



The Bulletin 437

The Royal Society of New South Wales

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For Your Diary:

7 November 2019

**RSNSW & Four Learned Academies
Forum**
'Making SPACE for Australia'

21 November 2019

Southern Highlands Branch Lecture
Dr Steve Harrison
'Porcelain through History'
(For more information, see p. 4)

21 November 2019

RSNSW & SMSA
Women & Science
Em Prof Anne Green FRSN
'An Accidental Astronomer'
(For more information, see p. 5)



Patron of The Royal Society of NSW
Her Excellency The Honourable Margaret
Beazley AO QC
Governor of New South Wales

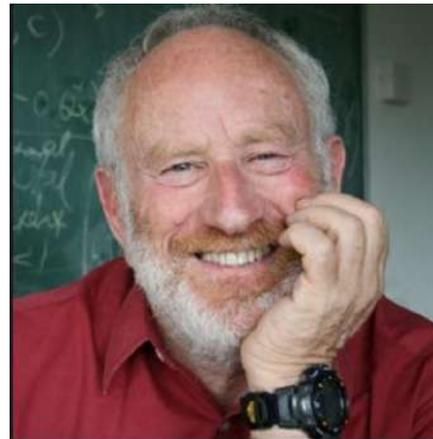
1278th OGM & Open Lecture

'The Beginning of Weather Forecasting'

Wednesday 6th November 2019

Professor Herbert Huppert FRS FRSN

University of Cambridge



See page 3 for more information

Date: Wednesday 6th November 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, \$75 for students.

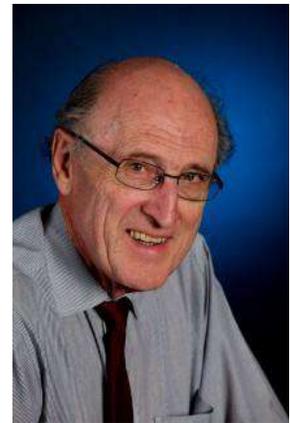
Reservations: <https://nsw-royalsoc.currinda.com/register/event/63>

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

All are welcome.

From the President

To be your President is always a privilege. Often enough it is also a pleasure. Two weeks ago I had the real pleasure of presiding at the inauguration of the new Hunter Branch of the Royal Society in NSW. Because this important event is reported elsewhere in this Bulletin, I will not talk about it here, beyond saying that it was manifestly successful in the highest degree, and also very enjoyable, because of the enormous enthusiasm and energy projecting from this fledgling branch. I have not the slightest doubt that the Hunter Branch will be a great success, and a source of pride for the Royal Society of NSW.



The following day I headed for Parkes, in the Central West of NSW, for something completely different, namely an important celebration of ‘The Dish’: the Parkes Radio Telescope. Fifty years ago the Parkes radio telescope, along with its smaller cousin at Honeysuckle Creek in the ACT, played a crucial role in transmitting the images from the Apollo 11 moon landing. The story of how this came about is well known, but perhaps still worth retelling. The intention had been that the first moon walk would take place while the moon was in sight of the USA, but because the astronauts were too excited to take a planned sleep, the moon walk took place earlier than intended. For the first eight minutes the signal was taken from Honeysuckle Creek, but after that (when Parkes could use its main beam) the controllers in Houston switched to the Parkes feed, and remained with Parkes throughout all or most of the two hours or more of the moon walk, because ‘Parkes’ televised images were superior to other ground stations.’ These are the events celebrated recently in Parkes: the IEEE (the international organisation formerly known as the Institute of Electrical and Electronic Engineers) awarded Australian telescopes the status of ‘IEEE Milestone’ – the first Australian IEEE Milestone. It became clear from the speeches, including that from the IEEE President Elect, that the Australian success was not just a matter of luck: thanks to CSIRO’s commitment, the telescope technology at both the Australian dishes was at a very advanced level. To continue the above quote from the plaque that now stands near the Parkes telescope: ‘One of the first to use the newly developed corrugated feed horn, Parkes became the model for the NASA Deep Space Network large aperture antennas.’ As a result the occasion was a full-on celebration of excellent Australian engineering and science, something wonderful to participate in.

A third pleasure for me as President was to see one of our younger Fellows, Elizabeth New FRSN from the University of Sydney, being awarded the Malcolm McIntosh Prize for Physical Science at the recent Prime Minister’s Prizes. Among her other accolades, Elizabeth was also the most recent winner of the Royal Society’s Edgworth David Medal. Well done Elizabeth.

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

Professor Herbert Huppert FRS FRSN
Emeritus Professor of Theoretical Geophysics
University of Cambridge

**‘The Beginning of Weather Forecasting:
Matthew Maury, Robert FitzRoy FRS and L.F.
Richardson FRS’**



We, with our ancestors, have often lived with unpredicted changes in the weather, even quite dramatic changes. For social and financial reasons it would be extremely beneficial to have accurate weather forecasts — over both land and sea. Quantitative forecasts – not just that it will be relatively hot in summer and cold in winter – were only introduced in the mid 1800s. How this came about, the individuals whose imagination and hard work made it possible and a short description of the (difficult) physical principles governing the often turbulent motions on many different spatial scales of the atmosphere will be summarized.

Professor Herbert Huppert FRS FRSN is Emeritus Professor of Theoretical Geophysics in the Department of Applied Mathematics and Theoretical Physics, University of Cambridge. His theoretical and laboratory-based work has improved our understanding of the behaviour of fluids in and on the Earth’s surface, and his work on convective systems has been crucial for an improved comprehension of our planet’s response to a changing climate. Often in demand as a scientific authority, Herbert served as Chair of a Royal Society working group on bioterrorism which prepared a report for the British Government; a European Academies working group on Carbon Capture and Storage, which prepared a report for the European Parliament; and has acted as an adviser to numerous other government bodies. He has received many awards for his work, including the Bakerian Lectureship of the Royal Society, a Leverhulme Emeritus Fellowship and The Australian Academy’s Selby Public Lectureship 2019.

Southern Highlands Branch Royal Society of New South Wales

Dr Steve Harrison

'Porcelain through History'



This presentation will focus on the discovery of porcelain at several sites around the world and the small part that Mittagong has had to play in its history. The discovery of porcelain over a one thousand year period from China, to Korea, Japan, UK and eventually Australia will be discussed.

To get a better understanding of the essence of porcelain, Harrison spent 20 years travelling to each of these fundamental sites around the world, staying and working in each to create his own contemporary porcelain pieces from these ancient materials. He brought samples of these unique porcelain stones from around the world back to Australia and had them analysed at the UNSW Mineral Analysis Laboratory. The findings from the analyses will be presented and discussed in this lecture.

Dr Steve Harrison is a woodfirer, teacher and kiln designer living at Balmoral Village where he set up the Loopline Pottery with Janine King in 1977. He studied ceramics at East Sydney Technical College and became an exhibiting member of the Australian Potters' Society in 1976. Pursuing a research interest in woodfiring using local clays and glazes, Harrison was awarded MA Hons from Wollongong University in 1995, and a PhD from the University of Western Sydney in 1998. As well as working in clay, he makes works in metal, stainless steel, aluminium and cast bronze. He has presented in many international conferences throughout Europe and Asia, including the Royal College of Art in London, and has published over 70 research papers and written 6 books, 3 of which have been translated into other languages.

Date: Thursday, 21 November 2019

Time: 6.30 pm

Location: Nattai/Joadja Room, Mittagong RSL

Further Information: www.royalsocietyhighlands.org.au/lectures/lectures.htm

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Royal Society of New South Wales & Sydney Mechanics' School of Arts Women and Science: Lecture 7

Em Professor Anne Green FTSE FASA FAIP FRSN 'An Accidental Astronomer'

As one of the first women radio astronomers, Anne Green faced unexpected challenges in undertaking panoramic and detailed surveys of the Milky Way Galaxy. Anne will track her career trajectory alongside the evolution of the Molonglo Radio Telescope that has been a pioneering astronomical instrument for more than 50 years. Anne's journey has produced some exciting discoveries and rewarding collaborations in the study of the structure and ecology of the Galaxy, and has also encompassed observations with several of the world's most powerful telescopes.



Anne Green FRSN is Emeritus Professor at the University of Sydney. Following her graduate studies at Sydney University, she was an Alexander von Humboldt Fellow at the Max Planck Institute for Radioastronomy in Bonn, Germany. Restarting her academic career at Sydney University after a 15 year pause for family and community work, she joined the School of Physics and progressed from post-doc to professor. During this period, she was Director of the Molonglo Telescope and was appointed as the first female Head of the School of Physics. She has been on numerous national and international astronomy advisory committees, including as President of the Astronomical Society of Australia. Most recently, this body has established the Anne Green Prize to be awarded to a mid-career scientist for a significant body of work or accomplishment.

Date: Thursday, 21 November 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: Sydney Mechanics' School of Arts, 280 Pitt St, Sydney
Registration: <https://smsa.org.au/events/event/anne-green-an-accidental-astronomer/>

Report of the 1277th OGM
Wednesday 2nd October 2019

Professor Peter Godfrey-Smith FRSN
School of History and Philosophy of Science
University of Sydney

‘Bodies and Minds in Animal Evolution’



Dr Donald Hector FRSN presenting the vote of thanks and speaker's medal to Professor Godfrey-Smith FRSN

Charting the evolution of different kinds of animal bodies helps us understand the evolution of the mind – both the varieties of minds that might exist, and how minds could arise at all through natural processes. Cephalopods, including octopuses, are an especially interesting case in bodily and behavioural evolution, and Professor Godfrey-Smith spent some time describing octopus behaviours at field sites in NSW.

The speaker treated the audience to several enlightening videos taken at those rare sites which showed previous unrecorded octopus behaviour.

Report of 17 October 2019
Royal Society of NSW
Southern Highlands Branch

Ian Bryce BSc BE (Hons)
Rocket Scientist and Ethics Teacher

**‘The Physics of the Mind:
Exploring sentience, freewill, and morality’**



Sometimes it happens in lecture series that, despite many months of planning and careful organization, circumstances arise that mean a lecture must be cancelled at the last minute, or a suitable replacement found. Such was the situation that the RSNSW Southern Highlands Branch found itself in two days before the scheduled and well publicized October lecture. Professor Toby Walsh was unable to fly home from Europe due to illness in his family. Fortunately Ian Bryce offered to step up to the challenge. The publicity machines went into last minute action, with the happy result that an audience of 82 people greeted him as he entered the lecture venue. They were to hear an extraordinary lecture which would keep many excitedly discussing the subject long after the lecture had ended.

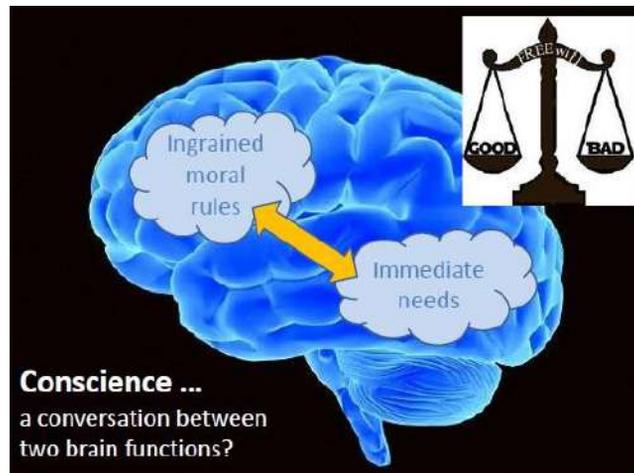
Ian Bryce has had long experience as an aerospace engineer with Telstra, Optus and Hawker de Havilland, the projects covering a wide field of aircraft, spacecraft and launch vehicles. As Chief Engineer for Asia Pacific Space Centre, he worked closely with the Russians on a proposed spaceport on Christmas Island. With Aerospace Concepts, he developed complex methodologies for risk analysis of weapons and rocket tests at Australia’s test site at Woomera. He has lectured at several universities in space sciences, including seven years at UNSW, where he created a subject entitled Space Vehicle Design.

Ian has now moved to applying the methods of science to human welfare, in particular, exploring the physics of the mind. He described how the four basic forces of physics explain at a fundamental level everything going on in the universe, yet arising from that we see brain function, consciousness, freewill, religion and all belief systems. This lecture addressed these issues in a very exciting way.

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Ian opened his lecture with the simple example of a new car that would not go when taken out of the showroom. All tests were done to no avail, and the engineer in charge stated that the only possibility left was that the laws of physics did not apply on that particular stretch of road – an obvious impossibility. Ian went on to use this analogy as he presented the known physics of the brain where many commonly accepted explanations of numerous phenomena could readily be ruled out, because they simply contradicted the basic laws of physics – phenomena such as the effectiveness of prayer, life after death and the development of conscience.



He quoted British theoretical physicist Brian Cox, who recently pointed out that there's no room in the Standard Model of Physics for a substance or medium that can carry on our information after death, yet go undetected in the Large Hadron Collider. Science theory shows that such communication would require a new effect in physics. Ian added that science has shown that the mind is a function of the brain. The brain develops in the fetus and the child, then memories are created from experiences. There is no mechanism for installing the memories from a different brain. The conclusion must be that past lives are not possible. As for freewill, Ian described this as the feeling we have while our brain performs the operation of choosing.

As for the physical substance of the brain, Bryce called upon a quote:

The stars died so that you could be here today... The amazing thing is that every atom in your body came from a star that exploded. And, the atoms in your left hand probably came from a different star than your right hand. It really is the most poetic thing I know about physics: You are all stardust. (Lawrence M. Krauss)

In summary, Ian stated that the mind is what the brain does, paralleling software in a computer. Reflection, prayer, conscience, etc., must be internal brain processes. So many questions from the audience arose that Ian Bryce very kindly gave his contact details so that audience members could study again the material presented in his thought-provoking lecture. His contact is ianrbryce@gmail.com

Anne Wood FRSN

Report on the Inaugural Meeting of the RSNSW Hunter Branch

The inaugural meeting of the Hunter Branch of the Royal Society of NSW was held at the Newcastle Club on 9th October 2019, with the President Professor Ian Sloan AO FRSN presiding. Professor Sloan presented certificates to two new members from the Hunter region: Emeritus Professor Kenneth Dutton AM FRSN and Professor Brett Nixon FRSN. The meeting resolved:

- that the following be elected as office bearers of the Hunter Branch :

Chairman	Mr Paul Jeans
Vice-Chairman	Laureate Professor John Aitken
Honorary Secretary	Emeritus Scientia Professor Eugenie Lumbers
Honorary Treasurer	Professor George Willis
Committee Members	Emeritus Professor John Boulton, Father Andrew Doohan, Mr John Dunnet, Professor Brett Ninness, Mr Robert Whittaker, Professor Natalie Thamwattana

- that Emeritus Professor Eugenie Lumbers be appointed interim Branch representative on the Council until a permanent appointment be made.
- to recommend to Council that the Royal Society of NSW establish a Hunter Branch.

Following the business meeting Professor Hugh Durrant-Whyte FRS FRSN, NSW Chief Scientist and Engineer, delivered a lecture on 'Industries of the Future'. A Speaker's Medal was presented to Professor Durrant-Whyte by Professor Alex Zelinsky FRSN and the meeting was closed by Professor Sloan.



The Committee of the Hunter Branch, Royal Society of NSW

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Professor Hugh Durrant-Whyte FRS FAA FRSN NSW Chief Scientist and Engineer ‘Industries of the Future’



The Office of the Chief Scientist and Engineer provides independent advice to the New South Wales Government on a range of environmental and economic issues, such as groundwater resources and energy security. Science engagement and outreach are also supported through such activities as the NSW Premier’s Prizes, which in the last 10 years have gone from relatively low key awards to high profile celebrations in Parliament, and the Science and Engineering Challenge. The Office also sponsors conferences and provides co-investment support for successful NSW applications for the Commonwealth Government’s Industrial Transformation Research Program.

Professor Durrant-Whyte emphasised the role of research in the ‘prosperity economy’. His Office supports initiatives which aim to translate the best of NSW research into industry outcomes: from quantum technologies to robotics for agriculture, from advanced manufacturing to synthetic biology. These initiatives include the support of Centres of Excellence, National Collaborative Research Infrastructure, industry innovation networks and the new Physical Sciences Investment fund. His Office also works closely with other NSW Government Departments and Industry to develop a future industry strategy around emerging precincts, such as the proposed new Sydney Technology and Innovation Precinct.

He concluded his lecture by referring to the past and future roles of the Royal Society. Outside his new office in the Warren Centre at the University of Sydney copies of the Society’s *Journal* dating from the late nineteenth century may be found. They contain important papers about projects significant for New South Wales at that time, and show that the Society was clearly embedded in the NSW community. We now need to return to this position of having strong links with the community and of publishing research relevant to local industries.

Report on The Clarke Lecture 2019

Professor Emma Johnston AO FRSN

‘The Flying Eyes: How Ecologists are Using New Technology to See Hidden Worlds’

The Clarke Lecture for 2019 was given by Professor Emma Johnston AO FRSN at the Australian National Maritime Museum in Sydney on Thursday 19 September 2019, as part of the UNSW ‘Sci-Fi’ Series. Introduced by Professor Michael Archer Dist FRSN, Professor Johnston shared the stage with Associate Professor Tracy Ainsworth and Professor Andy Pitman.

Professor Johnston was awarded the 2018 Clarke Medal with the citation:

‘Professor Johnston is widely regarded for her exceptional contributions of our understanding of community ecology of marine animals. She applied the conceptual underpinnings of ecology to investigations of the most important contemporary drivers of ecosystem dynamics - human activities. By applying ecological principles to the study of human impacts on marine animals, Professor Johnston has created a highly original programme of research that not only progresses our fundamental knowledge in ecology, but also directly enables significant improvements in the management of marine systems.’



Professor Emma Johnston AO FRSN receiving the Clarke Medal from Her Excellency The Honourable Margaret Beazley AO QC, Governor of New South Wales and Patron of the Society

Her talk described the evolution of the way we can physically interact with oceans and features in the seas, particularly in the cold Antarctic ocean. Technology of underwater drones and cameras have advanced greatly and, with sophisticated mathematical and statistical analysis, enormous amounts of useful data are now being gathered.

Brynn Hibbert AM FRSN

Honours to Royal Society NSW Fellows



Associate Professor Elizabeth New FRSN Malcolm McIntosh Prize for Physical Scientist of the Year 2019 Prime Minister's Prizes for Science

The Malcolm McIntosh Prize for Physical Scientist of the Year was awarded to Associate Professor Elizabeth New FRSN for pioneering imaging tools that allow scientists to see deeper into cells than ever before. The Prime Minister's Prizes for Science are Australia's most prestigious awards for outstanding achievements in scientific research, research-based innovation, and excellence in science teaching. The Malcolm McIntosh Prize is the premier award in the Physical Sciences.

Professor Elizabeth New is a Chemical Biologist at the University of Sydney. She has pioneered the development of new chemical imaging tools to observe healthy and diseased cells. Existing imaging systems such as ultrasound and MRI provide structural information about biological systems, but cannot provide information about the nature or distribution of chemicals within the cell. Instead, she has developed molecules that act as fluorescent sensors, emitting light to make the observation of complex chemical processes within cells possible.



One major way her sensors are being used is in the field of oxidative stress. The imbalance of oxidising and reducing molecules in the cell is understood to be related to diseases associated with ageing. Until now, existing sensors could not distinguish between the chemical activity of healthy cells and diseased cells. Professor New's reversible sensors overcame this problem, allowing observation of how cells cycle through oxidative events over long periods of time. This will assist in the identification of potential treatments for diseases associated with ageing (e.g., cardiovascular disease, cancer and diabetes) – an important breakthrough considering that these affect 50 per cent of the Australian population and contribute to 85 per cent of deaths.

Using the same technology, Professor New prepared the first sensor for a metabolite of the anticancer drug cisplatin, which is widely used in chemotherapy (platinum drugs such as cisplatin are employed in about half of all chemotherapeutic regimens in Australia). This new sensor allows, for the first time, real-time visualisation of the metabolism of these drugs in cells.

At her awards presentation, she recalled, 'When I was ten my parents showed me a drop of blood under the microscope and I remember being fascinated by seeing all of the different types of cells. ... And now in my research, we're able to develop imaging tools that allow us to look even deeper into the cell to see the very molecules.'

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Honours to Royal Society NSW Fellows (contin.)

Scientia Professor Rose Amal AC FRSN

2019 NSW Scientist of the Year

NSW Premier's Prizes for Science & Engineering



Premier Gladys Berejiklian presents Scientia Professor Rose Amal with the 2019 Scientist of the Year Award

Scientia Professor Rose Amal AC FRSN has won the the 2019 NSW Scientist of the Year award at the NSW Premier's Prizes for Science & Engineering. She was honoured for her world-leading research in the fields of fine particle technology, photocatalysis and functional nanomaterials, which have profound implications for solar and chemical energy conversion applications such as water and air purification, and generating renewable hydrogen economically and sustainably. The annual prizes, awarded in ten categories, are held by the NSW Government to celebrate the achievements of the state's finest scientists, engineers and educators for cutting-edge work that has led to economic, environmental, health, social or technological benefits for the state.

Professor Amal is a chemical engineer and the leader of the Particles and Catalysis Research Group at the University of NSW. Her research contributions span from fundamental chemistry to applied chemical engineering, from material science and nano-research to specialised photochemistry. She has made significant contributions to these related areas of research for over 25 years. In 2018 she received a Companion of the Order of Australia 'for eminent service to chemical engineering, particularly in the field of particle technology, through seminal contributions to photocatalysis, to education as a researcher and academic, and to women in science as a role model.'

Upon receiving the 2019 NSW Scientist of the Year award, Professor Amal stated, 'When I first came to Australia from Indonesia more than 35 years ago, I never imagined that I would ever receive this award.'

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Honours to Royal Society NSW Fellows (contin.)

Payne-Scott Professor Nalini Joshi AO FRSN

Category I Prize for Excellence in Mathematics, Earth Sciences,
Chemistry or Physics

NSW Premier's Prizes for Science & Engineering



Payne-Scott Professor Nalini Joshi AO FRSN from the University of Sydney has won the Category 1 Prize for Excellence in Mathematics, Earth Sciences, Chemistry or Physics in the NSW Premier's Prizes for Science & Engineering 2019.

Professor Nalini Joshi was born and spent her early childhood in Burma, before her family migrated to Australia, where she completed a BSc, leading then to a PhD in applied mathematics at Princeton University. Her research focuses on mathematical methods to study nonlinear systems that arise as universal models in modern physics. She has developed precise definitions of elusive functions, enabling descriptions that extend to the whole domain of existence. They relate behaviours before and after critical transition points in applications such as spontaneous magnetisation in metals and water waves with surface tension. Her new methodologies have uncovered hidden information across multiple fields, stimulating mathematicians across the globe to take up significant new research directions. She said, 'Mathematics is so deeply a part of science and engineering that its impact is not always visible to everyone. I am particularly pleased for my work to be recognised as representative of mathematics through this award.'

Professor Joshi also has a keen interest in diversity. She was foundation co-Chair of the Science in Australia Gender Equity national initiative. In 2016, Nalini was appointed an Officer of the Order of Australia for distinguished service to mathematical science and tertiary education, to professional societies, and as a role model and mentor of young mathematicians. She is currently a Vice-President of the International Mathematical Union and a Councillor of the Royal Society of New South Wales.



Schedule of RSNW Events 2019

Date	Event	Speakers	Topics and Presentations	Location
6-Nov-19	Ordinary General Meeting	Professor Herbert Huppert	The Beginning of Weather Forecasting: Matthew Maury, Robert FitzRoy FRS and L.F. Richardson FRS	State Library of NSW
7-Nov-19	RSNSW & Four Learned Academies Forum	Anne Green AO FRSN, Kerrie Dougherty, Paul Scully-Power AM and others	Making SPACE for Australia	NSW Government House
21-Nov-19	Southern Highlands Branch Public Lecture	Dr Steve Harrison	Porcelain through History	Nattai/Joadja Room, Mittagong RSL
21-Nov-19	Women and Science	Em Prof Anne Green AO FRSN	An Accidental Astronomer	SMSA
4-Dec-19	Ordinary General Meeting	Jak Kelly Award Winner	2019 Jak Kelly Award Presentation & Christmas Party	State Library of NSW

Contacts for Your Officer Bearers and Council Members

Em Prof Ian Sloan AO President: president@royalsoc.org.au
 Em Prof D. Brynn Hibbert AM Vice-President (Immediate Past President): b.hibbert@unsw.edu.au
 Mr John R. Hardie Vice-President: john.hardie@royalsoc.org.au
 Ms Judith Wheeldon AM Vice President: judith.wheeldon@mac.com
 Mr Richard Wilmott Hon Treasurer: rjwilmott@gmail.com
 Bruce Rammage Hon Secretary (General): secretary@royalsoc.org.au
 Em Prof Robert Marks Hon Sec (Editorial): editor@royalsoc.org.au
 Dr Ragbir Bhathal Hon Librarian: R.Bhathal@westernsydney.edu.au
 Em Prof Lindsay Botten Hon Webmaster: Lindsay.Botten@uts.edu.au
 Ms Anne Wood (Southern Highlands Chair): wood.anne@gmail.com

Dr Mohammad Choucair: mohammad.choucair@sydney.edu.au
 Em Prof Robert Clancy AM: robert.clancy181@gmail.com
 Dr Laurel Evelyn Dyson (Bulletin Editor): Laurel.E.Dyson@uts.edu.au
 Dr Donald Hector AM: dchector@royalsoc.org.au
 Prof Nalini Joshi AO: nalini.joshi@sydney.edu.au
 The Hon Virginia Judge: diannejudge@hotmail.com
 Stuart Midgley: stuart.midgley@icloud.com
 Em Professor Bruce Milthorpe: Bruce.Milthorpe@uts.edu.au
 Dr Susan Pond AM: susan@pondemail.com
 Hon Prof Ian Wilkinson: ian.wilkinson@sydney.edu.au

The Bulletin is issued monthly by the Royal Society of New South Wales

Editor: Dr Laurel Evelyn Dyson

Contact: Ms Rachel Greenwood, Phone: +61 2 9431 8691 Fax: +61 2 9431 8677 Email: royalsoc@royalsoc.org.au

Mailing Address: The Royal Society of NSW, PO Box 576, Crows Nest NSW 1585, Australia

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