The Royal Society of New South Wales
Bulletin and Proceedings 326
ABN 76 470 896 415 ISSN 1039-1843 June 2009

Future Events 2009

Lectures in Sydney are held in Lecture Room 1, Darlington Centre, University of Sydney at 7 pm on the first Wednesday of the month with drinks available from 6 pm.

Wednesday 1 July 2009 7pm

Accurate Measurement: the vital backbone of Australian science & industry
Dr Laurie Besley
Chief Executive & Chief Metrologist, National Measurement Institute

Wednesday 5 August 2009 7pm

What Will Coral Reefs Look Like in 2050?
A/Prof Peter Ralph
Head, Aquatic Photosynthesis Group,
University of Technology

Southern Highlands Branch

Meetings are held on the third Thursday of each month in the Drama Theatre at Frensham School, Mittagong (enter off Waverley Parade), at 6.30pm.

next talk
Thursday July 16, at 6.30pm

Crooks, Cranks and Charlatans – scientific scams and how to avoid them
Professor D Brynn Hibbert

Bulletin Editor, Bruce Welch

Membership Renewals

Thank you to the many members who have renewed their membership promptly. Many more members paid by direct debit this year than last. Only two members made it a bit difficult to identify themselves by not putting their name in the reference section. Reminders will be mailed to members who remain un-financial in June. Your support is very much appreciated.
Marian Haire, Hon. Treasurer

Lecture 1 July 2009, Darlington Centre at 7pm

Accurate Measurement: the vital backbone of Australian science & industry

Dr Laurie Besley
Chief Executive & Chief Metrologist
National Measurement Institute

Measurement pervades all aspects of our society, from the sale of food by weight in the supermarket, to the management of data transfer systems to better than nanosecond precision for the telecommunications sector. The National Measurement Institute (NMI) is the national core of Australia's expertise in measurement and has the responsibility to address this entire spectrum of needs. It not only maintains, develops and disseminates the primary measurement standards for Australia in physics, chemistry and biology, but also operates specialist laboratories based on these measurement skills, such as a mainstream forensic laboratory, Australia's only WADA-accredited sports drugs laboratory, and a high-voltage laboratory for the electrical utilities. The talk will discuss how NMI addresses this myriad of challenges and outline the outcomes to Australia from its activities.

Dr Besley's scientific and management career has spanned a diversity of fields including, for the last dozen years, metrology in chemistry. After beginning his career in cryogenic temperature measurement and spending 20 years working in physical metrology, he applied his PhD in chemistry to transplanting the metrological approach from physics to chemistry and initiated work in this area within what was then the National Measurement Laboratory (NML) in Australia. He then became Director of the National Analytical Reference Laboratory within the Australian government body AGAL. When AGAL and NML both became part of the new organisation NMI in 2004, he was first appointed to a role as general manager of the metrology in chemistry branch and late in 2007 was given his present role as Chief Executive. Dr Besley has a publication list of some 75 journal publications in a variety of different fields of metrology.

Dr Besley is a member of the Royal Australian Chemical Institute and a Fellow of the Institute of Physics (UK). He is also a member of the NATA Council. He is active in a number of international forums including being a consultant to the Executive Committee of the Asia-Pacific Metrology Programme. He is a member of the editorial boards of the international journals "Metrologia", "IET Science Measurement & Technology", and "Accreditation and Quality Assurance". He has worked on a number of occasions as a consultant for the Technical Cooperation programme of the German metrology institute (PTB), mostly in Thailand, and most recently in Sri Lanka.

New environmentally friendly approaches to cooling buildings

A summary of the July lecture by Professor Geoff Smith

There is a hole in the atmosphere that can be used to cool buildings. This is important because the electricity used for air-conditioning is a major contributor to green house gas emissions and building running costs.

Professor Geoff Smith from UTS explained that at wavelengths below 8 micrometers, the atmosphere is opaque because of absorption from water vapour. Above 13 micrometres it is opaque because of absorption from carbon dioxide and water vapour. So for long and short wavelengths we see a hot opaque atmosphere and no radiative cooling is possible.

However, between 8 and 13 micrometers the atmosphere is fairly transparent (opacity is 17% at the vertical, increasing to 100 % at the horizon). So at this "wavelength hole", an object can radiate its heat away through the atmosphere into space and receive little heat back from the atmosphere. The cooling effect is greatest towards the vertical. Prof Smith has shown that net-cooling powers can in principle exceed 200 W/m^2. Experimental systems developed by his group can run 10^{o}C below ambient at night and pump 135 W/m^2. Or they can achieve much lower temperatures with smaller cooling powers. The key is to use an optical design in which the radiator only sees the "cool" sky at the zenith. If these systems are shielded from the direct sun, they can also give good cooling during the day. Prof Smith has investigated special selective surfaces that radiate most efficiently in the "wavelength hole" with little emission at other wavelengths. Surprisingly, these selective surfaces offer little advantage, except when one is striving for the lowest possible temperature.

Professor Smith then discussed new building materials he has worked on that can help cool buildings. With BASF and others he has helped develop special paints that reflect the infrared part of sunlight but look like ordinary pigments to the naked eye. A special white paint developed by UTS can greatly decrease solar heating. When tested on a Queensland supermarket it cut air-conditioning power consumption by two thirds.

Another interesting material described by Prof Smith is Micronal sheeting (made by BASF). This is plasterboard with a high loading of microcapsules of an alkane wax that changes phase at room temperature. This gives the material superb heat storage capabilities. A 3 cm sheet has the same heat capacity as 18 cm of concrete or 23 cm of brick. A building using this material can have enhanced comfort and reduced costs with minimal air conditioning or heating. In summer one lets in the cold night air to chill the sheets, and then uses them to cool the building during the hot part of the day. In winter, the noon sun warms the sheets, which can heat the building at night.

Clearly radiative cooling and new, high tech materials have an important future in cooling buildings.

Jim Franklin

Vale

Howard Hamlet George McKern

Howard McKern, who was the Society's President in 1963 and the recipient of the Society's medal in 1968, passed away on 7 June 2009, aged 92.

He was employed at the Museum of Applied Arts and Sciences, Sydney (now generally known as the Powerhouse Museum), from 1945 and retired as Deputy Director in 1977. Howard published several papers in the Society's journal, principally in the field of phytochemistry and chemotaxonomy.

Howard was a chemist and did a vast amount of work on essential oils, a subject which was also a speciality of an earlier society president, A. R. Penfold, as well as a society councillor M. B. Welch, one of his predecessors at the Museum.

RACI News

Weekly E-News (including forthcoming events) of The Royal Australian Chemical Institute Inc. NSW Branch are obtainable on their web site at http://www.chem.unsw.edu.au/raci/News.html

From the President

On 1 June I was fortunate in being able to meet with the Chief Scientist and Scientific Engineer of NSW, Professor Mary O'Kane. The meeting centred around the concept of Science House and strategies for its reinvigouration as a 'hub' for science in NSW. Professor O'Kane is very supportive of our efforts and is working with us to find ways of achieving our aim.

I have been having further discussions with the Executive Dean of Science at Macquarie University, Professor Stephen Thurgate, and some of his colleagues, about the implementation of a joint program for schools, in a sense a modern version of the Summer Schools the Society used to run in conjunction with that university. Julie Haeusler, our new Council member, and I are developing a pilot program which we propose to run towards the end of Term 3 this year involving a small group of schools from the northern beaches of Sydney. We would then run further pilot programs next year with a view to expanding it for the summer of 2010/11. More on this will appear in subsequent Bulletins.

Julie and I are also pursuing some ideas which might enable the Society to have input into the Department of Education and Training's Connected Classrooms program, where new communications technologies are being progressively introduced into schools. This may be an opportunity for practising scientists to have more of an impact on the teaching of science in schools.

On Friday 5 June I was pleased to represent the Society at the State Library for a performance of Harmonious Revolutions: Galileo and the Music of the Spheres, which the Society helped sponsor, thanks to the generous support of a member. It was a wonderful evening with recitations, music and song, and the magnificent astronomical images of David Malin. I was very pleased to see quite a few Society members enjoying the event.

Our office staffing arrangements have now started to settle down with the appointment of Sonia Chan to replace Val Gregory. Many thanks to Michelle for her efforts to create a smooth transition during the recruitment phase. Liz de Rome continues as the overall manager of the office.

John Hardie

Queen's Birthday Honours

One of our longest serving members, Dr Gerald Westheimer, has been honoured with the award of Member of the Order of Australia (AM) in the recently announced Queen's Birthday Honours. We congratulate Dr Westheimer for his achievement and for his long-standing support of the Society. Dr Westheimer, who now lives in the USA, is one of the pioneers of modern optometry.

We also congratulate Professor Kurt Lambeck, AO, President of the Australian Academy of Science, who became an Officer of the Order of Australia at the same time.

New Members

Four new members were announced at the June meeting of the Society.

Frank Stening - Full member
Clive Probyn - Full member
Christopher McErlean - Full member
Anne Wood - Full member

We welcome them into the Society.

Australian Institute of Physics NSW Branch

5th General Meeting 2009
Tuesday 28 July 2009 @ 6:30pm
'Physics for Medicine and Astronomy'
Dr Zdenka Kuncic
University of Sydney

6th General Meeting 2009
Tuesday 18 August 2009 @ 6:30pm
'High-Power Ultrasonics and its Applications'
Dr Tony Farmer
CSIRO

Location of talks: Slade Lecture Theatre, School of Physics, University of Sydney. Refreshments are available from 6:00pm. Entrance to all events is free.

Dinner to follow at Buon Gusto Restaurant, Abercrombie St. Please contact Dr Fred Osman on 0418 444 477 to book.

A Physician's Feast: Galen and Ancient Greek Food

The Sydney Friends of the AAIA (The Australian Archaeological Institute at Athens) are pleased to announce a new collaboration between David Tsirekas of Perama Restaurant, Petersham and Renée Regal of Sydney University.

Saturday July 11, 2009 10:30am to 2:30pm

To be held in the Old Teachers' College teaching kitchens (University of Sydney)..

The class will be followed by lunch where participants can sample the dishes cooked on the day.

Cost: $100 including GST

Call 9351 4759 or email aaia.sydney@usyd.edu.au for more information or bookings. Class is limited to 25 persons.

Southern Highlands Branch

Report of May Meeting

Mammals from the Age of Dinosaurs: an Australian Perspective by Dr Thomas Rich

The Branch held its May meeting at 6.30 pm on Thursday 21st May in the Drama Theatre, Frensham School, Mittagong.

Dr Rich was a member of a team of paleaontologists contributing to mammalian discovery in Australia on the Victorian coast at two sites, one near the town of Inverloch and the other near Cape Otway. Study of the fossils collected has shown not only that there are a variety of different species belonging to these two groups but also provided information about how they lived in a polar habitat and their relationships with similar animals on other continents. The mammals have been found to have features that contradict long-held expectations of what those of that age in Australia would be like.

Dr Rich gave an outline of mammals that arose at about the same time as the dinosaurs, during the Late Triassic period 210 million years ago. For two-thirds of their history, until the extinction of the dinosaurs, for the most part they were small, presumably nocturnal animals that at least superficially looked much like one another. In terms of today's mammals we would see their greatest similarity for the most part with shrews and rats. During the first 130 million years of their history, significant evolutionary events did take place as the mammals evolved. They were not simply "waiting in the wings" for their "evolutionary opportunity" when the dinosaurs would no longer dominate the terrestrial fauna.

Dr Rich also pointed out that Australian mammalian fossil discovery was slow compared to other parts of the world. Mesozoic mammals were first discovered nearly two centuries ago in England.

Ever since, and despite their rarity, they have been of particular interest to scholars seeking to understand the origins of the group. Extensive records have been found of them, primarily in North America and Asia, with lesser amounts being now known from Europe, Africa and South America. Within Australia, the first Mesozoic mammal specimen was not reported until 1985. Appropriately enough it was uniquely Australian in two ways: it was a monotreme and preserved as a natural cast composed of opal. In total, less than 100 specimens of Australian Mesozoic mammals have been subsequently found. These few fossils effectively address questions about their origin and relationships to groups on other land masses. Unfortunately the four or five sites where these fossils occur span only 10 million years of the 130 million year Mesozoic history of the mammals.

Dr Rich was involved in the discovery of The Ausktribosphenidae, "the southern ones with multiple functioning teeth", is a family endemic to Australia. They have been interpreted as either an unexpectedly early record of a placental mammal on this continent or an entirely unknown group of mammals equivalent in rank to the monotremes, marsupials and placentals that was centred on the Gondwana continents. Fossils possibly allied to the group have subsequently been discovered in South America and Madagascar. The former interpretation is quite radical but the latter is even more so.

Dr Rich showed pictures of the oldest, undoubted monotremes recovered from Australia which show evidence in the lower jaw that they had a condition found not in other mammals but in the synapsid ancestors of mammals. This was the presence of multiple bones in the lower jaw instead of a single one. In other mammals those extra bones in the lower jaw have either been incorporated into two tiny bones in the middle ear or completely lost. Amongst other things, this feature is evidence for a separation between monotremes on the one hand and marsupials and placentals on the other long before the latter two groups divided from one another.

With most peculiar teeth, Kollikodon is a third group that is either a monotreme or a basal mammal of uncertain affinities.

Dr Rich talked about a fourth group of Mesozoic mammals, the multituberculates, which are quite common in the Northern Hemisphere. They are known from single teeth in South America and Australia plus a few from Africa and India. Their presence on all continents save Antarctica reflects the widespread interchange of mammals

and other terrestrial vertebrates between what are today separate continents that took place during the Jurassic Period. By the Cretaceous, as the continents had moved further apart with first the breakup of Pangea followed by that of Gondwana, the barriers to interchange became progressively greater and the terrestrial vertebrates including mammals consequently more differentiated between landmasses..

Dr Rich discussed the different migration of marsupials versus placental animals.

Hub Regtop.

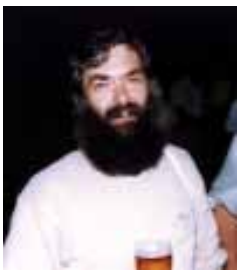
Next meeting: Thursday 16 July 2009

Drama Theatre, Frensham School, Mittagong at 6.30 pm

Crooks, Cranks and Charlatans – scientific scams and how to avoid them

Professor D Brynn Hibbert

Professor Hibbert occupies the Chair of Analytical Chemistry at the University of New South Wales in Sydney.



His research interests are in electroanalytical chemistry and chemometrics and metrology in chemistry, but he also does a sideline in expert opinion, scientific fraud and presenting science to the public.

Hibbert will give tips for avoiding loss of savings, and will vehemently deny he has been bought off by oil companies, the CIA or other vested interests.

Introducing our new office administrative assistant - Sonia Chan

Sonia has just been appointed as assistant to Liz de Rome in running the Society's office. The addition of Sonia to the team means that from this week, the office will be open, at least part time, Monday to Friday to provide member services and to promote the profile and activities of the Society.

Sonia completed her secondary education in 2003 with major units of study in Science and English. Her keen interest in these disciplines led her to undertake undergraduate tertiary studies in similar areas. She is currently in her sixth year of a double bachelor degree in Science and Arts at the University of Sydney, where she is majoring in Biochemistry, History and Philosophy of Science and English Literature. After completing a year of honours research in 2010, Sonia would like to progress into post-graduate study that would eventually lead her to a career in Science Journalism. Meanwhile she is enjoying finishing her final year of her double degree as well as fulfilling the role of Administrative Assistant at the Royal Society of New South Wales.

THE NEAR EASTERN ARCHAEOLOGY FOUNDATION

Public Lecture Series

Before the Pyramids: The Origins of Ancient Egyptian Civilization

A/Prof. Dr. E. Christiana Köhler

Wednesday 8th July 2009, 6.30 - 8.30 pm

Women's College, University of Sydney

Bookings are essential for this event, please forward your payment by 3rd July 2009.

All prepaid tickets will be available for collection at the door.

We prefer prepayment for our events this year - payment at the door will attract a fee of $30.00 for all entries.

Lecture will be from 6.30-7.30 pm followed by a light supper

In this lecture, we will investigate the technological, social, economic, political and religious factors behind this development from the time of the first farming villages during Egyptian prehistory until the emergence of Old Kingdom society and culture.

NEAF Members: $18.00

Student Members of NEAF: $5.00

Non members: $22.00

NEAF, SOPHI A14, University of Sydney 2006

Phone: (02) 9351 4151 Fax: (02) 91140921

neaf@arts.usyd.edu.au

NOTICES

AUSTRALIAN ACADEMY OF SCIENCE AWARDS FOR SCIENTIFIC EXCELLENCE FOR 2010

Nominations for the Academy's 2010 honorific awards for early-career and career researchers are now invited for the following:

Early-career awards

* Anton Hales Medal (Earth sciences)
* Dorothy Hill Award (Earth sciences, reef sciences, marine geology and taxonomy)
* Fenner Medal (biology, excluding biomedical sciences)
* Frederick White Prize (physical sciences)
* Gottschalk Medal (medical sciences)
* Le Fèvre Memorial Prize (chemistry)
* Pawsey Medal (physics)
* Ruth Stephens Gani Medal (human genetics including clinical, molecular, population and epidemiological genetics and cytogenetics)

Career awards

* David Craig Medal (chemistry)
* Haddon Forrester King Medal, sponsored by Rio Tinto (mineral exploration)
* Ian Wark Medal and Lecture (applied research)
* Mawson Medal and Lecture (Earth sciences)
* 2011 Matthew Flinders Medal and Lecture (physical sciences; nominations from Academy Fellows only)

Nominations close 31 July. Information and nomination forms are available from www.science.org.au/awards

TRAVELLING FELLOWSHIPS AND RESEARCH CONFERENCES FOR 2010

The Australian Academy of Science is calling for nominations for the Graeme Caughley and the Rudi Lemberg Travelling Fellowships, and the Selby Fellowship.

Expressions of interest to receive funds to hold the Boden Research Conference, the Elizabeth and Frederick White Conference, and the Fenner Conference on the Environment are also being accepted.

The closing date is 30 August. Further information is available from www.science.org.au/awards/research or contact Jene Fletcher on 02 6201 9407.

ATSE CLUNIESROSS FOUNDATION

Nominations for the 2010 ATSE Clunies Ross Awards are now open until 30 June 2009.

Download nomination forms at www.cluniesross.org.au

Australian Museum

nature culture discover

Australian Museum Open Day on Sunday 5th July.

Free entry to the general museum (normally $12 for adults, $30 per family).

>50% reduction to the "When Mammoths Roamed" exhibition.

For more details see

http://australianmuseum.net.au/event/Australian-Museum-Open-Day-2009/

One Hundred Years Ago . . .

Note on Action of Nitric Acid in Neutralizing Alkaline Soil

By R. S. Symmonds

Communicated by F. B. Guthrie, F.I.C., F.C.S.

Read before the Royal Society of N. S. Wales, July 3, 1907

Knowing that considerable doubt exists as to the utility of alkaline artesian water for agricultural purposes, and the injurious effects of carbonate of soda on the soil, it occurred to me that the carbonate of soda could be neutralized by nitric acid, and thereby converted into nitrate of soda – an excellent fertilizer.

With this object in view I obtained some alkaline soil that had been under irrigation by artesian bore water, and on September 28th, 1906, filled three 6 inch flower pots with the soil, No. 1 being the ordinary soil, and Nos. 2 and 3, treated with nitric acid. Two grains of wheat were sown in each pot and allowed to mature, the wheat was cut on January 28th, 1907, and the grain weighed, giving the following results :-

No. 1 Untreated ... 2.65 grams of wheat.

No. 2 Treated ... 11.30

No. 3 Treated ... 14.40

showing more than five times the yield, which was considered a very satisfactory result.

[details of the experiment duplicated to confirm the results have been omitted]

From these experiments, which must be regarded as purely of a preliminary nature, it is quite impossible to attempt to estimate the cost, and until the experiment has been tried in the field on a comparatively large area, I would prefer not to express an opinion on this point. Mr. Guthrie, Chemist, Department of Agriculture, on seeing the photographs of this experiment, sent to Moree for some alkaline soil, and kindly made arrangements for me to carry out larger pot experiments at the Botanic Gardens; the results of these experiments will form the subject of a paper now in preparation.

The mechanical power derivable from the pressure given in the outflow from artesian bores could probably be turned to account in producing, on the spot, electro-chemical nitric acid from the atmosphere, a process which is now being successfully carried out in Europe, at a cost of £8 3s. 6d. per ton. As the cost of raw material and power is nil, it is simply a question of plant, working expenses, and intelligent supervision. I am certainly of the opinion that this will be of the utmost importance in the future irrigation scheme of New South Wales.

Since writing the above, a paper dealing with the electro-thermic combustion of atmospheric nitrogen, has come under my notice. The author of that paper refers to a process, recently investigated in Germany, as offering some novel features which render the process particularly applicable to our unique conditions, the high pressure artesian bores providing the power to produce from the atmosphere an antidote for their own toxicity, and thereby enormously increasing the fertility of the soil and rendering us independent of a precarious rainfall.

The workers of the process referred to, state that they obtained a maximum output of 440 kilos HNO_3 per kilowatt year, when using a current of 0.05 ampère of 6,000 to 10,000 periods per second, at 50,000 volts, each arc absorbing 2.5 kilowatts. So that 2.5 kilowatts (about 3.4 hp.) produced 1.1 ton of nitric acid per year.

A plant such as that mentioned could be duplicated according to the power available. There would not be any expensive transport or packing of the acid, and it would be quite unnecessary to concentrate it for our purpose – this would mean a considerable reduction in the cost of the plant and working expenses. The advantage of such a process is apparent, when working on an area of about 80,000 square miles, which is the extent of the Artesian basin of New South Wales.

Dr Michael Lake,

June 2009

Dr Michael Lake rejoins Council

Mike had been a member of Council for a number of years and has been typesetting the Journal and administering our web site. He has also been a member of our Publications Committee. We are very happy to have him back as a Councillor and that he has agreed to continue his previous roles.

The Bulletin and Proceedings is issued monthly by the Royal Society of New South Wales
Office address: 121 Darlington Road, UNIVERSITY OF SYDNEY, NSW 2006, AUSTRALIA
Postal address: Building H47, UNIVERSITY OF SYDNEY, NSW 2006, AUSTRALIA
Phone: 61 2 9036 5282 • Fax: 61 2 9036 5309
Liz de Rome, Office Manager • Sonia Chan, Administrative Assistant
Email: royalsoc@usyd.edu.au • Web page: http://nsw.royalsoc.org.au