



The Bulletin 390

The Royal Society of New South Wales

ABN 76 470 896 415

ISSN 1039-1843

22 July 2015

Future Events

Wednesday 5 August 2015
1235th Ordinary General Meeting
Complexity and Cultural Transitions 100,000 BP to the Present
Delivered by: **Dr Roland Fletcher**
Union, University & Schools Club
25 Bent St, Sydney, 6.00 pm for 6:30 pm

Sydney Science Festival

+ Free to public +

13–23 August 2015

Open Lunchtime Talks by Society Fellows
All talks **12:30–1:30 pm** at U. of Sydney, CBD
Campus, Level 17, 133 Castlereagh St.

Fri, 14 Aug – Prof Michael Jacobson
Failing to Learn: Using Artificial Worlds to Teach Science in a New Way

Tue, 18 Aug – Prof Ragbir Bhathal
Aboriginal Astronomy and the Clash of Cultures

Thur, 20 Aug – Prof David Christian
Big Science and Big History: From the Big Bang to Us

Fri, 21 Aug – Prof Michael Burton
The Wonders of the Hubble Space Telescope

Thursday 27 Aug 2015
Southern Highlands Branch Meeting
Discovery of “The Hobbit” *Homo floresiensis*
Prof. Richard Roberts
University of Wollongong
Performing Arts Centre, Chevalier College, Bowral.
Starting Time: **6:30 pm**

Patron of The Royal Society of NSW
His Excellency General The Honourable
David Hurley AC DSC (Ret'd)
Governor of New South Wales

PUBLIC LECTURE – Wednesday, 5 August 2015

**“Complexity and Cultural Transitions
100,000 BP to the Present”**
Professor Roland Fletcher
The University of Sydney
Director – Greater Angkor Project

Union, Universities, & Schools Club, 25 Bent St, Sydney
6:00 for 6:30 pm, Welcome drink at 6:00 pm
Fellows & Members \$5; Guests, \$20
Please note dress code: jacket and tie
Please join us for dinner afterward, \$75 per person



'Angkor Wat's Hidden Megacity' SBS 2014

Professor Roland Fletcher has developed a global and interdisciplinary perspective in archaeology concerning large-scale cultural phenomena over millennia. This work has been described in his 2007 book, *The Limits of Settlement Growth: A Theoretical Outline*.

Prof. Fletcher will present his thinking about cultural transitions that have occurred in human settlement patterns over the past 100,000 years. They include the development of sedentary communities about 10,000 years ago, agrarian-based urbanism about 5000 years ago, and industrial-based urbanism in the past 200 years. According to 19th-century Stage Theory, each development is characterised by cultural type fossils, e.g., writing in agrarian-based urbanism. However, these fossils are known from contexts other than the ones for which they are supposed to be diagnostic.

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From the President

In addition to our August monthly meeting, the Clarke Lecture will take place at Macquarie University at 5:45 on Thursday 6 August (Building Y3A, Theatre T1). The lecture will be delivered by Professor Bill Griffin, the 2013 Clarke Medal winner. Professor Griffin is an international authority on the petrology geochemistry of the Earth's crust and mantle. His research is of particular importance to the minerals industry.

The Royal Society of NSW and Four Academies Forum will take place on Tuesday 15 September. Our patron, the Governor, has kindly offered to host the event at Government House. We expect the topic, "The future of work" to attract particular interest and are delighted to have the support of the four national Academies and the

office of the Chief Scientist and Engineer of NSW. Unfortunately, the attendance numbers are quite limited at Government House, so the event is by invitation only.

As I mentioned last month, nominations are now open for the Society's 2015 awards. These are some of the most prestigious awards in Australian science and every year we have very strong fields of candidates have been nominated. If you are aware of worthy individuals, we would encourage you to submit a nomination. Details are available on the website.

Work is progressing on redesigning the Society's website to modernise it and to greatly increase its functionality. We expect the new site to be launched in the next

month.

We have a busy programme between now and the end of the year with our awards, a number of named lectures and planning the programme that is emerging from the consultation process earlier in the year. As I mentioned last month, we expect to be able to publish an updated much more comprehensive version of this in the next few weeks.

As always, I am easily contacted by email at president@royalsoc.all.au and would like to hear from you.

Donald Hector
May 2015

Complexity and Cultural Transitions

Continued from page 1.

What is needed is a model of transitions for which the "type fossils" are actually antecedent prerequisites. However, changes in the material assemblage are not sufficient; social and material conditions can be at odds with each other. The path to large, long-term emerging patterns is not deterministic.

Professor Fletcher received his PhD from Cambridge University in 1975. He joined the University of Sydney in 1976. He is the instigator and now Director of the Greater Angkor Project. He has established a multi-disciplinary team of local and

international researchers. They have published work concerning monsoon extremes and society over the past 1,000 years in Southeast Asia. They currently are investigating the growth and decline of low-density pre-industrial urbanism at Angkor, surveying the area using laser-based remote sensing (LiDAR).

Prof. Fletcher has been a Distinguished Fellow of Durban University's Institute of Advanced Study in 2007 and invited speaker at the Falling Walls Conference in Berlin in November 2014. He was recently elected as a Fellow of the Society of Antiquaries of London.

Dates for Your Diary

2 September - 1236th OGM

15 September - Royal Society Forum on the Future of Work

24 September – SHB Lecture

7 October - 1237th OGM

15 October – SHB Lecture

4 November- 1238th OGM

17 November –AIP Postgraduate Awards Day and Jak Kelly Award judging

19 November – SHB Lecture

2 December - 1239th OGM (Jak Kelly Award, Christmas Party)

Sydney Science Festival 13–23 August 2015

Led by the Museum of Applied Arts and Sciences, this city-wide festival will provide serious science fun for adults, families, school groups, for young and old and in-between, for geeks, non-geeks, for everyone with curiosity.

There will be talks by researchers, hands-on workshops, opportunities to chat with scientists, children's activities and panel discussions where you can have your say alongside celebrity science speakers. The full program will be available in late June. Four Fellows of the Society will be giving lunchtime talks. Please go to page 4 for the details.

Superlaser Partnership presented at Romanian Embassy

A symposium hosted by the Romanian Embassy in Canberra (15/16 June 2015) provided opportunities for the Australian high-intensity laser research community, which established itself in 2014 under the auspices of the RSNSW (formalized by letters exchanged between the President with the leader Gerard Mourou, Director of IZEST, on the European side) for joining a Partnership, see page 3 of the February 2015 Bulletin No. 285 of the RSNSW. The worldwide list of cooperation includes significant institutions such as CERN in Geneva, KEK in Japan and the Lawrence Livermore National Laboratory in California. The European activity is ELI, the 'Extreme Light Infrastructure', a One Billion-Euro research project that is currently being built in Romania, Czech Republic, and Hungary.

Several existing links and opportunities between Australia and Romania were presented, such as the unique laser (Go to p. 6)



Sydney Science Festival

All talks **12:30-1:30 pm** at CBD Campus, U. of Sydney Level 17, 133 Castlereagh St.

Fri, 14 Aug – Prof Michael Jacobson, The University of Sydney
“Beyond Failing to Learn: Restructurations, Productive Failure, and Transforming Science Education”



Computer-based visualization and experimentation enable us to understand the behaviour of complex systems in new and exciting ways, technically called “restructuration.” It opens up new opportunities to teach and learn science, drawing on what kids these days naturally do – play computer games. One way we have used these methods with high school students is “productive failure,” which reverses the normal order of teaching. Instead of teach first and then apply, we apply first, fail, and learn better. Students confront challenging problems up front which opens up their minds and leads to a deeper understanding of the how and why things work.

Tue, 18 Aug – Prof Ragbir Bhathal, University of Western Sydney
Aboriginal Astronomy and the Clash of Cultures



The Aboriginal and Torres Strait Islander people have been observing the night sky for thousands of years. In that period of time, they named the celestial objects and created fascinating stories about them. Their astronomy was social-cultural astronomy, and as such, some aspects of it clashed with the dominant culture in Australia with significant consequences for Australian society.

Thur, 20 Aug – Prof David Christian, Macquarie University
Big Science and Big History: From the Big Bang to Us



Big History examines our past, explains our present, and imagines our future. It's a story about us. This growing, multi-disciplinary approach is focused on high school students, yet designed for anyone seeking answers to the big questions about the history of our Universe. Since 1989, Prof Christian has been surveying the past on the largest possible scales, including those of biology and astronomy. See: www.bighistoryproject.com/home

Fri, 21 Aug – Prof Michael Burton
The Wonders of the Hubble Space Telescope



Other than perhaps Galileo's original telescope of 1609, the Hubble Space Telescope has done more than any other telescope to transform the scientific and public views of the cosmos, far beyond original intentions. To mark the Hubble's 25th anniversary, NASA has released a wonderful set of its most iconic images and many more. This talk will present these images, interspersed with the presenter's interpretation of their role and significance in modern astronomy.

Report of 16 July 2015 Meeting of the Royal Society Southern Highlands Branch

**Speaker: Dr. Brian Keating, Executive Director, CSIRO
Agriculture, Food and Health Sector**



Dr. Brian Keating

Topic: Food Security in a Changing World

Dr Brian Keating surprised his 61 member audience with the question as to whether they felt the “mining boom” had been replaced by the “dining boom”. This question raised a good deal of interest in the attendees who had come to hear about global food security. When told however that the question was prompted by the fact that last week in Beijing, the cost of a tonne of cabbages had for the first time exceeded the cost of a tonne of steel, people realized that they were about to take part in a very fulfilling lecture on food availability and the factors controlling it.

Dr Brian Keating opened his lecture formally with the FAO definition of “food security” that he would be using throughout the evening. He described food security as existing when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

From 1960 to 2000, the Green Revolution more than doubled crop yields in much of the world, and while population rose by 98%, food production per capita still rose by 24%. This meant land cultivated for agriculture rose by only 8%, sparing land, water and biodiversity around the world. Still, over 800 million people remain food insecure and the Green Revolution is yet to fully reach sub-Saharan Africa. The food

price crises of 2007-2008 and 2010-2011 provided a timely wake-up call that food security in the 21st century is not assured with demand growth forecast in the range 50-80%.

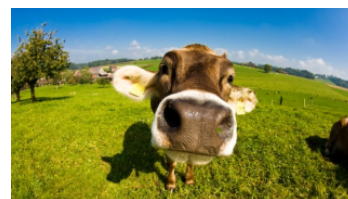
The suggestion is often made that Australia could become the food bowl of Asia, but Brian Keating says that a reality check is called for when those claims are made. Currently Australia grows 1% of the world’s food. This rises to 2% of all traded food. Production increases are possible from existing industries and areas, and agricultural expansion in Northern Australia is possible. However, overall contribution will still be modest. He said that we must remember that we compete on a global stage and productivity growth will determine whether we can capture the opportunities. He said it may be more appropriate for us to see Australia, not as the food bowl of Asia, but maybe the delicatessen.

There are multiple dimensions to the issue of food security, a major one being the utilization of the food. Food processing, storage, waste, safety, nutritional value of diet and health outcomes are all factors here. Dr Keating stated that it is estimated that 40 % of available food is wasted, a dreadful statistic. In the modern world we have only to look at the amount of food we throw away from our refrigerators, and then consider the proportion of unopened cans and packages we discard because of the

use-by date. In more primitive societies, it is commonly seen that what was thought to be a good crop rapidly diminishes in food value due to the inadequate storage methods available.

In concluding his lecture, Dr Keating outlined the challenges that lie ahead in this very difficult and constantly changing field. He said that the absolute increase in food demand over the next 40 years is a little greater than was the case for the Green revolution, but that the rates of yield gain have been declining, and new land and water sources are more difficult to sustainably develop. He added that we have reduced our investments in agricultural development and that lead times are long. In addition we have to deal with uncertainties arising from climate change. A very well received lecture.

Anne Wood





In the front row from left to the right: Prof. Heinrich Hora; Dr. Stuart Kohlhausen; Prof. Richard Banati, Director of Questacon; The Honorable Minister Malcolm Turnbull MP; Her Excellency the Ambassador of Romania for Australia and New Zealand Nineta Barbulesco. Second row between Dr. Kohlhausen and Prof Banati is the representative of ELI-NP, Prof. Ioan Ursu.

(continued from p. 3) research facility ELI Nuclear Physics (ELI-NP) at Magurele, near Bucharest, Romania, as well as Romania's leadership in the role out of information technology that places her amongst the top in the world. Heinrich Hora FRSN, UNSW and Richard Banati FRSN, ANSTO, outlined the potential of ultrahigh-power laser pulses in hadron cancer therapy, as well as the possibility of providing clean, low-cost energy from nuclear fusion using the laser types available at ELI.

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