



THE AUSTRALIAN NATIONAL UNIVERSITY



**Faculty of Science**

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## Proceedings of the Second Annual PhB Conference

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### **Organising Committee**

Frank Cai  
Nathan Deutscher  
Ruth Mills  
Melissa Tacy

FRIDAY 20TH OCTOBER, 2006  
H W ARNDT BUILDING LECTURE THEATRE 2

## Schedule of Events

Time	Event
2:00pm – 3:00pm	Arrival at H W Arndt Building <b>Mr Craig Cormick:</b> Are Scientists Mad, Bad and Dangerous to Know?
3:00pm – 3:20pm	<b>Stuart Szigeti:</b> Intensity Profiles for Superdeformed Nuclei
3:20pm – 3:40pm	<b>Tegan Cruwys:</b> Exploring Styles of Empathy
3:40pm – 4:00pm	<b>Matthew Pinson:</b> Circle Packing
4:00pm – 4:20pm	<b>Edward Boydell:</b> Australian State of the Environment Reporting: Exposing Underlying Challenges to Sustainability
4:20pm – 4:40pm	<b>Matthew Pollard:</b> Artificial Stock Markets and Heterogeneous Agent Models
4:40pm – 4:55pm	Refreshments
4:55pm – 5:15pm	<b>Karen Zhang:</b> Accounting for the Variability in Biofilm Formation by Escherichia coli: The Impact of Genetic Factors
5:15pm – 5:35pm	<b>Caitlin Grace:</b> Some Problems with Orthodox Economic Theory
5:35pm – 5:55pm	<b>Ben Swift:</b> The Eureka Effect in the Musical Brain
5:55pm – 6:15pm	<b>Jennifer Zhu:</b> Global Climate Change: A Paleoclimate Perspective
6:15pm – 6:35pm	<b>Ruth Mills:</b> Dominos, Chessboards and Self-Avoiding Walks
6:35pm – 6:50pm	Refreshments
6:50pm – 7:10pm	<b>Robert d'Apice:</b> Entrepreneurism: A Study in e-Business Design and Development
7:10pm – 7:30pm	<b>Finnian Lattimore:</b> Pushing Around Cold Atoms: An Experiment in Atom Optics
7:30pm – 7:50pm	<b>Stefan Webb:</b> Paradigm Function Morphology
7:50pm – 8:10pm	<b>Jacqui Poldy:</b> Sex, Deceit and the Chemical Lies of Chiloglottis
8:10pm – 9:00pm	Dinner and Prize Presentation

## **Keynote Speaker**

### **Mr Craig Cormick**

Craig Cormick is the Manager of Public Awareness for the Government agency Biotechnology Australia. He has previously worked as a science journalist and has taught public relations and writing at university. He is widely published on drivers of public attitudes towards biotechnology, and is a regular commentator in the media and at industry and research conferences, both in Australia and overseas, on causes of public concern towards applications of biotechnology. In 2006 he published the report *Cloning Goes to the Movies*, a study of how Hollywood portrayals of human reproductive cloning influence public knowledge and attitudes. He has published several books and has won numerous awards including the ACT Chief Minister's Book of the Year Award (1999) and a Queensland Premier's Literary Award (2006).

### **Are Scientists Mad, Bad and Dangerous to Know?**

In this presentation, Craig Cormick will present snippets of Hollywood films to analyse the portrayal of scientists and the science of biotechnology in the popular media. These representations will be compared with the results of public attitude studies conducted by Biotechnology Australia into sources of trust, the influence of different media, and the impact of popular media on the formation of ethical and scientific attitudes.

## **Student Abstracts**

### **Stuart Szigetti — Intensity Profiles for Superdeformed Nuclei**

When spinning nuclei are “superdeformed”, we observe rotational band spectra comprising levels of decreasing angular momentum and excitation energy. The  $> 100$  superdeformed bands now observed share one striking feature: all the intensity disappears over only 2 or 3 levels, well above the “ground-state” level. The question is: can current theoretical models account for this?

### **Tegan Cruwys — Exploring Styles of Empathy**

Empathy has been vaguely defined and remains debated in the psychology literature. This project aimed to examine some of the processes involved in empathy and thereby contribute to a clarification of its definition. Philosophical speculation has suggested a number of empathic styles, and a qualitative interview study was developed to investigate the existence and use of these different methods.

### **Matthew Pinson — Circle Packing**

Arrangements of circles, with each circle externally tangent to its neighbours, have great mathematical and aesthetic interest. Such packings of circles range from a four member “Descartes configuration” to infinite patterns filling a plane or hyperbola. This talk will provide an introduction to some of the most interesting and important results in the field of circle packing.

## **Edward Boydell — Australian State of the Environment Reporting: Exposing Underlying Challenges to Sustainability**

State of the Environment reporting provides insight into Australian environmental issues and challenges. The reports are an invaluable tool, evaluating existing responses to issues and recommending future action. Synthesis of report findings on Land and Human Settlements within a policy framework reveals two layers of issues: substantive, quantifiable trends, and underlying challenges that link them. Existing policy responses typically target the former, and neglecting the underlying issues impedes effective progress towards sustainability.

## **Matthew Pollard — Artificial Stock Markets and Heterogeneous Agent Models**

Financial prices show non-linearity, non-stationarity, non-normality and long-range dependence. The underlying stochastic process generating prices, and why this arises out of economic behaviour, is poorly understood. Heterogeneous Agent Models (HAMs) offer insights into economic mechanisms responsible. They explain the origins of price dynamics from “the bottom up”, the actions of individual traders. I present the Matthew Market Model, a minimal HAM for generating volatility clustering in stock prices.

## **Karen Zhang — Accounting for the Variability in Biofilm Formation by *Escherichia coli*: The Impact of Genetic Factors**

The present study was designed to determine the extent to which the variation observed in biofilm formation by *Escherichia coli* in vitro can be explained in terms of genetic diversity using a large collection of extensively characterised bacterial strains. Based on the results, the combination of source of strain, genetic group membership and the virulence factor *fyuA* was able to explain a considerable amount of the variation.

## **Caitlin Grace — Some Problems with Orthodox Economic Theory**

This talk considers some of the arguments against the usefulness of important aspects of orthodox economic theory, and the practical results if these are accurate. It includes whether supply and demand curves behave as expected and consequently whether markets have equilibriums that ensure maximal utility.

## **Ben Swift — The Eureka Effect in the Musical Brain**

The ‘eureka effect’ describes the act of solving a problem by sudden insight, as famously experienced by Archimedes in his bathtub. Studies have detected neurophysiological activity corresponding specifically to this phenomenon in verbal problem solving tasks [Jung-Beeman et al. 2004]. Less is known, however, about insight in relation to nonverbal tasks. Some individuals with musical training can detect harmonic structure, such as a chord progression, in a piece of music. This study sets out to investigate the physiological correlates, if any, of this sort of insightful problem solving in the musically trained brain.

## **Jennifer Zhu — Global Climate Change: A Paleoclimate Perspective**

Climate change is one of the most hotly debated issues today. Yet to fully understand the issue, global temperature change must be put into perspective over geological time scales. We must use several methods to look deep into the past in order to predict the future.

### **Ruth Mills — Dominos, Chessboards and Self-Avoiding Walks**

Did you know there are 12 988 816 ways of arranging 32 dominos on a chessboard? And now that you do know, why should you care? In this talk, I will discuss the significance of the Domino Problem, the methods used to count the number of arrangements and the connection to Self-Avoiding Walks.

### **Robert d'Apice — Entrepreneurism: A Study in e-Business Design and Development**

Three months ago, I had an idea, a computer, and an ASC. Now I have experience in concept proposals, IPO charts, business planning, cashflow analysis, accounting, e-commerce, web design, web hosting, domain registration, PHP, HTML MySQL programming, and CSS layouts. Where next? dapShare.com needs your help...

### **Finnian Lattimore — Pushing around Cold atoms:an experiment in Atom Optics**

Atom optics is about using light to manipulate atoms. By cooling and trapping atoms with light it is possible to create ultra-cold clouds of weakly interacting atoms. This allows us to probe interesting low temperature quantum effects without the complication of the strong interactions between atoms that occurs in liquids and solids.

### **Stefan Webb — Paradigm Function Morphology**

Do you find words fascinating? Then this talk is for you. Morphology is the branch of linguistics dealing with word-formation, and PFM is a recent morphological theory that has been carefully devised with a sound formalism. We will examine the morphology of several languages, exotic and familiar, and show how PFM can explain the phenomena in these languages. Finally we will see what extensions can be made to PFM and how it can be applied to computational morphology.

### **Jacqui Poldy — Sex, Deceit and the Chemical Lies of Chiloglottis**

The Orchidaceae is well known for its diversity of pollination systems, and is the only plant family in which pollination by sexual deception is known to occur. In the Australian orchid genus Chiloglottis chemical mimicry of female sex pheromones is used to lure male thynnine wasps that act as pollination vectors. The preparation of these compounds and analogues, and biological implications will be the focus of this presentation.

### **Robert Wiblin — Auxin Presence During Nodulation in *M. Trucatula* (Poster)**

The model legume *Medicago truncatula*, like all legumes, can form a novel symbiotic organ, the nodule, in its roots in response to the soil bacteria Rhizobacteria. It has been found that *M. truncatula* roots that cannot inhibit auxin transport do not form nodules. In this experiment we examined whether auxin build-ups occur near sites of nodulation in *M. truncatula*. Low and inconsistent rates of transformation with the auxin detecting DNA construct were obtained. After transformation, the roots were inoculated with rhizobia to induce nodules. Root hair curling was observed as a sign of successful nodulation. Auxin patterns were observed but found to be too variable to draw conclusions. Contaminating bacteria made results more difficult to determine.