



The Royal Society of New South Wales

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March 2012

Future Events

Lectures in Sydney are held on the first Wednesday of the month at 6:30pm.

April

Wednesday 4 April 2012 at 5:00pm

Annual General Meeting

The Boardroom, Powerhouse Museum

The Society's AGM followed by The Royal Society Forum 2012.

Wednesday 4 April 2012 6:30 - 8:00pm

The Royal Society Forum 2012

Coles Theatre, Powerhouse Museum

The Royal Society Forum 2012 "The media and scientific research: impact and influences". All welcome. (see separate flyer)

Southern Highlands Branch

Thursday 19 April 2012 at 6:30pm

Drama Theatre at Frensham, Mittagong

"Advanced Radiation Oncology Modalities for Cancer Treatment: Current Status and Verification of Treatment Delivery" delivered by Prof Anatoly Rosenfel, Centre for Medical Radiation Physics, University of Wollongong.

Keep an eye on the Society's website for more events and information. Event flyers also available on the website.

The Royal Society Forum 2012

The media and scientific research: impact and influences

Wednesday 4 April 6:30 - 8:00 pm

Coles Theatre, Powerhouse Museum

Contact the Society's office to reserve your place.

Following the success of last year's Forum, the Royal Society has again brought together two high profile thinkers to debate a critical issue in the world of science. Hear the ABC's Mark Scott and Sydney University's Jill Trehwella discuss science and the media, expertly guided by the ABC's Robyn Williams at the magnificent Powerhouse Museum.



Mark Scott



Jill Trehwella



Robyn Williams

We hear a lot about medical research these days, about breakthroughs being made in the fight against cancer, diabetes and heart disease, but what other research is going on? How can we find out? Yes we might find ways to allow us to live longer and disease-free, but in what sorts of social environments and using what sorts of technologies? Come to the Forum and hear the debate.

Annual General Meeting

Wednesday 4 April at 5:00 pm *Boardroom, The Powerhouse Museum*

The Society's 145th AGM will be held immediately preceding the Forum, at 5:00pm in the Boardroom, Powerhouse Museum, 500 Harris St, Ultimo.

At the meeting the President will outline the Society's achievements over the past year and discuss plans for the future. The election of the next Council will take place and the Society's Annual Report and Annual Financial Report will be presented.

Patrons of The Royal Society of NSW

Her Excellency Ms Quentin Bryce AC CVO, Governor-General of the Commonwealth of Australia

Her Excellency Professor Marie Bashir AC CVO Governor of NSW

Annual Meeting of the Four Societies

“Counting atoms for a living – tales of Accelerator Mass Spectrometry”

Dr Andrew M. Smith



Dr Andrew M. Smith

The meeting was held on Wednesday 7 March 2012 in the Hamilton-Parkes Room, the Trade & Investment Centre, Industry & Investment NSW, MLC Centre, Sydney.

Andrew Smith counts cosmogenic radionuclides for a living! These are radioactive cosmic rays (or, more accurately, cosmic particles) most of which are generated in the sun and the far reaches of the universe. The facilities at ANSTO use accelerator mass spectrometry (AMS) which is an assembly of tandem accelerators to detect rare isotopes of intermediate half-life.

Cosmic rays were discovered in 1904. They are energetic particles that impinge upon the Earth's atmosphere – about 90% are protons, 10% are helium nuclei (alpha particles) and less than 1% are heavier nuclei. They are generated by the sun, supernovae and what astronomers refer to as “unknown events”. When these particles hit the Earth's atmosphere and collide with other molecules, the products of these collisions can be observed and measured.

One of the applications of this technology is in carbon-dating. Carbon-dating technology relies on the fact that the atmospheric concentration of the ^{14}C , the radioactive isotope of carbon, is constant with about 7.5 kg being produced in the atmosphere every year.

While an organism is alive, it is in equilibrium with the atmosphere. When it dies the “clock” starts because ^{14}C uptake ceases and radioactive decay gradually reduces the ^{14}C concentration. The older technology is radiometry which is a passive technique that requires a relatively large sample (up to several grams) but using AMS (the ANSTO equipment uses the 2 MV STAR accelerator) only requires a much smaller sample of around 0.1 mg.

One area of particular interest for Dr Smith and his team is using a highly sensitive analytical technique to examine the polar sheet in Antarctica. As it falls, snow traps atmospheric gas and particles and once the ice has accumulated to its thickness of 50-100 m, the air pockets are closed off, trapping the gas. To investigate theories relating to climate change, establishing historical concentrations of greenhouse gases is of particular interest. Carbon dioxide, methane and nitrous oxide (these three constitute only about 0.1% of the atmosphere) are trapped in the bubbles in the ice. Both natural sources of methane (termites, geologically produced methane, clathrates – these are methane molecules trapped in a cage of water molecules due to very high pressure and are found extensively in deep parts of the ocean – and anaerobic decay) and anthropogenic sources (landfills, livestock, rice cultivation, and waste water treatment) each has its own unique signature of carbon isotopes.

The experimental work being done in ANSTO over the last several years has been drilling down to extract cores from ice which has been deposited over several thousand years. Large quantities of ice are needed to get even the tiny samples needed for analysis (Dr Smith's recent expedition to the area near Casey base collected 7½ tons of ice). Once the samples go through a very careful preparation process and are analysed (including corrections for cosmic ray generation of ^{14}C and the changes in ^{14}C concentration caused by nuclear testing in the 1950s and 1960s when its concentration doubled) some very interesting information emerges. For example, historically there have been some very sharp changes in

methane concentration. This could be due to clathrates releasing their methane in previous eras. If so, this indicates a major problem should global warming cause large methane releases either from clathrates or peat bogs as permafrost melts.

Another area of investigation that ANSTO is pursuing is whether there is a connection between sunspot activity and climate change. Historical astronomical records suggest that during the Maunder minimum (a period that has been described as “a mini ice age” in Europe from about 1635 to 1700) sunspot activity was unusually low. The first step is to measure the ratio of ^7Be to ^{10}Be which is well correlated to sunspot activity. This investigation is very complex and will have some years to run while such issues as beryllium transfer through the ice sheet needs to be understood.

Dr Smith's team is at the cutting-edge of climate change research and is just one example of ANSTO's unique contribution to world-leading science.

The Society is grateful for the sponsorship of this event by NSW Industry & Investment and ANSTO.

New Members of the Society

We welcome the following new members to the Society:

- Junran Cao
- Marcus Lawford Cole
- Geoffrey Lewis Hedge
- Charles Peter Ingle

For information about membership please contact the Society's office or visit the Society's website at

<http://royalsoc.org.au/membership/membership.htm>

From the President



John Hardie

frequently, given its centrality and the opportunities it provides for networking with government and industry. My thanks also go to ANSTO who very kindly sponsored the refreshments for this year's event.

John Hardie

Royal Society of NSW Ties

Every purchase helps support the Society. Contact the Society's office for an order form. Just \$40.00 plus postage & handling.



I'm very pleased to report that once again the Society's Annual Dinner at St Paul's College was a great success. The venue provided the perfect setting for the event, which was preceded by drinks in the cloisters. I would like to thank the College for the use of the venue, for the excellent fare and for the attentive staff provided.

I'd also like to thank Professor Mary O'Kane, the Chief Scientist of NSW, for agreeing to be Guest-of-Honour for the event and for her kind and inspirational words in her after-dinner address. Our Annual Dinners are our opportunity to show what the Society is made of and to celebrate our very existence, our resplendent history and traditions and the ways we impact on the world around us. I am certainly looking forward to next year's.

February also saw the Annual General Meeting of the Royal Societies of Australia, an umbrella body of which we are a member, which strives to give voice to the various Royal Societies in Australia at a national level. At the meeting a revised constitution was considered which may well lead to the participation of all the Royal Societies in Australia. This would give us all a stronger voice in the federal arena and greater opportunities to access federal funding for national activities.

Our tradition of holding a 'Four Societies Meeting' in the early part of the year is also worth maintaining. This year it was our turn to host the event and we were able to do so in the NSW Trade and Investment Centre in the MLC Centre in the city, courtesy of the NSW Department of Industry and Investment. I think this is an excellent venue which we should try to utilise more

The Society's Annual Dinner 2012



Jill Trehwella, Mary O'Kane, Noel Hush

The Society celebrated the end of its year with a splendid black-tie dinner at St Paul's College at Sydney University on Friday 24 February. The dinner provided an opportunity to recognise excellence in the scientific and related community across Australia.

We were very pleased that the NSW Chief Scientist and Scientific Engineer, Professor Mary O'Kane, was able to be our Guest-of-Honour. She presented certificates to our two new Fellows, Emeritus Professor Noel Hush and Professor Jill Trehwella, and to our two medallists. She also delivered an after-dinner address on the importance of societies such as ours in the modern world.

The Clarke Medal for 2011 was awarded to Emeritus Professor Byron Lamont of

Curtin University in Western Australia for his life-long work on Australian flora, particularly the Banksias. The Edgeworth David Medal for 2011 (for a young scientist under the age of 35) was awarded to Dr Trent Woodruff of the University of Queensland for his important and groundbreaking biomedical work. The Society congratulates its new Fellows and Medallists.

This year we were pleased to have two Deans of Science from NSW universities present at the dinner. We were also pleased that the Warden of St Paul's, Rev Dr Head and his wife, were able to join us, and we thank them for being able to hold the event in such a wonderful setting.



Byron Lamont, Mary O'Kane, Trent Woodruff

Southern Highlands Branch

Branch Reports

“GM Essential for Health and Food Security”

Delivered Thursday 16 February 2012

by **Dr Bruce Lee**

Director CSIRO Food Futures National Research Flagship

Dr Bruce Lee was welcomed by a packed audience of seventy at the Frensham School Drama Hall. Bruce is the Director of the Food Futures National Research Flagship at CSIRO, his lecture topic clearly offering wide appeal to the scientific community, senior science students and the public in general.

Dr Lee stated that between now and 2050, analysis of food demand suggests an increased requirement from 50 to 80% in total supply. This is a major challenge, brought about by four key drivers: 1) population growth – 9 billion people by 2050, 2) changing shifts in diet associated with greater affluence, 3) diversion of crops to biofuel – currently a couple of per cent, and 4) wastage from paddock to fork – estimates vary from 10 to 40%. CSIRO through the Food Futures Flagship is taking on these challenges and is developing new plant varieties through breeding and biotechnology solutions to help increase farm yields throughout the world.

Dr Lee’s lecture detailed the types of research and development being undertaken in order to provide global communities with options to address these challenges sustainably. He also addressed the consideration of nutritional quality, essential for optimal growth and development, and also playing a significant role in the prevention of important diet-related diseases. In addition, he described the positive attributes of several new grains either currently on the market or in the development pipeline.

The Flagship’s programs embrace work on grains, aquaculture, beef and biosensors, the programs in the last eight years having delivered commercial impact in the market place. Notably, a novel barley grain, *BARLEY max*, can currently be found in the breakfast cereal category of the major supermarkets here in Australia, selective breeding of Black

Tiger prawns has achieved yields of threefold increase in commercial production, and similar results have been achieved in selective breeding for the Australian salmon industry based in Tasmania. In the development pipeline, products include healthy grains such as high amylose wheats for resistant starch, celiac friendly barley, higher yielding wheat, healthy oils and a novel aquafeed.

Development of superior high quality wheat varieties is a main focus of the Flagship because wheat is not only Australia’s most important grain crop, but also one of the most important sources of food in the world. One of the innovative techniques to increase the speed and efficiency of wheat breeding has been termed MAGIC by the CSIRO Food Futures Flagship. MAGIC will have a direct impact on farm production, as well as changing the way that scientists identify the genes that control characteristics such as quality and disease resistance.

Traditional wheat genetic studies, involving only two parent varieties, have limited ability to define the genes determining key traits. In some cases, they produce results which may reflect the parent varieties, but are not applicable for use on a commercial scale. The new approach, MAGIC – Multi-parent Advanced Gene Inter-Cross, allows the identification of genes controlling quantitative traits by crossing different combinations of multiple parents. The results of these crosses are plants that have a genome which is a mosaic of their multiple parents.

MAGIC has multiple advantages compared with existing approaches. It permits a more precise identification of genes that are responsible for wheat traits, and even allows the pinpointing of genes that have only minor effects. In addition, as the multiple parents originate from geographically diverse regions from Australia and around the world, MAGIC incorporates genetic factors useful for adaptation for a range of environments.



Dr Ken McCracken

“A Controversial Theory Regarding Sunspots and Solar Activity”

Delivered Thursday 15 March 2012

by **Dr Ken McCracken**

Dr Ken McCracken was greeted by a large audience of 70 as he entered the Drama Hall at Frensham. He had delivered many exciting lectures to the Southern Highlands Branch over recent years, and people arriving from a wide area of Illawarra and the Southern Highlands were again anticipating a stimulating presentation of cutting edge science. Even so, few would have guessed how extraordinary that lecture would be.

Since 2000, McCracken has been a visiting research scientist with the University of Maryland, and has collaborated closely with the Swiss Department of the Environment. During this time, he and his colleagues have been using glaciological data to study the properties of the Sun and the solar system over the past 10000 years. He and Juerg Beer (a previous speaker at our meetings) have recently published a professional text entitled “The Cosmogenic Radionuclides”.

Dr McCracken described how he and his Swiss colleagues are now challenging the very foundations of solar physics. The accepted theory is that the magnetic fields of the Sun, and the sunspots, are produced by a “solar dynamo” inside the Sun. Using 10000 years of information from tree rings, and ice-core data from the

(Continued on page 5)

Upcoming Lecture

“Advanced Radiation Oncology Modalities for Cancer Treatment: Current Status and Verification of Treatment Delivery”



Dr Anatoly Rosenfeld

Thursday
19 April 2012
6:30pm

Drama Theatre
at Frensham,
Mittagong

Twenty six years have passed since the Chernobyl nuclear power plant accident which was an incredible lesson for mankind. Since then an essential part of Professor Rosenfeld's scientific career has been devoted to the development of new approaches to radiation dosimetry for radiation therapy, radiology and radiation protection. During the last decade much R & D in the field of semiconductor radiation detectors for dosimetry has been carried out to improve cancer treatment in conventional and new radiation oncology modalities.

Incredible progress has been achieved over the last decade in new radiation oncology modalities, capable of very conformal and accurate delivery of radiation to the tumour only and sparing normal tissue. The complex technology behind the new radiation oncology brought new requirements for quality assurance (QA) of treatment delivery. At Centre for Medical Radiation Physics (CMRP), University of Wollongong, new semiconductor dosimetry instruments for QA were invented and developed allowing verification of treatment delivery and minimisation of error in radiation therapy.

The latest achievements in radiation therapy include proton and heavy ions therapies and how QA is addressed by new approaches for dosimetry developed at CMRP to improve quality of life of many Australians.

Recent research at CMRP has been developed for radiation protection in space missions and individual radiation protections and will be overviewed in brief.

Dr Anatoly Rosenfeld is Professor of Medical Physics and Founder and Director of Centre for Medical Radiation Physics (CMRP) at the School of Engineering Physics, University of Wollongong.

The CMRP is a research strength of the University of Wollongong and a major provider of education and multidisciplinary research in medical radiation physics in Australasia. The CMRP was recognised as the best medical physics multidisciplinary research and education centre in Australia that was recognized by ERA in 2010.

His scientific interest and major international contribution is in the development of innovative radiation instrumentation for real time medical radiation dosimetry, microdosimetry and nanodosimetry for quality assurance in radiation therapy including IMRT, IGRT, prostate cancer brachytherapy, proton therapy, heavy ions and synchrotron microbeam radiation therapies.

Anatoly has a strong interest in translational research in prostate cancer radiation treatment. This has led to a strong collaboration between the CMRP with top USA radiation oncology institutions like Memorial Sloan-Kettering Cancer Centre in New York, ICCG, MGH and LLUMC proton therapy facilities and in Australia with POWH, Liverpool Hospital, St George Cancer Care Centre and the Prostate Cancer Institute where Professor Rosenfeld is a research member. Professor Rosenfeld is a member of IEEE Radiation Instrumentation Steering Committee (RISC) and served as a Member of the NHMRC Academy.

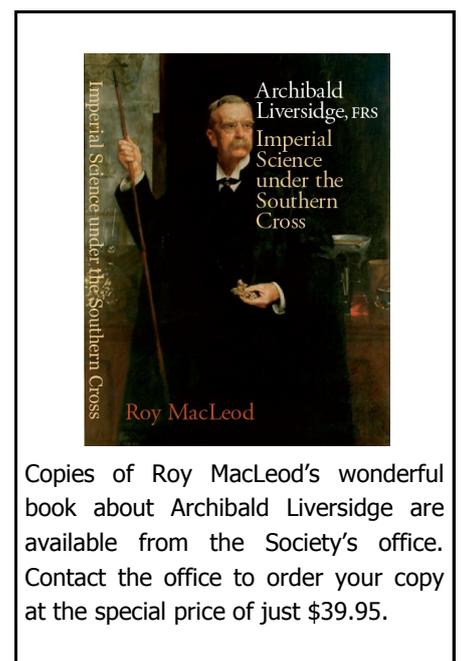
Professor Rosenfeld has authored more than 190 peer reviewed papers, 4 invited book chapters and editor of 1 book. He holds 16 patents in a field of medical radiation detectors instrumentation.

(Continued from page 4)

Arctic and Antarctic, they have studied the properties of the dynamo in a much more detailed manner than has been previously possible. The results have been nothing short of astounding.

They are astounding because they provide extremely strong support for a hypothesis that has been around for 150 years, and which is completely contrary to our present-day understanding of solar physics. Much of the material presented at the lecture is currently the subject of ground-breaking papers in the process of publication. Despite the complexity of the research and its mathematical analysis, the speaker managed to clearly describe his findings, and their implications, to the intrigued members of the audience.

After the meeting, there was much excited discussion over dinner where Dr McCracken was our guest. People realized that there is a long process to go through before this extraordinary research appears in the leading scientific journals to which it has been presented. It was agreed by all that it was exciting to realize that they had attended the first public presentation of this work anywhere in the world, and that they hoped to see the day when the hypothesis that had been presented to them had become the “perceived wisdom” of our culture.



Copies of Roy MacLeod's wonderful book about Archibald Liversidge are available from the Society's office. Contact the office to order your copy at the special price of just \$39.95.

Proposals for Fellows of the RSNSW

Members are invited to forward proposals with a member as seconder for consideration for the 2012 nominations of Fellows of the RSNSW to be directed confidentially to the President. Deadline for submissions is

1 June 2012.

H. Hora for the Fellows Committee of the Council.

Call for details

Do we have your correct address?

We strive to keep accurate and up to date details in the Society's office. Please let us know if any of your contact details have recently changed.

If you would like to receive this newsletter by email please email the office and we'll add you to our growing list of savvy digital subscribers.

e: info@royalsoc.org.au

SOMETHING FROM NOTHING

An evening with Richard Dawkins and Lawrence Krauss

How did the universe get here? Where did life come from? And what's it all about? Join British evolutionary biologist Richard Dawkins and American theoretical physicist Lawrence Krauss as they discuss biology, cosmology, religion, and a host of other topics at two fabulous events in Sydney and Canberra.



Richard Dawkins



Lawrence Krauss

Sydney Event: SOMETHING FROM NOTHING

Thursday 12th April 6:30-8.00pm (Doors open at 6pm)

Sydney Grammar School, entry via Yurong Street

Cost: \$23/\$15 (plus booking fee)

Bookings: <http://somethingfromnothingsydney.eventbrite.com.au>

Canberra Event: SOMETHING FROM NOTHING

Tuesday 10th April 6:30-8.00pm (Doors open at 6pm)

Manning Clark lecture theatre 1, ANU

Cost: Free (booking required)

Bookings: <http://somethingfromnothingcanberra.eventbrite.com>

Contact your office bearers

John R Hardie President	02 9363 9630	Prof. Heinrich Hora Vice President	02 4627 7769
Clive Wilmot Vice President (SHB rep)	02 4886 4199	Prof. D. Brynn Hibbert Vice President	02 9398 9134
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Prof. Bruce A Warren	02 9665 7537	A/Prof Maree Simpson (C/W Branch)	02 6365 7818
Julie Haeusler	02 4829 2202		

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121 Darlington Rd, Building H47, UNIVERSITY OF SYDNEY NSW 2006 Australia

Office hours: 11:00am - 4:00pm Mon - Wed and Fridays.

Office Manager: Emma Dallas

t: 02 9036 5282

e: info@royalsoc.org.au

w: <http://nsw.royalsoc.org.au>