



The Bulletin 371

The Royal Society of New South Wales

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October 2013

Wednesday 6 November 2013

The Senior Science National Curriculum

Presented by Dr Mark Butler

Union, University & Schools Club, 25 Bent St, Sydney City

6:00 for 6:30 pm

Future Events

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

Wednesday 6 November 2013

SPECIAL MEETING 6:20 pm

— appointment of auditors—

6:00 pm for 6:30 pm

1216th OGM

Re-thinking science education in Australian schools: development and implementation of the National Science Curriculum

Delivered by:

Dr Mark Butler, Department of Education and Communities

Union, University and Schools Club

25 Bent St, Sydney

Members and Fellows: \$5.00

Non-members: \$10.00

Tuesday 19 November 2013

Jak Kelly Awards

Student presentations from 2:00 pm to 6:00 pm
Physics of High Efficiency Photovoltaic Solar Energy Conversion

Delivered by:

Prof Martin Green

Professor Green will speak at 6:30 pm

Room 273, Carslaw Building,
University of Sydney

Thursday 21 November 2013

5:45 pm for 6:00 pm

Dirac Lecture and Medal Presentation:

Semiconductor Nanostructures and Quantum Phenomena

Delivered by:

Professor Pepper

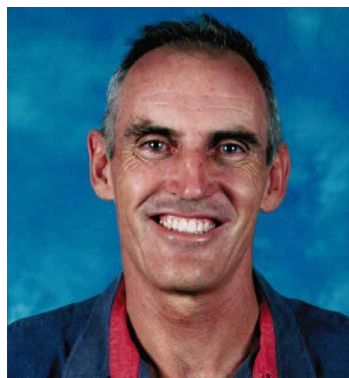
RSVP essential, see page 4

Thursday 21 November 2013

(Continued on page 4)

Dr Butler will examine the development and nature of the new national senior high school science curriculum. In 2008 the Federal Government secured agreement with all state and territory governments to develop a national F-12 school curriculum.

Responsibility for developing the curriculum was assigned to the newly established, **Australian Curriculum, Assessment and Reporting Authority (ACARA)**. The national F-10 Science curriculum was completed in 2011 and will be implemented in NSW schools from 2014.



consultation and over two years of refinement, the national senior science curriculum remains controversial and the content chosen, and the three strands (Science as Human Endeavour, Science Inquiry Skills and Knowledge and Understanding) used to present it, continue to cause some concern. While the new courses will undoubtedly address the issues of comparability and consistency, only time will tell if the new courses will attract more students to study science and/or more effectively prepare

students for studying science at tertiary level.

In December 2012 the curricula for senior courses in Physics, Chemistry, Biology and Earth and Environmental Science were completed and signed off by the state and territory governments. Provided the newly elected Federal Government continues to support the new curriculum, the national senior science courses will be introduced in NSW schools in 2016.

The senior science curriculum was developed to reflect international best practice in science education. The courses were designed to cater for students who wished to pursue further study in science and for those who would not continue to study science beyond school level. But in spite of two extensive rounds of public

Dr Mark Butler is currently Head Teacher of Science at Gosford High School and the National Education Convener of the Australian Institute of Physics. He has taught science in secondary schools in NSW and has been an active member of the professional science education community for over thirty years. Dr Butler is particularly interested in developing strategies to encourage more students to study science in senior high school and at tertiary level.

Dress code: jacket and tie.

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

1214th Ordinary General Meeting

Held on Wednesday 2 October 2013

Astrobiology: the latest from 'Curiosity'

Prof Malcolm Walter

"Seven seconds of terror" was how the operators at the Jet Propulsion Laboratory in the US describe the landing of "Curiosity", the latest rover mission that landed on Mars in August last year. In the last stage of the landing the entry vehicle hovered about 80 m above the surface of Mars and lowered Curiosity (which weighs nearly a tonne) by cranes to a gentle touch-down. Given that it can take up to 20 minutes for signals to reach Mars (or a up to a 40 minute round-trip) there is a significant delay that constrains the Earth-based control station.

The purpose of the Curiosity mission is to understand the geological and biological context to determine whether life may have existed or, indeed, still exist on Mars. Mars is somewhat smaller than the Earth with the surface area of Mars being about the same as the exposed surface area of the Earth's continents. Until as recently as 60 years ago, up it was thought that advanced life may have once existed on Mars and could have been responsible for the canals and other geological phenomena that have been observed through telescopes. It is now thought that the most advanced form of life to be possible on Mars would be single cell organisms, probably similar to those that existed on Earth in the early stages of life. To put this in perspective life first appeared on Earth about 3500 million years ago and, until about 500 million years ago, consisted entirely of single cell organisms. Nearly all of the diversity of life on Earth is microscopic, so it makes sense to look for this as the first signs of life in other places in the universe.

One way to understand what early life might look like is to examine geological formations in very old rocks, such as the 3,500 million-year-old rocks in the Pilbara. Fortunately, these rocks are of great interest to geologists because they often hold valuable mineral deposits, so quite a lot is known about them. They are known to have been formed by volcanic action, so a second, complimentary approach is to see what



Professor Malcolm Walter

forms of life exist in active volcanoes. One such volcano is White Island in New Zealand. Single cell life forms have been found there in water up to 123°C, so it is now known that life can exist from about -30°C to over 120°C.

In order to try to understand the evolutionary context of these single cell organisms, biologists look at bio-markers in the geological samples that are characteristic of life and see how these evolve. This is analogous to looking at skeleton evolution in more advanced life forms.

Already, a great deal has been learned about the geological environment on Mars. An early mission, Phoenix, found ice at northern latitudes. The channels suggest that there was flowing liquid at one point in Mars' geological history. That was almost certainly water. Imaging shows that there is still channel formation taking place on the surface of Mars now which suggests that at times at least there is fluid flow. It is too cold for

pure water, so if indeed this turns out to be due to rivers, they would have to be highly saline to be liquid at these temperatures.

Earlier investigations suggested that there was methane in the Martian atmosphere, however Curiosity has found none. The earlier observations are now thought to be due to a C-13 isotope of methane in Earth's atmosphere.

Curiosity is an extremely expensive mission – it takes 265 people every day to keep it running but the contribution to our understanding of Mars and the origins of the solar system and, by implication other phenomena in the universe is enormous. There are a further 15 missions planned by various public and private agencies over the next decade or so.

Donald Hector

Southern Highlands Branch

Report of October Meeting 2013

The Dynamic Brain

Prof Peter Robinson

School of Physics, University of Sydney, Deputy Director of the Brain Dynamics Centre at Westmead Millenium Institute

In this lecture, Professor Robinson outlined how new insights into the operation of the brain can be obtained by applying ideas from physics in tandem with those from the biological sciences. An outstanding feature of the lecture was the frequently observed close correlation he was able to demonstrate between his quantitative modeling of brain dynamics and the actual behavior of the brain as seen in clinical data.

In this wide-ranging lecture, Robinson described how these new insights into the operation of the brain could be applied to phenomena as diverse as epilepsy, Parkinson's disease, fatigue, shift work, jet lag, and drug effects among others. His interdisciplinary work has led to numerous awards.

In 2012 he won the NSW Science and Engineering Award. He has also been the recipient of the Australian Academy of Science Pewsey Medal, the Bede Morris Fellowship, the Royal Society's Eureka Prize for interdisciplinary research, the Edward David medal and the Institute of Physics's Walter Boas Medal. Robinson works closely with organizations as diverse as the Westmead Hospital Brain Dynamic Centre, the Woodcock Institute (leaders in breathing and sleep disorders), and the Black Dog Institute. Overseas he is working with NASA on the current STEREO space mission.

While neural activity in the brain has been observed for over a century and is widely used to probe brain functions and disorders, the connections between stimuli, physiology, processing and measurements have until recently been largely qualitative.



range of linear and nonlinear phenomena at many scales. These include time series, spectra, evoked responses to stimuli, seizure dynamics, visual phenomena during perception, arousal (sleep-wake) dynamics, and influences of pharmacology and aging.

Fitting to experimental data enables physiological parameters to be inferred in normal and abnormal conditions. Such multiscale modeling thus provides a framework within which to interrelate, predict and interpret diverse phenomena and measurements. The physiological basis of the model enables it to predict experimental observables such as electroencephalographic and functional MRI measurements, and the results have given rise to commercial applications.

At the end of this stimulating lecture, the 45 person audience asked numerous questions of the speaker. Due to time restraints, several had to bide their time until a little later when they could continue the discussion over the dinner table.

Robinson's research has now resulted in a quantitative multiscale model of brain stimulus-activity-measurement dynamics that includes key physiology and anatomy from synapses to the whole brain and from milliseconds up in timescale.

With the inclusion of measurement effects, the model successfully predicts a wide

Anne Wood

Paperless Bulletin?



If you have the capability to read the Bulletin digitally please email the office.

royalsoc@royalsoc.org.au.

AIP Call for Nominations

Nominations are now open for key executive positions on the 2014 NSW Branch committee of the Australian Institute of Physics.

The Australian Institute of Physics (AIP) committee meets monthly from February to November. Our primary focus is developing and coordinating an interesting program of events and speakers during the year on a range of topics related to Physics. You need to be a financial member of the AIP to nominate and you must attend the AGM, so please ensure that your membership is current if you wish to submit your nomination.

To nominate yourself please forward your nomination by email to Dr Frederick Osman (fred_osman@exemail.com.au) by COB on 12th November 2013 (prior to the NSW Branch AGM scheduled for 19 November 2013).

If you wish to be considered as a Committee Member, please attend the AGM on Tuesday 19 November 2013 at 6PM, Slade Lecture Theatre, University of Sydney and make yourself known to Dr Frederick Osman.

From the President

October and November are busy months for the Society. The Pollock Lecture was delivered by on Monday 28 October at Sydney University by Professor Michelle Simmons, a Fellow of the Society and Director of the Centre for Quantum Computation and Communication Technology at the University of NSW.

On Tuesday 19 November, in conjunction with the Australian Institute of Physics, the Jak Kelly award will be determined. This award is for young physicists and the winner will be invited to present to the Society at the December meeting. There will be a guest speaker: Professor Martin Green whose topic will be "The Physics of High Efficiency Photovoltaic Solar Energy Conversion". The student presentations start at 2:00, followed by the talk at 6 o'clock for 6:30.

The Dirac Lecture will be delivered at the University of NSW on the evening of Thursday 21 November by Sir Michael Pepper. Sir Michael is a British physicist notable for his work in semiconductor nanostructures and is founder and former head of the Semiconductor Physics Group at the Cavendish Laboratory, Cambridge. He

is one of the most distinguished researchers in the world in the areas of semiconductor nanostructures, so it should be a very interesting evening.



As I mentioned previously, the Council is nearing completion of a substantial review of the Rules and Bylaws of the Society to modernise them and make some changes that we expect will give further opportunities to grow our membership. The Council intends calling the general meeting of the Society to coincide with the December meeting on Wednesday 4 December to consider these. A notice of meeting will be circulated in the next couple of weeks.

Donald Hector

For information about membership please contact the Society's office or visit the Society's website or contact Emma at royalsoc@royalsoc.org.au

We encourage members to introduce new members to the Society.

(Continued from page 1)

5:45 pm for 6:00 pm

Dirac Lecture and Medal Presentation:

Semiconductor Nanostructures and Quantum Phenomena

Delivered by:

Professor Pepper

Special Notice: Professor Pepper will also be presented with an Honorary Degree from UNSW after his lecture.

Law Theatre, UNSW

RSVP Essential

email: RSVP@science.unsw.edu.au

online: www.science.unsw.edu.au/dirac2013

Thursday 27 February 2014

5:30 pm for 6:00 pm

Meeting of the Four Societies

Future of Power Generation for NSW

Delivered by:

Prof Mary O'Kane, NSW Chief Scientist & Engineer

Hamilton Room, Level 47, MLC centre, Martin Place, Sydney

Southern Highlands Branch

Thursday 21 November 2013

6:00 pm for 6:30 pm

Superbugs

Delivered by:

Prof Liz Harry

The Performing Arts Centre

Chevalier College, Bowral

Members and Fellows: \$5.00

Non-members: \$10.00

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