

Summary of Discovery Projects Applications for Funding to Commence in 2006

Australian Capital Territory

The Australian National University

DP0663216 Prof Dr NN Akhmediev

Approved Project Title **Bifurcations of dissipative solitons**

2006 : \$110,000

2007 : \$100,000

2008 : \$100,000

Primary RFCD 2404 OPTICAL PHYSICS

Administering Institution The Australian National University

Project Summary

Fundamental research on the basic concepts of solitons in dissipative systems and their bifurcations is the next essential step for further progress in the science of optical pulse generators and amplifiers. Australia was the first country in the world to use self-organized ultra-short pulses, called solitons, in a commercially-deployed optical transmission line. This proposed new research will answer the question of how solitons behave at the ultimate limits of optics. New principles of ultra-short pulse generation and amplification, developed in our research, will provide the basis for an unprecedented increase in the capacity of optical transmission and processing of information.

DP0666546 Dr TJ Alexander

Approved Project Title **Matter-wave vortices in engineered nanostructures**

2006 : \$74,340

2007 : \$74,340

2008 : \$74,340

Primary RFCD 2402 THEORETICAL AND CONDENSED MATTER PHYSICS

APD Dr TJ Alexander

Administering Institution The Australian National University

Project Summary

This project tackles some of the key problems which must be solved before any applications of manipulating and controlling Bose-Einstein condensates with nanostructures can be realised. This project is therefore of National Benefit for its advances in critical fundamental research and for the potential applications which may be ultimately derived from harnessing the power of this new state of matter. Australia is at the forefront of this revolution in quantum technology. This project furthers Australia's competitive position and opens up new opportunities for ground-breaking research and applications in an area which has the potential to be as revolutionary as the development of the laser.

DP0664546 Prof AJ Anderson; Dr K Szabo; Dr E CONTE

Approved Project Title **The origins of human colonization in East Polynesia and their relevance to maritime migration**

2006 : \$65,000

2007 : \$65,000

2008 : \$65,000

Primary RFCD 4302 ARCHAEOLOGY AND PREHISTORY

Administering Institution The Australian National University

Project Summary

The Indo-Pacific is a world of islands, including Australia, which was colonized during prehistory in several phases of migration, the last and longest of which was in East Polynesia. Extensive excavation of a large, waterlogged archaeological site of this era in French Polynesia will provide a better understanding of the period, society and external relationships of the early migrants, and of the processes of prehistoric maritime migration which link Australian peoples to those of our neighbours across the Pacific and Indian Oceans.

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DP0664427 Prof BD Anderson; Dr A Lanzon

Approved Project Title **Development of robust adaptive and nonlinear control methodologies**

2006 : \$133,000

2007 : \$98,000

2008 : \$105,000

Primary RFCD 2301 MATHEMATICS

Administering Institution The Australian National University

Project Summary

Techniques will be developed that will allow industrial plants to operate with lower direct or environmental cost, and airborne vehicles to operate more efficiently or more safely.

DP0664583 Prof MR Badger

Approved Project Title **Identifying genes controlling the regulatory and metabolic interactions between the energy organelles of the leaf.**

2006 : \$145,000

2007 : \$115,000

2008 : \$115,000

Primary RFCD 2701 BIOCHEMISTRY AND CELL BIOLOGY

Administering Institution The Australian National University

Project Summary

Plant energy metabolism underlies the synthesis of many important products in crops, and subtle changes in metabolism can enhance key plant traits, such as germination rates, early seedling vigour, biomass/yield, and tolerance to harsh environments. Furthering our understanding on the complex interplay of genes controlling energy metabolism and its impact on leaf function has potential outcomes for smart genetic manipulation either by classical breeding or genetic transformation. There are more than 10,000 genes of unknown function in plant genomes and this represents a tremendous untapped resource for future Australian R&D outcomes and insights from this research proposal will have application to all plant-based agriculture.

DP0663026 Dr KG Baldwin; Prof BJ Orr; Prof EE Eyler

Approved Project Title **Precision Measurement of Highly Excited Atoms and Molecules: From the Infrared to the Vacuum Ultraviolet**

2006 : \$90,000

2007 : \$65,000

2008 : \$70,000

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

Administering Institution The Australian National University

Project Summary

Precise measurements of the structure and dynamics of atomic and molecular systems provide important benchmarks against which our fundamental understanding of matter can be tested. Such measurements also provide reference standards, with applications in many subfields (e.g. testing theories that indicate time dependence of the fundamental constants). Determination of the behaviour of simple molecules such as oxygen and nitrogen is important for understanding the complex processes that shape the atmosphere of the earth and other planets. These experiments will also enable the understanding of other chemical processes, and will build on our strengths in developing precision laser technologies.

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DP0663773 Prof MT Batchelor; Prof VV Bazhanov; Prof MD Gould; Dr JR Links

Approved Project Title **The mathematical analysis of ultracold quantum gases**

2006 : \$181,000

2007 : \$158,000

2008 : \$162,000

Primary RFCD 2301 MATHEMATICS

Administering Institution The Australian National University

Project Summary

Ongoing developments in the experimental realisation of ultracold quantum gases play a leading role in the international effort towards the eventual realisation of quantum technology. This project brings together Australian researchers with complementary strengths to develop a sophisticated range of innovative mathematical tools for understanding these fundamental quantum systems. The expected outcomes will thus include potentially far reaching impacts on downstream quantum technology. The project will contribute to training mathematically talented students and thus take essential steps to establish the long term future of mathematical physics in Australia. It will also establish enduring key international research links.

DP0663259 Dr JM Behrens; Mr BM Smyth

Approved Project Title **The Experiences of Parents and Children After Family Court Decisions About Relocation**

2006 : \$100,000

2007 : \$36,000

Primary RFCD 3901 LAW

Administering Institution The Australian National University

Project Summary

This research will contribute to the improvement of decision-making about children in the family law system. It will enable an assessment of judicial decisions about whether a parent can relocate with children. It will make a unique contribution by gathering information from children and their parents about the effects of these decisions. The analysis will help parents, law-makers and judges to make better decisions in this important and controversial area. This will have benefits for the happiness, health and prosperity of children and their parents. Better decision-making will also reduce the costs to government of family breakdown.

DP0663587 Dr SM Bellm

Approved Project Title **Probing Electron Dynamics in the Molecular Frame**

2006 : \$98,000

2007 : \$75,000

2008 : \$76,000

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

APD Dr SM Bellm

Administering Institution The Australian National University

Project Summary

The outcome of this project will be an improved understanding of the molecular fragmentation process, enhancing our ability to control chemical reactions through a better knowledge of the mechanisms which drive them. By providing data which will stimulate the development of theory it will encourage creativity and innovation. Results will contribute to building a strong foundation in the fundamental physical sciences and lead to advances in areas ranging from quantum chemistry, the chemistry of planetary atmospheres to mechanisms responsible for radiation damage in biological systems.

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DP0663562 Prof MS Bessell; Prof JE Norris; Dr M Asplund; Prof TC Beers; Dr N Christlieb

Approved Project Title **Nucleosynthetic Signatures of the First Stars**

2006 : \$190,000

2007 : \$130,000

2008 : \$145,000

2009 : \$126,000

Primary RFCD 2401 ASTRONOMICAL SCIENCES

Administering Institution The Australian National University

Project Summary

By examining the chemical compositions of the oldest stars observable today, our program seeks to identify the nature of first objects to form in the Universe and to examine conditions at the earliest times in our Galaxy. This work will stimulate interest in the natural sciences among the general public and the nation's youth. Our team seeks access to the world's largest telescopes to a monetary value of several million dollars. We shall train young researchers in cutting-edge observational and theoretical science, enhancing their skills in data analysis, problem solving, project management, and effective communications.

DP0666059 Dr SM Blackburn; Prof KS McKinley

Approved Project Title **Dynamic Cooperative Performance Optimizations**

2006 : \$133,000

2007 : \$121,000

2008 : \$121,000

2009 : \$100,000

2010 : \$100,000

Primary RFCD 2803 COMPUTER SOFTWARE

ARF Dr SM Blackburn

Administering Institution The Australian National University

Project Summary

This project seeks to improve the reliability, security, and performance of modern software systems. Security is a problem of such scale that outbreaks of computer viruses etc. headline in major financial newspapers. We approach the problem by addressing the key performance problems that hold back the programming languages widely used for secure and reliable systems. By improving the reliability, security and performance of computer systems, this project will help alleviate the millions of hours and dollars lost to inadvertent errors and malicious software attacks. The project will give Australia an international presence in a research area of great academic and commercial importance.

DP0663388 Prof T Bonyhady; A/Prof N Lendon

Approved Project Title **The War Rug: the history, iconography and theory of the war art tradition of the Baluch of Afghanistan 1979-2004**

2006 : \$130,000

2007 : \$38,000

2008 : \$60,000

Primary RFCD 4199 OTHER ARTS

Administering Institution The Australian National University

Project Summary

The 'war rugs' of Afghanistan, a new topic of art-historical, sociopolitical, and cross-cultural communications, reflects an Indigenous perspective of twenty five years of conflict in the region. This project will: *Produce new knowledge on a regional topic of considerable sociopolitical relevance *Enable Australia to take a leading role in the articulation of new fields of knowledge and academic discourse, enhancing both our international reputation and knowledge of the region *Provide an exemplary model for the role of museums in the conceptualisation of artistic categories cross-culturally *Develop new applications of online database technologies *Develop new modes of integrating new digital technologies in an exhibition setting.

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DP0664028 Prof J Braithwaite; Prof HC Charlesworth

Approved Project Title **Peace Building and Responsive Governance in Asia and the Pacific**

2006 : \$135,000

2007 : \$135,000

2008 : \$135,000

Primary RFCD 3701 SOCIOLOGY

Administering Institution The Australian National University

Project Summary

War causes not only human suffering; it threatens the health and education of generations of children, sets back regional economies and encourages warlords to become transnational criminals who traffic in drugs, people, money laundering, guns and terror across Australia's region.

Fresh insights will be obtained from the successes and failures of attempts to build peace in failing states that Australia sees as a threat to our security. These national and regional diagnoses will enhance the quality of Australia's contribution to security and stability in our part of the globe and enhance national capacity to contribute to global peace strategies.

DP0666337 Dr VA Braithwaite; Dr KL Murphy

Approved Project Title **The Governance of Defiance**

2006 : \$100,000

2007 : \$100,000

2008 : \$90,000

Primary RFCD 3801 PSYCHOLOGY

APD Dr KL Murphy

Administering Institution The Australian National University

Project Summary

Defiance is a threat to social order. For this reason sanctioning institutions are in place to punish the defiant through legal, financial and sometimes physical means. The institutional rationale is that, at worst defiance will be silenced and at best, compliance will take its place. Increasingly, adverse and unexpected consequences of dealing with defiance in this way have been exposed. To be accountable for their actions, therefore, authorities have begun to develop more responsive and deliberative systems. But they also need to know how to read defiance. When is defiance an inappropriate response to a more than reasonable request? And when is defiance a reflection of institutional failure? This project can inform such decision making.

DP0662955 Prof SJ Buckman; Dr JP Sullivan; Dr JC Lower; Em/Prof PD Burrow

Approved Project Title **Electron and Positron Interactions with Bio-Molecules**

2006 : \$130,000

2007 : \$90,000

2008 : \$90,000

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

Administering Institution The Australian National University

Project Summary

This program of research will quantify reaction rates and elucidate reaction pathways for a range of important processes in our bodies involving ionising radiation. It will lead to a greatly improved understanding of positron and electron interactions with biological systems, including DNA and its constituent molecules and, through a better understanding of the underlying fundamental interactions, will lay foundations for improvements in technologies such as PET imaging.

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DP0666607 Dr FD Bulbeck; Dr MF Oxenham

Approved Project Title **The Flores hobbit - Homo floresiensis or microcephalic eastern Indonesian?**

2006 : \$40,000

Primary RFCD 3703 ANTHROPOLOGY

Administering Institution The Australian National University

Project Summary

The hobbit is so controversial as it implies that a tiny hominin with a miniature brain coexisted for 30,000 years with modern humans in our region. This would have immense, fundamental implications for understanding the human colonisation of our region and the role of brain size in human evolution. Our research will determine whether the alternative explanation of microcephalic pathology is viable. If so the hobbit would still be of unique significance as the only known microcephalic hunter-gatherer who had survived to adulthood. The role of Australian scientists in spearheading the hobbit discovery places a high priority on resolving the debate objectively.

DP0665920 Em/Prof JC Caldwell

Approved Project Title **Socio-economic determinants of future fertility trends in Australia and other developed countries**

2006 : \$60,000

2007 : \$60,000

2008 : \$60,000

Primary RFCD 3705 DEMOGRAPHY

Administering Institution The Australian National University

Project Summary

Future demographic trends will do much to determine Australia's future. Fertility levels will dominate in deciding population numbers, age structure, and the optimum balance between natural increase and immigration. Current ARC-supported research on the theory of demographic transition provides a paradigm for forecasting likely trends, especially when employed with an existing data bank of findings on social and demographic interrelations. The research is of great national benefit because even small differences in age structure will impact significantly on the size of the labour force, health services, the support of the aged and taxation levels. Relevant policy decisions will need to be made in the near future.

DP0667107 Prof HC Charlesworth

Approved Project Title **Building Democracy and Justice after Conflict**

2006 : \$148,000

2007 : \$127,000

2008 : \$124,000

2009 : \$127,000

2010 : \$93,634

Primary RFCD 3901 LAW

Administering Institution The Australian National University

Project Summary

Weak governance is a cause of terrorism. Australia is increasingly involved in nation-building projects, both in its region and internationally. This project will build Australia's expertise in the ways that international law can promote democracy and justice after conflict. It will develop guidelines for states and organisations involved in peace and nation-building. The project will thus contribute to safeguarding Australia by increasing Australia's capacity to engage with, and interpret itself to, its neighbours and the broader international community, as well as by tackling the threat of terrorism.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0664719 Dr WS Chow; Prof J Barber

Approved Project Title **Disorder as a novel determinant of photosynthetic structure and function: an experimental study**

2006 : \$105,000

2007 : \$80,000

2008 : \$80,000

Primary RFCD 2704 BOTANY

Administering Institution The Australian National University

Project Summary

Australia enjoys a world reputation in photosynthesis research, typified by hosting the 2001 International Photosynthesis Congress. It also has a claim to fame for theoretical work in non-equilibrium thermodynamics concerning production of disorder or entropy, yielding new insights into planetary climates. This experimental project investigates the novel relation between entropy/entropy production and the structure/function of the solar powerhouse of plants (chloroplasts), and addresses fundamental questions at the interface of biology and physics. The research explores chloroplasts as a manifestation of the all-pervading Second Law of Thermodynamics, advancing Australia's contribution to basic science and helping to train researchers.

DP0666158 Dr D Cobb-Clark

Approved Project Title **The Wealth and Asset Holdings of Native- and Foreign-born Australian Families**

2006 : \$75,000

2007 : \$75,000

2008 : \$75,000

Primary RFCD 3402 APPLIED ECONOMICS

Administering Institution The Australian National University

Project Summary

The national/community benefits of this project are twofold. First, understanding net worth, portfolio allocation, and wealth accumulation is central to a number of Australian policy debates. Our ability to lessen the budget pressures caused by population aging will rest on finding incentives for families to accumulate more personal wealth, while the ability of immigration to solve this budget problem rests on determining whether foreign- and native-born families accumulate wealth in the same way. Second, this project allows Australia to make a unique contribution to the international evidence on the relationship between race, ethnicity, and nativity and economic well being.

DP0665253 Prof MD Crisp

Approved Project Title **Australia's monsoon tropical flora: invader or relict?**

2006 : \$125,000

2007 : \$95,000

2008 : \$75,000

Primary RFCD 2707 ECOLOGY AND EVOLUTION

Administering Institution The Australian National University

Project Summary

The monsoonal tropics is a large region with unique yet poorly understood biodiversity. It is undergoing rapid agricultural, urban and tourist development, all of which threaten the sustainability of that biodiversity. The region includes three World Heritage areas, all with flora in their listed values: Kakadu National Park, Purnulu NP (Bungle Bungles) and Riversleigh. Additionally, the Kimberley is considered one of the last great wilderness areas in the world. This project will help us understand the evolutionary and geographic origins of the biodiversity of the monsoonal tropics, including the World Heritage areas, and it will identify those components that are uniquely Australian and therefore have the greatest heritage values.

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DP0663892 Prof A Cuevas

Approved Project Title **New Directions in Silicon Solar Cell Technology**

2006 : \$170,000

2007 : \$120,000

2008 : \$120,000

Primary RFCD 2402 THEORETICAL AND CONDENSED MATTER PHYSICS

Administering Institution The Australian National University

Project Summary

The fabrication of pure silicon is energy intensive, but solar cells can return 10 times more energy than is used to fabricate them. By investing in the development of silicon solar cells, Australia will develop a technology capable of encapsulating its vast coal resources within pure silicon. This has the potential to create an export market of clean energy and have an explosive effect on the growth of the local industry and skilled jobs.

This project will bolster the already prominent position of Australia in the field of photovoltaic solar energy by establishing collaborations with the top international organisations in the field. It will also coordinate efforts with all the main university research groups in the country.

DP0666225 Dr EJ Curthoys

Approved Project Title **Hannah Arendt, Émigré Intellectuals, and the Ethos of World Literature**

2006 : \$74,790

2007 : \$84,000

2008 : \$74,790

Primary RFCD 4202 LITERATURE STUDIES

APD Dr EJ Curthoys

Administering Institution The Australian National University

Project Summary

My project will bring an inspiring movement of ethical resistance to the dehumanising forces of fascism, nationalism, and parochialism to the Australian public's attention. It will help ensure that Australia, a nation that now successfully exports its literature to the world, is also at the centre of a fruitful dialogue about methods of research and interpretation appropriate to the study of the world's literatures. It will address the relative paucity of the historiography and theory of comparative literature in Australian Universities and suggest the educational and moral value of comparative literature studies for future generations of Australian students.

DP0664077 Dr M Dasgupta; Prof DJ Hinde; Dr JF Liang; Dr K Schmidt

Approved Project Title **Reaching the superheavy elements: a new approach with a novel ultra-sensitive detector array**

2006 : \$190,000

2007 : \$100,000

2008 : \$100,000

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

Administering Institution The Australian National University

Project Summary

Our project aims to build the knowledge base underpinning the creation of new heavy elements and isotopes. This first direct investigation of the hoped-for benefits of using radioactive beams will enhance the strong reputation of Australian research in the fundamental subject of nuclear fusion. The unique and sophisticated scientific instrument to be developed will enhance the capability of our RIEF-funded fusion product separator at the ANU, and use at overseas radioactive beam accelerators will showcase Australian technological achievement. This early participation in exciting, leading-edge developments will help Australian researchers to make full use of future, intense radioactive beam facilities, both in pure and applied research.

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DP0665579 Prof MK Davies; Prof C Wright

Approved Project Title **Epistemic Warrant: Transmission Failure, Basic Knowledge, and Entitlement**

2006 : \$75,553

2007 : \$75,553

2008 : \$80,500

Primary RFCD 4401 PHILOSOPHY

Administering Institution The Australian National University

Project Summary

This Project will bring substantial intellectual, cultural, and economic benefits to the nation - not only by increasing research strength, contributing to research output and establishing an international research partnership, but also by deepening the relationship between the study of the mind and theory of knowledge as a traditional area within philosophy and thus helping to maintain the pivotal position of philosophy in our intellectual life. Students, early-career researchers and established philosophers will benefit from access to the intellectual and institutional resources of international partner universities and there will be substantial and quantifiable financial contributions by international universities and research agencies.

DP0663293 Dr NE Dixon

Approved Project Title **Molecular Interactions in the Eubacterial Replisome: A Paradigm for Study of Dynamic Macromolecular Machines**

2006 : \$155,000

2007 : \$105,000

2008 : \$105,000

Primary RFCD 2701 BIOCHEMISTRY AND CELL BIOLOGY

Administering Institution The Australian National University

Project Summary

Many pathogenic bacteria have developed resistance to antibiotics in common use, and new drugs are urgently required to kill them. Copying of their chromosomes before they divide into two new cells is essential for bacteria to live, so DNA synthesis is a good process to target for development of new antibiotics. This project will use state-of-the-art equipment available in several laboratories in Australia and overseas to develop new understanding of how the molecular machine that copies DNA works. This knowledge could lead to new drugs, and will give us new information about how cellular machines function.

DP0665356 Dr B Douglas; Dr C Ballard

Approved Project Title **European Naturalists and the Constitution of Human Difference in Oceania: Crosscultural Encounters and the Science of Race, 1768-1888**

2006 : \$85,000

2007 : \$85,000

2008 : \$70,000

Primary RFCD 4301 HISTORICAL STUDIES

Administering Institution The Australian National University

Project Summary

This research will promote better understanding of the historical antecedents to contemporary Australian regional interventions, relations with our neighbours and conceptions of racial or ethnic differences. It thus directly addresses current debates on the politics of history. The assumptions about regional differences which underpin current Australian attitudes and policies stem from much earlier debates on the racial histories and collective physical variations of Oceanian people and from beliefs about natural European dominance over indigenous populations. This project will produce an accessible history of the genesis of such ideas and demonstrate the historical embeddedness of Australia within the wider context of Oceania.

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DP0663734 Prof CJ Easton

Approved Project Title Platform Technologies for the Regulation of Peptide Hormones

2006 : \$205,000
2007 : \$180,000
2008 : \$180,000
2009 : \$190,000
2010 : \$150,000

Primary RFCD 2503 ORGANIC CHEMISTRY

Administering Institution The Australian National University

Project Summary

Research in the field of this application is expected to contribute to the social and economic welfare of Australians. It is anticipated that a platform of technologies will be developed, for the treatment of human and animal disorders associated with imbalances in levels of peptide hormones. This will provide better therapies to improve human and animal health. Related potential applications include the development of more effective insecticides. The range of new materials and protocols that will result from the research will be suitable for commercial exploitation. Particular benefit to Australians will result from the research being carried out locally, where the intellectual property and expertise will be developed and maintained.

DP0662890 Dr LP Edwards

Approved Project Title Warriors, Patriots, Traitors and Opportunists: Chinese Women and War

2006 : \$159,000
2007 : \$141,000
2008 : \$110,000

Primary RFCD 4301 HISTORICAL STUDIES

Administering Institution The Australian National University

Project Summary

This project furthers our knowledge of the workings of the political, military and security scene in one of our most strategically important neighbours, the PRC. The better we understand the PRC and how it responds in times of military disruption the more likely we are to be able to further Australian interests within this large market and ensure continued national security. The project also enhances Australia's strong reputation as leaders in scholarship in Chinese Studies by producing research publications of high impact that present new perspectives on old projects. This project will keep Australia at the forefront of research in Chinese Studies.

DP0663385 Dr AS Fairbairn

Approved Project Title Plant use at the dawn of agriculture in central Anatolia

2006 : \$20,000
2007 : \$20,000

Primary RFCD 4302 ARCHAEOLOGY AND PREHISTORY

Administering Institution The Australian National University

Project Summary

The project will increase collaboration with researchers in the UK, and Turkish archaeological authorities. It will refine our understanding of the process, rate and direction of agricultural origins in Western Asia and improve Australia's profile in origins of agriculture research. It will increase Australia's knowledge base about other regions and help to consolidate and promote archaeobotany/archaeological science in Australia's research community.

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DP0663392 Prof JJ Fox

Approved Project Title **The Semantics of Canonical Parallelism: Oral composition among Rotinese poets, eastern Indonesia**

2006 : \$50,000

2007 : \$40,000

2008 : \$45,000

Primary RFCD 3802 LINGUISTICS

Administering Institution The Australian National University

Project Summary

The pairing of words, known in linguistics as parallelism, is a critical feature of the oral traditions of the world. This strict use of couplets for oral compositions is a characteristic of the vibrant traditions of verbal communication on all the islands of eastern Indonesia. This project focuses on the oral traditions of the island of Roti, Australia's closest Indonesian neighbour. Using new analytic techniques applied to an extensive recorded corpus, it seeks to identify underlying mechanisms of verbal composition that may be applied comparatively to other oral traditions throughout the world, thus locating Australia at the forefront of the international study of oral traditions.

DP0664024 Dr RA Fry; Prof WJ McKibbin; Dr MH Dungey

Approved Project Title **Empirical and Theoretical Coherence of Macroeconometric Models**

2006 : \$95,000

2007 : \$85,000

2008 : \$70,000

Primary RFCD 3404 ECONOMETRICS

Administering Institution The Australian National University

Project Summary

Variants of the G-Cubed models are used by researchers, governments and international institutions for policy analysis. The need for policy makers to have models with substantial structural detail and a strong theoretical base is paramount for transparency and accountability. The development of simple SVAR models which capture these theoretical underpinnings will provide Australian policy makers with an effective tool for economic analysis. It will also provide powerful tools that enable forecasting and detailed policy analysis within the same broad conceptual framework. The emphasis is on international and financial market linkages which encompass key issues facing the Australian economy.

DP0665839 Dr L Fu; Dr M JOHNSTON

Approved Project Title **Development of high performance III-V semiconductor photoconductive antennas for terahertz applications**

2006 : \$107,669

2007 : \$93,240

2008 : \$93,240

2009 : \$93,240

2010 : \$93,240

Primary RFCD 2914 MATERIALS ENGINEERING

ARF Dr L Fu

Administering Institution The Australian National University

Project Summary

The practical applications of terahertz (THz) radiation include scientific probing for material characterisation, screening for weapons, explosives and biohazards, imaging for concealed objects and medical diagnostics, chemical and biological analysis, astronomy and space research. The success of this project will lead to the creation of a new generation of high performance THz emitters/detectors essential for above applications, making great contribution to the Nation in the areas of science, technology, health, security and economy.

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DP0663227 Dr MK Gagan; Dr WS Hantoro; Dr DH Natawidjaja; Dr JM Lough; Dr G Meyers; Prof Z Liu; Prof K Sieh

Approved Project Title **The Indian Ocean Dipole, Australasian drought, and the great-earthquake cycle: Long-term perspectives for improved prediction**

2006 : \$260,000
2007 : \$190,000
2008 : \$180,000
2009 : \$183,000
2010 : \$203,000

Primary RFCD 2606 ATMOSPHERIC SCIENCES

Administering Institution The Australian National University

Project Summary

The protracted drought across Australia and Boxing Day 2004 earthquake in Sumatra defied prediction, and are causing incalculable environmental, economic, and social harm. Knowledge of past climate extremes will enhance our ability to predict climate change, and alleviate adverse affects for Australasian nations who miss-out in the future redistribution of life-giving moisture. Insights into the great-earthquake cycle will help fulfil Australia's responsibility to predict tsunamis, for the benefit of nations fringing Australasian seismotectonic zones. Development of improved techniques in palaeoclimatology, palaeoclimate modelling, and palaeoseismology will provide new collaborations and opportunities for research, training, and education.

DP0663274 Dr MK Gagan; Dr J Zhao; Dr RN Drysdale; Dr WS Hantoro; Dr GA Schmidt

Approved Project Title **Monsoon extremes, environmental shifts, and catastrophic volcanic eruptions: quantifying impacts on the early human history of southern Australasia**

2006 : \$245,000
2007 : \$100,000
2008 : \$100,000

Primary RFCD 2606 ATMOSPHERIC SCIENCES

Administering Institution The Australian National University

Project Summary

The coincidence of a long, diverse Australasian human history with Earth's greatest climate systems presents the Australian and Indonesian communities with unrivalled opportunities for scientific discovery. Our study will improve understanding of global climate change, environmental shifts, volcanic catastrophes, and their role in early human dispersal, and extinction, in Australasia. The significance of the results will extend to the modern world, where human behaviour modifies, and is modified by, climate and environment. Integration of research strengths in Australia and Indonesia will contribute to an improved bilateral relationship in science, education, and training, and engage the public in the excitement of scientific discovery.

DP0663161 Dr Q Gao

Approved Project Title **Band gap engineering of novel (In,Ga)SbN epitaxial semiconductors for high-performance long-wavelength optoelectronic devices**

2006 : \$120,000
2007 : \$110,000
2008 : \$100,000

Primary RFCD 2914 MATERIALS ENGINEERING

APD Dr Q Gao

Administering Institution The Australian National University

Project Summary

This proposal is at the forefront of a number of important fields, and therefore the outcomes are expected to be of great interest to a broad spectrum of industry sectors, including national defence, health care, environment and manufacturing. This novel material system could create new high technologies for various infrared devices. The outcomes of this project will position Australian researchers among the pioneering groups in this area and will be beneficial to several major technology-related fields: global warming and associated environmental monitoring, security systems, thermal-imaging systems for night vision, and healthcare with the emphasis on disease diagnosis and treatment.

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DP0666267 Dr ST Gibson

Approved Project Title **Imaging chemical reaction dynamics from the transition state to reaction products**

2006 : \$140,000

2007 : \$95,000

2008 : \$95,000

Primary RFCD 2501 PHYSICAL CHEMISTRY (INCL. STRUCTURAL)

Administering Institution The Australian National University

Project Summary

Chemical reactions play a key role in many atmospheric, environmental and industrial processes. An understanding of reactions at the molecular level will lead to significant economic benefits, through more efficient reaction control, and through the identification of the key environmental factors which influence why particular reactions proceed. Our study of chemical reaction dynamics has been driven by technological advances which enable key stages of a reaction to be imaged and studied at the molecular level.

DP0664466 Prof PM Gill

Approved Project Title **Development and implementation of efficient new models for electron correlation**

2006 : \$73,000

2007 : \$80,000

2008 : \$85,000

Primary RFCD 2506 THEORETICAL AND COMPUTATIONAL CHEMISTRY

Administering Institution The Australian National University

Project Summary

The two new approaches will allow researchers in the chemical, pharmaceutical and materials sciences to predict the physical and chemical behaviour of moderately large molecular systems with an accuracy and efficiency that has not previously been possible. The software that will result will enable cost and time savings in the design of advanced materials in the medical and agricultural contexts.

DP0663060 Prof RE Goodin; Prof HG Brennan

Approved Project Title **Norms, Reasons & Values**

2006 : \$170,000

2007 : \$180,000

2008 : \$170,000

Primary RFCD 3601 POLITICAL SCIENCE

Administering Institution The Australian National University

Project Summary

Social norms often come adrift from the reasons and values that they are supposed to serve. Strengthening Australia's social and economic fabric (a National Research Priority) requires understanding how norms work and revising them in changing circumstances. This project explores such ideas in relation to crucial issues-democracy, terrorism (another NRP), historical injustice and sexuality-and interjects practical suggestions into the public debate over how norms ought be revised. It also furthers Australia's world standing in political science and philosophy and, by enlisting international scholars to help explore these issues, focuses the intellectual firepower of the world on problems of national importance to Australia.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0664453 Dr DM Gordon; Dr B Barnes

Approved Project Title **The ecological dynamics of secreted bacteriocins and the evolution of multiple bacteriocin production in Escherichia coli**

2006 : \$93,000

2007 : \$83,000

2008 : \$83,000

Primary RFCD 2703 MICROBIOLOGY

Administering Institution The Australian National University

Project Summary

Bacteria produce compounds known as bacteriocins that are toxic to other microorganisms. The success of bacteria as bio-control agents and in probiotic formulations for the control microbial pathogens is, in part, due to bacteriocins. Bacteriocins may also have a role as replacements for traditional antibiotics and as natural food preservatives. The potential usefulness of bacteriocins as the active agent in bio-control agents, as antibiotic replacements, as food preservatives, and as part of the repertoire of traits in probiotic formulations requires a sound understanding of the eco-evolutionary dynamics of bacteriocins. Understanding the ecology and evolution of bacteriocins is the goal of the proposed research.

DP0666437 Dr MB Gray; Dr DA Shaddock; Prof Dr K Danzmann; Dr G Mueller

Approved Project Title **Technologies for space-based optical interferometry**

2006 : \$70,000

2007 : \$70,000

2008 : \$70,000

Primary RFCD 2917 COMMUNICATIONS TECHNOLOGIES

Administering Institution The Australian National University

Project Summary

Gravitational waves are ripples in the curvature of space-time produced by the motion of massive celestial objects. Gravitational waves provide a different kind of information about the universe and their measurement will lead to an entirely new type of astronomy. The quest to detect gravitational waves is entering a new era with the Laser Interferometer Space Antenna (LISA) now under development. LISA is a two billion dollar joint NASA/ESA deep space mission to build a gravitational wave observatory in space. This research will develop Australian technologies critical to the success of LISA and other future deep space missions.

DP0665816 Prof JE Gready; Dr PL Cummins

Approved Project Title **Importance of conformational and electrostatic contributions in simulations of enzyme reaction mechanisms**

2006 : \$90,000

2007 : \$85,000

2008 : \$85,000

Primary RFCD 2506 THEORETICAL AND COMPUTATIONAL CHEMISTRY

Administering Institution The Australian National University

Project Summary

The research will contribute to the development of biomolecular simulation in Australia by demonstrating its potential to complement experiment, and also promote the effective use of APAC (Australian national supercomputer facilities) resources by providing advanced programs and computational protocols for other researchers. It will assist the diffusion of computational biology technology into industrial applications such as rational drug design and protein engineering, as, for example, in our associated Linkage project grant, and provide novel insights into protein engineering and other sorts of design, which transcend concepts currently used in biomimetic chemistry.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0664255 Prof SD Gregor; Dr WD Fernandez; Dr MA Martin; Dr J Ng; Dr S Stern

Approved Project Title **The key strategies in firms' realisation of value from ICT: A transformational model of ICT value generation**

2006 : \$68,000

2007 : \$91,000

2008 : \$59,000

Primary RFCD 2801 INFORMATION SYSTEMS

Administering Institution The Australian National University

Project Summary

Studies indicate that information and communication technologies (ICT) have contributed significantly to Australia's productivity gains over the last decade. It is not well understood, however, why some firms and some industries have been able to benefit significantly more from ICT use than others. This study will show the strategies and practices that are used by the firms that gain maximum benefit from ICT - the 'ICT winners'. The lessons learned will allow other firms to gain further benefits from ICT, potentially leading overall to further economic gains by industries and the nation.

DP0664115 Prof RW Griffiths

Approved Project Title **From The Ocean Depths To Abrupt Climate Change - Missing Processes In The Global Overturning Circulation**

2006 : \$141,000

2007 : \$140,000

2008 : \$120,000

Primary RFCD 2604 OCEANOGRAPHY

Administering Institution The Australian National University

Project Summary

The overturning circulation of the oceans is a driver of large and surprisingly abrupt climate shifts. We aim to understand the factors that control the rate of overturning, and whether it might soon slow down or cease owing to global warming. We also aim to resolve one of the biggest conundrums in oceanography by reconciling theoretical and measured rates of mixing in the deep ocean. Improved knowledge of deep ocean dynamics, particularly in the Southern Ocean, will help us gauge the likely nature and pace of imminent climate changes in the Australian region, an essential step in assessing the impacts on water resources, ecosystems, agriculture, and energy demands. The research will add to a major new initiative in marine science at ANU.

DP0667253 Dr RH Grove

Approved Project Title **British Empire and the Natural World: the Environmental History of the British Empire and Commonwealth 1600-2000**

2006 : \$134,420

2007 : \$135,420

2008 : \$135,420

2009 : \$136,520

2010 : \$131,420

Primary RFCD 3706 HISTORY AND PHILOSOPHY OF SCIENCE AND MEDICINE

APF Dr RH Grove

Administering Institution The Australian National University

Project Summary

Australia faces multiplying environmental crises in climate change, including soil erosion, salinisation, deforestation. Most of these crises originate in faulty land use management. An understanding of the causes of this predicament require deep insights into the global impact of European colonisation and an understanding of the environmental history of the British empire and the ideas and intellectual networks that underpinned the expansion of the geographical and resource frontier.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0664267 Dr FS Gruetzner; Dr E Tsend-Ayush

Approved Project Title **Many Ys in monotremes: multiple sex chromosomes and sex determination in platypus and echidna**

2006 : \$150,000
2007 : \$110,000
2008 : \$110,000
2009 : \$110,000
2010 : \$110,000

Primary RFCD 2702 GENETICS

ARF Dr FS Gruetzner

Administering Institution The Australian National University

Project Summary

Platypus and Echidna are Australian icons, even featuring on our coins. Their unusual biology and ancient relationship to humans make them unique for understanding the mammalian genome, as demonstrated by our recent discovery of ten sex chromosomes in platypus that link mammal and bird sex. Still little is known about their genome, embryo development and how sex is determined. We will identify new genes on all ten sex chromosomes and investigate how they determine sex. The set up of an Australian Monotreme Resource Centre will be crucial for this research and attract worldwide high profile collaborations. We will answer important general questions in monotreme biology and contribute to our understanding of sexual abnormalities in humans.

DP0664144 Prof Dr R Grun; Prof MJ Spriggs; Dr IS Williams

Approved Project Title **Microanalysis of human fossils: new insights into age, diet and migration**

2006 : \$105,000
2007 : \$90,000
2008 : \$90,000

Primary RFCD 2603 GEOCHEMISTRY

Administering Institution The Australian National University

Project Summary

Human occupation of Australia and the Pacific dates back tens of thousands of years. New micro-analytical techniques now make it possible to learn about the life histories of these ancient peoples: their diet, migration paths and the climate in which they lived. This project will benefit the Indigenous populations and researchers of neighbouring countries through collaboration and increased knowledge of their ancestors, thus enhancing Australia's links and status as a good neighbour in the region. This falls squarely into the Research Priority 'Safeguarding Australia - Understanding our Region and the World'. In the future, our analytical approach will give important insights into the complex and rich archaeological heritage of Australia.

DP0663269 Mr JJ Hanley

Approved Project Title **The Role Of Halide Melts In Platinum-Group Element Mobility**

2006 : \$83,090
2007 : \$81,340
2008 : \$81,340

Primary RFCD 2601 GEOLOGY

APD Mr JJ Hanley

Administering Institution The Australian National University

Project Summary

The proposed research will introduce a new, high profile application of analytical and experimental facilities at ANU, thereby maintaining Australia's standing as a world leader in the global geoscience community. The data generated in the proposed study may critically impact exploration models and assist the Australian mining industry in locating new reserves of platinum-group elements (PGE). Therefore, the study will benefit the people of Australia by providing the means to find an important resource base for sustainable society. The research will be timely as Australia's future demand for the environmentally-safe PGE metals in medicine, transportation, and energy production will be very significant.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0666497 Prof TM Harrison; Dr J Blichert-Toft; Prof G Turner; Prof B Bourdon; Prof SJ Mojzsis

Approved Project Title **Exploring the Hadean Earth**

2006 : \$120,000

2007 : \$80,000

2008 : \$80,000

Primary RFCD 2603 GEOCHEMISTRY

Administering Institution The Australian National University

Project Summary

This research spotlights a globally unique Australian natural resource that preserves the most detailed record of how our planet worked during its formative stages. The project showcases Australian scientific and technical leadership in a field of widespread interest, aids in capturing the imagination of young people considering a career in science and technology, provides training opportunities for young scientists, and enhances the international visibility and prestige of Australian science.

DP0663818 Prof CE Hill; Dr F Edwards

Approved Project Title **Involvement of cell coupling in vascular function: Development of a computational model**

2006 : \$105,000

2007 : \$85,000

2008 : \$85,000

Primary RFCD 2706 PHYSIOLOGY

Administering Institution The Australian National University

Project Summary

Gap junctions are intercellular channels which enable the production of coordinated responses in multicellular tissues and organs. Blood vessels are comprised of endothelial cells surrounded by smooth muscle cells and gap junctions exist within and between these layers. The present proposal will determine the fundamental role of gap junctions in regulating blood flow and blood pressure. Our data will enable us to develop a computational model of the vascular wall and so predict how changes in electrical properties, as occur during pressure changes, can influence blood flow. Since ageing is accompanied by an increase in blood pressure, our results will contribute to a better understanding of blood flow regulation in our ageing population.

DP0663390 Mr BT Hillman

Approved Project Title **Social Networks and Political Change in Contemporary Rural China**

2006 : \$80,000

2007 : \$80,000

2008 : \$80,000

Primary RFCD 3701 SOCIOLOGY

APD Mr BT Hillman

Administering Institution The Australian National University

Project Summary

Rural China is home to nearly one-sixth of the world's population. Reforms in the Chinese countryside triggered a prolonged period of economic growth that has become the engine of the world economy and the major destination for Australian exports. Political and economic developments in the agricultural sector and the continued industrialisation of China's rural regions have an immediate impact on the Australian economy and will shape Australia's relations with China long into the twenty-first century. Australia is a world leader in research on contemporary China and this project will help to consolidate that position.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0667064 Dr J Howard; Prof MB Persson

Approved Project Title **Development of microwave tomography techniques and inverse methods for biomedical imaging applications.**

2006 : \$133,000

2007 : \$121,000

2008 : \$116,000

Primary RFCD 2499 OTHER PHYSICAL SCIENCES

Administering Institution The Australian National University

Project Summary

Microwave tomography is a rapidly emerging imaging technology with highly significant applications in industry and medicine. In particular, given its sensitivity to differences between normal and malignant breast tissue, non-invasive microwave imaging has been the subject of intense research interest in the last ten years. In collaboration with workers at Chalmers University in Sweden, we will develop and evaluate a scanning microwave imaging tomographic system with a number of potential industrial and biomedical applications. This appears to be a new Australian initiative.

DP0666662 Dr BH Hunter; Prof DA De Vaus

Approved Project Title **An Integrated Analysis of the Social Context of Indigenous Poverty**

2006 : \$90,000

2007 : \$85,000

2008 : \$78,000

Primary RFCD 3402 APPLIED ECONOMICS

Administering Institution The Australian National University

Project Summary

The project will identify the processes that improve Indigenous participation in social and economic life of the nation—an important pre-condition for a lasting reconciliation between indigenous and other Australians. The new poverty benchmarks developed will provide evidence about the adequacy of income support payments with associated implications for child welfare. Given that Indigenous people are a substantial and increasing proportion of remote Australia, improvements in their income and welfare would have significant multipliers for regional economies. Also, the national debate on these issues will be augmented by scholarly articles and a readable book providing an integrated analysis of the social context of Indigenous poverty.

DP0666365 Prof ST Hyde; A/Prof H Hasegawa; Prof N Hadjichristidis

Approved Project Title **Self-assembled polyphiles: molecular nanopatterns**

2006 : \$146,000

2007 : \$127,000

2008 : \$127,000

Primary RFCD 2402 THEORETICAL AND CONDENSED MATTER PHYSICS

Administering Institution The Australian National University

Project Summary

21st century technology is certain to rely on advanced materials, utterly new in character, function and manufacturing process. Control of material structure, from the atomic and molecular scales and upward will be a central focus, to engineer specific features from electronic or photonic functionality, to chemical selectivity. The manufacturing principle of biological materials, made routinely in vivo with exquisite economy and control at all length scales, will be adopted for materials design. The route to these materials is self-assembly. We will explore in detail theory and practical manufacture of self-assembled nanostructured materials, building molecular honeycombs combining composite material features at the nanoscale.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0666751 Dr TR Ireland; Dr Y Amelin; Prof EK Zinner

Approved Project Title Sources and processes in the early solar system - an isotopic study

2006 : \$90,000

2007 : \$70,000

2008 : \$70,000

Primary RFCD 2603 GEOCHEMISTRY

Administering Institution The Australian National University

Project Summary

Our solar system formed over 4.5 billion years ago. We aim to develop techniques that will allow us to determine the sequence of events that led to our planetary system with unprecedented detail. The same techniques can be applied to dating geological events, for example, correlating ore-forming events and dating opal formation. This project utilizes new Australian technologies that will have potential economic benefits both in instrument sales and applications.

DP0663389 Dr T Jacka

Approved Project Title Changing approaches to gender and development in rural China

2006 : \$60,036

2007 : \$40,000

2008 : \$50,822

Primary RFCD 3799 OTHER STUDIES IN HUMAN SOCIETY

Administering Institution The Australian National University

Project Summary

Harmonious and cooperative relations with China are crucial to Australia's economic and cultural development and to security in the region. By contributing to Australian understanding of Chinese society, this project will enhance such relations. Knowledge gained through this project will also enhance Australian development projects in China, and more generally, contribute to development projects focusing on gender and development in Asia and elsewhere. In addition, the contributions of the project to research and postgraduate training in Chinese studies, gender studies and development studies will benefit Australia by raising the international profile of Australian institutions within these disciplines.

DP0663049 Prof FC Jackson; Dr D Braddon-Mitchell; Prof PR Godfrey-Smith

Approved Project Title Belief singular versus beliefs plural

2006 : \$60,000

2007 : \$35,000

2008 : \$35,000

2009 : \$55,000

2010 : \$25,000

Primary RFCD 4401 PHILOSOPHY

Administering Institution The Australian National University

Project Summary

Research on the brain and how it represents the environment has the potential to reconfigure our ordinary conceptions of belief and rationality. This project explores the impact of the changes and their implications.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0663997 Dr J Jupp

Approved Project Title **Researching the Social Role of Religions in Australia**

2006 : \$78,000
2007 : \$39,000
2008 : \$39,000

Primary RFCD 4402 RELIGION AND RELIGIOUS TRADITIONS

Administering Institution The Australian National University

Project Summary

Most Australians claim allegiance to various religions in the Census. The number of religious denominations has greatly increased in recent years, most notably through immigration, with significant numbers from all world religions. Political and social policies are frequently influenced by religious principles and a detailed analysis of this variety is of crucial national importance. Religions from neighbouring societies are significantly represented in Australia. Understanding them is of central importance in international political and commercial activity. Current research is essential, based on the most recent Census and other recent socio-economic information.

DP0663786 Dr H Keane

Approved Project Title **Reforming the Male: Masculinity, Medicalisation and Men's Health**

2006 : \$21,000
2007 : \$45,000
2008 : \$20,000

Primary RFCD 4203 CULTURAL STUDIES

Administering Institution The Australian National University

Project Summary

Men's health is an issue of significant national importance and community concern. This project will contribute to knowledge of the social and cultural determinants of men's health and health practices in Australia. It is at the forefront of new approaches to men's health which emphasise the impact of norms and practices of masculinity on wellbeing. As well as providing specific insight into problems such as attention deficit disorder and depression in men, the project will also contribute to international debate about medicalisation, the rise of pharmacological treatments for problems of living and the existence of a crisis in masculinity.

DP0662984 Prof BL Kennett

Approved Project Title **Seismic constraints on the assembly of cratons**

2006 : \$200,000
2007 : \$120,000
2008 : \$120,000
2009 : \$95,000

Primary RFCD 2602 GEOPHYSICS

Administering Institution The Australian National University

Project Summary

Improved definition of the 3-D seismological structure and nature of the major lithospheric blocks in Australia and their assembly to form the present-day continent will be sought from seismological data. The inclusion of information on the depth extent and character of the lithosphere will improve geological understanding of the evolution of the continent, with relevance to the interaction of the crust and mantle and the placement of mineral resources.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0662772 Dr JS Keogh

Approved Project Title **Comparative phylogeography and conservation genetics of Australia's biodiversity hotspot**

2006 : \$110,000

2007 : \$95,000

2008 : \$95,000

Primary RFCD 2705 ZOOLOGY

Administering Institution The Australian National University

Project Summary

Southwestern Australia has been identified as one of the world's 25 biodiversity hotspots. The project will address broad questions in evolutionary biology with unique Australian systems, make a world class contribution to the fields of phylogeography, molecular phylogenetics and conservation genetics and contribute substantially to the continued training of high quality research students. I am a foundation member of the new ARC Environmental Futures Network: Discovering the Past and Present to Shape the Future. One of its primary listed objectives is "documenting Australia's biodiversity: recognising, understanding and managing key hotspots". My research plan fits in precisely with this research agenda.

DP0667104 Dr Y Kinfu; Dr J Taylor

Approved Project Title **Below replacement fertility among Indigenous Australians: Course, Causes and Regional Variations**

2006 : \$83,000

2007 : \$69,000

2008 : \$96,000

Primary RFCD 3705 DEMOGRAPHY

Administering Institution The Australian National University

Project Summary

This research will enhance the knowledge base on Indigenous Australian fertility and provide a timely contribution to current debate about the social and economic consequences of low fertility and ageing. By engaging an early career researcher and an Indigenous research student, it will expand Australia's research capability on current and future Indigenous population dynamics in what has become a neglected area of research. It will ensure that full use is made of public expenditure on the collection of Indigenous social and demographic data. By extending linkages with researchers internationally, it will place Australia at the forefront of global efforts to understand Indigenous demographic transition.

DP0666080 Prof WZ Krolikowski; Dr AV Rode; Prof EG Gamaly

Approved Project Title **Ultra-high density permanent and/or erasable optical memory in photorefractive media formed by ultrafast laser pulses**

2006 : \$178,000

2007 : \$146,000

2008 : \$121,000

2009 : \$125,000

2010 : \$125,000

Primary RFCD 2801 INFORMATION SYSTEMS

Administering Institution The Australian National University

Project Summary

A possibility to form tree-dimensional 10Tb-density optical memory based on permanent modification, or damage, of transparent dielectrics, using powerful femtosecond laser pulses has already been demonstrated by the Applicants. This project aims to improve the fundamental understanding of ultrafast laser formation of nano-bits using unique ability of photorefractive materials to reversible change and the refractive index. We aim to find ways for controlling the storage time, density and the writing-reading-erasing rate without inducing damage in the material. The results will be applied to efficient formation of high-speed, high density, write-read-erase 3D optical memory for applications in the information technology.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0665260 Dr A Leigh

Approved Project Title Understanding and Improving Teacher Quality

2006 : \$90,000

2007 : \$70,000

2008 : \$50,000

Primary RFCD 3402 APPLIED ECONOMICS

Administering Institution The Australian National University

Project Summary

The quality of Australia's schooling system is a key determinant of skills in the economy, affecting economic growth, unemployment and inequality. With 3 percent of GDP currently devoted to primary and secondary education, improving educational productivity could lead to enormous gains. International evidence suggests that a promising approach to improving our education system is to boost teacher quality, yet we currently know little about the differences between the best and worst teachers. With large numbers of teachers due to retire in the next decade, now is an ideal time to learn more about teacher quality, and implement policies to ensure that the calibre of the teaching profession is as good as it can be.

DP0663694 Dr Q Li

Approved Project Title Carrier dynamics in III-V semiconductor quantum dots and nanostructures

2006 : \$130,000

2007 : \$90,000

2008 : \$90,000

Primary RFCD 2404 OPTICAL PHYSICS

APD Dr Q Li

Administering Institution The Australian National University

Project Summary

Quantum dots and related nanostructures are one of the most attractive topics in the recently years. This project will investigate the role of carrier dynamics in these nanostructures by using state-of-the-art ultrafast spectroscopy techniques. The wealth of information obtained from this study will not only enhance our knowledge base but also allow us to design high performance QD lasers and detectors and to demonstrate innovative optoelectronic devices for optical communication systems as well as quantum information processing. It will ensure that Australia is at the cutting edge of nanotechnology and optoelectronics research.

DP0665459 Dr JM Lo

Approved Project Title Diaspora, Hybridity and the Nation: Asian-Australian Perspectives in Literature and Theatre

2006 : \$52,533

2007 : \$41,386

Primary RFCD 4203 CULTURAL STUDIES

Administering Institution The Australian National University

Project Summary

Australia's engagement with Asia remains central to our national security and economic development. Better understanding about Asians in Australia will enhance Australia's capacity to interpret itself to the Asian region. This research also addresses major concerns that are of significance to the wellbeing and cohesiveness of the nation: race relations, reconciliation, nationhood, and globalisation. By foregrounding the contribution of Asian-Australians in the cultural life of the nation, the research serves to enrich public life and foster stronger community relations.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0665481 Dr RD Magrath

Approved Project Title Interspecific communication and the evolution of alarm calls in birds

2006 : \$91,000

2007 : \$76,000

2008 : \$72,000

Primary RFCD 2707 ECOLOGY AND EVOLUTION

Administering Institution The Australian National University

Project Summary

There are probably more papers on vocal communication in some individual European and American species of birds than there are on all Australian species combined. Our work will contribute to redressing this imbalance by carrying out detailed studies on acoustic communication in a major group of Australian songbirds (scrubwrens, fairy-wrens, honeyeaters and allies), while at the same time addressing an unsolved general problem in call design first identified 50 years ago in European songbirds. Specifically, we will test whether different prey species have repeatedly evolved 'hawk' alarm calls of similar structure, and whether such evolution could be due to benefits of having similar calls when communicating with other prey species.

DP0664603 Prof RA Maller; Prof CC Klueppelberg

Approved Project Title Financial Risk Processes: Stochastic and Statistical Models and their Applications

2006 : \$126,000

2007 : \$114,000

2008 : \$114,000

Primary RFCD 2302 STATISTICS

Administering Institution The Australian National University

Project Summary

On the one hand, the misuse of complex financial instruments has contributed to recent major disasters in the Australian financial and insurance industries; on the other hand, great benefits can be obtained by correct use of these kinds of instruments, to share risk between markets and segments of markets. The overall research effort in Australia in these areas is relatively small. This project will target the development of cutting edge technologies underlying the use of financial derivatives, not presently studied in this country or elsewhere, by bringing together a variety of top level international researchers in an integrated effort to lift the Australian understanding and application of this methodology.

DP0664243 Prof DG Marr

Approved Project Title State, War and Revolution in Vietnam, 1945-1954

2006 : \$45,000

2007 : \$40,000

2008 : \$30,000

Primary RFCD 4301 HISTORICAL STUDIES

Administering Institution The Australian National University

Project Summary

The explosive experience of state formation, war and revolution combining together, thought by many to have vanished along with colonialism and the Cold War, now threatens to engulf the Middle East and/or Central Asia, much as it did Indochina fifty years ago. The largely untold story of Vietnam's 'Anti-French Resistance' in 1945-1954 offers plenty of policy warnings, if no prescriptions. Notably, those who argue that Australia's interests overseas can be safeguarded by technology and big-power alliances, ignoring human grievances, contentious politics, mass movements and social upheavals, put future generations at risk.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0663459 Prof PF McDonald; Prof JH Baxter; Dr DA Mitchell; Dr EE Gray; Ms JA Baxter

Approved Project Title **Negotiating the Life Course: Education, Work, Family and Lifestyle Behaviour in Australia**

2006 : \$370,000

2007 : \$60,000

2008 : \$60,000

Primary RFCD 3701 SOCIOLOGY

Administering Institution The Australian National University

Project Summary

The Negotiating the Life Course Project is a leading Australian social science resource accessible to and widely used by university researchers and students, especially PhD students. Beyond its major academic contributions, its results have been extensively reported in the media and have greatly increased community understanding of Australian society. It has an important and on-going role in several areas of policy formulation especially in the development of policies related to the balance of work and family. Its principals are leading social commentators in these policy areas because, in large part, they are able to draw upon this significant national resource.

DP0663768 Prof F Menezes; Dr RV Breunig

Approved Project Title **The Consistency of Price Regulation of Infrastructure Businesses across Australian Jurisdictions**

2006 : \$90,000

2007 : \$75,000

2008 : \$90,000

Primary RFCD 3402 APPLIED ECONOMICS

Administering Institution The Australian National University

Project Summary

The spread of regulation across the majority of the economy necessitates that regulatory policy should be consistent across jurisdictions and industries. This project would offer policy and regulatory institutions quantitative analysis of the consistency of regulatory decisions across Australia. This research would develop a new database that would maintain and supply details on regulatory decisions across jurisdictions and industries. This project would enable the new Australian Centre of Regulatory Economics (ACORE) to supply independent database and quantitative analysis from an open, fully documented, scholarly environment to Australia's policy and regulatory agencies and its regulated firms.

DP0664775 Dr L Narangoa; Dr RB Cribb

Approved Project Title **Borders and Empires: A Historical Atlas of Northeast Asia, 1636 - 2006**

2006 : \$35,000

2007 : \$80,557

2008 : \$39,300

Primary RFCD 4301 HISTORICAL STUDIES

Administering Institution The Australian National University

Project Summary

This historical atlas brings insights into the continuing tensions in Northeast Asia, both in the Korean Peninsula, and between China and Russia, where old antagonisms have repeatedly led to armed conflict and where border friction today is exacerbated by economic disparities, population movements and rival nationalist rhetorics. Our research deepens the understanding of decision-makers and of the Australian public concerning these issues. The project contributes important insights into the flexibility of borders at a time when they under new challenge. Our study of settler politics in Northeast Asia and the settler relations with indigenous political forces is also relevant to Australia's history and present.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0664860 Dr R O'Kearney

Approved Project Title Trauma memory and narrative structure in post-traumatic distress

2006 : \$55,000

2007 : \$35,000

2008 : \$45,000

Primary RFCD 3801 PSYCHOLOGY

Administering Institution The Australian National University

Project Summary

The project enhances understanding of factors that maintain enduring distress and disability following traumatic experiences which have major social and financial costs to individuals, communities and to the nation. Better knowledge of these factors is central to improving early detection and refining prevention and early intervention for individuals and to help understand how communities can better manage their response to severe traumatic events. The results may lead to significant refinements to efficacious psychological treatments involving exposure to emotional memories. The project's innovative approach to studying autobiographical memories will enhance Australia's internationally competitiveness in a key area within psychology.

DP0664039 Prof DL Ollis; A/Prof LR Gahan; Dr G Schenk

Approved Project Title Directed evolution of enzymes for bioremediation: structure function studies of bimetalloenzymes.

2006 : \$100,000

2007 : \$78,000

2008 : \$78,000

Primary RFCD 2708 BIOTECHNOLOGY

Administering Institution The Australian National University

Project Summary

We will evolve enzymes that degrade organophosphate pesticides (OPs) that are used in Australian agriculture. Although these OPs were designed to kill insects they are closely related to chemical warfare agents and are known to be toxic to humans. Bacteria have acquired a number of enzymes that degrade some OPs. One such enzyme has been used in field trials demonstrating its potential to degrade OP residues. However, many pesticides are not removed rapidly and OP-degrading enzymes require modification(s) if they are to be useful environmental reagents - this can be achieved with directed evolution.

DP0663319 Prof HS O'Neill; Prof B Wood; Prof T Irifune

Approved Project Title Understanding the deep mantle: experimental petrology at very high pressures

2006 : \$190,000

2007 : \$145,000

2008 : \$145,000

Primary RFCD 2601 GEOLOGY

Administering Institution The Australian National University

Project Summary

The great processes that shape the Earth at its surface, including plate tectonics and continental drift, can only be understood by appreciating how the interior of the Earth works. However, studying the deep Earth is difficult because of the enormous pressures and temperatures involved. This research proposes to simulate conditions in the Earth's lower mantle (that is, below 670 km in depth) by making use of an Australian invented diamond-based ceramic, to double the pressure at which experiments can be performed. The information gained from this fundamental research will help predict how giant ore bodies form. The development of the high-pressure apparatus will also aid material scientists in their quest for novel materials.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0666289 Adj/Prof CB Osmond; Dr KK Niyogi

Approved Project Title **Novel photoprotective mechanisms and functional biodiversity of high light tolerance in the model alga Chlamydomonas**

2006 : \$115,000

2007 : \$84,000

2008 : \$84,000

Primary RFCD 2704 BOTANY

Administering Institution The Australian National University

Project Summary

Most plants have limited capacity to avoid high light (HL) stress which commonly accompanies drought and high temperature stress. We will identify novel genes and proteins that underlie diverse mechanisms of photoprotection in unique very high light resistant (VHLR) mutants in the alga Chlamydomonas and develop new tools to screen other plants for these attributes. Depending on progress, we expect to express them in the higher plant Arabidopsis as a first step towards utilization of VHLR genes for crop improvement. Understanding the mechanisms conferring HL photoprotection is a research priority in plant sciences and will further strengthen Australia's innovative contributions to the internationally networked Chlamydomonas Genome Project.

DP0664184 Prof G Otting; Dr T Huber

Approved Project Title **Fluorine-labelled proteins for NMR spectroscopy**

2006 : \$150,000

2007 : \$119,000

2008 : \$119,000

Primary RFCD 2701 BIOCHEMISTRY AND CELL BIOLOGY

Administering Institution The Australian National University

Project Summary

The technique developed in this project has direct impact on pharmaceutical research: NMR spectroscopy is used routinely to identify chemical compounds that bind to protein targets. This project includes the development of novel assignment techniques of ¹⁹F-labelled proteins, so that ¹⁹F-NMR can be used to detect specific binding interactions. One of the methods proposed here is designed to reveal structural information about the binding mode in solution with atomic detail. This knowledge can significantly accelerate drug development. It is otherwise only available from crystal structures that can not always be determined.

DP0665718 A/Prof RJ Pace; Prof R Stranger; Prof J Barber; Prof L Hammarström

Approved Project Title **Structural and Mechanistic Studies of the Oxygen Evolving Centre in Photosystem II**

2006 : \$115,000

2007 : \$100,000

2008 : \$100,000

Primary RFCD 2502 INORGANIC CHEMISTRY

Administering Institution The Australian National University

Project Summary

Hydrogen fuel production from electricity and water sources, such as sea water, represents the ultimate goal for the research described here. This is part of an overall scheme, called "Artificial Photosynthesis", to generate clean renewable energy. The present project is an important step in this ambitious program and directly addresses a key hurdle which must be overcome to make artificial photosynthesis feasible. This hurdle is the efficient electrical conversion of water into hydrogen and oxygen, a two part process of which the latter is the most chemically difficult. The project aims to 'steal nature's secrets', by deciphering and then technologically mimicking the highly efficient means by which plants carry out these processes.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0663170 Prof AK Pawley; Prof MD Ross

Approved Project Title **Proto Oceanic language, people and society: Foundations of the Austronesian settlement of the Pacific**

2006 : \$110,000

2007 : \$110,000

Primary RFCD 3802 LINGUISTICS

Administering Institution The Australian National University

Project Summary

The settlement of the farflung Pacific Islands is an important chapter in human history. The origins of the languages and cultures of this region, and how the first settlers adapted to and exploited the island environments they encountered, which this study investigates in great detail, are matters of interest not only to scientists but to a wider public which includes Pacific Islanders themselves. Research on this scale requires a great deal of intellectual capital and this project will help to ensure that Australia maintains at least one strong research centre in this field.

DP0665679 Prof TW Pogge; Prof JA Whitworth

Approved Project Title **Just Rules for Incentivizing Pharmaceutical Research and for Disseminating its Benefits**

2006 : \$136,000

2007 : \$116,000

2008 : \$106,000

Primary RFCD 4401 PHILOSOPHY

Administering Institution The Australian National University

Project Summary

Intelligent reform of the rules for incentivizing pharmaceutical research and for disseminating its benefits can cost-effectively decimate the global disease burden. Australians would benefit directly, through lower drug prices, enhanced pharmaceutical research employment, and improved public health, as well as indirectly, through reduced threats from foreign diseases and better relations with the developing countries.

DP0665363 Dr BJ Pogson; Dr WS Chow; Dr J Rossel; Prof PM Mullineaux

Approved Project Title **Elucidating the interactions between drought tolerance and photoprotection in plants**

2006 : \$130,000

2007 : \$113,000

2008 : \$113,000

2009 : \$113,000

Primary RFCD 2701 BIOCHEMISTRY AND CELL BIOLOGY

APD Dr J Rossel

Administering Institution The Australian National University

Project Summary

The 2002-03 drought cost Australia in the order of \$10Billion and 70,000 jobs. Associated with reduced rainfall is increased sunlight irradiance, which exacerbates the reduction in crop yield due to the combined damage of a water deficit and oxidative damage caused by the excess light. Plants have networks of responses to minimise damage due to drought and excess light. We have identified a novel class of genes that optimise or alter different aspects of these networks and we wish to define the nature of that optimisation to determine how it could be transferred to crop plants.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0665941 Prof Q Qin; Dr S Kalyanasundaram

Approved Project Title **Theoretical and experimental studies on magneto-electroelastic bone remodelling process**

2006 : \$100,000

2007 : \$80,000

2008 : \$80,000

Primary RFCD 3214 HUMAN MOVEMENT AND SPORTS SCIENCE

Administering Institution The Australian National University

Project Summary

The project combines biotechnology and material science which will have national economic, social and environment impact. It can benefit industry by providing knowledge that help scientists understand remodeling under coupled fields and is used to develop bone replacement. By better understanding remodeling due to multi-field loading, we can assist scientists in aeronautical industry in developing countermeasures that reduce or eliminate bone loss resulting from long-duration space flight. It can provide knowledge that can be used to explore underlying mechanisms controlling bone remodeling and self-repair in gaining insight into debilitating diseases such as osteoporosis, to develop high-performance prosthetics for medical injury healing.

DP0666673 Prof FJ Ravenhill

Approved Project Title **Responding to Globalization: Firms, the State and Upgrading in the Automotive Industry on the Western Pacific Rim**

2006 : \$60,000

2007 : \$90,000

2008 : \$100,000

Primary RFCD 3601 POLITICAL SCIENCE

Administering Institution The Australian National University

Project Summary

The automotive industry is arguably still the most important manufacturing sector in the world economy. It is one of the most 'globalized' of industrial sectors, whether considered in terms of geographical dispersion of production or of trade. In Australia, the turnover of the auto industry is around \$17 billions per year. It employs more than 50,000 people. Like other auto industries around the region, that in Australia must adjust to several rapidly changing contexts driven by technological developments, industry consolidation, and new trade regimes. This project will provide a better understanding of the forces driving change, and of the range of possible policy responses available to firms and governments.

DP0663375 Dr B Reilly

Approved Project Title **Democratization, Institutional Reform and Ethnic Politics in the Asia-Pacific**

2006 : \$34,000

2007 : \$30,000

2008 : \$35,000

Primary RFCD 3601 POLITICAL SCIENCE

Administering Institution The Australian National University

Project Summary

The democratisation of the Asia-Pacific has significant implications for Australia. Consolidated democracies are better able to manage internal conflicts, and less likely to pose a threat to their neighbours via arms trafficking, refugee flows, and transnational terrorism. However, the initial transitional period of democratisation can be highly fraught, and many of the new democracies of the Asia-Pacific are fragile, beset by internal cleavages and conflicts. If ways can be found to manage ethnic and other cleavages within a democratic framework, the prospects for peaceful and stable governance in the region will be significantly enhanced. This has the potential to transform the security of the region and Australia's relations with it.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0663314 Dr K Reynolds; Prof JC Turner; Dr KI Mavor; Prof NR Branscombe

Approved Project Title **Self-categorization and personal identity: Integrating group and personality processes**

2006 : \$140,000
2007 : \$125,000
2008 : \$135,000
2009 : \$135,000
2010 : \$135,000

Primary RFCD 3801 PSYCHOLOGY
ARF Dr K Reynolds

Administering Institution The Australian National University

Project Summary

This project will maintain and advance Australia's contribution to social psychology and strengthen international collaboration. It also will support a high-profile researcher and contribute to the quality research training of students. The project questions the widespread belief that personal identity and the personal self (how we define ourselves as being unique from others - the 'I' or 'me') are relatively stable. It explores the possibility that personal identity can be both stable and variable depending on a range of factors. The project informs how we understand personality processes and the role that our group memberships (work, family, institutions) play in shaping our personal selves and associated attitudes, beliefs and values.

DP0665477 Prof M Richardson

Approved Project Title **An economic analysis of local content requirements in radio broadcasting: a model and an empirical investigation of the Australian experience**

2006 : \$28,942

Primary RFCD 3402 APPLIED ECONOMICS

Administering Institution The Australian National University

Project Summary

How much local music should radio stations be required to play? Twenty per cent? Thirty per cent? As much or as little as they wish? Who benefits from such schemes? Local musicians? International record companies? Who is hurt? Radio stations? The listening public? By better understanding the effects of local content quotas on radio broadcasters (and the ways in which they lead to those effects) and by being aware of the actual consequences of the Australian scheme (and, potentially, those of other countries) we can better answer these sorts of questions. Gaining such understanding is the goal of this research.

DP0665592 Dr MC Ridgway; Prof AP Byrne; Prof Dr W Wesch

Approved Project Title **Amorphous-Phase Formation and Structure in Semiconductor Substrates following Swift Heavy-Ion Irradiation**

2006 : \$160,000
2007 : \$120,000
2008 : \$120,000

Primary RFCD 2914 MATERIALS ENGINEERING

Administering Institution The Australian National University

Project Summary

This proposal is consistent with Research Priority 3: Frontier Technologies for Building and Transforming Australian Industries and the Priority Goals: Breakthrough Science, Frontier Technologies and Advanced Materials. We seek to deduce and understand the processes operative during swift heavy-ion irradiation of elemental and binary semiconductor substrates and identify and measure the resulting amorphous-phase structure. Our results and accompanying scientific insight will broaden the applicability of these materials in advanced technologies, enhance the national research profile, increase the domestic knowledge base and yield skilled, young scientists trained to utilize the Australian Synchrotron when commissioned in 2007.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0665034 Dr L Robin; Dr DB Rose

Approved Project Title **Producing Biodiversity: A History of Science in Australia's Desert Lands**

2006 : \$42,000

2007 : \$43,000

2008 : \$40,000

2009 : \$40,000

Primary RFCD 3706 HISTORY AND PHILOSOPHY OF SCIENCE AND MEDICINE

Administering Institution The Australian National University

Project Summary

Biodiversity conservation is regarded by most people as desirable, but its historical and cultural aspects are poorly understood. It is not just about scientific understanding of animals and plants, but also a matter of practice and negotiation. People and places are changed through conservation and these changes in turn shape the ways nature is imagined and managed. Producing Biodiversity documents historical and contemporary initiatives in biodiversity management on six very different pastoral properties on the margins of the Australian desert. We provide a long-term perspective on national and local conservation imperatives in different eras, and explore how they affect pastoral, Aboriginal and scientific communities.

DP0665866 Dr TM Rowse; Dr LR Smith

Approved Project Title **The politics of Indigenous enumeration in Australia, Canada and New Zealand - a history**

2006 : \$49,000

2007 : \$66,095

2008 : \$62,205

Primary RFCD 4301 HISTORICAL STUDIES

Administering Institution The Australian National University

Project Summary

The recent 'History Wars' demonstrated that how we tell our national story is more than an 'academic' issue. Settler-colonial nations, whether they enjoy it or not, are bound to ponder and to debate the histories of the relationships between colonisers and colonised. By being comparative, the project will enable Australians to consider what is common and what is unique in the Australian story. By highlighting social science and social policy, the project will give interested Australians a context for their recent discussions about what policy (if any) should succeed 'self-determination'.

DP0665308 Dr GE Russell

Approved Project Title **A History of the Theatre in Late Georgian Britain: Spaces, Sociability and Cultural Networks**

2006 : \$82,120

2007 : \$80,900

2008 : \$77,200

Primary RFCD 4202 LITERATURE STUDIES

Administering Institution The Australian National University

Project Summary

The Romantic period in Britain was formative in the history of Australia and the reconfiguring of Romantic period culture which this project entails will be of relevance to the understanding of our history. The ideologies and practices of Enlightenment sociability underpinned the early years of the colony, as much as they influenced metropolitan culture. In 2005, when many of the achievements of Enlightenment modernity have been questioned or are perceived to be under threat, it is also worth re-examining the egalitarianism underlying the ideals if sometimes not the practice of Georgian sociability. This research will also enhance Australia's overseas reputation in the field of eighteenth-century and Romantic studies.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0665111 Dr M Sambridge; Dr RK Snieder

Approved Project Title **Precise location of earthquakes: combining arrival times with Coda Wave Interferometry**

2006 : \$113,000

2007 : \$112,000

2008 : \$112,000

Primary RFCD 2602 GEOPHYSICS

Administering Institution The Australian National University

Project Summary

The location of earthquakes is important for improving our knowledge of the contemporary plate tectonic regime, mapping of active crustal faults and quantifying risk posed to population centres and infrastructure. Precise relative location of micro-earthquakes also has important industrial applications, including mapping the extent of underground geothermal reservoirs, and in exploration for ore producing hydrothermal systems. This project will advance the field of earthquake location by introducing new techniques that will increase the amount of seismic information that can be used for both research and national monitoring purposes.

DP0664133 Prof M Sawyer

Approved Project Title **Democratic Choices: Ideas and Outcomes**

2006 : \$50,000

2007 : \$50,000

2008 : \$50,000

Primary RFCD 3601 POLITICAL SCIENCE

Administering Institution The Australian National University

Project Summary

Democratic Choices will provide important evidence for policy actors and policy makers on Australian democratic beliefs and on current performance of institutions relative to those beliefs. It will stimulate debate and inform strategies for democratic renewal, particularly in relation to youth disengagement and the crisis of confidence in representative institutions. It will sustain Australia's capacity for democracy assessment and contribute to international best practice in this field. In improving capacity for critical self-assessment it will enhance the credibility of our democracy assistance programs and promote regional and international understanding of our democratic institutions.

DP0666262 Dr MJ Sellars; Dr JJ Longdell

Approved Project Title **Solid state optical quantum information technology**

2006 : \$220,000

2007 : \$160,000

2008 : \$160,000

Primary RFCD 2404 OPTICAL PHYSICS

Administering Institution The Australian National University

Project Summary

There is a significant effort in Australia and around the world to develop quantum information technologies. This project, by demonstrating a suite of critical building blocks for quantum information processing, will support Australia's strong position in this emerging technology.

A major motivation for the effort directed at quantum information technologies is the impact they will have on the security of data transmission, both in breaking existing encryptions and implementing new encryption systems. The successful completion of this project will provide the essential components for a secure long distance quantum communication network.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0662953 Dr EM Sevick; Prof DJ Evans

Approved Project Title Experimental Demonstrations of New Theorems of Nonequilibrium Thermodynamics

2006 : \$160,000

2007 : \$100,000

2008 : \$105,000

Primary RFCD 2405 CLASSICAL PHYSICS

Administering Institution The Australian National University

Project Summary

In the last decade, two theorems have been proposed to revolutionise the field of thermodynamics. These theorems lift the restriction of the thermodynamic limit, allowing thermodynamic concepts to be applied to small systems such as nanomachines, and characterise systems that may be far-from-equilibrium. These theorems are at odds with a traditional understanding of 19th century thermodynamics where equilibrium is central and the Second Law inviolate. However they are critical to the application of thermodynamic concepts to modern systems of the 21st century. Using Optical Tweezers, we will experimentally demonstrate these theorems, present irrefutable evidence of their validity, and demonstrate their application in modern systems.

DP0666442 Dr AP Sheppard; Dr V Robins; Dr K Mecke

Approved Project Title 3D Image segmentation and shape characterisation driven by topological persistence

2006 : \$127,000

2007 : \$100,000

2008 : \$83,000

Primary RFCD 2802 ARTIFICIAL INTELLIGENCE AND SIGNAL AND IMAGE PROCESSING

Administering Institution The Australian National University

Project Summary

Tomographic imaging is emerging as a new tool to help tackle a remarkable array of scientific challenges. What distinguishes healthy bone from that of osteoporosis sufferers? How does groundwater contamination spread? Why is a macadamia nut so hard to crack? What causes the iridescence in a butterfly wing? These are just a few of the questions being answered at tomographic facilities in Australia alone. By combining sophisticated mathematics with cutting edge image-processing algorithms, this project will yield a new class of topology driven image analysis techniques that will improve the accuracy and reliability of predictions made from tomographic images.

DP0665161 Dr MS Sherburn; Prof MN Paddon-Row

Approved Project Title Experimental-Computational Investigations into Diels-Alder Sequences

2006 : \$105,000

2007 : \$90,000

2008 : \$90,000

Primary RFCD 2503 ORGANIC CHEMISTRY

Administering Institution The Australian National University

Project Summary

Organic molecules are an integral part of our world - in us, around us and, importantly, in our medicines. Chemists design experiments to make specific molecules by mixing the appropriate chemicals. Often, however, the outcome can't be predicted. We are developing ways to accurately predict these outcomes using computer modelling of chemical reactions. This will allow us to better understand reactions and make molecules more efficiently. Such research is the basis for the development of new pharmaceuticals. Few people in Australia are working in this area and we expect to train four to six people during the course of this project.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0665664 Dr BR Smith

Approved Project Title **The subject of the state? Changing relations between government and Indigenous North Queenslanders**

2006 : \$20,000

Primary RFCD 3703 ANTHROPOLOGY

Administering Institution The Australian National University

Project Summary

This project will provide a detailed analysis of the relationship between the state and Indigenous Australians in three north Queensland townships. This research is directly relevant to Indigenous social policy at a time when innovative solutions to chronic Indigenous disadvantage are being sought. The project will provide empirical data on the effectiveness of projects promoting practical reconciliation and mutual responsibility through increased intervention in Indigenous lives. As well as providing input to policy debates at the State and Federal level, the project aims to inform Indigenous community organizations and local Indigenous groups about current changes resulting from a new Indigenous policy environment.

DP0664145 Dr D Stoljar; Prof FC Jackson

Approved Project Title **Conscious Experience and the Hegemony of Representation**

2006 : \$80,000

2007 : \$80,000

2008 : \$90,000

Primary RFCD 4401 PHILOSOPHY

Administering Institution The Australian National University

Project Summary

Many things make humans special but three stand out: the possession of a moral sense, rationality, and consciousness. This project aims to explain consciousness in a way fully compatible with the aspirations of cognitive science to see humans as a natural part of the physical world.

DP0664995 Dr C Strange; A/Prof AC Bashford; A/Prof T Loo

Approved Project Title **Thomas Griffith Taylor (1880-1963): Visions of 'Man and Nature' in the Twentieth Century**

2006 : \$40,000

2007 : \$52,000

2008 : \$70,000

Primary RFCD 4301 HISTORICAL STUDIES

Administering Institution The Australian National University

Project Summary

This project will enhance Australians' appreciation of environmental problems as complex historical issues. Since scientists have recently rediscovered Thomas Griffith Taylor, an Australian geographer who studied climate, sustainability and settlement in the early to mid 20th century, it is timely that he also be reassessed by humanities scholars. By fully historicising environmental ideas of the recent past, this project will clarify and focus public debate on climate and the environment in the present and future.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0663045 Prof R Stranger; A/Prof BF Yates; Prof K Morokuma; Prof M Head-Gordon; Prof CC Cummins

Approved Project Title **Metal Complexes for Activation and Scission of Small, Multiply-Bonded Molecules**

2006 : \$180,000

2007 : \$130,000

2008 : \$150,000

Primary RFCD 2506 THEORETICAL AND COMPUTATIONAL CHEMISTRY

Administering Institution The Australian National University

Project Summary

The immediate outcome of this work is a series of new metal complexes capable of selectively cleaving the strong bonds present in a number of small molecules of industrial and synthetic importance. These outcomes will have a significant impact on the development of both novel transition metal systems for synthetic chemistry and new industrial procedures for the activation and cleavage of multiply-bonded molecules such as molecular nitrogen and carbon dioxide. They will lead to new consumer products, better methods of production, and potential downstream applications such as nitric oxide/nitrogen dioxide converters and carbon dioxide emission controls.

DP0663875 Dr JM Sumner

Approved Project Title **Testing Theories of Historical Divergence using South Eastern Australian Reptiles**

2006 : \$116,000

2007 : \$101,000

2008 : \$101,000

Primary RFCD 2705 ZOOLOGY

APD Dr JM Sumner

Administering Institution The Australian National University

Project Summary

The processes that serve to create species diversity must also be preserved in order to allow evolution to continue. My study will clarify the number and distribution of water skink species in south eastern Australia, a biologically diverse, yet under studied area of Australia. I will also be looking at processes, such as dispersal, that determine patterns of species distribution over time. These lizards are also found on mountain tops and may be affected by global warming. Understanding how climate change has affected these lizards in the past may help us to predict how climate changes will affect them in the future and better enable us to conserve these and other species in the future.

DP0664434 Dr RS Sutherland; Prof MA Dopita; Dr GV Bicknell; Dr WJ van Breugel; Dr RJ Ivison; Dr LJ Kewley; Dr J Bland-Hawthorn

Approved Project Title **Feedback Processes in Galaxy Formation**

2006 : \$180,000

2007 : \$130,000

2008 : \$130,000

Primary RFCD 2401 ASTRONOMICAL SCIENCES

Administering Institution The Australian National University

Project Summary

We have an opportunity to combine the best Australian theory with the best local and international telescopes, to probe the murky story of how galaxies form and why they look the way they do today. By looking back to a time when the Universe was only 1 billion years old, and comparing what we see with cutting edge supercomputer simulations plus pure theory, we will gain insight into the birth of entire galaxies. The results will form part of the study of how the universe works - that is driving astrophysics today, and represents pure research for the sake of advancing knowledge and showing us where we fit into the Universe. In doing so we will also advance Australia's base of theoretical and computational expertise.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0665247 Dr HH Tan

Approved Project Title **Photonic Crystal Enhanced Wavelength Selective, Multi-Colour Quantum Dot Infrared Photodetectors**

2006 : \$148,000
2007 : \$120,000
2008 : \$120,000

Primary RFCD 2999 OTHER ENGINEERING AND TECHNOLOGY

Administering Institution The Australian National University

Project Summary

Photonic crystal enhanced quantum dot infrared photodetectors are a new generation of detectors developed from integrating nanotechnology with material science and optics. This would not only enhance the detector performance but the structure will now detect a narrow band around the desired wavelength with multi-colour detectivity. The technology developed in this project is anticipated to attract interest from the industries and government agencies. It will be pervasive for use at home, in the manufacturing and mining industry, environmental and pollution monitoring, defence and national security. Applications include spectral imaging, remote sensing, environmental/pollution monitoring, toxic gas and bio-hazardous material detection.

DP0665611 Dr PK Taylor

Approved Project Title **Ethnic, Religious and Social Bases of Community in the Mekong Delta of Vietnam**

2006 : \$127,000
2007 : \$124,500
2008 : \$125,500
2009 : \$126,000
2010 : \$122,000

Primary RFCD 3703 ANTHROPOLOGY

QEII Dr PK Taylor

Administering Institution The Australian National University

Project Summary

This project will promote understanding of a fast developing region of Vietnam in which large amounts of Australian development aid resources have been spent and with which Australian companies have growing trade and investment activities. The Mekong delta is a multicultural and religiously diverse area, very different from other parts of the country. Yet we know very little about why the delta is so economically productive and why there has been little conflict between its many ethnic and religious groups. This project will advance Australia's reputation as a world leader in social scientific research on Vietnam.

DP0662894 Dr L Tomba

Approved Project Title **Communities and New Patterns of Stratification in a Chinese City**

2006 : \$50,000
2007 : \$55,000
2008 : \$40,000

Primary RFCD 3701 SOCIOLOGY

Administering Institution The Australian National University

Project Summary

China plays a major geopolitical role in the Asia-Pacific region. It is essential to understand the political and social challenges faced by China. Whether or not Chinese urban areas are going to experience a period of further growth and stability depends largely on the ability of the Chinese government to manage social change. This research will be the first systematic investigation into contemporary community building in China. By looking at the fundamental re-organisation of urban society, it will significantly improve the understanding of the complex social implications of China's rapid modernization and regional integration, and provide unprecedented insights on the perspectives for political reform.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0664517 Prof NS Trudinger; Dr X Wang

Approved Project Title **Nonlinear elliptic equations and applications**

2006 : \$118,000

2007 : \$106,000

2008 : \$106,000

Primary RFCD 2301 MATHEMATICS

Administering Institution The Australian National University

Project Summary

Many fundamental advances in modern technology, science and economics are driven through the analysis of nonlinear models based on nonlinear partial differential equations. In recent years there has been an explosion in applications of partial differential equations of elliptic type with major discoveries in underlying theory being made by the two Chief Investigators. This project provides for the continuation of Australian leadership in key strategic areas of international science, such as optimal transportation, as well as the continued building of related expertise and training.

DP0663155 Dr M Vos; Dr AS Kheifets; Dr F Aryasetiawan

Approved Project Title **Many-Electron Dynamics and Electronic Structure of Materials Studied by Electron Momentum Spectroscopy**

2006 : \$135,000

2007 : \$100,000

2008 : \$100,000

Primary RFCD 2402 THEORETICAL AND CONDENSED MATTER PHYSICS

Administering Institution The Australian National University

Project Summary

Electron momentum spectroscopy is a technique that resembles playing pool with electrons. This technique, largely developed in Australia, determines the binding energy and velocity distribution of electrons in matter. This distribution, closely related to the quantum mechanical wave function of the electrons, can be compared directly with calculations of the electronic structure. Such a comparison helps establish which theory approaches nature most closely, and thus improves our understanding of the electronic structure. This understanding helps to predict the properties of materials, and hence this knowledge will facilitate the design of materials with desirable properties.

DP0664357 Dr KJ Weber; Dr P Deenapanray

Approved Project Title **Investigation of P Type Emitters for Future Generation Photovoltaics**

2006 : \$115,000

2007 : \$75,000

2008 : \$75,000

Primary RFCD 2909 ELECTRICAL AND ELECTRONIC ENGINEERING

Administering Institution The Australian National University

Project Summary

The overseas market for photovoltaic panels is large and rapidly expanding - it is expected to grow six-fold over the next decade, to nearly US\$10 billion per annum. Australia is well placed to capture a significant share of this market, creating employment and export earnings. The project is expected to make a significant contribution to the development of a vibrant and highly competitive photovoltaics industry in Australia, since the results of the research are expected to lead to improved manufacturing processes. In addition, photovoltaics will be a key technology to reduce greenhouse gas emissions and thus mitigate the magnitude and severity of the effects of global warming.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0664428 Dr DR Williams; Prof T Odijk

Approved Project Title **Macromolecular Condensates: From Globules to Toroids and Beyond**

2006 : \$90,000

2007 : \$90,000

2008 : \$90,000

Primary RFCD 2402 THEORETICAL AND CONDENSED MATTER PHYSICS

Administering Institution The Australian National University

Project Summary

Polymers are long-chain molecules which are vital for all living things. Examples include proteins and DNA which carries all of the information needed for life. In the cell and in the laboratory these polymers are often found in a compact folded state. Current polymer science is good at describing very flexible polymers, but fails to describe most biological polymers which have backbones that are difficult to bend. Our aim is to describe the folded or globular state for many kinds of biological polymers and thus improve our understanding of the role of polymers in living things.

DP0663445 Prof JS Williams; Dr JC McCallum; Dr YJ Wong-Leung; Dr PJ Simpson; Dr HL Gossmann

Approved Project Title **Fundamental Implantation, Epitaxy and Defect studies in Silicon to support ultra-shallow junction formation**

2006 : \$150,000

2007 : \$145,000

2008 : \$139,000

Primary RFCD 2402 THEORETICAL AND CONDENSED MATTER PHYSICS

Administering Institution The Australian National University

Project Summary

If successful this project will provide key data and understanding that are fundamentally important for semiconductor science and technologically essential for the global semiconductor industry. Hence successful outcomes will benefit the Nation by raising the international profile of Australian science in these areas. More direct benefit will be derived from the two Australian ventures that require successful implementation of ultra-shallow junction formation. One is the new silicon phase-change memory company, WRiota, that requires ultra-shallow silicon layers. The second is the quantum computing initiatives in silicon, where understanding of defect-mediated processes in shallow implanted layers is essential to the technology.

DP0665069 Prof RE Williamson; Dr S Kalyanasundaram

Approved Project Title **Predicting cell wall mechanics from structure in a materials engineering approach to plant growth**

2006 : \$69,000

2007 : \$80,000

2008 : \$80,000

Primary RFCD 2701 BIOCHEMISTRY AND CELL BIOLOGY

Administering Institution The Australian National University

Project Summary

The project fosters a novel, interdisciplinary approach to understanding how the structure of plant cell walls determines their mechanical properties. Such understanding requires combining biological and engineering approaches and will illuminate how plants grow and produce cells and organs with particular shapes. This is scientifically important but is also important for industries depending on specialised cell shapes such as those of cotton and wood fibres. Our work will improve our understanding of how wall structure determines fibre and other cell shapes and give us tools which can be used to understand how final wall structure determines the fibre mechanics on which industrial users depend.

Summary of Discovery Projects Applications for Funding to Commence in 2006

DP0666721 Prof GA Withers

Approved Project Title **A New Economic History of Australia**

2006 : \$70,000

2007 : \$35,000

2008 : \$61,000

Primary RFCD 3403 ECONOMIC HISTORY AND HISTORY OF ECONOMIC THOUGHT

Administering Institution The Australian National University

Project Summary

Australia is at a cross-roads. After almost a century of protectionism we have globally re-integrated and liberalised, as we were when we possessed the world's highest standard of living in the nineteenth century. But we have yet to truly rebuild our capability to compete well in a global knowledge economy and to do so sustainably and justly. It is the presumption of this Project that a new understanding of the role of human investment in our history can help underpin a clearer understanding of the policy imperatives for our future. The Project will lead to an explicit and detailed policy agenda for re-shaping Australia's future so as to be again a clever country.

DP0663617 Prof RL Withers; Dr Y Liu

Approved Project Title **An integrated approach towards the development of new generation RF/microwave dielectric materials**

2006 : \$200,000

2007 : \$170,000

2008 : \$170,000

2009 : \$150,000

2010 : \$140,000

Primary RFCD 2502 INORGANIC CHEMISTRY

QEII Dr Y Liu

Administering Institution The Australian National University

Project Summary

The ultimate aim of this project is to rationally design and optimize new types of environmentally-sustainable, cost-effective and high performance microwave dielectric materials and devices for advanced information and communication technology (ICT) applications. This is a designated National Research Priority area. Our fundamental understanding of dielectric materials and their properties will be enhanced considerably by working on this project. Further, we will promote the relationship between the fundamental science of polar crystalline materials and practical applications. If successful, the results will enhance Australia's capacity and standing in this highly competitive area.