

Summary of Discovery Projects Applications for Funding to Commence in 2006

Western Australia

Curtin University of Technology

DP0666328 Dr MC Besemeres

Approved Project Title **Anglos Abroad: Memoirs of Immersion in a Foreign Language and Culture**

2006 : \$30,017

2007 : \$20,000

2008 : \$31,343

Primary RFCD 4203 CULTURAL STUDIES

Administering Institution Curtin University of Technology

Project Summary

A study of Anglophone narratives of language immersion offers a significant intellectual resource for thinking about ways in which Australian non-immigrant selves are shaped by culture and language: an issue with important implications for just practises within a wide range of national institutions and agencies, including education, immigration and social work. It thus contributes to the priority goal of strengthening Australia's social and economic fabric (Research Priority 2). It also contributes to enhancing our capacity to interpret and engage with our region and the world through a greater understanding of other languages and cultures (Research Priority 4).

DP0663929 Prof HB Bloch

Approved Project Title **Innovation, Competition and Economic Performance: Understanding the Dynamics of Industry Development**

2006 : \$95,000

2007 : \$96,000

2008 : \$98,000

2009 : \$75,000

Primary RFCD 3402 APPLIED ECONOMICS

Administering Institution Curtin University of Technology

Project Summary

An improved understanding of the impact of innovation on competition and economic performance will inform the design of public policy in terms of industry assistance, research and development support, competition policy and regulatory activity. This will help ensure that the billions of dollars of private and public expenditure devoted to innovative activities and industry development has the greatest possible impact in terms of improved products, lower prices and the enhanced competitiveness of Australian businesses.

DP0665946 Prof L Caccetta; Dr G Zhou

Approved Project Title **Robust methods for hard optimization problems**

2006 : \$136,000

2007 : \$124,000

2008 : \$124,000

2009 : \$110,880

2010 : \$110,880

Primary RFCD 2301 MATHEMATICS

QEII Dr G Zhou

Administering Institution Curtin University of Technology

Project Summary

Highly advanced industrial and information-based societies depend on complex systems that underpin their infrastructure and technologies. Mathematical modelling and optimization techniques are most frequently deployed for the development and refinement of these systems. This project focuses on an important class of difficult optimization problems that arise in many applications. A significant benefit of this project is the development of a number of robust methods for these hard optimization problems. These methods will be built upon advances in the fundamental theory developed by the research team. The resulting high quality publications and associated algorithms will greatly enhance Australia's international scientific reputation.

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DP0665044 Dr CE Cooper; Prof PC Withers

Approved Project Title **Evaporative water loss and relative water economy in marsupials**

2006 : \$85,000

2007 : \$55,000

2008 : \$35,000

Primary RFCD 2706 PHYSIOLOGY

Administering Institution Curtin University of Technology

Project Summary

Marsupials are an iconic element of the Australian fauna, so the robust physiological database we will establish has intrinsic educational and scientific value to Australians. We will provide important methodological and analytical advances at the cutting edge of physiological research. This project will sustain our leading role as marsupial physiologists in the international scientific community, contribute to the high-quality training of research students, foster national and international collaboration, and generally enhance the scientific profile of Australia. Knowledge of a species' biology and its interactions with the environment are essential for conservation in the face of landscape modification and climate change.

DP0665400 A/Prof R De Marco; Prof E Pretsch; Prof E Bakker

Approved Project Title **Probing the internal contacts of all solid-state polymeric ion sensors**

2006 : \$90,000

2007 : \$60,000

2008 : \$60,000

Primary RFCD 2501 PHYSICAL CHEMISTRY (INCL. STRUCTURAL)

Administering Institution Curtin University of Technology

Project Summary

The results of this research will enable the development of robust and reliable all solid-state polymeric ion sensors. These sensors will enable solutions to significant environmental problems such as soil salinity and acidity, and may pave the way for new and exciting analytical applications, e.g., miniaturized implantable sensors for in-vivo use, microfluidics and Forensic Science, single blood droplet clinical analyzers, rugged solid contact ion sensors for use in submersible oceanographic analyzers, etc. The research will develop a unique in-situ neutron reflectometry technique for the study of electrochemical interfaces, providing scientific opportunities for the new Australian Replacement Research Reactor.

DP0663020 Prof Dr WE Featherstone; Mr SJ Claessens

Approved Project Title **Ellipsoidal physical geodesy - improved global and local gravity field modelling**

2006 : \$150,000

2007 : \$150,000

2008 : \$150,000

2009 : \$150,000

2010 : \$150,000

Primary RFCD 2910 GEOMATIC ENGINEERING

APF Prof Dr WE Featherstone

Administering Institution Curtin University of Technology

Project Summary

Improved techniques for gravity field modelling, using the ellipsoidal approach proposed in this research, will increase the accuracy of the Australian geoid model. A more accurate model of the geoid will bring great cost-benefits mainly to the Australian surveying, mapping and exploration community. For example, height determination from GPS [Global Positioning System] or similar satellite-based measurements is only possible with the aid of an accurate geoid model. This will allow the use GPS to its full capacity and save valuable time and money (by as much as a factor of 10).

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DP0664679 Dr IC Fitzsimons; Prof SL Harley

Approved Project Title **Mineral reaction, deformation, and accessory phases in migmatites: What controls monazite behaviour during high-grade metamorphism?**

2006 : \$75,000

2007 : \$65,000

2008 : \$70,000

Primary RFCD 2601 GEOLOGY

Administering Institution Curtin University of Technology

Project Summary

Isotopic dating of rocks and minerals has revolutionized the way we view our planet, and allowed us to attach an absolute timescale to a range of Earth processes from the evolution of life to formation of mineral deposits. Australian technology has long been at the forefront of this field, but it is apparent that our ability to date Earth materials has overtaken our ability to interpret these ages in terms of geologic processes. The results of this study and the associated collaboration will ensure that Australian understanding of what isotopic ages mean keeps pace with our ability to measure them. This will allow us to resolve finer details of Earth history, and improve our understanding of the planet and how best to manage it.

DP0662839 A/Prof K Grice; Dr PF Greenwood; Prof RE Summons; Dr PD Franzmann

Approved Project Title **New molecular and isotopic biomarker approaches to establishing source, palaeoclimate, facies and thermal history of sedimentary organic matter**

2006 : \$134,000

2007 : \$100,000

2008 : \$100,000

Primary RFCD 2603 GEOCHEMISTRY

Administering Institution Curtin University of Technology

Project Summary

The ability to identify crude oil sources is a key issue in petroleum exploration, especially in Australia where vast gas deposits occur but very limited reserves of liquid hydrocarbons have been discovered. Discoveries of new petroleum reservoirs/provinces will benefit all Australians. Technological developments made will be extended to other Australian basins leading to more effective petroleum and mineral exploration strategies. The project described will also help our understanding of climate variability of past episodes and help predict what might happen in the future. The PhD scholars will foster high-calibre postgraduate research students suitable for employment in research or in industry.

DP0664586 A/Prof I Low; Dr IJ Davies

Approved Project Title **Synthesis of Novel Nanostructured Ternary Carbide Composites**

2006 : \$40,000

2007 : \$40,000

2008 : \$40,000

Primary RFCD 2914 MATERIALS ENGINEERING

Administering Institution Curtin University of Technology

Project Summary

This research will lead to (a) new advances and provide contribution of new knowledge to the Priority Research Areas of Advanced Materials; (b) a novel vacuum heat-treatment process for nanostructured materials design. This will offer the ceramics industry in Australia a new technology for producing wear- and heat-resistant components for advanced engineering applications. (c) design of new layer-graded materials with a unique combination of hardness for wear resistance and toughness for damage tolerance. This will enable the ceramics industry in Australia to compete internationally in the business of advanced and high performance ceramic products.

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DP0667240 Prof AD Lucey; Prof PW Carpenter

Approved Project Title **Taming turbulence: Hydrodynamic stability and flow-structure interaction using grid-free computation**

2006 : \$80,000

2007 : \$75,000

2008 : \$73,000

Primary RFCD 2905 MECHANICAL AND INDUSTRIAL ENGINEERING

Administering Institution Curtin University of Technology

Project Summary

Turbulence is characterized as seemingly disordered fluctuations that impede the progress of an object through a fluid by creating increased frictional or drag forces. Using a new type of fluid-flow simulation, this project will generate advanced understanding of turbulence in the flow over the surface of a vehicle, be it a ship, car, aircraft or within a pipe, with the technological objective of reducing drag by adhering a compliant skin to the surface. While the correct choice of compliance relies upon understanding very complex flow-structure dynamics, the resulting technology is simple, robust and has low capital and maintenance costs. Clearly, drag reduction reduces fuel costs and lower fuel consumption is environmentally beneficial.

DP0662826 Prof RA Nile; Dr TP Dolin

Approved Project Title **Colonial Publishing and Literary Democracy in Australia: an analysis of the influences on Australian literature of British and Australian publishing.**

2006 : \$125,000

2007 : \$90,000

2008 : \$90,000

Primary RFCD 4301 HISTORICAL STUDIES

Administering Institution Curtin University of Technology

Project Summary

Colonial Publishing and Literary Democracy is concerned with the complex relationship between colonialism and nationalism within the context of Australia as a settler society and involves an exploration of the powerful but complicated interplay between literature, law and commerce as expressed through the production of the Australian novel. The project proceeds from an assumption that for much of the twentieth century literature was the flagship of national creativity in an industry worth around \$1 billion pa at century's end. From that perspective, it engages directly with the cultural capital and heritage of the nation.

DP0664078 Dr SM Reddy; Dr PD Kinny; Prof SA Wilde; Dr PV Crowhurst; Dr JK Lee

Approved Project Title **The Effects of Crystal-Plastic Deformation on Zircon Geochemical Systems**

2006 : \$115,000

2007 : \$114,000

2008 : \$92,000

Primary RFCD 2603 GEOCHEMISTRY

Administering Institution Curtin University of Technology

Project Summary

This project establishes the significance of deformation-related fast-diffusion pathways on the zircon geochemical system and develops intragrain compositional variations as new tools for tracking geological processes. The unique application of zircon to constrain geological processes in numerous Earth Science disciplines over 4.4 billion years of Earth history ensures that results will have far-reaching impact in the Australian and International Earth Science community. As such this project will maintain Australia's leading international reputation in accessory mineral research.

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DP0665948 Prof KL Teo; Dr V Rehbock

Approved Project Title **A Study of Stabilisation and Optimal Control Computation of Impulsive Control Systems**

2006 : \$110,000

2007 : \$92,000

2008 : \$99,000

Primary RFCD 2301 MATHEMATICS

Administering Institution Curtin University of Technology

Project Summary

Impulsive systems exhibit the phenomenon of jumps occurring at various time points along their trajectories. They arise from many applications, such as determining appropriate levels of drug administration in cancer and diabetes treatment, optimizing investment strategies in capacity expansion, and sustainable optimal forest management. This project will result in fundamental theory on stability and efficient computational algorithms and software packages for stabilizing controls and optimal controls of impulsive control problems. The outcomes will enhance Australia's reputation for leading edge research and facilitate opportunity for international collaboration. It will also provide an excellent opportunity for research training.

DP0665028 Prof DF Treagust

Approved Project Title **Using diagnostic tests in science as formative assessment to enhance teaching and learning**

2006 : \$65,000

2007 : \$55,000

2008 : \$55,000

Primary RFCD 3803 COGNITIVE SCIENCE

Administering Institution Curtin University of Technology

Project Summary

The success and continuation of science programs in upper secondary school and university is dependent on foundational improvements in science education in lower secondary schools. This proposal is designed to address this national concern by fostering talent in science and encouraging more students to study and enjoy science in a meaningful way. Through planned formative assessment, teachers will enable students in Years 8-10 to think about the science concepts and consider alternative explanations rather than memorise basic facts for a test or examination which are then forgotten. Practical benefits are a large range of valid and reliable tests and a range of teaching approaches for diagnosing student learning difficulties.

DP0667282 Prof DF Treagust; Dr M Mocerino

Approved Project Title **Using explanatory frameworks to enhance students' metacognitive capabilities in science**

2006 : \$65,000

2007 : \$60,000

2008 : \$55,000

Primary RFCD 3302 CURRICULUM STUDIES

Administering Institution Curtin University of Technology

Project Summary

The success and continuation of science programs in secondary schools and universities is dependent on foundational improvements in teaching and learning. This proposal is designed to address this national concern by fostering potential science talent by encouraging more students to study and enjoy science in a meaningful way. Through the development of carefully analysed explanatory frameworks, science teachers and university lecturers will enable students to develop their metacognitive capabilities so that they are able to think logically about science concepts rather than memorise basic facts which are easily forgotten. Expected practical benefits are students who are better able to learn and communicate, especially in science.