The Bulletin 382

The Royal Society of New South Wales

ABN 76 470 896 415 ISSN 1039-1843 October 2014

Future Events

Wednesday 5 November 2014
1227th Ordinary General Meeting
A Drop of Optics
Delivered by:
Dr. Steve Lee and Dr. Tri Phan
Union, University & Schools Club
25 Bent St, Sydney
6:00 for 6:30 pm

Thursday 20 November 2014
The Liversidge Research Lecture
Recent Studies on the Total Synthesis of Natural Products and Related Systems
Delivered by:
Professor Martin Banwell, ANU
Lecture Theatre 4, School of Chemistry, University of Sydney
5:30 for 6:15 pm

Wednesday 3 December 2014
1228th Ordinary General Meeting
2014 Jak Kelly Award and Presentation followed by the Society's Christmas Party
Union, University & Schools Club
25 Bent St, Sydney
6:00 for 6:30 pm
Enjoy a welcome drink from 6 pm
Book for the function after the meeting: $35 per head
Dress code: jacket and tie

SOUTHERN HIGHLANDS BRANCH
Thursday 6 November 2014
Bees in the Food Chain, Economy and Threats
Delivered by:
Professor Medeleine Beekman
6:30pm

Thursday 20 November 2014
Genes and their relationship with Epigenes
Delivered by:
Dr. Catherine Suter **6:30 pm**

Wednesday 5 November 2014

A Drop of Optics

Dr. Steve Lee and Dr. Tri Phan, joint winners of the 2014 ANSTO Eureka Prize for Innovative Use of Technology

1227th Ordinary General Meeting

Union, University &Schools Club

25 Bent St. Sydney 6:00 for 6:30 pm

Lenses are an integral part of our technology-driven society that are used in areas of lighting, vision, communication, health and entertainment. Yet individuals cannot make their own lenses tailored to their own purposes. Why is this? For centuries, lenses are traditionally made with complex machinery because the need for fine grinding and re-flow moulding techniques to create smooth lens surface. So, how can we simplify such a complex process?

Dr Steve Lee

Nature makes lenses with droplets on a daily basis. Single dew (macrodroplet) forms through the process of condensation, where miniscule drops of water nucleate and coalesce to form millimetre-sized water droplets on a solid surface. This happens on window panes (partially wetted surface) and on glass panes of greenhouses, where they form a natural diffuser halving the transmission of the sunlight. A half-empty wine glass often displays a thin film of liquid with "tears drops" - beads of liquid forming due to the surface tension gradient (Marangoni effect). A droplet of liquid hanging off a flat surface assumes the shape of a lentil and behaves like a thin lens due to opposing forces (gravity and surface tension).

In this talk, we shall discuss the role of liquid droplets in optics and our recent discovery in harvesting solid lenses from hanging liquid droplets. Our droplet lens fabrication approach is an additive process and leaves little material loss

(Continued on page 2)

(Continued from page 1)

that contrasts traditional lens manufacturing techniques such as cutting, milling and polishing. Our lenses were shown to image microscopic structures down to around 4 µm with 160x magnification. We were able to transform an ordinary commercial smartphone camera into a low-cost digital dermascope (60x magnification) that can readily visualize microscopic structures on skin such as sweat glands.

Dr W M (Steve) Lee is a Lecturer in the Research School of Engineering at the Australian National University, Canberra, where he is the head of the Applied Optics Lab. He is also a visiting fellow at the Garvan Institute of Medical Research and an Associate Investigator of the ARC Centre of Excellence in Advanced Molecular Imaging. He has been awarded multiple fellowships including ANU Future Engineering Research Leader Fellowship, UNSW Vice Chancellor Fellowship and the Royal Society (UK) International Incoming Fellowship. He previously held senior industry appointments and led a team in the specialized commercial microscopy unit. In 2014, he is the co-recipient (with Dr Tri Phan) of the 2014 ANTSO Eureka Prize in Innovative Use of Technology.

He received interdisciplinary training first in electronics (NTU), followed by optical physics (Uni of St Andrews) and biomedical imaging (MGH/Harvard). He has published > 50 technical articles in top tier Optics, Applied Physics, Biochemical method journals and international conference proceedings. Recently, he has been invited to speak at the Biophotonics symposium (ICMAT 2015, Singapore), OSA Optical Congress Meeting (OFT'2014, Hawaii) and TEDx 2014 (Tedx Canberra'14). He chaired the Bioimaging session at Australian Biomedical Engineering Conference 2014 and is an active member of OSA and SPIE.

Dr. Tri Phan

The droplet lens technology has been reported in over 30 international articles and local press articles: Time.com (USA), The Australian (Australia), Xinhua (China), International Business Times (UK), Times of India (India), ABC (News), SBS-One (World News), Nine News.

Dr Tri Phan studied undergraduate medicine at the University of Sydney and undertook clinical training at the Royal Prince Alfred Hospital. He completed a double fellowship in Internal Medicine and Pathology under the guidance Drs Stephen Adelstein and Roger Garsia in the Department of Clinical Immunology at RPAH. He subsequently established a B cell receptor knock-in mouse model to study B cell in vivo responses in tolerance and immunity for his PhD with Professor Tony Basten and Dr Robert Brink at the Centenary Institute. His interest in defining the in vivo contexts and resolving dynamic processes in space and time lead him to post-doctoral studies with Professor Jason Cyster at the University of California, San Francisco where he used intravital two-photon microscopy to investigate the microanatomy of B cell activation.

Tri is currently at the Garvan Institute where he has established an intravital two-photon microscope facility and is focussed on applying localised photochemistry to optically mark and track rare biological events over long distances and time windows. Tri was a joint winner of the 2014 ANSTO Eureka Prize for Innovative Use of Technology.

Dress code: jacket & tie
Members: $5; non-members: $20
Dinner after the meeting: $75

Australian Institute of Physics

NSW Branch

2014 Postgraduate Awards Event

Tuesday 18 November 2014
at 6 pm

VENUE:
The Slade Lecture Theatre, University of Sydney

Guest Speaker:
Dr. Ragbir Bhathal,
University of Western Sydney

Topic:
Astronomy of the Ancient Australians

The Liversidge Research Lecture for 2014

Recent Studies on the Total Synthesis of Natural Products and Related Systems

to be delivered by

Professor Martin Banwell

Research School of Chemistry, Institute of Advanced Studies, Australian National University, Canberra

Thursday 20 November 2014 at 5:30 pm for 6:15 pm start.
Refreshments served outside the theatre from 5:30 pm

A diverse range of biologically active natural products is being targeted for synthesis in our laboratories. The motivations for undertaking such work are three-fold: (a) to develop structure-activity relationship (SAR) profiles for the relevant class, (b) to develop new synthetic methodologies and (c) sometimes to establish the true structure of the natural product.[M. G. Banwell*, Tetrahedron,* 2008, **64**, 4669]. Of course, such pursuits can become all the more fascinating when completely unexpected processes are uncovered. In this presentation, examples of all of these possibilities will be presented.

Martin Banwell was born and educated in New Zealand. In 1979 he completed his PhD in organic chemistry at the Victoria University of Wellington where he worked under the supervision of Brian Halton. After a post-Doctoral period with Leo Paquette at the Ohio State University he took up a Senior Teaching Fellowship at the University of Adelaide in South Australia. In 1982 Banwell moved to a Lectureship at the University of Auckland in New Zealand and then to an equivalent position at the University of Melbourne in 1986. He was promoted to a Readership in Organic Chemistry at the same institution in 1993. In 1995 he moved to the Research School of Chemistry (RSC) at the Australian National University as Senior Fellow. In 1999 he was appointed Professor of Chemistry and served as Director of the RSC from the beginning of 2008 until mid-2013.

Professor Banwell's research interests are in the area of synthetic organic chemistry, particularly the development of new methodologies and their application to the total synthesis of biologically active natural products. He is the author or co-author of some three hundred journal articles in this broad area. A particular emphasis has been the exploitation of strained organic compounds and the products of whole-cell biotransformations for such purposes. In recognition of his work, Professor Banwell has received a number of awards including the Rennie and Birch Medals of the Royal Australian Chemical Institute. In 2003 he received the Royal Society of Chemistry (UK) Award in Synthetic Organic Chemistry and was elected to Fellowship of the Australian Academy of Science in the following year.

Report on the Society's 1226th Ordinary General Meeting held on 1 October 2014

Australia's most spectacular environmental rehabilitation project: Phillip Island, Pacific Ocean

Dr Peter Coyne

Dr Coyne presented with a Speaker's Medal by Vice-President John Hardie

Perched atop a submerged seamount, in turn atop a submarine ridge, Phillip Island and its close neighbour Norfolk Island are tiny specks, the only land in a vast expanse (2.5 million square kilometres) of the southwest Pacific Ocean. Both islands were created by volcanic activity between 2.8 and 2.2 million years ago. The plateau top of the seamount, 100 x 35 kilometres, is between 30 and 75 metres below present sea level.

Sequential ice ages during the last 2 million years exposed the entire plateau, an area about 100 times the size of the present islands. Such an area could have accommodated about four times as many species as the present islands. During the last ice age the entire plateau was exposed for 24,000 years until 13,000 years ago. Sea level 25 metres higher, reached 10,000 years ago, still exposed an island about 35 km long, large enough to accommodate more than double the species count of the present islands and joining these islands with dry land. An island at least this large was exposed for 60,000 years during the last ice age, before the sea reached its present level just 6,000 years ago. The generally much larger size of the islands and the ecological stress caused by their declining area, and the consequent loss of three-quarters of their species, between 13,000 and 6,000 years ago, could help explain the great biological value of the islands and Phillip Island specifically.

Phillip Island was densely vegetated when pigs were released there in 1793, followed by goats and rabbits by 1830. The feral grazers quickly destroyed the vegetation and by 1860 the island was mostly bare. Photographs dated 1906, when only rabbits remained, show landscapes almost identical to those of 1980 — almost no vegetation was present. In 1979 Dr Coyne began a three-year experimental program to investigate the effects of the rabbits and potential for vegetation re-establishment. The work was physically difficult and often hazardous. The first year's results were enough to persuade decision-makers the rabbits should be eradicated.

That work began in 1981 and by 1986 the rabbits had been destroyed by a combination of an artificial strain of myxoma virus, poisoning, shooting, trapping and fumigating. The eradication program required swimming to habitat accessible only from the sea, archery to distribute the myxoma vector (rabbit fleas) to other inaccessible areas of habitat, and a lot of rock climbing on cliffs to 250 metres high. Since then the island has been transformed by new vegetation, most arising spontaneously. Some of the world's rarest plant species have been discovered, rediscovered or have increased in numbers. One has only a single genotype, two have fewer than fifty individuals and another has fewer than 250 individuals. A genus and species endemic to Phillip Island sadly was not rediscovered and at least two Phillip Island plants are extinct. Fauna have also benefitted from the revegetation, and being free of rats and cats the island has potential as a refuge for threatened fauna endemic to Norfolk Island.

Brendon Hyde

Southern Highlands Branch

Report of October Meeting 2014

What could be neater than spending your working days trying to understand something about the fundamental building blocks of the Universe?

Associate Professor Kevin Varvell

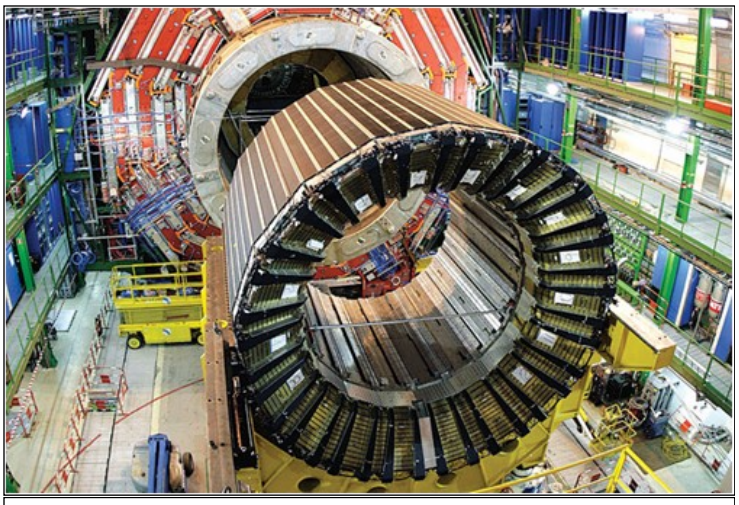
Director of the University of Sydney node of the ARC Centre of Excellence for Particle Physics at the Terascale

Associate Professor Kevin Varvell is an experimental particle physicist working in large scale international endeavors such as the ATLAS experiment at CERN's Large Hadron Collider and the Belle experiment at KEK in Japan. Kevin is with a group of Australian scientists who are at the core of the largest and one of the most controversial science experiments in history – recreating conditions at the beginning of the universe.

The $10 billion, 27 km circle of the Large Hadron Collider built by CERN lies 100 metres below ground on the border of Switzerland and France. Particles are accelerated around the most powerful collider in the world until they reach close to the speed of light, then smash together inside a seven-storey high containment chamber known as ATLAS. Scientists are trying to discover the secrets of the origin of the universe, to simulate what happened in the millisecond after the Big Bang, to work out how it led to the creation of stars, organisms and planets.

In 2012, scientists at CERN announced that they had found evidence of the existence of the Higgs-boson particle, the particle that gives mass to all particles. In the experiments which lead to this conclusion, beams of protons are sent in each direction, each beam containing 2800 bunches of protons, and each bunch containing 100 billion protons. Each proton crosses the French-Swiss border 11,200 times per second, the inside of the beam pipe being colder than deep space.

The ATLAS collaboration is truly global, involving 38 countries, 177 institutions and 3000+ scientific authors. The Nobel Prize in Physics 2013 was awarded jointly to Francois Englert and Peter W.Higgs *"for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the discovery of the predicted fundamental particle, by the ATLAS and CMS experiments at CERN's Large Hadron Collider."*



CERN's Large Hadron Collider

Professor Varvell, in discussing our understanding of why particles have mass, spoke of Peter W Higgs' theory from 45 years ago. Part of Higgs' theory predicted that there should be another particle that hadn't yet been found, and which would be responsible for giving all other particles mass. Amazingly it took until 2 years ago for proof that the predicted particle really existed. The Higgs-boson particle has been found to be extremely short-lived in experiments to date. It seems that it has a life of only 1/10,000,000,000,000,000,000,000 seconds before it decays to other entities.

The new boson's mass has been estimated to be around 135 times that of a proton. Dr Varvell told the 77 person audience that if the Standard Model of physics is all there is, then from galactic rotation curve studies, the Higgs mass should be more like 1,000,000,000,000,000 times the mass of a proton, or even greater. There is clearly much more research to be done.

Currently the composition of the universe is described as 4.6% atoms, 23% dark matter and 72% dark energy. Dr Varvell stated that it is only by understanding what particles are in the universe, or used to be in the universe when it first began, that we can actually understand how the universe changed from what we call the Big Bang to how it looks and behaves today.

Anne Wood

From the President

Migration of the Society's back-office services to The Association Specialists (TAS) has now been completed and I am pleased to report that it has been most successful. We hope to have the new, web-based member management and event registration system available shortly and this will allow members to easily update their own information and book and pay for events, such as monthly meetings, dinner reservations and merchandise purchases.

There are two important lectures coming up over the next couple of months. The first is the Liversidge Research Lecture 2014. This will be delivered by Professor Martin Banwell of the Australian National University. Professor Banwell is one of Australia's most accomplished chemists. His research focuses on organic synthesis, in particular, the total synthesis of biologically-active natural compounds and their analogues. The lecture will be on Thursday 20 November at Sydney University – see the website for details. The Liversidge Research Lecture has a great tradition, having been delivered in conjunction with Sydney University every two years since 1931.

Another very important occasion is the 2014 Dirac Lecture presented by the University of NSW in conjunction with the Society. This year we are very fortunate that the lecture will be delivered by Professor Serge Haroche of the Collège de France. Professor Haroche (jointly with David J. Wineland) was awarded the 2012 Nobel Prize for Physicsfor "ground-breaking experimental methods that enable measuring and manipulation of individual quantum systems", for their work on understanding the photon. The Dirac lecture will be presented on Tuesday 9 December at UNSW. (Further details will be available on the website shortly.)

The 2014 Jak Kelly award seminar will be held in November with a presentation by the winner to take place at our meeting prior to the Christmas party on Wednesday 3 December.

Planning continues on the events programme for 2015 – if there are specific subject areas you would like to see included, please contact John Hardie, chairman of the Events Committee. We have a number of brand-new concepts under development that we hope will be particularly attractive across our entire membership of Fellows and Members.

If there are any issues you would like to raise with me, I am easily contacted by e-mail at *president@royalsoc.org.au* and would like to hear from you.

Donald Hector

The Bulletin is issued monthly by the Royal Society of New South Wales
Contact: Mr Ben Williams Phone: +61 2 9431 8691 Fax: +61 2 9431 8677 Email: info@royalsoc.org.au
Mailing Address: The Royal Society of NSW, PO Box 576, Crows Nest NSW 1585, Australia