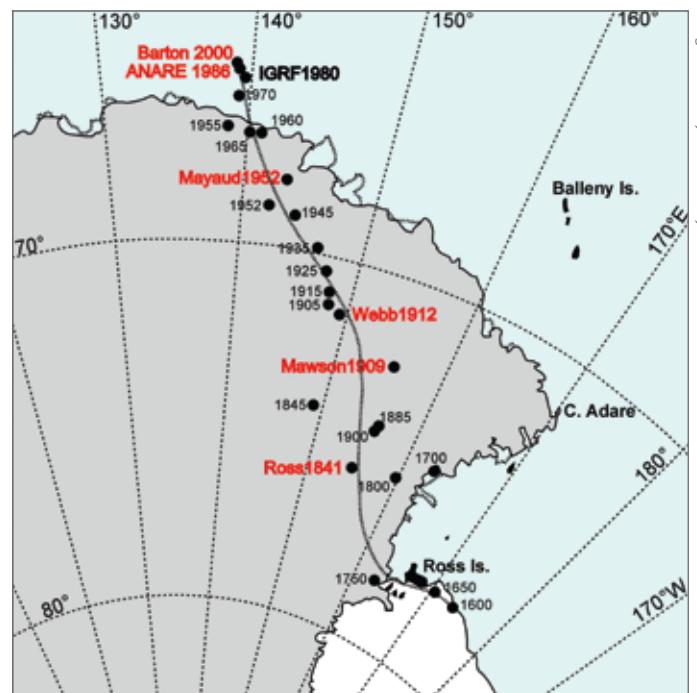


Image: Courtesy of Pat Quilty

Path followed by the south magnetic pole (the principal point where the Earth's magnetic field is vertically upwards) since its position was first accurately determined by James Clark Ross in 1841. Observed positions are in red; black dots, going back to 1600, are positions inferred from numerical models of world-wide observations, such as the International Geomagnetic Reference Field.

the society's education, outreach and communication contribution to the International Polar Year (IPY), 2007–08 (www.ipy.org), the society having been associated with all three past international polar years in 1882–83, 1932–33, and 1957–58. The latter became the

International Geophysical Year. The society, in association with the Royal Australian Mint and Australia Post, has also contributed to the design and release of the polar series of coins and stamp issues to mark Australia's involvement in the current polar year, which concludes on 1 March 2009. ■