

Science at the Shine Dome 2011



Photo: Mark Graham

Guest speaker Lord May at the annual dinner

In May the Australian Academy of Science held what has been hailed as its 'best ever' *Science at the Shine Dome*. The 2011 flagship annual event and celebration of Australian science was officially opened by Professor Suzanne Cory AC PresAA FRS – her first *Science at the Shine Dome* as Academy President.

Eighteen Fellows were formally admitted to the Academy and presented highlights of their research to an enthralled audience.

Fellows and guests came together for the annual black tie dinner held at the National Museum of Australia in Canberra on 5 May. Guest speaker Professor Lord May of Oxford OM AC FAA FRS, a Corresponding Member of this Academy and former President of the Royal Society of London, gave a stirring speech urging science academies internationally to be strong public advocates for government policy to be underpinned by sound science.

The four career medallists, who received their medals during the evening from President Suzanne Cory, graciously

acknowledged the role of their teachers, mentors, and heroes in attaining their achievements.

Professor Brian Kennett FAA FRS of the Australian National University, who received the 2011 Matthew Flinders Medal, pointed out that seismology requires long term global collaboration and that what we know today has been achieved by, to quote Isaac Newton, 'standing on the shoulders of giants'.

Professor Ian Dance FAA of The University of New South Wales was awarded the 2011 David Craig Medal for his pioneering work in four areas of fundamental chemistry. He spoke fondly of his first chemistry teacher at Homebush Boys High School, who inspired him to delve further into science and chemistry.

Professor Colin Rogers FAA of The University of New South Wales was awarded the 2011 Hannan Medal for his influential work in nonlinear mathematical systems. Speaking

on the theme 'Only connect' from EM Forster's novel *Howards End*, Colin illustrated the application of his work to understanding complex processes in nature.

Professor Ian Jackson of the Australian National University was awarded the 2011 Jaeger Medal for his novel methods for interpreting the Earth's internal structure. He told the assembled dinner guests of the privilege of having known both Professor Jaeger, Foundation Professor of Physics at ANU, and Professor Anton Hales, Founding Director of the Research School of Earth Sciences at ANU, who revolutionised the Earth sciences by bringing the enabling sciences into the discipline.

Eleven early career researchers received honorific awards this year, and more than 70 younger researchers attended *Science at the Shine Dome*. All were enthusiastic about the opportunity to meet Fellows of the Academy – their science heroes.

Six doctoral students that the Academy is sending to this year's annual meeting of the Nobel Laureates in Lindau, Germany, also participated. They appreciated the advice of Fellows as to how to maximise their coming opportunities in Germany.

Nine Australian science teachers and science communicators from all over Australia took part in *Science at the Shine Dome* activities this year. The teachers and early career researchers participated in the general program and attended professional development sessions.

The annual symposium, *Australia 2050: population challenges to sustainability*, presented a thought-provoking program of nationally and internationally-renowned speakers. It is covered in detail later in this newsletter, as are the programs for teachers and early career researchers. ▴

Message from the President

The last few months have been extremely busy for the Academy as we prepared for our annual *Science at the Shine Dome* event and put our case to Government ahead of the Federal Budget. I would like to warmly acknowledge the many individuals in the Fellowship and the Secretariat who have worked tirelessly for these events and made exceptional contributions.

Science at the Shine Dome

Our annual celebration of Australian science was a great success. The Shine Dome was at capacity throughout the event. Fellows were joined by numerous teachers, awardees, family, friends and Canberra identities. The program was rich in cutting edge Australian science. Standout presentations included the Flinders Lecture by seismologist Professor Kennett and seminars by the three other career medalists. Also of note were talks by the 11 early career honorific award recipients – testament to the Academy's ongoing commitment to supporting younger researchers.

The 2012 awards for scientific excellence are now open to all Australian scientists and I encourage you to consider nominating a colleague. Please see page 15 for more information.

This year, 18 Fellows formalised their admission to the Academy by signing the Charter Book and presenting highlights of their research. We warmly welcome them and look forward to their active participation in the life and work of the Academy.

At a lively and productive Annual General Meeting, we acknowledged

the outstanding contributions of Professor Graham Farquhar, the outgoing Secretary for Biological Sciences, and retiring Members of Council, Professor Doug Hilton and Dr Oliver Mayo. We also formally welcomed Professor Marilyn Renfree, the incoming Secretary for Biological Sciences, and new Councillors Professor Steve Simpson and Dr TJ Higgins.

Population and environment has long been of concern for the Academy and the 2011 Symposium *Australia 2050: population challenges to sustainability* offered a range of perspectives and approaches to addressing issues associated with the size and rate of growth of the human population in Australia. Professor Bob Williamson and Professor Roger Short are to be congratulated for bringing together an excellent group of speakers. We are particularly grateful to our overseas speakers, Professor Lord May of Oxford, former President of the Royal Society, and Sir Peter Gluckman, Chief Science Advisor to the New Zealand Government.

Federal Budget

We have been working hard in recent months to ensure the Federal Government recognises the importance of the work done by science researchers and educators. We have also argued that the investment of some of the returns from the resources boom in science and science education will help provide for our future. We were pleased that the Government chose to maintain support for science research in the Federal Budget on 10 May, following a highly effective public campaign in which the Academy played an important role. Unfortunately,



Suzanne Cory

however, no funding was allocated to replace the International Science Linkages (ISL) program and we will be working with the Department of Innovation, Industry, Science and Research to explore new options for supporting bilateral international scientific collaborative relationships. While no support was announced in the Budget, we remain hopeful that the Government will find a way to support the Academy's two highly effective primary and high school science education programs, **PrimaryConnections** and *Science by Doing*. The Academy is committed to these programs and will seek to identify alternative sources of funding for both.

Fellowship

I am delighted to inform you that several Fellows have recently been awarded high honours. Professor Alan Cowman, Professor Ian Frazer, Professor Mark Randolph and Dr Patrick Ping Leung Tam were elected as Fellows of the Royal Society and will be formally admitted to the Society on Friday 15 July. A complete list of recent awards to Fellows is provided on page 7.

Finally, it is with sadness that we learned last month of the deaths of Fellows Professor Ken Le Couteur and Professor Bernard Mills. In conveying our condolences to their families, we acknowledged the fine contributions of both these men to Australian science.

Professor Suzanne Cory AC PresAA FRS

UPCOMING EVENTS

The evolution of photosynthesis and oxygenation of the Earth

Elizabeth and Frederick White Research Conference, Australian Centre for Astrobiology, University of New South Wales, 28–29 June

Seeing further: interdisciplinary approaches in a complex scientific age

Public lecture in the *Fenner's science today and tomorrow* series by Dr Ann Moyal, Shine Dome, 5 July. Live streaming of this lecture will begin 6 pm Tuesday 5 July science.org.au/livestream/

What's cooking at the Shine Dome?

Open day at the Australian Academy of Science, 10 am to 4 pm Saturday 13 August

Election and admission of new Fellows

Sixteen new Fellows who were elected to the Fellowship on 23 March 2011, and two Fellows elected in 2010, signed the Charter Book on 5 May 2011, formalising their admission to the Academy. Short biographies for each Fellow are available from science.org.au/sats2011/

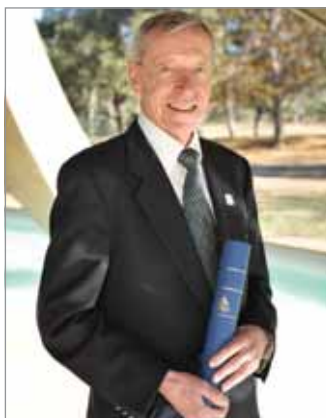
Photos: Mark Graham



John Aitken



Marilyn Anderson



David Black



Mark Blows



Jonathan Borwein



Mahananda Dasgupta

Professor John Aitken *FAA*

John Aitken's ground-breaking research has elucidated fundamental cellular and molecular mechanisms regulating mammalian sperm function, fertilisation and early embryonic development. John has identified a number of novel mediators of sperm-egg interactions with applications in the development of fertility treatments and new contraceptives.

Professor Marilyn Anderson *FAA FTSE*

Marilyn Anderson is recognised internationally for fundamental discoveries in biochemistry that have critical implications for agriculture on a global scale. Marilyn is distinguished for her discovery of defence molecules produced by plants which provide protection from attack by insects and fungi and may have application in enhancing crop protection.

Professor David Black *FAA*

David Black is distinguished for his innovative research in organic chemistry with the synthesis of new types of organic molecules and the discovery of new synthetic methodologies. David has provided exemplary leadership in science diplomacy and is a worldwide ambassador for Australian science and chemistry.

Professor Mark Blows *FAA*

Mark Blows' work on the evolution of complex traits has overturned conventional thinking about what causes evolution to fail in the presence of genetic variation and strong selection for continued evolutionary change. Mark is interested in how genetic variance evolves, how genetic covariance structure biases evolutionary trajectories and how genetic variation limits evolutionary change.

Professor Jonathan Borwein *FAA*

Jonathan Borwein was elected to the Academy in 2010. A short citation appeared on page 8 of *Newsletter* 80, June 2010.

Professor Mahananda Dasgupta *FAA*

Mahananda Dasgupta is distinguished for her work on complex quantum interactions in collisions of heavy nuclei including pioneering measurements of nuclear fusion with unmatched precision. Using novel experimental techniques and theoretical collaborations, Mahananda played a key role in demonstrating the enormous effects of quantum properties of nuclei on reaction outcomes.

Professor Michael Goddard *FAA*

Michael Goddard is distinguished for his work in quantitative genetics. His innovative genetic markers and statistical genetic methods can be used to reveal the genetic architecture of complex traits for agriculture. Michael was not able to attend the formal admission ceremony this year.

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Photos: Mark Graham



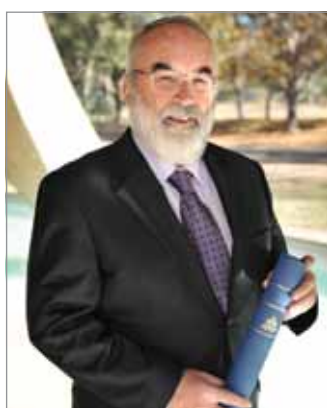
Trevor Hambley



Staffan Kjelleberg



Thomas Maschmeyer



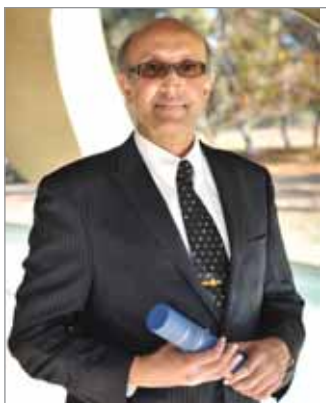
Ross McPhedran



Joseph Monaghan



Ian Petersen



Mathai Varghese



Colin Ward

Professor Trevor Hambley FAA

Trevor Hambley is distinguished for his work in medicinal inorganic chemistry with an emphasis on anti-cancer drugs and anti-inflammatory compounds. Trevor's multidisciplinary research has enhanced understanding of the penetration and effectiveness of anticancer agents on solid tumours with the potential for improved application, effectiveness and outcomes.

Professor Staffan Kjelleberg FAA

Staffan Kjelleberg's findings on mechanisms that regulate the biofilm lifecycle have contributed to microbial ecology, environmental biotechnology and to the uptake of microbial life sciences into environmental engineering. His discovery of naturally derived antagonists of bacterial communication systems has laid the foundation for interdisciplinary research programs and novel biotechnology applications.

Professor Thomas Maschmeyer FAA

Thomas Maschmeyer's groundbreaking research in materials and catalysis has gained him international recognition. His contributions to the fundamental understanding of catalysts at the molecular level include the design and operation of catalytically controlled active sites in porous solids. Thomas sees catalysts as being key to sustainability with wide application including biofuels research.

Professor Ross McPhedran FAA

Ross McPhedran's contributions to wave science have provided methods of unprecedented accuracy, improving performance of microstructured optical fibres, composite materials, diffraction gratings and photonic crystals. Ross pioneered multipole methods for the calculation of the properties of composite materials which are now being developed for application in communication science.

Professor Joseph Monaghan FAA

Joseph Monaghan has received international recognition for his work on smoothed particle hydrodynamics. Joseph's work has had an enormous influence in the vast cosmological simulations that illuminate the evolution of the universe. Joseph's work is distinguished for its breadth of application to astrophysical, geophysical and engineering problems.

Professor Ian Petersen FAA

Ian Petersen's fundamental contributions to robust control theory with innovative advances enabling the synthesis of robust state feedback controllers using standard software tools have received international acclaim. Ian's research on H-infinity control theory, one of the most significant developments in modern control theory, has been applied extensively to many practical control problems.

Professor Robert Pressey FAA

Robert Pressey was elected to the Academy in 2010. A short citation appeared on page 9 of *Newsletter* 80, June 2010.

Photos: Mark Graham



Emma Whitelaw



George Williams



Aibing Yu



Professor Mathai Varghese FAA

Mathai Varghese is distinguished for his work in geometric analysis involving the topology of manifolds and mathematical problems that originate from physics including topological field theories (Mathai-Quillen formalism), the fractional quantum Hall effect and string theory.

Dr Colin Ward FAA FTSE

Colin Ward is distinguished for his work in protein chemistry including unravelling of the 3D structures of the extracellular domains of four growth factor receptors important in cancer, psoriasis and diabetes. Colin's research has revolutionised understanding of the activation mechanisms for these receptors with implications for the development of therapeutic agents.

Professor Emma Whitelaw FAA

Emma Whitelaw has contributed significantly to the field of epigenetics, pioneering the study of transgenerational epigenetic inheritance and clarifying the genotype-phenotype

relationships in higher organisms. Emma's research includes the study of human diseases caused by gene-environment interactions to identify novel targets for drug discovery, and markers to predict disease risk.

Dr George Williams FAA

George Williams has made outstanding contributions to sedimentology, paleoclimatology, paleomagnetic, meteoritics and Earth-Moon dynamics. George's research has shed light on Precambrian glacial environments, the geological and environmental effects of asteroid impact on the Earth and past dynamics of the Earth's rotation and lunar orbit.

Professor Aibing Yu FAA FTSE

Aibing Yu is distinguished for his contributions to particle science and technology. He is world-renowned for the development of methods for the simulation and modelling of the motion of individual particles within large populations in flowing systems. Aibing's research emphasises micro-hydrodynamic interactions and has application in the resource industries. ▲



NEW CORRESPONDING MEMBER

The Academy is delighted to welcome internationally renowned Professor John Dewey of the University of Oxford to its ranks. Geologist Professor Dewey has been at the forefront of transforming tectonic geology to its modern form and has made significant contributions to the understanding of Australian geology. Professor Dewey is a Fellow of the Royal Society of London and a member of the National Academy of Sciences US.

2011 Matthew Flinders Medal and Lecture

The Matthew Flinders Medal and Lecture is awarded in recognition of research of the highest standing in the physical sciences and honours the contributions of Australia's early scientific researchers. It is the Academy's highest award in the physical sciences and is presented on alternate years to the Macfarlane Burnet Medal and Lecture for the biological sciences. The 2011 recipient, Professor Brian Kennett *FAA FRS*, presented the Matthew Flinders Lecture on the topical subject of mapping earthquakes.

In his lecture, *Probing subduction zones: seismic wave propagation and tomography*, Brian described how high frequency energy from deep earthquakes provides useful probes to understand features such as subduction zones in tomographic images. He illustrated, using seismic tomography, how distinct segmentation of the earthquake is linked to changes in the physical properties of the subduction zone for the 2004 Sumatran-Andaman

earthquake and tsunami event (moment-magnitude (*M_w*) 9.3), likening the earthquake to a sequence of falling dominos.

Brian went on to discuss the recent earthquake off the eastern coast of Japan (*M_w* 9.0) that also produced a devastating tsunami on 11 March 2011. Tomographic images – taken prior to the earthquake – indicate that the zone in which the rupture occurred off the coast of Honshu is structurally different to its surrounds, suggesting the significance of structural controls acting on the earthquake.

In concluding, Brian noted that these findings may be used to assist in better identifying places where earthquakes are likely to occur. He likened the study of seismology to the 'chicken and egg' situation – an understanding of earthquakes is required to image the Earth and the images help to understand the earthquakes. When Secretary for

Physical Sciences Professor Peter Hall asked about the main obstacles that lie in the way of earthquake prediction, Brian replied: 'The problem is with the Earth itself. We can recognise the potential for earthquakes, forecasting is feasible, but predicting is another matter'.

Professor Kennett is Distinguished Professor of Seismology at the Research School of Earth Sciences, Australian National University. His research covers a wide range of topics in seismology, from reflection seismology to studies of the deep Earth, from theoretical to observational studies. He has made seminal advances in understanding the Earth's internal processes, pioneered the development of influential new methods for understanding the propagation of seismic waves in complex media and made significant innovations in inversion methods for geophysical problems. ▲



Brian Kennett accepts the Matthew Flinders Medal from Academy President Suzanne Cory



Brian Kennett presenting the Matthew Flinders Lecture at the Shine Dome

Photos: Mark Graham

Awards to Fellows

Fellows of The Royal Society of London

The following Fellows of the Academy have been elected to the Royal Society:

Professor Alan Cowman FAA – for his work in illuminating the mechanisms used by the malaria parasite and

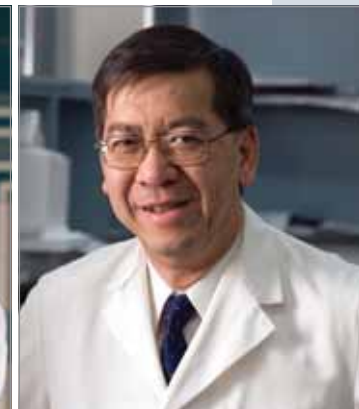
evolving antimalarial drugs including potential vaccines

Professor Ian Frazer FAA FTSE – for his work on developing a vaccine against human papillomavirus (HPV) to protect against cervical cancer

Professor Mark Randolph FAA FTSE – for advancing the design of piled

foundations, new techniques for offshore site investigation and analysis of soil penetration

Professor Patrick Tam FAA – for advancing understanding of early embryonic development and origins of congenital malformations



L to R (Photos): Alan Cowman (WEHI); Ian Frazer; Mark Randolph (Matt Galligan, UWA); and Patrick Tam (CMRI)

2011 ATSE Clunies Ross Awards

This year marked the 20th anniversary of the Academy of Technological Sciences and Engineering's prestigious awards for pre-eminent Australian scientists and technologists who have bridged the gap between research and the marketplace

Academy Fellows **Professor Antony Burgess FAA FTSE** and **Professor Ashley Dunn FAA** together with Dr Nicholas Gough FTSE were awarded for their work on purifying and cloning the blood cell growth factor GM-CSF, and its development for future clinical uses

Roy Woodall FAA FTSE also received a special Lifetime Contribution Award for his work as a geologist and role in many major Australian mineral discoveries

National Academy of Sciences US

Professor Mark Harrison FAA was elected as a Member in recognition

of distinguished and continuing achievements in original research in Earth and planetary sciences

Professor Noel Hush FAA FRs was elected as a Foreign Associate in recognition of his outstanding career in theoretical chemistry research

Other awards

Professor Ken Campbell FAA was awarded the Clarke Medal for 2010 presented by the Royal Society of New South Wales for outstanding contribution to the field of geology

Professor Peter Hall FAA FRs was awarded the Guy Medal in Silver for 2011 by the Royal Statistical Society for papers of special merit which were communicated to the Society, and to his outstanding contributions to the theory and practice of statistics

Professor Chennupati Jagadish FAA FTSE was awarded the 2011 Distinguished Service Award by the IEEE Nanotechnology Council for his distinguished service as President of the Council

Professor Ross Street AO FAA was appointed as Chaire de la Vallée Poussin by the Catholic University of Louvain for 2011, and lecture series

Professor Kurt Lambeck AO FAA FRs was awarded France's highest honour, the French decoration of Chevalier de l'Ordre National de la Légion d'Honneur in recognition of his dedication to promoting bilateral collaborations in science, education and culture and developing amicable relations between France and Australia



Kurt Lambeck

New councillors

In 2011, three new Council members were elected to replace outgoing Secretary Biological Sciences, Professor Farquhar, and ordinary members Professor Hilton and Dr Mayo whose significant contributions during the last three years are greatly appreciated.

Professor Marilyn Renfree FAA – Secretary Biological Sciences

Professor Marilyn Renfree was elected to the Fellowship in 1997 and was a member of Council from 2000 to 2003. She rejoins Council and Executive Committee as the new Secretary Biological Sciences. As Ian Potter Professor of Zoology at The University of Melbourne, Marilyn's research focuses on the control of reproduction and

development in mammals, with special interests in the Australian mammalian fauna, particularly marsupials and monotremes and the evolution of reproduction.

Dr TJ Higgins FAA FTSE

Dr Higgins is a new member in the biological sciences. He was elected as a Fellow in 2004 and is a strong advocate for public awareness of science, regularly discussing gene technology in public forums. TJ is an Honorary Fellow at CSIRO Plant Industry and a leading researcher in plant gene technology. He works on protecting food legumes from insect damage, researching the application of gene technology for plant improvement. His current research focus is on

international agriculture with particular emphasis on West Africa and India.

Professor Steve Simpson FAA

Professor Simpson was elected as a Fellow in 2007 and is a new member in the biological sciences. An Australian Research Council Laureate Fellow in the School of Biological Sciences at The University of Sydney, Stephen has pioneered developments at the interface of nutritional physiology, ecology, and behaviour. His research on locusts has led to an understanding of locust swarming that links chemical events in the brains of individual insects to landscape-scale mass migration. ▲

Photo: Peter Pockley



Marilyn Renfree



TJ Higgins



Steve Simpson

Women in science

The Australian Academy of Science sponsored the recent Women in Science and Engineering Summit (WiSE) at Parliament House, organised by the Australian National Commission for UNESCO, the Australian National Committee for UN Women and the Federation of Australian Scientific and Technological Societies (FASTS).

Attended by Academy President Professor Suzanne Cory and Chief Executive Dr Sue Meek, the Summit brought together science leaders,

advocates and high-achieving young women in science and engineering to explore practical steps to attract and retain women.

During the event Professor Cory and Dr Meek joined senior representatives from industry, research organisations, funding bodies and state and federal government agencies for a closed session discussion with the Minister for the Status of Women, Kate Ellis.

At the Summit's conclusion, CSIRO committed to remove barriers to the

promotion of skilled women, and the Australian Research Council (ARC) and the National Health and Medical Research Council (NHMRC) agreed to changes in how they assess research publications in the grant applications of those with interrupted careers. The ARC committed to extending the period taken into account. The NHMRC this year will consider any nominated five years of an applicant's career rather than the previous five years, and has agreed to monitor gender issues in general.

2010–11 Boden Research Conference

Genome biology of corals and their relatives

The imminent release of the whole genome sequences of two corals formed the focal point for the Boden Research Conference *Genomics of corals and their relatives* on Magnetic Island in north Queensland. The Boden conferences were established by the Australian Academy of Science in 1981 to support an annual series of research conferences in the biological sciences. This conference, held from 6 to 9 March 2011, was also sponsored by the ARC Centre of Excellence for Coral Reef Studies (COECRS) with support from James Cook University and the Australia and New Zealand Society for Cell and Developmental Biology.

The coral *Acropora millepora* will be the first fully 'home-grown' complex genome project; the first animal whose genome has been sequenced and assembled entirely locally. The genome of a second *Acropora* species is being sequenced by a Japanese team at the Okinawa Institute of Science and Technology. Professor Nori Satoh and several members of his marine genomics team attended the Magnetic Island meeting, and made an outstanding contribution.

Fifty delegates attended, including members of the COECRS and six Australian



Photo: Matt Wakefield

Boden Conference delegates at Magnetic Island

universities, along with 15 overseas speakers from eight institutions. The meeting featured an eclectic mix of scientists from bioinformatics, genomics, developmental biology, physiology and microbiology, united by a common interest in corals, their relatives and their symbionts. The meeting explored the application of 'next-generation' DNA sequencing technology to coral biology, and the power of using these methods coupled to the reference genomes and transcriptomes. A second major theme

of the meeting was the interaction of the coral animal with microbes and viruses.

The meeting helped to forge stronger Australian links between institutions, as well as collaborations between individual researchers.

Organisers: Professor David Miller, ARC Centre of Excellence for Coral Reef Studies, James Cook University, and Professor Ove Hoegh-Guldberg, Centre for Marine Studies, The University of Queensland, Brisbane ▲

THE SCIENCE OF CLIMATE CHANGE

Share your thoughts on the exclusive Fellows-only Australian Academy of Science forum discussion. To sign in go to science.org.au/forum/



Photo: iStockphoto

TRAVELLING FELLOWSHIPS, CONFERENCE AND RESEARCH – SUPPORT FOR 2012 OPEN

The Academy has opened applications for funding for a range of travelling fellowships and research conferences, and from the Margaret Middleton Fund for research on the conservation of endangered Australian native vertebrate animals.

The Graeme Coughley Travelling Fellowship for ecologists to travel overseas, and the Rudi Lemberg Travelling Fellowship for Australian

or overseas biologists (especially in the fields of biochemistry and conservation of the environment) to visit Australia, as well as the Selby Fellowship for overseas scientists in all fields of science to visit Australia, are all available for 2012.

Applications are also invited for a Boden Research Conference in the biological sciences, a Fenner Conference on the Environment, and an Elizabeth and Frederick White Research Conference in the physical sciences to be held in 2012 or 2013.

Closing date is 31 August 2011. Further information is available from science.org.au/awards/research-award.html

National committees

Astronomy

The mid-term review of *New horizons: a decadal plan for Australian astronomy (2006–2015)* is nearing completion. The mid-term review subcommittee includes early and mid career scientists as well as members of the National Committee for Astronomy (NCA). During March the draft report was presented to the NCA and to the Academy's Executive Committee of Council. It will be published in coming months and launched at the Astronomical Society of Australia conference in July.



National Committee for Data in science (L to R): Jane Hunter, Chennupati Jagadish, Rhys Francis, Ross Wilkinson and Lesley Wyborn

Biomedical sciences

The National Committee for Biomedical Sciences met on the 16 May 2011 in Sydney. Key to their discussions was the continued development of the Biomedical Educational Forum, which will be held in Canberra at the Shine Dome on Monday 12 December. More information will be made available from the Academy website science.org.au/natcoms/nc-biomedical.html, or email the national committee secretariat at nc@science.org.au

Chemistry

The International Year of Chemistry started in January and various events have been held across Australia to mark the event. The National Committee for Chemistry (NCC) plans to fund a prestigious international speaker in chemistry to tour the major capital cities of Australia.

The NCC also provided a submission to the *2011 Strategic roadmap for Australian research infrastructure* discussion paper.

Crystallography

The National Committee for Crystallography (NCCr) met on 28 April 2011, during the 27th meeting of the Society of Crystallographers in Australia and New Zealand (SCANZ), Crystal 27, in Rotorua NZ. Discussion topics included Australian microscopy, OPAL activities, the *2011 Strategic roadmap for Australian research infrastructure* and the Australian Synchrotron.

The commemorative Bragg symposium will be held on 6 and 7 December 2012 in Adelaide. The Academy is sponsoring this celebration of the centenary of the Braggs' seminal work.

Data in science

The National Committee for Data in Science (NCDS) met at Ian Potter House on 9 March 2011, to discuss a response to the Department of Innovation, Industry, Science and Research (DIISR) discussion paper concerning the \$50 million Super Science Research Data Storage Infrastructure (RDSI) project. The RDSI investment project, developed as a result of the DIISR consultation, was signed on 23 December 2010 with The University of Queensland as the lead agent.

An NCDS proposal for better efforts to coordinate data standards amongst International Council for Science (ICSU) Unions was accepted at the 2010 International Committee on Data for Science and Technology (CODATA) General Assembly in South Africa. Following from this CODATA have prepared a grant proposal that was submitted to ICSU for possible funding.

Earth sciences

The 25th International Union of Geodesy and Geophysics General Assembly, the affiliated International Science Union

to the National Committee for Earth Sciences, is being held in Melbourne this year, from 28 June to 7 July. The topic for the General Assembly is *Earth on the edge: science for a sustainable planet* and is expected to attract in the order of 4000 delegates from Australia and overseas.

Earth system science

The National Committee for Earth System Science met on 25 March 2011 at Ian Potter House. Implementation of the committee's discipline review, *To live within Earth's limits: an Australian plan to develop a science of the whole Earth system*, was on the agenda including a website and office for Earth system science (ESS), and the next ESS outlook conference. A workshop on geoengineering, with a focus on carbon and radiation management, is planned for later in the year.

History and philosophy of science

The Australian Academy of Science's National Committee for History and Philosophy, along with the National Museum of Australia invited submissions for the National Museum of Australia Student Prize for the history of Australian science or Australian environmental history. The essay prize was open to enrolled, graduate or post-graduate

students at any tertiary institution in the world. Submissions closed Friday 25 March, with representatives from the National Committee for History and Philosophy of Science and the National Museum of Australia evaluating the essays. The 2011 award winner will be announced in June.

Mathematical sciences

The National Committee for Mathematical Sciences (NCMS) met in Perth on 28 February, including a joint meeting with the Executive Committee of the International Mathematical Union (IMU). The executive meeting was hosted by Professor Cheryl Praeger FAA, a member of the IMU Executive and the NCMS. The committee discussed the need for a forward-looking plan for the discipline to follow on from the *2006 national strategic review of mathematical sciences in Australia*, and *A national strategy for mathematical sciences in Australia 2009*. Nominations to positions on the International Commission on Mathematical Instruction were also discussed. In the joint meeting with the IMU executive, members of the executive explained how their respective countries approach the health of the discipline.

Nutrition

The National Committee for Nutrition (NCN) is co-financing a symposium on *Future directions in saturated fats: composition and metabolism* with the International Life Sciences Institute. The symposium will run in Melbourne on 14 September 2011, and will be opened by Professor Andy Sinclair, Chair of the NCN. Further information is available on the Academy website science.org.au/natcoms/nc-nutrition.html

The committee will meet on 15 June in Melbourne to discuss further opportunities to hold symposiums and events in the area of nutrition, and to assist with the development of government policy.

Physics

A working group established by the National Committee for Physics have met several times to further the development and the drafting of the physics decadal plan. A workshop is to be held in Sydney in June to provide the wide range of stakeholders involved in the education and development of physics, as well as employers of physics graduates, an opportunity to provide comment on the draft and have an input into the final document. Further information regarding the decadal plan development, working group membership and results of working groups and meetings can be found at the following website www.physicsdecadalplan.org.au/

Plant and animal sciences

The National Committee for Plant and Animal Sciences met on 15 April 2011 in Canberra. The meeting focused on the basic necessities of the disciplines and the major needs that can be addressed physically. The ongoing development of these ideas will feed into a strategic plan, and work towards the development of a decadal plan.

Quaternary research

The National Committee for Quaternary Research met at Ian Potter House on 8 April. Discussion included the upcoming 18th International Union of Quaternary Research (INQUA) Congress and General Assembly, 20 to 27 July 2011,


Bern, Switzerland. Dr Craig Sloss and Dr Steven Phipps will represent Australia as voting delegates. Reports were received on activities of the commissions of INQUA. Data has been collected from 120 respondents as preparatory work for a possible discipline strategic plan. Archiving of field and laboratory data was also on the agenda.

Space science

The National Committee for Space Science (NCSS) met in Sydney on Friday 27 May. The committee invited several government representatives to the first half of the meeting to promote discussion between the representatives and report on the activities of the committee. The NCSS provided a submission to the *2011 Strategic roadmap for Australian research infrastructure* discussion paper in May 2011.

2011 Strategic roadmap for Australian research infrastructure

Several national committees have made submissions to the DIISR Discussion Paper *2011 Strategic roadmap for Australian research infrastructure*. The Academy's response and comments are available at science.org.au/reports/documents/Roadmapinfrastructuresubmission.pdf

The discussion paper includes a reference and link to the Academy's publication *To live within Earth's limits: an Australian plan to develop a science of the whole Earth system*. 

ROYAL SOCIETY OF NEW ZEALAND VISITS ACADEMY

The Royal Society of New Zealand's (RSNZ) recently appointed External Affairs Manager, Dr Marc Rands, visited the Academy on 28 April 2011. Marc is responsible for the management of RSNZ's national and international relations. He met with the Chief Executive and secretariat officers responsible for international relations, science policy and communications to gain an understanding of the activities of the Academy, and to discuss policy positions and external relations issues in both countries, especially in relation to the ICSU. Opportunities to collaborate on future initiatives were also discussed.

International news



Wan Gang and Kim Carr (front left and right) share a meal and a laugh at the Shine Dome

Meetings of InterAcademy Panel: the global network of science academies

Foreign Secretary Professor Andrew Holmes attended a meeting of the Executive Committee of the *InterAcademy Panel: the global network of science academies* (IAP), and joint meetings of the IAP, the InterAcademy Council and the InterAcademy Medical Panel in Washington DC. The meetings were hosted by the US National Academy of Sciences from 28 to 30 March 2011. Topics covered included the fourth IAP Conference of Young Scientists, to be held in conjunction with the World Economic Forum's Annual Meeting of the New Champions in Dalian, China, from 14 to 16 September 2011. The Academy is nominating two Australian researchers to attend this event.

An IAP Global Activities Committee science education meeting was held at the French Academy of Sciences in Paris on 2 April 2011. The Academy was represented by **PrimaryConnections** Project Director Shelley Peers. Academy

past president Professor Kurt Lambeck attended in his capacity as President of the Federation of Asian Scientific Academies and Societies (FASAS).

Australia–Korea Foundation Early Career Science and Technology Researchers Program 2011

Fifteen young Australian researchers were selected to travel to Korea from 16 May to 27 May for the 2011 Australia–

Korea Foundation Early Career Science and Technology Researchers Program which is co-managed by the Academy and ATSE.

The program aims to enable active Australian early career researchers to raise awareness of and interest in Australian research in Korea and allow the researchers to meet with mentors and share their findings and skills with colleagues from Korea. Funding was provided by the Department of Foreign Affairs and Trade's Australia–Korea Foundation, the Korean National Research Foundation, the Academy, and the International Science Linkages Program.

China's Minister for Science and Technology visits Academy

On 23 March Dr Wan Gang, Minister of Science and Technology of the People's Republic of China, visited the Academy to deliver a lecture on China's Science and Technology Policy. The Shine Dome event was attended by more than 150 guests.

Following the lecture, Dr Wan Gang was hosted by the Minister for Innovation, Industry, Science and Research, Senator The Hon Kim Carr, at a private dinner function in the Jaeger Room. Other notable guests were His Excellency Mr Yuming Chen, Chinese Ambassador, Professor Warwick Anderson, ATSE Vice-President Professor Mary O'Kane, and Academy Fellows Dr Jim Peacock and Professor Chennupati Jagadish. ▲

BIRTHDAY WISHES TO GUS

Happy birthday to past president Sir Gustav Nossal AC FAA FRS FTSE who turned 80 on 4 June.



Photo: WEHI

Science by Doing

With Stage One of *Science by Doing* drawing to a close it is 'all hands on deck' to complete revision of the resources for release in July. Word of the program's success is spreading, as evidenced by the ever-increasing number of inquiries from teachers, principals and, in some cases, school systems.

The eagerly anticipated resources support teachers to adopt a more inquiry-based, or student-centred, approach to science education. The new *Australian Curriculum: Science* emphasises this same approach.

Changes in teaching and learning measured during the trial of the resources reflected the principles of inquiry-based education. For example, there was a significant decrease in students copying notes and listening to 'teacher talk', and a similarly significant increase in student group work, student investigation and the quantity of open questions being asked.

Stage One, initiated in 2009, achieved milestones including: the creation and publication of trial resources; trials of the *Science by Doing* Professional Learning Approach and resources; an independent evaluation of Stage One; and revision of resources based on feedback. This stage will come to a close on 30 June 2011.

The Academy is working hard to secure funding for the next stage of the program including production of three additional curriculum resources and two more professional learning resources (PLRs). The PLRs will consider diverse themes such as: science departments as professional learning communities; science as a human endeavour; and Indigenous perspectives. Work will also continue on collaborating with education systems to implement our professional learning approach. While Stage One has been a great start, there remains a great deal of work to be done to maintain the momentum for change and improvement in secondary school science. We remain ever hopeful that resources will be secured to continue this important work.

Support for the program has been overwhelming and including

endorsement by the Australian Science Teachers Association, Australian Secondary Principals Association, Australian Deans of Science and a number of state and territory education ministers and leaders. 



2011 is the International Year of Chemistry

Strengthening ties with South-East Asia through Education

In early May Amelia Druhan, Deputy Director of *Science by Doing*, met with Professor Sangkot Marzuki President, Indonesian Academy of Sciences, at the Eijkman Institute in Jakarta. The purpose of the meeting was to introduce *Science By Doing* and explore opportunities for collaboration with Indonesia and other countries in South-East Asia. The meeting was a great success and several invitations have since been extended to *Science by Doing*.

With the support of the Australian Embassy in Jakarta, Amelia will provide a keynote presentation at the South-East Asian Ministers of Education Organisation's (SEAMEO) *International*



conference on science education in Bali later this year. Following the conference she will run a workshop at the SEAMEO Regional Centre for Quality Improvement of Teacher and Educational Personnel in Science in Bandung, Indonesia. The grassroots workshop experience will inform the shape of future collaborations and determine the best way we can support our closest neighbours.

PrimaryConnections



Professor Jenny Graves assists Tinana State School students gather results in their light investigation

In early March an order was placed for all 19 **PrimaryConnections** curriculum units by Tinana State School near Maryborough, Queensland. This order included the 300,000th curriculum unit of the Academy's **PrimaryConnections** science education program. To mark this milestone, Professor Jenny Graves, the Academy's Secretary for Education and Public Awareness, presented the units in person to Tinana State School acting Principal David Burns on 12 April.

Following the presentation visitors were invited to watch Shane Sanderson's Year 4 class complete the investigation lesson from the unit *Light fantastic*, observed by members of the news media. As Jenny Graves' first experience of **PrimaryConnections** in the classroom, she was impressed to see students' high level of involvement and thinking skills and how effective the cooperative learning roles were. At the end of the lesson, Jenny spoke about her research, engaging the students by connecting them to science in the wider world.

Teachers of Tinana State School have been successfully teaching science with **PrimaryConnections** units since 2007. David Burns commented on how the well-structured inquiry-based approach

had improved the confidence of his teachers to teach science and enhanced the students' learning and enthusiasm for science. He expressed concern that Federal Government funding may cease before the completion of a program that had seen so much positive change in his school.

The Academy appreciates the concern expressed in a variety of forums for the future of **PrimaryConnections**, and has been overwhelmed by letters of support illustrating how **PrimaryConnections** continues to make a difference in primary science education in Australia.

The **PrimaryConnections** curriculum and professional learning teams moved into their new Sydney offices in February. The team is now well settled and forging ahead in writing and publishing new curriculum units aligned to the new *Australian Curriculum: Science*. The move enables the professional learning team to work more closely with state education sectors. ▲



Antarctic science from Mawson's expedition to today

In 1912 the Australasian Antarctic Expedition, led by Douglas Mawson, established a base that began Australia's involvement in Antarctic research. In recognition of this and many other achievements, Mawson later received a knighthood, was elected to the Royal Society of London and became a Foundation Fellow of the Australian Academy of Science. The Academy commemorates his work with the Mawson Medal and Lecture, recognising outstanding contributions to Earth science in Australia.

Next year, the Australian Academy of Science will commemorate the centenary of that expedition with an annual symposium on the topic *Antarctic science: from Mawson's expedition to today*. Taking place on 4 May 2012 at the Shine Dome, the symposium will highlight developments in modern Antarctic science. Symposium co-chairs Dr Trevor McDougall FAA and Professor Ian Allison have prepared an inspiring program of Antarctic science, traversing biology, geology, atmospheric and climate change research.

Annual symposium 2012

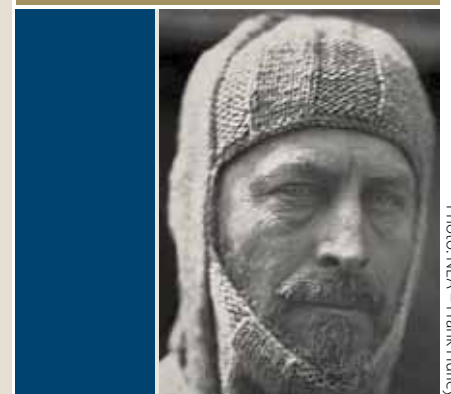


Photo: NLA - Frank Hurley

Nova: Science in the news

The following topic has been posted on the Academy's education website, *Nova: Science in the news* science.org.au/nova/

Piezoelectricity and self monitoring planes

Metal fatigue, the build up of stresses and strains in metal structures subjected to repetitive back and forward movements, has been the cause of many plane, drilling rig, bridge, ship and submarine disasters. Various forms of non-destructive testing exist, but finding the early signs of metal fatigue can be laborious, time consuming and costly. Australian researchers are now working on developing 'self-monitoring' structures, including planes that can check their own vital signs mid flight and give warning if trouble is looming. Such technology has been enabled through the application of piezoelectric sensors.

Discovered in the mid-18th century, piezoelectricity is the electrical charge that results when certain asymmetrical crystals are subjected to vibrations or mechanical stress. Piezoelectric crystals are already used in gadgets such as barbecue lighters, digital watches and electronic birthday cards. Australian defence scientists are now exploiting the properties of such crystals to produce sensors capable of detecting tiny metal

fatigue cracks as they occur. The technology involves incorporating piezoelectric sensors into engineered structures, particularly in those parts where stresses and strains tend to accumulate.

As a result of extensive research by defence scientists into piezoelectric sensor technology, air force planes are now able to fly longer and more cost effectively. In the future, similar structural health monitoring technology may be incorporated into structures such as

bridges and civilian aircraft, reducing the possibility of fatigue induced catastrophes. New devices are also being created that can better counteract mechanical stresses or close an opening crack. This is not a bad outcome, given that piezoelectricity was once nothing more than a laboratory curiosity. ▲



Photo: DSTO

Researchers at the Defence Science and Technology Organisation (DSTO) installing piezoelectric macro-fiber composites to the vertical tail of an F/A-18 test specimen for use in a buffet load alleviation test. This work is the result of an international collaboration between the US Air Force Research Laboratory, the National Research Council Canada, NASA Langley Research Center, and DSTO

Awards for scientific excellence are open

Nominations for the Academy's 2012 Honorary Awards for early career and career researchers are now invited for the following:

Early career awards

Fenner Medal (biology – excluding biomedical sciences)

Ruth Stephens Gani Medal (human genetics including clinical, molecular, population and epidemiological genetics and cytogenetics)

Gottschalk Medal (medical sciences)

Anton Hales Medal (Earth sciences)

Christopher Heyde Medal (applied, computational and financial mathematics)

Dorothy Hill Award (Earth sciences)

Le Fèvre Memorial Prize (chemistry)

Pawsey Medal (physics)

Frederick White Prize (physical, terrestrial and planetary sciences)

Career awards

David Craig Medal (chemistry)

Haddon Forrester King Medal, sponsored by Rio Tinto (mineral exploration)

Mawson Medal and Lecture (Earth sciences)

Ian Wark Medal and Lecture (applied science)

2013 Matthew Flinders Medal and Lecture (physical sciences – nominations from Academy Fellows only)

Nominations close 29 July 2011.

Criteria and nomination forms are available from science.org.au/awards/

Interviews with Australian scientists

Australian scientists are a diverse lot; shy, gregarious, cheeky, serious, charming, feisty and each with a fascinating story to tell. The *Interviews with Australian Scientists* project captures these stories from both Academy Fellows and other interesting scientists. Biographical in nature, the interviews follow the scientists from childhood, through their sometimes misspent youths, to post-doctoral fellowships and beyond. Interviews with Professor Ross Day FAA, Dr Angus McEwan FAA FTSE, Associate Professor Bryan Fry and Dr Alicia Oshlack were filmed in the past three months.

In February, Professor Max Coltheart FAA interviewed Professor Ross Day in Canberra about his life in science. Ross made his name in science for his work on dark adaptation, perception and geometric illusions. During the interview Ross reminisced about the challenges of trying to lecture on the complex topic of human perception with no audiovisual aids except a piece of chalk and a blackboard. This interview was sponsored by Monash University.

April Fool's Day found the *Interviews* project in Hobart, Tasmania with oceanographer Dr Angus McEwan. He was interviewed by Dr Trevor McDougall FAA who thankfully refrained from practical jokes (although he did make everyone laugh). Angus' research in geophysical fluid dynamics earned him an international reputation and a position as Chief of the CSIRO Division of Oceanography. While Angus is now retired, his expertise in fluid dynamics is being put to use in racing his yacht *Indigo*. This interview was kindly sponsored by the Bureau of Meteorology.

Early career medallists Associate Professor Bryan Fry and Dr Alicia Oshlack were interviewed during the annual *Science at the Shine Dome* meeting in May. During the interview, which was proudly sponsored by The University of Queensland, Bryan spoke about his life-long passion for venomous creatures and his worrying track-record of attacks from lizards, snakes and spiders, although it sounded like he got them more often than they got him! Meanwhile, Alicia,



On April fool's Day, jokester Trevor McDougall (left) interviewed Angus McEwan (right) in Hobart

spoke of her bold move from astrophysics to bioinformatics during her post-doctoral years. She also shared the challenges of balancing family and career.

Transcripts from the interviews with Professor Henry Burger FAA, Professor Nick Hoogenraad, Dr Garth Paltridge FAA and Professor Roger Short FAA are now available, along with 'teaser' length videos of Professor Andy Cole FAA

and Professor John Lovering FAA FTSE from science.org.au/scientists/



interviews
with **Australian
scientists**

Lindau participants at Science at the Shine Dome

Six young Australian researchers nominated by the Academy to attend the 61st Meeting of Nobel Laureates will travel to Lindau, Germany, in June 2011. They join around 600 other students from all over the world to meet and talk with Nobel Prize winners in the fields of physiology and medicine. As part of their award from the Academy, which includes funding of up to \$2000 to get to Lindau, they were sponsored to attend *Science at the Science Dome*.

All the Lindau participants were thrilled to be at the event. Of particular

interest was a briefing provided to them by four Academy Fellows, Professor Bob Williamson, Professor Ron Ekers, Professor Andrew Holmes (all three have led previous delegations) and this year's delegation leader, Professor Marilyn Renfree. The Fellows provided the Lindau participants with an insight into the 'behind the scenes' aspects of the event, emphasising that with some leg work, it is often the more casual meetings with Nobel Laureates that can be most rewarding.

Early-career researchers

More than 70 early-career researchers (ECRs) from a diverse range of disciplines participated in the ECR program at *Science at the Shine Dome*. Twelve ECRs were sponsored by CSIRO, National Health and Medical Research Council, Department of Environment and Sustainability, Victoria, and the South Australian Department of Environment and Natural Resources. In addition to the main program, the ECR stream offered a choice of three career development workshops. The *Media and communicating science* workshop with Dr Paul Willis, previously a presenter on ABC's *Catalyst* and recently appointed as the Director of the Royal Institution of Australia, explored the 'nuts and bolts' of science communication and armed ECRs with practical advice as to how they can most effectively present their research in the media. *Building successful collaborations*, presented by Academy early-career awardees Professor Bryan Gaensler of The University of Sydney and Dr Alicia Oshlack of the Murdoch Childrens Research Institute, was offered for the first time

in 2011. The workshop focused on tips for establishing a productive collaboration and how to resolve common issues that may arise between collaborators. The third workshop, *Grant writing skills*, was facilitated by new Fellow Professor Ian Petersen of The University of New South Wales at the Australian Defence Force Academy and Professor Brendan Crabb, Director of the Burnet Institute. Participants

were advised on how to 'sell' their research ideas successfully and avoid common pitfalls of the grant writing process.

Feedback on the event highlighted that the ECRs valued the opportunity to learn about research being conducted in a diverse range of disciplines by some of Australia's leading scientists, and to gain important career development skills. ▲

Comments about *Science at the Shine Dome* from ECRs

Hearing the science and stories of the New Fellows was very inspirational and a motivational boost for my own work and I wish I could attend every year.

The mixture of attendees... provided an exceptional opportunity. I met with scientists that I have had the utmost respect and admiration for my entire career...The dinner has made a profound impression on me and my commitment to research.

I really enjoyed the dinner and was amazed to be sitting next to one of Australia's most famous scientists [John Shine] who was really great to talk to.

I really enjoyed this night...and felt really privileged to have had the opportunity to meet and talk to the Fellows.

... the Fellows of the Academy of Science ... made an extraordinary effort to come around and talk to ECRs.

Teachers workshop

Science teachers from around Australia valued the opportunity to hear about the latest developments in a range of scientific disciplines at this year's *Science at the Shine Dome*. Through the generosity of Professor David Craig FAA, the Academy sponsored one teacher from each state and territory in Australia to attend. Debra Smith, the 2010 winner of the Prime Minister's Prize for Excellence in Science Teaching in Secondary Schools, Dr Jane Wright, the BHP Billiton Science Teacher awardee for 2010, and the President, Anna Davis, and CEO, Peter Russo, of the

Australian Science Teachers Association (ASTA) also participated.

A special teachers workshop program was conducted at the Research School of Biology at the Australian National University. Following a welcome by Anna Davis, the teachers participated in an interactive computer presentation run by Joanna Abbs from *Science by Doing*, as well as hearing about the breadth of education programs offered by the Academy.

The teachers also shared methods, ideas and curriculum approaches

through a series of short seminars based upon the theme of *What works when teaching science*. The ideas presented included: using investigative processes (such as how soft drink or wine is made) to introduce complex scientific concepts, how to make school science more hands-on and relevant, utilising analogies, role-play, excursions and e-learning technology in science teaching, and an overview of some new and exciting science teaching internet resources.

Feedback from the teachers was overwhelmingly positive and indicated that the experience had been a valuable one. Comments received included:

It was great to have such a diverse range of conversations with so many people outside of the teaching profession. It gave a glimpse of what other people's work involves which is a refreshing perspective from my own.

It was a truly rewarding experience... my thinking was stretched... I found it inspiring to hear of the latest research in the scientific community. ▲

Photo: Mark Graham



2011 Teacher awardees: Vanessa Mann, WA; Kym Knights, Tas; Georgie Wynne, NT; John Cherry, NSW; Nerida McCredie, NSW; Dominica Thomson, SA; Donna McDonald, ACT; Sue Monteath, Qld; and Catherine Zerbe, Vic

Obituaries

Ken Le Couteur



Kenneth James Le Couteur was born in Jersey, in the Channel Islands, on 16 September 1920 and died in Canberra on 18 April 2011. He was educated at Cambridge (BA 1941, MA 1945, PhD 1949), where he was the joint winner in 1941 of the Mayhew Prize for distinction in applied mathematics. His studies were interrupted by WWII and he spent 1941–45 as a scientific officer in the Ministry for Aircraft Production, working at Bletchley Park, the British codebreaking station.

After completing his PhD he spent a year as a Fellow in the Physics Department at Manchester University (1948–49), working on the evaporation theory of nuclear disintegration. He then took a senior lecturer's position at Liverpool University, where a synchrocyclotron was being built, and was promoted to reader later in his seven year appointment. During this period he invented the 'regenerative' method of beam extraction, which collimated the external particle beam, improving its intensity 100 to 1000-fold.

In 1956 he moved to the Australian National University as Foundation Professor and head of the Department of Theoretical Physics. He held this position until his retirement in 1985, when the title of emeritus professor was conferred on him. He bought the first computer for the ANU in 1960, an IBM 1620. He encouraged interaction with the experimental departments within the physics school and worked closely with the nuclear, particle and plasma groups. His research ranged from purely

fundamental mathematical studies on a conjecture of Bessis concerning the partition function for quantum statistical mechanical systems to the more practical considerations of focusing and guiding charged particles by magnetic fields. He played a very active role in building up the department, acting as head of the Research School of Physics, for extended periods on two separate occasions. His contribution to the development of not only the department but also the school was recognised by the ANU in 1996 when the mathematical sciences building was named the Le Couteur Building.

Ken was elected to the Academy in 1960 and received a Centenary Medal in 2003. He was a keen sailor and built his own boat which he sailed on Lake Burley Griffin with his family.

Ken married Enid in 1950. She survives him, together with their children Caroline, Penelope, Mary (now called Avinashi), their foster daughter Marion, and two grandchildren.

Bernard Mills



Bernard Yarrnton Mills was born on 8 August 1920 in Sydney, where he died on 26 April 2011. He was educated at The University of Sydney (BSc 1941, BE 1943, ME 1949, DSC Engineering 1959). Along with the other five students who completed electrical engineering honours in 1942 he joined CSIR Division of Radiophysics to work on radar research and development. After the end of the War he remained with Radiophysics, working his way up to senior principal

research officer. His first project was the successful development of a linear accelerator system for an X-ray tube. He then spent some time assisting Trevor Pearcey with the development of Australia's first digital computer before joining Joseph Pawsey's radio astronomy group to work on point radio sources using an interferometer with small and large spacings. However, he realised they didn't give a whole picture of what was in the sky and that resolution was more important than sensitivity for this low frequency work. He decided to build a cheap pencil beam instrument and the result was the two-dimensional Mills Cross Telescope, built at CSIRO's Fleurs field station in Badgerys Creek.

In 1960 he moved to The University of Sydney as reader in astrophysics and started a radio astronomy group there. In 1962 he established the Molonglo Radio Observatory near Canberra. The telescope built there, the 'One Mile Cross', was used to discover some of the first pulsars in the Southern hemisphere. From 1965 until his retirement in 1985 he was professor of astrophysics. He then had the title of emeritus professor conferred on him.

Bernie was elected as a Fellow of the Academy in 1959 and served on the Council from 1969 to 1971. Other honours include the Academy's Lyle Medal in 1957, election to the Royal Society in 1963, the Britannica Australia Award for Science in 1967, appointment as a Companion in the Order of Australia in 1976 and a Centenary Medal in 2003. In 2006 he was awarded the Grote Reber medal which is administered by the Queen Victoria Museum in Launceston, Tasmania.

During his university days Bernie was a very keen chess player. He returned to it after the war years, with some success, but gave it up in 1950 because of work pressures. He then took up painting.

Bernie married Lerida Karmalsky in 1942 and they had three children, Eric, Miranda and Deborah (now called Shamynka). After his wife's death in 1969 he married Crystal Davidson. She survives him, together with his children, two step children and five grandchildren. ▲

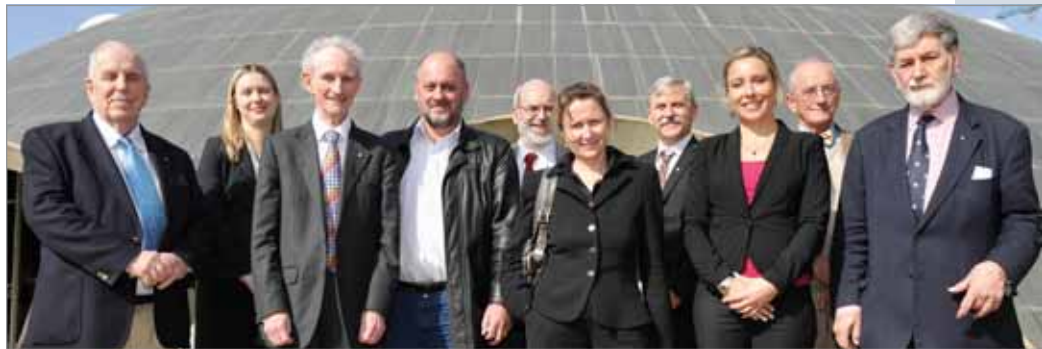
Australia 2050: population challenges to sustainability

Impacts associated with the size and rate of growth of the human population in Australia have long been a major concern of the Academy. As public awareness of these issues grows, this year's annual symposium was a timely opportunity to revisit the science that should inform our nation's approach to population, water and land resources, and environmental sustainability.

The proceedings from the Academy's 1994 symposium, *Population 2040: Australia's choice*, remain a key reference on this area, as does the 2004 Fenner Conference on the Environment, *Understanding the population–environment debate: bridging disciplinary divides*, held as part of the Academy's 50th anniversary celebrations. This was preceded by a report and online conference, *Population and the environment in Australia: 2003*, that were supported by the Population and Environment Fund established by longstanding benefactor, Dr Bill Gladstones. With the recent sad loss of Professor Frank Fenner FAA and Bill Gladstones, it was fitting that this year's symposium *Australia 2050: population challenges to sustainability* progressed the examination of a theme so close to both men's hearts.

Academy President Professor Suzanne Cory, who chaired the morning sessions, introduced proceedings by noting that while Australia's vast distances give the nation an 'empty' appearance from the air, from a resource perspective it could be considered 'full'. She said projected figures indicate that Australia's population will double by 2050, but consensus still has not been reached on whether this country is able to sustain a population greater than already exists.

The Hon Dr Barry Jones, a Fellow of all four learned academies, officially opened the annual symposium with his presentation *Getting the politics right on population: engaging the political mind on long term factors*. Barry suggested that the population and sustainability issue should not be just about the numbers, but numbers factored by resource use, and that debate has been hijacked by the refugee issue with barely a mention of Australia's carrying capacity and impact



2011 symposium speakers (L to R): Roger Short, Alison King, Lord May, Tim Flannery, Peter Gluckman, Robyn Norton, Tom Hatton, Vanessa Rauland, Tony Fischer and Barry Jones (Photo: Mark Graham)

on the environment. Barry warned that Australia's historical practice of 'wreck and move on' cannot continue indefinitely, and continued population increase will mean having to give some things up.

In his presentation *Hard choices and tomorrow's Australia*, Professor Lord May discussed our seeming inability to face the challenges we have created for ourselves as a consequence of increasing human population, consumption and impact on the environment. He urged Australia to maintain a focus on concrete solutions to population growth.

2011 Australian of the Year, Simon McKeon demonstrated that the relationship between prosperity and population is not linear in his talk *Is continued economic prosperity in Australia dependent on significant population growth?* Simon noted that an optimum, sustainable size for Australia is seldom considered, recommending a precautionary approach to sustainable growth as a policy priority.

CSIRO Plant Industry Honorary Research Fellow, Dr Tony Fischer AM FTSE discussed the notion of population growth as an opportunity for Australian agriculture in his presentation *Australian agriculture and the challenge of population growth*.

Curtin University's Vanessa Rauland illustrated how increasing population density in our cities can be a catalyst for urban transformation in her presentation *Decarbonising the built environment: can our cities accommodate an increasing population while reducing their carbon footprint?*

Professor Robyn Norton from the George Institute for Global Health continued the

theme of urban growth, discussing *Population growth in our cities: is there a tipping point for health and infrastructure?*

Robyn noted that urban residents have better health than rural residents, and that evidence suggests population growth in cities will continue to be associated with improved overall population health. However, overall positive benefits mask indications that the benefits of city living are not evenly distributed, and the urban poor are most likely to suffer a triple burden of increased exposure to communicable diseases, non-communicable disease and greater risk of exposure to violence and injury.

In 1994, Tim Flannery presented a paper on the *Biological considerations in determining an optimum human population for Australia* as part of the *Population 2040: Australia's choice* symposium. Professor Flannery's 2011 sequel *Determining an optimum, sustainable population for Australia* called for effective population policy formulation in discussing disconnections between policy setting and implementation, and the setting and reviewing of population targets.

The afternoon session chaired by the Secretary Education and Public Awareness, Professor Jenny Graves FAA began with Dr Tom Hatton, Director of CSIRO Flagship Wealth from Oceans. In his presentation *The relationship between Australia's water and her sustainability* he proposed water recycling and local desalination as cheap, energy efficient, safe solutions to ensuring local water supplies in cities. Tom noted a trend towards developing water security through a mixture of: demand



Roger Short giving an interview during *Australia 2050: population challenges to sustainability symposium*
(Photo: Mark Graham)

management; decreased reliance on fresh water; and increased reliance on manufactured sources, has the potential to decouple economic and population growth from pressures on freshwater environments.

Dr Alison King from the Arthur Rylah Institute for Environmental Research presented *Thirsty people and less water: can we sustain the freshwater environment?* Alison discussed the consequences of river regulation on freshwater ecosystems, citing the importance of flow regime,

pulse, timing and history in restoring environmental flows to freshwater systems in the context of her freshwater fish research.


Professor Graeme Hugo FTSE started his discussion on *Australia's contemporary population growth and the outlook: challenges and opportunities* with a warning that there is no silver bullet solution and that population discourse has been oversimplified. Graeme, in explaining the population dilemma, suggested that some growth is required

to replace the baby boomer workforce but with considerable environmental constraints on that growth. He suggested that informed policy requires interdisciplinary consideration of evidence based science and social science.

Maria Deveson Crabbe, CEO of Marie Stopes International Australia, spoke on the topic *Global family planning for our future*. She discussed how voluntary access to contraceptives, reproductive health care and family planning for women is the key to reducing fertility rates and unchecked population growth, thereby reducing poverty, making development sustainable and saving women's lives.

Professor Sir Peter Gluckman FRS, Chief Science Advisor for New Zealand spoke on *The demographic storm: direct and indirect implications for human health*. He highlighted the growing global double burden of malnutrition – over and under nutrition – and also raised the concern that increasing social density associated with increasing urban density is changing brain function and the way we communicate, with mental health and social cohesion implications.

Symposium co-organiser Professor Roger Short AM FAA FRS closed the meeting, remarking that as one of the most affluent and affluent nations, Australia must learn to live in equilibrium with the environment.

Full audio and video recordings of the 2011 symposium proceedings are available online from science.org.au/sats2011/ 

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