



The Bulletin 418

The Royal Society of New South Wales

ABN 76 470 896 415

ISSN 1039-1843

26 February 2018

For Your Diary:

1 March 2018

RSNSW & SMSA

Paul Brunton AOM FAHA

**'Learning, Adaptation & the
Enlightenment: The Library'**

6.00pm for 6.30-7.30pm

Mitchell Theatre, SMSA, 280 Pitt St

14 March 2018

Annual Meeting of the Four Societies

Professor Robin Grimes

**"Exciting Materials for Energy
Application in 2050"**

5.30pm for 6pm start

UNSW Colombo Theatre

15 March 2018

Southern Highlands Branch Lecture

Dr Bradley Tucker

**'Exploding Stars, Dark Energy, and the
End of the Universe'**

6.30pm start

Mittagong RSL



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

'Precision Healthcare: The Coming Revolution in Medicine' Wednesday, 7th March 2018

Professor Leslie Burnett

Chief Medical Officer of Genome.One
Kinghorn Centre for Clinical Genomics
Garvan Institute of Medical Research



See page 3 for more information

Date: Wednesday, 7 March 2018; 6:00 pm for 6:30 pm

Venue: Union, University and Schools Club, 25 Bent Street, Sydney

Entry: \$10 for Members and Associate Members of the Society,
\$20 for Non-Members, which includes a welcome drink.

Dress: Business

Dinner (including drinks): \$80 for Members and Associate Members, \$90 for
Non-Members.

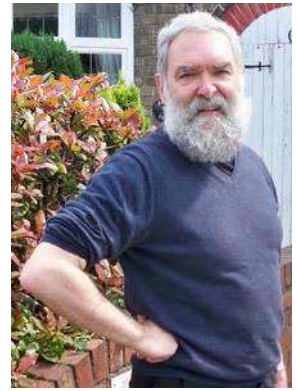
Reservations must be made at least 2 days in advance

Reservations: <https://nsw-royalsoc.currinda.com/register/event/45>

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

All are welcome.

From the President



The Australian Day honours were announced just as last month's Bulletin was being put together with my column already written, so I take this opportunity to warmly congratulate Michelle Simmons DistFRSN for being named as Australian of the Year, and Trevor McDougall FRSN for his Companion of the Order of Australia. We will be publishing Prof Simmons' Australia Day address in a forthcoming issue of the Journal and Proceedings of the RSNSW.

February sees the start of the planning process for the Four Academies and RSNSW Forum. The group, reconstituted from the triumph of 'The Future of Rationality in a Post Truth World', met last week to think of a topic for 2018 that is sufficiently broad, important, hard, interesting and worthwhile to justify the effort of the dozen or so people who make up the planning committee. I shall not divulge the conversation, but we have yet to decide a theme and so I invite any member to suggest the burning issue of the day. Write to me at president@royalsoc.org.au.

The Council of the Society met at the State Library last Saturday for a 'Strategy Day' (morning to be more exact). Among the issues discussed we are resolved to offer more to our Fellows, so look out for functions to welcome new Fellows, and other Fellows events. We are prosecuting our relations with various kindred organisations – recall the signing of an MOU with the Sydney Mechanics School of Arts last year. We are discussing collaborations with the State Library, having resolved to hold our Annual Dinner on May 18 in the Mitchell Galleries of the State Library, and then to hold the remaining OGMs for the year at the State Library. The facilities and surroundings of the Library make us very optimistic that this change will delight our regular attendees and perhaps entice a few new members to come along.

We were very pleased to announce the Gazetting of Fellows and Distinguished Fellows of the Society. This makes, as Robert Whittaker FRSN, who has worked very hard on behalf of the Society to cause this to happen, told the OGM in February, Fellowship of the RSNSW a statutory honour along with Australian honours, and Senior and Queen's Councillors. As the Gazette of Tuesday 6 February 2018 says:

'His Excellency, General The Honourable David Hurley AC DSC(Ret'd), Governor of New South Wales, as Patron of The Royal Society of New South Wales and in furtherance of the aims of the Society in encouraging and rewarding the study and practice of Science, Art, Literature and Philosophy, is pleased to advise and acknowledge the election of the following as Fellows and Distinguished Fellows of the Society.'

There follows our present Fellowship and Distinguished Fellowship. (I must apologise to the few of our number that were missed or incorrectly named or styled, despite the best efforts of the compilers of the list. All errors will be rectified on the next Gazetting later this year. If you do spot a mistake please write to Robert (robert.whittaker.am@gmail.com).

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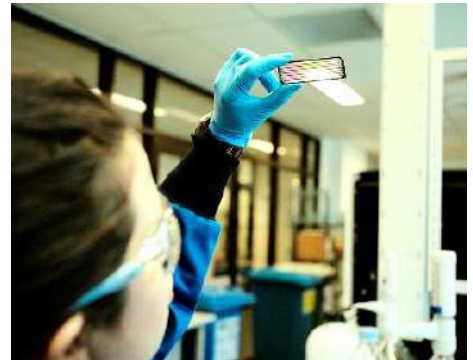
Professor Leslie Burnett

Chief Medical Officer of Genome.One

Kinghorn Centre for Clinical Genomics, Garvan Institute of Medical Research

‘Precision Healthcare: The Coming Revolution in Medicine’

Medicine has entered a period of major transformation. Advances in DNA sequencing have led to an explosion in data, information and knowledge about how the genes in our genome work. In turn, this is opening new avenues for diagnosis and treatment of both rare and common disorders. This presentation will provide a brief refresher overview of genetics and genomics. The range of genetic tests available will be described, culminating in whole genome analysis, which is now available in Australia, and where Australia is at the forefront of the world. Examples will be given of the application of genomic techniques to ‘precision medicine’, where a person’s genetic makeup is used to target treatments based on their specific needs. The era of preventative medicine and precision healthcare has arrived, but it will be accompanied with the need to recognise and responsibly address some complex ethical and societal issues.



www.genome.one/news

Professor Leslie Burnett is Chief Medical Officer of Genome.One, in the Kinghorn Centre for Clinical Genomics, Garvan Institute of Medical Research. Leslie has pioneered the development of many pathology and genetics initiatives, including being a Medical Director for the accreditation of Australasia’s first Whole Genome Sequencing laboratory and founding Australia’s first Community Genetics program.

He is a Clinical Pathologist with experience in both the public and private health sectors, and is a recipient of many Awards for Business and Technical Excellence, Service Excellence and Community Service. He has served as Ministerial appointee, Chairman, or President of a number of National and International bodies in pathology and genetics.

Professor Burnett is Conjoint Professor at the St Vincent’s Clinical School, UNSW Australia, Honorary Professor in Pathology and Genetic Medicine in the Sydney Medical School, and has been an Honorary Associate of the School of Information Technologies, at the University of Sydney. His current interests are in the areas of genomic pathology, genetic screening, bioinformatic modelling of population genetics and cell biology processes, and quality assurance. He is a passionate teacher and communicator about the genetics and genomics revolution.

2018 Events

Royal Society – Southern Highlands Branch

Date*	Event	Speaker	Topic	Location**
15-Mar-18	Public Lecture	Dr Bradley Tucker	Exploding Stars, Dark Energy, and the End of the Universe	Mittagong RSL
12-Apr-18	Public Lecture	Prof Anne Cutler	Babies are Working Harder than We Think	Mittagong RSL
17-May-18	Public Lecture	Prof Gordon Parker	Anti-depressants	Mittagong RSL
21-Jun-18	Public Lecture	Dr David Suggett	Future Reefs: How climate change will impact coral reefs	Mittagong RSL
19-Jul-18	Public Lecture	Dr Ken McCracken	t.b.a.	Mittagong RSL
16-Aug-18	Public Lecture	Dr Philip Cam	Philosophy in Schools	Mittagong RSL
20-Sep-18	Public Lecture	Prof Bert Roberts	Aboriginal Art from 65,000 years ago	Mittagong RSL
18-Oct-18	Public Lecture	Hugh Mackay	The State of the Nation Starts in Your Street	Mittagong RSL
15-Nov-18	Public Lecture	t.b.a.		Mittagong RSL

*Lectures are usually the third Thursday of each month.

**1st Floor, Room Joadja/Nattai.

Dr Bradley Tucker

to speak on

‘Exploding Stars, Dark Energy, and the End of the Universe’

Most stars end their lives in brilliant explosions known as supernova. These massive bursts briefly outshine all the light from the galaxy wherein they occur. The past 15 years has been a ‘boom’ period for supernovae, with vast amounts of time and effort being invested in these objects. Not only are they important for understanding the life of stars, but they can be employed as cosmological probes to study what the Universe is made of and how it is growing. This use has shown that the Universe is accelerating in its expansion – the subject of the 2011 Nobel Prize – and this is being caused by dark energy, which will cause the end of the Universe. Dr Tucker will show how our understanding of these objects has been revolutionised using new techniques, including the Kepler Space Telescope, and what this means for the Universe.

Brad Tucker is an Astrophysicist/Cosmologist, and currently a Research Fellow at the Research School of Astronomy and Astrophysics, Mt Stromlo Observatory, ANU.



Brad completed his PhD at Mt Stromlo Observatory working with Nobel Laureate Brian Schmidt. He is currently undertaking projects trying to discover the true nature of dark energy, the mysterious substance making up 70% of the Universe which is causing the Universe’s accelerating expansion. He is the lead of the Kepler Extra-Galactic Survey (a program to understand why and how stars blow up), and also leading projects to build a network of ultraviolet telescopes in the upper atmosphere, a search for Planet 9 (a proposed new planet in our Solar System), and the design of an Asteroid Mining Mission. In addition to his research, Brad frequently gives talks to school groups and the general public and has regular segments on radio and TV. He has developed a series of Astronomy coins with the Royal Australian Mint and consulted on science fiction movies such as *Alien: Covenant*.

Anne Wood FRSN

Is the Enlightenment Dead?

Lecture 4

Paul Brunton OAM FAHA

Emeritus Curator, State Library of NSW

'Learning, Adaptation and the Enlightenment: The Library'

Date: Thursday 1 March 2018, 6pm for 6.30 to 7.30pm. Light refreshments will be served.

Cost: \$15 members of RSNSW and SMSA, \$20 non-members

Location: Mitchell Theatre, Level 1, Sydney Mechanics School of Arts, 280 Pitt St, Sydney (near Town Hall Station)

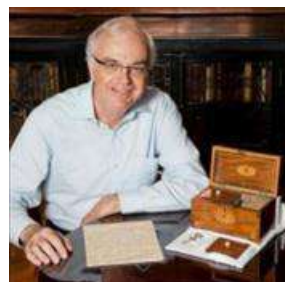
Registration: <https://smsa.org.au/events/booking-form-the-enlightenment-series/>



Main Reading Room, Free Public Library (later State Library of NSW), ca.1880-1910 (Courtesy Mitchell Library, Call No. PXE 1077. File No. FL915666)

Rather than a simple dumping ground for convicts, colonial New South Wales was a child of the Enlightenment. Founded on the belief in personal improvement and progress, the new penal colony was an experiment in Enlightenment values. Libraries could play a key role in the moral and intellectual growth of the individual. This talk will discuss the foundations of four libraries: Australian Subscription Library and Reading Room (now the State Library of New South Wales) (1826); Sydney Mechanics' School of Arts Library (1833); Evandale Subscription Library in Tasmania (1847); and the Melbourne Public Library (now State Library of Victoria) (1854) and the Enlightenment values which guided their founders.

Paul Brunton OAM FAHA is Emeritus Curator, State Library of New South Wales. He worked with the Mitchell Library's Australiana collections for 40 years and was Curator of Manuscripts from 1986 to 2001 and Senior Curator from 2002-2012. Paul has published on archives administration and on various aspects of the State Library's collection. He was President of the Australian Society of Archivists, 1991-1993. He was curator of the exhibition *Matthew Flinders: the Ultimate Voyage*, which opened at the State Library in 2001, and travelled nationally during 2002-2003. His annotated edition of Flinders' letters, *Matthew Flinders: Personal letters from an extraordinary life*, was published in 2002.





ANNUAL MEETING OF THE FOUR SOCIETIES

*Australian Nuclear Association
The Royal Society of New South Wales
Australian Institute of Energy
Nuclear Engineering Panel of Sydney Division of Engineers Australia
with support of
UNSW Nuclear Engineering, and
Australian Academy of Technological Sciences and Engineering (ATSE)*

Professor Robin Grimes

Professor of Materials Physics, Imperial College London
Chief Scientific Advisor at UK Foreign and Commonwealth Office

‘Exciting Materials for Energy Applications in 2050’

Date: 5:30 for 6 pm, Wednesday 14 March 2018
Venue: UNSW Colombo Theatre
Entry: Free
Registration: <https://www.trybooking.com/TOVZ>

Professor Grimes’ talk will focus on exciting developments in materials for energy applications and how they will improve the reliability, safety and economics of future energy systems.

Professor Grimes is Professor of Materials Physics at University College London. He has been Director of the Imperial Centre for Nuclear Engineering at Imperial College, London, since 2008 and became Director of the Imperial College Rolls Royce University Technology Centre in Nuclear Engineering in 2010. His research is focused on the use of high performance computing techniques to understand the behaviour of materials for energy applications including nuclear fission and fusion, fuel cells, batteries and solar cells. He is also Principal Investigator of the Research Council’s UK Nuclear Fission consortium project. In 2013 he was appointed the Foreign and Commonwealth Office Chief Scientific Advisor responsible for providing advice to the Foreign Secretary, Ministers and officials on science, technology and innovation.



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President's Column

The Enlightenment Series with the SMSA continued with more than 100 people listening to Kim McKay, Director of the Australia Museum, giving an entertaining account of the early years of the Museum, and describing the exciting developments that are now happening. Next in the series is Paul Brunton talking on the Library (<https://smsa.org.au/events/event/the-enlightenment-series/>) . We have been very pleased with the reception of this series and are planning the next. Following a suggestion by Tom Keneally DistFRSN we are putting together lectures on 'Important Australians you have never heard of'. (The first working title was 'Famous Australians you have never heard of' until we realised the contradiction.)

Finally, for the first time in ages we shall probably have elections for the Council at our AGM in April. We see this as an expression of the vibrant growth of the Society and encourage nominations by the deadline of 9 March, and members to attend and vote at the AGM on 4 April. I do not think my position as Past President can be challenged, and I would hope we confirm our President Elect Ian Sloan FRSN, but all executive and ordinary positions are up for grabs. Questions and requests for information should be directed to our Honorary Secretary (whom I also hope will be re-elected) Herma Buttner FRSN (secretary@royalsoc.org.au).

Have a great month! Comment and suggestions to president@royalsoc.org.au.

Brynn Hibbert FRSN

New Fellows

At the February OGM fellowships were awarded to Alison Bashford, Alan Broadfoot, Nicholas Enfield, Paul Heather, Andrew Jakubowicz, Stephen Leeder, William Mansell, Simeon Simoff, John Redmond, Phil Waite and Ronald Webber. Congratulations to all!



Professor Alison Bashford receives her certificate of fellowship from RSNNSW President Brynn Hibbert

Report of the 1260th OGM

RSNSW Scholarship Awards

Wednesday 7 February 2018



Grace Causer receives her scholarship from Prof Ian Wilkinson FRSN FANZMAC

Each year the Society awards three scholarships recognising the outstanding achievements of individuals working towards a research degree in a science-related field. The first meeting for 2018 opened with an impressive demonstration of the capabilities of some of the state's younger scientists. Before receiving their certificates and a \$500 cheque, each gave a talk on their research and findings to date. In her summing up, Judith Wheeldon AM thanked them for speaking with such depth, perception, curiosity and intelligence. She noted that they were all on the cutting edge of research in their fields, describing them as 'stunning young people'.

The first to speak was **Grace Causer** from the University Wollongong and Australian Nuclear Science and Technology Organisation (ANSTO). In her talk '**Uncovering Hidden Nanoscale Worlds with Neutrons**' she presented why neutrons are used as a probe to investigate matter: neutral charge, isotopic sensitivity and magnetic moment. The neutrons for her experiments are produced at ANSTO's multipurpose research reactor, the only nuclear reactor in Australia, used for the production of radio-isotopes for nuclear medicine, irradiation of materials and neutron scattering to probe material. In her PhD, Grace looks for new properties in magnetic materials, in particular interfaces between very thin films. One of her projects is the development of a hydrogen gas sensor to ensure passenger safety in hydrogen fuel-cell vehicles. Her second project is concerned with the chemical ordering of FePt₃: by irradiating the material with an ion-beam, disorder can be created and the resulting ferro- and antiferromagnetic bilayer has a magnetic pinning effect, important for high-density recording devices.

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Yu-wei (Wayne) Lin from the University of Sydney presented ‘**Developing New Ways to Treat “Superbugs” Using Old Antibiotics: Are we there yet?**’. In his research, Wayne is looking into the practice of the inhalation of polymyxins for treating respiratory infections as increasing antimicrobial resistance is one of the greatest threats to human health. Currently, the inhalation dosage regimens are empirical; therefore he investigated the pharmacokinetics of inhaled polymyxins in view of maximising the antimicrobial efficacy. Following the results of treated mice he developed a mathematical model for translating the outcomes into potential treatment for humans. Looking at patient data by Prof. Alan Forrest, North Carolina, he found that the current inhalation-dosage regimes are too low. Clinical studies are now under way to validate and refine the findings.



Cara van der Wal, also from the University of Sydney, spoke on ‘**Reconstructing the Phylogeny and Evolutionary History of Mantis Shrimps Using Molecular Data.**’ Cara’s studies deal with mantis shrimps, an important fisheries resource. There are ~500 species of mantis shrimps, a highly intelligent Stomatopod that has adapted to different marine environments. In various videos she showed ‘smashers’ and ‘spearers’ in action to catch prey in coastal ecosystems. Mantis shrimps have the most complex eye: their eyes are continuous, move independently, are di/monochromatic, and can see polarised and UV light. Although there are many studies on the detailed attributes of various mantis shrimps there is a no systemic study of their evolution. In the past scientists looked at morphological characteristics, whereas Cara now uses molecular sequence data to estimate their evolutionary timescale. Her studies found that Stomatopoda are an old group of crustaceans in which the spearing appendage arose before the smashing. The morphological complexity of stomatopod eyes arose independently in different lineages. Her findings show that the classification needs to be updated. Further studies are planned to improve dating estimates by analysing whole mitochondrial genomes.



Report of 15 February 2018
Royal Society Southern Highlands Branch

Professor Madeleine Beekman FRSN
School of Life and Environmental Sciences
University of Sydney

‘Are You More Intelligent than a Slime Mould?’



This lecture attracted a 60-person audience when it was presented in a pleasant conference room at Mittagong RSL, a new venue for the Southern Highlands Branch of the Royal Society. The change in location was necessitated by the building program taking place at the Performing Arts Centre, Chevalier College, Burradoo.

Professor Beekman is Professor of Behavioural Ecology at the University of Sydney and a fellow of the Royal Society of NSW. She previously held prestigious research fellowships such as the Australian Research Council (ARC) Queen Elizabeth II Fellowship (2003-2012) and an ARC Future fellowship (2013-2016). She did her PhD at the University of Amsterdam and was a postdoctoral researcher at the University of Sheffield before she moved to Australia to join the University of Sydney in 2001. She is currently the Deputy Head of School of the School of Life and Environmental Sciences, as well as the Chair of Ecology, Evolution and Environment.

Professor Beekman presented her findings on the slime mould, a unicellular organism with no neurons at all. The findings of her team have been astonishing. She now has a sound basis for asking such questions as to whether the slime mould is as smart as we are with our large brain. *Physarum polycephalum* – meaning the multi-headed slime mould – has emerged as a model system for decision making. Despite its simplicity, this organism has clearly demonstrated to the research team that it is capable of very complex behaviour.

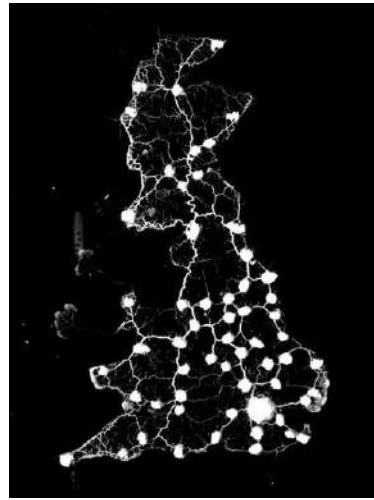
The audience was intrigued to see a number of time-lapse videos on the behaviour of the slime mould. As the organism expands and contracts tendrils called ‘pseudopods’, it can be seen that its network settles into the shortest possible routes as efficient as those designed by humans. It can make multi-objective foraging decisions and balance its nutrient intake. Sometimes though, when placed in perplexing situations designed by the researchers, it was observed making human-like ‘irrational’ choices among foods of different qualities.

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Professor Beekman presented unforgettable examples of the efficient networks created by the slime mould when she examined the railway networks in the Tokyo area and in the British Rail system. Her team placed a map of Britain on a suitable substrate for the slime mould, and then marked, using 50 dots of food, the locations of 50 cities in the rail network. The food source dotted on the city locations was a preparation of oats for which the slime mould had demonstrated a liking. To the astonishment of the researchers, the network created by the slime mould, as it foraged in the most efficient way from one food source, or 'city', to another, bore an uncanny resemblance to the actual network of British Rail (see figure below). The same observations were made when the slime mould was presented with 32 food sources in the Tokyo area.



Actual British Rail Network



Physarium Network

Constructing Networks using *Physarium*
(Courtesy Toshi Nakagaki)

It is difficult to do justice to Madeleine Beekman's beautifully presented and fascinating lecture in a space as limited as this. Even the questions she raised at the conclusion of her presentation heightened the intriguing essence of her lecture:

- Can the slime mould learn? *We think so.*
- Can it make associations? *We don't know yet.*
- If it can make associations, can it teach another slime mould? *Wouldn't that be amazing...*
- Can our questions become even weirder? *Probably.*

We look forward to her next lecture.

Anne Wood FRSN

Schedule of RSNSW Events 2018

Date	Event	Speakers	Topics and Presentations	Location
7-Mar-18	Ordinary General Meeting	Prof Leslie Burnett	Precision Healthcare: The coming revolution	Union, University & Schools Club
14-Mar-18	Annual Meeting of the Four Societies	Prof Robin Grimes	Exciting Materials for Energy Applications in 2050	UNSW Colombo Theatre
4-Apr-18	Annual General Meeting	Prof Paul Fennell	tba	tba
2-May-18	Pollock Memorial Lecture	Prof Andrea Morello	tba	
18-May-18	Annual Dinner	Tom Keneally, AO	Annual Dinner, Distinguished Fellows Lecture and 2017 Awards Presentation	State Library of NSW
6-Jun-18	Ordinary General Meeting	Prof Ben Oldroyd	No sex please, we're Cape bees	tba
4-Jul-18	Ordinary General Meeting	Prof Gordon Wallace	3D Printing of Body Parts	tba
8-Aug-18	Ordinary General Meeting	Prof Muireann Irish	Neuroscience	State Library of NSW
11-19 Aug-2018	National Science Week	TBA	Royal Society of NSW Lunchtime Science Talks	
5-Sep-18	Ordinary General Meeting	Prof Richard Kemp	Eyewitness Evidence	tba
tba	Poggendorff Lecture	Prof Brent Kaiser	tba	
3-Oct-18	Ordinary General Meeting	TBA		
7-Nov-18	Ordinary General Meeting	TBA		
November	RSNSW & Four Learned Academies Forum	TBA		
5-Dec-18	Ordinary General Meeting	Jak Kelly Award Winner	2018 Jak Kelly Award Presentation & Christmas Party	tba

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