

65 YEARS OF THE ACADEMY
60 YEARS OF THE SHINE DOME



PROGRAM 28–30 MAY
**SCIENCE AT THE
SHINE DOME 2019**

REACH NEW AUDIENCES.



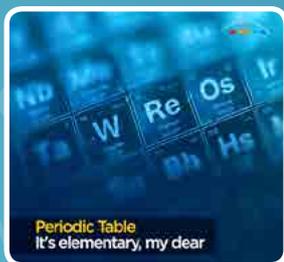
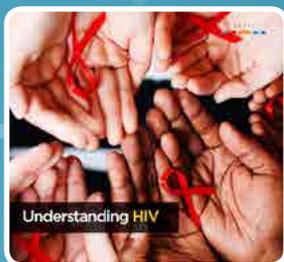
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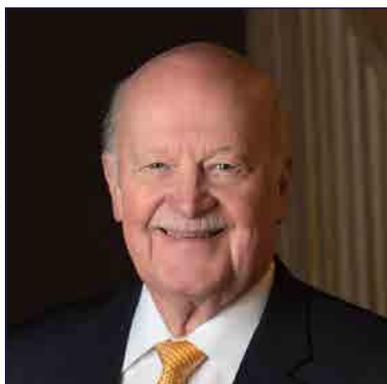


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President's welcome

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Welcome to the Academy's annual flagship event—Science at the Shine Dome. This is an opportunity for researchers to come together, celebrate science and honour outstanding achievements. It is a unique transdisciplinary networking opportunity for Academy Fellows, early- and mid-career researchers (EMCRs), government, education and industry representatives, parliamentarians, media, STEM sector organisations, and the science-interested general public. This is my first as President and I am inspired by the program—it shares and promotes the very best of Australian science.

This Science at the Shine Dome marks two significant milestones for the Academy. It is 65 years since the Australian Academy of Science was founded by 23 distinguished scientists, and 2019 also represents the 60th anniversary of the completion of the heritage-listed Shine Dome, the home of the Academy. Over the next few days we will reflect on and celebrate the Academy's past achievements, plus look to the future.

Diversity and inclusion is key to our future. The Academy can best champion and support excellence in Australian science if its Fellowship reflects the depth and breadth of science and scientists in our nation. The Academy's Fellowship must be diverse in every way: spanning scientific disciplines, in gender, in

cultural richness, in geographic distribution and in the many other forms of diversity. I thank our Diversity and Inclusion Presenting Partner, the University of Sydney, for again supporting accessibility, childcare and carer grants for Science at the Shine Dome.

I am delighted that the Academy will confer the inaugural Aboriginal and Torres Strait Islander Scientist Travelling Researcher Award this Science at the Shine Dome. We are constantly working to remove barriers and biases and to ensure that the Academy applies and models best practice in nominating and electing Fellows and in conferring our awards. I am also delighted that 37 per cent of the new Fellows elected in 2019 are women. Under-representation of senior women in the STEM pipeline remains one of the sector's biggest challenges. You will hear more about how the Academy is actively addressing diversity and inclusion throughout Science at the Shine Dome. However, I would like to acknowledge the work and commitment of the Academy's Council, the Equity and Diversity Reference Group, and the 'Champions of Diversity' who have identified, encouraged and mentored diverse nominees for Fellowship and awards.

The 2019 Annual Symposium is Power Up Australia, the sustainable way—a topic of high relevance which is sure to be thought provoking as Australia finds itself at a crossroads in energy policy. We will hear from a range of experts, including Australia's Chief Scientist, Dr Alan Finkel AO FAA FTSE. I wish to thank Professor Hans Bachor AM FAA and the Symposium Committee Members for developing such a rich program.

This year, in partnership with STEM Education Presenting Partner, 3M,

the Academy is excited to launch the first Science at the Shine Dome Schools Program. I know you will all enjoy meeting secondary students and their teachers, and hearing about their experiences undertaking the NSW Science Extension Course. I am delighted that Science at the Shine Dome will provide these secondary students and their teachers with a unique opportunity to meet with Australia's distinguished scientists as well as gain exposure to cutting-edge research being undertaken across the country in a range of scientific disciplines.

The Academy continues to build public awareness and understanding of science. Our digital content is not only engaging, but most importantly all published content is rigorously fact checked by at least five Fellows. We will be sharing Science at the Shine Dome with a massive online audience, including over 1.5 million people who follow the Academy online.

I would like to acknowledge and thank all partner organisations for this event. Without their support, Science at the Shine Dome would not be the dynamic meeting of minds that it is in 2019. I also wish to acknowledge our Gala Dinner Presenting Partner, the University of South Australia, our EMCR Engagement Presenting Partner, UniBank, and the many organisations who have sponsored individual EMCRs to attend. Partnerships are deeply important to the Academy, with many of our core activities only possible with the support of likeminded, independent organisations and individuals.

Enjoy your week here at the Academy celebrating excellence in Australian science—I look forward to meeting you.

Professor John Shine AC PresAA

Contents

Symposium	8	Academy awards	33
New Fellows	16	Early- and mid-career researcher workshops	44
Event partners	24	Maps	46
Gala dinner	31	Event information	47

Program

Colour coding in the program matches the lanyards worn by delegates. Delegates are welcome at every session unless restrictions apply.

■ New Fellows ■ Fellows ■ EMCRs/Lindau participants ■ Awardees ■ Symposium speakers ■ Event partners

Tuesday 28 May

Science at the Shine Dome Symposium – *Power Up Australia, the sustainable way*

8.30 am	Foyer	Registrations open	Arrival tea/coffee available in Jaeger Room
9.15 am	Ian Wark Theatre	Welcome	Ms Anna-Maria Arabia Chief Executive, Australian Academy of Science
		Welcome to country	Mr Wally Bell Chair/Cultural Heritage Officer, Buru Ngunawal Aboriginal Corporation
		President's welcome	Professor John Shine AC PresAA President, Australian Academy of Science
		Keynote address	Dr Alan Finkel AO FAA FTSE , Chief Scientist of Australia <i>Scaling up to meet the energy challenge</i> PAGE 9
9.30 am		Speaker 1	Professor Kylie Catchpole , Australian National University <i>The bright future of solar energy</i> PAGE 9
		Speaker 2	Professor Stuart White , University of Technology Sydney <i>Energy productivity and distributed energy resources – the quiet achievers</i> PAGE 10
		Speaker 3	Associate Professor Claudia Vickers , University of Queensland <i>Sustainable bio-based solutions to energy needs</i> PAGE 10
11.00 am	Jaeger Room and Dorothy Hill Room	Morning tea	 EMCRs group photo (meet in foyer)
	Jaeger Room Dorothy Hill Room Ian Wark Theatre	Simultaneous Q&A	Professor Kylie Catchpole Professor Stuart White Associate Professor Claudia Vickers
11.45 am	Ian Wark Theatre	Speaker 4	Scientia Professor Deo Prasad AO FTSE , CRC for Low Carbon Living <i>Towards zero carbon buildings</i> PAGE 11
		Speaker 5	Associate Professor Jenny Pringle , Deakin University <i>Supporting sustainability through electrochemical energy storage</i> PAGE 12
		Speaker 6	Associate Professor Gregor Verbic , University of Sydney <i>Prosumer-based decentralised power supply</i> PAGE 12
1.00 pm	Jaeger Room and Dorothy Hill Room	Lunch	 Symposium speakers and chairs group photo (meet in foyer)
	Jaeger Room Dorothy Hill Room Ian Wark Theatre	Simultaneous Q&A	Scientia Professor Deo Prasad AO FTSE Associate Professor Jenny Pringle Associate Professor Gregor Verbic
2.00 pm	Ian Wark Theatre	Speaker 7	Ms Claire Johnson , Hydrogen Mobility Australia <i>The advent of the hydrogen mobility age: Australia's journey to introduce hydrogen-powered vehicles and infrastructure</i> PAGE 13
		Speaker 8	Dr Mark Ho , Australia's Nuclear Science and Technology Organisation <i>Advanced nuclear reactors</i> PAGE 14
		Speaker 9	Professor Karen Hussey , University of Queensland <i>Climate change: the issue that shaped a nation</i> PAGE 15
3.10 pm		Panel Q&A	Ms Claire Johnson, Dr Mark Ho and Professor Karen Hussey
3.30 pm		Concluding remarks	Professor Hans Bachor AM FAA and Professor Ken Baldwin
3.45 pm–5.00 pm	University House, ANU	EMCR masterclass	Pre-registration required
5.00 pm–8.30 pm	Jaeger Room	New Fellows admission and cocktail reception	Pre-registration required
8.00 pm–10.00 pm	University House, ANU	EMCR networking dinner	Pre-registration required

Wednesday 29 May

New Fellows' presentations and gala dinner

7.30 am– 9.00 am	Ian Potter House	Lindau briefing (by invitation only)	Briefing and breakfast	
8.00 am	Foyer	Registrations open	Arrival tea/coffee available in Jaeger Room	
9.00 am	Ian Wark Theatre	Welcome	Ms Anna-Maria Arabia Chief Executive, Australian Academy of Science	
		President's address	Professor John Shine AC PresAA President, Australian Academy of Science	
9.20 am		Professor Alexander Zelinsky AO FAA FTSE , University of Newcastle <i>Science and technology for national and global impact</i>		PAGE 16
		Professor Warren Alexander FAA , Walter and Eliza Hall Institute of Medical Research <i>Molecular regulation of blood cells</i>		PAGE 16
		Professor David Balding FAA , University of Melbourne <i>Progress and controversy in mathematical genetics</i>		PAGE 17
		Professor Christopher Barner-Kowollik FAA , Queensland University of Technology <i>Making light work of material design</i>		PAGE 17
		Professor Debra Bernhardt FAA , University of Queensland <i>Why processes have a direction: a microscopic understanding of thermodynamic laws</i>		PAGE 18
		Scientia Professor Richard Bryant AC FAA , UNSW Sydney <i>The psychology of traumatic experiences</i>		PAGE 18
10.45 am	Jaeger Room and Dorothy Hill Room	Morning tea	 New Fellows group and individual photos (meet in foyer)	
11.15 am	Ian Wark Theatre	Professor Maria Byrne FAA , University of Sydney <i>Impact of environmental acidification and habitat warming on marine invertebrates: vulnerabilities and potential for persistence in a changing ocean</i>		PAGE 19
		Professor Mark Cassidy FAA FTSE , University of Melbourne <i>Frontiers of offshore geotechnics</i>		PAGE 19
		Professor Peter Cawood FAA , Monash University <i>Pulse of the Earth</i>		PAGE 20
		Professor Joanne Etheridge FAA , Monash University <i>Finding the atoms that matter</i>		PAGE 20
		Professor John Hamilton FAA , University of Melbourne <i>Addressing inflammation and pain: a journey from concept to clinic</i>		PAGE 21
		Professor Paul Hodges FAA , University of Queensland <i>Understanding movement from cells to systems: The path from new discoveries to improved health outcomes</i>		PAGE 21
		Professor David Karoly FAA , CSIRO Oceans and Atmosphere <i>The 'Furious Summer' of 2018–19: what role, if any, did climate change play?</i>		PAGE 22
		Professor Maria Makrides FAA , South Australian Health and Medical Research Institute <i>Omega-3 fatty acids and the prevention of preterm birth</i>		PAGE 23
1.10 pm	Jaeger Room and Dorothy Hill Room	Lunch	 New Fellows individual photos continued (meet in foyer)	
2.15 pm	Ian Wark Theatre	Professor Kerry Landman FAA , University of Melbourne <i>What has maths got to do with it?</i>		PAGE 22
		Professor Krzysztof Matyjaszewski FAA , Carnegie Mellon University <i>Macromolecular engineering by taming free radicals</i>		PAGE 23
		Professor Alexander Molev FAA , University of Sydney <i>Puzzles, algebras and lattice models</i>		PAGE 26
		Dr Surinder Singh FAA , CSIRO Agriculture and Food <i>Innovation in oilseed crops</i>		PAGE 26
		Professor Catherine Stampfl FAA , University of Sydney <i>Next generation computational materials discovery and design</i>		PAGE 26
		Professor James Whelan FAA , La Trobe University <i>Mitochondrial biogenesis and signalling</i>		PAGE 27
		Professor Cynthia Whitchurch FAA , University of Technology Sydney <i>Exploding bacteria release extracellular DNA slime and other public goods in bacterial biofilms</i>		PAGE 27
		Professor Ruth Williams FAA , University of California San Diego <i>Resource sharing in stochastic networks</i>		PAGE 28
		Professor Ian Wright FAA , Macquarie University <i>The economic life of leaves</i>		PAGE 28
4.30 pm		Session close		
6.20 pm		Coaches depart QT Hotel and University House		
6.30 pm– 10.00 pm	National Museum of Australia	Gala dinner	Pre-registration required	PAGE 31

Thursday 30 May

Awards presentations, Annual General meeting and EMCR workshops

8.00 am– 9.30 am	Jaeger Room	Supporters and guests breakfast (by invitation only)	Including the presentation of the inaugural Aboriginal and Torres Strait Islander Scientist Travelling Research Awards and the Max Day Environmental Science Fellowship Awards Individual and group photos for the above awardees	PAGE 41
8.30 am	Foyer	Registrations open	Arrival tea/coffee available in Dorothy Hill Room	
9.30 am	Ian Wark Theatre	Welcome	Ms Anna-Maria Arabia Chief Executive, Australian Academy of Science	
		President's welcome	Professor John Shine AC PresAA President, Australian Academy of Science	
		Sponsor's address	Professor Kathy Belov University of Sydney	
9.45 am		2019 Matthew Flinders Medal and Lecture	Dr Richard Manchester FAA CSIRO Astronomy and Space Science	PAGE 33
		2019 Thomas Ranken Lyle Medal	Professor Chennupati Jagadish AC FAA FTSE Australian National University	PAGE 34
10.20 am	Jaeger Room and Dorothy Hill Room	Morning tea		
11.00 am	Ian Wark Theatre	2019 David Craig Medal	Professor Peter Gill FAA Australian National University	PAGE 34
		2019 Jaeger Medal	Professor Dietmar Müller FAA University of Sydney	PAGE 34
		2019 Jacques Miller Medal	Professor Nicholas Huntington Walter and Eliza Hall Institute of Medical Research and Monash University	PAGE 35
		2019 Nancy Mills Medal for Women in Science	Professor Jacqueline Batley University of Western Australia	PAGE 35
		2019 Anton Hales Medal	Professor Isaac Santos Southern Cross University	PAGE 36
		2019 Christopher Heyde Medal	Professor Geordie Williamson FAA FRS University of Sydney	PAGE 36
		2019 Dorothy Hill Medal	Dr Laurie Menviel UNSW Sydney	PAGE 37
		2019 Fenner Medal	Dr Daniel Falster UNSW Sydney	PAGE 37
		2019 Gottschalk Medal	Associate Professor Laura Mackay Doherty Institute	PAGE 37
		2019 John Booker Medal	Associate Professor Anna Giacomini University of Newcastle	PAGE 38
			Professor Changbin Yu Curtin University	PAGE 38
		2019 Moran Medal	Dr Kim-Anh Lê Cao University of Melbourne	PAGE 39
			Associate Professor Stephen Leslie University of Melbourne	PAGE 39
	2019 Pawsey Medal	Professor Steven Flammia University of Sydney	PAGE 39	
	2019 Ruth Stephens Gani Medal	Dr Justin Wong Centenary Institute of Cancer Medicine and Cell Biology	PAGE 40	
12.20 pm		Schools presentation	NSW Science Extension Course student and teacher Proudly supported by STEM Education Presenting Partner, 3M	
12.30 pm	Jaeger Room and Dorothy Hill Room	Lunch	Awardee individual photos (meet in foyer)	
1.30 pm	Ian Wark Theatre	Annual General Meeting	Open to Fellows of the Academy only	
1.30 pm	Becker Room	EMCR workshop 1: Leadership development	Presented by Mr Philip Podgson from the Leading Partnership	PAGE 44
	Ian Potter House	EMCR workshop 2: Industry engagement for impact	Presented by Dr Julie Wheway from gemaker	PAGE 44
	Ian Potter House	EMCR workshop 3: Grant writing	Presented by Professor Kylie Ball from Indago Academy	PAGE 45
	Fenner Room	EMCR workshop 4: CV writing and interview skills	Presented by Mr Paul Grainger from Professionals Australia	PAGE 45
4.30 pm	Foyer	Coach to Canberra Airport	Please meet in the Shine Dome main foyer	

Students aim high: new STEM education program

The Australian Academy of Science and 3M have partnered to provide 10 NSW Science Extension course students and their teachers the opportunity to participate in the Science at the Shine Dome Schools Program.

This new program is an opportunity for participants to attend the Academy's major annual three-day celebration of Australian science including the gala dinner where they will interact with, learn from and be inspired by Australia's top scientists. The program supports gender equity in STEM and provides equal opportunity to NSW students regardless of their location and background.

Science Extension is an innovative NSW Higher School Certificate course designed for Year 12 students with an interest in scientific research. In collaboration with a practising scientist, students develop research and critical analysis skills to apply to evidence-based decision making and a research project.

The generous support of **Presenting Partner—STEM Education** 3M has enabled the Science at the Shine Dome Schools Program to take place.

3M Australia Managing Director, Mr Makoto Itoh, congratulated the Academy on creating the new Schools Program.

'The Australian Academy of Science has created a fantastic program to inspire Australia's future scientists,'

he said. 'By providing equal opportunity to all NSW Science Extension students and including their science teachers, we're creating a winning formula for success and the advancement of science in Australia. In future careers, these students could make their own scientific discoveries and apply them to solve some of life's biggest problems. They could change the world—and that alone is worth its weight in gold.'

Science is at the heart of everything 3M does. The company supports a collaborative culture that encourages problem-solving and the application of science to improve every life. 3M has thousands of innovations across 12 areas including health care, industrial, consumer, safety, automotive and energy.

3M has a longstanding commitment to education and developing tomorrow's workforce through strategic investments in STEM programs and skilled trades. 3M's *Science. Applied to Life.* culture specifically contributes to this and the community.

For more on 3M visit go.3M.com/ourstory.

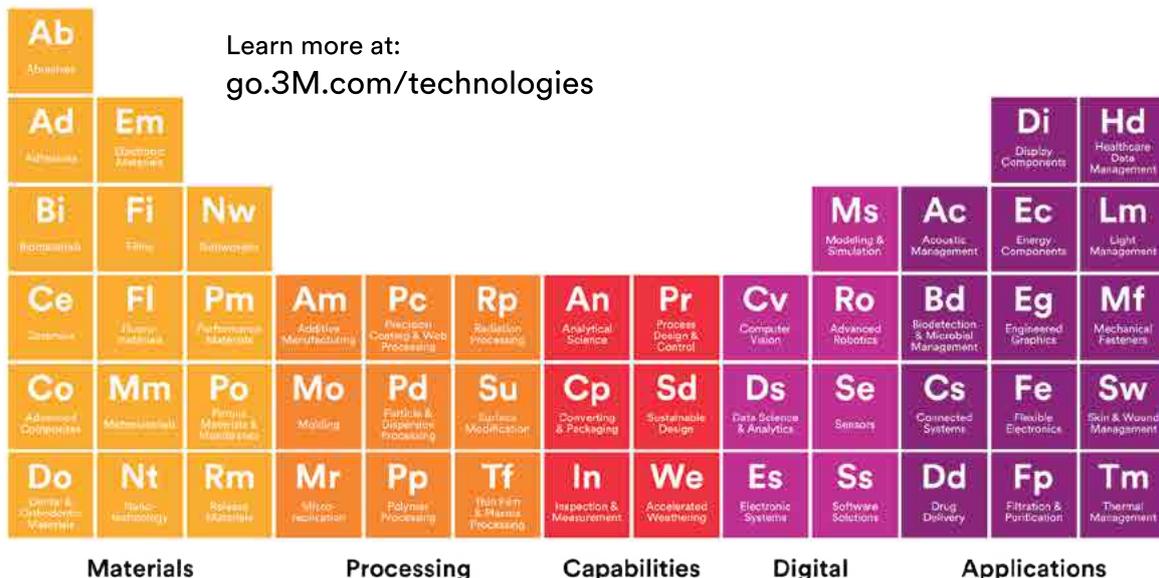
More on the Science at the Shine Dome Schools Program is on the Academy website.



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Symposium

This year's symposium is focused on the research we need to create sustainable power for Australia into the future, based on science and engineering.

Our speakers come from a diverse range of areas across the renewable and energy sector. They will highlight the most urgent facets of research required to create a sustainable power system for Australia, outline the challenges that lie ahead, and detail the possible solutions their research will create.

This year, for the first time, we will be conducting simultaneous Q&A sessions in the morning tea and lunch breaks. Speakers will be positioned at three locations around the Shine Dome (Ian Wark Theatre, Jaeger Room and Dorothy Hill Room) to enable them to engage with attendees in more depth, and to address questions specific to their work. The location for each of the speakers is listed on this page.

POWER UP AUSTRALIA THE SUSTAINABLE WAY

Session 1 Q&A during morning tea

- Speaker 1. Professor Kylie Catchpole—Jaeger Room
- Speaker 2. Professor Stuart White—Dorothy Hill Room
- Speaker 3. Associate Professor Claudia Vickers—
Ian Wark Theatre

Session 2 Q&A during lunch

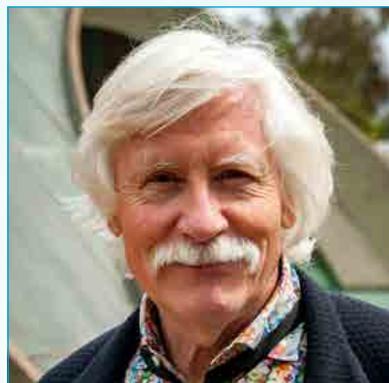
- Speaker 4. Scientia Professor Deo Prasad—Jaeger Room
- Speaker 5. Associate Professor Jenny Pringle—
Dorothy Hill Room
- Speaker 6. Associate Professor Gregor Verbic—
Ian Wark Theatre

Session 3 Q&A with panel in Ian Wark Theatre

- Speaker 7. Ms Claire Johnson
- Speaker 8. Dr Mark Ho
- Speaker 9. Professor Karen Hussey

The Australian Academy of Science offers sincere thanks to the symposium committee and speakers for supporting this event.

Committee



Professor Hans Bachor
AM FAA
Australian National University



Professor Ken Baldwin
Australian National University



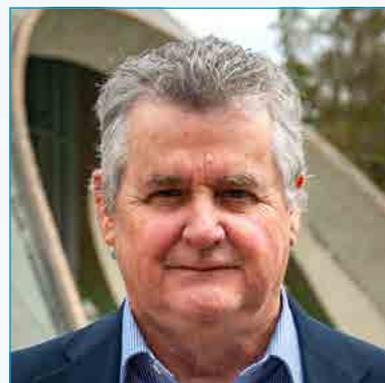
Professor Kylie Catchpole
Australian National University



Professor Thomas Maschmeyer FAA FTSE
University of Sydney



Associate Professor Jenny Pringle
Deakin University

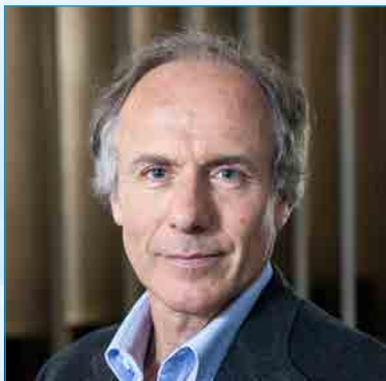


Professor Scott Sloan AO FAA FRS FTSE (dec)
University of Newcastle

Keynote speaker

Dr Alan Finkel AO FAA FTSE Chief Scientist of Australia

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Dr Alan Finkel commenced as Australia's Chief Scientist on 25 January 2016. Prior to his appointment, he served as President of the Australian Academy of Technology and Engineering, and for eight years as Chancellor of Monash University. As Chief Scientist, Dr Finkel is leading the development of the national hydrogen strategy at the request of the Council of Australian Governments. He also led the 2016 National Research Infrastructure Roadmap, the 2017 Review into the National Electricity Market ('Finkel Review') and the 2018 STEM Industry Partnership Forum report.

He serves as the Deputy Chair of Innovation and Science Australia.

In 2006, he focused his career in Australia and undertook a wide range of activities. He led the amalgamation that formed the Florey Neuroscience Institutes, chaired the Australian Centre of Excellence for All-Sky Astrophysics (CAASTRO) and was a director of the ASX-listed diagnostics company Cogstate Limited. He was Executive Chair of the educational software company Stile Education, Chair of Manhattan Investment Group, Chief Technology Officer of Better Place Australia and Chair of Speedpanel Australia.

Dr Finkel was the 2016 Victorian of the Year and the recipient of the 2015 Mountbatten Medal (UK). A winner of the Clunies Ross Award for facilitating international neuroscience research, Dr Finkel is committed to science education. He co-founded Cosmos Magazine, which in addition to magazine publishing operates a secondary schools science education program. At the Australian Academy of Technology and Engineering, he led the

development and implementation of the STELR program for secondary school science, which has been adopted in more than 600 Australian schools. As Chief Scientist he has led the development of the STARportal information web site for extracurricular STEM activities.

Scaling up to meet the energy challenge

Our civilisation is profoundly dependent on energy, and we use a lot of it. The energy sector of the global economy is massive, contributing 72% of the anthropogenic greenhouse gas emissions. Complete decarbonisation of the energy sector is achievable, but only if we start by acknowledging the huge scale of the challenge and that we have only taken the first baby steps. The solution will be a world in which all the primary energy will come from electricity instead of fossil fuels. Electrons will serve most of our needs, but sometimes we will need a high density energy carrier. Hydrogen is emerging as the ideal fuel to complement the direct use of electrons.

Speakers

Professor Kylie Catchpole Australian National University



Professor Kylie Catchpole is Professor in the Research School of Electrical Energy and Materials Engineering at the Australian

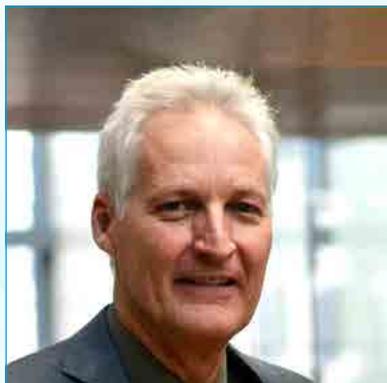
National University. She has over 100 scientific publications, with a focus on using new materials and nanotechnology to improve solar cells. She completed her PhD at ANU and was a postdoctoral fellow at the UNSW and the FOM Institute for Atomic and Molecular Physics in Amsterdam before returning to ANU in 2008. In 2013 she was awarded a Future Fellowship by the Australian Research Council and in 2015 she was awarded the John Booker Medal for Engineering Science by the Australian Academy of Science.

The bright future of solar energy

In recent years the price of solar electricity has dropped lower

than the price of conventional electricity, and globally renewables now account for more than half of new electricity capacity. This presentation will give an overview of the astonishing growth in solar we've seen to date, and what we can expect for the future. In particular, it will look at how to overcome the fundamental efficiency limitations of the dominant technology silicon technology. This is essential to enable further decreases in the costs of solar, allowing it to become not only the leading electricity technology, but also to open up a wide variety of applications of solar in other sectors.

Professor Stuart White
University of Technology Sydney



Professor Stuart White is Director of the Institute for Sustainable Futures at the University of Technology Sydney. Professor White's research background is in solar thermal energy. He was Cluster Leader of the Universities–CSIRO Intelligent Grid Research Program, and is a board member of the Australian Alliance for Energy Productivity and Acting Chair of Climate-KIC Australia. In 2012 he was awarded the Eureka Prize for Environmental Research.

Energy productivity and distributed energy resources—the quiet achievers

Lifting 'energy productivity'—getting more value from each unit of primary energy—is Australia's most important and most neglected energy resource, having contributed more to our growing energy needs since 1992 than coal, oil, gas and renewable energy combined. Improving energy productivity is also one of the lowest-cost means of meeting energy needs in the future. Evidence suggests that

doubling energy productivity by 2030, based on 2010 figures, is readily achievable. Combined with other distributed energy resources, innovation in energy productivity has the potential to solve the three challenges of our modern energy system: energy prices, reliability, and greenhouse emissions. 'Demand side response', that is, meeting electricity system peaks by shifting discretionary load, thermal storage, smart charging of electric vehicles and dynamic peak pricing is the largest and cheapest means of meeting peak demand. 'Distributed generation' is also transforming the Australian electricity sector, with the largest percentage of rooftop photovoltaic systems in the world. Combining the power of these distributed energy resources will enable the transition to a reliable affordable and clean energy future.

Associate Professor Claudia Vickers
University of Queensland



Associate Professor Claudia Vickers holds dual roles as Director of the CSIRO Synthetic Biology Future

Platform and Group Leader at the University of Queensland's Australian Institute for Bioengineering and Nanotechnology. She completed her PhD in plant molecular biotechnology at the University of Queensland and CSIRO Plant Industry in 2004. She held a postdoctoral position at Essex University in the UK from 2004–07, where she worked on abiotic stress. She returned to the University of Queensland in 2007. Her research focuses on understanding isoprenoid pathway metabolism and rational engineering to re-design organisms for production of industrially useful isoprenoids. Isoprenoids (terpenes) are a large group of natural products with multitude biological functions (signals, membrane components, location tags, electron transport components and pigments) and industrial applications (such as biofuels, agricultural chemicals, flavours, fragrances, pharmaceuticals and food additives). The CSIRO Synthetic Biology Future Platform is a \$60 million R&D program aimed at expanding Australia's capability in synthetic biology.

Sustainable bio-based solutions to energy needs

Earth essentially functions as a solar-powered battery that operates over various timeframes, from minutes to millennia. Biological processes capture, store and utilise incoming solar energy-using processes that have evolved over 3.5 billion years. Those processes resulted in the

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vast stores of fossil fuels that have formed the cornerstone of our industrialised economy and current way of life. Utilising fossil energy sources is, however, demonstrably unsustainable. The Earth system is in homeostasis, but our use of fossil resources is causing a relatively rapid shift in that homeostasis. This shift is happening too quickly for biology to evolve solutions to maintain biodiversity and productivity suitable to support our current way of life. There is an urgent need to transition to sustainable energy resources. Biological systems can deliver sustainable solutions, and will form part of this transition. However, biology has not evolved to deliver energy on the scale required to suit our energy demands. This presentation will discuss bio-based solutions to energy needs, including approaches to re-program biological systems to improve their ability to deliver energy at the scales required to have impact.

Scientia Professor Deo Prasad AO FTSE
CRC for Low Carbon Living



Professor Deo Prasad is an international authority and national leader in the field of sustainable buildings and cities. He is the Chief Investigator and CEO of the Cooperative Research Centre for Low Carbon Living. This is the largest ever industry—government—professions—research collaboration spin-off in Australia's built environment sector and is leading to transformative impacts—enabling Australian industry and

professions to compete globally in a low-carbon future. Professor Prasad has published close to 300 refereed publications. His contributions have been widely acknowledged at all levels of government and professions in Australia. Elected as a Fellow of the Royal Australian Institute of Architects in 1991, he has been a highly influential driving force for sustainable design in academia and professional practice, and in 2006 he received the Royal Australian Institute of Architect's National Education Award for contribution to sustainability education, research and design. In 2004 he received the NSW Government's individual GreenGlobe Award for leadership and commitment to the supply of renewable energy.

Towards zero carbon buildings
 Buildings and the built environment generally are among the largest contributors to carbon emissions and, arguably, have the best

The future of the planet is in our hands

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CREATE CHANGE



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opportunities for reductions. Evidence suggests that zero carbon buildings are feasible within cities and, of course, in regions with little extra investment. It's the appetite for driving change which has been lacking, together with knowledge, at point of need. The CRC for Low Carbon Living has taken a holistic approach to reducing carbon in buildings and cities at building, precinct and community scales. This presentation will highlight research outcomes and evidence for design, planning and policies which can fast-track change.

Associate Professor Jenny Pringle
Deakin University



Associate Professor Jenny Pringle is a Senior Research Fellow in the Institute for Frontier Materials at Deakin University and a chief investigator in the ARC Centre of Excellence for Electromaterials Science. She received her degree and PhD at the University of Edinburgh in Scotland before moving to Monash University in 2002. From 2008–12 she held an ARC QEII

Fellowship, investigating the use of ionic electrolytes for dye-sensitised solar cells. Associate Professor Pringle moved to Deakin University, Melbourne in 2013. There she leads research into the development and use of ionic electrolytes for applications including thermal energy harvesting, CO₂ separation and solid-state lithium batteries.

Supporting sustainability through electrochemical energy storage

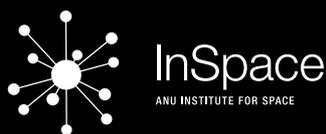
Technologies that can store large amounts of energy efficiently and cheaply are an important aspect of sustainable power in Australia. Sustainable sources of energy such as wind and solar are variable and intermittent, making storage important for ensuring its delivery in a reliable and controlled manner. Storage as electrochemical energy, that is, in batteries, has the potential to allow the supply of electricity rapidly, on demand, and on scales that can range from small domestic units to industrial-scale stationary storage. Each application brings specific requirements, and a plethora of battery technologies is emerging to meet these needs. These are primarily differentiated by the nature of the cathode, the anode and the electrolyte. Commercially available batteries include lithium ion, lead acid and vanadium redox flow batteries, while alternatives such as sodium ion or lithium-sulfur are being heavily researched. Ultimately, factors such as capacity, weight, size, cost, safety, temperature range and recyclability must be considered for

each application. Further, improving these parameters is crucial to enabling the widespread use of batteries to support sustainable power. This requires significant research into new materials and novel battery chemistries. This presentation will give an overview of the current technologies and the ongoing research in this important field.

Associate Professor Gregor Verbic
University of Sydney



Associate Professor Gregor Verbic received BSc, MSc and PhD degrees in electrical engineering from the University of Ljubljana, Slovenia, in 1995, 2000 and 2003 respectively. In 2005, he was a NATO-NSERC Postdoctoral Fellow with the University of Waterloo, Canada. Since 2010, he has been with the School of Electrical and Information Engineering at the University of Sydney. His expertise is in power system operation, stability and control, and electricity markets. His current research interests include grid and market integration of



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renewable energies and distributed energy resources, future grid modelling and scenario analysis, wide-area coordination of distributed energy resources, and demand response. He was a recipient of the IEEE Power and Energy Society Prize Paper Award in 2006. He is an Associate Editor of the IEEE Transactions on Smart Grid.

Prosumer-based decentralised power supply

Following the 2016 South Australian blackout, energy security and affordability have taken centre stage in national political discussions. Regardless of the blame game that ensued, energy industry transformation, driven initially by emission reduction targets but now predominantly by declining technology costs, is inevitable. The industry now widely accepts that renewable generation is the cheapest long-term supply option. At the other side of the energy supply chain, residential and small

commercial users increasingly opt for rooftop solar and battery storage to reduce their energy expenditure. Indeed, the representative body Energy Networks Australia and CSIRO predict that by 2050, more than 10 million customers, called prosumers, will own distributed energy resources such as rooftop solar, storage and home energy management systems. In addition to that, the technical advancements in sensor, computer and communication technologies now make it possible to harness the inherent flexibility of these 'behind-the-meter' energy resources in innovative ways. Using prosumers as a flexible resource is creating unique opportunities to address the challenges associated with the increasing uptake of variable renewable energy sources, like wind and solar. This presentation will discuss how the prosumer-driven decentralised power supply will make the power system more

reliable, affordable and sustainable, thus solving the energy trilemma.

Ms Claire Johnson Hydrogen Mobility Australia



Ms Claire Johnson is the CEO of Hydrogen Mobility Australia, the industry association representing Australia's emerging hydrogen sector. Ms Johnson has a background in policy development and government relations across the private and public sectors, including her previous position as manager of government affairs at Toyota Australia where she led the



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government advocacy program for the introduction of hydrogen fuel cell electric vehicles to Australia. Prior to this she worked for federal and state governments in areas including environmental, industry and trade policy.

Ms Johnson holds a Bachelor of Economics and a Master of Marketing from the University of Tasmania.

The advent of the hydrogen mobility age: Australia's journey to introduce hydrogen-powered vehicles and infrastructure

Accelerating the introduction of hydrogen fuel cell electric vehicles to Australia was one of the main drivers for the establishment of Hydrogen Mobility Australia (HMA). Ms Johnson will discuss the current status of the deployment of hydrogen mobility in Australia, and strategies and initiatives to overcome barriers to entry, the most significant being hydrogen refuelling infrastructure. HMA's mission is to support the development of a nationwide hydrogen station network and they are working with all levels of government and industry to realise this objective. This presentation will touch on HMA's requests to governments and their approach to working with all

stakeholders to support their vision of a hydrogen society for Australia.

Dr Mark Ho ANSTO



Dr Mark Ho is a reactor thermo-hydraulic specialist at the Australian Nuclear Science and Technology Organisation (ANSTO) with a PhD (UNSW) in computational fluid dynamics. His main interests lie in nuclear reactor design, energy systems, numerical and experimental fluid mechanics and the study of multiphase flow. He is the current president of the Australian Nuclear Association.

Advanced nuclear reactors

Nuclear can solve the energy trilemma of supplying baseload, clean (CO₂-free) and affordable power. Currently there are 450 nuclear power plants supplying 11% of the world's electricity. The initial build-out of nuclear

reactors started in the 1970s and was concentrated in the USA and Europe. Currently, nuclear power builds are concentrated in Asia, led by China which is using nuclear power to tackle CO₂ emissions and climate change. China is aiming for 500 gigawatts of nuclear power by 2050, alongside equally large amounts of hydro and renewable energy sources.

Currently most of the world's nuclear power plants are pressurised water reactors, built for their compactness and economy. In the near future, advanced nuclear reactors will come online. This includes passively-safe small modular reactors (SMRs) which can load-follow and work harmoniously with intermittent renewable sources. In the longer term, advanced nuclear reactors in the form of sodium-cooled, molten-salt-cooled and high-temperature gas-cooled reactors hold the promise of providing efficient electricity production and hydrogen production.

Australia recently joined the International Generation IV Forum which is dedicated to the development of advanced reactors. ANSTO contributes to this effort via the research and development of advanced reactor materials.



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Professor Karen Hussey University Of Queensland



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Professor Karen Hussey is Director of the Centre for Policy Futures located in the Faculty of Humanities and Social Sciences at the University of Queensland (UQ), a position she took up in July 2017. Trained as a political scientist and economist, Professor Hussey undertakes research in the field of public policy and governance, with a particular interest in public policy relating to sustainable development. Professor Hussey was previously Deputy

Director of the Global Change Institute at UQ, and prior to that she was Associate Professor in the Fenner School of Environment and Society at ANU, where she now holds an Adjunct Professorship. From 2007 to 2010 Professor Hussey was based in Brussels as the ANU Vice Chancellor's Representative in Europe.

Her recent research has focused on water and energy security, the role of the state in climate change mitigation and adaptation, the links between international trade and environmental regulation, and the peculiarities of public policy in federal and supranational systems.

Professor Hussey is a chief investigator on projects for Bushfire and Natural Hazards CRC and ARC Linkage as well as lead investigator for an ERIN project. She supervises nine PhD students. Professor Hussey is also a member of the Future

Earth Australia Scientific Steering Committee, and on several editorial boards of journals in her field.

Climate change: the issue that shaped a nation

The extent to which Australia can prosper and flourish in the 21st century depends on our capacity to capitalise on our innovation and proximity to key markets, to act deftly in dealing with complex geopolitical environments, and to put sustainability and social-equity at the centre of all our economic activity. The way in which we tackle climate change is a 'litmus test' for how we might (or might not) flourish as a country in the coming decades. Using climate change as an example, this presentation will explore the role and responsibility of scientists, social scientists and humanities scholars in supporting our political, policy, industry and community leaders to chart a future for Australia that is fit for the 21st century.

Building a sustainable energy future

Ensuring a stable supply of sustainable energy is one of the greatest challenges facing Australia and the world. CSIRO is helping to build a reliable, affordable and low-emissions energy future through innovative science and technology. Our latest report on hydrogen explores significant opportunities for Australia, and how we could export our vast renewable energy resources.

The National Hydrogen Roadmap provides a blueprint for the development of a hydrogen industry in Australia.

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New Fellows

Professor Alexander Zelinsky AO FAA FTSE University of Newcastle

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Prior to joining the University of Newcastle, Professor Alexander Zelinsky was Chief Defence Scientist, leading Defence Science and Technology. Before that, Professor Zelinsky was Group Executive for Information Sciences at CSIRO and was CEO and co-founder of Seeing Machines, a technology company focused on computer vision. Seeing Machines was a start-up from ANU where he was a Professor of Systems Engineering. Professor Zelinsky's career spans innovation, science and technology, research and commercial start-ups and education. Professor Zelinsky has a Bachelor of Mathematical Sciences (Honours), Doctor of Philosophy and Honorary Doctor of Science from the University of Wollongong, and is a graduate of the Australian Institute of Company Directors and has completed the

Advanced Management Program from Harvard University. Professor Zelinsky has received numerous national and international awards, including being awarded the Officer of the Order of Australia (AO) in 2017.

Science and technology for national and global impact

Over the last 20 years there has been a change in Australian government policy to funding research, with a shift from basic to applied research, and an emphasis on generating impact through the translation of research results into real-world impact. Professor Zelinsky has made a personal choice to move with the change in policy. This has led him to follow the torturous journey of transforming early-stage research into mature technology that could be packaged into consumer products. The work that he was involved in at ANU in the mid-90s is now incorporated into motor vehicles for improved driver safety. This was done through the spin-off company Seeing Machines, which today is the world leader in its field. At CSIRO, Professor Zelinsky led efforts to apply digital technology into the domains of agriculture, mining, health, energy and the environment. Today, Professor Zelinsky is working at the University of Newcastle, which, like all universities, has an emphasis on excellence in research and

education. It also wants to deliver excellence with equity, meaning that people with disadvantaged backgrounds can also excel. Today 50% of the university's students are first in family to attend university, with both the highest proportion (3.9%) and largest student numbers (over 1065 EFSL) for Indigenous students in the nation. This equity approach is being delivered without compromising excellence. Significant progress is being made, but there is more that needs to be done. Professor Zelinsky is working to make sure that the future adjustments that are needed do happen.

Professor Warren Alexander FAA

Walter and Eliza Hall Institute of Medical Research



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Professor Warren Alexander received his PhD in medical biology from the University of Melbourne and his postdoctoral studies were



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Australian Academy of Science

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Karen Holt Fellowship Director
T (02) 6201 9406 E karen.holt@science.org.au

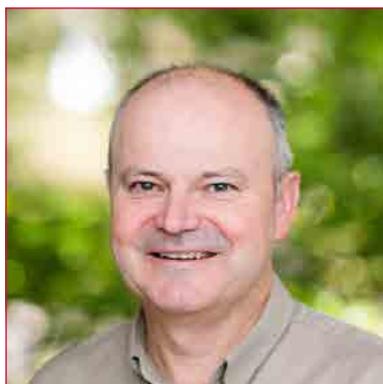
completed at the Research Institute for Molecular Pathology in Vienna, Austria and the Ludwig Institute for Cancer Research in Melbourne. Since 1994, he has been a member of Faculty at the Walter and Eliza Hall Institute of Medical Research and is currently Theme Leader, Cancer Research and Treatments and a Laboratory Head in the Blood Cells and Blood Cancer Division. A Fellow of the Australian Academy of Health and Medical Sciences, Professor Alexander's research focuses on the molecular regulation of blood cell production and function.

Molecular regulation of blood cells

Every day the body produces hundreds of billions of new blood cells: the red cells, white cells and platelets present in the circulation and tissues that are required to distribute oxygen, help fight infections and maintain haemostasis. To balance this remarkable cellular production, the body has evolved sophisticated regulatory systems to maintain numbers of blood cells within a relatively narrow normal range, avoiding potentially dangerous deficiencies or excess. Blood cell hormones, or cytokines, are an integral component of this regulatory system, interacting with specific receptors on the surface of blood cells to stimulate proliferation, maturation and/or functional activity. Thrombopoietin, the major cytokine regulator of platelet homeostasis will be discussed, including its role in controlling platelet numbers and in communicating with blood stem cells to regulate production. Blood cells also contain regulatory proteins that act to attenuate responses to cytokines, allowing healthy production and function while avoiding potentially pathological excess. Roles of members of the suppressors of cytokine signalling (SOCS) family of regulators will also be presented.

Professor David Balding FAA

University of Melbourne



Professor David Balding received a BMath from the University of Newcastle, Australia and a PhD in applied probability from the University of Oxford, UK. He then held academic posts in and around London, initially in mathematics but transitioning through applied statistics and epidemiology/public health to genetics. His research develops mathematical innovations in genetics. He has given expert evidence in many cases, including to the UK Forensic Science Service, mostly about interpretation of DNA profile evidence which is the topic of his 2015 monograph. His applied research has also encompassed genetics of purebred dogs and crop production, evolutionary and demographic inferences in humans and other species, as well as several human diseases. After 30 years in the UK, in 2014 he returned to Australia where he is Professor of Statistical Genetics at the University of Melbourne. He is also Director of the newly-established Melbourne Integrative Genomics (MIG). He is lead editor of the Handbook of Statistical Genomics, of which the fourth edition will appear in mid-2019.

Progress and controversy in mathematical genetics

Professor Balding argues that often both scientists and courtroom lawyers are poor at quantitative evaluation of evidence, even though this should be central to both professions. This can be illustrated

by examples from the evaluation of DNA profile evidence in prominent cases, and also the identification of some bones found under a carpark. Both these topics have attracted controversy, as has the question of what can be inferred about an individual's ancestry from their DNA sequence. Professor Balding will recount his experiences of genetic testing companies, media organisations and universities behaving badly in the quest for a good story, publicity or a profit, as well as some successes for those trying to promote the science and reasoned discussion.

Professor Christopher Barner-Kowollik FAA

**Queensland University
of Technology**



Professor Christopher Barner-Kowollik is currently Professor of Materials Science and Head of the Soft Matter Materials Laboratory at the Queensland University of Technology (QUT). He received a PhD in physical chemistry in 1999 (Göttingen University). After postdoctoral research (1999–2002) and academic positions at the Centre for Advanced Macromolecular Design at the University of New South Wales in Sydney, he was appointed Professor of Polymer Chemistry in 2006 at the same institution. From 2008 to 2017 he held the chair for Macromolecular Chemistry at the Karlsruhe Institute of Technology (KIT), where he continues to head a research team. Professor Barner-Kowollik has published over 610 peer-reviewed

studies that have been cited over 22,000 times.

Making light work of material design

Light is a powerful tool to control chemical reactivity. It is spatially resolved and can be finely temporally controlled. Its energy can be selected by the employed wavelength and its intensity by the number of photons. Professor Barner-Kowollik will highlight how light can be used in macromolecular chemistry to design advanced soft matter materials. He will demonstrate how macromolecular synthetic processes can be directed in their selectivity by different colours of light and, critically, how different colours of light can be used to control chemical reactivity and even completely hold thermal reaction channels. Such colour-guided reaction manifolds can be exploited as orthogonal triggers in nanoreactor design, the synthesis of sequence-defined macromolecules and diffraction unlimited laser lithography, chasing the dream of printing single polymer chains.

Professor Debra Bernhardt FAA

University of Queensland



Professor Debra Bernhardt is a Senior Group Leader and Professor in the Australian Institute for Bioengineering and Nanotechnology (AIBN) and School of Chemistry and Molecular Biosciences at the University of Queensland. She is also an Adjunct Professor at Griffith University. Her research

program focuses on theoretical and computational approaches to develop a fundamental understanding of the behaviour of matter and devices. She applies these approaches to a wide range of problems, particularly transport in nanoscale systems, fluctuation phenomena, design of materials, gas separation, and energy storage and conversion. Professor Bernhardt was awarded her PhD in 1991 from the University of Newcastle. Subsequently she held research/academic appointments at the University of Basel, the Australian National University and Griffith University. She is a Fellow of the Royal Australian Chemical Institute and an elected member of the European Academy of Sciences and Arts. Most of Professor Bernhardt's work is published with her maiden name (Searles).

Why processes have a direction: a microscopic understanding of thermodynamic laws

When we observe processes at a macroscopic level, we see a preferred direction: we can soon tell if a movie is run backwards. However, at the molecular level things are different. The fluctuations in the system can be as large as the changes that are occurring. By trying to understand the irreversibility of macroscopic systems, which is encompassed in the second law of thermodynamics, we derived the fluctuation theorem. This can be considered as a generalisation of the second law of thermodynamics that extends its application to also include small systems, observed for short times. It explains how one goes from a scale where the direction of a process might not be obvious, to the macroscopic behaviour that we see around us and where a direction is clear.

This result led to rigorous derivations of well-known and widely accepted laws of physics, and clarified the conditions under

which they apply. In addition, the approach we used has enabled new results for nonequilibrium and nanoscale systems to be obtained. This presentation will discuss the source of irreversibility and discuss implications of the work.

Scientia Professor Richard Bryant AC FAA

UNSW Sydney

(Elected 2018)



Professor Richard Bryant is a Scientia Professor of Psychology at UNSW Sydney. Professor Bryant has researched the nature, course, and treatment of posttraumatic stress disorder (PTSD) for over 20 years. His work has identified key genetic, neural and psychological factors underpinning PTSD. Through many longitudinal studies he has developed the world's leading screening tools for early identification of PTSD as well as development of the most commonly used early treatment protocols. These have been translated into over 15 languages and used in many countries. Professor Bryant has written five books, 70 book chapters, and over 560 journal articles. He has served on major international committees to define PTSD internationally. In 2016 he received the Companion of the Order of Australia for services to research and management of traumatic stress. He consults to many international agencies on management of psychological responses to trauma and adversity, including the World Health Organization.

The psychology of traumatic experiences

Most people experience a life-threatening event during their lives, and one in 10 will develop posttraumatic stress disorder (PTSD) as a result. This disorder affects as many people in Australia as depression. Professor Bryant's team has focused on understanding why only some people develop this condition, the course of the disorder, the factors that maintain it and the optimal means to treat it. Professor Bryant will outline his team's longitudinal studies of the course of trajectory of PTSD after trauma, the physiological and cognitive factors that predispose people to risk, social processes that promote spread of the disorder, and genetic and neural factors that predict treatment response. Understanding of these basic processes underpinning PTSD are critical to translating the findings to large-scale implementation; examples will be given of evaluating translations of this work to thousands of trauma-affected people in low- and middle-income countries.

Professor Maria Byrne FAA

University of Sydney



Professor Maria Byrne is Professor of Marine and Developmental Biology at the University of Sydney. She obtained her bachelor's degree from the National University of Ireland and her doctorate from the University of Victoria, Canada. Her research focuses on the biology, ecology, development and evolution of marine invertebrates. For 12 years she was Director of One Tree Island

Research Station. Professor Byrne served as President of the Australian Marine Sciences Association and on the boards of the National Oceans Advisory Group. Professor Byrne's research involves quantification of the impacts of climate change on fundamental processes including growth, physiology, development and calcification. This work investigates the responses of marine invertebrates across life stages and across latitudes and habitats. Her research on the evolution of development has revealed novel forms of reproduction leading to the discovery of new species and potential for resilience in the face of changing climate.

Impact of environmental acidification and habitat warming on marine invertebrates: vulnerabilities and potential for persistence in a changing ocean

Due to anthropogenic carbon dioxide (CO₂) emissions, marine ecosystems are being altered at an unprecedented rate. Global warming and ocean uptake of CO₂ are causing marine habitats to warm, decrease in seawater pH and saturation state of the calcium carbonate (CaCO₃) minerals needed for calcification and become hypercapnic. Sea level rise and increased precipitation are exacerbating coastal acidification. Climate change is also increasing the poleward flow of the East Australia Current. These covarying changes are presenting a complex mix of stressors to marine invertebrates and challenge our ability to predict outcomes for marine biota. Species that calcify in both planktonic and benthic life stages are particularly vulnerable with several trends evident, including local population declines, altered distributions, changes in phenology and decreasing body size. Some species and regional faunas will be more resilient than others. The capacity to acclimatise through plastic responses in the short term and the presence of a subset of

tolerant progeny in many species and selected family lines indicates variance that evolutionary selection will operate on to mediate species tolerance to changing climate. Differences in tolerance to climate change stressors has implications for species persistence, faunal shifts, species invasions and community function in a changing ocean.

Professor Mark Cassidy FAA FTSE

University of Melbourne



Prior to his appointment to the University of Melbourne in 2018, Professor Mark Cassidy was an Australian Research Council Laureate Fellow and Director of the internationally renowned Centre for Offshore Foundation Systems at the University of Western Australia. Professor Cassidy's research interests are in offshore geotechnics and engineering, predominantly in developing models for the analysis of oil and gas platforms, mobile drilling rigs, renewable wave and wind turbines, anchors and pipelines. He has published over 300 refereed journal and conference papers and jointly holds three international patents with Singaporean mobile jack-up builders Keppel Offshore and Marine and with Korean shipbuilders DSME. He has supervised over 20 PhD students.

Professor Cassidy was the 2015 Western Australian Scientist of the Year and the 2007 recipient of the Malcolm McIntosh Prize for Physical Scientist of the Year. He is a three-time recipient of the Institution of Civil Engineers (ICE) David

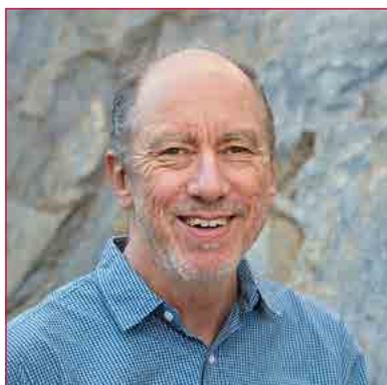
Hislop Award as well as the 2012 recipient of the ICE's Geotechnical Research Medal.

Frontiers of offshore geotechnics

Building in the oceans offshore Australia is challenging because of deep waters, large cyclonic storms and weak seabeds characterised by carbonate soils of which the mechanical behaviour differs significantly from 'conventional' onshore geotechnics. Professor Cassidy will describe how the synthesis of results from sophisticated physical and numerical experiments can help overcome these challenges and provide practical analytical models and calculation methods for engineers to use in their daily designs. Scientific contributions in developing novel solutions to predict the capacity of offshore foundations, as well as the stability of mobile platforms, pipelines and deep-water anchors, will be described. Professor Cassidy will also discuss why building Australia's research infrastructure, such as the new 10m-diameter geotechnical centrifuge within the collaborative National Geotechnical Centrifuge Facility, is essential for unlocking Australia's significant offshore gas reserves and in developing our nascent offshore renewable energy industry.

Professor Peter Cawood FAA

**Monash University
(Elected 2018)**



Professor Peter Cawood's research is focused on the origin of Earth's continental lithosphere (crust and

upper mantle) and the processes of its generation, stabilisation and reworking. He integrates direct field observations with leading laboratory techniques, and has worked in regions from Archean (>2500 million years) cratons to modern and active margins, and at scales ranging from global to microscopic. His work aims to resolve the processes involved in lithosphere formation and the feedbacks with the rest of the Earth system. He obtained undergraduate and PhD degrees from the University of Sydney and has held academic positions in Australia, New Zealand, Canada and the UK. He is currently ARC Laureate Fellow at Monash University.

Pulse of the Earth

Earth is a dynamic, evolving system in which the surficial and solid components of the planet interact through a series of cycles and at a variety of scales. The grand challenge for the Earth sciences is to unravel the feedbacks between the deep and surficial Earth, the record of which is preserved in the continental crust. The continental record indicates that the distribution of rock units and events is heterogeneous with distinctive peaks and troughs. Major step-changes in Earth evolution include: 1) protracted establishment of plate tectonics (3.2 Ga to 2.5 Ga) involving development of rigid lithosphere and the initial emergence of continents with resultant impacts on ocean and atmospheric chemistry; 2) Earth's middle age from 1.8-0.8 Ga, characterised by lithospheric, environmental and evolutionary stability; and 3) initiation of modern cold subduction at ~0.8 Ga, associated with a second rise in atmospheric oxygen, extensive global glaciations, and the radiation of animal life. Continental crustal volumes increased rapidly on the early Earth, then more slowly until the start of middle age, during which crustal volumes were relatively constant, and then for the last 1 Ga they may have been decreasing.

Professor Joanne Etheridge FAA

Monash University



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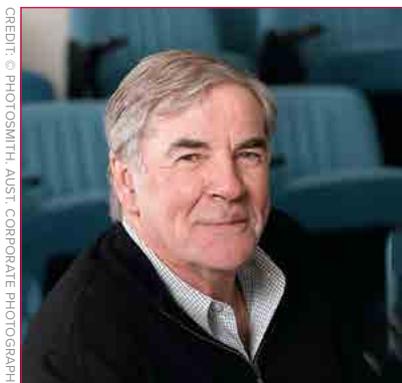
Professor Joanne Etheridge is the founding Director of the Monash Centre for Electron Microscopy and Professor in the Department of Materials Science and Engineering at Monash University. She obtained her degree and PhD in physics at the University of Melbourne and RMIT University respectively. She then held appointments at the University of Cambridge and Newnham College, including a Rosalind Franklin Research Fellowship and a Royal Society University Research Fellowship. She returned to Melbourne to join Monash University where she established the Monash Centre for Electron Microscopy. She conducts research in the theoretical and experimental development of new electron scattering methods for determining the structure of materials down to the atomic scale and applies these methods to the study of structure—property relationships in functional materials. She is the incoming Chair of the Australian Academy of Science National Committee for Materials Science and Engineering and previously was a member of the National Committee for Crystallography and the IUCr Commission for Electron Crystallography.

Finding the atoms that matter

Everything in this world is made of atoms. The type and arrangement of atoms in a material determines its properties, from colour to strength to conductivity. In some materials, it

can be a tiny subset of atoms that control a property of the whole. This can be the case, for example, for the colour of a gemstone, the speed of a computer chip or the strength of an aircraft wing. Finding these atoms can be challenging! Professor Etheridge will describe how, with the right mathematical and experimental methods, tiny electron beams available in electron microscopes can be used to find and measure these important atoms, so the properties of a material may be understood or engineered.

Professor John Hamilton
FAA
University of Melbourne



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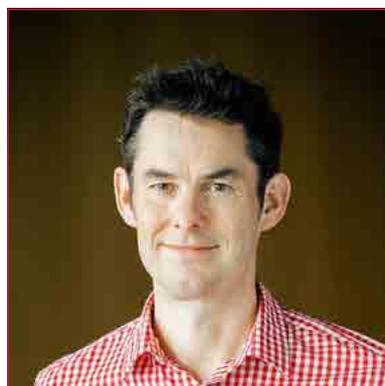
Professor John Hamilton transitioned from a PhD in chemistry to postdoctoral training in biochemistry, microbiology and immunology, followed by 10 years in Basel, Toronto and New York at leading academic research institutions. He returned to Melbourne as an NHMRC Research Fellow at the University of Melbourne in 1981, later becoming NHMRC Senior Principal Research Fellow. He received the DSc degree by the University of Melbourne in 1989. He has held appointments as the inaugural Director, Arthritis and Inflammation Research Centre, as the founding CEO of the Cooperative Research Centre for Chronic Inflammatory Diseases and served as President of the International Association of Inflammation Societies. His major research contributions have been towards the understanding of cytokine-mediated functions of macrophage lineage cells in

inflammation/autoimmunity. In 2010, Professor Hamilton was awarded the Australian Rheumatology Association Distinguished Service Medal and the American College of Rheumatology Distinguished Basic Investigator Award. He has authored 352 refereed publications and has a h-index of 74.

Addressing inflammation and pain: a journey from concept to clinic

Inflammation is a key component of many pathologies including arthritis and its associated chronic pain. Professor Hamilton will describe the long journey commencing with a novel hypothesis about a proinflammatory role for the protein, granulocyte macrophage-colony stimulating factor (GM-CSF), and leading ultimately to successful clinical trials targeting GM-CSF activity in inflammatory/autoimmune diseases. A new pathway likely to be critical for GM-CSF function will also be described.

Professor Paul Hodges
FAA
University of Queensland



Professor Paul Hodges is an NHMRC Senior Principal Research Fellow, Professor and Director of the NHMRC Centre for Research Excellence in Spinal Pain, Injury and Health at the University of Queensland. Professor Hodges has three doctorates: one in physiotherapy (PhD, UQ) and two in neuroscience (MedDr, Karolinska Institutet, Sweden; DSc, UQ). His multidisciplinary research centre bridges from basic science to clinical research and knowledge translation.

His work aims to understand movement from cells to the brain and how this changes in conditions ranging from pain to incontinence, to apply this to improved treatments and implement knowledge for better health outcomes. A major emphasis is low back pain, the world's leading cause of disability. He has more than 400 scientific papers and is the most highly cited physiotherapy researcher internationally. He has won the premier international back pain research prize four times and is an Honoured Member of the Australian Physiotherapy Association, its highest honour.

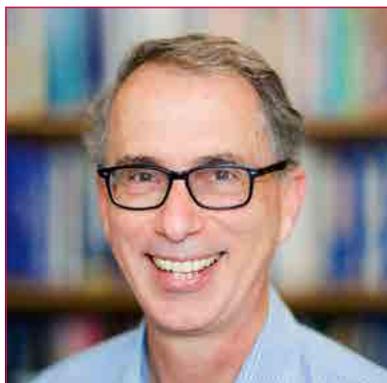
Understanding movement from cells to systems: the path from new discoveries to improved health outcomes

Movement is the primary way the nervous system interacts with the environment. Its control is governed by a complex interaction between the biomechanics of the body and an array of neural mechanisms, involving many levels of the nervous system. Optimal health is maintained by a delicate balance of demands, and disruption of this balance underlies many health complaints. Understanding of these problems requires knowledge from cells to systems. Taking this multiscale approach from molecular biology to studies that push boundaries of human experimentation has led to discoveries that disentangle clinical observations. Advances in understanding pain is one example. Chronic pain is a major international crisis. Although movement changes in pain are obvious, the mechanisms and implications for recovery have been surprisingly unclear. Investigation from cells in the tissues to brain function has uncovered novel mechanisms for movement changes that involve diverse effects from the inflammatory system to modified motor cortex organisation. These mechanisms have enabled explanation of apparently contradictory observations, have established

links between psychology and biology, and provided the basis for clinical strategies to improve health outcomes. Other examples include new understanding of control of continence and breathing. Advances have only been possible by using this broad approach.

Professor David Karoly FAA

CSIRO Oceans and Atmosphere



Professor David Karoly is Leader of the Earth Systems and Climate Change Hub in the Australian Government's National Environmental Science Program, based in CSIRO. He is also an honorary Professor at the University of Melbourne. He is an internationally recognised expert on climate change and climate variability.

The 'Furious Summer' of 2018–19: what role, if any, did climate change play?

There have been significant advances in understanding the role of human-caused climate change in extreme weather and climate events over the last decade, from very few studies to annual 'Explaining Extreme Events from a Climate Perspective' supplements in the Bulletin of the American Meteorological Society.

The so-called 'Angry Summer' of 2012–13, with record high summer average temperatures across Australia and numerous heatwaves, was the focus of the first attribution studies in Australia linking climate

change to an observed extreme event with high confidence.

The most recent summer of 2018–19 set many new records for extreme high temperatures across Australia and at single locations. The summer average maximum temperature across Australia broke the previous record, set in the Angry Summer, by more than one degree. So, what role did climate change play in these new records? Should the Australian summer of 2018–19 be called the 'Furious Summer'?

Professor Maria Makrides FAA

South Australian Health and
Medical Research Institute



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Professor Maria Makrides is the Theme Leader for SAHMRI Women and Kids, which is based at the Women's and Children's Hospital and Deputy Director at the South Australian Health and Medical Research Institute (SAHMRI), Adelaide. As a research dietitian, Professor Makrides is committed to improving the nutrition and health of mothers and their babies through the conduct and translation of high-quality research. She has over 235 peer reviewed publications including in the prestigious journals the Lancet, the New England Journal of Medicine, the Journal of the American Medical Association and the British Medical Journal. Professor Makrides' work has been responsible for changes in international policy regarding the

safe composition of infant foods, national and international guidance on diet and supplementation during pregnancy, and infant feeding guidelines to minimise the risk of childhood allergies. In 2018 she was awarded the Alexander Leaf Distinguished Scientist Award for Lifetime Achievement by the International Society for the Study of Fatty Acids and Lipids (ISSFAL).

Omega-3 fatty acids and the prevention of preterm birth

How often have you heard that eating fish is good for you? Claims are made that eating fish lowers your risk of heart attacks and stroke, helps cognitive development in infants and increases grey matter in the brain to prevent age-related cognitive deterioration and depression. Few of these claims have stood the test of critical randomised controlled trials. However, we now know that the active ingredient in fish are the omega-3 long chain polyunsaturated fatty acids (LCPUFA) and one claim that has stood the test of time is the reported increase in the length of pregnancy. Finding ways to safely increase the duration of gestation and avoid preterm (or premature) birth has been a major challenge of perinatal medicine as preterm birth is a major cause of morbidity and mortality for young children. Professor Makrides' studies, as well as others, have shown that omega-3 LCPUFA supplementation in pregnancy will increase the duration of gestation by an average of about two days. This two-day increase is associated with approximately a 30% reduction in the relative risk of birth before 34 weeks (early preterm birth) and a 10% reduction in preterm birth before 37 weeks. Potentially this provides the opportunity to optimise the benefits of omega-3 LCPUFA supplementation by reducing preterm and early preterm birth, while avoiding possible adverse outcomes of supplementation.

Professor Kerry Landman FAA

University of Melbourne



Professor Kerry Landman obtained her PhD in mathematics from the University of Melbourne and then spent six years working in the USA, at the Massachusetts Institute of Technology, the Environmental Protection Agency and Southern Methodist University. She returned to Melbourne to join Siromath, a mathematical sciences consulting firm, before joining the University of Melbourne. She directed the Mathematics-in-Industry Study Group from 1993–97. Professor Landman was appointed to Professor in the School of Mathematics and Statistics at the University of Melbourne in 2007, becoming the first female mathematics professor in the university's history. Her research has been devoted to cross-disciplinary research and real-world problems. She has made crucial contributions to a range of fields, from colloidal fluid mechanics to developmental biology. In recognition of her career contribution to industrial and applied mathematics, she was awarded the

2014 ANZIAM medal, the premier medal of the Australia and New Zealand Industrial and Applied Mathematics Society.

What has maths got to do with it?

As an applied mathematician working on real-world problems in industrial, environmental and biological areas, Professor Landman is regularly asked this question. She will describe how mathematical models provide essential insights using examples from her collaborations.

Professor Krzysztof Matyjaszewski FAA Carnegie Mellon University (Corresponding Member)



CREDIT: © CARNEGIE MELLON UNIVERSITY / TIM KAULLEN

Professor Krzysztof Matyjaszewski received his PhD from the Polish Academy of Sciences in 1976. Since 1985 he has held the title of J.C. Warner University Professor of Natural Sciences at Carnegie Mellon University. In 1994 he discovered Cu-mediated atom transfer radical polymerisation, which was commercialised in 2004 in the US, Japan and Europe to prepare

various advanced materials. His research is focused on synthesis of well-defined macromolecules and hybrid materials via living and controlled polymerisations using radical and ionic mechanisms to prepare advanced materials for optoelectronic, biomedical, environmental and energy-related applications. He has co-authored over 1000 publications, co-edited more than 20 books, and holds 62 US patents. Professor Matyjaszewski is also the editor of Progress in Polymer Science. He is a member of the National Academy of Engineering and the National Academy of Inventors. He received the 2017 Franklin Medal in Chemistry, 2015 Dreyfus Prize in Chemical Sciences, 2011 Wolf Prize in Chemistry, 2009 Presidential Green Chemistry Challenge Award and eleven honorary degrees.

Macromolecular engineering by taming free radicals

Macromolecular engineering (ME) is a process comprising rational design of (co)polymers with specific architecture and functionality, followed by precise and efficient polymer synthesis and processing to prepare advanced materials with target properties. Preparative ME requires controlled/living polymerisation. Radical polymerisation is very well suited for ME due to tolerance to many functionalities. Unfortunately, free radicals are difficult to control and have very short lifetimes.

NEW FELLOWS CONTINUED ON PAGE 26

AT MONASH, WE'RE COMMITTED TO A SUSTAINABLE FUTURE. BY 2030, ALL OUR CAMPUSES WILL USE RENEWABLE RESOURCES.

But we're not content just solving problems in our own backyard.

At the Monash Energy Materials and Systems Institute, our researchers are unlocking the potential of an abundant material class, perovskites, to develop next-generation solar technologies

that are printable, lighter, less energy-intensive to produce.

The aim is to incorporate the technology into other forms of the built environment, resulting in – literally – windows of opportunity.

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Professor Alexander Molev FAA

University of Sydney



Professor Alexander Molev was born near Nizhny Novgorod (former Gorky) in Russia in a family of school teachers. He moved to Gorky in 1975 to study in a mathematical boarding school for two years and then entered the Moscow State University in 1977. After completing his degree in mathematics in 1982 he began PhD studies under the supervision of Professor Alexandre Kirillov and earned his PhD in 1986. From 1985 to 1993 Professor Molev worked as a lecturer at the Moscow Institute of Electronics and Mathematics. He moved to Canberra in 1993 to take up a Research Fellow position at the Centre of Mathematics and its Applications at the Australian National University. Since 1998 he has worked as a lecturer at the University of Sydney.

Puzzles, algebras and lattice models

The theory of quantum groups is an area of pure mathematics that originated in solvable lattice models in statistical mechanics in the mid-1980s. It has numerous connections with a wide range of branches in mathematics and physics, including combinatorics and representation theory. Professor Molev will illustrate these connections by using some remarkable families of combinatorial objects known as 'puzzles', which underline the structure of the algebra of symmetric functions.

Dr Surinder Singh FAA

CSIRO Agriculture and Food



Dr Surinder Singh was born in Pune, India. He obtained his BSc in biological sciences, from Guru Nanak University, India in 1976; his MSc in plant physiology and biochemistry from the GB Pant University Pantnagar, India in 1980 and his PhD in plant physiology and biochemistry from the University of Adelaide in 1985. He joined CSIRO Agriculture and Food as a research scientist in 1991, and currently has an appointment as Chief Research Scientist. Dr Singh is a leading translational researcher in the field of plant lipid biotechnology and holder of more than 50 patents. Cited by Nature Biotechnology as one of the world's top ten translational researchers for 2014, Dr Singh is the only plant biologist on that list. For the last two decades, Dr Singh has been at the forefront in developing new genetically engineered oilseed crops. Two new crops, Omega-3 Canola and Super-high Oleic Safflower, are ready to enter global commercial production through licensees in 2019.

Innovation in oilseed crops

Metabolic engineering provides a rapid and direct method for manipulating fatty acid composition in oilseeds and other oil-bearing plant tissues. Over the last two decades, advances in understanding of the biochemical, cellular, and molecular mechanisms of plant oil biosynthesis, coupled with the cloning of many of the genes involved in this process, have facilitated the production of designer

plant oils with improved nutritional benefits and enhanced functional properties. These advances present exciting opportunities by harnessing metabolic engineering to provide sustainable sources of healthier plant oils, as well as specialised industrial oils that can serve as replacements for fossil oils and assist in mitigating the effects of climate change.

CSIRO's Plant Oils Engineering Group has been at the forefront of employing metabolic engineering strategies for the development of new oilseed crops that will deliver industrially and nutritionally improved plant oils. Dr Singh will describe the development of a canola crop with DHA and EPA in its seed oil. Omega-3 long-chain ($\geq C20$) polyunsaturated fatty acids like DHA and EPA have critical roles in human health and development. The increasing demand for these oils provides an urgent need for an alternative, safe, and sustainable source of DHA and EPA. The development of a DHA-rich canola crop is a triumph in plant metabolic engineering, in both the complexity of the biosynthetic pathways that have been transferred to higher plants, and the number of genes that have been introduced to encode these pathways.

Professor Catherine Stampfl FAA

University of Sydney



Professor Catherine Stampfl has been a Professor in the School of Physics at the University of Sydney since 2003, and recipient of an

ARC Federation Fellow. From 1990 to 1998 she worked at the Fritz-Haber-Institute of the Max-Planck Society, Berlin, Germany, with a year in 1997 working in the Electronic Materials Laboratory at Xerox Palo Alto Research Center, California USA. From 1999 she worked in the Department of Physics and Astronomy, Northwestern University, Evanston Chicago, USA until 2002, and also lectured at the Technical University in Berlin, receiving her Habilitation from the Technical University of Berlin in 2006. Her research field is theoretical and computational condensed matter physics where she uses first-principles quantum mechanical calculations to gain fundamental understanding into the behaviour of solids, their surfaces, interfaces, and nanostructures, to predict new and improved materials for future technological applications. She is the author of over 200 publications.

Next generation computational materials discovery and design

Theory and experiment have long informed our understanding of the world. Over the years, computing has evolved to become the third pillar of science, connecting theory and experiment, and irrevocably changing how scientists conduct their research. Professor Stampfl will discuss current research in theoretical and computational condensed matter physics that highlights how first-principles quantum mechanical calculations are being used to understand and predict new materials and structures with desired properties for future applications in areas such as heterogeneous catalysis, nanoelectronics and sensors.

Professor James Whelan FAA

La Trobe University



Professor James Whelan obtained his BSc and PhD degrees from University College Dublin, then spent five years as a postdoctoral fellow at the Australian National University before being appointed as a lecturer at the University of Western Australia in 1995, where he stayed until his appointment at La Trobe University in 2013 as a Professor of AgriBioscience. He also holds a foreign expert professorship at Zhejiang University, China, and an honorary doctorate from Stockholm University.

Mitochondrial biogenesis and signalling

In addition to the classical energy conserving cyanide-sensitive cytochrome electron transport chain, plants contain an alternative respiratory pathway not linked to ATP production. Professor Whelan's study defined a crucial role for the alternative oxidase as defining the tolerance equilibrium in plants and playing a central role in mitochondrial signalling. Subsequent research identified and characterised the first components involved in mitochondrial retrograde signalling in plants.

These advances have fundamentally changed how the alternative oxidase is viewed—from a simple metabolic overflow mechanism to a pathway that defines stress responses in plants, prompting the concept of mitochondrial signalling that is widely

used in the plant mitochondrial literature.

Retrograde signalling from mitochondria signals to the nucleus to alter gene expression, and importantly these signalling pathways interact with other cellular signalling pathways such as chloroplast retrograde signalling and stress and hormonal signalling pathways. These studies led to the identification of a novel stress signalling pathway involving ER-bound NAC transcription factors that are proteolytically released upon perturbation of mitochondrial function. The identification of this pathway linked mitochondrial function to the ER stress response and also provided a mechanism whereby molecules such as ROS or calcium could specifically signal mitochondrial functional status.

Professor Cynthia Whitchurch FAA

University of Technology Sydney



Professor Cynthia Whitchurch has investigated various aspects of bacterial pathogenesis and biofilms for over 25 years and has held NHMRC CDA and SRF fellowships. She obtained her BSc (Hons I) in 1989 and her PhD in 1994 from the University of Queensland and undertook postdoctoral research at the University of Queensland and the University of California San Francisco. In 2004 she established her research group in the Department of Microbiology at Monash University and in 2008 was recruited to the University of Technology Sydney where she

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currently leads a research team in the itthree institute and where she also established the Microbial Imaging Facility.

Exploding bacteria release extracellular DNA slime and other public goods in bacterial biofilms

A major contributor to the ability of pathogenic bacteria to establish infections and resist the actions of antibiotics and host immune defenses is their ability to form slime-encased communities termed biofilms. Extracellular DNA (eDNA) is a ubiquitous component of the slime matrix of the biofilms of many bacterial species where it functions as a 'glue' to interconnect cells and attach them to the substratum. Furthermore, eDNA also facilitates the active expansion of *Pseudomonas aeruginosa* biofilms by engineering the formation of a network of interconnected furrows and directing traffic flow throughout the furrow network to efficiently supply cells to the leading edge of the expanding biofilm. Thus, surprisingly, eDNA provides functions to bacterial communities that are independent of its genetic role. 'Public goods' in bacterial communities are extracellular products that are released by a sub-set of individuals that provide benefits to the local population. Explosive cell lysis has recently been identified as a novel mechanism for the release of cytosolic content, including eDNA, and membrane vesicles for use as 'public goods' in *P. aeruginosa* biofilms. Current research explores opportunities to exploit this new knowledge to develop innovative approaches to prevent and treat bacterial infections.

Professor Ruth Williams FAA University of California San Diego (corresponding Member— Elected 2018)



Professor Ruth Williams is a Distinguished Professor of Mathematics and holds the Charles Lee Powell Chair in Mathematics I at the University of California San Diego. Her current research in probability theory concerns the study of stochastic networks. Such networks arise, for example, in internet congestion control and systems biology. Professor Williams studied mathematics at the University of Melbourne where she earned her BSc (Hons) and MSc degrees. She then went abroad to study at Stanford University in California, where she earned her PhD degree in mathematics. Her work has been recognised by many honours, including election to the National Academy of Sciences (USA) and the American Academy of Arts and Sciences. In 2016, she received the prestigious John von Neumann Theory Prize from the Institute for Operations Research and the Management Sciences. She was elected as a Corresponding Member of the Australian Academy of Science in 2018.

Resource sharing in stochastic networks

Dynamic stochastic models of complex networks with limited resources arise in a wide variety of applications in science and engineering, for example in manufacturing, transportation, telecommunications, computer

networks, business systems, and systems biology. Bottlenecks in such networks cause congestion, leading to queueing and delay. Professor Williams will illustrate how mathematical analysis can help us predict and control the behaviour of such networks. In particular, she will show how shared resources can lead to entrainment and result in a reduction of dimension called state space collapse. Examples will be drawn from internet congestion control and systems biology.

Professor Ian Wright FAA Macquarie University



CREDIT: © MACQUARIE UNIVERSITY / CHRIS STACEY

Professor Ian Wright is known for global scale analysis of plant traits, for careful quantification of plant structure-function relationships, and for using concepts from economics to understand plant evolution and plant ecological strategies. The concept of a unifying, worldwide Leaf Economic Spectrum (LES) has become standard in textbooks covering plant ecology, physiology and ecological climatology. Both the LES and 'least-cost theory', which addresses co-optimisation of carboxylation and water costs during photosynthesis, are becoming embedded in global vegetation and production models, providing a more robust theoretical basis to these important tools. Recent work has twinned empirical analysis and a fresh twist on energy balance theory to tackle the question of what drives global variation in leaf size.

The economic life of leaves

Leaves are like engines or factories, with economic traits including

construction and maintenance costs, production rates and expected lifespans. Our research has shown these traits are predictably coordinated (for example, longer lifespan requires expensive construction; higher productivity reduces expected lifespan), forming a 'leaf economic spectrum' that describes key aspects of plant ecological strategy for species worldwide. Still, the complex business life of leaves has other aspects also. For understanding three-way transactions between photosynthesis, transpiration and leaf nutrients Professor Wright's team introduced 'least-cost' optimality theory, proposing that over a variety of time scales plants adjust their use of key resources to achieve a

given production rate at least total cost. Predictions from this theory lineage have been supported by analysis of regional and global trait datasets, while work remains to better understand seasonal adjustments in plant behaviour and canopy organisation. Twinning these various theories for leaf 'economics' with empirical tests has led to powerful generalisations including how plant morphological and physiological traits scale up to ecosystem and biogeochemical properties. This knowledge is central to developing 'next-generation' vegetation and global productivity models which ideally will incorporate optimality principles as well as sophisticated representations of plant trait variation.

Absent new Fellows

Also elected this year, but unable to join us for the new Fellows' presentations, are:

- Professor Lyn Beazley AO FAA
- Professor Peter Corke FAA
- Professor David McClelland FAA
- Professor Akshay Venkatesh FAA (Corresponding Member)



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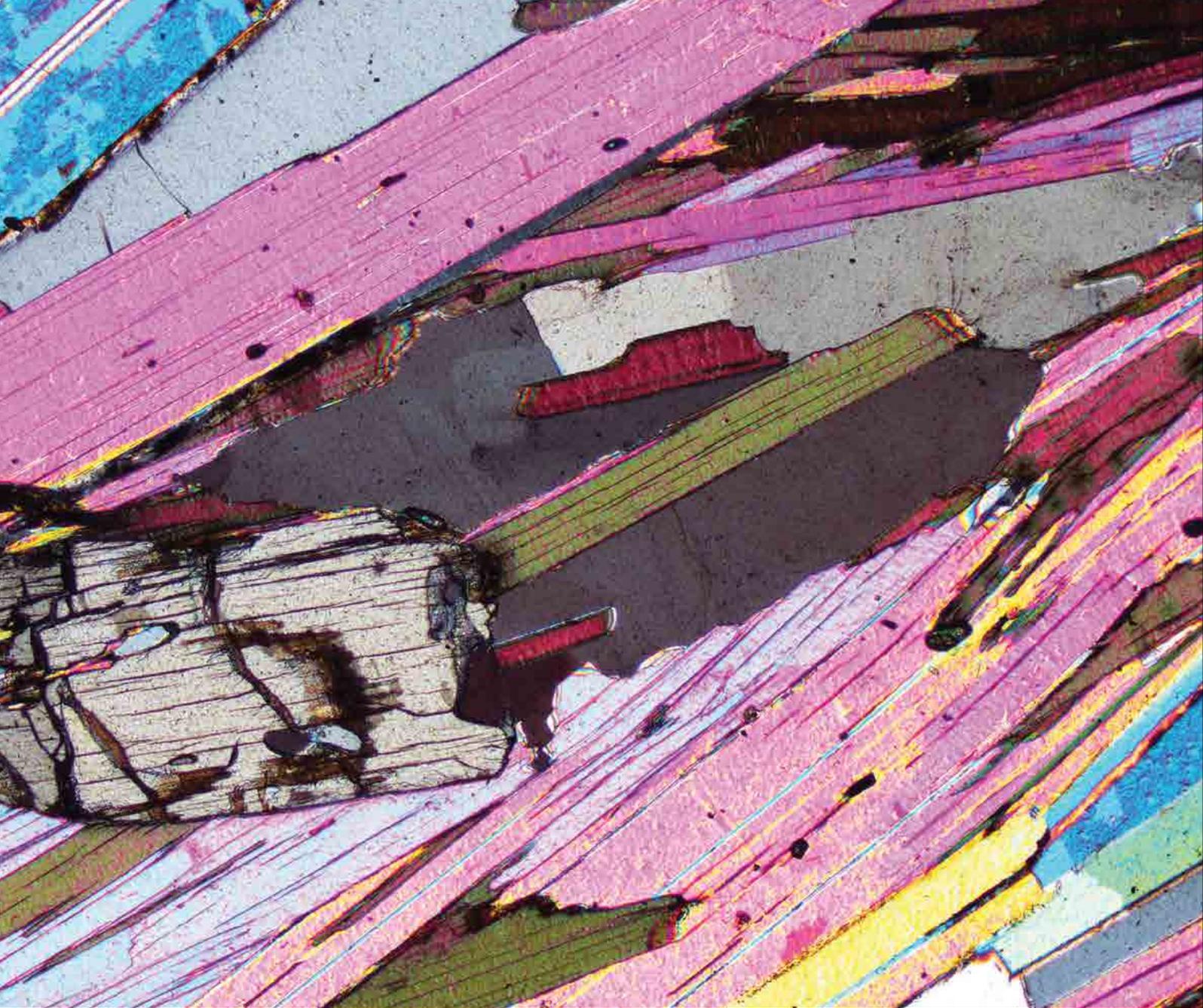
UC has accelerated in the Times Higher Education World University Rankings from placement in the 501–600 band in 2016 to the 251–300 band in 2019.

'The University of Canberra is ranked in the Top 100 universities under the age of 50.' QS Young University Rankings 2018



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Images of Research Finalist: A journey into Australia's tumultuous geological past, and into a groovy future - Jan Varga, PhD Candidate

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Gala Dinner

We look forward to celebrating the Academy's 65th anniversary at this year's gala dinner at the National Museum of Australia.

This event, in the National Museum's grand Gandel Atrium, brings together the who's who of Australian science. We will welcome Nobel Laureates, Prime Minister's Prize for Science winners, Chief Scientists, Academy Fellows, senior representatives from the research and education sectors, STEM industry representatives, members and senators of the Australian Parliament, government officials, and members of the diplomatic community.

This special event will include an address by His Excellency the Honourable Sir Peter Cosgrove AK MC (Retd) and an address by Dr Andrew Thomas AO, retired NASA Astronaut.

The evening will also include the presentation of the prestigious Matthew Flinders Medal to Dr Richard Manchester FAA.

To mark the 65th anniversary of the Academy and the 60th anniversary of the Shine Dome, there will be

special silent auction items on which to place a bid at this year's gala dinner. The items will include:

- framed blueprints of the Shine Dome
- framed newspaper front pages from 16 February 1954, the date the Academy was founded
- limited edition Maipenrai wine, donated and signed by Academy Fellow, Professor Brian Schmidt AC FAA FRS.

We are delighted to be able to bring this event to you in such a glorious venue, with the generous support of the University of South Australia, **Presenting Partner—Gala Dinner.**

Coaches depart QT and University House at 6.20 pm.

Drinks & canapes served at 6.30 pm, with formal proceedings beginning at 7.00 pm.

Dress code: Black tie/formal



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Diversity and inclusion

The Australian Academy of Science is committed to supporting excellence in science. To achieve this, we must celebrate and embrace diversity and inclusion in all its forms.

The Academy is fully committed to improving the diversity of the Academy Fellowship and those nominated for the Academy's awards. The Academy is actively encouraging Fellows and the wider science community to nominate diverse candidates for Fellowship and award opportunities.

The Academy is also proud to be supporting diversity and inclusion at events, including Science at the Shine Dome. With the generous support of the University of Sydney, Science at the Shine Dome offers onsite childminding, parent-friendly facilities at the venue,

carer grants for delegates to attend when support is needed at home, and accessibility assistance at the event to ensure full participation for delegates requiring additional support.

We're pleased to be able to offer this additional support thanks to the University of Sydney, **Presenting Partner—Diversity and Inclusion.**

Find out more about the Academy's diversity and inclusion initiatives at science.org.au/diversity-and-inclusion

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Academy awards



2019 Matthew Flinders Medal and Lecture

The Matthew Flinders Medal and Lecture recognises scientific research of the highest standing in the physical sciences, and honours the contributions of Australia's early scientific researchers.



Dr Richard Manchester FAA

CSIRO Astronomy and Space Science

Dr Richard N (Dick) Manchester completed a BSc (Hons) at the University of Canterbury, New Zealand in 1963. He moved to the University of Newcastle in Australia in early 1965 and completed a PhD in ionospheric studies. In 1968 he and his wife Barbara moved to Parkes where they both worked at the CSIRO radio telescope.

After five years in the USA, including postdoctoral positions at the National Radio Astronomy Observatory and at the University of Massachusetts, they returned to Australia in 1974. He rejoined the CSIRO Division of Radiophysics where he led the Astrophysics Group from 1980 to 1987. In 1978 he was awarded the Pawsey Medal of the Australian Academy of Science and in 1989 he was elected a Fellow of the Academy. He holds honorary professorships at several institutions and has supervised about 20 graduate students. In 2003 he was awarded an Australian Research Council Federation Fellowship and set up the Parkes Pulsar Timing Array project with the aim of detecting gravitational waves. He was an ISI Citation Laureate in 2001 and has published about 480 papers in refereed journals. He retired from CSIRO in 2008 and is now an honorary CSIRO Fellow.

50 years of pulsars

Pulsars were discovered just over 50 years ago. Detected as periodic pulses of radio, x-ray or gamma-ray emission, they are believed to be rapidly rotating neutron stars which send out intense beams of emission that we detect as pulses when they sweep over Earth. Observed pulse periods are extremely stable and range from 1.4 milliseconds to about 12 seconds, corresponding to rotation rates of the underlying star as high as 700 times every second. About 2700 pulsars are now known, most lying within our Milky Way Galaxy. About 10% of all pulsars are members of a binary system, in orbit with another star. This combination of properties makes them unique and valuable probes of a wide range of astrophysical phenomena. For example, they have provided the most stringent test yet of Einstein's general theory of relativity in strong gravitational fields, given insight into the interior structure of neutron stars and been used to study the three-dimensional structure of the interstellar magnetic field in our Galaxy. Dr Manchester's career in radio astronomy covers the whole 50 years since the announcement of the first discovery by the Cambridge (UK) group in 1968. He will review some of the highlights of this 50 years, including the searches using the Parkes 64-metre radio telescope that have discovered more than half of the known pulsars, studies of the galactic distribution and evolution of pulsars, the results of precision timing programs that have tested theories of gravitation, and studies of the interstellar medium using pulsars as probes.

Honoric awards

Career honorific awards

recognise lifelong achievement in the outstanding contribution to the advancement of science.

Thomas Ranken Lyle Medal

The Thomas Ranken Lyle Medal commemorates the contribution of Sir Thomas Ranken Lyle FRS to Australian science and industry generally and in particular to his own fields of physics and mathematics. The purpose of the medal is to recognise outstanding achievement by a scientist in Australia for research in mathematics or physics.

Professor Chennupati Jagadish AC FAA FTSE

Australian National University



Professor Jagadish AC FAA FTSE is a Distinguished Professor in the Research School of Physics and Engineering, Australian National University. He served as Vice-President and Secretary Physical Sciences of the Australian Academy of Science during 2012–16. He is currently President of the IEEE Photonics Society and President of the Australian Materials Research Society. Professor Jagadish is an Editor/Associate editor of five journals and three book series, and serves on editorial boards of 20 other journals. He has published more than 900 research papers (620 journal papers), holds five US patents, co-authored a book and has

co-edited 13 books and 17 special issues of journals. He is a Fellow of eight science and engineering academies and four professional societies. He has received the Peter Baume Award, Quantum Device Award, Walter Boas Medal, IEEE Pioneer Award in Nanotechnology, IEEE Photonics Society Engineering Achievement Award, 2016 MRSI Silver Jubilee Anniversary Medal, CAS Distinguished Fellow, OSA Nick Holonyak Jr Award, Welker Award, IUMRS Somiya Award and UNESCO medal.

David Craig Medal and Lecture

The David Craig Medal and Lecture is awarded in honour of the outstanding contribution to chemical research of the late Emeritus Professor David Craig AO FAA FRS. It recognises contributions of a high order to any branch of chemistry by active researchers. The recipient of this medal delivers several public lectures across Australia.

Professor Peter Gill FAA

Australian National University



Professor Peter Gill received his PhD on hemi-bonded systems and their dicationic analogues from the Research School of Chemistry at the Australian National University in 1988. He then moved to Carnegie-Mellon University where he was one of the early developers of density functional theory (DFT) in the chemical community. He held positions at Massey University, the University of Cambridge, and the

University of Nottingham before returning to ANU in 2004. He has been awarded the Dirac and Schrödinger Medals of the World Association of Theoretical and Computational Chemists (WATOC) and the Pople and Fukui Medals of the Asia-Pacific Association of Theoretical and Computational Chemists (APATCC). He has published almost 200 papers attracting more than 13,000 citations (Web of Science) and 135,000 citations (Google Scholar). He is the president of WATOC and the founder and president of the quantum chemistry software company Q-Chem Inc.

Jaeger Medal

The Jaeger Medal is made in honour of the contribution of the late Professor John Conrad Jaeger FAA FRS to Australian Earth science. The award is made to a scientist for investigations of a high order into the solid Earth or its oceans carried out in Australia or having some connection with Australian Earth science.

Professor Dietmar Müller FAA

University of Sydney



Professor Dietmar Müller received his undergraduate degree from the University of Kiel, Germany, and his PhD in Earth Science from the Scripps Institution of Oceanography, UC San Diego, California in 1993. After joining the University of Sydney, he built the EarthByte Research Group, pursuing the construction of a

deep time travel machine—a virtual laboratory to see deep into Earth through space and time. Professor Müller was inspired to become a geoscientist by taking long walks along Germany's Baltic Sea beaches as a child with his family, picking up unusual rocks and fossils, none of which belonged there. They had originated in Scandinavia, scraped off by glaciers and dropped much further south after being transported in the ice over 1000 km. The rise of supercomputing and artificial intelligence now allows the EarthByters to use computers to decipher what rock archives can tell us about ancient worlds, or even the future!

Mid-career awards

recognise outstanding contributions to the advancement of science by researchers 8 to 15 years post-PhD in the calendar year of nomination.

Jacques Miller Medal

The Jacques Miller Medal recognises research of the highest standing in the field of experimental biology research, and is made in honour of the contributions made to science by Professor Jacques Miller AC FAA FRS that include the discovery of the function of the thymus and the identification, in mammalian species, of the two major subsets of lymphocytes and their functions.

Professor Nicholas Huntington

Walter and Eliza Hall Institute of Medical Research and Monash University



Professor Nicholas Huntington is an NHMRC fellow and laboratory head in the Department of Biochemistry, Monash University and Biomedicine Discovery Institute with a joint appointment at the Walter and Eliza Hall Institute of Medical Research. He is an international authority on natural killer (NK) cell biology and tumour immunity with 84 research articles on the topic. Professor Huntington leads a research program aimed at deciphering the regulatory networks that control NK cell development, homeostasis and activation with discoveries applied in cancer immunotherapy. Professor Huntington has attracted over \$10 million in public and private research funding to date and serves as project director for several industry drug development collaborations. He was recognised for his recent contributions to cancer immunotherapy and innovation in receiving the Burnet Prize and the NFMRI John Dixon Hughes Medal.

He acts as a scientific advisor to several US pharmaceutical companies and is a co-founder and CSO of oNko-Innate Pty Ltd.

Nancy Millis Medal for Women in Science

The Nancy Millis Medal for Women in Science honours the contributions made to science by the late Professor Nancy Millis AC MBE FAA FTSE, and recognises her importance as a role model for women aspiring to be research leaders.

Professor Jacqueline Batley

University of Western Australia



After gaining a BSc (Hons) in Biology from the University of Bristol, Professor Jacqueline Batley was awarded an MSc from the University of Durham. She undertook her PhD studies at Long Ashton Research Station and was awarded her PhD from the University of Bristol in 2001. After a short postdoc at the University of Bristol Jacqui moved to Australia in 2002 as a senior research scientist at the Department of Primary Industries Victoria. She returned to academia



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in 2007, leading a research group at the University of Queensland as an ARC QEII Research Fellow. In 2014 Professor Batley moved to the University of Western Australia to undertake her ARC Future Fellowship and is currently leading her research group in crop genetics and genomics in the School of Biological Sciences. She has received several awards for her research including a University of Queensland Foundation Research Excellence Award, an ARC QEII Fellowship and an ARC Future Fellowship.

Early-career awards

recognise outstanding contributions to the advancement of science by researchers no more than 10 years post-PhD in the calendar year of nomination.

Anton Hales Medal

The Anton Hales Medal recognises distinguished research in the Earth sciences and honours the contributions to the Earth sciences by the late Professor Anton L Hales FAA. Professor Hales was the founding director of the Research School of Earth Sciences at the Australian National University.

Professor Isaac Santos

Southern Cross University



Professor Isaac Santos obtained his BSc in Oceanography (Hons) and Masters of Environmental Geochemistry in Brazil. He later obtained a PhD in Chemical Oceanography at Florida State University in the USA with the backing of a Fulbright Fellowship. He moved to Southern Cross University in Australia in 2009. Since then, he has conducted scientific research projects on all continents but Africa, including Antarctica. Professor Santos has obtained 16 ARC grants and is currently an ARC Future Fellow. He has published more than 150 peer-reviewed articles in leading disciplinary journals, and supervised nine PhD and 22 honours students to completion. He leads the Barefoot Biogeochemistry Group at the National Marine Science Centre in Coffs Harbour (NSW). His group of 15+ researchers and students use cutting-edge analytical infrastructure to investigate water quality and biogeochemistry in mangroves, wetlands, coral reefs,

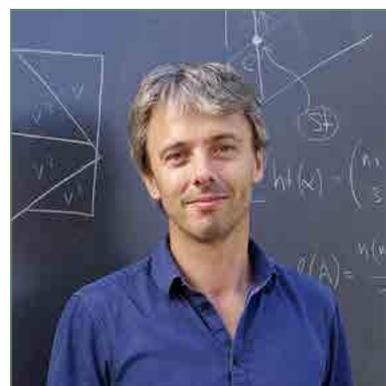
rivers, estuaries, and beaches all over Australia and overseas.

Christopher Heyde Medal

The Christopher Heyde Medal honours contributions to mathematics by the late Professor Christopher Heyde AM FAA. In recognition of Professor Heyde's broad interests in the mathematical sciences, the award is offered in one of three fields of mathematics on a rotating basis. In 2019 it recognises outstanding achievement in pure mathematics.

Professor Geordie Williamson FAA FRS

University of Sydney



Geordie Williamson is Professor of Mathematics and Director of the Mathematical Research Institute at the University of Sydney.

Professor Williamson grew up in the Southern Highlands of New South Wales, Australia. He was an undergraduate at the University of Sydney, and completed his PhD at the University of Freiburg in Germany. Following his PhD studies



Australian Academy of Science



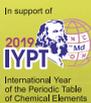
AUSTRALIAN SCIENCE TEACHERS ASSOCIATION



IUPAC



United Nations Educational, Scientific and Cultural Organization



In support of
2019 IYPT
International Year of the Periodic Table of Chemical Elements

science art

elements in everyday life

To celebrate the International Year of the Periodic Table and the centennial of IUPAC, the National Committee for Chemistry is hosting *scienceXart: elements in everyday life*, an art competition for schools. Selected submissions will be on show at the Academy's evening reception in Paris on Monday 8 July, as part of the 47th IUPAC World Chemistry Congress.

To find out more visit:
science.org.au/scienceXart

he was a Junior Research Fellow at Oxford for three years, and then an Advanced Researcher at the Max Planck Institute for Mathematics in Bonn. In 2020–21 he will direct a year-long program at the Institute for Advanced Study in Princeton.

Professor Williamson has lectured all over the world, and has had visiting positions in the US, Germany and Japan. His has been awarded several prizes for his work, including the Chevalley Prize of the American Mathematical Society (2016), the European Mathematical Society Prize (2016), the Clay Research Award (2016), the New Horizons in Mathematics Prize (2017) and the Medal of the Australian Mathematical Society (2018). In 2018 he was elected to the Australian Academy of Science and the Royal Society, and is currently the youngest living fellow of both institutions.

Dorothy Hill Medal

The Dorothy Hill Award honours the contributions of the late Professor Dorothy Hill AC CBE FAA FRS to Australian Earth science, and her work in opening up tertiary science education to women.

Dr Laurie Menviel

UNSW Sydney



Dr Laurie Menviel is a Scientia Fellow at the University of New South Wales (UNSW) Sydney. She received a MS in geochemistry from the University of Aix-Marseille (France) and a PhD in oceanography from the University of Hawaii (USA). She was a postdoctoral fellow at the International Pacific Research Centre (Hawaii, USA), at the

University of Bern (Switzerland), and UNSW Sydney. She obtained an ARC DECRA fellowship in 2015 to study the impact of abrupt climate change on the global carbon cycle, and in 2018, she was awarded an ARC Future Fellowship to study the oceanic circulation during past warm periods.

Dr Menviel combines numerical experiments and paleoproxy records to study climate-carbon cycle interactions on millennial to glacial timescales. She is particularly interested in the impact of water masses changes on the climate and the marine carbon cycle.

Fenner Medal

The Fenner Medal is awarded in honour of the outstanding contributions to science by the late Professor Frank Fenner AC CMG MBE FAA FRS. It recognises distinguished research in biology.

Dr Daniel Falster

UNSW Sydney



Dr Daniel Falster is a plant ecologist, evolutionary biologist and mathematical modeller. He is passionate about forests, open data, reproducible research, and teaching biologists to code. His research seeks to uncover the key processes shaping the structure and function of vegetation. Dr Falster completed his undergraduate degree at the University of New South Wales Sydney (UNSW) and, after working as a research assistant in Australia and Norway, a PhD in ecology at Macquarie University in 2010, where he was supervised by Professor Mark Westoby. During his

PhD Dr Falster also collaborated with researchers from the International Institute for Applied Systems Analysis (Vienna). In 2010 he was awarded an ARC postdoctoral fellowship, continuing at Macquarie University, before moving to UNSW in 2017 to take up an ARC Future Fellowship project Niche 2.0—Australian and global plant diversity from first principles.

Gottschalk Medal

The Gottschalk Medal recognises outstanding research in medical science and honours the contributions to science of the late Dr Alfred Gottschalk FAA.

Associate Professor

Laura Mackay

Doherty Institute



Associate Professor Laura Mackay is an Associate Professor at the University of Melbourne, and holds an Adjunct appointment at the Singapore Immunology Network at A*STAR in Singapore. She obtained her PhD from the University of Birmingham, UK in 2009, before taking up a postdoctoral position with Professor Francis Carbone at the University of Melbourne. Associate Professor Mackay established an independent group at the Peter Doherty Institute in 2015, where her laboratory studies memory T cell responses, with a focus on the signals that control tissue-resident memory T cell differentiation, with a view to harness these cells to develop new treatments against infection and cancer. She is a Howard Hughes Medical Institute (HHMI) and Bill

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CREDIT: LOUISE REILLY ©

and Melinda Gates International Scholar, a Sylvia and Charles Viertel Charitable Foundation Senior Medical Research Fellow, and a National Health and Medical Research Council (NHMRC) Career Development Fellow. Her research is supported by project grants from the NHMRC, and has been recognised by awards including the Michelson Prize for Human Immunology (2018) and the Victorian Young Tall Poppy Award (2016). Dr Mackay is a co-host on Melbourne Triple R Radio science show Einstein-A-Go-Go, and serves on the council of the Australian Society of Immunology. She is the recently appointed President of the Federation of Immunological Societies of Asia-Oceania (FIMSA).

John Booker Medal

The John Booker Medal in Engineering Science recognises outstanding research in engineering mechanics that addresses problems in the static and dynamic response of physical systems within engineering and applied mathematics disciplines. It honours the memory of Professor John Robert Booker AO FAA who worked in the area of theoretical geomechanics and was Professor in the Department of Civil and Mining Engineering at the University of Sydney 1970–98, and held a personal chair in engineering mechanics at the University of Sydney.

Associate Professor Anna Giacomini

University of Newcastle



Associate Professor Anna Giacomini received her PhD in 2003 from the University of Parma, Italy, and joined the University of Newcastle in 2006. She is Principal Researcher in the Priority Research Centre of Geotechnical Science in Engineering in the Faculty of Engineering and Built Environment of the University of Newcastle.

Since her arrival in Australia, she has pioneered research in rock mechanics and rockfall analysis applied to civil and mining engineering. Between 2009 and 2011, she was the principal researcher of an ARC Linkage Project devoted to developing new designs for engineered barriers to protect valuable infrastructure from rockfall hazards.

Since 2010, she has been leading six major research projects through the Australian Coal Association Research Program (ACARP) on rockfall hazard, risk and mitigation and is currently leading an ARC

Linkage Project for the development of new innovating monitoring methodologies of rock slopes instabilities.

Professor Changbin Yu

Curtin University



Professor Changbin (Brad) Yu received a BEng (Hon 1) degree in Computer Engineering from Nanyang Technological University, Singapore and a PhD degree in Engineering from the Australian National University in 2008. He joined the faculty at the ANU on an ARC Australian Postdoctoral Fellowship and then Queen Elizabeth II Fellowship, and becoming then a Reader and the Leader of Networked Systems Research Group. He was recently appointed the Optus Chair in Artificial Intelligence with Curtin University. Among various overseas positions held, Professor Yu founded the Artificial Intelligence and Robotics Center at the Westlake University, Hangzhou, China. His research has been continuously supported by the ARC with five Discovery Projects and 1 LIEF



The Australian Academy of Science invites nominations and applications for its 2020 research conference, research awards and travelling fellowships.

Information on the awards, including eligibility criteria and nomination/application procedures, is available on the website www.science.org.au/opportunities

2020 FUNDING

project, and more than \$10 million industry and overseas competitive funding. He was a recipient of an Australian Government's Endeavour Asia Award, Endeavour Executive Fellowship, multiple Australian Academy of Science and Australian Academy of Technology and Engineering visiting fellowships and grants; and a finalist of the Eureka Prize for Outstanding Science in Safeguarding Australia. Professor Yu is a Senior Member of the IEEE and a Fellow of Engineers Australia.

Moran Medal

The Moran Medal recognises the contributions to science of the late P.A.P. Moran FAA. Its purpose is to recognise outstanding research in one or more of the fields of applied probability, biometrics, mathematical genetics, psychometrics and statistics.

Dr Kim-Anh Lê Cao
University of Melbourne



Dr Kim-Anh Lê Cao received her PhD from the Toulouse Mathematics Institute, France in 2009. She moved to the University of Queensland, Australia for a research fellow position, where she developed computational and statistical methods for biological data integration and established strong collaborations with researchers from the biomedical, clinical and fundamental biology fields. She was recruited as senior lecturer at the University of Melbourne in 2017 at the School of Mathematics and Statistics and Melbourne Integrative Genomics. She was awarded

two National Health and Medical Research Council (NHMRC) Career Development Fellowships (level 1: 2014–19; level 2: 2019–22), she is a named inventor on four biomedical patents, has implemented software that has been downloaded more than 500,000 times and has published 73 articles attracting 3000 citations.

**Associate Professor
Stephen Leslie**
University of Melbourne



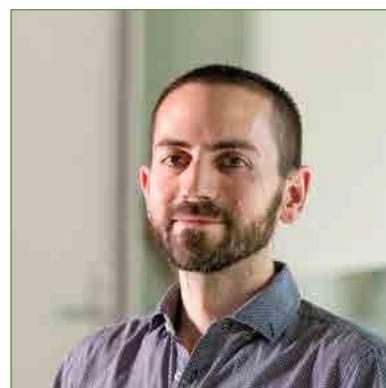
Associate Professor Stephen Leslie is a statistician working in the field of mathematical genetics. He did his undergraduate degree at ANU, including honours in mathematics. He obtained his doctorate from the Department of Statistics, University of Oxford in 2008. After graduating he was a postdoctoral researcher in the Department of Statistics at Oxford. He was awarded one of Oxford's prestigious Nuffield Department of Medicine Scientific Leadership Fellowships. In 2012 Associate Professor Leslie returned to Australia to establish his own research group at the Murdoch Children's Research Institute as Group Leader in Statistical Genetics. Since 2016 he has been Associate Professor of Statistical Genomics at the University of Melbourne, in the Schools of Mathematics and Statistics, and Biosciences, and Melbourne Integrated Genomics. In 2009 he was awarded the University of Oxford's Teaching Excellence Award. Associate Professor Leslie's work covers several aspects of statistical and population genetics.

His main interests are in detecting and controlling for population differences in genetic data; typing complex genetic variation, with a particular focus on immune-associated loci; and performing statistically rigorous analyses of the relationship of genetic variants to disease.

Pawsey Medal

The Pawsey Medal recognises distinguished research in physics and commemorates the work of the late Dr Joseph Pawsey FAA FRS.

Professor Steven Flammia
University of Sydney



Professor Steven Flammia completed his PhD at the University of New Mexico under the supervision of Carl Caves, and then did postdoctoral work at the Perimeter Institute and Caltech. He joined the University of Sydney in 2012. His work centres around quantum information theory and applications of the theory to a broad range of topics, including condensed matter physics, topologically ordered phases, tensor networks, quantum error correction, quantum optics, precision metrology, and classical statistical inference and machine learning, including compressed sensing. Together with his co-authors, he has developed numerous novel methods for characterising noise in quantum devices that has increased the scalability, precision and accuracy over prior art.

Ruth Stephens Gani Medal

The Ruth Stephens Gani Medal honours the contribution to human cytogenetics of the late Ruth Stephens Gani. It recognises distinguished research in human genetics including clinical, molecular, population and epidemiological genetics and cytogenetics.

Dr Justin Wong

Centenary Institute of Cancer Medicine and Cell Biology



Dr Justin Wong completed his PhD in 2009 at the University of New South Wales. After a postdoctoral role at the Centenary Institute in the areas of RNA biology, he was promoted to Laboratory Head at Centenary in 2015. In 2018, he established and headed the Epigenetics and RNA Biology Program.

Dr Wong has contributed significantly towards elucidating the role that non protein-coding sequences of the DNA called 'introns' plays in normal biology and disease. His paradigm shifting work established that retention of introns in genes could act as a 'suicide signal' to trigger the degradation of messenger RNA transcribed from the DNA. Consequently, the translation of messenger RNA into protein is halted. This mechanism of gene expression control is key to shutting down specific genes for the normal development of diverse cell types.

In addition, Dr Wong has discovered that a chemical modification to the DNA called DNA methylation regulates the retention of introns. His work has provided critical insights into novel mechanisms of gene expression control with vast therapeutic potential for cancers and other genetic diseases.



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Aboriginal and Torres Strait Islander Scientist Travelling Research Award

This award recognises research in the natural sciences, allowing interdisciplinary and sociocultural research that could straddle the social sciences and humanities, by outstanding Aboriginal and Torres Strait Islander PhD students and early- and mid-career scientists. It aims to support the expansion and growth of their research networks and international knowledge exchange through visits to relevant international centres of research. Two annual awards of \$5500 are planned, with additional support provided to attend the Academy's annual Science at the Shine Dome event.

Mr Tui Nolan

University of Technology Sydney—To visit the Alan Turing Institute in London to study computational methods that have applications in public health and education.



Mr Tui Nolan is a Gudjal man who grew up in Sydney. He has completed a Bachelor of Science (Honours I) and a Master of Science (Honours I), and is currently completing a PhD in statistics at the University of Technology Sydney (UTS). In 2018, he received a Fulbright Future Postdoctoral Scholarship, which will enable him to take on a postdoctoral position at Cornell University in 2019. His research in physics, statistics and

mathematics has been applied in determining the major factors preventing Indigenous Australians from entering the driver licensing system through The George Institute for Global Health, which was the basis for the New South Wales Driver Licensing Access Program. Mr Nolan has mentored Aboriginal and Torres Strait Islander students as they transition to university through the Jumbunna Institute for Indigenous Education and Research, the Aboriginal Summer School for Excellence in Technology and Science, Aurora Education Outreach and the Galuwa Science Experience at UTS.

Ms Amy Searle

Baker IDI Heart and Diabetes Institute—To attend Science at the Shine Dome 2019.



Ms Amy Searle is completing the final year of her PhD at the Baker Heart and Diabetes Institute in the Atherothrombosis and Vascular Biology laboratory, supervised by Prof Karlheinz Peter and Dr Xiaowei Wang. Her research focuses on the development of targeted theranostic (dual diagnostic and therapeutic) applications towards cardiovascular diseases. Of Anglo-Australian and Aboriginal heritage, Ms Searle was awarded one of the Academy's inaugural Aboriginal and Torres

Strait Islander Scientist Travelling Research Awards.

Mr Bradley Moggridge

University of Canberra—To visit New Zealand to learn how Māori culture has incorporated Indigenous knowledge and values into their water management practice



Mr Bradley Moggridge is a proud Murri from the Kamilaroi Nation (North-West NSW) with strong connections to water and water management. He is currently a full-time PhD candidate at the University of Canberra's Institute of Applied Ecology and part-time Indigenous Liaison Officer for the Threatened Species Recovery Hub. Mr Moggridge holds a Master of Science (Hydrogeology and Groundwater Management) from UTS and Bachelor of Science (Environmental Science) from ACU, is a Fellow of the Peter Cullen Trust, was involved with the IWC Water Leadership Program and Indigenous Leadership from AILC. He was recently awarded the Aboriginal and Torres Strait Islander Alumni Award from ACU for 2017. Prior to his PhD, he was employed by NSW DPI Water as the Team Leader for the Aboriginal Water Initiative, which was the only dedicated Aboriginal water unit in Australia at the time. He has also worked with CSIRO as an Indigenous Water Specialist.

Max Day Environmental Science Fellowship Award

This award provides up to \$20,000 to support early career researchers working on the conservation of Australia's flora and fauna, ecologically sustainable use of resources, protection of the environment and ecosystem services. The award is named in honour of the late Dr Maxwell Frank Cooper Day AO FAA who spent a lifetime championing entomology, conservation and forestry, as well as helping other scientists. Through sponsoring this award Dr Day acknowledges the support that he received as a young researcher to travel overseas to gain his PhD at Harvard.

Dr Tim Doherty

Deakin University—Ecological consequences of introduced predator removal for a native mesopredator and ecosystem engineer *Varanus gouldii*



Dr Tim Doherty is an Alfred Deakin Post-doctoral Research Fellow at Deakin University in Melbourne. He is an applied wildlife ecologist, specialising in the fields of disturbance ecology, invasive species and predator-prey ecology. His research aims to advance ecological theory and improve ecosystem management and threatened species conservation. Dr Doherty has been at the forefront of quantifying the impacts of invasive predators, such as cats and rats, on biodiversity in Australia and globally. His research has revealed that invasive predators have contributed

to more than 50% of bird, mammal and reptile extinctions worldwide. He is currently working on the behavioural and population-level responses of native mammals and reptiles to introduced cats and foxes, and the development of appropriate management strategies.

Ms Nicole Foster

University of Adelaide—Prioritising for success: Innovative approaches to management of coastal environments



Ms Nicole Foster completed a Bachelor of Science (Advanced) in 2015, majoring in ecology and botany at the University of Adelaide, with honours in ecology and environmental science in 2016. Her honours work focused on the ecological impacts of ocean acidification on marine organisms and resulted in two publications. Ms Foster is currently enrolled in a PhD in sciences at the University of Adelaide. Her research focuses on assessing environmental change through time in coastal vegetation communities using a multidisciplinary approach by combining isotopic analysis and DNA evidence, along with analysis of satellite data and aerial photography. Ms Foster has worked at the University of Adelaide as a laboratory assistant (2015–17) where she assisted in databasing plant specimens at the State Herbarium of South Australia and conducted a population genetics study on various species of seagrass. In 2017, she won the

Hansjorg Eichler award and she has given presentations at the Australasian Systematic Botany Society conference in Adelaide, as well as at a workshop run by Macquarie University on ancient DNA in marine sediments. In 2018 she won the Biology Society of South Australia research field grant and presented at the National Resources Management Conference in Adelaide and the World Seagrass Conference in Singapore.

Highly commended

Ms Anita Perkins

Southern Cross University—Fungi as degraders of kelp detritus: unravelling the role of fungi in coastal carbon cycling and storage



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Ms Anita Perkins completed a Masters of Research as part of a collaboration between Macquarie University and the IGB-Berlin Institute to investigate the presence of fungi in groundwater environments and assess the role of fungi in carbon cycling processes using a variety of organic polymers. As a PhD candidate, she expanded on this research using the abundant kelp wracks that are deposited along the Australian coast. Ms Perkins plans to 'close the gap' regarding how terrestrial and marine carbon cycles interact and how fungi contribute to this interaction through measuring kelp carbon degradation via multiple pathways and quantifying the role of different microbes, including fungi, in carbon processing.

Engagement program supports early- and mid-career researchers

Science at the Shine Dome offers unique opportunities for early- and mid-career researchers (EMCRs) to meet and exchange ideas with renowned scientists and to hear from newly elected Fellows and awardees about their latest research across a range of science disciplines.

Thanks to UniBank, **Presenting Partner—EMCR Engagement**, the event will feature a dedicated EMCR engagement program. This will allow EMCRs even more opportunities to connect with their peers and build meaningful networks. In addition to the main events held at the Shine Dome, EMCR attendees have the opportunity to participate in events at University House at the ANU.

Tuesday 28 May

- EMCR Masterclass: work–life management in STEM
- Networking dinner.

Thursday 30 May

EMCR Professional development workshop series

- Leadership development
- Industry engagement for impact
- Grant writing
- CV writing and interview skills.

UniBank General Manager, Mike Lanzing, said UniBank was ‘delighted to be the Presenting Partner for an important event series as part of Science at the Shine Dome 2019, in support of some of Australia’s

brightest minds. We believe cross-institutional partnerships are vital if we are going to support scientific ingenuity and sustainability around Australia.’

UniBank is committed to continuously creating and delivering exceptional lifetime banking experiences exclusively for university staff, students, graduates and their families. It is the only Australian company to be named one of this year’s World’s Most Ethical Companies by the Ethisphere Institute, a rating it has achieved for four years in a row.

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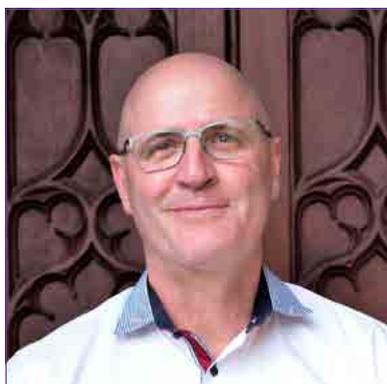
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Early- and mid-career researcher workshops

Workshop 1: Leadership development

Presented by Mr Philip Pogson,
The Leading Partnership



As researchers develop their careers, they typically play an increasing number of roles: teacher, mentor, lab or team leader, advocate and media commentator. Others become line managers or move into start-up businesses. All of these roles require leadership skills. This practical seminar is tailored to provide mid-career scientists with the opportunity to better understand their leadership style and to exercise thoughtful, ethical leadership in a range of contexts.

About the speaker

Mr Philip Pogson FAICD has consulted to universities, research organisations and independent medical research institutes for 25 years. He has developed leadership programs for academics, veterinary

students and senior medical clinicians. Originally trained as a classical musician in Australia and Europe, Mr Pogson works as a senior advisor, company director and company chair. He also runs a classical music and jazz production company. He holds a research degree in non-academic intelligences and lives in Sydney.

Workshop 2: Industry engagement for impact

Presented by Dr Julie Wheway,
gemaker



This workshop will equip you with insights and tools for getting out of the lab and building relationships with industry. Gemaker helps Australian researchers to have global impact by providing strategic advice, services and training to commercialise new knowledge and technologies. They have significant experience training researchers on

how to engage with industry, with more than 300 researchers from eight universities trained.

Dr Julie Wheway, Manager, Strategic Engagement will facilitate the workshop, which includes:

- finding industry connections
- developing listening, questioning and relationship-building skills
- developing a compelling value proposition
- planning a compelling pitch for potential industry partners.

About the speaker

As a STEM commercialisation specialist, Dr Wheway combines her passions for scientific research, science communication and technology transfer. At gemaker, Dr Wheway helps to take new ideas to market by developing and implementing commercialisation, funding and marketing strategies for research organisations and innovative businesses.

Prior to joining the gemaker team, Dr Wheway worked as a researcher and lecturer in the field of immunology. Her 15-year academic career saw her complete a PhD in Immunology at UNSW before going on to become a Young Garvan Postdoctoral Fellow in 2007, and an NHMRC Postdoctoral Fellow in 2009.



Our mission is to be the voice of Australia's EMCRs, championing improvement in the national research environment through engagement and advocacy.

Become a member Add your voice to EMCRs around the country and help create change. www.science.org.au/emcr-membership-registration

The EMCR Forum will keep you updated on the work we are doing and how you can contribute, as well as informing you about opportunities for professional development, networking, funding and awards. Membership is free.

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emcr@science.org.au

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Workshop 3: Grant writing

Presented by Professor Kylie Ball, Indago Academy



Everyone working in university or research settings needs to write and win grants or fellowships in order to test and progress ideas. Success rates for many schemes are depressingly low, so how do you approach writing a grant or fellowship application, and what are the secrets to success?

This workshop is aimed at researchers in the early stages of considering or starting to apply for funding, and will:

- support participants to develop a funding strategy
- discuss where and when to begin
- identify what funders are looking for
- provide key tips on writing the proposal
- explore strategies to remain resilient.

About the speaker

Professor Kylie Ball FAHMS is a world-leading researcher with 20 years' research and leadership experience. Professor Ball is an award-winning mentor, has consistently ranked in the top 1% of her field internationally and has attracted more than \$25 million in competitive research funding, including four consecutive NHMRC Fellowships. In 2017 Professor Ball established the Happy Academic blog (www.happyacademic.wordpress.com) as a virtual mentoring channel for researchers; it is recognised as one of the top 10 academic blogs worldwide. She has since founded Indago Academy (www.indagoacademy.com) to invest more in researcher development.

Workshop 4: CV writing and interview skills

Presented by Mr Paul Grainger, Professionals Australia



CV writing workshop

In this workshop, we will talk about how to get your CV to do its job

and get you an interview. Today virtually every company uses applicant tracking software to filter their applications. This is actually good news because we can show you how to reverse engineer the system to get your CV through. Once your CV is reviewed by us, your average improves to getting an interview for every five applications versus the industry average of about 30 applications per interview. Come along to this workshop and find out how!

Interview skills workshop

Interviews are not about determining your qualifications. Companies do not waste their time interviewing candidates who aren't qualified for the position. Interviews are about determining whether you are a good fit for their existing team. In our workshop we will teach you how to win the interview in three simple steps. Curious? Come along and find out how!

About the speaker

Mr Paul Grainger leads the Learning and Development Team at Professionals Australia. He has spent the past eight years helping thousands of STEM professionals find jobs they love, deliver exceptional results at work and build reputations as experts in their field. Prior to Professionals Australia, Mr Grainger was a senior policy advisor to state and federal members of parliament with a focus on industry and innovation.



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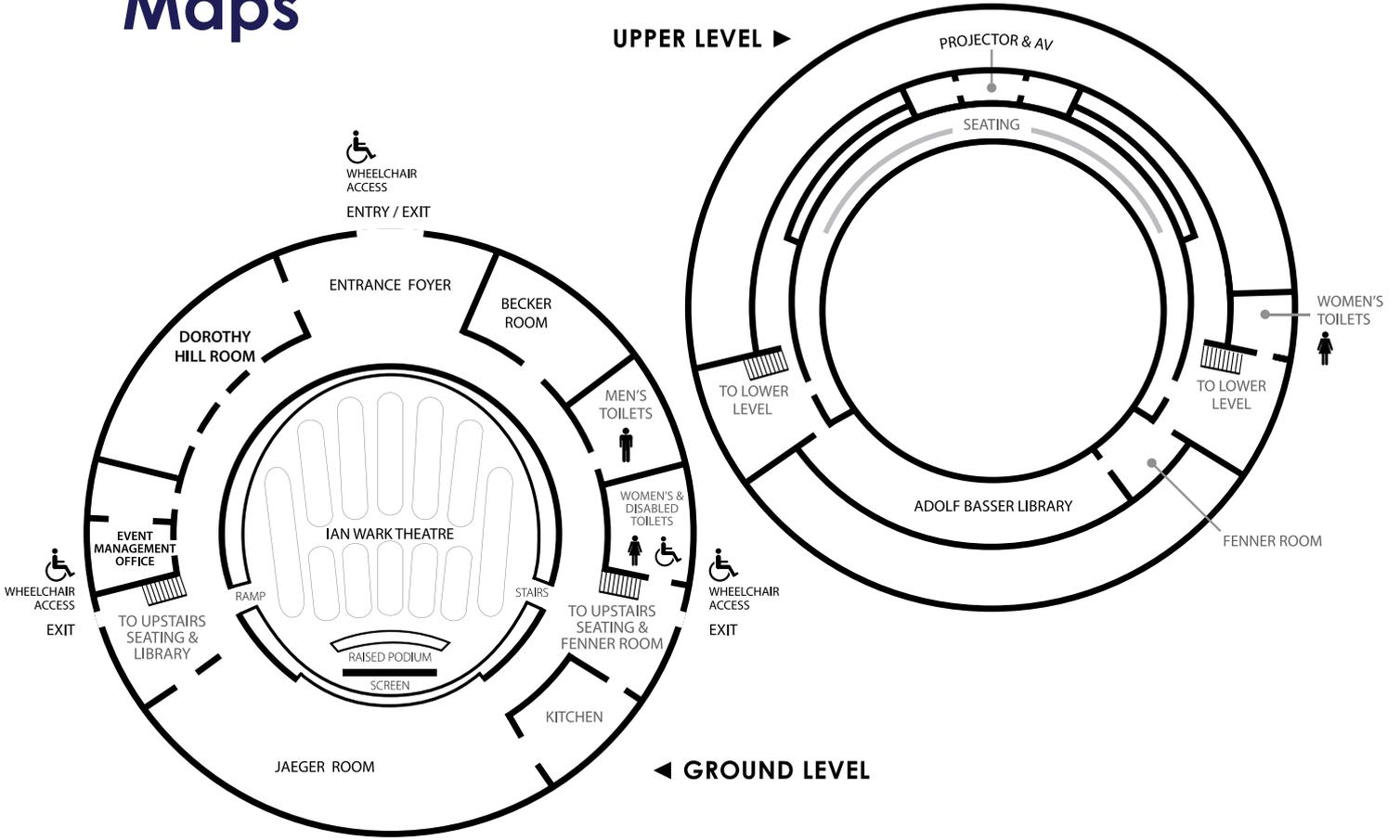
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Maps



Event information

Code of conduct

As per registration, all delegates attending Science at the Shine Dome 2019 have agreed to adhere to the Academy's Participants Conduct Policy. The policy is at science.org.au/code-conduct

Colour coding

Colour coding in the program matches the lanyards worn by delegates. Delegates are welcome at every session unless restrictions apply.

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

Photo sessions

Please meet in the foyer.

Tuesday morning tea

 EMCRs group photo

Tuesday lunch

 Symposium speakers and chairs group photo

Wednesday morning tea

 New Fellows group and individual photos

Wednesday lunch

 New Fellows individual photos continued

Thursday breakfast

 Aboriginal and Torres Strait Islander Scientist Travelling Research Award and Max Day Environmental Science Fellowship Award individual and group photos of awardees

Thursday lunch

 Honorific awardee individual photos

Information desk

The main foyer information desk will be staffed at all times for your assistance.

Event app

The Science at the Shine Dome event app is available through app stores for delegates to download on

all smartphones. The app contains information about the event, speakers and delegates, as well as an in-app messaging function to connect with delegates and speakers. Instructions on how to download and access this app are on the back of your name badge.

Please see information desk staff if you need assistance.

Luggage

Luggage can be left with staff at the information desk to be stored as required.

Parking

Limited free car parking is available in the Academy's Gordon St carpark.

The forecourt area of the Shine Dome is set down and pick up only.

Additional paid parking areas are marked on the Academy map on page 46.

Transfers

Gala dinner: Coach transfers will be provided to and from the National Museum of Australia for the dinner on Wednesday evening at 6.20 pm. Coaches will pick up and drop off at University House and QT Canberra. No bookings are required.

Coach to the airport: Transport to the airport from the Shine Dome will be provided at 4.30 pm on Thursday 30 May. Please let information desk staff know if you wish to take the coach but have not booked as part of your online registration.

Taxi

ACT Cabs **02 6280 0077**

Staff at the information desk can book taxis for delegates.

Accessibility

Two disabled parking spaces are available within the Academy car park.

The ground floor of the Ian Wark Theatre, Jaeger Room, Becker Room and amenities are all wheelchair accessible. Due to the heritage of

the building however, doorways into the venue are only equipped for access by standard wheelchairs. Please see the information desk if you require assistance.

Hearing loop

The entire Ian Wark Theatre is equipped with an infrared hearing loop. Please see information desk staff to obtain a device.

Parents' quiet room

A parents' quiet room is available next to the Event Management Office in the Shine Dome. Please see the information desk if other facilities are required (water, microwave etc).

First aid

In case of emergencies or first aid please see an Academy staff member at the information desk.

Wi-fi

Network: SHINEDOME

Password: 5hinedome

Please disable personal mobile hotspots while in Academy buildings these slow down the network for all delegates.

Contacts

The following Academy staff are available to assist you. Please don't hesitate to call them.

General enquiries

Lisa Crocker **0488 044 186**

Lindau delegates

Hayley Teasdale **0432 822 191**

Early- and mid-career researchers

Sandra Gardam **0488 400 119**

New Fellows

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Awardees

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