Australian Academy of Science

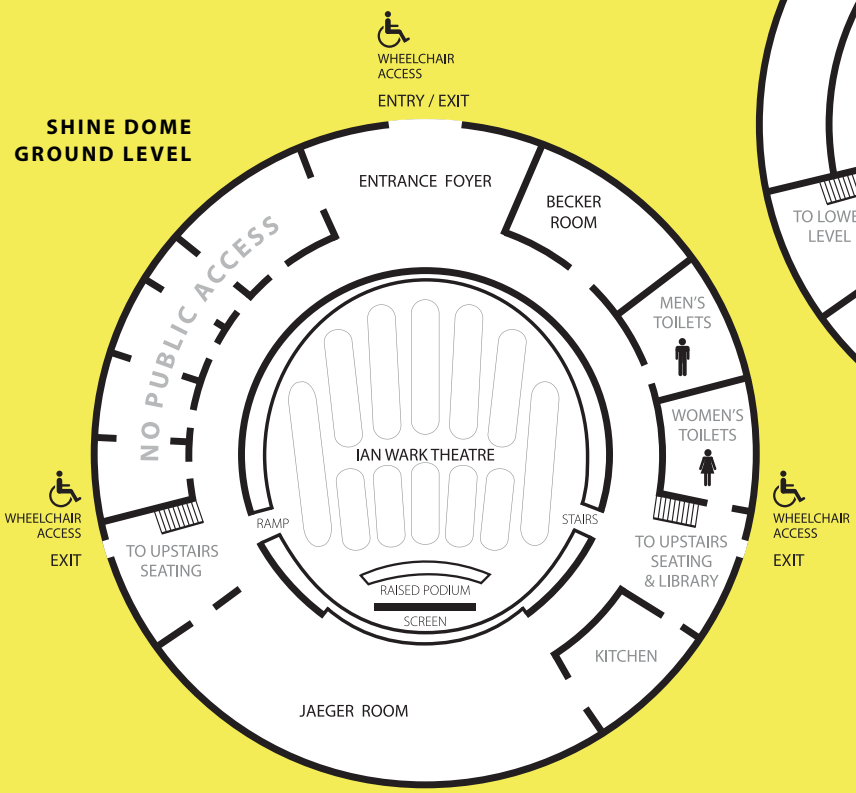
SCIENCE AT THE SHINE DOME 2014

Celebrating Australian science

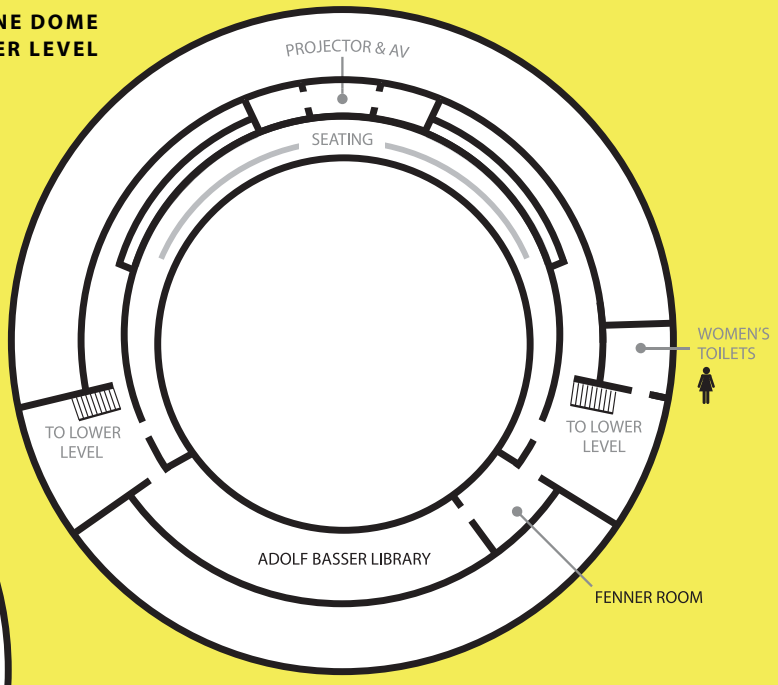
PAST **PRESENT** **FUTURE**

Program **27–29 MAY**

SHINE DOME GROUND LEVEL



SHINE DOME UPPER LEVEL



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President's welcome

It is my great pleasure to welcome Fellows of the Australian Academy of Science, sponsors, special guests, early career researchers, policy makers and other friends of science to our flagship annual event, *Science at the Shine Dome*.

This year's event marks 60 years since the Academy was established by Royal Charter. Just as the Academy itself has grown and extended its scope of activity, so too has this meeting grown over the decades, to become a true celebration of great science in Australia; a three-day feast of knowledge and inspiration.

Warm congratulations to the 21 new Fellows who were elected this year. Election to the Fellowship is a singular recognition of your important contributions to advancing the sum of human knowledge. I look forward to welcoming you formally to the Fellowship at your admission ceremony and to hearing you present the highlights of your outstanding work.

I look forward also to presiding over the awards ceremony: each year the Academy recognises a small number of scientists for extraordinary lifetime achievements, and for highly significant attainments in early- to mid-career. I am sure the 2014 awardees will enlighten us with stimulating expositions of their research.

The Academy is committed to nurturing the careers of young scientists. I welcome the participation of 78 early- and mid-career researchers from around Australia, 18 of whom have been supported to attend through the generosity of sponsors. You will find all our sponsors listed through the pages of this program, and on the back page. We are also delighted to host the 14 young scientists who have been selected through a highly competitive process to travel later this year to Lindau, Germany, to participate in the annual meeting of Nobel Laureates.

As well as attending the science highlights, early- and mid-career delegates will engage in professional development activities. The week's activities provide a wonderful opportunity to form new friendships and initiate collaborative relationships that cross disciplinary, rank and geographic boundaries.

The grand finale of the week will be the Symposium organised by Professor Tony Klein AM FAA and a small and dedicated committee, in honour of the Academy's 60th anniversary. *Celebrating Australian science PAST PRESENT FUTURE* brings together an impressive program of speakers to remember important achievements in Australia's scientific history, look at the great work being done today, and explore the exciting possibilities for research in the future.

On a more personal note: when the celebrations finish this week I shall end my term as President and pass the baton into the very capable hands of Professor Andrew Holmes AM FAA FRS FTSE. It has been an honour and a privilege to lead this great organisation. I am so pleased you could join us for this 60th annual general meeting of the Australian Academy of Science.

Suzanne Cory AC PresAA FRS

Program *Tuesday 27 May*

> Formal admission of New Fellows **> New Fellows presentations**

9.00 am	**Welcome** **Professor Suzanne Cory** AC PresAA FRS President, Australian Academy of Science
9.05 am	**Formal admission of new Fellows**
Chairs	**Professor Chennupati Jagadish** FAA FTSE, **Professor Marilyn Renfree** AO FAA
Session one — New Fellows presentations	
9.45 am	Professor Rose Amal FAA FTSE *Photocatalysis — from material design to engineering reactor systems* Professor Ben Andrews FAA *Soap bubbles in spherical space* Professor Hans Bachor AM FAA *Using quantum optics concepts for new technologies* Professor John Bowman FAA *Evolution in the cycles of life*
10.45 am	**Morning tea** **EMCRs group photo** **Please meet in the foyer**
11.15 am	Professor Georgia Chenevix-Trench FAA *The spectrum of breast cancer susceptibility genes* Professor Michelle Coote FAA *Computer-aided chemical design — the future of chemistry?* Professor Matthew England FAA *The ocean's overturning circulation: timescales, heat uptake, and impacts on global climate* Dr Elizabeth Jean Finnegan FAA *DNA methylation: now and then* Professor Peter Gill FAA *Quantum chemistry: the good, the bad and the ugly* Professor Barbara Howlett FAA *Controlling plant disease: from genome to paddock*
12.45 pm	**Lunch** **New Fellows individual photos** **Please meet in the foyer**

Session two — New Fellows presentations	
1.45 pm	Professor Lisa Kewley FAA *Oxygen: breathing the Universe* Professor Angel Lopez FAA *Mechanistic insights into cytokine signalling* Professor Stephen MacMahon FAA *'Frugal' healthcare innovation — a global research priority* Professor Ivan Marusic FAA *Order in the chaos: towards taming turbulence* Professor John Miners FAA *Drug metabolism: from enzymes to rational therapeutics* Professor Craig Moritz FAA *Understanding biodiversity responses to climate change — a critical role for museum-based science*
3.15 pm	**Afternoon tea** **New Fellows individual photos continued** **Please meet in the foyer**
3.45 pm	Professor Margaret Reid FAA *Einstein versus quantum mechanics* Professor Jamie Rossjohn FAA *Immune sensing of vitamin B metabolites* Professor Ingrid Scheffer FAA *Shedding light on the sacred disease — epilepsy genes reveal novel mechanisms* Dr Brian Walker FAA *Evolution and resilience in the anthropocene*
4.45 pm	**Close** **Professor Suzanne Cory** AC PresAA FRS President, Australian Academy of Science
6.30 pm – 9.00 pm	**Cocktail reception** Participating early- and mid-career researchers are invited to a special cocktail reception at the Shine Dome. This is an informal opportunity to get to know one another, make connections and perhaps even meet a mentor: some Fellows of the Academy will attend.

Colour code New Fellows Fellows EMCRs/Lindau participants Awardees Symposium speakers

Program *Wednesday 28 May*

> Awards presentations > Early- and mid-career researcher workshops
> Annual General Meeting > Annual dinner

9.00 am **President's address**
Professor Suzanne Cory AC PresAA FRS
President, Australian Academy of Science

9.30 am **2014 Macfarlane Burnet Medal and Lecture**
Professor Jerry Adams FAA FRS
Walter and Eliza Hall Institute of Medical Research
Control of cell suicide by the Bcl-2 protein family

Honorific Awards presentations

10.00 am **2014 David Craig Medal**
Emeritus Professor Curt Wentrup FAA
The University of Queensland
Short-lived molecules: research on reactive intermediates and chemical reactivity

2014 Mawson Medal and Lecture
Dr Gavin Young
Australian National University
Early vertebrate evolution — some contributions from the rocks of East Gondwana (Australia-Antarctica)

10.25 am **Morning tea**
EMCR awardees and Lindau participants group photos
Please meet in the foyer

Early career Honorific Awards presentations

10.50 am **2014 Fenner Medal**
Professor Katherine Belov
The University of Sydney
Genomes of Australian animals: the devil's cancer, defence and new elixirs

2013 Ruth Stephens Gani Medal
Professor Aleksandra Filipovska
Western Australian Institute for Medical Research
Regulation of mitochondrial gene expression

2014 Ruth Stephens Gani Medal
Winthrop Professor Ryan Lister
The University of Western Australia
Rewiring of the brain epigenome during development

2014 Gottschalk Medal
Associate Professor Kieran F Harvey
Peter MacCallum Cancer Centre
Control of organ size by the Hippo pathway

2014 Nancy Millis Medal
Professor Emma Johnston
University of New South Wales
Stress ecology

2014 Anton Hales Medal
Dr Julie Arblaster
Australian Bureau of Meteorology
The ozone hole and climate change

12.05 pm **Short break**

12.15 pm **2014 Christopher Heyde Medal**
Associate Professor David Warton
University of New South Wales
Ecology, statistics, and Rick Astley

2014 Dorothy Hill Award
Dr Maria Seton
The University of Sydney
Reconstructing vanished ocean basins

2014 Pawsey Medal
Professor Geoffrey John Pryde
Griffith University
Photonic quantum information science and technology

2014 Frederick White Prize
Professor Chris Turney
University of New South Wales
Using the past to understand and plan for abrupt future climate change

1.00 pm **Lunch**
Awardees group and individual photos
Please meet in the foyer

2.00 pm – 5.00 pm **Early- to mid-career researchers workshops**

- Management and leadership in research careers
- Practical grants writing workshop: Guide to successful funding applications
- Facilitating multidisciplinary scientific collaborations
- Communicating science: media and social media

2.30 pm – 5.00 pm **Annual General Meeting**
(closed session for Fellows of the Academy)

7.00 pm **Annual dinner**
(Pre-dinner drinks at 7.00 pm, dinner at 7.30 pm)
Village Centre, National Arboretum, Canberra

Presentations

- Macfarlane Burnet Medal
  Professor Jerry Adams FAA FRS
- Academy Medal
  Mr Simon McKeon AO
  Professor Harry Messel AC CBE

Guest speaker

- Professor Robyn Williams FAA

Dress code: black tie/cocktail

Colour code New Fellows | Fellows | EMCRs/Lindau participants | Awardees | Symposium speakers

Program *Thursday 29 May*

> Annual symposium: *Celebrating Australian science PAST PRESENT FUTURE*

8.40 am	**Morning session one**
Chair	**Professor Suzanne Cory** AC PresAA FRS
8.40 am	**Welcome** Professor Suzanne Cory President, Australian Academy of Science
8.50 am	**Opening remarks** Professor Tony Klein AM FAA
	MEDICAL SCIENCE
9.00 am	*Biomedical research: a success story* Sir Gustav Nossal AC CBE FAA FRS FTSE The University of Melbourne
	LIFE SCIENCES
9.35 am	*Australian life science in the age of genomics* Professor Jenny Graves AO FAA Australian National University / La Trobe University
	LAND, FOOD AND AGRICULTURE
10.10 am	*Land, food and agriculture* Professor Steve Simpson FAA FRS The University of Sydney
10.45 am	**Morning tea**
11.15 am	**Morning session two**
Chair	**Professor Cheryl Praeger** AM FAA
	PHYSICAL SCIENCE AND ASTRONOMY
	The history of physics and astronomy in Australia Professor Brian Schmidt AC FAA FRS Australian National University
	EARTH SCIENCES
11.50 am	*Australian geoscience: past, present and future* Professor John Dewey FAA FRS Oxford University
12.25 pm	**Lunch** **Symposium speakers group photo** **Please meet in the foyer**
2.00 pm	**Afternoon session one**
Chair	**Professor Marilyn Renfree** AO FAA
	ENVIRONMENTAL SCIENCE
	The past, present and future of Australian environmental science Professor Michael Raupach FAA FTSE Australian National University
	CHEMISTRY AND MATERIALS SCIENCE
2.35 pm	*Changing chemistry* Professor John White CMG FAA FRS Australian National University
3.10 pm	**Afternoon tea**
3.40 pm	**Afternoon session two**
Chair	**Professor Andrew Holmes** AM FAA FRS FTSE
	INFORMATION AND COMMUNICATIONS SCIENCE
	The quantum revolution: computing, past present and future Professor Michelle Simmons FAA University of New South Wales
4.15 pm	**Conclusion and close of meeting**
	Incoming President Professor Andrew Holmes AM FAA FRS FTSE

Colour code New Fellows Fellows EMCRs/Lindau participants Awardees Symposium speakers

New Fellows presentations

Professor Rose Amal, University of NSW

Rose Amal is a world leader in the field of photocatalysis, heading the Particle and Catalyst Research (PartCat) group within the School of Chemical Engineering at the University of New South Wales since 1997. Her photocatalysis research addresses the core issues of energy and water, two highly critical resources in Australia as well as worldwide. Professor Amal's unique multidisciplinary expertise in interfacing photocatalyst design with related applications has enabled her to successfully harness scientific research of photocatalysis into a range of frontier technologies. Applications include water pollution and air quality control, self-cleaning surfaces, and sustainable and clean alternate energy technologies.

Photocatalysis — from material design to engineering reactor systems

Water, environment and energy are three of the most important issues facing mankind in the coming 50 years. The demand for clean drinking water, fresh air and sustainable energy becomes more challenging in view of the ever-growing population. The need to develop ecologically clean solar-induced chemical processes, such as photocatalysis, are at present limited by low quantum efficiencies. This presentation illustrates past and ongoing research in the development of a highly efficient photocatalyst system for water and air purification, as well as H_2 generation through: 1) design hybrid/composite materials that can absorb a wider range of the solar spectrum and possess higher quantum efficiencies; 2) understanding relationships between photoelectrical properties of photocatalysts and mechanisms for degrading organics; and 3) developing an improved 'light penetration' reactor system.

Professor Ben Andrews, Australian National University

Ben Andrews works in the field of geometric analysis, combining analysis and partial differential equations and techniques of differential geometry. His work spans isoperimetric inequalities and geometric inequalities in spectral theory, minimal surfaces and related geometric problems, with a particular focus on geometric heat equations and their applications. Early in his career he proved a conjecture of Firey on a model of tumbling stones, and more recently his work has included the proof of two well-known conjectures: the Fundamental Gap conjecture for the eigenvalues of Schrödinger operators on convex domains, and the Pinkall-Sterling conjecture on embedded constant mean curvature surfaces.

Soap bubbles in spherical space

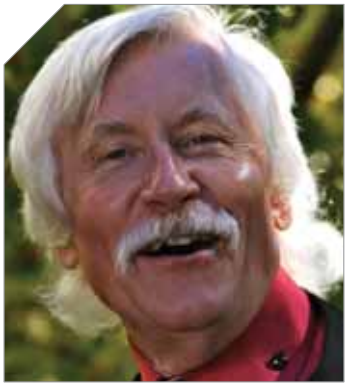
I will give a quick survey of the history of the mathematical study of minimal surfaces (soap films), leading up to some spectacular recent progress, including the resolution of two famous conjectures: the Lawson conjecture and the Pinkall-Sterling conjecture on the classification of soap bubbles in the three-dimensional sphere.

Professor Hans-A Bachor AM, Australian National University

Hans-Albert Bachor arrived in Australia in 1981 with a PhD form the University of Hannover, Germany. He established experimental quantum optics in Australia and created a widely known research group for quantum optics and laser physics. He founded and was Director of the Australian Centre for Quantum-Atom Optics (ACQAO), a national centre of excellence to

Rose Amal

Ben Andrews



Hans Bachor

study atoms and light at the quantum level and to explore options for future quantum technologies. He was an ARC Federation Fellow from 2003–2008, and is active in the professional management of science, including the ARC college of experts (1997–2001, 2010–2012) and European Research Council (2009–2013). Professor Bachor was chairman of the council of the National Youth Science Forum 2008–2013, and in 2012 was awarded an AM, recognising his achievements as a researcher and educator. He is Emeritus Professor at the Australian National University and an independent consultant and presenter in the areas of physics, science communication and education.

Using quantum optics concepts for new technologies

Light and lasers have been the foundation for numerous technological advances. They are a key component of many of our activities. However, the full potential of the quantum properties of optics, whether with photons or matter waves, still has to be explored and will give us new technological opportunities. Secure communication and precision metrology are just two examples. Australia has great opportunities — based on groundbreaking research in optics and entanglement. This talk will show some of the links between past achievements and future ideas.

Professor John Bowman, Monash University

After obtaining a BSc in biochemistry from the University of Illinois, John Bowman trained as a geneticist during his PhD at Caltech, where he started working on *Arabidopsis* as a model plant to address fundamental questions in plant development. During his PhD and subsequent postdoctoral fellowship at Monash, he contributed substantially to understanding the developmental genetics of flowers. In 1995, he established his own laboratory at the University of California, Davis, where his group discovered several gene families whose action determines the polar growth of leaves. During his time at Davis he was named a Chancellor's Fellow and received a Beckman Young Investigator Award. He co-organised the Cold Spring Harbor Laboratory course of Plant Biology from 2000–2003. In 2006 he moved as a Federation Fellow to Monash, where his laboratory continues to investigate fundamental questions in land plant development with an evolutionary perspective.

Evolution in the cycles of life

One innovation of eukaryotes is sex, which establishes a life cycle alternating between haploid (one set of chromosomes) and diploid (two sets) phases. The transition from haploid to diploid is via fertilisation, while that from diploid to haploid is via meiosis. In several lineages of eukaryotic life multicellularity has evolved in one or both of the phases. We, for example, have multicellular diploid bodies but our haploid phase is only a single cell, egg or sperm. In contrast, a key innovation in land plants was the evolution of multicellular bodies in both haploid and diploid phases of the life cycle — an alternation of generations. We recently identified a key genetic mechanism by which the developmental program of the diploid generation is initiated in land plants. In its absence, the haploid developmental program is instead followed. In single celled algae thought to resemble land plant ancestors, the diploid gene regulatory network is simple. In contrast, in land plants gene duplication followed by acquisition of novel genetic functions has led to more complex diploid gene regulatory networks that we believe facilitated the evolution of multicellularity in the diploid generation. Harnessing the ability to manipulate generational changes could have implications for production of agricultural crops.

Professor Georgia Chenevix-Trench, Queensland Institute of Medical Research

Georgia Chenevix-Trench is a graduate of Trinity College Dublin. She obtained her PhD from the Medical College of Virginia in 1985, joined the Queensland Institute of Medical Research in 1986, and has been there ever since, now as a Senior Principal Research Fellow of the NHMRC. Georgia is a cancer geneticist, internationally recognised for her work on the genetics of breast,

John Bowman

Georgia Chenevix-Trench

Michelle Coote

ovarian and other cancers. She played a critical role in the identification of the *PTCH* gene, responsible for nevoid basal cell carcinoma syndrome. Professor Chenevix-Trench has also led groundbreaking work that showed that mutations in the *ATM* gene confer moderate risks for breast cancer, which has major implications for research into the genetic architecture of other complex diseases. She leads an international consortium focused on identifying genetic modifiers of the breast cancer genes, *BRCA1* and *BRCA2*, which will enable personalised risk prediction in mutation carriers.

The spectrum of breast cancer susceptibility genes

Breast cancer was the first common, complex disease for which a highly penetrant predisposition gene was mapped to a chromosomal location. This was followed rapidly, in the 1990s, by the identification of the *BRCA1* and *BRCA2* genes, rare mutations which account for about one third of multiple-case breast (and ovarian) cancer families. Since that time, we and others have identified a small number of genes, mostly involved in double strand DNA repair and including *ATM*, in which uncommon mutations show moderate penetrance. However, since the advent of genome-wide association studies we have identified more than 100 common genetic polymorphisms associated with small increased risk of breast cancer, some of which also modify the risk of breast cancer in women with mutations in *BRCA1* and *BRCA2*. The great challenge is now to find the causal variants at these loci, and determine the mechanisms underlying their association with breast cancer risk. Most of the causal variants appear to lie in regulatory regions, and affect the expression of one or more genes in the vicinity, some of which might provide the key for the development of novel risk reduction medications.

Professor Michelle Coote, Australian National University

Michelle Coote is a graduate of the University of New South Wales, where she studied industrial chemistry, followed by a PhD in polymer chemistry (2000). Following postdoctoral work in polymer physics at the University of Durham, UK, she decided to specialise in computational chemistry and in 2001 joined the Research School of Chemistry, Australian National University. She established her own research group in 2004 and became the first female Professor of Chemistry at ANU in 2011. The focus of her research, which spans organic, polymer and biological chemistry, is the use of theory to clarify the mechanisms of chemical processes and to design novel reagents for manipulating their outcome. She has received many awards including the International Union of Pure and Applied Chemistry Prize for Young Scientists (2001), the Royal Australian Chemical Institute Cornforth Medal (2000), Rennie Medal (2006), David Sangster Polymer Science and Technology Achievement Award (2010), and the Academy's Le Fevre Memorial Prize (2010).

Computer-aided chemical design — the future of chemistry?

Computational quantum chemistry is a powerful tool for studying the mechanism and kinetics of complicated multi-step chemical processes such as radical polymerisation. Unlike experiment, it allows for the direct calculation of the rate coefficients of the various chemical reactions taking place, without recourse to kinetic model fitting. It also provides useful mechanistic information that can help guide reagent design. However, to obtain accurate results, high-level ab initio procedures are required, and these are too computationally intensive to be applied directly to most practically relevant problems. We have been working toward adapting computational chemistry for these difficult problems through the design of small chemical models capable of mimicking the behaviour of real chemical systems, along with various cost-saving measures such as an efficient algorithm for conformational optimisation. With these tools we can now predict the outcomes of complicated chemical processes with an accuracy that rivals experiment, while providing a deeper mechanistic understanding that has guided the design of improved reagents and materials ranging from control agents for radical polymerisation, polymers with improved thermal stability, chiral auxiliaries for the resolution of amino acids, redox mediators for solar cells, and self-healing materials with tuneable debonding temperatures.

Professor Matthew England, University of NSW

Matthew England is an ARC Laureate Fellow and Deputy Director of the UNSW Climate Change Research Centre. England obtained his PhD in physical oceanography from The University of Sydney in 1992 after being awarded the University Medal and First Class Honours in 1987. After completing a postdoctoral fellowship at Le Centre National de la Recherche Scientifique in France during 1992–94, Professor England worked as a research scientist at CSIRO during 1994–95. Since 1995 he has lectured in ocean/climate physics at UNSW, where he was awarded an ARC Federation Fellowship in 2005 and an ARC Laureate Fellowship in 2010. Professor England is a former Fulbright Scholar, winner of the Royal Society of Victoria Research Medal 2007; two Eureka Prizes (Environmental Research 2006; Land and Water 2008); the 2005 AMOS Priestley Medal, and the Australian Academy of Science Frederick White Prize 2004. His expertise covers the physics of the oceans and their role in climate variability and climate change.

The ocean's overturning circulation: timescales, heat uptake, and impacts on global climate

Beneath the surface of the ocean lies a highly dynamic environment, with large volumes of water moving immense distances over timescales of decades to millennia. This interior circulation of seawater moves vast quantities of heat, fresh water and carbon through the global climate system, thereby regulating Earth's climate in profound ways. I outline the methods used to understand the global circulation of intermediate, deep and abyssal waters, and how these water masses impact global climate. The timescales of interior ocean ventilation and water-mass age will also be quantified. A mode of wind-driven decadal overturning of surface waters in the Pacific Ocean will be explored. This mode will be shown to explain the sporadic nature of global warming over the past century, oscillating between periods of accelerated trade winds and increased ocean overturning of heat, and periods when the trade winds weaken and more heat accumulates at the ocean surface. The most recent slowdown in global surface warming can be explained by this Pacific mode, caused by an unprecedented acceleration in trade winds. This warming slowdown could persist for much of the present decade if the trade wind trends continue, however rapid warming is expected to resume when the anomalous wind trends abate.

Dr Elizabeth Jean Finnegan, CSIRO Plant Industry

Jean Finnegan studied at The University of Adelaide where she did her PhD in biochemistry with Professor Barry Egan FAA. She was a postdoctoral fellow at the Universities of Sussex and Glasgow, before returning to Australia in 1982 as a postdoctoral scientist at CSIRO Plant Industry (CPI). She is currently a Senior Principal Research Scientist at CPI. In 1991, Dr Finnegan began working on epigenetic regulation to investigate the basis for the memory of winter in vernalised plants. She isolated the first plant gene encoding a DNA methyltransferase, and generated plants with reduced levels of DNA methylation. Her group then determined the molecular basis for some abnormal phenotypes displayed by these plants. Since then her lab has made a major contribution to understanding the mechanisms contributing to the memory of winter in vernalised plants and to the quantitative nature of the vernalisation response. She and her colleagues are working on imprinting in rice and epialleles in wheat.

DNA methylation: now and then

Many laboratories have contributed to our understanding of the role of DNA methylation in eukaryote genomes. The story began in 1948 when methylated cytosine residues were first detected in mammalian DNA, but it was almost 30 years before Riggs, Holliday and Pugh suggested that DNA methylation patterns could be inherited and that DNA methylation might regulate gene expression. This idea was supported by the observation that chemical disruption of DNA methylation could activate gene expression. Subsequently, the isolation of a mouse DNA methyltransferase gene followed by methyltransferase gene knock-out experiments in mice showed that DNA methylation was essential for life. We isolated the first plant DNA methyltransferase (*METI*) from *Arabidopsis thaliana*, using the mouse enzyme as a guide. We showed that disruption of *METI* expression affects many aspects of plant development by reducing DNA methylation across the genome. This led to the reactivation of some genes and transposable elements, disrupting genome integrity. In contrast, other regions of the genome acquired DNA methylation *de novo*, silencing the underlying genes. We are currently investigating whether transient disruption to DNA methylation can be used to uncover novel phenotypes in wheat.

Professor Peter Gill, Australian National University

After obtaining his BSc and MSc from The University of Auckland, Peter Gill gained his PhD in 1988 under the supervision of Professor Leo Radom FAA at ANU, where he studied the structure of hemi-bonds, the dissociation of dications, and the convergence of perturbation theory. He undertook a five-year postdoctoral fellowship with Professor John Pople KBE FRS Nobel Laureate before accepting a lectureship at Massey University in New

Matthew England

Jean Finnegan

Peter Gill

Barbara Howlett

Lisa Kewley

Zealand (1993–1996), a lectureship at Cambridge University (1996–1999) and a chair at The University of Nottingham (1999–2004). He then returned to ANU where he filled the position that had recently been vacated by Professor Radom. He received the Dirac (1999) and Schrödinger (2011) medals of the World Association of Theoretical and Computational Chemists, and the Pople (2005) and Fukui (2013) medals of the Asia-Pacific Association of Theoretical and Computational Chemists. He founded the US software company Q-Chem Inc. in 1993 and has been its President since 1998.

Quantum chemistry: the good, the bad and the ugly

Dirac famously observed in 1929 that the fundamental laws necessary for the mathematical treatment of the whole of chemistry are completely known, and the difficulty lies only in the fact that application of these laws leads to equations that are too complex to be solved. In the 85 years that have elapsed since that time, the computer revolution has fundamentally redefined the limits of what is practically computable and the award of the 1998 Nobel Prize in Chemistry to Kohn and Pople recognised that computational chemistry had become a fully-fledged partner of the traditional experimental arm of the subject. Popular software packages can now use the laws of quantum mechanics to predict chemical structure, bonding and reactivity in systems with hundreds of atoms and, in the coming decade, the arrival of exascale computing will allow even larger systems to be investigated. I will sketch the state of the field as it stands and speculate on the possible paths that it may follow in the future.

Professor Barbara Howlett, The University of Melbourne

Barbara Howlett has a BSc (Hons) in biochemistry from The University of Melbourne, an MSc in Botany from the Australian National University, and a PhD from The University of Melbourne. She is a Fellow of the American Academy of Microbiology, and has worked on diverse topics including influenza, bacterial chemotaxis, pollen allergy, nitrogen fixation and plant disease. At Stanford University Professor Howlett learnt fungal genetics using the model bread mould *Neurospora crassa*. Back in Australia she applied these skills to the blackleg fungus, which threatens canola crops worldwide. With French colleagues, Professor Howlett sequenced the genome of the blackleg fungus and discovered processes that shape fungal genomes and cause rapid evolution of virulence. From this knowledge she developed high throughput molecular assays to monitor changes in virulence of fungal populations. Professor Howlett leads a project that assesses disease resistance in canola cultivars, monitors disease and develops disease management strategies implemented by Australian canola growers.

Controlling plant disease: from genome to paddock

Fungal disease causes major crop losses worldwide. The Australian canola industry is continually threatened by blackleg disease, caused by *Leptosphaeria maculans*. Crops are sometimes devastated when disease resistance bred into cultivars breaks down, because of rapid evolution of virulence in this fungus. My research group takes a 'genome to paddock' approach to controlling blackleg. Analysis of the genome sequence of the blackleg fungus shows how populations rapidly evolve virulence. Key disease-related 'avirulence' genes are embedded in gene-poor regions amongst transposable elements (jumping genes) that have been inactivated by a specific mutation process. This location enables these key disease genes to be easily gained, lost or inactivated during sexual reproduction, which occurs prolifically on canola stubble. We use markers to monitor changes of virulence of fungal populations from canola stubble collected across Australia. This information, along with field and glasshouse data, is used to determine the risk of disease in particular canola cultivars. If an epidemic is predicted in a particular region, then farmers are advised to plant a canola cultivar with a different complement of resistance genes. This approach averted a 'breakdown' of blackleg resistance in canola cultivars in South Australia in 2012, saving $13 million in yield losses.

Professor Lisa Kewley, Australian National University

Lisa Kewley obtained her PhD in 2002 from the ANU on star formation and supermassive black holes in infrared galaxies. She received a CfA fellowship at the Harvard-Smithsonian Center for Astrophysics where she worked on the star formation and chemical properties of nearby galaxies. In 2004, Professor Kewley was awarded a NASA Hubble Fellowship which she took to the University of Hawaii. There, she used the Keck and Subaru telescopes on Mauna Kea to understand the star formation and chemical abundances in galaxies in the distant universe. She received the 2005 American Astronomical Society Annie Jump Cannon Award, a 2008 National Science Foundation Early Career Award, and the 2008 American Astronomical Society Newton Lacy Pierce Prize. In 2011, she returned to Australia as Professor and Future Fellow at the ANU. Professor Kewley leads a large research program that combines Australia's telescopes with international and space telescopes to gain a three-dimensional picture of how galaxies form and evolve.

Oxygen: breathing the Universe

I will discuss the history of oxygen, from the Big Bang through to the air we breathe today. Oxygen atoms were created in the first stars in the Universe and expelled through powerful supernovae and vast stellar winds. As matter collided, forming galaxies, oxygen was created in many generations of star formation throughout the history of the Universe. I will present recent observations of the amount of oxygen in the Universe combining the ANU 2.3m telescope with the Keck and Subaru telescopes on Mauna Kea in Hawaii.

Professor Angel Lopez, SA Pathology and the University of South Australia

Angel Lopez is Co-Director of the Centre for Cancer Biology at SA Pathology and the University of South Australia, and Head of the Cytokine Receptor Laboratory. He holds an MD from the University of Rosario, Argentina; a PhD from the University of London, UK, and is a Fellow of the Royal College of Pathologists of Australasia. He has worked for more than 30 years on the structure and function of cytokine receptors, with his laboratory being internationally recognised for its insights into the βc cytokine family. His more than 200 publications have been cited more than 10 000 times, being the foundation of discoveries of new paradigms in understanding how βc receptors signal, and of the development of new potential therapeutics for the treatment of certain types of leukaemia and inflammatory diseases. In 2010 he won the South Australian Scientist of the Year Award and was the 2010 South Australian of the Year — Science Category.

Mechanistic insights into cytokine signalling

Cytokines and growth factors are soluble proteins that play an important role in controlling the balance between health and disease. They act on many tissues and cells in the body regulating a multitude of functions. Whilst some have become widely used in clinical medicine saving millions of lives annually, others have been recognised as being important in pathology, spurring major efforts to understand how they work and how to modulate their functions. In particular, the subgroup of cytokines termed the 'βc family' is of significance in infection, certain myeloid leukaemias and in chronic inflammatory conditions such as asthma and rheumatoid arthritis. The βc family of cytokines exerts its biological activities through a sequential process that involves binding to specific protein receptors on the surface of cells, followed by the clustering of receptor components into unique high-order assembled complexes that trigger cell signalling. The signals control the lifespan of the cells and may tell them to divide and proliferate as well. Defining each of these steps has provided seminal information into the molecular basis of cytokine receptor activation and the initiation of cell signalling. These insights are paving the way for the development of novel approaches and drugs for the treatment of myeloid leukaemias and chronic inflammatory diseases.

Professor Stephen MacMahon, The George Institute for Global Health

Stephen MacMahon is Principal Director of The George Institute for Global Health. He holds professorships in medicine at The University of Sydney and the University of Oxford, and has been awarded honorary professorships at Peking University and Utrecht University. He is an authority on the prevention and treatment of cardiovascular diseases, with a special interest in the management of these conditions in resource-poor settings. Professor MacMahon is responsible for around 450 staff at The George Institute research facilities in Australia, the UK, China and India. He has published several hundred scientific papers and delivered many invited lectures. For his work in the field of cardiovascular disease, he has received numerous awards, fellowships and honours. Most recently, he was appointed to the Fellowship of the British Academy of Medical Sciences (2012) and was named EY Australian Social Entrepreneur of the Year (2013).

'Frugal' healthcare innovation — a global research priority

Of the seven billion people alive today, less than two billion have reliable access to the medical care required to manage those conditions most likely to cause

Angel Lopez

Stephen MacMahon

Ivan Marusic

premature death and disability. About half of those without such access live in the emerging economies of Asia. In these regions there is increasing awareness that the consequences of poor healthcare include reduced economic productivity and increased social unrest. However, there remains considerable uncertainty as to how to provide essential healthcare affordably to all that require it. Certainly, the models of care developed in countries such as Australia are unaffordable and impractical for most low- or middle-income countries (and are arguably unsustainable for most high-income countries). As a consequence, there is a pressing need to expand efforts to develop 'frugal' solutions targeting a range of core healthcare components. At The George Institute for Global Health a major focus of our research is the formulation and evaluation of innovative low-cost strategies to deliver care for the management of serious cardiovascular and metabolic diseases in resource-poor regions of India and China.

Professor Ivan Marusic, The University of Melbourne

Ivan Marusic is an ARC Laureate Fellow and Professor in the Department of Mechanical Engineering at The University of Melbourne. He received his PhD in 1992 and BE (Hons) Mech in 1987 from The University of Melbourne. His research is primarily in experimental and theoretical studies of turbulence at high Reynolds numbers. This includes studies in atmospheric surface layer flows and aquatic ecosystems. Prior to arriving in Melbourne in 2007 as an ARC Federation Fellow he was a faculty member at the University of Minnesota, where he was a recipient of an National Science Foundation Career Award and a Packard Fellowship in Science and Engineering. He is a Fellow of the American Physical Society, and an Associate Editor of the *Journal of Fluid Mechanics* and the *Journal of Hydraulic Research*.

Order in the chaos: towards taming turbulence

Turbulent fluid flows, particularly in the thin fluid layers immediately adjacent to solid boundaries, have proven to be notoriously difficult to understand or predict. These boundary layers account for up to 50% of the aerodynamic drag on modern airliners and occupy the lower portion of the atmosphere in which we live, thus governing wider meteorological phenomena and pollution dispersion processes. Turbulence also manifests itself in the rapids of a river, in wakes of cars or boats and in countless other prevalent situations. With advances in technology, and the heightened need to quantify environmental change, so too grows the need for an understanding of turbulence. In this talk an outline will be given of recent insights into organised coherent motions within the turbulence, and how they open the way for prediction and control of these complex flows.

Professor John Miners, Flinders University

John Miners received his PhD from Victoria University of Wellington and DSc from Flinders University. He was Professorial Head of the Department of Clinical Pharmacology of Flinders University and Flinders Medical Centre from 2003 to 2013, and currently holds a personal chair of Pharmacology and Therapeutics in the Flinders University School of Medicine. He is recognised internationally for his work on drug and chemical metabolism in humans, especially the importance of metabolism in drug response and the preclinical development of newly discovered drugs. Professor Miners has published 270 papers and is an ISI highly cited author in the discipline of pharmacology. He is President of the International Society for the Study of Xenobiotics, a member of the Executive Committee of the International Union of Basic and Clinical Pharmacology, and a member of the editorial boards of seven international journals.

Drug metabolism: from enzymes to rational therapeutics

Hepatic metabolism, or biotransformation, is the principal mechanism responsible for the elimination of drugs and other chemicals from the body. For many drugs, the rate of metabolism varies widely between patients and this necessitates individualisation of drug dosage. Inter-patient variability arises largely from differences in the activities of the enzymes responsible

for drug metabolism, notably the cytochromes P450 (CYP) and UDP-glucuronosyltransferases (UGT). Both CYP and UGT exist as 'super-families' of enzymes. Thus, rationalisation and prediction of variability in drug elimination requires identification of the CYP or UGT enzyme responsible for metabolism, and knowledge of the factors which influence the activity of that enzyme in humans. Molecular, biochemical and clinical approaches have been applied to identify sources of variability in drug metabolism, characterise the substrate and inhibitor specificities and structure-function relationships of key drug metabolising CYP and UGT enzymes, and develop *in vitro* experimental paradigms that predict drug metabolism parameters in humans. The research provides a basis for the individualisation of drug therapy in humans and supports the discovery and development of drugs with favourable metabolic properties.

Professor Craig Moritz, Australian National University

Craig Moritz is Professor and ARC Laureate Fellow at ANU and Director of the ANU-CSIRO Centre for Biodiversity Analysis. Previously he was Director of the Museum of Vertebrate Zoology at University of California Berkeley and Head of the School of Life Sciences at The University of Queensland. He is an evolutionary biologist, with research contributions spanning biogeography, speciation biology, innovations in use of molecular techniques and statistical models to infer dynamics of populations and lineages and, most recently, use of data-rich museum collections to understand responses to recent climate change. A consistent theme has been to develop and apply concepts from evolutionary biology and molecular ecology to conservation of species, communities and habitats. Without doubt, the most important contribution has been through the students he has mentored and his ability to forge collaborations across traditional disciplinary boundaries.

Understanding biodiversity responses to climate change — a critical role for museum-based science

As highlighted by the most recent International Panel on Climate Change report, there is increasing concern that accelerating climate change, in concert with other stressors, will lead to wholesale extinction of species and ecosystem disruption. While this concern is justified, it is also true that current natural systems have weathered the dramatic climate changes over the past few million years, especially the dramatic late Pleistocene cycles. Put simply, we need to learn from the past to improve prediction of vulnerability to the future. Museums hold the record of the past, and this can be exploited to meet this new challenge. I will emphasise how new tools can be applied to old collections to accelerate discovery of biodiversity hotspots. Further, we can infer how current patterns of diversity have been shaped by evolutionary response to climate change over the recent geological past, and how species within one hotspot have responded to 20th century warming. Far from being dusty and obscure repositories of natural curiosities, modern natural history museums have a key role to play in doing the science and public education necessary to retain our evolutionary heritage as we continue to mess with the planet.

Professor Margaret Reid, Swinburne University of Technology

Margaret Reid graduated from The University of Auckland with an MSc in theoretical physics and then undertook PhD studies in New Zealand with Dan Walls FRS, graduating in 1984. She developed theories for the generation of squeezed states of light and quantum non-demolition measurement. Following several years as a lecturer at the University of Waikato, New Zealand, she was awarded an Australian QEII Fellowship to do research at The University of Queensland. She later became a researcher with the Australian Research Council Centre of Excellence in Quantum and Atom Optics. Her work has been to develop fundamental tests of quantum mechanics, including of the Einstein-

John Miners

Craig Moritz

Margaret Reid

Jamie Rossjohn

Ingrid Scheffer

Brian Walker

Podolsky-Rosen paradox and Bell's theorem, based on parametric down conversion and quantum optics. She is currently an Associate Professor at Swinburne University of Technology in Melbourne and works as a researcher within the Centre for Quantum and Optical Sciences.

Einstein versus quantum mechanics

Einstein had reservations about quantum mechanics, as it developed in the early part of last century. His concerns were crystallised in the famous 1935 Einstein-Podolsky-Rosen (EPR) paradox, an argument for the completion of quantum mechanics based on the validity of the premise called 'local realism'. The argument depended on two well-separated particles having strongly correlated positions and momenta. Such correlations appear contradictory, once one accepts the Heisenberg uncertainty relation together with local realism, but are predicted possible for certain 'entangled' quantum states. Einstein described these quantum effects as like 'spooky action-at-a-distance'. Our understanding of the discrepancy between quantum mechanics and EPR's local realism has evolved since 1935. Bell showed that local realism itself can be falsified, based on quantum predictions for two spin-½ particles. I explain how both EPR and Bell's work have been experimentally tested, using parametric down conversion as a source of correlated photons. I also distinguish between the different tests, explaining how one has been realised at a mesoscopic level and links with Schrodinger cats. While initially considered to be of philosophical importance only, EPR quantum correlations have underpinned the development of the new quantum applications, like quantum cryptography and quantum teleportation.

Professor Jamie Rossjohn, Monash University

Professor Jamie Rossjohn (PhD, Bath University) is currently an NHMRC Australia Fellow at Monash University. He has provided profound insight into T-cell biology, specifically defining the basis of key immune recognition events by T-cells. He has used structural biology to explain pre-T-cell receptor (TCR) self-association in T-cell development, and how the TCR specifically recognises polymorphic Human Leukocyte Antigen (HLA) molecules in the context of viral immunity and aberrant T-cell reactivity. He has unearthed mechanisms of HLA polymorphism impacting on drug and food hypersensitivities, as well as Natural Killer cell receptor recognition. He has pioneered our understanding of lipid-based and vitamin B metabolite-based immunity by the innate Natural Killer T-cells and Mucosal-associated T-cells respectively.

Immune sensing of vitamin B metabolites

Vertebrates defend themselves from microbial infection and cellular damage through a multi-layered immune system. The immune system functions via specialised receptors that sense the presence of foreign or altered molecules (antigens). These antigen recognition events signal the presence of microorganisms (viruses, bacteria and fungi), or abnormal or damaged cells and tissues, which leads to recruitment and activation of immune cells or extracellular killing machines at sites of infection or injury and ultimately the formation of a protective immune response. The immune system is broadly divided into innate and adaptive arms that include a diverse array of cell types, including T cells. Despite more than a century of investigation, important new functions and subsets are still being identified for each of these immune cell types in host defence and in the development of disease. The T cell receptor (TCR) complex, expressed on the surface of T-cells, comprises the antigen-specific heterodimeric αβ T-cell receptor (TCR). Ligation of the TCR by an Antigen (Ag) presenting molecule initiates T-cell signalling and hence initiates the T-cell response. While it is conventionally considered that TCRs interacts with peptide Ags bound to the Major Histocompatibility Complex (MHC), TCRs also interact with lipid-based Ags bound by CD1 family members, a family of MHC-like molecules. Moreover, we have recently established how certain T-cells, namely MAIT cells, can recognise microbial-based vitamin B metabolites. I shall discuss our recent findings in the emerging field of metabolite-specific immunity.

Professor Ingrid Scheffer, The University of Melbourne, Florey Institute

Ingrid Scheffer is a physician-scientist whose work as a paediatric neurologist and epileptologist at The University of Melbourne and Florey Institute has led the field of epilepsy genetics over more than 20 years, in collaboration with Professor Samuel Berkovic and molecular geneticists. This has resulted in identification of the first epilepsy gene and many more genes subsequently. Professor Scheffer has described many novel epilepsy syndromes and refines genotype–phenotype correlation. She recently led the first major reclassification of the epilepsies in two decades as Chair of the International League Against Epilepsy's Commission for Classification and Terminology. She has received many awards: 2007 American Epilepsy Society Clinical Research Recognition Award, 2009 RACP Eric Susman Prize, 2013 GSK Award for Research Excellence, ILAE Ambassador for Epilepsy Award, 2013 Australian Neuroscience Medallion, 2013 Emil Becker Prize for child neurology, and the L'Oréal-UNESCO Laureate for Women in Science for the Asia-Pacific region for 2012.

Shedding light on the sacred disease — epilepsy genes reveal novel mechanisms

Epilepsy, the 'sacred disease', has been around since time immemorial. While initially thought of divine origin, genetic causes were not invoked for many centuries, partly due to the intense stigma associated with seizures. Following our discovery of the first gene for epilepsy in 1995 in a large multiplex family, gene identification has flourished, shedding light on the pathophysiology of seizure disorders. Initially attention focused on ion channel dysfunction with different ion channels implicated in specific epilepsy syndromes. With the recent advent of next generation sequencing, in both families and special cohorts, new genes with surprising mechanisms are emerging. Recently we identified a protein involved in the mTOR pathway, a major regulator of cell growth, in which a familial mutation causes focal epilepsy with normal structural imaging of the brain in one individual and focal malformation in another. These observations open the door to new molecular mechanisms such as somatic mosaicism with mutations present in the brain alone causing epilepsy and absent from other tissues. The genetic architecture of the epilepsies is complex and fascinating; unraveling the specific molecular components will serve as the basis for the development of targeted therapies in the future.

Dr Brian Walker, CSIRO ECOSystem Sciences

Brian Walker is a retirement Fellow in Australia's CSIRO Ecosystem Sciences Division and part-time Visiting Scientist at the Stockholm Resilience Centre. His main research interest is in the dynamics and resilience of ecosystems and social-ecological systems. Professor Walker was born and schooled in Zimbabwe and received his BSc from the University of Natal, South Africa, and PhD in ecology from the University of Saskatchewan, Canada. He has been a lecturer at the University of Zimbabwe, a Professor of Botany and Director of the Centre for Resource Ecology, University of the Witwatersrand in Johannesburg, and Chief of the CSIRO Division of Wildlife and Ecology (1985–1999). Dr Walker is also a Fellow of the Australian Academy of Technological Sciences and Engineering, and a Foreign Member of the Royal Swedish Academy of Agriculture and Forestry. His awards include Canadian Commonwealth Scholar; Charles Bullard Research Fellow, Harvard University; Distinguished Graduate in Agriculture Award, University of Saskatchewan's 75th Anniversary (1986); Ecological Society of Australia Gold Medal; Australian Centenary Medal for Service to Australian Society in Ecology; and joint recipient, Ecological Society of America Sustainability Award.

Evolution and resilience in the Anthropocene

I make four points in developing a proposition for shepherded self-organisation. 1) Evolution: with its message of contingency on chance and natural selection, pure biological evolution is dispiriting for many people, who then embrace either religion or short-termism (growth). However, the increasing rate and influence of social evolution (the rapid spread and development of ideas — 'memes') offers a hopeful way forward. At this time in human and Earth development (the Anthropocene) pure biological evolution has been subsumed within an interactive process of biological-ecological-social evolution, and human activity is the dominant force in this process. 2) Self-organisation is a key part of evolution, and understanding the limits to the self-organising capacity of a system is the basis for understanding resilience. 3) Under the ruling paradigm of growth, looming catastrophe in the face of the water-energy-food nexus is the current trajectory of the world, and corporate leaders are looking for solutions. 4) Building resilience through shepherded self-organisation is an alternative paradigm. Guided self-organisation is a developing area in complex systems applications, linking purposeful design with self-organisation. But the theme of choosing specifically where to go conflicts with building resilience; so hence I propose shepherded self-organisation, choosing where not to go by avoiding unwanted thresholds. Rather than aiming for impossible growth targets with an inevitable catastrophe, there is the option, through shepherding the self-organising processes in social-ecological systems, to enhance our capacity to remain within a set of acceptable trajectories.

2014 Macfarlane Burnet Medal and Lecture for research in the biological sciences

Professor Jerry Adams FAA FRS

Jerry Adams is Joint Head of the Molecular Genetics of Cancer Division of the Walter and Eliza Hall Institute of Medical Research (WEHI) in Melbourne; Director of a Leukemia & Lymphoma Society Specialized Center of Research focussed on the role of apoptosis in cancer; and Professor of Molecular Genetics at The University of Melbourne.

Professor Adams' career was launched with distinction when his PhD studies, from 1962–66 with Professor James D Watson at Harvard, revealed the role of methionine in initiating protein synthesis. In postdoctoral studies with Dr Frederick Sanger in Cambridge, England, his pioneering studies on mRNA sequencing provided the first direct verification of the newly described genetic code. There he met his career-long associate Professor Suzanne Cory AC PresAA FRS. After further postdoctoral work in Geneva, they established a laboratory at the Walter and Eliza Hall Institute in 1971. It initially focussed on the genetics of the immune system but from 1981 onwards on the genetic basis of cancer.

Professor Adams and colleagues are best known for their contributions to unravelling the role of chromosome translocation in tumorigenesis through establishing and characterising transgenic mouse models, for discoveries on the impact of impaired apoptosis on the development and therapy of cancer and for clarifying the mechanisms by which the Bcl-2 protein family controls the life and death of cells. Their findings have galvanised the development, to which they have contributed, of a new class of anti-cancer drugs that directly engage the apoptotic regulators. These discoveries led to his election to the Australian Academy of Science in 1986, the Royal Society in 1992, the US National Academy of Sciences in 2008, and this year to the Academy of the American Association for Cancer Research.

Control of cell suicide by the Bcl-2 protein family

Apoptosis is an ancient cell suicide program that plays essential roles in vertebrates for development, tissue homeostasis and immunity. Apoptosis needs exquisite control because too little cell death can promote

cancer and autoimmune diseases, whereas too much can contribute to degenerative disorders. Whether a cell lives or dies in response to stress or DNA damage is governed principally by interactions between three factions of the Bcl-2 protein family. Bcl-2 and its closest relatives keep cells alive by sequestering proteins of the two opposing factions, which instead promote cell death. Members of the pro-apoptotic 'BH3-only' faction signal for apoptosis by inserting their BH3 domain into a groove on the surface of globular Bcl-2 family members. However, apoptosis ensues only if a member of the second pro-apoptotic faction, BAX or BAK, becomes activated. They then undergo a remarkable metamorphosis from inert globular monomers into oligomers that permeabilise the outer membrane of mitochondria, releasing proteins such as cytochrome c that provoke the tidy dismantlement of the cell via dedicated proteases termed caspases. The discovery that impaired apoptosis is both a hallmark of many malignancies and a significant barrier to effective therapy has galvanised the search for new types of anti-cancer agents that directly switch on apoptosis by targeting proteins like Bcl-2. The first of these 'BH3 mimetic' drugs are now showing considerable promise in the clinic.

2014 Academy Medals

Mr Simon McKeon AO

Simon McKeon is Chairman of CSIRO and AMP Limited and was the 2011 Australian of the Year. He recently retired as Executive Chairman (Melbourne Office), Macquarie Group, after a 30-year career.

Mr McKeon has law and commerce degrees from The University of Melbourne and previously practised as a solicitor with Blake Dawson Waldron in Sydney. His legal and investment banking careers were largely focused on contested, public company takeovers. He has also long been inspired by the work of the not-for-profit sector and also making a contribution to the government sector.

He has held numerous roles in the not-for-profit world, for example as Chairman of Independent Schools Victoria, Business for Millennium Development, Global Poverty Project Australia, Essendon Football Club's Hutchison Foundation, In2Science and MS Research Australia. He has also served on the boards of *The Big Issue*, The University of Melbourne $500m campaign and Red Dust Role Models.

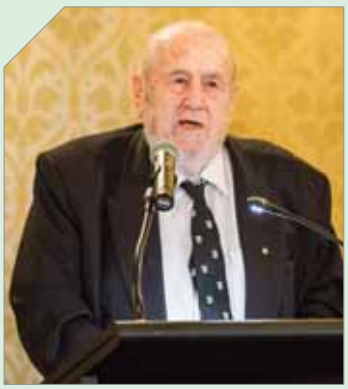
In the public sector, Mr McKeon is an Australia Day Ambassador for the Victorian Government and a Business Ambassador for the Northern Territory Government. He has served on the federal government's Human Rights Grant Scheme Advisory Panel and AusAid's Business Engagement Steering Committee and was Founding President of both the Australian Takeovers Panel and the Point Nepean Community Trust.

Mr McKeon has always had an inquiring mind and appreciated the importance of science in the well-being and sustainability of our planet. He has taken many opportunities, as a non-scientist, to impress upon business and the wider community the need to take science seriously. For example, he has consistently pointed out that an overwhelming majority of our best peer-reviewed climate scientists agree on the existence of climate change and the impact of mankind.

From 2011–13 he chaired a strategic review into health and medical research, which contained many far-reaching recommendations.

In 2013, he received Research Australia's Leadership and Innovation Award.

Professor Harry Messel AC CBE



Emeritus Professor Harry Messel was born at Levine Siding, Manitoba, Canada in 1922. After serving in the Canadian Armed Forces during World War II, he undertook Honours in Arts and Science at Queen's University, Ontario. He gained his PhD in 1951 at the Institute for Advanced Studies, Ireland, where he worked under world-renowned theoretical physicist and Nobel Laureate Professor Erwin Schrodinger. Later that year he accepted an appointment to The University of Adelaide, but within 12 months was appointed Chair of Physics at The University of Sydney.

He built up the School of Physics to one of the leading undergraduate and postgraduate schools in the British Commonwealth. Upon his retirement the school had six research departments, each with its individual Professorial Head. His solar energy work in the early 1970s led to some exciting discoveries, commercialised in a number of countries, and led to excellent cooperative arrangements with industry, both in Australia and overseas. He pioneered electronic computing in Australia with the construction in 1954 of Australia's first university computer.

Professor Messel established a Science Foundation for research funding for physics, which also contributed to the development of secondary education in Australia. This centred on the International Science Schools for High School Students program, and publication of eight integrated science text books (integrating physics, chemistry, biology and geology).

He made more than 150 world tours, has given thousands of lectures, published numerous articles and research papers in leading journals, and authored, co-authored or edited more than 60 books.

Professor Messel retired as Head of the School of Physics and Director of the Science Foundation in 1987. In 1992 he was appointed Chancellor of Bond University and in 1993 Chief Executive (as Executive Chancellor). Following the appointment of a Vice-Chancellor in 1996, Professor Messel returned to the role of Chancellor, from which he retired in 1991.

Honorific awards

2014 David Craig Medal for research in chemistry

Professor Curt Wentrup FAA, The University of Queensland

Curt Wentrup was educated at the University of Copenhagen (Cand. Scient. 1966; DSc 1976) and the Australian National University (PhD 1969). After postdoctoral periods with Hans Dahn (Lausanne), WM Jones (Gainesville, FL) and Maitland Jones Jr (Princeton), he held a position as Privat-Docent at the Université de Lausanne, Switzerland, and a professorship at the Universität Marburg, Germany, before returning to Australia in 1985 as professor and chair of organic chemistry and Head of the Organic Chemistry Section at the University of Queensland, where he is now Emeritus Professor. Since 2008 he has been Editor-in-Chief of the *Australian Journal of Chemistry*. He has published more than 300 research papers and more than 30 reviews and book chapters, as well as three books on reactive intermediates. His interests are in the fields of both experimental and computational chemistry of reactive intermediates and unusual molecules. He collaborates extensively with research groups in Australia and Europe and frequently holds visiting professorships in Europe.

Short-lived molecules: research on reactive intermediates and chemical reactivity

Chemical reactions usually take place in stages involving short-lived and often undetected 'reactive intermediates'. In order to understand chemical reactivity, and to make informed and useful predictions of new reactions, it is desirable to understand the nature of these reactive intermediates. We use a number of techniques for this purpose in the laboratory, where the aim is to capture the intermediates at very low temperatures, a few degrees above absolute zero, where they will be long-lived and therefore amenable to interrogation by spectroscopic methods. Low temperature photochemistry is used as well as gas-phase thermal reactions with very short contact times (so-called flash vacuum thermolysis) followed by immediate isolation at very low temperatures of the reactive molecules so formed. Using these and related techniques, it has been possible to probe the detailed properties and behaviours of a wide range of reactive intermediates and unusual molecules, including free radicals, carbenes, nitrenes, and cumulenes. Hand-in-hand with these investigations we carry out computational investigations of the energetics of these species. The reactions of some of these reactive intermediates lead to pharmaceutically important molecules, e.g. antibiotics.

2014 Mawson Medal and Lecture

Dr Gavin Young, Australian National University

Gavin Young began his geological studies with an honours degree at ANU, followed by a PhD in zoology at the University of London. After 26 years as a geologist and palaeontologist with the Australian government's geological survey (now Geoscience Australia), in 1997 he returned to ANU as a Visiting Fellow. His outstanding achievements in Earth science research have covered dating and correlation of sedimentary sequences across the world, and the reconstruction of ancient continental positions, based on the distribution of fossil vertebrates in time and space. He has conducted fieldwork throughout Australia and in many overseas countries, including three months collecting fossil fish in the Transantarctic Mountains of Australian Antarctic Territory. His research on remarkably preserved Australian fossils has provided

Curt Wentrup

Gavin Young

Katherine Belov

unique insights into early evolution of the vertebrate eye and brain, revealed ancient methods of vertebrate sexual reproduction, and detailed the evolutionary origin of vertebrate hard tissues and jaws. In his substantial contribution to taxonomic and scientific knowledge, he has documented one new class, four new families, and more than 50 new genera and 80 new species of ancient fossil vertebrates from the supercontinent of Gondwana.

Early vertebrate evolution — some contributions from the rocks of East Gondwana (Australia-Antarctica)

'Deep time' (the great age of the Earth) became widely accepted in western science less than 200 years ago, facilitating Charles Darwin's evolutionary theory, when fossils (biological inclusions in sedimentary rocks) received detailed discussion as tangible evidence of past evolutionary change. In 1859 fossil vertebrates from Australian rocks were hardly known. The giant extinct marsupial *Diprotodon* from Wellington caves was noted in Darwin's book, but much older fossils were already discovered. Reverend WB Clarke ('Father of Australian geology') identified 360-million-year-old fossil bones in coastal red mudstones near Eden, NSW (first Southern Hemisphere record). Later, the Devonian limestones at Buchan, Victoria, yielded bones, then on Scott's Antarctic Expedition (1911) Debenham and Griffith Taylor (the Australian geologists) found the first fossil vertebrates and evidence of Devonian rocks from Antarctica. Ongoing research on these, and numerous subsequent fossil discoveries, documents the great diversity of the first vertebrates to inhabit our continent, at a time when the first forests and complex terrestrial ecosystems were evolving, and our ancestors moved from water onto land. Exceptional preservation in our Devonian vertebrate fossils was recognised in the 1950s–60s, when the British Museum removed to London over 2000 specimens from two internationally significant sites: Burrinjuck (near Canberra) and Gogo (Kimberley, WA). High resolution computed tomography of these remarkable fossils at ANU provides new data on jaw evolution, brain morphology, and function of major sense organs in ancient vertebrates, at a level of detail Charles Darwin could never have imagined.

2014 Fenner Medal for research in biology

Professor Katherine Belov, The University of Sydney

Kathy Belov is an ARC Future Fellow and Professor of Comparative Genomics in the Faculty of Veterinary Science at The University of Sydney. She received her PhD from Macquarie University in 2002 and subsequently held research fellowships at the Australian Museum and The University of Sydney. Her research expertise is in the area of comparative genomics and immunogenetics of Australian wildlife. A main focus of her work is saving the Tasmanian devil from extinction by understanding how transmissible cancer evades the immune system, mapping the evolutionary trajectory of the cancer and preserving the genetic diversity of the species through an insurance program. Professor Belov's research team has participated in the opossum, platypus and wallaby genome projects where they have gained insights into genes involved in immunity and defence, including discovering platypus venom genes and novel antimicrobial peptides in the pouch. Professor Belov has received two Eureka awards for her research. She is President-elect of the Genetics Society of Australasia.

Genomes of Australian animals: the devil's cancer, defence and new elixirs

The recent sequencing of the genomes and transcriptomes of the tammar wallaby, opossum, Tasmanian devil, koala, platypus and echidna have revealed innovations in immunity and defence in marsupials and monotremes that are of importance to both conservation of our native wildlife and development of novel therapeutics for humans and other animals. I will highlight four research areas that I have worked on with my amazing team and fantastic collaborators: firstly, marsupials and monotremes were previously touted as being primitive; we have shown that their immune system is as advanced as our own, with some novel innovations; secondly, we have shown that a contagious cancer is able to be transmitted between Tasmanian devils due to low levels of genetic diversity in devil populations plus evolution of immune evasion strategies by the cancer; thirdly, we have identified powerful antimicrobial peptides in the milk, pouch and skin of marsupials and monotremes. These peptides are able to kill multi-drug resistant bacteria and fungi and hold promise as a new class of antibiotics; and lastly, we have used a combined 'omics approach to characterise platypus venom and have identified a number of peptides that may lead to novel therapeutics that target blood pressure and pain pathways.

2013 Ruth Stephens Gani Medallist for research in human genetics

Professor Aleksandra Filipovska, The University of Western Australia

Aleksandra Filipovska has made significant contributions to the field of human mitochondrial gene expression. She has developed new technologies to investigate mitochondrial nucleic acids and the roles of proteins that regulate the expression of genes encoded on the mitochondrial DNA. Furthermore she has discovered several mitochondrial proteins that are important for energy production and consequently cell health. Aleksandra has developed new tools to modulate mitochondrial gene expression and is using them currently as potential therapeutics for the treatment of diseases caused by mutations in the mitochondrial genome.

Aleksandra Filipovska

Ryan Lister

Kieran Harvey

Regulation of mitochondrial gene expression

Mitochondria are microscopic, energy producing machines within cells, which contain a small set of genes that must work properly to make the energy our bodies require for health. Defects in the expression of mitochondrial genes cause mitochondrial diseases, a group of more than 100 genetic disorders that cause mitochondrial dysfunction and result in progressive and debilitating neuromuscular diseases for which there are no cures. Treatment of mitochondrial diseases is limited to palliative care, and the diagnosis is difficult, costly and frequently omitted. These diseases occur at a frequency of 1 in 4000, and recently it has been found that mitochondrial DNA mutations are present in one in 200–250 people. To better understand these conditions and identify therapeutic targets it is necessary to elucidate how gene expression is regulated within mitochondria. Recently, using integrated analyses, we provided the first comprehensive maps of the human mitochondrial transcriptome and revealed its unexpected complexity. We have discovered mitochondrial proteins that regulate the expression of the mitochondrial genome and are essential for cell health. We have developed a new set of technologies that will be applied to understand how mutations in genes coding for mitochondrial proteins cause disease, and provide insights into possible treatments.

2014 Ruth Stephens Gani Medal for research in human genetics

Professor Ryan Lister, The University of Western Australia

Ryan Lister is a genome biologist whose research focuses on mapping and decoding the epigenome, the layer of information superimposed upon the genome that controls the readout of the underlying genetic information. His development of key techniques to accurately map the epigenome has enabled major advances in our understanding of its role in genome regulation, including the first comprehensive maps of epigenome dynamics throughout human brain development. His discoveries provide an essential foundation for understanding how complex epigenome patterns are established and altered in normal and disease states, and how they regulate the readout of information encoded within the DNA of the genome.

Rewiring of the brain epigenome during development

A central challenge in biology is determining how the information contained in one genome gives rise to the hundreds of specialised cell types in a complex organism. The epigenome is a molecular code consisting of many millions of molecular 'signposts' added to the genome, which controls the readout of the underlying DNA sequence and plays key roles in governing cellular form and function. The epigenome is essential for proper brain function and is implicated in memory, learning, and neural plasticity. Accordingly, it is crucial to construct a comprehensive understanding of epigenome patterns in the brain and how they change during critical phases of neural development. We used new DNA sequencing technologies to produce the first comprehensive maps of the brain epigenome throughout development and ageing. This revealed widespread epigenome reconfiguration during human brain development, and identified a novel epigenome signature associated with gene inactivation that emerges in neurons as the neural circuits are formed and refined during early childhood. These discoveries provide new insights into the role of the epigenome in mammalian gene regulation, brain development, and neural function, and pave the way for examining how the brain-specific epigenome is established.

2014 Gottschalk Medal for research in the medical sciences

Associate Professor Kieran Harvey, Peter MacCallum Cancer Centre

Kieran Harvey is a Group Leader at the Peter MacCallum Cancer Centre. He investigates the fundamental biological process of organ size control, using the vinegar fly *Drosophila*. Associate Professor Harvey was part of the team that discovered the Hippo pathway and its role in organ size control and human cancer.

Emma Johnston

Julie Arblaster

David Warton

Kieran's laboratory has identified multiple components of the Hippo pathway, including the first transmembrane receptor, which has provided important insights into how pathway activity is regulated. His group also discovered a role for the Hippo pathway in the control of regenerative tissue growth.

Control of organ size by the Hippo pathway

The Hippo tumour suppressor pathway is a complex signalling network that controls developmental tissue growth and is frequently deregulated in human cancers. Discovered by us and others in *Drosophila* genetic screens in 2002, the Hippo pathway is now the subject of intense investigation. At its core are the kinases Warts and Hippo, which limit tissue growth by repressing the Yorkie oncoprotein. My laboratory has focused a large part of its effort on elucidating the mechanism of signal transduction within the Hippo pathway, by performing large-scale genetic and proteomic screens. We discovered the first transmembrane receptor protein in the Hippo pathway — the atypical cadherin Fat. More recently, we identified Tao-1 as a kinase that regulates activity of the Hippo kinase, and Hipk as a kinase that promotes Yorkie activity. In further studies we found that the human homologues of both Tao-1 (TAOK1) and Hipk (HIPK2) are functionally conserved in human cells. More recently, we identified a new branch of the Hippo pathway, from transmembrane receptor to the nucleus, which controls organ size downstream of the Dachsous cadherin. We have also discovered important roles for the Hippo pathway in regenerative tissue growth, and human ovarian cancer. Our studies have provided important insights into how the Hippo pathway controls organ size and cancer.

2014 Nancy Millis Medal

Professor Emma Johnston, University of New South Wales

Emma Johnston is an Australian Research Fellow at UNSW and Director of the Sydney Harbour Research Program at the Sydney Institute of Marine Science. Professor Johnston investigates the ecological impacts of human activities in marine ecosystems. She combines the disciplines of ecology, ecotoxicology and invasion biology in an exciting research program that expands our fundamental understanding of marine systems and provides recommendations for management. Her research is conducted in such diverse field environments as Antarctica, the Great Barrier Reef and temperate Australian estuaries. She contributes expert opinion to state, federal and international government agencies and consults with industry through the development and implementation of environmental monitoring programs.

Stress ecology

Humans are changing environmental conditions on local, regional and global scales. My research examines interactions between contamination and community dynamics and is conducted in the laboratory and sub-tidal environments from the tropics to the poles. My team has generated important insights into the ecological and evolutionary consequences of contamination. By combining the largely disparate fields of ecology and ecotoxicology, we have identified drivers of invasion success, indirect effects of chemical stress, plasticity of environmental niche space and a suite of new ecological indicators. We've shown that contamination causes severe indirect effects that cannot be predicted by conventional toxicity tests. Avoiding, or ameliorating, intense ecological impact remains an important challenge for society. The scientific advances required to better inform environmental management demand collaboration, and a respectful exchange between disciplines.

2014 Anton Hales Medal for research in the Earth sciences

Dr Julie Arblaster, Australian Government Bureau of Meteorology

Julie Arblaster is a senior research scientist in the Centre for Australian Weather and Climate Research at the Bureau of Meteorology. She grew up in country Victoria, received her undergraduate degree from Macquarie University and a PhD from The University of Melbourne. She spent a number of years at the National Center for Atmospheric Research in Colorado

and still maintains strong collaborative ties with colleagues there. Dr Arblaster's research has explored meteorological data and utilised climate models as tools to improve understanding of climate variability and change. She has investigated a broad range of phenomena, from tropical modes such as the El Niño-Southern Oscillation to the impact of the Antarctic ozone hole on winds and rainfall over the Southern Hemisphere. Her international standing has been acknowledged through appointments to prominent panels and reports, including the Intergovernmental Panel on Climate Change's Fifth Assessment Report and the World Meteorological Organization/United Nations Environment Programme's ozone assessment.

The ozone hole and climate change

Since the discovery of the Antarctic ozone hole in the 1980s, extensive research has shown that manufactured chemicals, such as chlorofluorocarbons (CFCs), are the cause of ozone depletion in the upper atmosphere. The ozone layer sits within the stratosphere (approximately 10 km above the surface) and has been depleted by more than 50% over Antarctica compared to 1980 levels. However, ozone depletion is not only of concern because it protects us from the harmful effects of ultraviolet radiation. In the past decade, research has also established a connection between ozone depletion and climate patterns at the surface. A reduction in ozone has led to local cooling in the stratosphere over Antarctica, which has changed the temperature gradient between Antarctica and latitudes further north. At the same time a strengthening and southward shift of the westerly winds located over Southern Ocean has been observed in summer. Robust evidence based on theoretical arguments as well as simple and comprehensive climate models has built a strong case for the dominance of ozone depletion in driving these wind changes. The altered winds have associated impacts on the ocean circulation and rainfall patterns, with changes identified as far north as Australia. This presentation will outline the historical links between ozone depletion and climate change and discuss projections of their interaction into the future.

2014 Christopher Heyde Medal for research in probability theory, statistical methodology and their applications

Associate Professor David Warton, University of New South Wales

David Warton is an Australian Research Council Future Fellow at the Department of Statistics, UNSW. His studies focused on statistics and ecology as an undergraduate and postgraduate student at The University of Sydney and Macquarie University respectively. Since being awarded his PhD in 2004 he has continued research at the interface between these two fields, developing new statistical methodology inspired by important problems in ecology such as allometry, predicting species' distributions and their potential response to climate change, and biodiversity modelling. This has led to methodological contributions for point process modelling, model selection, and multivariate and high dimensional data analysis. He is active in the ecological community, making new results accessible to end users, with some success — about 500 ISI citations per year and more than 10 000 views of his blog posts and YouTube videos. Whether his incessant pop culture referencing helps or hinders these efforts remains untested.

Ecology, statistics, and Rick Astley

Technological advances are rapidly expanding our research capacity in exciting ways, and in ecology, many important but methodologically challenging questions remain unanswered. One example is the question of how to simultaneously analyse abundance data for many species, when studying the community-level effects of environmental change, e.g. assessing potential impact of mining activities, urban expansion, or climate change. This is a 'big data' problem that is quite challenging to statisticians given that there are typically a large number of species in a community, thus joint characterisation of community-level effects is technically difficult. Over the past couple of decades, ecologists have attempted to address the issue using naive solutions that are seriously flawed, and which in many cases return spurious, misleading results. The methods they have been using are a bit like Rick Astley — very cool in the 80s, not so much nowadays. But developing better alternatives is only half the battle — convincing non-specialist ecologists they need them is a major challenge.

2014 Dorothy Hill Award for research in the Earth sciences

Dr Maria Seton, The University of Sydney

Maria Seton is a Future Fellow at the School of Geosciences, The University of Sydney. She is an international expert on global tectonics, long-term sea-level change, global geodynamics and backarc basin formation. Her work on global tectonics has led to major scientific and technological advances by changing the way traditional plate tectonic reconstructions are created. She has been part of groundbreaking studies on the effect of ocean basin changes on global long-term sea level, crustal production and ocean chemistry. In 2013, she was awarded a prestigious Future Fellowship, which followed on from the Australian Postdoctoral Fellowship awarded in 2009. Maria chairs an Interridge international working group on island arc and backarc systems and

Maria Seton

Geoff Pryde

Chris Turney

was chief scientist on a marine research voyage to the eastern Coral Sea in 2012. Her current research is focused on the role of oceanic gateways on modulating ocean circulation and climate over the past 60 million years.

Reconstructing vanished ocean basins

Earth is unique among the planets in our solar system for its active plate tectonic system. The Wilson cycle is a fundamental concept of plate tectonics and describes how, on hundred-million-year timescales, ocean basins open then close, or conversely how continents amalgamate and then disperse. Reconstructing the history of the world's ocean basins through deep-time relies on an analysis of the present day seafloor-spreading record using satellite and marine geophysical datasets, a spatio-temporal interpretation of plate boundary processes from the onshore geological record, and an adherence to the rules governing plate tectonics. Mantle imaging techniques, such as seismic tomography, provide a model of present day mantle structure, which are increasingly being used to constrain past plate boundary locations. In this talk I will demonstrate how, by reconstructing these ancient oceans, we are able to understand some of Earth's fundamental evolutionary cycles, including supercontinent formation and dispersal, major sea-level fluctuations, extinctions, and long-term greenhouse-icehouse cycles.

2014 Pawsey Medal for research in the physical sciences

Professor Geoff Pryde, Griffith University

Geoff Pryde investigates the fundamental properties of the quantum world and how these can be harnessed for radical advances in information technologies, sensing and measurement. Working with quantum states of light, Professor Pryde has demonstrated the first quantum measurement scaling at the absolute quantum limit of measurement sensitivity, and has realised key steps on the path towards optical quantum computing. His recent investigations of quantum entanglement and the quantum limits of amplification are providing new resources for realising ultra-secure long range communications. Geoff has researched at Griffith University's Centre for Quantum Dynamics since 2006, where he is currently Deputy Director. He completed his PhD at the Australian National University (2001), and was a postdoctoral researcher at Montana State University and then The University of Queensland. He is presently an Australian Research Council Future Fellow and a Program Manager in the ARC Centre of Excellence for Quantum Computation and Communication Technology.

Photonic quantum information science and technology

In the regime where quantum mechanics reigns, physical systems behave very differently from what our intuition would suggest. Quantum information science addresses the complementary questions of how the physics of quantum systems can impact information technology, and how the formal techniques of information science can help us to understand and harness the quantum world. In the laboratory, photons (single particles of light) provide an excellent system for exploring quantum information concepts and developing quantum technologies. Photons can be readily and precisely manipulated, transmitted over long distances, and measured with low noise. In my experiments, I have used the quantum state of photons to investigate the fundamental aspects of quantum entanglement, advance our understanding of quantum measurement science, and realise key steps towards optical quantum computers. The continued development of photonic quantum information science will transform technology in the 21st century and beyond, and allow us to address deep fundamental questions about the quantum nature of our universe.

2014 Frederick White Prize

Professor Chris Turney, University of New South Wales

Chris Turney is an Earth scientist, and an ARC Laureate Fellow at the University of New South Wales. He has published three popular science books (the most

recent being *1912: The Year the World Discovered Antarctica*) and more than 100 refereed scientific papers on past climate, environmental and archaeological change and the insights they offer for better understanding the future. By pioneering new ways of integrating records of past change (spanning centuries to millennia) with models, Chris has discovered new links between modes of variability in the Australian region and global climate change. Chris is passionate about science communication. He regularly writes articles for the media and uses social media to report his findings from the field and laboratory. Chris's awards include the 2007 Sir Nicholas Shackleton Medal for outstanding young quaternary scientists, and the 2009 Geological Society of London's Bigsby Medal for services to geology.

Using the past to understand and plan for abrupt future climate change

A key problem for reducing the uncertainty in future climate projections is that historical records of change are too short to test the skill of climate models, raising concerns over our ability to successfully plan for abrupt change. Published records only allow a robust reconstruction of global temperature back to 1850 and appear to show a 'gradual' warming trend of around 0.8°C. However, a wealth of geological, chemical, and biological records clearly indicate that large-scale, abrupt and often irreversible (centennial to millennial in duration) shifts in the climate system took place in the past. The forcing associated with these changes appears to have been relatively small, implying the associated thresholds (often described as 'tipping points') are considerably smaller than generally supposed. The Australasian region is potentially highly sensitive to abrupt changes caused by the passing of tipping points within different components of the climate system. These include collapse of Antarctic and/or Greenland ice sheets (leading to a global sea level rise of several metres), changes in mean El Niño-Southern Oscillation (ENSO) state (resulting in increasing aridity in Australia), dieback of tropical rainforests (causing CO_2 release, amplifying global warming), and widespread melting of permafrost in high-latitudes (causing CO_2 and CH_4 release, amplifying global warming). Innovative analyses of high-resolution records of abrupt past change suggest the climate system characteristically slowed down when a tipping point was approached, raising the prospect that palaeo records may help to identify the thresholds of components in the Australasian region. Here I will present examples from a range of ice, marine and terrestrial archives that provide different insights into how the Earth system may behave in the future.

Early- and mid-career researcher workshops

> 2.00 – 5.00 pm, Wednesday 28 May 2014

Topic 1: Management and leadership in research careers

University House, The Australian National University, Cnr Balmain Cr & Liversidge St, Acton

Have you spent many years learning how to be a scientist but don't know how to lead or manage a team? You're not alone. Associate Professor Kieran Harvey and Dr Krystal Evans will discuss leadership and management in research — fundamental skills for a successful career. They will draw on their experiences as well as discuss strategies adopted in other sectors. They will also discuss leadership and management strategies suitable for employees and students at various career points.

Topic 2: Practical grants writing workshop — guide to successful funding applications

Ground floor boardroom, Ian Potter House

The Academy is hosting a grant and fellowship writing workshop for new and early career scientists. Professors Ryan Lister and Aleksandra Filipovska will discuss funding opportunities and preparing successful applications to the Australian Research Council and the National Health and Medical Research Council. The presentations will focus on strategies for applying for national funding, insight into the review process, skills in grant writing and responding to reviewers, followed by group discussion and feedback from delegates. There will be opportunities for networking with other participants and scientists during the workshop.

Topic 3: Facilitating multidisciplinary scientific collaborations

Level 1 boardroom, Ian Potter House

Sharing expertise, results or data is a key component of a successful career in science. However, initiating and maintaining productive collaborations is not always easy. This workshop, presented by Professors David Warton and Andreas Fouras, will identify and discuss issues that can affect whether these collaborations succeed. Participants will be encouraged to share their own experiences and highlight challenging areas. The aim of the workshop is to provide participants with an understanding of different cross-disciplinary strategies and the confidence to embark on new collaborations.

Topic 4: Communicating science: media and social media

Becker Room, Shine Dome

Communicating the results and impact of our research is a critical part of every scientist's job. Yet, many scientists are intimidated by the thought of dealing with the media. Dr Darren Saunders and Professor Emma Johnston will draw on their experience to discuss various aspects of science communication. We will discuss why communication is so important, provide good (and bad) examples, discuss potential pitfalls and provide practical advice, feedback and skills on interacting with the media (print, radio, TV). The workshop will be hands-on, showing how to get started using social media and how to optimise your experience in this space. Participants will be encouraged to share their experiences.

Tuesday 27 May 2014

EMCRs cocktail reception **6.30 pm – 9.00 pm, the Shine Dome**

Participating early- and mid-career researchers are invited to a special cocktail reception and barbecue at the Shine Dome. This is a unique opportunity to get to know one another and meet some Fellows of the Academy in an informal and relaxed setting.

Symposium speakers

Professor Suzanne Cory AC PresAA FRS
Chair

Professor Suzanne Cory is one of Australia's most distinguished molecular biologists. She was born in Melbourne and graduated in biochemistry from The University of Melbourne. She gained her PhD from the University of Cambridge, England, and then continued studies at the University of Geneva before returning to Melbourne in 1971 to a research position at the Walter and Eliza Hall Institute of Medical Research. From 1996 to 2009 she was Director of the Walter and Eliza Hall Institute and Professor of Medical Biology at The University of Melbourne. She is currently a Vice-Chancellor's Fellow at The University of Melbourne and Honorary Professorial Fellow at the Walter and Eliza Hall Institute. Her research has had a major impact in the fields of immunology and cancer and her scientific achievements have attracted numerous honours and awards. In 2010 she was elected President of the Australian Academy of Science.

EARTH SCIENCES

Professor John F Dewey FAA FRS, University College, Oxford

John Dewey is a distinguished geologist who has been at the forefront of the development of new concepts in tectonics during the past 50 years. He has been a leader in transforming tectonic geology to its modern form. His work on mountain belts shows how their evolution is related to collisions between tectonic plates at the Earth's surface. He has made major contributions to understanding both the detailed nature and the timing of those events. As a frequent visitor to Australia during the past 20 years, Professor Dewey has made significant contributions to the understanding of Australian geology. In 2011, he was elected as a Corresponding Member of the Australian Academy of Science. He has received numerous previous honours including the highest awards of the geological societies of London and America, the Wollaston and Penrose Medals. He is a Fellow of the Royal Society and a member of the National Academy of Sciences in the US. He has more than 160 publications in leading journals and is writing two books.

Australian geoscience: past, present, and future

The first systematic mapping of huge areas of NSW, on foot and horse, by the Reverend WB Clarke FRS (1798–1878), was followed by Sir Edgeworth David's (1858–1934) early fieldwork, which led to the extraction of £10 000 000 worth of silver (Vegetable Creek) and £50 000 000 of coal (Hunter Valley). From 1891 David KBE CMG FRS, father of Australian geology, made massive contributions and introduced Mawson to Antarctica. Sam Carey AO FAA (1911–2002) had many inceptive ideas including sphenochasms and nemataths, long before their time, as elements of plate tectonics and recognised early the necessity for sea floor spreading. Allen White (1932–2009) and Bruce Chappell FAA (1936–2012) recognised I and S type granites, and forged our understanding of the role of granites in the re-ordering of the continental crust and their role in copper, molybdenum and gold, and gold mineral exploration. After the early discovery of copper (Moonta), gold (Ballarat/Bendigo), and lead-zinc polyminerallic (Broken Hill/Mount Isa), Sir HG Raggatt Kt CBE FAA (1900–1968), the first Director of the Bureau of Mineral Resources, mapped huge areas of Australia and New Guinea. He organised the first systematic exploration of Australia's mineral wealth, leading to the outstanding role of Geoscience Australia, Australia's


Suzanne Cory


John Dewey


Jenny Graves

exploration companies, and individuals, especially Roy Woodall AO FAA FTSE and Dick Stanton AO FAA, using field mapping, satellite, geophysical, geochemical, and numerical modelling techniques. The results are many nickel and platinum deposits, the Cadia gold quarry, and the Olympic Dam uranium/polymineralic discovery that, with controlled sales and compulsory domestic reprocessing, will make Australia a very rich nation. Many, past and present, have left their mark on Australian and world geoscience but the greatest was Ted Ringwood FAA FRS (1930–1993). From his PhD work on the origin of ore deposits, he worked on the geochemical evolution of Earth. He used thermodynamics and experimental studies of germanates to investigate Earth's interior and develop modern ideas of polymorphic phase transitions in the mantle. From meteorites, he developed the chondritic Earth model and the correct value for the solar abundance of iron. This led to his groundbreaking experimental work with David Green AM FAA FRS on the partial melting of mantle lherzolite to generate a basaltic magma and a harzburgite residue, the central plank of the generation of oceanic crust at ridges. Ringwood's career was the underpinning of the petrology of plate tectonics and the evolution of the Earth-Moon system.

AUSTRALIAN LIFE SCIENCES

Professor Jenny Graves AO FAA, La Trobe University

Jenny Graves is an evolutionary geneticist who works on Australian animals, including kangaroos and platypus, devils (Tasmanian) and dragons (lizards). Her group uses their distant relationship to humans to discover how genes and chromosomes and regulatory systems evolved, and how they work in all animals including us. Her laboratory uses this unique perspective to explore the origin, function and fate of human sex genes and chromosomes — (in)famously predicting that the Y chromosome will disappear. Professor Graves graduated (BSc, MSc) from The University of Adelaide, then a Fulbright Travel grant took her to the University of California at Berkeley for a PhD in Molecular Biology. She lectured at La Trobe for many years, then headed a department at the Australian National University before returning to La Trobe as Distinguished Professor; she is also Professor Emeritus at ANU, Thinker-in-Residence at the University of Canberra and Professorial Fellow at The University of Melbourne. She has produced three books and more than 400 research articles. Professor Graves has received many honours and awards, including the Australian Academy of Science's Macfarlane Burnet medal in 2006 and an AO in 2010. She is 2006 L'Oréal-UNESCO Laureate for Women in Science. She is a Fellow of the Academy, and as Secretary Education and Public Affairs oversees its school science education projects.

Australian life science in the age of genomics

From Darwin's time, Australia was famous for its remarkable plants and animals, which evolved separately for millions of years. Biologists in this country have capitalised on our unique flora and fauna to make fundamental discoveries about genetics, physiology, reproduction and evolution — everything from early animal development learned from the premature young in the pouch of a kangaroo, to responses to stress of leaves in mangroves and gum trees, and of coral in the Great Barrier Reef. The isolation of Australia also prompted support of research into solving agricultural problems, sparking world-leading research on plant breeding. The molecular biology revolution in the 1980s dramatically changed the kinds of investigations possible, and now all life science, and its spinoffs into medicine, agriculture and the environment, are being reshaped by our new-found ability to see into the core of our being, our DNA sequence. Australia, although strong in genetics, molecular biology and bioinformatics, was slow to adopt sequencing technology. However, international interest ensured that the kangaroo and platypus genomes were early pin-ups, delivering stunning insight into vertebrate biology and evolution, and setting the stage for the revolution to come. Now sequencing DNA and comparing gene expression profiles and epigenetic modifications are a core part of biological research in institutions all over Australia. These new techniques are increasingly offering opportunity to explore and exploit our genetic resources to make fundamental discoveries, as well as to underpin advances in medicine, agriculture and the environment.

Professor Andrew Holmes AM FAA FRS
Chair

Andrew Holmes is a Laureate Professor of the School of Chemistry at The University of Melbourne. In October, 2004 he was appointed ARC Federation Fellow and inaugural VESKI Fellow at the Bio21 Institute at The University of Melbourne and at CSIRO Molecular and Health Technologies. Andrew is interested in the synthesis of all kinds of compounds, from those used to probe signalling processes in cells to polymeric light-emitting diodes with potential applications in many fields.

Professor Anthony Klein AM FAA
Convenor

Anthony Klein is an Emeritus Professor in the School of Physics of The University of Melbourne, where he held a personal chair in physics until his retirement in 1998. He served as Head of the School of Physics from 1987 to 1996; was a member of the University Council representing the professors (1995–97); President of

Andrew Holmes

Anthony Klein

Gus Nossal

the Australian Institute of Physics (1989–91); President of the Australian Optical Society (1985–86); Chairman of the Standards Advisory Committee of the CSIRO National Measurement Laboratories (1985–95); and Chairman of the Research Committee of the Royal Victorian Eye and Ear Hospital (1991–2010). He also chaired the Beam Instruments Advisory Committee for the research reactor OPAL. His research accomplishments include several significant fundamental experiments in quantum physics using beams of slow neutrons and many contributions to instrumentation in experimental physics. He shared the Walter Boas Medal of the Australian Institute of Physics in 1990 and shared an 'R&D 100' Award for 'one of the 100 most technologically significant products of the year 1995'. He was elected a Fellow of the Australian Academy of Science in 1994 and serves as the Chair of the Victorian Regional Group. He was appointed a Member of the Order of Australia in 1999.

MEDICAL SCIENCE

Sir Gustav Nossal AC CBE FAA FRS FTSE, The University of Melbourne

Sir Gustav Nossal was Director of the Walter and Eliza Hall Institute of Medical Research 1965–1996 and Professor of Medical Biology at The University of Melbourne. He is distinguished for his contributions to the fields of antibody formation and immunological tolerance. In 1996 he was one of the founders of Foursight, a company providing advice on R&D and science to companies, investment institutions, academics and government. Born in 1931 and arriving in Australia at the age of eight, Sir Gus entered The University of Sydney's Medical School in 1948, graduating with first class honours. At the age of 26, he left his job in Sydney and moved to Melbourne to work with Sir Macfarlane Burnet OM AK KBE FAA FRS Nobel Laureate in medical science. Sir Gus gained his PhD degree in 1960 at the age of 29. He has received numerous awards and recognition throughout his career, including being knighted in 1977 for his groundbreaking work in immunology and made a companion of the Order of Australia in 1989. He was awarded the Albert Einstein World Award of Science in 1990 and in 1996 he won the highly prized Koch Gold Medal for major advances in biomedical science. He has been Australian of the Year and is named as one of Australia's national living treasures. Sir Gus is involved in a number of other organisations that allow him to reach people in many areas of the community, including the Bill and Melinda Gates Foundation, the Centenary of Federation Victoria Committee, the Council for Aboriginal Reconciliation and The Global Foundation.

Professor Cheryl Praeger AM FAA

Chair

Cheryl Praeger is Winthrop Professor of Mathematics at The University of Western Australia. Her work on groups, networks and algorithms brings an area of mathematics with a proud history of 200 years firmly into the 21st century. Her new theories, algorithms and designs have advanced every field seeking to exploit the symmetry of large complex systems. Professor Praeger is a member of the Order of Australia, Fellow and incoming Foreign Secretary of the Australian Academy of Science, Executive Committee member of the International Mathematical Union, Vice-President of the International Commission for Mathematical Instruction, foundation board member of the Australian Mathematics Trust, Chair of the Australian Mathematics Olympiad Committee, former president and an Honorary Member of the Australian Mathematical Society, former Chair of the Australian Council of Heads of Mathematical Sciences, former Director of the Centre for the Mathematics of Symmetry and Computation at The University of Western Australia, former Australian Research Council Federation Fellow, and was 2009 Western Australian Scientist of the Year, and 2013 Thomas Ranken Lyle Medallist of the Australian Academy of Science.

ENVIRONMENTAL SCIENCE

Professor Michael Raupach FAA FTSE, Australian National University

Michael Raupach is the Director of the Climate Change Institute, Australian National University, Canberra. This position follows a career of many years with CSIRO. His scientific foci include Earth system science, carbon-climate-human interactions, land-air interactions, and fluid mechanics. From 2000 to 2008 he was an inaugural co-chair of the Global Carbon Project, an international project studying the natural and human influences on the global carbon cycle. In recent years he has co-chaired the working group drafting the Australian Academy of Science booklet *The science of climate change: questions and answers*; led the report 'Challenges at energy-water-carbon intersections' for the Prime Minister's Science, Engineering and Innovation Council; and led the Australian Academy of Science project 'Negotiating our future: living scenarios for Australia to 2050'. He is a Fellow of the Academy of Science, the Australian Academy of Technological Sciences and Engineering, and the American Geophysical Union.

The past, present and future of Australian environmental science

Through growth in the scale and reach of its activities, humankind is now profoundly influencing the environment of the Earth — its climate, land, waters and ecosystems. Australian science has made critical past contributions to observing and understanding these processes, at both Australian and global scales. Examples include Australian water resources, soils and ecosystems; the flows of water and carbon through plants and landscapes; carbon dioxide and other gases in the atmosphere; and the role of the Southern Ocean in the global deep ocean circulation. The emerging environmental understandings of the present and the future are fundamentally trans-disciplinary, embracing both natural and human sciences. By pointing to objective realities about the way the Earth works, these understandings are changing the ways that people think, and thus contributing to the emergence of new societal ethics for guiding the cohabitation of human societies and a natural world that is no longer invulnerable.

Professor Marilyn Renfree AO FAA
Chair

Professor Renfree was elected to the Fellowship in 1997 and was previously a member of Council from 2000 to 2003. She rejoins Council and Executive Committee as Secretary Biological Sciences.

The central focus of Professor Renfree's research is to understand the control of reproduction and development in mammals. Professor Renfree studies a wide range of mammals, from wallabies to women, but she has special interests in the Australian mammalian fauna, particularly marsupials and monotremes and the evolution of reproduction. Reproductive projects funded by the ARC currently being conducted are on physiology and endocrinology of parturition, the uterine, hormonal and metabolic control of embryonic diapause, embryo culture, the lactational and seasonal control of breeding and biology of germ cells. Professor Renfree has a large NHMRC funded program on the developmental biology of sexual differentiation in marsupials and the genes and hormones that control male and female development. She also has an ARC and ARC SPIRT supported program on conservation and fertility control of macropodid marsupials.

PHYSICAL SCIENCE AND ASTRONOMY

Professor Brian Schmidt AC FAA FRS Nobel Laureate, Australian National University

Brian Schmidt is a Laureate Fellow and Distinguished Professor at the Australian National University. Professor Schmidt received undergraduate degrees in astronomy and physics from the University of Arizona in 1989, and completed his astronomy master's degree (1992) and PhD (1993) at Harvard University. Under his leadership, in 1998 the High-Z Supernova Search team made the startling discovery that the expansion rate of the

Cheryl Praeger

Michael Raupach

Marilyn Renfree

Brian Schmidt

Michelle Simmons

Universe is accelerating, work that earned him the 2011 Nobel Prize in Physics. A Fellow of the Australian Academy of Science, the United States Academy of Science, and the Royal Society, he was made a Companion of the Order of Australia in 2013.

Physics in Australia since federation

Australia's physical isolation from the European and American hubs of physics research meant that before World War II very few groups managed to reach the critical mass necessary to undertake research at the international forefront, and those who did typically moved overseas to further their careers. Sir William Bragg OM KBE FRS defied the odds, undertaking seminal work within the newly emerging area of X-ray physics in Adelaide, before emigrating to England where he soon after made, along with his son, his Nobel Prize winning discovery. Astronomers had the advantage of the southern sky, but they too did not flourish until the world was opened in the postwar era, and Australia rapidly became industrialised. Based on radar work from the war, Australians soon established themselves as leaders in the emerging discipline of radio astronomy, the legacy of which continues to this day. With the return of Sir Mark Oliphant AC KBE FAA FRS FTSE from the UK as a one of the key appointees for the establishment of the Australian National University, Australia embarked on a vigorous program of research in atomic and nuclear physics, including commissioning the HIFAR reactor. It pursued an active space program, becoming, after the US and the Soviet Union, the third country to launch a satellite to orbit from its own territory in 1967. Optical astronomy joined radio astronomy in the 1960s to world prominence, and sizeable physics programs were built up at all of the country's major universities. In 2014, Australia finds its physics research covering the complete spectrum of the discipline, with strengths covering quantum computing, astrophysics, nanotechnology, laser physics, photonics, and particle physics, to name just a few. I will review the history of Australian physics reflecting on some of its defining moments, and ponder what we can expect from the future.

INFORMATION AND COMMUNICATIONS SCIENCE

Professor Michelle Y Simmons FAA, University of New South Wales

Michelle Simmons is the Director of the Australian Research Council Centre of Excellence for Quantum Computation and Communication Technology, a Laureate Fellow and a Scientia Professor of Physics at the University of New South Wales. Following her PhD in II-VI solar cells at the University of Durham in the UK in 1992 she became a Research Fellow at the Cavendish Laboratory in Cambridge, UK, working with Professor Sir Michael Pepper FRS in GaAs-based quantum electronics. In 1999, she came to Australia on a QEII Fellowship and established a large research group dedicated to the fabrication of atomic-scale devices in silicon using the atomic precision of a scanning tunnelling microscopy. Her group has developed the world's thinnest conducting wires in silicon and the smallest transistors made with atomic precision. She has published more than 350 papers in refereed journals and presented more than 80 invited and plenary presentations at international conferences. In 2005 she was awarded the Pawsey Medal by the Australian Academy of Science and in 2006 became one of the youngest elected Fellows of the Academy. In 2008 she was awarded a second Federation Fellowship and in 2012 was named NSW Scientist of the Year. In 2014 she became an ARC Laureate Fellow.

The quantum revolution: computing, past present and future

Down-scaling has been the leading paradigm of the semiconductor industry since the invention of the first transistor in 1947, producing faster and smaller computers every year. However, device miniaturisation will soon reach the atomic limit, set by the discreteness of matter, leading to intensified research in alternative approaches for creating logic devices of the future. In this talk I will discuss the development of computing since its inception and describe the emerging field of quantum information. In particular I will focus on the development of quantum computing, where Australia is leading an international race to build a large-scale prototype in silicon.

Stephen Simpson

John White

LAND, FOOD AND AGRICULTURE

Professor Stephen J Simpson FAA FRS, The University of Sydney

Stephen Simpson is Academic Director of the Charles Perkins Centre and Australian Research Council Laureate Fellow in the School of Biological Sciences at The University of Sydney. The Charles Perkins Centre is a new $500 million cross-faculty initiative at the university. Its mission is to research and implement cross-disciplinary approaches to alleviating the individual and societal burden of obesity, diabetes and cardiovascular disease. Professor Simpson returned to Australia in 2005 as an ARC Federation Fellow after 22 years at Oxford University. Before that he completed his PhD at the University of London, and his undergraduate degree and honours at The University of Queensland. Together with colleague Professor David Raubenheimer, he developed an integrative modelling framework for nutrition, the Geometric Framework, which was devised and tested using insects but has since been applied to a wide range of organisms, from slime moulds to humans, and problems from aquaculture and conservation biology to dietary causes of human obesity and ageing. A synthesis of this work can be found in *The nature of nutrition: a unifying framework from animal adaptation to human obesity* (2012). Professor Simpson's research on locusts has also led to an understanding of locust swarming that links chemical events in the brains of individual insects to landscape-scale mass migration. He has been Visiting Professor at Oxford, a Fellow of the Institute for Advanced Study (Wissenschaftskolleg) in Berlin, Distinguished Visiting Fellow at the University of Arizona, and Guest Professor at the University of Basel. In 2007 he was elected a Fellow of the Academy; in 2008 he was awarded the Eureka Prize for Scientific Research; in 2009 he was named NSW Scientist of the Year; and in 2010 he was named as the Wigglesworth Medallist by the Royal Entomological Society of London. In 2013 he was elected Fellow of the Royal Society, and awarded an Honorary Fellowship by the Royal Entomological Society. He was also co-writer, narrator and presenter of the four-part documentary *Great Southern Land*, for ABC TV, which was aired to critical and viewer acclaim in September 2012.

Land, food and agriculture

In this lecture I will tell the story of how Australian ecologists and agricultural scientists have changed the world by a combination of developing revolutionary new theory, basic laboratory work, long-term field studies, and by working hand-in-hand with practitioners, equipment inventors, economists and others. I will show how new theories in population and evolutionary ecology have shaped conservation and landscape management, and our understanding of species distributions; helped in the battle against invasive species; and led to a new mathematics of disease epidemiology. I will then show how advances in agriculture have been the result of innovative integration, in which plant breeders and geneticists, agronomists, farmer groups, farm equipment inventors and economists have come together to revolutionise food production.

CHEMISTRY AND MATERIALS SCIENCE

Professor John White CMG FAA FRS, Australian National University

JW White is a Fellow of the Australian Academy of Science and the Royal Society and acknowledged for his development of neutron contrast variation in structure determination. His current work is in pillared graphite intercalation compounds for hydrogen storage and the fundamentals of nano-toxicology. He has been Director, Institute Laue-Langevin, Grenoble, France; Pro-Vice Chancellor and Chair, Board of the Institute of Advanced Studies, Australian National University; Chairman, Oxford-Australia Scholarships Committee; Chairman, International Advisory Committee, J-PARC Project, Tokai, Japan; President, Royal Australian Chemical Institute (RACI); President Australian Institute of Nuclear Science and Engineering; and President Asia-Oceania Neutron Scattering Association. Recent recognition of his work includes the Leighton Medal, (RACI), 2005; the Craig Medal, Australian Academy of Science, 2006; Founder's

lecturer, St Johns College Oxford, 2007; Liversidge Lecture, Royal Society of New South Wales, 2010; and Kashiwa Lecture, Tokyo University, 2011.

Changing chemistry

This lecture will focus only on advances in synthetic chemistry including natural products and pharmaceuticals, molecular electronics and the chance to understand energy capture in photosynthesis. Attempts are in hand to revolutionise synthetic methods and to use computerised databases to target successful reaction pathways. Some of the illustrations will be drawn from young Australians' work. The great gift of synthetic chemists — to visualise in three dimensions the way in which a reagent approaches a molecule — cannot be underestimated, but the availability of advanced physical and theoretical methods in the past 60 years has been a great boon. Now, an accurate understanding of reaction mechanisms and outcomes (as a synthesis proceeds) is possible, on micro-gram quantities by nuclear magnetic resonance, and tiny crystals by X-ray crystallography. The impact of both methods in chemical pharmacology and biological chemistry grows as does an understanding of biological structure and function using synchrotron and neutron scattering methods. It is important that this in-flow to chemistry from physics and biology continues — but there are impediments. 'Molecular electronics' encapsulates the importance of 'past, present and future' achievements. Australians laid some of the foundations of this area. Current work on the underlying theory of electron transport in organic materials — relevant to biology as well as new materials — and on highly practical polymeric systems for energy efficient lighting will be mentioned. The future will be something like the past — only better. The lecture will show some 'wonders' with us now, which could be of chemical significance and useful.

Housekeeping

Colour coding

- New Fellows
- Fellows
- EMCRs/Lindau participants
- Awardees
- Symposium speakers

Photo sessions

Please meet in the foyer where you will be directed.

Tuesday

Morning tea
EMCR (all) group photos

Lunch
New Fellows group photo followed by individual photos

Afternoon tea
New Fellows remaining individual photos

Wednesday

Morning tea
Lindau awardee and EMCR awardee group photos

Lunch
Career and early career honorific awardee group and individual photos

Thursday

Lunch
Symposium speakers group photo

Registration desk

A registration desk is located in the main foyer and will be occupied at all times should you have any questions.

Luggage

A large luggage cabinet is located in the main foyer of the Shine Dome. Please drop your luggage off at the registration desk and wait until you have received a claim number.

Replacement silk ties and scarves

Replacement silk ties and scarves with the Academy logo are available for purchase by Fellows by emailing **fellowship@science.org.au**

Twitter

Follow us on twitter
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Wi-fi

Wireless internet access is available throughout the Shine Dome. The networks are **Shine-01**, **Shine-02**, **Shine-03** and **Shine-04**, a password is not required.

Taxi

Canberra Elite **13 22 27**

The Shine Dome
15 Gordon Street
Canberra ACT 2601

Please use the phone located in the foyer.

Bus routes

The following bus routes drop off within walking distance of the Shine Dome — 3, 4, 5 and 7
www.action.act.gov.au/timetables_and_maps

Parking

The forecourt area of the Shine Dome is 'set down and pick up only'. Limited free car parking is available in the Academy's car park off Gordon Street. Additional pay parking areas are marked on the Academy area map on the inside front cover of this program.

Disabled access

Two disabled parking spaces are available within the Academy car park. The Shine Dome is also equipped with wheelchair access and disabled facilities.

Quiet spaces/hearing loop

You will find a quiet space to check your email (using your own device) in the Fenner Room or the Basser Library located on level 1 of the Shine Dome.

The Ian Wark Theatre is equipped with a hearing loop, should you require it during your time at the Shine Dome. Please look for seats in the lower area of the theatre with a gold plaque indicating a hearing loop is available.

Coach timetable

Wednesday annual dinner

6.40 pm **From** University House **to** the National Arboretum **via** the Diamant Hotel

6.40 pm **From** the Diamant Hotel **to** the National Arboretum **via** University House

10.25 pm **From** the National Arboretum **to** University House **via** the Diamant Hotel

10.40 pm **From** the National Arboretum **to** University House **via** the Diamant Hotel

10.55 pm **From** the National Arboretum **to** University House **via** the Diamant Hotel

11.10 pm **From** the National Arboretum **to** University House **via** the Diamant Hotel

Thursday airport shuttle

4.30 pm **From** the Shine Dome **to** the airport

5.15 pm **From** the Shine Dome **to** the airport

Contacts

The following Academy staff will be available at the Shine Dome to assist you, please don't hesitate to call them with general or specific enquiries:

General enquiries

Mitchell Piercey	0466 271 430
Nearose Soares	0413 543 850

Lindau delegates

Meaghan O'Brien	0438 458 637

Early career researchers

Camille Couralet	0425 699 259
Samires Hook	0412 438 626

New Fellows

Jen Nixon	02 6201 9406

Awardees

Dominic Burton	02 6201 9407

Media inquiries

Bella Counihan	0419 212 219
Kylie Walker	0405 229 152

UPCOMING SPEAKERS

TUESDAY 1 JULY
Associate Professor Bryan Fry
Seeing the woods for the trees: understanding venom evolution as a guide for biodiscovery

TUESDAY 5 AUGUST
Dr Lisa Alexander
Extreme events: the new normal

TUESDAY 2 SEPTEMBER
Professor Vipul Bansal
The nanotech revolution

2014 Public speaker series

In 2014 the Australian Academy of Science celebrates its 60th Anniversary with an exciting speaker series featuring some of the nation's brightest rising stars of science. Chaired by three prominent public friends of science — veteran science broadcaster Professor Robyn Williams FAA, former Climate Commissioner and prolific author Professor Tim Flannery FAA, and long-time ABC journalist Louise Maher — *Science stars of tomorrow* will showcase young scientists whose work offers astonishing insights into outer space, inner space and the world around us.
www.science.org.au/science-stars-tomorrow

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