

Summary of Discovery Projects Applications for Funding to Commence in 2006

New South Wales

University of Wollongong

DP0666700 Prof DJ Ayre; Prof RJ Whelan

Approved Project Title **Why conserve genetic variation? Is this misdirected effort or a crucial concern?**

2006 : \$106,000

2007 : \$96,000

2008 : \$96,000

Primary RFCD 2707 ECOLOGY AND EVOLUTION

Administering Institution University of Wollongong

Project Summary

In attempting to conserve populations of threatened plants, ecosystem managers must prioritise allocation of resources to both immediate and long-term threats, including loss of genetic variation. This study will determine the importance of maintaining existing genetic variation within populations of several species in a major Australian plant group. As well as advancing theory in the area of plant ecological genetics and evolutionary biology, our results will provide a stronger scientific basis for the development of conservation policy and management decisions for conserving threatened plant species.

DP0666787 Prof DJ Ayre; Dr TE Minchinton

Approved Project Title **Setting the limits: Ecological and genetic tests of the status of marine populations at species borders.**

2006 : \$95,000

2007 : \$90,000

2008 : \$90,000

Primary RFCD 2707 ECOLOGY AND EVOLUTION

Administering Institution University of Wollongong

Project Summary

The wide dispersion of Australia's population along our coastal fringe combined with global climate change poses severe threats to marine biodiversity and necessitates urgent conservation measures. Our study will use ecological and genetic approaches to contribute to our understanding of the roles of reproduction and dispersal in maintaining biodiversity. We will determine whether some locations are highly productive sources of larval colonists, whereas others are unproductive and dependent on other sources of recruits, and we will inform management practices such as the creation of marine protected areas.

DP0665531 Prof RJ Barry; Dr AR Clarke; Dr SJ Johnstone

Approved Project Title **Exploring the brain mechanisms underlying hyperactivity in Attention-Deficit/Hyperactivity Disorder**

2006 : \$60,000

2007 : \$55,000

2008 : \$60,000

Primary RFCD 3801 PSYCHOLOGY

Administering Institution University of Wollongong

Project Summary

Attention-deficit/Hyperactivity Disorder (AD/HD) is the most common psychiatric disorder affecting children, resulting in substantial costs (both human and financial) to the child, their family and Australian society. The outcomes of this project will provide a better foundation for understanding dysfunctional brain mechanisms in AD/HD, which is expected to lead to better diagnosis, treatment, and community support. Ultimately this will contribute to a healthy start to life for these children. This project will also demonstrate how an integrated Australian approach can lead the research agenda in both basic neuroscience, at the interface of psychology and physiology, and its applications in health.

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DP066628 Dr JL Beck; Prof MM Sheil

Approved Project Title **Gas Phase Dynamics of a Biological Molecular Machine: Fundamentals, Stoichiometries and Stabilities**

2006 : \$100,000

2007 : \$80,000

2008 : \$80,000

Primary RFCD 2503 ORGANIC CHEMISTRY

Administering Institution University of Wollongong

Project Summary

Over the last twenty years advanced molecular measurement techniques have enabled the characterization of individual biological molecules (proteins and DNA) within different types of cells and diseased tissues. This project uses a new technique that literally "weighs" groups of proteins and/or DNA to help us understand how such large molecules fit together and function within cells (sometimes referred to as molecular machinery). More detailed knowledge of processes such as those involved in copying DNA when new cells are produced will, in the long term, improve our understanding and treatment of conditions or diseases that result from errors in molecular machinery.

DP0665932 Prof LM Head

Approved Project Title **Beyond dualisms in the conceptualisation and management of Australian landscapes and species**

2006 : \$58,000

2007 : \$94,000

2008 : \$94,000

2009 : \$53,000

Primary RFCD 3704 HUMAN GEOGRAPHY

Administering Institution University of Wollongong

Project Summary

It is increasingly recognised that the major barriers to the urgent challenges of environmental sustainability are social, cultural and organisational rather than scientific. This project will help Australia imagine and implement environmental strategies that come to terms with the reality of a peopled landscape and thus better manage landscapes and species. It will place Australia at the forefront of international intellectual debates about relationships between the human and non-human worlds, and contribute to our continued international leadership in biodiversity conservation and heritage management. It will foster linkages with Sweden and build a node of innovative interdisciplinary postgraduate research training.

DP0664199 Prof BN Indraratna; Prof FA DARVE

Approved Project Title **Assessment and Prediction of Particle Breakage under Cyclic Loading**

2006 : \$70,000

2007 : \$55,000

2008 : \$55,000

Primary RFCD 2908 CIVIL ENGINEERING

Administering Institution University of Wollongong

Project Summary

Every year, transport industries spend millions of dollars to maintain existing tracks suffering excessive settlement due to heavy traffic. In railways, differential settlement and track fouling are mostly due to ballast breakage. Frequent maintenance requires large amounts of quarried ballast causing environmental degradation. Simulation of particle breakage subject to cyclic loading is pioneering fundamental research that will have significant impact on the design and maintenance of future rail and road networks. A full understanding of the breakage mechanisms of aggregates will lead to innovative techniques in design and construction, including faster trains carrying heavier loads with reduced maintenance costs.

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DP0666707 Dr PC Innis; Prof DL Officer; Prof RN Warrener

Approved Project Title **Self-Assembled Porphyrin-Fullerene Photovoltaic Electrodes: Towards Nanostructured Organic Solar Cells**

2006 : \$153,000

2007 : \$138,000

2008 : \$138,000

Primary RFCD 2503 ORGANIC CHEMISTRY

Administering Institution University of Wollongong

Project Summary

Energy is arguably the single most important problem facing humanity today. The development of cheap, efficient photovoltaic technology could dramatically change this, providing humanity with renewable, environmentally acceptable energy resources. The need to replace present electrical energy generation, largely based on fossil fuel, is without argument given the detrimental effects of global warming from increasing carbon dioxide production. The development and implementation of cheap, efficient photovoltaic technologies in Australia will not only ensure its sustainable economic growth but also contribute in a major way to the improved use of land, water, mineral and other energy resources in Australia.

DP0665652 A/Prof SC Jones

Approved Project Title **Evidence-based community standards for ethics in advertising**

2006 : \$50,000

2007 : \$40,000

2008 : \$40,000

Primary RFCD 3502 BUSINESS AND MANAGEMENT

Administering Institution University of Wollongong

Project Summary

The primary social benefit of this project is the development of evidence-based standards representing community views on acceptable practices in advertising, providing a basis on which to lobby for improvements in regulation. Such improvements will contribute to the ability of consumers to make informed choices about product purchase and behaviour change. This project also has economic benefit for commercial and social advertisers in Australia, enabling them to: pre-test potential advertisements to ensure that they comply with community standards; develop advertisements which are better suited to their target audience(s); better forecast the effects of appeals on advertising outcomes; and reduce complaints to the ASB and other bodies.

DP0665292 A/Prof RA Lewis

Approved Project Title **High Efficiency Terahertz Emitters**

2006 : \$123,000

2007 : \$110,000

2008 : \$112,000

Primary RFCD 2909 ELECTRICAL AND ELECTRONIC ENGINEERING

Administering Institution University of Wollongong

Project Summary

Between microwaves and visible light lies the terahertz gap - the least explored region of the electromagnetic spectrum. Yet the THz region is precisely where many materials exhibit characteristic signatures that allow them to be detected and identified. For example, anthrax, explosives, water, DNA, plastics, and carcinomas all have distinctive THz signatures. THz methods are revolutionizing medicine, agriculture, industry, and national security. Wider application is hampered by the lack of powerful sources of THz radiation. We aim to develop more efficient emitters of THz radiation. The national economy, security, and well-being will benefit.

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DP0664386 Dr D Li

Approved Project Title **Electronically Conducting Nanofibres and Assemblies**

2006 : \$110,880
2007 : \$110,880
2008 : \$110,880
2009 : \$110,880
2010 : \$110,880

Primary RFCD 2918 INTERDISCIPLINARY ENGINEERING

QEII Dr D Li

Administering Institution University of Wollongong

Project Summary

With the use of new techniques that have just emerged in the last two years and are receiving rapidly growing interest throughout the world, this project will bring to Australia a new nanofabrication platform for making a variety of complex nanostructures. Fundamental researches on these complex nanostructures will greatly advance nanoscience. New nanotechnologies will be developed to address some world-wide challenging problems, e.g. energy conversion and storage, chemical/biological sensing and other micro- and nanoelectronic devices. This project will bring both breakthrough science and frontier technologies for building and transforming Australian industries and help place Australia at the forefront of nanotechnology.

DP0667182 Prof GC Nanson; A/Prof BG Jones

Approved Project Title **Palaeoclimatic and environmental significance of major Late Quaternary drainage contributions and disruptions in the Lake Eyre basin.**

2006 : \$110,000
2007 : \$80,000
2008 : \$80,000

Primary RFCD 2601 GEOLOGY

Administering Institution University of Wollongong

Project Summary

This study will advance our knowledge of the most remarkable floods ever known to have occurred in Australia. They were associated with a vast aquatic ecosystem in what today is the barren northern end of the Flinders Ranges, a region of desert dunes and salt lakes. Remarkably, such wet conditions appear to have coincided with episodes of megafaunal extinction and with the human occupation of Australia. The results will provide valuable information with which to better understand the main global drivers of episodes of profound wetness and dryness in Australian climate.

DP0665752 Prof SG Pyne

Approved Project Title **Asymmetric Synthesis and Biological Evaluation of Bioactive Alkaloids and their Analogues**

2006 : \$135,000
2007 : \$120,000
2008 : \$130,000

Primary RFCD 2503 ORGANIC CHEMISTRY

Administering Institution University of Wollongong

Project Summary

We propose to develop innovative methods for preparing bioactive natural products and their analogues with potential applications as new and safer therapeutic drugs and agricultural chemicals. This project would make important scientific contributions to the advancement of the fundamentals of synthetic organic chemistry and contribute to Australia's development as a knowledge-based economy. The methodology and products developed may have potential pharmaceutical and agricultural applications from which the country could benefit from in the future. This project would help develop skilled people that may develop innovative outcomes in the future, especially in the developing pharmaceutical and biotechnology industries in Australia.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0666084 Prof RG Roberts; Prof Dr R Grun; Dr Z Jacobs; Dr GA Duller

Approved Project Title **Out of Africa and into Australia: robust chronologies for turning points in modern human evolution and dispersal**

2006 : \$86,000
2007 : \$30,000
2008 : \$60,000
2009 : \$70,000
2010 : \$70,000

Primary RFCD 2603 GEOCHEMISTRY

Administering Institution University of Wollongong

Project Summary

This project will yield important new data on the timing of major turning points in human evolution and the human colonisation of Australia. This will improve our knowledge of Aboriginal cultural heritage and provide a long-term perspective on human/environment interactions to help forecast future impacts of human disruption of the Australian ecosystem (Environmentally Sustainable Australia NRP). Modern dating techniques underpin many archaeological and environmental projects, so the advances made in this study will benefit researchers worldwide, increase capacity for commercial services, and enhance Australia's international standing in geochronology. We will also generate high-quality research students and new collaborative initiatives.

DP0663642 Dr S Roodenrys; Prof C Hulme

Approved Project Title **Phonological neighbourhood effects in short-term memory and speech production: Towards a unified account.**

2006 : \$65,000
2007 : \$55,000
2008 : \$24,650

Primary RFCD 3801 PSYCHOLOGY

Administering Institution University of Wollongong

Project Summary

This research will help to define the interaction between speech production processes and verbal short-term memory. As short-term memory is important in learning language a greater understanding of this interaction will help in the development of better educational and remedial language instruction practices. Children with developmental language problems, and adults who have suffered a stroke or other form of brain damage, benefit from remedial language training. The more we understand about the relationship between speech processes and short-term memory, the manner in which they interact, and the degree to which language acquisition depends on short-term memory the better able we will be to develop effective language programs.

DP0663785 Prof AB Rozenfeld; Dr IM Cornelius; Prof AS Dzurak; Dr GJ Takacs; Prof M Zaider; Dr MI Reinhard

Approved Project Title **Radiation protection for space, aviation, and terrestrial applications: the development of novel radiation detectors and computational techniques**

2006 : \$150,000
2007 : \$140,000
2008 : \$140,000

Primary RFCD 2403 ATOMIC AND MOLECULAR PHYSICS; NUCLEAR AND PARTICLE PHYSICS; PLASMA PHYSICS

APD Dr IM Cornelius

Administering Institution University of Wollongong

Project Summary

Personnel in space, aviation, and terrestrial applications may be exposed to potentially harmful levels of densely ionising radiation. This project will produce improved radiation detectors and computational techniques, addressing needs in the prediction and assessment of equivalent dose in these applications. The "preventative healthcare" priority goal of the National Research Priority "Promoting and Maintaining Good Health" will be addressed, serving to reduce the risk to personnel involved in such activities. This research will also enhance Australia's international reputation in this field, stimulate local expertise, and create a critical mass of researchers in this field.

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DP0663423 A/Prof KG Russell; Prof JA Eccleston; Prof SM Lewis; Dr DC Woods

Approved Project Title **Efficient Design for Generalized Linear Models**

2006 : \$58,000

2007 : \$50,000

2008 : \$56,000

Primary RFCD 2302 STATISTICS

Administering Institution University of Wollongong

Project Summary

In industrial, commercial and social research, we collect data in order to predict the outcome of a process based on the inputs to that process. We want to maximize the information that is gained from the data. Good planning is crucially important to achieve this. This project will determine how best to select the inputs to the process for many situations that occur in research. A computer package to answer these questions will be written. The nation will benefit from a fundamental increase in efficiency of research and, therefore, in efficient use of research dollars.

DP0666163 Prof R Safavi-Naini; Mr VD To; Dr P Nickolas

Approved Project Title **Approximate authentication systems for digital information**

2006 : \$105,000

2007 : \$100,000

2008 : \$100,000

Primary RFCD 2805 DATA FORMAT

APD Mr VD To

Administering Institution University of Wollongong

Project Summary

Assurance about the origin and integrity of digital content is crucial not only in high security applications but also in everyday life scenarios such as providing proof that an X-ray image presented as part of an insurance claim is authentic, or a news clip is not tampered with. The outcomes of this project will significantly enhance trustworthiness of multimedia information systems which are increasingly used in areas such as surveillance (traffic control), health, digital content production and distribution, tourism and journalism. It will also result in the development of secure biometric authentication systems which are critical in securing cyber space.

DP0666273 Dr CH Schofield; Prof SB Kaye; Prof BM Tsamenyi

Approved Project Title **Maritime Legal Practice and Policy in Southeast Asia and the South Pacific: Synergies and Challenges for Australian Trade and Security**

2006 : \$120,000

2007 : \$147,000

2008 : \$141,000

2009 : \$132,000

2010 : \$120,970

Primary RFCD 3901 LAW

QEII Dr CH Schofield

Administering Institution University of Wollongong

Project Summary

Analysis of maritime legal practice in Southeast Asia and the South Pacific will bolster Australia's national maritime policy-making and regional capacity to address key maritime concerns, leading to enhanced sustainable management of the ocean environment and its resources, economic security, maritime enforcement and security for trade and shipping. This will deliver profound political, economic and security benefits to the countries concerned. The research will help to safeguard Australia's vital maritime interests as well as those of our maritime neighbours and therefore impact directly on Australia's economic security and prosperity, the protection and preservation of the marine environment and thus the well being of its society.

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DP0666771 Dr D Shi

Approved Project Title **Development of conductive buffer layers for RABiTS-based coated conductors**

2006 : \$80,000
2007 : \$60,000
2008 : \$60,000

Primary RFCD 2402 THEORETICAL AND CONDENSED MATTER PHYSICS

Administering Institution University of Wollongong

Project Summary

YBCO coated conductor has already been identified and developed as far as second generation HTS wire in power applications. Major advances have been made in the last 10 years in coated conductor development mainly in all aspects: substrate, buffer layer and YBCO layer. The research on conductive buffers layer will improve and expand the R&D on coated conductor in Australia. On the economic side, dramatic advantages and savings could be achieved if the coated conductors can be put to use. Superconductivity can have a significant role in deregulated electricity markets and in lessening CO2 emissions and other environmental impacts.

DP0663306 Dr W Susilo; Ms KT Win; Dr F Zhang

Approved Project Title **Credential Systems and Their Applications in Securing Electronic Health Records**

2006 : \$98,608
2007 : \$62,000
2008 : \$69,000

Primary RFCD 2805 DATA FORMAT

Administering Institution University of Wollongong

Project Summary

The expected result of this project will be frontier technologies that are essential in applications and services, whose acceptance and take-up will depend on users' assurance of their security in the cyber world. In particular, a service such as the EHR system, which is known to be a complex system, requires the use of new and innovative credential-based systems. The result will also contribute to maintaining Australia's leading position in the telecommunication and information technology industries, which has been recognised by increased government funding levels. The resulting applications of this project will place Australia as the first country able to design and implement a secure EHR system.

DP0664898 Dr CS Turney; Dr SG Haberle

Approved Project Title **Testing the hypothesis of synchronous inter-hemispheric climatic change during the Last Termination (20,000-10,000 years ago)**

2006 : \$169,000
2007 : \$110,000
2008 : \$100,000

Primary RFCD 2606 ATMOSPHERIC SCIENCES

Administering Institution University of Wollongong

Project Summary

The results generated in this project will provide a greater understanding of the sensitivity of the Australasian region to a range of different climatic conditions (far beyond that recorded in historical datasets). Focussing on climate at the end of the last ice age (20,000-10,000 years ago) we will investigate the timing, rate and magnitude of change in the Australasian region and test whether the variability was in phase with other records from the mid- and high-latitudes of the Southern and Northern Hemisphere. The results will provide a considerably improved context for understanding present and future climate change in Australia.

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DP0664403 Dr T Uller

Approved Project Title Evolution of maternal effects: a life-history perspective

2006 : \$83,000

2007 : \$60,000

2008 : \$48,000

Primary RFCD 2707 ECOLOGY AND EVOLUTION

Administering Institution University of Wollongong

Project Summary

The community benefits from the present project are two-fold. Firstly, it strengthens Australia's competitive position in evolutionary biology research, and its applications in conservation and medicine. The projects focus on long-term consequences of early developmental conditions is considered to be a priority in both medical and evolutionary research. Secondly, understanding variation in phenotypic traits in relation to environmental factors, such as prenatal stress, is important for designing conservation and animal breeding programs to minimize the risk of population decline and to ensure uncompromised husbandry conditions to avoid animal suffering.

DP0665873 Dr X Wang; Dr Z Cheng; Prof T Shrout; Prof W Wen; Dr K Yamaura; Dr K Liss; Dr RO Piltz

Approved Project Title Development of novel ferroelectric magnetic materials for multi-functional applications

2006 : \$130,000

2007 : \$100,000

2008 : \$100,000

Primary RFCD 2914 MATERIALS ENGINEERING

Administering Institution University of Wollongong

Project Summary

Ferroelectric magnets having simultaneous ferroelectricity and ferromagnetism is an area of emerging scientific interest. This project is to develop novel ferroelectric magnetic materials for multifunctional applications and falls into National Research Priority, Frontier Technologies for Building and Transforming Australian Industries. This project will provide trainings for postgraduate students and develop patentable science and technologies. The scope for use of the novel multifunctional materials will be enormous with great markets in the fields of magnetoelectronics, magnetic electromechanical industrial devices. It will benefit Australian manufacturing industry in the long term.

DP0664313 A/Prof CD Woodroffe

Approved Project Title Variability in El Niño frequency and intensity over the past 4000 years

2006 : \$45,000

2007 : \$35,000

2008 : \$35,000

Primary RFCD 2606 ATMOSPHERIC SCIENCES

Administering Institution University of Wollongong

Project Summary

Fossil corals contain a rich archive of past climate variability for tropical oceans which can extend the limited instrumental data and increase our understanding of climate sensitivity. El Niño variations in the Pacific have far-reaching impacts on Australian climate, and this project will reconstruct variations in the past in order to better forecast climate sensitivity in the future. It focuses on Christmas Island which is the optimal site to capture El Niño variability at several different time scales, and will lead to a better understanding of atmospheric and oceanic factors that have caused climate variability.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0666853 Mr Y Zhao; Dr M Ionescu; Dr J Du; Prof EW Collings

Approved Project Title **Superconducting MgB₂ thin films and structures for electronic devices and telecommunication applications**

2006 : \$125,000

2007 : \$100,000

2008 : \$100,000

Primary RFCD 2914 MATERIALS ENGINEERING

APD Mr Y Zhao

Administering Institution University of Wollongong

Project Summary

Two important directions of electronic application for MgB₂ films are superconducting Josephson junction (JJ) technology and passive microwave devices. Superconducting JJ technology will have a small but important niche in high-performance digital signal and data processing applications for civilian, commercial, and military terrestrial, as well as space deployment. With superconducting passive microwave devices, the potentially largest market in this segment are filter systems for ground- or satellite based wireless communication systems. The research outcome could support Australian companies to develop corresponding products, as well as broaden Australia's knowledge of the physics of the new MgB₂ superconductor.