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31 October 2018

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'Towards a Prosperous yet Sustainable

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Patron of The Royal Society of NSW

His Excellency General The Honourable

David Hurley AC DSC (Ret'd)

Governor of New South Wales

Open Lecture & OGM

'Breakthrough! The Detection of Gravitational Waves from a Neutron Star Merger'

Associate Professor Tara Murphy

School of Physics

University of Sydney



See page 3 for more information

Date: Wednesday 7th November 2018

Time: 6:00 pm for 6:30 pm

Venue: Gallery Room, State Library of NSW
(Entrance: Shakespeare Place, Sydney)

Dress: Business

Entry (including a welcome drink): \$15 for Members and Associate Members of the Society, \$5 for Students, \$25 for Non-Members.

Dinner (including drinks): \$85 for Members and Associate Members, \$95 for Non-Members.

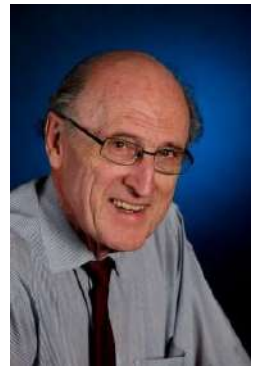
Reservations must be made at least 2 days in advance

Reservations: <https://nsw-royalsoc.currinda.com/register/event/53>

Enquiries: royalsoc@royalsoc.org.au Phone: 9431 8691

All are welcome.

From the President – A Special Prize for a Distinguished Fellow



I am delighted to be able to tell you that the 2018 Prime Minister's Prize for Science has gone to our Distinguished Fellow Kurt Lambeck FRS FAA DistFRSN.

According to 'The Conversation' of October 17:

The award recognises Lambeck's 50-year contribution to Australian and global science through his research 'watching' planet Earth – it's a specialist field known as geodesy.

His work enables more accurate guidance of satellites and space missions, helps track changes in sea levels over time, and facilitates detailed understanding of the deep structure of Earth.

Lambeck's research also underpins the GPS technology on which we rely for accurate navigation.

'The Earth is remarkable. It has this wonderful record of its history going back to almost its very beginning. Almost everywhere you look, you learn something new about what's been going on in our planet,' Lambeck said.

Kurt Lambeck recognised early in his career that the earth's surface is not static, and that its detailed movements needed to be studied and recorded, because they tell us of the changes happening underneath our feet. According to the prize announcement from the Prime Minister's office:

Kurt Lambeck AO has revealed how our planet changes shape—every second, every day, and over millennia. These changes influence sea levels, the movement of continents, and the orbits of satellites. Kurt's original work in the 1960s enabled accurate planning of space missions. It led him to use the deformation of continents during the ice ages to study changes deep in the mantle of the planet. It also led to a better understanding of the impact of sea level changes on human civilization in the past, present and future.

Geodesy is concerned not only with the shape of the earth but also with its intricate gravitational fields. Again from the official announcement:

Kurt discovered that the gravity field of the Earth was much more complex than anyone had thought. That turned out to be important for spaceflight, because the gravity field determines trajectories of satellites, and we needed better gravity field models to be able to navigate to the moon and beyond. But for Kurt, what was more important was the insight that changes in the planet's gravity field were directly related to plate tectonics, the movements of continents on the Earth's surface.

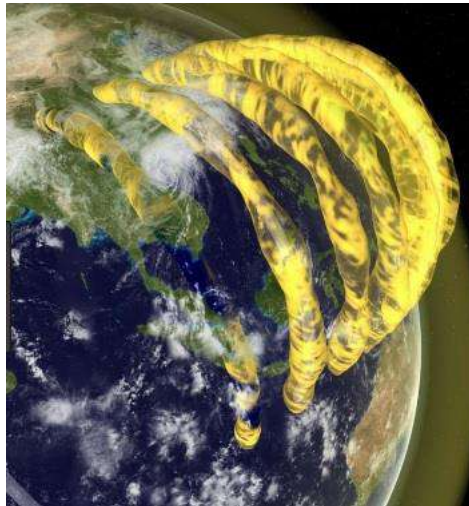
I know you will want to join in celebrating this special prize for one of our own.

Ian H. Sloan AO FAA FRSN
President, Royal Society of New South Wales
President@royalsoc.org.au

Associate Professor Tara Murphy

School of Physics
University of Sydney

‘Breakthrough! The Detection of Gravitational Waves from a Neutron Star Merger’



On August 17th 2017 the LIGO-Virgo interferometer detected gravitational waves from a neutron star merger in a galaxy 130 million light years away. This was a breakthrough for physics and astronomy. What followed was a frenzy of activity as astronomers around the world worked to discern electromagnetic radiation with conventional telescopes. After this unprecedented effort the event was observed in gamma-rays, x-rays, visible light and radio waves. I will discuss this incredible scientific result and its implications, including: predictions made by Einstein; the production of gold and other heavy elements; and our understanding of black hole formation. I will also give a ‘behind the scenes’ perspective of how it happened, and discuss the changes in the way we do science in this era of big astronomy.

Associate Professor Tara Murphy is an astrophysicist working at the University of Sydney and an Australian Research Council Future Fellow. She has a Bachelor of Science from the University of Sydney and a PhD in astrophysics from the University of Edinburgh. Tara leads an international team of researchers trying to identify and study transient and highly variable astrophysical phenomena with the MWA and ASKAP radio telescopes in Western Australia. In 2017 her team detected the first radio emission from a gravitational wave event caused by the merger of two neutron stars. Tara is also passionate about teaching and public outreach. In 2014 she co-founded a start-up company, Grok Learning, to get high school students around the world excited about computational thinking.

Royal Society – Southern Highlands Branch

Dr Dana Cordell

Research Director

Institute for Sustainable Futures
University of Technology, Sydney

‘Sydney’s Food Futures’



Date: Thursday 15 November 2018, 6.30 pm start

Location: 1st Floor, Joadja/Nattai, Mittagong RSL

Sydney’s Food Futures is a collaborative research project being undertaken by the Institute for Sustainable Futures at the University of Technology, Sydney, in conjunction with a number of government and industry partners. There are enormous benefits to growing fresh food in the Sydney basin – and, indeed, near any city. Perishable foods like Asian greens and eggs can be grown close to market, thereby reducing spoilage, supply chain waste and food miles, and buffering against fuel price shocks. Agriculture and food processing are labour-intensive, providing significant local job opportunities. In fact, the benefit of Sydney’s agriculture to the economy is estimated at upwards of \$4.5 billion.

Loss of agriculture therefore presents serious risks to the resilience of the city, the health of residents and the viability of farmers’ operations. For example, a disruption in the major transport routes into Sydney from a bushfire or fuel shortages could leave Sydney with only days’ worth of fresh produce. This research finds that if we continue down the path we are on, Sydney stands to lose over 90% of its current fresh vegetable production. Sydney foodbowl’s capacity to feed its residents could drop from meeting 20% of food demand down to a mere 6%.

However a wide range of future food production scenarios demonstrate that the path we’re on – urban sprawl – needn’t be set in stone: sustainable strategies and innovations could open up possibilities for increasing food production in the basin, while providing for 1.6 million new residents over the next 15 years, thereby balancing housing with food production, environmental protection and health.

Dr Dana Cordell leads the Food Systems research group at the Institute for Sustainable Futures, UTS. She directs and undertakes international and Australian research projects on sustainable food and phosphorus futures. She has worked on collaborative projects with partners in Australia, Vietnam, Sri Lanka, India, Malawi, Sweden, the UK, EU and the US. As a leader in global food security, Dr Cordell provides expert advice and commentary to the United Nations Environment Programme (UNEP), Australia’s Chief Scientist and the UK Parliament. She most recently joined UNEP’s Global Environment Outlook team as a food security contributor. Dr Cordell’s research contributions have led to numerous prestigious recognitions including one of Australia’s top science prize, the Eureka Prize for Environmental Research (2012).

Anne Wood FRSN

Great Australians You Have Never Heard Of

Lecture 4

A Geologist, Geographer and Anthropologist

Professor Alison Bashford FRSN

School of Humanities & Languages UNSW



Our final Great Australian was a geologist, geographer, and anthropologist. His travels took him from Scott's final expedition in Antarctica to every continent on Earth, in a life that stretched from the South African War to the Cold War. Highly controversial in 1920s Australia, he relocated to the University of Toronto, pursuing a stellar career. Yet this Great Australian has been both acclaimed and derided as one of the twentieth century's most insistent environmental determinists. Join Alison Bashford to learn this Great Australian's identity and to hear about his remarkable life.

Alison Bashford FRSN is Research Professor in History, UNSW. Her work connects the history of science, global history, and environmental history into new assessments of the modern world, from the eighteenth to the twentieth centuries. She has recently focused on the geopolitics of world population, presented in two books: *The New Worlds of Thomas Robert Malthus: Re-reading the Principle of Population*, with Joyce E. Chaplin (Princeton University Press, 2016) and *Global Population: History, Geopolitics and Life on Earth* (Columbia University Press, 2014).



Before taking up her Research Chair, Alison Bashford was the Vere Harmsworth Professor of Imperial and Naval History at the University of Cambridge, Fellow of Jesus College, Cambridge, and Trustee of Royal Museums, Greenwich, UK. In 2009-10 she was the Whitlam and Fraser Chair of Australian Studies at Harvard University's Department of the History of Science. She has researched and taught at the University of Sydney and the Australian National University, and is a Fellow of the British Academy and of the Australian Academy of Humanities.

- Date:** Monday 12 November 2018, 6pm for 6.30 to 7.30pm. Light refreshments will be served.
- Cost:** \$15 members of RSNSW and SMSA, \$20 non-members and guests
- Location:** Mitchell Theatre, Level 1, Sydney Mechanics' School of Arts, 280 Pitt St, Sydney (near Town Hall Station)
- Registration:** <https://smsa.org.au/events/event/great-australians-youve-never-heard-of-4/>

Australian Institute of Physics, Royal Australian Chemical Institute and Royal Society of NSW Joint Lecture

Tibor G Molnar

Department of Philosophy, University of Sydney

‘Alice and Bob in Wonderland’

Date: Tuesday 13th November 2018

Location: University of New South Wales, Room G59/60 Old Main Building

Time: 5.30-6.00 pm **Refreshments**

6.30-7.30 pm **Lecture**

8.00 pm **Annual Dinner** with the Speaker at Giovanna Restaurant, 285 Anzac Parade, Kingsford. Email Dr Fred Osman (fosman@trinity.nsw.edu.au) if you are able to join us for dinner.

Free Event - Everyone Welcome

Like Lewis Carroll’s *Wonderland*, our own ‘real’ world appears to be filled with endless surprises. Might we, too, be wandering around down a rabbit-hole? With ever-more-powerful instruments, we peer further and further into the unknown. What we find is mostly novel, unexpected, surprising. This is what makes Science so interesting. It is also what makes Science difficult. While technologically challenging, performing experiments and making observations is the easy part of scientific research. Describing our observations is even easier. The hard part is *interpreting* what we see – ‘*making sense*’ of the patterns, correlations, invariances and regularities apparent in the data. Not only is ‘making sense’ hard, it is, strictly speaking, not even *scientific* – observations/experiments don’t come with instructions for how to make sense of them. Rather, ‘making sense’ is a task for *metaphysics* – something which scientists, and especially physicists, tend to eschew with a passion! Absent metaphysics, the physicists’ tool-of-choice is the so-called ‘Language of Science’: mathematics. Produce the correct mathematical formulation, they say, and all is explained! Well, not so. Mathematics is a powerful tool, but it is not at all suited to the task of ‘making sense’. Mathematics can *describe* patterns and correlations, but it cannot tell us what they *mean*. We all expect that Science help us ‘*make sense*’ of the world, an expectation that contemporary physics is finding increasingly difficult to meet. In this presentation, Tibor Molnar explores this problem of ‘making sense’, and suggests that a little *metaphysics* – so-called ‘Analytic Philosophy’ – might actually help to achieve it.

Tibor Molnar studied Chemical Engineering at UNSW in the 1960s, but then forged a career in IT and business. Retired in 2003, he now pursues a wide range of interests: from physics and neuroscience to AI and philosophy. An Honorary Associate of the Department of Philosophy, University of Sydney, Tibor teaches Philosophy and Science at the university’s Centre for Continuing Education and the WEA. A book is also on the way. For Tibor, the pursuit of understanding is the most rewarding of human endeavours, and his enthusiasm for Science in all its forms is well reflected in his presentation style.



RSNSW and Four Academies Forum 2018

‘Towards a Prosperous yet Sustainable Australia: What now for the lucky country?’



Hosted by His Excellency General The Honourable David Hurley AC DSC (ret'd.), Governor of NSW and Patron of the Royal Society of NSW

Date: Thursday, 29 November 2018, 9am–4.30pm, followed by drinks reception

Location: Government House, Sydney

Bookings: Details of how to book will be announced shortly. Numbers will necessarily be limited.

Australia's 27 years of uninterrupted growth, the longest period without a recession of any developed country, puts it in an enviable position. Yet polling of the Australian population shows a large diversity of opinion on whether people feel better off. Rising wealth inequality, unaffordable housing, increasing traffic congestion, under-employment and increasingly polarised political opinion are hardly signs of a prosperous and harmonious society. Our environment is also suffering – loss of biodiversity, wildlife habitat and topsoil through land clearing and land-use change; the health and resilience of our river systems, forests and agricultural industries are subject to an inexorably warming climate and greater weather extremes.

Is the focus on growth and GDP pushing Australia in the wrong direction? Does Australia have an optimal population? What happens when we stop borrowing from future generations to support our current lifestyles and incessant consumption? Is a steady-state society possible, or desirable, and if so what would it look like?

The 2018 Royal Society of NSW and Four Academies Forum will examine the implications of the focus on growth (as measured by GDP) and population on our society, our economy and the environment. What are the social constructs and economic assumptions on which government policies are based? Our economy has become bifurcated towards resources and services – is this a healthy evolution or is it a hollowing-out of the economy that imperils Australia's future? What role can science and technology play in a world of increasing automation and computer power? Join us for a day dissecting the big questions facing Australia today and into the future.

**Report of the 1267th OGM
Wednesday 3rd October 2018**

Professor Gordon Wallace AO
University of Wollongong

‘3D Printing of Body Parts: Practical Applications and Fundamental Explorations’



Professor Gordon Wallace AO presenting at the OGM

Professor Wallace is Executive Research Director of the Australian Research Council Centre of Excellence for Electromaterials Science (ACES) and Director of the Australian National Fabrication Facility (ANFF), Materials Node, at the University of Wollongong (UoW). His research focuses on the design and discovery of new materials for use in energy and health. In his talk, he presented how converging technologies deliver clinical solutions assisted by a collaborative research network. This effective collaboration works on multiple levels by combining research into new materials, cell technologies and additive fabrication, subsequently tackling clinical needs as well as addressing regulatory matters and looking at social acceptance. For example the research on carbon that produced graphene (Nobel prize in physics in 2010) led to the development of an implantable graphene electrode for neural stimulations. He refers to Graeme Clarke’s book *Sounds From Silence: The Bionic Ear Story* as illustrating Australian leadership in delivering clinical solutions with interdisciplinary research collaborations.

3D printing is an ideal method for finding new clinical solutions as it builds up layer by layer, is localised, adaptable to many materials and can be customised. There are various structural biopolymers that can be used; it is important to establish a materials inventory and track the source. Professor Wallace showed examples of different applications of printing graphene, a soft conductor. Delivery of bioactives is also possible by inkjet printing of cells.

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By establishing a clinical network for research and technology, their team developed 3D printing protocols for nerve conduits. *In situ* handheld 3D bio-printing is used for cartilage regeneration. The 'iFix Pen' applies 3D printing bioinks to treat corneal ulceration. For the development of 3D printed ears, a map of mechanical distribution was established using hybrid printing with enhanced chondrogenesis and tailoring mechanical properties to mimic the human ear. This customised printing system project for ear cartilage, '3D Alek', is part of the Australia-India research collaboration programme. 'Brain on a bench' makes more accurate models of the brain by using 3D printing in comparison to previously used 2D systems. This is also helping scientists to move away from animal models to *in vivo* imaging to obtain not only a clearer picture of neurodegenerative diseases, but also assisting in pharma testing, developing electroceuticals and prosthetic interfaces. In order to build skills and capacity in this new technology, ACES offers training courses, e.g., a free online course 'Bioprinting: 3D printing body parts' (see https://www.futurelearn.com/courses/bioprinting?utm_campaign=university_of_wollongong_bioprinting_february_2017&utm_medium=cpc_social&utm_source=linkedin).



Distinguished Fellow Emeritus Professor Peter Baume AC (centre) presenting the speaker with a medal after the talk, assisted by Vice-President Judith Wheeldon AM FRSN

Professor Wallace invited the audience to visit UoW's Innovation Campus if they would like to learn more. This was welcomed. In question time, he explained that the stabilisation of the 3D structures uses phase transformations that can be provoked by (UV) light, temperature changes, electrical and magnetic fields, etc. Traditional bio-manufacturing will be challenged by the new techniques because of the possibility to customise implants. An important aspect is provision of primary source materials. In order to make stem-cell production more viable, it will be vital to get good characterisation tools. For many years his group has worked in international and interdisciplinary collaboration and so they have developed protocols for intellectual property. They are also aware that they need to engage with people, especially in view of ethical questions on aspects like the 'brain in the bench'.

Report of 18 October 2018

Royal Society Southern Highlands Branch

Hugh Mackay AO

‘The State of the Nation Starts in your Street’

An audience of 83 greeted Hugh Mackay as he arrived for his lecture to the Southern Highlands Branch of the Royal Society. He is a prolific writer in the social research space, having just published his 19th book *Australia Reimagined – towards a more compassionate, less anxious society*. In recognition of his pioneering work in social research, Hugh has been elected a fellow of the Australian Psychological Society and awarded honorary doctorates by Charles Sturt, Macquarie, NSW, Western Sydney and Wollongong universities. He was appointed an Officer of the Order of Australia in 2015.



In previous lectures to the Royal Society Southern Highlands Branch, Hugh Mackay has presented compelling research analysis and conclusions he had reached after questioning numerous Australians about their basic concerns, the factors that are most important to them in life, and why they do what they do. He has now extended these studies to ask how it is possible that, despite all the natural advantages that we enjoy, such as peace, affluence, stable parliamentary democracy, freedom of assembly, press and religion, our country is experiencing a troubling epidemic of anxiety, at the same time becoming unquestionably more fragmented. The anxiety issue is now clearly societal as well as personal.

Mackay presented remarkable statistics to support his argument about anxiety and depression levels. One-third of us are likely to be affected by mental illness at some time in our life, with over 65,000 Australians attempting suicide each year. Two million of us suffer from an anxiety disorder in any one year, with one million engaged in the silent battle against depression. The relationship between such anxiety levels and the accompanying societal fragmentation is described by Mackay as two sides of the same coin.

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It does not take much imagination to understand the link between these twin factors and the societal context in which they exist. Because we are herd animals by nature, we become anxious when we are cut off from the herd, and our anxiety in turn induces the kind of self-absorption that further inhibits social interaction. Mackay mentioned solitary confinement in this context as one of the worst punishments we can imagine. In our society, it is not difficult to find examples where being cut off from the herd is taking place. We need only look at the rate of relationship breakdown, our shrinking households, our busy lives and our ever-increasing reliance on information technology. Mackay's view is that when such social fragmentation, exacerbated by rampant individualism and competitive materialism, is occurring, the social fabric is inevitably damaged and so too our capacity for greatness.

Hugh Mackay concluded his lecture on a positive note, explaining why he had chosen the title, *The State of the Nation Starts in your Street*. The title sprang from his firm belief that how we choose to live will help determine the kind of neighbourhood ours will become, and the composite character of all neighbourhoods determines the kind of society we will become. How responsive we are to the needs of those around us, how ready we are to engage with, rather than ignore, our neighbours, how willing we are to contribute to the life and health of the community, how determined we are to cooperate rather than compete...these are hugely influential factors in shaping the state of the nation, because the state of the nation is a reflection of the state of our society and that ultimately depends on the quality of our interactions with each other. A beautifully presented and thought-provoking evening.

Anne Wood FRSN

Yingyod Lapwong Presents 'Know Your Alien'

Continuing our new series of presentations by winners of 3-Minute Thesis Competitions, the 2018 winner of the Faculty of Science UTS Competition Mr Yingyod Lapwong presented 'Know Your Alien' at the October OGM. His research focuses on the invasion and impact of alien species on the environment in view of developing adequate control management systems. Every year, the government spends a lot of money and effort to try to curb these unwanted species. With more understanding about them, we might develop better management systems to control them.



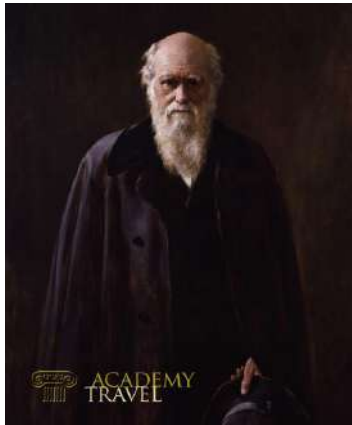
Specifically, Yingyod is studying the behaviour of the Asian house gecko (indigenous to Thailand), which was accidentally introduced to Northern Australia several decades ago and is now moving into NSW. After the presentation he received his Associate Membership from the Vice-President.

The History of Science:

Padua – Florence – Paris – London

A tour for the Royal Society of NSW in conjunction with the
State Library of NSW Foundation

19 September – 4 October 2019



Overview

Explore the history of science from Vesalius in Padua, to Galileo in Florence and the flourishing of modern science in Paris and London. This 16-day private tour for the Royal Society of NSW in conjunction with The State Library of NSW Foundation includes guided visits to many exceptional museums, rare access to collections, libraries and archival material, and the expert guidance of specialists and curators. It follows the great story of modern science, taking you from Padua, to Florence, Paris and London and includes day trips to Bologna, Siena and Cambridge. A four-night pre-tour extension to Venice is also available.

Discover

- The birth of modern science, from Galileo's telescopes to Darwin's theory of evolution
- The history of medicine: Vesalius in Padua, Pasteur in Paris and the medical collections of London
- The transmission of knowledge, from rare books and manuscripts to the modern museum
- The history of the university at Padua, Bologna, Paris and Cambridge
- Interaction between the arts and sciences in moments of great change from the Renaissance to the modern world.

Tour Details

Dates: 19 September – 4 October 2019

Price: \$9,270 pp. twin share; \$2,280 single supplement

For more information and to register your interest contact: Academy Travel, 9235 0023

info@academytravel.com.au.

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The History of Science (contin.)

Tour Highlights

- Padua: the world's first anatomy theatre, the oldest botanic garden and Giotto's Scrovegni Chapel
- Special access to library collections in Florence, Paris and London
- Private tour of the Pompidou Centre, Paris' modern art museum
- Day trips to Siena, Bologna, Cambridge and Greenwich
- Specialist museums dedicated to Pasteur, Curie, Galileo & Darwin
- London science: from the manuscripts of the Wellcome Library to the National Science Museum.

Itinerary



Days 1–3: Arrive Padua; visit the world's oldest anatomy theatre and oldest botanic garden, visit Scrovegni Chapel, Giotto's masterpiece; day trip to Bologna.

Days 4–6: Explore Florence, including the Galileo Museum, Uffizi, and special access to rare collections; day trip to Siena and the wonderful cuisine of Chianti.

Days 7–10: Discover a different side of Paris, from special museums dedicated to Pasteur and Curie to a private tour of the Pompidou Centre.

Days 11–15: Arrive London. Enjoy visits to Down House, the home of Charles Darwin, the National Observatory and prime meridian at Greenwich, and a range of museums from the Museum of Natural History, to the private collection of the Royal College of Physicians; day trip to Cambridge.

Day 16: Departure.

Tour Leader

Emeritus Prof Robert Clancy AM FRSN has a distinguished career in medical research and has published books on the early mapping of Australia. He has led many similar successful expeditions. Expert guides will meet the group in each destination.

Maximum Group Size: 20



Schedule of RSNSW Events 2018

Date	Event	Speakers	Topics and Presentations	Location
7-Nov-18	Ordinary General Meeting	A/Prof Tara Murphy	Breakthrough! The Detection of Gravitational Waves from a Neutron Star Merger	State Library of NSW
12-Nov-18	Great Australians Lecture 4	Prof Alison Bashford	Great Australians You Have Never Heard Of: A Geologist, Geographer and Anthropologist	SMSA
13-Nov-18	AIP, RACI & RSNSW	Tibor G Molnar	Alice and Bob in Wonderland	UNSW, Rm G59/60 Old Main Bldg
29-Nov-18	RSNSW & Four Learned Academies Forum	TBA	Towards a Prosperous yet Sustainable Australia: What now for the lucky country?	NSW Government House
5-Dec-18	Ordinary General Meeting	Jak Kelly Award Winner	2018 Jak Kelly Award Presentation & Christmas Party	State Library of NSW

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