The Bulletin 419

The Royal Society of New South Wales

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For Your Diary:

5 April 2018
RSNSW & SMSA
Scientia Professor George Paxinos AO
'Global Deflation:
The Enlightenment has Failed!'
6.00pm or 7.30pm (see p. 5)
Mitchell Theatre, SMSA, 280 Pitt St

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12 April 2018
Southern Highlands Branch Lecture
Professor Anne Cutler
'Language in the First Year of Life
(Babies are working even harder than we thought)'
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

AGM and Open Lecture

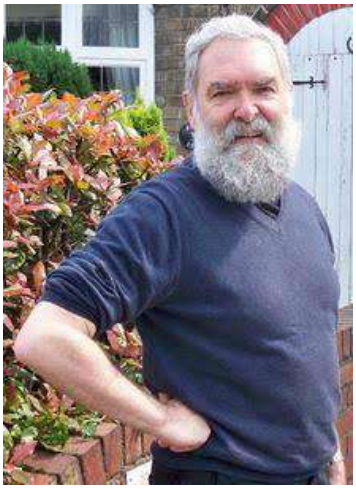
'Decarbonation of Industry'
Wednesday, 4th April 2018

Professor Paul Fennell
Professor of Clean Energy
Imperial College London

See page 3 for more information

Date: Wednesday 4th April 2018
Time: 5.45 for 6 pm start for AGM; 6:30 pm Open Lecture
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



As I reach the end of my two year tenure I must thank all the people in the RSNSW who have supported me during this time. Too many to individually name, they range from my fellow Officers and Councillors, through the grand staff at The Association Specialists, to the many members and fellows who have rocked up to meetings and perhaps have given one of our memorable talks. To you all – thank you.

I have briefed incoming President Ian Sloan, who is no stranger to running organisations of somewhat disparate (desperate?) individuals, and the transition to him and the new Council will happen smoothly. Life continues and I look forward having a stress-free Annual Dinner and the move of our OGMs to the State Library.

In April I shall be attending a lunch hosted by His Excellency the Governor to honour Professor Mary O'Kane FRSN. Professor O'Kane has retired from the post of Chief Scientist and Engineer of NSW and we wish her well in her new role as Chair of the Independent Planning Commission of NSW. The Society also looks forward to engaging with her successor at the office of the Chief Scientist and Engineer. Mary has been a good friend of the Society and offered help and advice as we were starting the new phase of our existence. Her suggestion of providing the Deans of Science and Engineering with a 'free lunch' in return for helping our awards committee choose suitable awardees was such a great idea. The Deans get to meet with the Chief Scientist and her staff when, as Mary put it, 'no one was fighting for money', and the RSNSW did not shirk from signing up all and sundry as members and fellows.

We have just heard the sad news that Scientia Professor David Cooper, the winner of the 2016 James Cook Medal, and one of Australia's most distinguished scientists in the field of infectious diseases and pioneer of responses to HIV, died on Sunday 18 March after a short illness. Vale David.

There is not much more to say, but do check out my annual report which will be available with the papers for the AGM. Good luck Ian, and welcome to our new Council!
Comment and suggestions to president@royalsoc.org.au.

Brynn Hibbert FRSN

… Continued from p. 1

Professor Paul Fennell

Professor of Clean Energy

Imperial College London

'Decarbonation of Industry'

In order to meet the IPCC (International Panel on Climate Change) recommendation for an 80% cut in CO_2 emissions by 2050, industries will be required to drastically reduce their emissions. To meet these targets, technologies such as carbon capture and storage (CCS) must be part of the economic set of decarbonisation options for industry. Options for decarbonising four of the largest industrial sectors (the iron and steel industry, the cement industry, the petroleum refining industry and the pulp and paper industry) as well as selected high-purity sources of CO_2 will be discussed. The factors found to have the greatest overall impact were the initial cost of CCS at the start of deployment and the start date at which large scale deployment is begun. The talk will then move on to the applications of high temperature solid looping cycles (Calcium and Chemical Looping) and their integration with different industries, including research conducted at Imperial College London investigating the applications of pressurized calcium looping. The presentation will also include an update on research conducted as part of the EU ASCENT and LEILAC projects.

Paul Fennell is a Professor of Clean Energy at Imperial College London. He obtained his degree in Chemical Engineering and PhD from the University of Cambridge. He is a Chartered Chemical Engineer and Scientist and Fellow of the IChemE. He also has Chaired the Institution of Chemical Engineers Clean Energy SIG, was a previous member of the International Energy Authority High-Temperature Solid Looping Cycles Network Executive, and has written reports for the Department for Energy and Climate Change (DECC) on future technologies for Carbon Capture and Storage (CCS) and carbon capture readiness. He has been director of Imperial College's Centre for Carbon Capture and Storage and is the deputy director (CO_2 capture) of the recently re-funded UKCCSRC. He has published 100 + papers since 2005 and is the 2015 winner of the Institution of Chemical Engineers' Ambassador prize. His interests are broad, encompassing waste utilisation, cement production and phytoremediation, as well as carbon capture and storage.

2018 Events
Royal Society – Southern Highlands Branch

Date*	Event	Speaker	Topic	Location**
12-Apr-18	Public Lecture	Prof Anne Cutler	Language in the First Year of Life (Babies are working even harder than we thought)	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

*Note that the April lecture will take place on the second Thursday of the month, not the usual third Thursday.

**1st Floor, Room Joadja/Nattai.

Professor Anne Cutler
'Language in the First Year of Life (Babies are working even harder than we thought)'

Babies are born without predisposition to a particular language; whatever language they hear, that is the language they acquire. In other words, the processes in the baby brain must be language-universal.

Adults listen extremely efficiently to speech in their native language, drawing on processes that would work poorly with other languages. In other words, speech processing in the adult brain is language-specific.

How does the baby's universality become the adult's language-specificity? How rapidly does this happen? (Whoops – looks like the title is giving away some of the conclusion!)

Professor Cutler studied languages and psychology in Melbourne, Berlin and Bonn, but embraced psycholinguistics when it emerged as an independent field, studying it for a PhD at the University of Texas. After postdoctoral fellowships at MIT and Sussex University, she was a research scientist at the MRC Applied Psychology Unit (Cambridge), then director at the Max Planck Institute for Psycholinguistics (Nijmegen, the Netherlands), and professor of comparative psycholinguistics at Radboud University Nijmegen. She is now professor in the MARCS Institute, University of Western Sydney, and program leader of the Australian Research Council Centre of Excellence in the Dynamics of Language. Her research, summarised in her book *Native Listening* (MIT Press 2012), centres on human listeners' recognition of spoken language, and in particular how the brain's processes of decoding speech are shaped by language-specific listening experience. Her work has been honoured with the Spinoza Prize of the Dutch Research Council and the ISCA Medal of the International Speech Communication Association, and she is an elected member of scientific academies in Europe, the US and Australia.

Anne Wood FRSN

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

Is the Enlightenment Dead?
Lecture 5

Scientia Professor George Paxinos AO FASSA FAA FRSN

University of New South Wales

Sophistry – 'Global Deflation: The Enlightenment has Failed!'

Reception to Socrates at the House of Agathon (*Creative commons via Wikimedia*)

Scientia Professor George Paxinos AO will lead an interactive sophistry that will discuss the statement 'the Enlightenment has failed' and the extent to which Nobel Laureate Joseph Stiglitz is correct in his view that 'Global Deflation is reversing international progress through rejection of the principals of the Enlightenment'. Attendees are encouraged to participate in the discussion.

This event's unique format will feature a buffet dinner (optional), followed by the sophistry and live music. All are welcome. **Advance bookings for Optional 1 are essential for catering purposes.**

Date: Thursday 5 April 2018
Times: 6:00 Arrival, Registration, Drinks
6:30 Buffet Dinner (optional)
7:30 Sophistry*
8:30 Live Music

Option 1: Dinner, Sophistry and Live Music
$35 SMSA & Royal Society Members & Fellows
$45 Non-Members & Guests

Option 2: Sophistry and Live Music <u>only</u> (from 7.30 pm onwards)
$15 SMSA & Royal Society Members & Fellows
$20 Non-Members & Guests

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

Registration: https://smsa.org.au/events/event/sophistry-the-enlightenment-has-failed/

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Scientia Professor George Paxinos AO completed his BA at The University of California at Berkeley, his PhD at McGill University, and spent a postdoctoral year at Yale University. He and Charles Watson are the authors of *The Rat Brain in Stereotaxic Coordinates*. With over 50,000 citations across its 7 Editions (March 2014), it is the third most cited book in science after *Molecular Cloning* and the *Diagnostic and Statistical Manual of Mental Disorders*. Prof Paxinos has also published another 45 books on the structure of the brain of humans and experimental animals, his most recent being *MRI/DTI Atlas of the Rat Brain*.

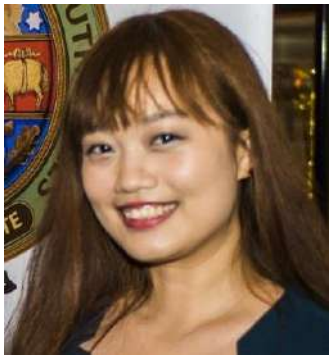
His work was recognised by an AO, Ramaciotti Medal, Humboldt Prize, a $4 million NHMRC Australia Fellowship and the NSW Premier's Prize for Excellence in Medical Biological Sciences in 2015. He is a Fellow of the Australian Academy of Science, the Academy of Social Sciences in Australia and a corresponding member of the Academy of Athens. His novel *Κατ' Εικόνα (In His Image)* was published in Greek in 2015 (English version pending).

New Members

At the March OGM a Fellowship was awarded to Prof Conigrave, and we welcomed new Members Dr Merrilyn Clancy, Dr Diana Farlow, Prof Bernard Pailthorpe and Angel Khin.

Merrilyn Clancy

Diana Farlow



Angel Khin

Bernard Pailthorpe

Arthur Conigrave

Report of the 1261st OGM
Wednesday 7th March 2017

Professor Leslie Burnett FRSN
'Precision Healthcare: The Coming Revolution in Medicine'

Prof Leslie Burnett FRSN receives his medal from Prof Ian Sloan FRSN FANZMAC

Pathology is a major part of medicine as it tackles the cause and processes of diseases. Genetic Pathology searches for abnormalities in our DNA to diagnose disease. There is genetics – the heredity of a disease, studying one gene at a time – and genomics, the study of all genes in a person's genome. Major categories of genetic disorders include germ-line (that is, inherited) or somatic (acquired during the subject's life).

Prof Leslie Burnett, Chief Medical Officer of Genome.One, the Garvan Institute of Medical Research, introduced us to how doctors think with regards to the testing and diagnosis of disease. Zooming into a person's DNA provides a picture of how it is organised, firstly the chromosomes, and then coding variations in genes: 6.4 billion nucleotides, ~21,000 protein-coding genes and ~100 pathogenic variants.

In recent years, genetic testing has evolved enormously from a single gene test to gene panels, whole exome sequencing and now to whole genome sequencing (WGS). Testing for a single gene is simple and cheap, ~$50-200, e.g., cystic fibrosis or Tay Sachs disease. Gene panels are for testing a group of disorders, e.g., neuromuscular disorders or familial cancer syndromes, in which ~20-200 genes might be involved. These cost about $500-1,500. A whole exome sequencing is complex and requires a high degree of expertise, with a price tag of about $2,000.

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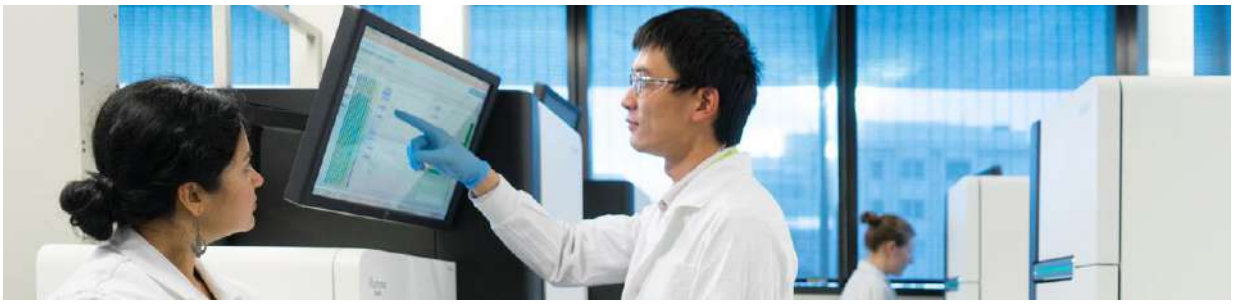
The WGS is 100 times larger than exome sequencing. Obviously, it yields maximum diagnostic power as it finds everything. It provides the lowest cost per gene and will be the way forward. However, it is complex and expensive unless really needed. Nor would everybody like to know what the future brings: there are major ethical issues and the doctor needs to ascertain the patient's wishes. For example, there is the issue of 'incidental findings' which were not expected and which the patient might not want to be informed about, e.g., cognitive decline. The cost of WGS has dramatically come down from ~$100 million in 2001 to $1,000 now, with costs predicted to decline further.

Leslie presented an overview of the process with pre-test, sequencing, bioinformatics and post-analytics. DNA sequencing technology allows computers to pull out regions of interest where perhaps mutations have occurred. The Kinghorn Centre uses the spare computing power from Amazon. The genes of an individual are compared to a 'reference genome'. The initial stages of the process are automated, but the final stages of analysis are conducted manually by experts: the expense derives largely from this cost of interpretation.



(*Photo: P. Morris, Garvan Institute*)

In 2012, the Garvan Institute set up the Kinghorn Centre for Clinical Genomics (https://www.garvan.org.au/research/kinghorn-centre-for-clinical-genomics/clinical-genomics) to advance the use of genomic information in patient care. They started with 8 staff and have now about 60 people applying genomics in whole-life healthcare, beginning with newborn screening. Genomic testing will have a particular impact on (i) rare and inherited disease diagnosis, (ii) cancer, and (iii) health management, including predisposition testing, carrier testing and preventive drug reaction. For a personalised risk assessment they offer face-to-face counselling, but need consent before taking a blood sample, extracting DNA and putting it into a sequencer. (By contrast, for use in ancestry testing there is no medical involvement.) Different variants are grouped into 5 classes of risk using an international system. Currently, testing is focused on cardiac, cancer and other medically treatable conditions, and on pharmacogenomics, that is, on genes which have implications for our ability to absorb, metabolize and clear medications from our body. Pharmacogenomics allows the personalization of medication, e.g., the selection of the most affective drugs. Precision medicine is on the horizon with the 4 Ps: predictive, preventive, personalised and participatory. In question time, Leslie informed us that the interest in genomics is no longer driven only by people of European descent, but the Chinese are getting heavily involved. Genomic privacy and insurance remain an issue, but might also be positive in view of mitigating risks.

Report of the 15 March 2018 Meeting
Royal Society Southern Highlands Branch

Dr Bradley Tucker
Research School of Astronomy and Astrophysics
Mt Stromlo Observatory, ANU
'Exploding Stars, Dark Energy, and the End of the Universe'

This exciting speaker attracted an audience of 58 in the Joadja/Nattai conference room at the Mittagong RSL on Wednesday 15 March. Professor Tucker mentioned in his opening address that much of the work he was about to present may be seen by some as a special tribute to Professor Steven Hawking, who had passed away the day before. Hawking's theories had set a profoundly solid base for all astrophysicists for many years to come, and Tucker added that no lecture such as this could be complete without frequent reference to the relationship between space and time as described by that outstanding scientist.

Bradley Tucker received degrees in Physics, Philosophy and Theology from the University of Notre Dame before undertaking a PhD at Mt Stromlo Observatory at ANU, working with Nobel Laureate Brian Schmidt. He is currently working on projects trying to discover the true nature of dark energy which makes up 70% of the Universe. He is also the lead of the Kepler Extra-Galactic Survey, a program to understand why and how stars blow up. In addition, he is leading a project to build a network of ultraviolet telescopes in the upper atmosphere, these telescopes being built at Mt Stromlo.

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The research of astronomers and astrophysicists to explore the expanding nature of the Universe has been based in recent years on observations of the most powerful explosions in the cosmos, the exploding stars known as supernovae. From this data, it was found by Brian Schmidt and his team several years ago that the expansion of the Universe is not just happening, but is occurring at an accelerating rate due to dark energy which will cause the end of the Universe.

In this lecture, Dr Bradley Tucker described in detail the characteristics of different supernovae resulting from the particular ways that a star had exploded. The energy emanating from one supernova is equivalent to that from 100 million billion billion billion (100 decillion) lightning bolts. 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, they can be used as cosmological probes to study what the Universe is made of and how it is growing. In this wide-ranging lecture, Dr Tucker showed in detail how supernovae are found, and how to identify different types. He discussed how to find supernova progenitors, and then described, among others, core-collapse supernovae, and the shockwaves resulting from them.

Supernovae (http://www.mso.anu.edu.au/~brad/#)

At the conclusion of the lecture, and during question time, there was a great deal of robust discussion with the speaker as the large audience pondered the ultimate fate of the Universe. Dr Tucker raised the possibility that at the time of the *Big Bang* approximately 14 billion years ago, our Universe was formed at the same time that a previous Universe was passing into history. A memorable and challenging lecture.

Anne Wood FRSN

Schedule of RSNSW Events 2018

Date	Event	Speakers	Topics and Presentations	Location
4-Apr-18	Annual General Meeting	Prof Paul Fennell	Decarbonation of Industry	Union, University & Schools Club
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	State Library of NSW
4-Jul-18	Ordinary General Meeting	Prof Gordon Wallace	3D Printing of Body Parts	State Library of NSW
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	State Library of NSW
tba	Poggendorff Lecture	Prof Brent Kaiser	tba	
3-Oct-18	Ordinary General Meeting	TBA		State Library of NSW
7-Nov-18	Ordinary General Meeting	TBA		State Library of NSW
November	RSNSW & Four Learned Academies Forum	TBA		
5-Dec-18	Ordinary General Meeting	Jak Kelly Award Winner	2018 Jak Kelly Award Presentation & Christmas Party	State Library of NSW

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