

Summary of Applications Linkage - International to Commence in 2005

New South Wales

Macquarie University

LX0560182 Dr MR Leishman; A/Prof DM Richardson

Title: Comparative studies of invasive plants: a leaf carbon strategy approach

2005 : \$4,487

2006 : \$5,000

Category: 2707 - ECOLOGY AND EVOLUTION

Collaborating Countries

South Africa

Administering Institution: Macquarie University

Summary:

Invasion of communities by exotic plants is a significant threat to biodiversity globally. This proposal is to strengthen collaborative links between the Plant Invasion Research Laboratories of Leishman in Australia and Richardson in South Africa. Their current research seeks to understand strategies of invasive plants in novel environments using the framework of leaf carbon strategies. Australian plants invasive in South Africa and South African plants invasive in Australia provide an ideal model system. This collaborative research will enable better prediction of potential invaders, as well as providing important input for models of plant, ecosystem and biosphere responses to global change incorporating invasion dynamics.

The University of New South Wales

LX0561255 Dr HA Abbass; Prof X Yao

Title: Ensembles of Collaborative Neural Networks

2005 : \$14,000

Category: 2802 - ARTIFICIAL INTELLIGENCE AND SIGNAL AND IMAGE PROCESSING

Collaborating Countries

UK

Administering Institution: The University of New South Wales

Summary:

Artificial neural networks have been used successfully for data mining and control. A neural network ensemble(NNE) is a collection of networks that exhibits properties of self-organization, plasticity, and adaptive behaviour. The aim of this research is to develop an efficient and theoretically sound algorithm for NNE learning. The outcomes of the project will include insights into self-organization of complex NNE and automatic problem decomposition and an efficient algorithm for constructing and training NNE. Practical outcomes will include research training for early career researchers and new modelling tools for data mining, robotics and multi-agent systems. The project contributes to the national priority area of smart information use.

LX0560296 Dr C Barner-Kowollik; Prof TP Davis; Dr M Stenzel; Prof AH Mueller; Dr L Barner

Title: Living Free Radical Polymerization for Nano Technology Applications

2005 : \$16,600

2006 : \$9,000

2007 : \$15,600

Category: 2505 - MACROMOLECULAR CHEMISTRY

Collaborating Countries

Germany

Administering Institution: The University of New South Wales

Summary:

The proposed linkage project centres on a series of core projects from both the Australian and German collaborators. These core projects range from the synthesis of multifunctional nano- and micro-sphere particles, block copolymer systems used as efficient vehicles for drug delivery purposes to polymer brushes for nano-wires. The collaborating teams will carry out joint research tasks in the above mentioned fields via the exchange of the CIs and PhD students. The project is planned for a duration of three years to ensure an in-depth approach to the proposed projects.

LX0561138 Dr KM Dunn; Prof D Hiebert; A/Prof J Forrest

Title: Comparing racism in Australian and Canada

2005 : \$11,000

Category: 3701 - SOCIOLOGY

Collaborating Countries

Canada

Administering Institution: The University of New South Wales

Summary:

Surveys of racist attitudes in Australia and Canada present a unique opportunity for comparative analysis. This project will demonstrate the central influence of place and context to attitudes to and experiences of racism. International comparative assessments of racism are rare. Comparable key concepts will be agreed, e.g.: attitudes towards cultural diversity and national identity; extent and experience of racism; multicultural policies. Overall findings and spatial variations will be compared, aiming at publication in international journals. It will strengthen a significant relationship between geographers in Sydney and Vancouver. International recognition of the Sydney-based research cluster on racism will be enhanced.

LX0560456 Prof BK Milthorpe; Prof R Barbucci

Title: Interfacial interactions with hydrogel biomaterials

2005 : \$15,200

2006 : \$10,300

Category: 2915 - BIOMEDICAL ENGINEERING

Collaborating Countries

Italy

Administering Institution: The University of New South Wales

Summary:

The interactions between cells of the body and the surfaces of medical implants are controlled largely by the molecules that are adsorbed on the surface. The aim of this project is to evaluate the effect of modifying hydrogel biomaterials on the interactions of the molecules with the hydrogel. This, in turn, allows us to determine the factors affecting the control of the cell's response. The significance of this work is in the improved ability to control cellular responses to implants. Such improved response will result in better health outcomes for patients, and outcomes in the form of papers and intellectual property.

The University of Newcastle

LX0561089 Dr PJ Lewis; Dr RJ Lewis; A/Prof AW McDowall

Title: Structural analysis of RNA polymerase elongation complexes

2005 : \$6,376

2006 : \$8,000

2007 : \$10,688

Category: 2703 - MICROBIOLOGY

Collaborating Countries

UK

Administering Institution: The University of Newcastle

Summary:

RNA polymerase (RNAP) is an essential enzyme in all living cells. Its role is to convert the genetic information stored in genes into a message that can be converted into protein. Many additional factors are required to ensure that this enzyme functions correctly in the cell. The aim of this project is to obtain structural information on a bacterial RNAP complexed with an essential transcription factor called NusA. Using this information, plus data already obtained on the structure of this enzyme complexed with another essential factor called sigma, we will design small molecules to inhibit the interaction of these essential factors with polymerase. These molecules will serve as leads for the development of new antibiotics.

University of Wollongong

LX0559628 A/Prof S Dolnicar; Dr F Leisch

Title: Advanced issues in market segmentation research

2005 : \$5,420

2006 : \$9,000

2007 : \$8,040

Category: 3502 - BUSINESS AND MANAGEMENT

Collaborating Countries

Austria

Administering Institution: University of Wollongong

Summary:

We will investigate unresolved questions in market segmentation research that will provide answers to the following questions as outcome:

- How to pre-assess market segmentation data structure.
- How to improve the partitioning.
- How to visualize and present the resulting segmentation solutions.
- How to generalize the outcomes over multiple periods of time.

These tasks represent fundamental methodological research. The scientific significance consequently lies in knowledge development and methodological improvement. Findings will also enable both academic researchers using market segmentation methodology as well as practitioners applying such techniques to significantly improve the quality of their market structure analyses.

LX0559621 A/Prof C Zhang; Prof J Cao

Title: Photon induced nonlinear absorption and transport in semiconductor nanostructures

2005 : \$8,000

2006 : \$13,000

2007 : \$5,000

Category: 2909 - ELECTRICAL AND ELECTRONIC ENGINEERING

Collaborating Countries

China

Administering Institution: University of Wollongong

Summary:

Photon induced transport in electronic systems is of great importance in fundamental science and in development of new optoelectronics devices. In this project we aim to study the microwave radiation induced dc transport and nonlinear absorption in high mobility systems. The result will shed light on newly discovered zero-resistance state in semiconductor nanostructures. The expected outcome is an improved understanding on the mechanism of reducing dc resistance in low-dimensional electronic systems.

Victoria

Deakin University

LX0560616 A/Prof Y Chen; Dr L Wong; Dr J Li

Title: Development of Knowledge Discovery for High Dimensional Biomedical Data

2005 : \$7,000

2006 : \$10,500

2007 : \$11,000

Category: 2801 - INFORMATION SYSTEMS

Collaborating Countries

Singapore

Administering Institution: Deakin University

Summary:

The recent progress in experimental techniques of molecular genetics has made available a wealth of genome data and raised the interest for analysis of DNA sequences. As the human and mouse genome projects are in a phase of systematic sequencing, computational tools based on concepts used in science fields have recently played a prominent role. Significant contributions to this project will increasingly depend upon original application and development of algorithms for the analysis of genomic data, and of the computational systems that support them. These challenges have fostered major progress in computer science, leading to collaborative research of global significance.

The University of Melbourne

LX0559963 Dr CR Warren; Prof MA Adams; Dr E Dreyer; Prof M Tausz; Prof D Epron

Title: High temperature limits of leaf function

2005 : \$18,400

2006 : \$6,000

Category: 2704 - BOTANY

Collaborating Countries

Austria

France

Administering Institution: The University of Melbourne

Summary:

In arid and semi-arid central Australia, Acacia spp. dominate the over-storey, but this shifts to Eucalyptus and Corymbia spp. in more mesic coastal regions. Areas of central Australia are extremely hot, dry and sunny, and it is this combination of stresses that likely excludes Eucalyptus spp. from many landforms. There has been little research on high temperature tolerance of Acacia and Eucalyptus, despite the putative importance of this stress, in combination with other stresses, in limiting species' distributions. Our program of collaborative research will examine the tolerance of Acacia and Eucalyptus to a combination of high temperatures, drought and high light.

Queensland

Queensland University of Technology

LX0560213 Prof GF Ledwich; Prof B Han

Title: Performance analysis of the Unified Power Flow Controller based on multi-bridge converter

2005 : \$12,500

Category: 2909 - ELECTRICAL AND ELECTRONIC ENGINEERING

Collaborating Countries

Korea

Administering Institution: Queensland University of Technology

Summary:

The objective of this research is to conceive a new configuration of UPFC without series injection transformers, based on two-level full-bridge modules. The conceived system can be utilized for the power systems to control the power flow through the transmission line.

The benefit is in reducing restrictions on electricity transfer links.

The project will develop a laboratory version of the novel UPFC demonstrating the hardware and control requirements for this form of UPFC which could reduce the costs of this corrective solution up to 30% below existing solutions.

LX0561016 A/Prof RC Wolff; Prof DM Guegan

Title: Financial Instability and Risk Management: New Statistical Treatment of the Occurrence and Persistence of Shocks in International Markets

2005 : \$12,798

2006 : \$11,500

Category: 3404 - ECONOMETRICS

Collaborating Countries

France

Administering Institution: Queensland University of Technology

Summary:

Global economies are complex systems: their complexity is increasing due to market connectivity, borderless trading and rapid electronic transactions. This collaboration will improve understanding of market interdependence, important because of its profound macroeconomic influence on individual consumers' decisions and corporate investment. A novel combination of nonlinear time series and dynamical systems theories will be used to describe propagation and persistence of market shocks. Focusing on smart information use and innovation economies, this project will deliver publications on new practical econometric methodologies, training for early career researchers, and a strong sustainable research relationship between Australia and France.

The University of Queensland

LX0560194 A/Prof PV Bernhardt; Prof Y Kim

Title: New Synthetic Routes to the Immobilisation of Mixed Valence Transition Metal Complexes on Conducting Metal Oxides

2005 : \$19,900

Category: 2502 - INORGANIC CHEMISTRY

Collaborating Countries

Korea

Administering Institution: The University of Queensland

Summary:

Highly coloured, electrochemically active transition metal dyes may find application electrochromic devices, where they may switch between contrasting coloured forms through a simple redox reaction. A prerequisite is that the dye be immobilised onto a solid conducting support whilst preserving the electrochemical and optical properties of the dye found in solution. This project tackles this problem through a combination of organic and inorganic synthesis to develop new electrochromic dyes that may be attached to mesoporous titania.

LX0561185 Prof SK Bhatia; Dr D Nicholson

Title: Frictional and viscous effects during transport in nanopores

2005 : \$15,600

2006 : \$15,600

2007 : \$15,600

Category: 2906 - CHEMICAL ENGINEERING

Collaborating Countries

UK

Administering Institution: The University of Queensland

Summary:

Gas mixtures exposed to materials containing molecular sized pores (nanopores) are adsorbed, forming states of matter not existing in the bulk. Differential forces acting on the components of mixtures promote industrially and environmentally important separations. However, transport of confined fluids has been poorly understood. Recently we have made progress using computer simulation, and have proposed a highly successful theory. These investigations have revealed the crucial role of scattering from the surface atoms of the confining solid. Theoretical investigation of single spherical species has been initiated, and extension to other species and to mixtures is now envisaged.

LX0561262 Dr M Zhang; A/Prof PM Kelly; Prof K Lu; A/Prof Y Shi

Title: A Novel Surface Alloying Technique to Improve the Corrosion and Wear Resistance of Magnesium

2005 : \$10,000

2006 : \$3,000

2007 : \$5,000

Category: 2914 - MATERIALS ENGINEERING

Collaborating Countries

China

Administering Institution: The University of Queensland

Summary:

Surface mechanical attrition treatment will be used to generate nanometer-sized grains in the surface layer of engineering magnesium alloys, and therefore activate the surface of this material. Together with the use of efficient activators, the project will develop a novel low temperature surface alloying technique to significantly improve the wear and corrosion resistance of magnesium alloys without changing the substrate properties. Microstructural features and the wear and corrosion resistance of the ultrafine-grained surface layer will be examined. In addition, it may be possible to combine the surface alloying process with the conventional ageing process together in order to save energy.

South Australia

The University of Adelaide

LX0560474 A/Prof MC Griffith; A/Prof G Magenes; A/Prof JL Wilson; Dr NT Lam

Title: Displacement-based assessment of the seismic resistance of unreinforced masonry buildings

2005 : \$15,300

2006 : \$17,000

2007 : \$20,150

Category: 2908 - CIVIL ENGINEERING

Collaborating Countries

Italy

Administering Institution: The University of Adelaide

Summary:

Earthquakes have caused over \$1,000 billion of damage and more than 100,000 deaths in the last decade. This devastation occurred mainly in unreinforced brick masonry (URM) buildings which constitute the bulk of the domestic building stock in low seismicity regions, including Australia. These buildings were designed to resist forces, not the displacements, caused by earthquake ground shaking. This project will develop a new displacement-based method for assessing the earthquake resistance of URM buildings. Research outcomes will be in the form of improved analytical methods for the design of new buildings and the seismic assessment and retrofit of existing buildings.

University of South Australia

LX0560049 Dr VV Ejov; Prof JA Filar; A/Prof V Gaitsgory; Prof PG Howlett; A/Prof CE Pearce; Em/Prof J Aubin; Dr K Avrachenkov; Mrs H Frankowska; Dr A Gnedin; Dr JB Lasserre; Prof M Quincampoix; A/Prof P Saint-Pierre

Title: **Singular and Analytic Perturbations, Slow and Fast Time Scales in Control Theory and Viability Theory and their Applications**

2005 : \$22,000

2006 : \$20,000

2007 : \$20,000

Category: 2301 - MATHEMATICS

Collaborating Countries

France

Netherlands

Administering Institution: University of South Australia

Summary:

We propose an innovative approach to several important classes of mathematical problems, whose data depend analytically on small perturbation parameters. Time scale problems, and, in particular, the interaction of two types of evolution, slow and fast, arise in many scientific domains (biotechnology, physics, engineering, etc). We expect to develop new techniques for analysis and asymptotic optimisation of singularly perturbed control systems and Markov decision processes. In particular, we plan to establish links between general nonlinear optimal control problems with time average criteria and linear programming problems in the space of limit occupational measures generated by the underlying control system.

Western Australia

The University of Western Australia

LX0560459 Dr MJ Cassidy; Prof GT Houlby; Dr I Einav; Dr BW Byrne; Dr CM Martin

Title: **Development of cyclic loading models for application in offshore geotechnics**

2005 : \$15,000

2006 : \$14,000

Category: 2907 - RESOURCES ENGINEERING

Collaborating Countries

UK

Administering Institution: The University of Western Australia

Summary:

The response of foundations for offshore structures to repetitive (cyclic) loads is a critical but still inadequately understood area of offshore geotechnics, with designs still usually based on simple modifications to monotonic loading conditions. In this project, a definitive framework for modelling cyclic behaviour will be established. Using this new approach, numerical models will be developed to address problems at all scales from fundamental constitutive behaviour of soils to macroscopic models for large foundation systems. Their application to offshore design problems (for renewable energy as well as traditional oil and gas applications) will be assessed. Recommendations to current international guidelines will also be made.

LX0560460 Dr K Miller; Dr K Chinzei

Title: **Biomechanics of Needle Insertion**

2005 : \$11,800

2006 : \$11,000

2007 : \$5,000

Category: 2915 - BIOMEDICAL ENGINEERING

Collaborating Countries

Japan

Administering Institution: The University of Western Australia

Summary:

Needle insertion is one of the most common neurosurgical procedures. However, the biomechanics of this process is poorly understood. The unknown factors include brain tissue deformation under load imposed by the needle and needle deflection when penetrating brain tissue. We will develop computational models of needle insertion. They will include non-linear material properties of the brain tissue, large deformations, and needle-tissue contact model including friction. The Japanese group will develop testing methods to validate mathematical models. Experimental set-up includes bi-axial x-ray to measure deformation within the tissue and needle deflection, and a sensor measuring reaction force on needle tip and friction force on needle sides.

LX0560485 A/Prof RL Stamps; Prof D Greig; Dr G Gubbiotti; Prof P Politi; Dr DC Crew

Title: **Fast and slow dynamics at coupled magnetic interfaces: Theory and Experiment**

2005 : \$15,000

2006 : \$10,000

Category: 2402 - THEORETICAL AND CONDENSED MATTER PHYSICS

Collaborating Countries

Italy

UK

Administering Institution: The University of Western Australia

Summary:

Immediate needs for advances in materials for spin electronics and information technology require a deeper physical understanding of new materials in which interfaces and nanometre dimensions determine properties. Interfacial exchange coupling between magnetic layers is a key issue in the formation of many multilayer structures, and several important issues remain unresolved. This is a proposal for a joint theoretical and experimental study of technologically important magnetic interfaces by groups at Universities of Florence, Perugia, Leeds and Western Australia.

Tasmania

University of Tasmania

LX0561258 Dr S Shabala; Prof RR Lew; Dr NN Levina

Title: **The role of turgor in hyphal extension of the Ascomycete Neurospora crassa**

2005 : \$6,600

2006 : \$5,000

Category: 2701 - BIOCHEMISTRY AND CELL BIOLOGY

Collaborating Countries

Canada

Administering Institution: University of Tasmania

Summary:

Cellular expansion is an absolute necessity during the growth and development of plants and fungi. This process relies heavily upon the accumulation of inorganic ions. Osmotically driven water influx then creates the hydrostatic pressure that underlies the increase in cell volume. Cellular expansion is normally asymmetric and localised in one small region, such as hyphal tip. How does the cell maintain the turgor that drives expansion? How is expansion controlled spatially? These questions will be addressed in this project by comprehensive study of ion transport processes in a model organism, *Neurospora crassa*, using osmotic sensitive and transport mutants.

Australian Capital Territory

The Australian National University

LX0560599 Dr JE Bradby; Dr SO Kucheyev

Title: **Structure-property correlation in metal-oxide aerogels**

2005 : \$14,100

Category: 2402 - THEORETICAL AND CONDENSED MATTER PHYSICS

Collaborating Countries

USA

Administering Institution: The Australian National University

Summary:

Aerogels are truly remarkable materials with unique physical properties including extraordinary thermal insulation capabilities. The influence of mechanical deformation on these nanoscale materials is only poorly understood, despite key technological interest. This project aims to measure the response of a variety of aerogels samples to forces applied by nanoindentation and, using advanced electron microscopy and ion-beam analysis techniques, to directly identify the atomic-level deformation mechanisms.

LX0561265 Dr FD Bulbeck; Prof Dr SJ Oppenheimer; Prof A Cooper

Title: **Echoes of the earliest Homo sapiens movement out of Africa**

2005 : \$5,000

Category: 2702 - GENETICS

Collaborating Countries

UK

Administering Institution: The Australian National University

Summary:

The "Out of Africa" and "Multiregional Evolution" theories have proposed sharply different accounts for the origins of our species Homo sapiens. These have converged on opposite readings of the Australian human fossil record. Recent perspectives resulting from research on Pleistocene Australian mitochondrial DNA, and by osteologists on early Homo sapiens remains in Africa and Israel, hint at a chapter, as yet unwritten, in our species' Late Pleistocene dispersal from Africa. This project's collaborative research on fossils from Sri Lanka and Australasia will explore and test the implications for the colonisation history of the Indian Ocean region.

LX0561266 Dr MH Dungey; Prof HM Anderson; Prof F Vahid; Prof DR Osborn

Title: **International linkages between financial and real economy cycles**

2005 : \$9,600

2006 : \$7,200

2007 : \$10,950

Category: 3404 - ECONOMETRICS

Collaborating Countries

UK

Administering Institution: The Australian National University

Summary:

This project will develop empirical multivariate models of business cycles for different countries, and will study how they are linked via international financial markets. The significance of the project is that the models will integrate previous work done on financial-real economy links in single country settings, and it will explicitly study the effects of disequilibrium in international financial markets (such as overvaluation of foreign currency) on individual economies. The project will determine the appropriate domestic monetary policy response to such shocks, and the potential for forecasting both the advent of such shocks and their impact on individual economies.