



**College of Science**

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## **Proceedings of the Fourth Annual PhB Conference**

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**Organising Committee**

**Tee Shern Ren**

**Matthew Pinson**

**Friday 24<sup>th</sup> October, 2008**  
**Interactive Learning Laboratory**

## Schedule of events

| <i>Time</i>    | <i>Event</i>   |
|----------------|--|
| 9:45-10:00 am  | <i>Arrival at Interactive Learning Theatre, Baume Building</i>   |
| 10:00-10:40 am | <b>Keynote Speaker: Dr Sigi Goode</b>  |
| 10:40-11:00 am | <b>Jessica Fitch</b><br>Career vs Family – Reproductive Options for Women and Their Role in Society  |
| 11:00-11:20 am | <b>Tee Shern Ren</b><br>Characterising Solar Cells as Proton Detectors (and Making Carbon in Stars)  |
| 11:20-11:40 am | <b>Break</b>   |
| 11:40-12:00 am | <b>Fiona Skerman</b>   |
| 12:00-12:20 pm | <b>Kelly Nguyen</b><br>Isolating Bioactive Products in Queensland Fungi  |
| 12:20-12:40 pm | <b>Kathleen Griffiths</b><br>Monitoring the movement of <i>Neozeleboria cryptoides</i> , pollinator of the sexually deceptive orchid <i>Chiloglottis trapeziformis</i> |
| 12:40-1:20 pm  | <b>Lunch</b>   |
| 1:20-1:40pm    | <b>John Tng</b><br>Expressing Plasmodium falciparum Chloroquine Resistance Transporter (PfCRT) in <i>Saccharomyces cerevisiae</i>                                      |
| 1:40-2:00pm    | <b>Byron Vickers</b><br>Quantum Physics in a Super Mario 64 Minigame   |
| 2:00-2:20pm    | <b>Allan Xiao</b><br>Nanochemiluminescence   |
| 2:20-2:40pm    | <b>Hwi-Young Lee</b><br>Photochemically Switchable Host for the Transport of Methyl Orange   |
| 2:40-3:00pm    | <b>Break</b>   |
| 3:00-3:20pm    | <b>Jennifer Zhu</b><br>From NATO Bombings to Energy Sources – History, Politics and Global Leadership at Oxford  |
| 3:20-3:40pm    | <b>Nadia Thorman</b><br>Computational Chemistry: Activation and Cleavage of the Phosphorus Diatomic  |
| 3:40-4:00pm    | <b>Alvin Pratama</b><br>Investigation of Function and Expression of <i>C. elegans</i> gene <i>F48C1.4</i>  |
| 4:00-4:10pm    | <b>Awards</b>  |

## Abstracts

### **Jessica Fitch: Career vs Family – Reproductive Options for Women and Their Role in Society**

There has been an increase in the proportion of women remaining childless at each age for cohorts born after the 1950s, triggering research into causative factors. Studies have found that women with no children tend to be better educated and be professionally or career-orientated and ambitious. The majority of the abovementioned studied into these issues of female fertility have been focussed upon women in their thirties. Currently, no study has investigated these issues in a younger demographic to see if the trends are already apparent, or if formation of the observed views and choices has begun. I have developed a survey to probe the future and current views and attitudes of ANU students towards their career and starting a family.

### **Tee Shern Ren: Characterising Solar Cells as Proton Detectors (and Making Carbon in Stars)**

Can professional surface barrier detectors, costing thousands of dollars apiece, be replaced with solar cells at a fraction of the price? This project examined the possibility by comparing the response of a surface barrier detector and a solar cell under bombardment with backscattered protons of energies up to 3 MeV. The two detectors were found to have equivalent response at lower energies but returned significantly different signals in the 2.7-3.0 MeV range. This discrepancy was studied using computer simulations of energetic proton penetration for varying depletion depths in the solar cell. As well as discussing the results of this project, I will also give an overview of the Hoyle state of C12 nuclei, which is being studied by the research group for which this project was done.

### **Kelly Nguyen: Isolating Bioactive Products in Queensland Fungi**

In this project, bioactive secondary metabolites against *S. aureus* and *S. epidermidis* from three Queensland fungi (USQ12.1, USQ129.1 and USQ6.5) were subjected to isolation and characterization. Two bioactive components had been isolated from USQ12.1 and characterized. One of them was obtained in a pure form and found to be montagnetol while the other was a mixture of three fatty acids; stearic acid, palmitic acid and a monounsaturated C18 fatty acid (to be updated). USQ129.1 also demonstrated some antibiotic activity against the same bacteria, yet its bioactive components had not been isolated.

### **Kathleen Griffiths: Monitoring the movement of *Neozeleboria cryptoides*, pollinator of the sexually deceptive orchid *Chiloglottis trapeziformis***

Animal pollinators such as insects, birds and bats, play a critical role in the life cycles of almost all flowering plants by mediating pollen and gene flow. Sexual deception is a bizarre mode of pollination, utilised by a few hundred members of the orchid family. Orchid flowers visually and chemically mimic female insects to attract males as pollinators. Evaluation of pollinator movement

underpins assessment of gene and pollen flow between plants. In this seminar I present and discuss preliminary findings of a project investigating movement of the wasp *Neozeleboria cryptoides*, which pollinates the sexually-deceptive orchid *Chiloglottis trapeziformis*. It seems pollinator movement is highly localised, with implications for orchid population size and viability.

### **John Tng: Expressing Plasmodium falciparum Chloroquine Resistance Transporter (PfCRT) in *Saccharomyces cerevisiae***

Malaria is a vector-borne infectious disease caused by protozoan parasites of the genus *Plasmodium*, accounting for 400–900 million cases of fever and 1-3 million deaths annually. The vast majority of cases occur in children under the age of 5 years. Chloroquine has been a cheap and effective antimalarial drug but the recent rise of chloroquine resistant *Plasmodium* strains limits its use today. Recent studies highlight the importance of a particular parasite protein in chloroquine resistance, *Plasmodium falciparum* chloroquine resistance transporter (PfCRT). In this study, we attempted to express PfCRT in *Saccharomyces cerevisiae* which is a robust and well characterized expression system in order to better understand the molecular basis for chloroquine resistance and the natural physiological role of PfCRT.

### **Byron Vickers: Quantum Physics in a Super Mario 64 Minigame**

Quantum mechanics is a core part of modern physics, yet is seen as a topic which is particularly difficult to learn, let alone grasp to a degree such that it becomes intuitive. We propose that this perception is not necessarily true -- that a suitable method can be found which presents key concepts of quantum mechanics in an intuitive and easy to grasp fashion, through the interface of an interactive computer program. We develop a prototype which shows that such a teaching tool should be possible, and lay out a design for an educational game of this nature which we hope to develop: a quantum variation on a minigame from Super Mario 64.

### **Allan Xiao: Nanochemiluminescence**

One of the most amazing effects in nature, chemiluminescence is everywhere, ranging from mushrooms to phytoplanktons. We can reproduce the effect in the lab by mixing up chemical solutions. However, can we do it on a molecular scale? And can we control the luminescence reaction so that light can be produced on demand? How do we make the “chemical switch”? In this talk, you will find how an atomic force microscope (AFM) can be used to control the chemical process of chemiluminescence, how luminescence can be generated in our very own beakers, how to manipulate particles on a micro-/nano-scale and much more.

### **Hwi-Young Lee: Photochemically Switchable Host for the Transport of Methyl Orange**

Molecular machines designed to transport methyl orange have binding abilities that are dependent on their state of isomerization. The machines are able to interconvert between *E* and *Z* isomers by irradiation of light at appropriate wavelengths. These molecular machines work such that when turned on, the guest molecule is transported from one point to another at an enhanced rate relative to when they are in their off state. The association constants regarded as the transport coefficients, *K*, of two systems have been studied. Comparisons between the two coefficients and the chemical mechanisms involved will be discussed.

### **Jennifer Zhu: From NATO Bombings to Energy Sources – History, Politics and Global Leadership at Oxford**

Recently I found myself on the other side of the world, in a place rich with centuries of academia, where winding spires graced the skyline - the University of Oxford. My time there was an unforgettable experience. It was an honour to be a scholar in one of the oldest and leading research and education institutions in the world. The History, Politics and Society course gave me many insights into fascinating aspects of the social sciences. The university tutorials tackled some of the biggest questions of our generation and many aspects of Global Leadership in the 21st Century.

Travel was never far from my agenda. In England, I made it to Bath, Blenheim Palace, Cambridge, Stonehenge and the Cotswolds, and of course the bustling city of London. A weekend in Germany exploring Berlin and Postdam was a gateway to the rest of Europe. And on the way back, I even managed to spend a few hours in Hong Kong.

So come and share in my fascinating journey.

### **Nadia Thorman: Computational Chemistry: Activation and Cleavage of the Phosphorus Diatomic**

The cleavage of the P-P bond of the phosphorus diatomic was studied using computational techniques to calculate the structure and energies of species along the reaction path. This was done using sterically hindered transition metal complexes of the type  $(R_nX)_mM$  in particular that of  $(H_2N)_3Mo$  and  $(H_2N)_3Cr$ . The suitability of other metals was also examined.

### **Alvin Pratama: Investigation of Function and Expression of *C. elegans* gene *F48C1.4***

This project investigated expression and function of a *Caenorhabditis elegans* gene, *F48C1.4*, using two different methods. To examine the expression, transcriptional and translational green fluorescent protein (GFP) reporter genes for *F48C1.4* were constructed using Gateway® cloning. The transforming DNA constructs were then coated onto gold particles and bombarded into *C.elegans unc-119* mutants. Some of these worms may become transgenic and express GFP which will be visible as green fluorescence under UV light. This should reveal the anatomical locations where

*F48C1.4* is expressed in *C.elegans*. The GFP constructs were sent for DNA sequencing and the results confirmed that the clones contained the correct gene. Whether GFP-expressing transgenic nematodes have been obtained will become evident in the next two weeks. The second method involved carrying out RNA interference experiments to knock down the expression of *F48C1.4* in different RNAi-hypersensitive strains of *C.elegans* followed by analysing the consequences on the worms' phenotypes. Conditions such as egg-laying defects, reduced maternal brood size, protruding and ruptured vulva were seen. As published by Schmitz *et al* (PNAS (2007) 104: 834), abnormalities in the neural commissures were observed, although the consequence of that is not yet clear.