



# The Bulletin 433

The Royal Society of New South Wales

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## For Your Diary:

**18 July 2019**

**Southern Highlands Branch Lecture  
Dr Christian Heim & Dr Caroline Heim**

**'Understanding the Mental Health  
Crisis and How Your Relationships  
Can Save You'**

*(For more information, see p. 4)*

**18 July 2019**

**RSNSW & SMSA**

**Women and Science**

**Lecture 4: 'Visual Perception and  
Aboriginal Art'**

**Em Prof Barbara Gillam FRSN**

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**23 July 2019**

**Dirac Lecture**

**'Nothing Goes Faster than Light -  
Usually!'**

**Prof Lene Vestergaard Hau**

*(For more information and how to  
register, see p. 6)*



**Patron of The Royal Society of NSW**

**Her Excellency The Honourable Margaret  
Beazley AO QC  
Governor of New South Wales**

## 1274<sup>th</sup> OGM & Open Lecture

# 'Past, Present and Future of Polymers:

# Is the Plastics Age Over?'

## Wednesday, 3<sup>rd</sup> July 2019

### Em Professor Robert Burford FRSN

School of Chemical Engineering  
University of NSW



*See page 3 for more information*

**Date:** Wednesday 3<sup>rd</sup> July 2019

**Time:** 6:00 pm for 6:30 pm

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

**Dress:** Business

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

**Dinner (including drinks):** \$85 for Members and Associate Members,  
\$95 for Non-Members, \$70 for students.

**Reservations:** <https://nsw-royalsoc.currinda.com/register/event/58>

**Enquiries:** [royalsoc@royalsoc.org.au](mailto:royalsoc@royalsoc.org.au) Phone: 9431 8691

**All are welcome.**

# From the President



As a mathematician I am often asked, ‘How can people do research in mathematics? Hasn’t it all been done already?’ I have been reflecting on this since I had the recent privilege of spending five weeks at Cambridge’s Newton Institute, or to give it its full name, ‘The Isaac Newton Institute for Mathematical Sciences.’ This remarkable Institute, now 25 years old, is dedicated to 6-months-long programs that bring together researchers from around the United Kingdom and the world, all with expertise related to a particular theme. During each program there are occasional workshops with lectures on current research by colleagues, but most of the time is reserved for informal, unsupervised research, preferably collaborative. Outreach to industry is also a significant part of its mission.

My program had the difficult title ‘Approximation, Sampling and Compression in Data Science’. What was it about? One aim was to gain a mathematical understanding of the computer-based methods (e.g., ‘deep learning’) used nowadays to analyse the mountains of data collected by Google, social media platforms, health and security agencies, and many other organisations. An example is facial recognition. The idea behind deep learning in this example is that a computer algorithm is trained to distinguish images by looking at vast numbers of examples. (I skip the technical description!) The problem made clear during the program is that while such ‘deep networks’ are often successful in practice, there is poor understanding of why and when they work or don’t work. Does that matter? Maybe it does not matter if a merchant has the wrong idea of your culinary preferences, but if your surgeon is relying on a deep network to guide his knife, then it would be comforting to know that this piece of artificial intelligence can be relied upon.

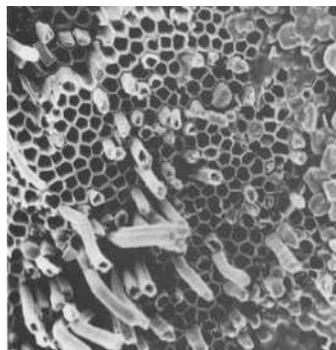
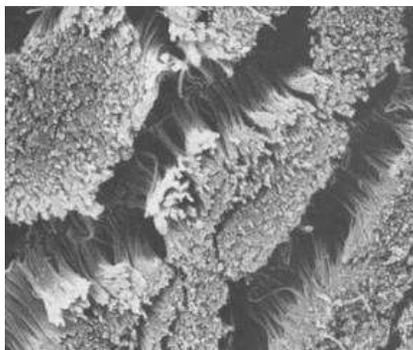
There are other remarkable mathematical research centres around the world: in Vienna, Montreal, Toronto, China, France, several in the United States, and yet others. The earliest, and perhaps most famous, is the German centre in Oberwolfach, an isolated village beautifully situated in the Black Forest. It was set up during the Second World War as a refuge for research mathematicians. (Its model is different, being based mainly on week-long workshops on specific topics, each with 40 or so invited participants from around the world.)

I am glad to say that there is now a fledgling research centre with similar programs closer to home: called ‘Matrix’, it is located in Creswick, Victoria, in the beautiful setting of the old Forestry School, and is supported by both Melbourne and Monash Universities. And finally, a source of special pride is the new Sydney Mathematical Research Centre, set up by Sydney University, with Anthony Henderson as Executive Director and Geordie Williamson, one of our own Fellows, as Director. Its model is different again, with a large focus on bringing distinguished international researchers to Sydney and Australia. This is a wonderful initiative, one already having significant influence on mathematical research in Australia.

Ian H. Sloan AO FAA FRSN  
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Royal Society of New South Wales  
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**Em Professor Robert Burford FRSN**  
School of Chemical Engineering  
University of NSW

## **‘Past, Present and Future of Polymers: Is the Plastics Age Over?’**



Polymers (Source:  
Jaleh Mansouri &  
Robert Burford)

The search for synthetic alternatives (including polymers) to scarce natural materials is not new, and substitution occurred well before today’s plastic bottles and packaging. A reward of \$10,000 for billiard balls, hitherto made from Sri Lankan elephant tusks, ultimately led to thermosets derived from cellulose. Synthetic nylon stockings replaced unavailable silk (and made Du Pont wealthy) whilst synthetic rubber helped win the war. The early history of polymer manufacture combines uneducated invention and entrepreneurship with debtor’s courts and skulduggery. During the 20th century today’s ‘commodity’ polymers emerged, these being based on hydrocarbons including ethylene and propylene. The public appetite for new synthetics that peaked in the 1950s and 60s (think of the movie *The Graduate*) has reversed despite polymer production showing unabated growth. Scarcely a day now passes without reminders of waste, whether it is floating ‘continents’ or containers of Australian plastic being returned from overseas. The solutions to today’s ‘polymer pollution’ need creative ideas and imaginative solutions but may provide lucrative opportunities. Several possibilities will be discussed that may catalyse blue-sky input from the audience.

**Emeritus Professor Robert Burford FRSN** has made and broken plastics and rubber for over 40 years, first investigating cracking in nylons before research at the Australian Synthetic Rubber Company. Since joining UNSW in 1978 he has interacted with the polymer industry at many levels. He took students to draconian factories to motivate them beyond the factory floor, was a Co-op Program coordinator to attract top students to sometimes enter the same factories, and has been actively engaged in consulting, often examining polymer failures. He was a lead researcher with the Cooperative Research Centre for Polymers, helping for example to develop a new family of fire performance cables. He retired as Head of Chemical Engineering at UNSW in 2014 but still consults and volunteers at the Powerhouse Museum in conservation.

# 2019 Events

## Royal Society – Southern Highlands Branch

Date*	Event	Speaker	Topic	Location**
18-Jul-19	Public Lecture	Dr Christian Heim & Dr Caroline Heim	Understanding the Mental Health Crisis and How Your Relationships Can Save You	Mittagong RSL
15-Aug-19	Public Lecture	Prof Rick Shine	Sequencing the Cane Toad Genome (DNA)	Mittagong RSL
19-Sep-19	Public Lecture	Dr Rebecca Carey	Volcanology	Mittagong RSL
17-Oct-19	Public Lecture	Prof Toby Walsh	2062 - The World that Artificial Intelligence Made	Mittagong RSL
21-Nov-19	Public Lecture	Prof Geordie Williamson	t.b.a.	Mittagong RSL

\*Lectures are normally the third Thursday of each month.

\*\*1st Floor, Room Joadja/Nattai.

### Dr Christian Heim FRANZCP

Consultant Psychiatrist

&

### Dr Caroline Heim

Senior Lecturer, Queensland  
University of Technology

## ‘Understanding the Mental Health Crisis and How Your Relationships Can Save You’



It seems we all know someone grappling with mental illness, the problem of rising concern, particularly for our younger people. Almost 1 in 5 adults in our society is on an antidepressant and this number is rising. It is estimated that half of us will experience mental illness in our lifetime. Behind the closed doors of his office, Dr Heim has heard thousands of heart-breaking stories. It is time to change those stories. Drawing from his 18 years of clinical experience, the latest scientific evidence and their own research, this team share remarkable insights into why mental illness rates are soaring and give practical advice to help prevent it in your life. In this lecture, Doctors Christian and Caroline Heim combine science and entertainment to help you get the right DOSE of four healthy brain chemicals. They will illustrate how relationships with people on all levels – from partners, family and friends, to people in greater society – can help us all to create mentally-healthy, pleasurable lives.

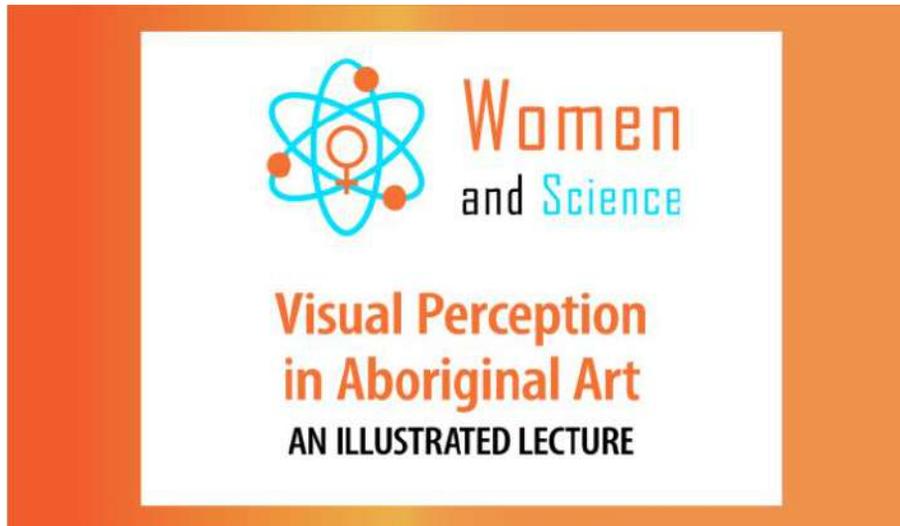
Dr. Christian Heim is a clinical psychiatrist, Australian music lecturer and a Churchill fellow. He is an associate senior lecturer at the University of Queensland in the School of Medicine. Dr. Caroline Heim is a senior lecturer in Theatre at Queensland University of Technology. Her research interests are in the area of audience reception and actor/audience relationships.

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Royal Society of New South Wales & Sydney Mechanics' School of Arts

## Women and Science: Lecture 4

Em Professor Barbara Gillam FRSN



Aboriginal painting now has a world-wide reputation. However it has largely been regarded as conceptual rather than perceptual with a very strong emphasis on the stories depicted. In the fourth Women and Science lecture, Barbara Gillam will examine the innovative perceptual skills of Aboriginal bark painters, especially in depicting figure-ground and occlusion. She will also discuss the visual meaning of this art and its interaction with conceptual meanings.

**Professor Barbara Gillam FRSN** was educated at the University of Sydney and ANU. After two years as a Lecturer in the UK, she moved to New York with academic positions at Columbia and the State University of New York. She returned to Australia in 1987 to take up the Chair of Psychology at the University of New South Wales, where she is still a professor.



**Date:** Thursday, 18 July 2019  
**Time:** 6 pm (for registration and light refreshments), talk 6.30 to 7.30pm  
**Cost:** \$15 members of RSNSW and SMSA, \$20 non-members and guests  
**Location:** Tom Kenneally Centre, Sydney Mechanics' School of Arts, 280 Pitt St, Sydney  
**Registration:** <https://smsa.org.au/events/event/visual-perception-aboriginal-art/>

# The Dirac Lecture

**Professor Lene Vestergaard Hau**

Mallinckrodt Professor of Physics and Applied Physics

Harvard University

**‘Nothing Goes Faster than Light - Usually!’**



This year’s lecture will explore how Lene and her team have slowed, stopped and restarted light. The observations represent the ultimate control over the inter-conversion of light and matter, and point to novel paradigms for quantum information processing.

*‘In our laboratory, we have used ultra-cold atom clouds to slow light pulses to the speed of a bicycle, which is 50 million times lower than the light speed in a vacuum. In the process, a light pulse spatially compresses by the same large factor, from 1 km to only 0.02 mm, and the pulse can then be completely stopped and later restarted.*

*‘From here, we have taken matters further: stopped and extinguished a light pulse in one part of space and revived it in a completely different location. In the process, the light pulse is converted to a perfect matter copy that can be stored – put on the shelf – sculpted, and then turned back to light. The storage time can be many seconds, and during this time light could – under normal circumstances – travel back and forth to the Moon several times over.’*

The Dirac Medal for the Advancement of Theoretical Physics is awarded by UNSW in association with the Australian Institute of Physics (NSW) and The Royal Society of NSW. The Lecture and the Medal commemorate the visit to UNSW in 1975 of the British Nobel laureate, Professor Paul Dirac. Professor Dirac gave five lectures which were published as a book *Directions of Physics*. He donated the royalties to UNSW for the establishment of the Dirac Lecture and Prize, which consists of a silver medal and honorarium. It was first awarded in 1979.

**Date:** Tuesday, 23 July 2019

**Time:** 6-8 pm

**Cost:** Free

**Location:** Tyree Room, John Niland Scientia Building, UNSW, Sydney

**Registration:** <https://www.eventbrite.com.au/e/nothing-goes-faster-than-light-usually-2019-dirac-lecture-with-lene-hau-tickets-62032226058?aff=SINV>

# Report of the 1273<sup>rd</sup> OGM

Wednesday 5<sup>th</sup> June 2019

**Dr Kate Faasse**

Senior Lecturer and ARC Discovery Early Career Research Fellow  
School of Psychology, UNSW

## 'This Talk May Cause Side Effects: Nocebo Effects in Medicine'



Almost everyone has experienced unpleasant side effects from a medical treatment. But what if most of these side effects aren't caused by the treatment itself, but by a powerful psychobiological phenomenon called the nocebo effect? The nocebo effect is sometimes seen as the 'dark side' of the better-known placebo effect where healing or health improvements are triggered by the treatment context rather than any therapeutic effects of the treatment itself. In contrast, nocebo effects are the unpleasant or adverse outcomes that can be triggered by the treatment *context*, including information about possible side effects, seeing or reading about someone else's experience of unpleasant side effects, and generic versus brand name labelling of the medication. The talk used a case study to illustrate the potential impact of nocebo effects in daily life, and discussed recent evidence on the development of nocebo effects, the different treatment context factors that can increase the experience of nocebo effects and the implications of nocebo effects for patients and public health. Dr Faasse presented evidence on strategies that might help to reduce nocebo effects.



The vote of thanks to Dr Faasse was given by Professor James Kehoe FRSN, who presented Dr Faasse with a speaker's medal.

**Report of 20 June 2019**  
**Royal Society, Southern Highlands Branch**

**Professor Ken Baldwin**

Director, ANU Energy Change Institute

**‘Australia’s Climate Change and Energy Future’**

The dark evening of June 20 was at freezing point at 6pm in the Southern Highlands. Not surprisingly, committee members of the Royal Society Southern Highlands (RSSH) were quietly anticipating that the evening’s attendance would be lower than usual because of the extreme cold. Contrary to these expectations, an overflow audience poured into the Nattai/Joadja conference room to hear a lecture on a matter that is of great concern to the population in general. After 40 more chairs had been installed, the audience of 99 was comfortably seated and Professor Ken Baldwin could begin his lecture.

It should also be recorded that when the attendance figures were broken down, it was found that there were 9 members present, approximately half of our very small membership. The rest of this huge audience consisted of 90 non-members including 4 teachers. Teachers are invited to attend RSSH lectures free of charge, members pay \$5 and general admission is \$10. The conclusion must be drawn that this lecture series in the Southern Highlands is certainly making a significant contribution to the academic life of residents.



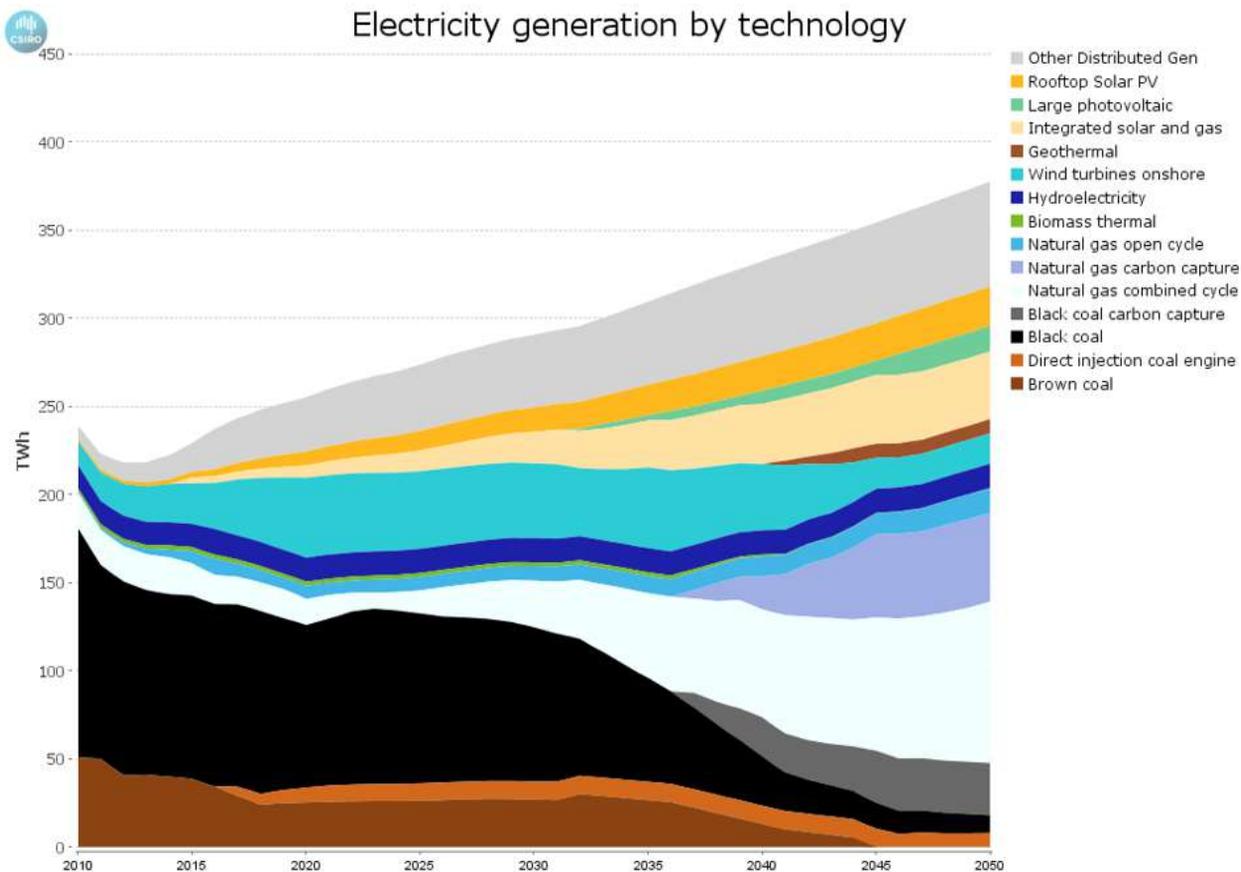
The huge audience at Ken Baldwin’s talk

Professor Baldwin began his lecture outlining the many challenges facing the world today as the trend to a world-wide switch to carbon-free forms of energy production takes hold. The Energy Change Institute (ECI) provides authoritative leadership in Energy Change research through a broad portfolio ranging from future energy technologies, to energy efficiency, regulation, economics, sociology and policy. The ECI comprises more than 300 staff and PhD students and around \$100 million in infrastructure and facilities, supported by a major portfolio of external grant funding.

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Although Professor Baldwin is a laser physicist, he delivered this lecture through the eyes of an economist as he presented his analysis of future energy demands and fulfilment in Australia. One of his first statements was that there is a massive transformation taking place in the world's energy supply *that will affect everything*. The factors motivating energy change are climate change, energy security, energy access and energy productivity. Whereas in the past global energy consumption has relied on biomass, coal, oil, gas, hydropower and nuclear, Baldwin stated that 'other renewables' will soon replace fossil fuel generation. He defined Australia as a Renewable Energy Superpower, one simple example being found in areas such as the Kimberley where strong winds blow at night and sunshine hours are extensive, excellent conditions for addressing the problem of intermittency in the generation of renewal energy.

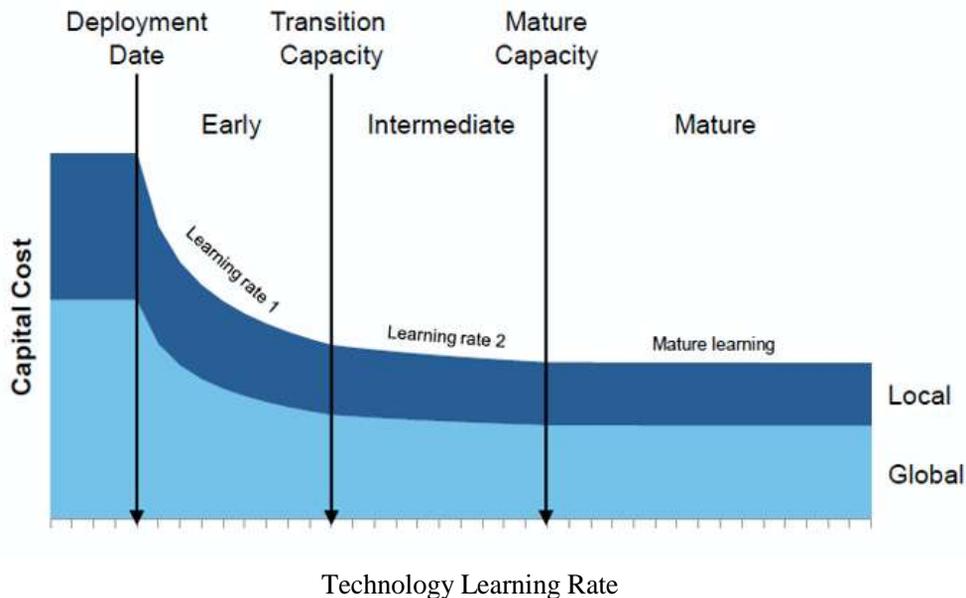


Source: Copyright Commonwealth Scientific and Industrial Research Organisation 2012-.  
Chart based on user selected assumptions and generated by CSIROs eFuture tool,  
Electricity Simulation Model #1953. Conditions of use, see [www.efuture.csiro.au](http://www.efuture.csiro.au) (Back-ground).

### Predicted Changes in Electricity Generation Sources over Time

A great deal of this excellent lecture concerned 'technology learning rate'. Learning rate, as demonstrated in the case of solar photovoltaics, is shown by the fact that for the last 37 years, each time the cumulative production doubled, the price went down by 24%. Generally speaking, the more experienced a system becomes, the more affordable it is.

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Baldwin stated that Australia leads the world with 250W per capita p.a. renewable energy installation rate. Future improvements can only improve this rate. He offered the following projections, provided industry installation is allowed to continue at the current rate: Australia will: 1) Eclipse the 2020 RET in 2019; 2) Reduce *electricity sector* emissions by 26% by 2021; 3) Attain our 26% Paris goals for the *entire economy* by 2025; 4) Reach 50% renewable electricity by 2024; 5) Approach 100% renewable energy in the early 2030s.

This was a gripping lecture, warmly received by the audience. It was followed by an extremely long question session.

Anne Wood FRSN

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## Schedule of RSNSW Events 2019

Date	Event	Speakers	Topics and Presentations	Location
3-Jul-19	Ordinary General Meeting	Em Prof Robert Burford FRSN	Past, Present and Future of Polymers: Is the Plastics Age Over?	State Library of NSW
18-Jul-19	Women and Science	Prof Barbara Gillam FRSN	Visual Perception and Aboriginal Art	SMSA
23-Jul-19	Dirac Lecture	Prof Lene Vestergaard Hau	Nothing Goes Faster than Light - Usually!	UNSW
7-Aug-19	Ordinary General Meeting	Prof Peter Shergold AC FRSN	Science and Politics	State Library of NSW
August	Poggendorf Lecture	Professor Robert F. Park FRSN	tba	
August	Science Week Talks	tba	tba	SMSA
4-Sep-19	Ordinary General Meeting	A/Prof Hans Pols	History and Sociology of Medicine in South-East Asia	State Library of NSW
19-Sep-19	Clarke Lecture	Prof Emma Johnston AO FAA FRSN	tba	
2-Oct-19	Ordinary General Meeting	Prof Peter Godfrey-Smith	Other Minds	State Library of NSW
17-Oct-19	Women and Science	Anne Harbers	Electricity, Astronomy and Natural History	SMSA
6-Nov-19	Ordinary General Meeting	Professor Herbert Huppert	The Beginning of Weather Forecasting	State Library of NSW
7-Nov-19	RSNSW & Four Learned Academies Forum	tba	Making Space for Australia	NSW Government House
21-Nov-19	Women and Science	Em Prof Anne Green	An Accidental Radio Astronomer	SMSA
4-Dec-19	Ordinary General Meeting	Jak Kelly Award Winner	2019 Jak Kelly Award Presentation & Christmas Party	State Library of NSW