The Bulletin 411

The Royal Society of New South Wales

For Your Diary:
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20 July 17
Southern Highlands Branch

Dr. Wes Stein
"Solar Power Generation"

6:30 pm start
Venue: For up-to-date information, see http://
www.royalsocietyhighlands.org.au/
lectures/lectures_2017.htm
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2 August 2017
Ordinary General Meeting

Professor Ann Williamson
"Self Driving Cars: Will They Help?

Union, University & Schools Club, 6:00 for 6:30
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17 August 2017
Southern Highlands Branch
Hugh MacKay AO
"The changing place of religion in Australia"
6:30 pm start

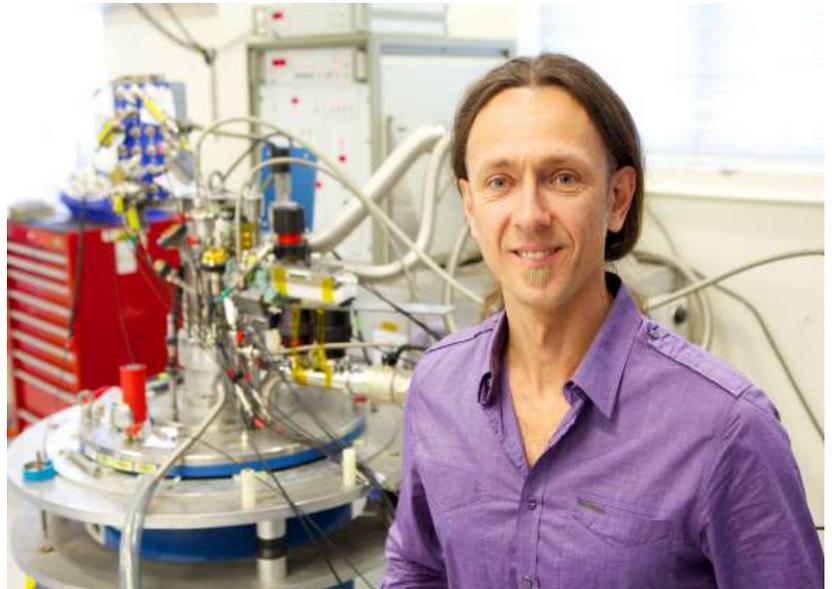**Patron of The Royal Society of NSW**
His Excellency General The Honourable
David Hurley AC DSC (Ret'd)
Governor of New South Wales

Open Lecture & OGM
Wednesday, 5 July

Professor Andrea Morella
"Understanding Quantum Theory"

Date: Wednesday, 5 July 2017; 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/33
Enquiries: royalsoc@royalsoc.org.au Phone: 9431 8691
All are welcome.

From dishwashing tablets to property management services, the attribute "quantum" is broadly used to signify "better". But quantum is not just better: it's different. The most striking example of how quantum is both "better" and "different" is a quantum computer. The idea of using

From the President

President's Column May 2017

First, thanks to Vice-President Ian Sloan who excellently managed the June OGM while I was away in Europe. I was sorry to have missed Professor Madeleine Beekman FRSN tell us about the intelligence of slime mould to a full house and oversubscribed dinner. Thanks to the Chair of our Events Committee, Ian Wilkinson FRSN, who is always interested to hear suggestions for our m o n t h l y p r e s e n t a t i o n s (ian.wilkinson@sydney.edu.au).

I arrived back in time to represent the Royal Society of NSW at the Garden Party at Government House for the Queen's Birthday celebrations, more of which later. The Queen's birthday marks a round of the Australian Honours and I was exceptionally pleased that John Shine FRSN was awarded an AC, and he is joined, with an AOM, by Fellow-elect Susannah Fullerton.

The excitements of the Garden Party at Government House included Mrs Hurley leading us in a rousing "Happy Birthday … to Her Majesty", a police Pipe Band and a token horse contingent also from NSW Police. The going (as they say at Royal Randwick Racecourse) was very heavy, so the full squad of horses were not able to perform on the well-kept grass outside Government House. (See page 6 for a photo of the ceremony.) All full of pageantry, with the famous red-carpeted steps placed overlooking the parade ground. These are, as we were told, for Her Majesty to review the proceedings, and are left un-stepped upon on account of the clear absence of Her Majesty. In his speech His Excellency General The Honourable David Hurley AC DSC (Ret'd) Governor of NSW, asked us to remember not Her Majesty's long reign, but her long years of service to the nation. His Excellency is following the tradition in style, hosting displays by several community organisations of which he is patron.

Emeritus Professor Robert Clancy FRSN is organising a series of lectures to be held at, and co-hosted by, the Sydney Mechanicals School of Arts over the next twelve months. Final details will be released soon, but look out for the lectures going under the title "Is the Enlightenment dead?" , and finishing up next April with a 'Sophistry' which will debate the proposition "Global deflation is a failure of the Enlightenment". The SMSA at 280 Pitt Street has something of a parallel history to the RSNSW, being founded in 1833 pioneered by artisans and tradesmen who had studied with Henry Carmichael aboard the Stirling Castle during their voyage to Sydney. Schools of Arts and Mechanics' Institutes came out of a progressive, forward-thinking movement that emerged in Scotland with the aim of providing open access to education for the working classes who were excluded from more formal and traditional education. The SMSA became Ultimo College and can be seen as the forerunner of TAFE, UNSW and UTS. (See The Sydney Mechanics' School of Arts: A History, Garry Wotherspoon, SMSA, 2013, https://smsa.org.au/).

Finally, let me commend our June OGM talk on Quantum Computing. I heard our speaker, Professor Andrea Morello FRSN, give his Inaugural Professorial Lecture at UNSW Sydney, and rushed to sign him up for the RSNSW. After his talk I had the distinct impression that I knew more about quantum computing that I had before. If you think it might work for you, please come along and be enlightened.

As usual, please write with comment and suggestions to president@royalsoc.org.au .

Report of Open Lecture

Wednesday, 7 June

"Are You More Intelligent than a Slime Mould?"
## Prof. Madeleine Beekman FRSN

Professor Beekman receiving her certificate of Fellowship in the Royal Society of NSW

Professor Beekman presented her investigations on the slime mould, a unicellular organism without so much as a single neuron. Is it as smart as we are, with our large brain, she asked? Over the last few years, *Physarum polycephalum* – meaning the multi-headed slime mould – has emerged as a model system for decision making.

Despite its simplicity, this organism is capable of rather complex behaviour, Not only is the organism able to detect the presence and location of food, its chemical senses allow it to even discriminate between oats from Woolworths and Coles. A number of fascinating time-lapse videos demonstrated, as the organism extends and contracts tendrils called 'pseudopods,' this network will settle into the shortest possible

routes as efficient as those designed by humans, make multi-objective foraging decisions, and balance its nutrient intake, although sometimes making human-like intransitive, "irrational" choices among foods of different qualities.

In addition to route finding, *Physarum polycephalum* has an external "memory" of where it has been. As its pseudopods move across a surface, they leave behind a trail of translucent slime. Subsequently, *Physarum* strongly avoids crossing surfaces that are already covered with slime. This avoidance mechanism prevents the organism from wasting energy by recrossing previously-explored ground. Prof. Beekman showed how this avoidance mechanism allows the organism to escape dead-ends and manoeuvre around obstacles. However, detection of a good food site can cause the organism to extend pseudopods across an old slime trail. ***Continued page 5….***
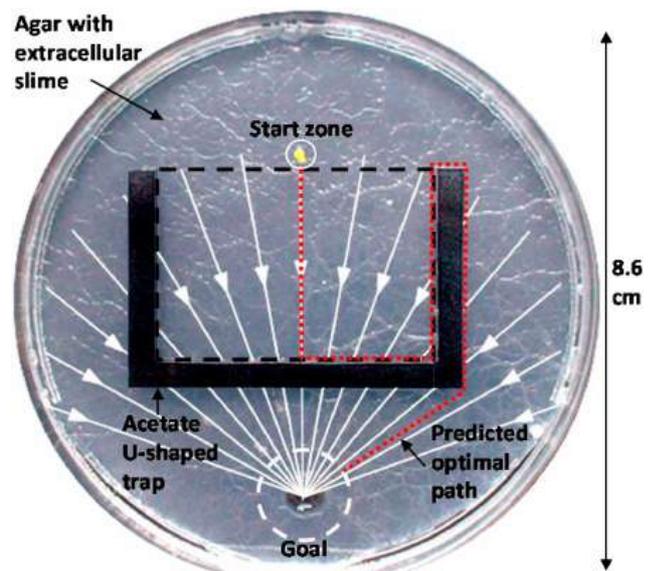
Set-up for the U-shaped trap navigational task. Reid, Lattya, T., Dussutourc, & Beekman, A. (2012).. *Proceedings of the National Academy to Science 109,*17490-17494

Southern Highlands Branch Lecture, 15 June 2017
Dr. Michael Birrell
"Luxor Temple: The Southern Harem of Amun-Re"

Dr Michael Birrell obtained his BA(Hons) in Archaeology at Sydney University in 1988, receiving an MA (1992) and a PhD (1999) in Egyptology from Macquarie University. Michael has worked on numerous archeological excavations in both Egypt and Israel, and has travelled widely in the Middle East, Asia and Europe. He has research interests in ancient Egyptian religion and government, and is collecting data for a book on New Kingdom temple architecture. For the last 20 years, he has run a travel company called *B.C. Archaeology* which specializes in history and archaeology.

Michael's lecture attracted an audience of fifty who were clearly fascinated by his presentation. Many had accompanied him on previous tours to Egypt and the Luxor Temple which lies in the heart of the modern city of Luxor in southern Egypt. It was the cult place for the worship of the Egyptian god Amun-Re who was the imperial state god during the New Kingdom. The temple holds a remarkable place in history.

Amenhotep III built the main part of the temple which we see today, the structure growing in three main phases. The first phase included the main sanctuaries on the southern end, vestibules and the hypostyle hall. In the second phase, the king added a peristyle 'sun court', then in the third phase he began construction of a large pillared colonnade after the Amarna period of Tutankhamun (1336-1327) BC. The temple of Luxor was intimately connected with the festival of Opet, a religious celebration taking place during the second month of the Inundation and lasting up to 4 weeks. The main event was a

procession of the divine images from Karnak to Luxor Temple which is depicted on the walls of the pillared colonnade.

Sety I and Ramesses II added a peristyle court to the front of the building and a massive pylon entrance with obelisks and statues. This construction work has a different orientation to the rest of the temple, since later Pharoahs developed a major procession route between Luxor Temple and Karnak Temple and wanted a flush façade facing the road. The road to Karnak was subsequently refurbished in the 30th Dynasty by Nectanebo I (380-363 BC) who lined the way with about 1000 sphinxes on either side.

The main sanctuary of the temple was devastated during the Second Persian invasion (around 340 BC) and was rebuilt in the name of Alexander the Great (320 BC). This Macedonian king equated Amun with his divine father Zeus, and had himself

## Are You More Intelligent than a Slime Mould?

Prof. Beekman discussed whether the slime mould's achievements are just 'cute', worthy of mentioning in passing, but nothing to take too seriously? Or, do they hint at the fundamental processes underlying all decision-making and, more broadly, "cognition"? These questions, as well as Madeleine's very engaging style of presentation, led to a vigorous discussion, which would have provided the audience with food for further thought.

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), an ARC Future Fellowship (2013-2016), and a Sydney University Senior International Research Fellowship (2006-2010).She did her PhD in 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 has been editor of numerous scientific journals and 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. Her main model organism besides the slime mould is honeybees.
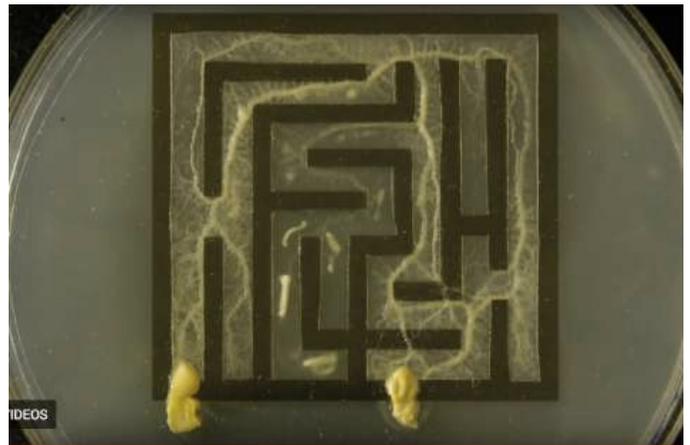
Slime mould connecting food sources in a maze

Dr. Birrell: Luxor Temple

represented there in traditional guise as an Egyptian pharaoh. Michael noted the differences between the two styles of art in this part of the temple! A small chapel to the Graeco-Roman god Serapis was added by Trajan (AD 98-117) to the forecourt.

In the Roman period during the reign of Emperor Diocletian (AD 284-305), the temple precinct was converted into an army camp which was heavily fortified. Then in the medieval period, the town encroached on the ruins of the temple resulting in houses being built against the walls. As the town grew around the temple, a mosque dedicated to the local saint Abu el-Haggag was built in the Ramesside court. It has been retained even though the rest of the domestic structures have been removed.

As for the future, Michael Birrell noted that due to political unrest in the Middle East, tourist numbers have plummeted from 15 million per year to just 800 000. Sad news indeed for Egypt so dependent on tourism to keep alive the history of magnificent structures such as Luxor Temple.

Anne Wood FRSN

Understanding Quantum Theory

quantum physics to perform computational tasks is 35 years old now, but only in the last few years has the development of the basic components of a quantum computer advanced far enough to trigger large investments from industry giants and start-up companies alike. In this talk, I will explain simply but rigorously what a quantum computer is, how it works, what it does, and how it can become one of the most transformational technologies for the 21st century. The talk will be sprinkled with some mind-opening facts about human achievements using quantum effects, and some visual examples of quantum bits doing their work.

Andrea Morello is a Professor of Quantum Engineering at UNSW Sydney and a Program Manager in the ARC Centre of Excellence for Quantum Computation & Communication Technology. He is a Fellow of the Royal Society of NSW, and a Fellow of the American Physical Society. His completed his PhD in the birthplace of low-temperature physics, the Kamerlingh Onnes Laboratorium in Leiden, Netherlands, followed by a postdoc at UBC in Vancouver. He joined UNSW in late 2006. He and his team were the first in the world to demonstrate the operation of a single electron and a single nucleus quantum bit in silicon. They still hold the record for quantum memory time, and the most accurate demonstration of quantum entanglement in the solid state. For these achievements, Andrea was awarded a Eureka Prize (2011), the Malcolm McIntosh Prize for Physical Scientist of the Year (2013), the David Syme Research Prize (2013), the NSW Science & Engineering Award (2014), and was the inaugural winner of the R. Landauer & C.H. Bennett Award for Quantum Computing (2017).

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His Excellency (second from right) reviewing (from the left) mounted police, the Governor's aides de camp, and the steps.

Schedule of RSNSW Meetings 2017

Date	Event	Speaker(s)	Topics and Presentations	Location
2-Aug-17	**Ordinary General Meeting**	Prof. Ann Williamson FRSN UNSW	Self Driving Cars: Will They Help?	Union, University & Schools Club
6-Sep-17	**Ordinary General Meeting**	Dr. Helen Mitchell Conservatorium of Music	Complexity of Music	Union, University & Schools Club
4-Oct-17	**Ordinary General Meeting**	Prof. Pip Patterson	Science of Social Networks	Union, University & Schools Club
1-Nov-17	**Ordinary General Meeting**	Pamela Griffith FRSN	Women in Art	Union, University & Schools Club
6-Dec-17	**Ordinary General Meeting**	Jak Kelly Award Winner	2017 Jak Kelly Award Presentation & Christmas Party	Union, University & Schools Club

RSNSW - Southern Highlands Branch

Date*	Event	Speaker	Topic	Location**
17-Aug-17	Public Lecture	Hugh MacKay AO	The changing place of religion in Australia	Chevalier College, Bowral
21-Sep-17	Public Lecture	Prof Peter Schofield	Alzheimer's Disease	Chevalier College, Bowral
19-Oct-17	Public Lecture	Prof Dean Rickles	Quantum Gravity	Chevalier College, Bowral
16-Nov-17	Public Lecture	Yik Lung (Jeremy) Chan	Effects of Maternal Cigarette Smoke Exposure	Chevalier College, Bowral

*Lectures are the third Thursday of each month. **Location may change due to renovations
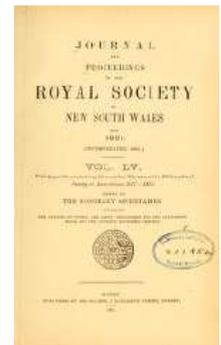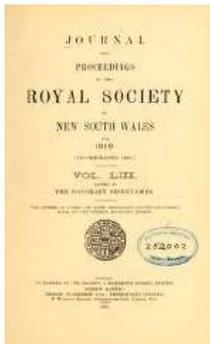
Contacts for Your Officer Bearers and Council Members

Em Prof D. Brynn Hibbert President: president@royalsoc.org.au
Dr Donald Hector AM Vice President: dchector@royalsoc.org.au
Prof Ian Sloan AO Vice President: i.sloan@unsw.edu.au
Ms Judith Wheeldon AM Vice President: judith.wheeldon@mac.com
Mr John Wilmott Treasurer: rjwilmott@gmail.com
Em Prof Robert Marks Hon Sectry (Editorial): editor@royalsoc.org.au
Dr Herma Buttner Hon. Secretary: <secretary@royalsoc.org.au>
Dr Ragbir Bhathal Hon. Librarian: R.Bhathal@westernsydney.edu.au
A/Prof Chris Bertram Hon Webmaster: c.bertram@sydney.edu.au
Dr Erik Aslaksen <erik.aslaksen@bigpond.com>

Dr Mohammad Choucair <mohammad.choucair@sydney.edu.au
Dr Desmond Griffin AM: <desgriffin@optusnet.com.au>
Mr John R Hardie: john.hardie@royalsoc.org.au
Em Prof Stephen Hill AM: <sthill@uow.edu.au>
Em Prof Heinrich Hora: <h.hora@unsw.edu.au>
Prof E. James Kehoe: <ejameskehoe@gmail.com>
Prof Bruce Milthorpe: Bruce.Milthorpe@uts.edu.au
Hon Prof Ian Wilkinson < ian.wilkinson@sydney.edu.au>
Ms Anne Wood wood.anne@gmail.com

For further information: http://www.royalsoc.org.au/