

**New South Wales**

**The University of Newcastle**

**DP0985945** Prof RA Antonia; A/Prof L Djenidi

**Approved Project Title** **Turbulent mixing of a passive scalar**

**2009 :** \$ 180,000

**2010 :** \$ 135,000

**2011 :** \$ 135,000

**Primary RFCD** 2918 INTERDISCIPLINARY ENGINEERING

**Administering Organisation** The University of Newcastle

**Project Summary**

Turbulence is the usual state of fluid motion. This proposal will increase Australia's expertise in fundamental turbulence research, especially in the area of turbulent mixing, which is of major importance in many natural and engineering problems involving combustion, chemical reactions and pollution. A better knowledge of mixing at small scales will lead to more efficient combustion, savings in energy expenditure as well as a reduction in pollutant emissions.

**DP0987445** Prof NL Boland; Prof JM Borwein; Prof AC Eberhard

**Approved Project Title** **New Theory and Algorithms for Nonsmooth Optimisation with Application to Integer Programming**

**2009 :** \$ 85,000

**2010 :** \$ 82,000

**2011 :** \$ 82,000

**Primary RFCD** 2301 MATHEMATICS

**Administering Organisation** The University of Newcastle

**Project Summary**

Mathematical optimisation plays a key role in a wide variety of applications in business, industry, engineering and science. For example, airlines cannot fly and radiation treatment for cancer cannot be delivered without solving (a series of) optimisation problems. Some classes of optimisation problem are very well solved, with clear mathematical foundations, efficient algorithms, and reliable software implementations. Both nonsmooth and integer optimisation problems have a good mathematical basis, but there are "gaps"; existing methods cannot always solve real industrial problems. This project will deliver better methods, built on better theory, and so will yield better solutions for important applications.

**DP0987446** Prof SF Bourke; Dr RH Cantwell; Dr JJ Scevak; A/Prof AP Holbrook

**Approved Project Title** **Influences of metacognitive beliefs on success in PhD candidature**

**2009 :** \$ 80,000

**2010 :** \$ 50,000

**2011 :** \$ 60,000

**Primary RFCD** 3301 EDUCATION STUDIES

**Administering Organisation** The University of Newcastle

**Project Summary**

In a knowledge-fuelled world our dependence on professionals is acute. There is an imperative to gain fundamental information about how adult learners approach and surmount obstacles to learning in complex situations. Persistence of major gaps in our knowledge about professional learning is a concern particularly in high stakes research degrees such as the PhD. Drawing on candidates from Australia and overseas this project will shed light on what until now have been the 'invisible processes' that have led to the visible results of both successful and problematic doctoral candidature. The findings will provide direction for stakeholders, impact on global debates about doctoral quality, and enhance research capacity.

## Summary of Discovery Projects Proposals for Funding to Commence in 2009

**DP0988907** Prof BZ Dlugogorski; Prof EM Kennedy; Prof JC Mackie; Dr MW Radny; Dr M Stockenhuber; Prof MA Delichatsios; Prof G Hadjisophocleous

**Approved Project Title** **Fires of pesticides: New source of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/F) in the environment**

**2009 :** \$ 200,000  
**2010 :** \$ 180,000  
**2011 :** \$ 180,000

**Primary RFCD** 2906 CHEMICAL ENGINEERING

**Administering Organisation** The University of Newcastle

### Project Summary

This project will quantify the emission of carcinogenic pollutants, produced as a consequence of intended and unintended combustion of pesticides and pesticide-contaminated biomass. The project will identify specific pesticides and agricultural practices (such as burning of sugar cane prior to harvest or burning biomass contaminated with pesticides for energy recovery) which may become regulated in Australia. The research will benefit Australia socially, by reducing the emissions of polychlorinated dibenzo-p-dioxins and dibenzofurans and thus protecting the environment and the population, and economically by identifying pesticides that do not produce pollutants in combustion processes and thus do not contaminate biomass intended for energy recovery.

**DP0986319** Dr AJ Fleming

**Approved Project Title** **New drives and control techniques for high performance piezoelectric actuation**

**2009 :** \$ 130,000  
**2010 :** \$ 99,000  
**2011 :** \$ 99,000  
**2012 :** \$ 120,000  
**2013 :** \$ 132,000

**Primary RFCD** 2909 ELECTRICAL AND ELECTRONIC ENGINEERING

**ARF** Dr AJ Fleming

**Administering Organisation** The University of Newcastle

### Project Summary

Piezoelectric actuators are made from a ceramic material that expands in response to an applied voltage. Although these actuators develop the greatest forces and most precise motion of any actuator, a number of performance limitations exist. This proposal aims to overcome these limitations and greatly increase the performance of piezoelectric actuators.

Improved piezoelectric actuators will result in a parallel improvement of analytic and process machines throughout the scientific and industrial community. Examples include: improved atomic scale microscopes, finer tolerance steel rolling mills, more accurate micro-surgical tools, and automated manipulation of sperm and egg cells in IVF therapy.

**DP0985745** Prof M Gray; Prof SA Webb; Dr N Kavanagh

**Approved Project Title** **Changing modes: A study of the knowledge economy of human service research in Australia**

**2009 :** \$ 80,000  
**2010 :** \$ 30,000  
**2011 :** \$ 30,000

**Primary RFCD** 3702 SOCIAL WORK

**Administering Organisation** The University of Newcastle

### Project Summary

Significant national benefits will accrue through this study of the human services knowledge economy. The creation of human services employing knowledge-based interventions will address the real needs of Australians in the current socio-political environment. In investigating how current systems of knowledge production contribute to the creation of relevant and effective human services, the research will identify the restraints to innovation in human services and the structures in which knowledge production is articulated. In modelling an 'ideal-type' of knowledge transfer conducive to the development of socially accountable research, it will inform changes needed for effective human service delivery.

## Summary of Discovery Projects Proposals for Funding to Commence in 2009

**DP0987599** Dr DM Hodgson; A/Prof VL Clifton; Prof KW Beagley; Prof Y Shavit

**Approved Project Title** **The Ontogeny of Pain Behaviour: A Novel Neuroimmune Pathway.**

**2009 :** \$ 60,000

**2010 :** \$ 40,000

**2011 :** \$ 50,000

**Primary RFCD** 3801 PSYCHOLOGY

**Administering Organisation** The University of Newcastle

### Project Summary

In Australia, 20% of the population report suffering from chronic pain. The cost of pain to Australian business per year is over \$3 billion. Attempts to explain many chronic pain states, based on current knowledge, have failed. The central hypothesis of this project is that pain sensitivity is determined by programming of the fetal immune system during pregnancy. This research proposal will determine whether exposure to infection early in life determines sensitivity to pain in adult life. In doing so, this research offers a new theoretical explanation for the ontogeny of pain and may begin to account for the many forms of chronic pain that are currently not only unexplainable from current pain theory, but difficult to manage clinically.

**DP0986217** Prof KT Jones; Dr O Stemmann

**Approved Project Title** **Elucidation of the signalling pathways during fertilization in mammals**

**2009 :** \$ 110,000

**2010 :** \$ 105,000

**2011 :** \$ 110,000

**Primary RFCD** 2701 BIOCHEMISTRY AND CELL BIOLOGY

**Administering Organisation** The University of Newcastle

### Project Summary

This grant sets out to understand how the union of the sperm and egg at fertilization generates a viable embryo: this is a fundamental event in biology. We aim to understand the basic signalling pathways from the sperm which allow the egg to become an embryo and are known to influence embryo quality. They are therefore important in our understanding of what constitutes a healthy early start to life. Australia also has economic interests in understanding the reproductive process in aiding breeding programs for commercially important livestock and endangered species and contraception programs for pest populations.

**DP0986140** Prof EH Kisi; Dr DP Riley; Adj/Prof CJ Howard

**Approved Project Title** **A New Paradigm for the Solid State Synthesis of Layered Materials**

**2009 :** \$ 121,000

**2010 :** \$ 121,000

**2011 :** \$ 121,000

**Primary RFCD** 2914 MATERIALS ENGINEERING

**Administering Organisation** The University of Newcastle

### Project Summary

Advanced ceramic materials with outstanding properties or combinations of properties are usually made from three (ternary) or more components. Their solid-state synthesis is hampered by the formation and retention of intermediate phases which degrade their performance. We have devised a method for circumventing intermediate phase formation in advanced materials and reducing synthesis temperatures by up to 600 degrees. This project will explore the underlying atomic scale mechanism of the method. This knowledge will allow the low cost, low greenhouse gas emission synthesis of advanced ceramics for use in renewable, conventional and nuclear power generation.

## Summary of Discovery Projects Proposals for Funding to Commence in 2009

**DP0988663** A/Prof AV Lyamin; Dr K Krabbenhoft

**Approved Project Title** **Variational Plasticity Models and Algorithms for Frictional Geomaterials**

**2009 :** \$ 110,000

**2010 :** \$ 100,000

**2011 :** \$ 90,000

**Primary RFCD** 2908 CIVIL ENGINEERING

**Administering Organisation** The University of Newcastle

### Project Summary

Although the proposed project makes use of a number of advanced concepts in mathematics, thermodynamics, and numerical analysis, and in this way could be labelled 'theoretical', its main ambition is to formulate models and methods that are much more practical than the ones currently in use. Ultimately, this will result in cheaper and safer designs of both standard and non-standard geotechnical structures. The project builds on and extends the tradition which has been established in Australia over the past 15-20 years of applying mathematical programming methods to plasticity problems, many of these in the field of geotechnical engineering.

**DP0986471** Mr CR McHenry

**Approved Project Title** **The role of natural selection in macroevolution: a case study examining convergence of form and function in marine predator guilds**

**2009 :** \$ 120,000

**2010 :** \$ 78,591

**2011 :** \$ 78,591

**Primary RFCD** 2707 ECOLOGY AND EVOLUTION

**APD** Mr CR McHenry

**Administering Organisation** The University of Newcastle

### Project Summary

Darwin's theory of evolution natural selection is one of the most successful in the history of science and provides the framework for modern biology: however, areas of debate or uncertainty are often misinterpreted by non-scientists as indication of fundamental flaws in the theory. New 'hi-tech' tools provide the opportunity to re-examine these areas, and also to demonstrate the process of science to the public. The new tool is Computational Biomechanics, the future of studying biological form, and this project will further develop the leading role of Australian research in this technology which has applications for palaeontology, environmental management, medical science, and the next generation of engineering using 'biomaterials'.

**DP0985770** Prof RE Melchers

**Approved Project Title** **Engineering models for inland atmospheric corrosion of steel infrastructure considering microbiological and environmental influences**

**2009 :** \$ 280,000

**2010 :** \$ 165,000

**2011 :** \$ 180,000

**2012 :** \$ 280,000

**2013 :** \$ 280,000

**Primary RFCD** 2908 CIVIL ENGINEERING

**APF** Prof RE Melchers

**Administering Organisation** The University of Newcastle

### Project Summary

Some 2-3% of Gross Domestic Product is estimated to be lost every year to corrosion and by measures to counteract it. Of this a significant proportion relates to steel infrastructure, which includes buildings, bridges, transmission towers, ships, offshore and coastal structures, tanks and pipelines. Better understanding and modelling of corrosion will improve our capability for assessing the long-term safety and serviceability of infrastructure. It may also be useful in improving the composition of steel to resist rusting and in the formulation of protective coatings. This project will contribute to better understanding of the likely involvement of bacteria in the longer-term corrosion of steel exposed to various inland environments.

## Summary of Discovery Projects Proposals for Funding to Commence in 2009

**DP0988601** Dr DE Quevedo; Dr J Ostergaard

**Approved Project Title** **Feedback Architectures with Parallel Communication Channels**

**2009 :** \$ 100,000  
**2010 :** \$ 99,000  
**2011 :** \$ 99,000  
**2012 :** \$ 101,000  
**2013 :** \$ 101,000

**Primary RFCD** 2301 MATHEMATICS

**ARF** Dr DE Quevedo

**Administering Organisation** The University of Newcastle

### Project Summary

Feedback control is an enabling, though often hidden, technology. For example, without control loops, cars, mining and manufacturing plants cannot operate in an efficient and safe manner. To reduce costs, there has been a trend to use general purpose communication systems, such as WiFi, for feedback control. These communication systems have only limited capacity and reliability. This can lead to performance degradation and system failure. The current project aims at proposing novel robust networked control system architectures. Our results will be useful to allow industries to use standard communications technology for control, thus, alleviating costs associated with developing dedicated application specific communication infrastructure.

**DP0986391** Dr P Schreier

**Approved Project Title** **Novel time-frequency techniques for analysing and modeling non-stationary physical and engineering data**

**2009 :** \$ 90,000  
**2010 :** \$ 85,000  
**2011 :** \$ 85,000

**Primary RFCD** 2802 ARTIFICIAL INTELLIGENCE AND SIGNAL AND IMAGE PROCESSING

**Administering Organisation** The University of Newcastle

### Project Summary

This project addresses an issue of fundamental importance in science and technology, where non-stationary data (which have time-varying statistics) are ubiquitous. Therefore, the development of time-frequency tools to model and analyse non-stationary data has great potential for impact in a wide range of areas reaching from seismic data analysis to biomedical signal processing to sonar and radar. Employing techniques to be developed in this proposal, we expect to be able to classify and detect features of non-stationary data that were unrecognisable using hitherto known methods.

**DP0986916** Dr P Schreier; A/Prof SR Weller; Prof LL Scharf

**Approved Project Title** **Iterative subspace expansions for space-time adaptive wireless communications, radar and sonar**

**2009 :** \$ 120,000  
**2010 :** \$ 75,000  
**2011 :** \$ 75,000

**Primary RFCD** 2805 DATA FORMAT

**Administering Organisation** The University of Newcastle

### Project Summary

This project addresses the fundamental challenge of high receiver complexity for bandwidth-efficient, high data-rate wireless communications, radar and sonar. We do this by designing the signal transmissions so that smart receivers can detect the signals in "warp speed". We expect these results to have an immediate impact on the design of next generation communications technologies. Information and Communications Technology (ICT) has been recognised by the Australian Government as a National Research Priority. This research project will contribute to the intellectual property in ICT held by Australia, and help supply Australian industries with the knowledge necessary to participate in the development of frontier technologies.

## Summary of Discovery Projects Proposals for Funding to Commence in 2009

**DP0986334** Prof HA Tarrant; Dr DC Baltzly; A/Prof EE Benitez; Prof F Renaud; Dr JS Rocca

**Approved Project Title** **Academies under Stress: the Reinvention and Survival of Platonist Schools, 360BC-AD565**

**2009 :** \$ 52,000

**2010 :** \$ 60,514

**2011 :** \$ 99,000

**Primary RFCD** 4401 PHILOSOPHY

**Administering Organisation** The University of Newcastle

### Project Summary

This project promises new insights into the versatility that is required for an intellectual movement to fend off social, political, religious, and intellectual pressures, preserving whatever is thought central to its mission, and responding positively to the needs and demands of successive eras. Though grounded in antiquity, and involving a Greek movement's response to successive Macedonian, Roman, and Christian pressures, or to other pressures of a social, political, scientific, and religious nature, modern analogies will be instructive. In particular it should offer lessons both for higher educational bodies and for minority intellectual or religious movements responding to mono-cultural pressures that regularly arise.

**DP0985174** Prof SA Webb; Prof M Gray; Dr DA Plath

**Approved Project Title** **Implementing Evidence-Based Practice: Factors that Influence the Use of Research Evidence by Human Service Professionals**

**2009 :** \$ 80,000

**2010 :** \$ 76,000

**2011 :** \$ 84,000

**Primary RFCD** 3702 SOCIAL WORK

**Administering Organisation** The University of Newcastle

### Project Summary

Implementing research evidence in human services is vitally important in providing more effective and accountable provision. It promotes an innovation culture by maximizing technological capability by understanding factors conducive to change. Nationally, it is significant in three key respects: (1) it is the first Australian research project to examine the implementation of research evidence in the human services; (2) it is the first project to conduct a systematic review in this field; (3) it develops a national policy framework for guiding implementation and identify attainment outcomes in human services. A multifaceted strategy for policy formation based on audit and feedback will be proposed.

**DP0984342** A/Prof GA Willis; A/Prof J Ramagge

**Approved Project Title** **Totally disconnected groups in algebra and geometry**

**2009 :** \$ 82,000

**2010 :** \$ 82,000

**2011 :** \$ 77,000

**2012 :** \$ 67,934

**2013 :** \$ 72,934

**Primary RFCD** 2301 MATHEMATICS

APF A/Prof GA Willis

**Administering Organisation** The University of Newcastle

### Project Summary

Mathematics research creates and develops new concepts for understanding the world. Group theory is a branch of mathematics based on our innate sense of symmetry. It was invented 200 hundred years ago and has grown into a language for analysing and classifying things ranging from wallpaper patterns to crystals, the fundamental particles of physics and Rubik's cube. The chief investigators have made significant breakthroughs in the study of symmetry groups of networks, giving Australia an international lead in this research area. The project will develop the insights gained to make Australia a centre of expertise on these symmetry groups, which have applications to many areas including information and communication technology.