

Summary of Successful Discovery Proposals for Funding Commencing in 2014 by State and Organisation

The University of Newcastle

DP140101417 Borwein, Prof Jonathan M; Brent, Prof Richard P; Bailey, Dr David H

2014	\$150,000.00
2015	\$135,000.00
2016	\$130,000.00

Total **\$415,000.00**

Primary FOR	0102	APPLIED MATHEMATICS
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Funded Participants:

Administering Organisation

The University of Newcastle

Project Summary

Seemingly disparate mathematical research projects rely on subtle experimental mathematics methods, and have unveiled weaknesses in current computer algebra systems and symbolic-numeric-graphic tools. The project attacks issues of efficiency, effectiveness, reliability, and certifiability in high-precision mathematical and scientific computation. This will be done by developing enhanced tools for advanced computation of special functions driven by pursuit of challenging research problems. The focus is on tractable components that arose in prior research on effective high-precision algorithms for multiple integrals, such as arise throughout mathematical physics, number theory and elsewhere.

DP140104141 Goodwin, Prof Graham C

2014	\$131,000.00
2015	\$135,000.00
2016	\$139,000.00

Total **\$405,000.00**

Primary FOR	0102	APPLIED MATHEMATICS
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Funded Participants:

Administering Organisation

The University of Newcastle

Project Summary

This project aims to exploit new sampling and sampled-data modelling insights to bridge the continuous/sampled-data gap in the control of nonlinear systems. The goal is to investigate the impact of these insights on the control design problem and provide a new class of digital control laws for continuous time non-linear systems.

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DP140101565	McCluskey, Prof Adam; Haucke, Prof Dr Volker	
2014	\$160,000.00	
2015	\$130,000.00	
2016	\$140,000.00	
Total	\$430,000.00	
Primary FOR	0304	MEDICINAL AND BIOMOLECULAR CHEMISTRY

Funded Participants:

Administering Organisation **The University of Newcastle**

Project Summary

Synthetic chemistry approaches to new drugs rely on access to robust reliable reactions. Traditionally these approaches are highly wasteful with the pharmaceutical industries producing five to a hundred kilograms of waste per kilogram of product. Total flow chemistry approaches will significantly reduce waste, allow rapid reaction sequence optimisation, and seamless scale up. In a collaborative effort spanning Australia, Germany and the USA, in an exemplar of a real world application, this project will produce benefits not only in enhanced and greener synthetic approaches, but also in the development of strategies for the identification of small molecules, the precursors to a new mode of action class of anti-viral drugs.

DP140102894	Page, Dr Alister J; Irle, Prof Dr Stephan; Morokuma, Prof Keiji	
2014	\$110,000.00	
2015	\$110,000.00	
2016	\$110,000.00	
Total	\$330,000.00	
Primary FOR	0307	THEORETICAL AND COMPUTATIONAL CHEMISTRY

Funded Participants:

Administering Organisation **The University of Newcastle**

Project Summary

Carbon nanotubes have remarkable electronic and optical properties that are determined precisely by their atomic structure, or 'chirality'. Development of future carbon nanotube-based technologies is currently prevented by our inability to synthesise particular carbon nanotubes selectively, and this is because the factors that enable selective synthesis remain unknown. This project will develop and use accelerated molecular simulations to determine the factors that enable selective synthesis of particular carbon nanotubes. These simulations will enable targeted carbon nanotube growth, and in doing so will pave the way for the future development of carbon nanotube-based technologies.

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DP140102656 Wroe, A/Prof Stephen W; Weisbecker, Dr Vera

2014	\$230,000.00
2015	\$183,000.00
2016	\$193,000.00

Total **\$606,000.00**

Primary FOR 0403 GEOLOGY

Funded Participants:

CI-DORA2 A/Prof Stephen W Wroe

Administering Organisation **The University of Newcastle**

Project Summary

The extraordinary transformation of the mammalian middle ear through biomechanical 're-tooling' of the ancestral reptilian jaw joint, also recapitulated in mammalian development, yielded the greatly improved feeding and hearing efficiency that are key to the mammalian success story. Building on recent methodological advances, this project will employ cutting-edge two-dimensional protocols to explain these mechanical details of this transition. This includes integration of the first undistorted embryological soft-tissue evidence for muscular arrangements in the transitioning jaw. Through vastly improving on conventional two-dimensional approaches, the project will maintain Australia's leading position in the fast developing field of virtual biomechanics.

DP140104183 Moscato, Prof Pablo A; Berretta, Dr Regina

2014	\$113,000.00
2015	\$116,000.00
2016	\$119,000.00

Total **\$348,000.00**

Primary FOR 0801 ARTIFICIAL INTELLIGENCE AND IMAGE
PROCESSING

Funded Participants:

Administering Organisation **The University of Newcastle**

Project Summary

Supernetworks are built "above and beyond" existing networks. In bioinformatics they arise from the integration of a set of networks with different types of nodes and edges. While large companies and governments have already understood the importance of decision problems in supernetworks, the power of this perspective has not yet been exploited in the life sciences. Using supercomputer-based approaches together with memetic algorithms, this project will address the first key areas that will lead to smart information use of existing networks in distributed databases. This project will deliver the next generation of algorithms for network alignment, identification of connected-cohesive subnetworks and embedding large graphs in multi-planar structures.

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DP140104492 Dlugogorski, Prof Bogdan Z; Altarawneh, Dr Mohammednoor K

2014	\$220,000.00
2015	\$210,000.00
2016	\$140,000.00

Total **\$570,000.00**

Primary FOR 0904 CHEMICAL ENGINEERING

Funded Participants:

Administering Organisation **The University of Newcastle**

Project Summary

This project aims to determine the origin of the initiation reactions that set off the self-heating of wood chips, coal, milk powder and other economically-important materials, leading to spontaneous fires. This project will provide fundamental understanding of the reactions between electronically excited species of oxygen and carbonaceous fuels, with applications to improved safety in wood, mineral and food industries. The outcomes include identification of the initiation mechanisms and development of mechanistic models that include the initiation step of the self-heating process, and development of new technologies for mitigation of spontaneous fires, based on quenching of the initiation reactions.

DP140100509 Wang, Dr Shanyong

2014	\$165,000.00
2015	\$130,000.00
2016	\$130,000.00

Total **\$425,000.00**

Primary FOR 0905 CIVIL ENGINEERING

Funded Participants:

Administering Organisation **The University of Newcastle**

Project Summary

The proposed project will develop a flexible, cost-effective and environmentally friendly engineering solution (Encapsulated Compaction Grouting or ECG) for improving the performance of loose, soft soils. Important applications of the research include the mitigation of landslides, which pose a major threat to communities and infrastructure worldwide. Small-scale laboratory tests, full-scale field tests and numerical analyses will be carried out to ensure that the proposed ECG method is an effective and economical engineering solution. The results of this integrated study will provide a valuable tool for engineers who wish to stabilise loose fill slopes or soft grounds.

Summary of Successful Discovery Proposals for Funding Commencing in 2014 by State and Organisation

DP140103388 Melchers, Prof Robert E

2014	\$370,000.00
2015	\$360,000.00
2016	\$370,000.00

Total **\$1,100,000.00**

Primary FOR 0905 CIVIL ENGINEERING

Funded Participants:

CI-DORA3 Prof Robert E Melchers

Administering Organisation **The University of Newcastle**

Project Summary

Marine corrosion is known to be aggressive, but how aggressive it can be under long term exposures is the critical question for the safety and economics of much industrial infrastructure, including harbour, coastal and offshore oil industry facilities. Bacterial and microbiological activity is known to contribute. However, recent findings have observed very aggressive corrosion also under sterile and apparently benign conditions. No theory to explain these observations currently exists. A new hypothesis is proposed that in certain circumstances second-phase constituents of steels will facilitate autocatalytic corrosion under anoxic conditions. This project investigates the problem and explores mechanisms and conditions.

DP140104350 Ninness, Prof Brett M

2014	\$155,000.00
2015	\$159,000.00
2016	\$152,000.00

Total **\$466,000.00**

Primary FOR 0906 ELECTRICAL AND ELECTRONIC ENGINEERING

Funded Participants:

Administering Organisation **The University of Newcastle**

Project Summary

An essential part of science and engineering is the development of mathematical models to describe how observed quantities relate to one another. For example, such models have proven to be extremely powerful in predicting the value of financial instruments, in providing high performance control of robots, and in detecting faults or changes in petrochemical processing plants. Constructing these models based on measurements from the system itself is known as system identification. This project is directed at developing new system identification methods for situations that, on the one hand, have previously been considered unsolvable, and on the other, are acknowledged as being of high practical interest.

Summary of Successful Discovery Proposals for Funding Commencing in 2014 by State and Organisation

DP140104178 Saco, Dr Patricia M; Willgoose, Prof Garry R; Tongway, Mr David J; Moreno de las Heras, Dr Mariano; Kumar, Prof Praveen; Wainwright, Prof John

2014	\$140,000.00
2015	\$140,000.00
2016	\$140,000.00

Total **\$420,000.00**

Primary FOR 0907 ENVIRONMENTAL ENGINEERING

Funded Participants:

Administering Organisation **The University of Newcastle**

Project Summary

Semiarid rangelands cover over 70 per cent of the Australian continent. These areas already face serious degradation problems. Observed trends in rainfall variability indicate that high rainfall pulses and dry periods will intensify, with serious implications for hydrology and erosion. The impact of these trends in addition to increasing human pressures could have devastating socioeconomic consequences for these areas. This project, by examining in detail the hydrologic and soil transport processes in semiarid rangelands, will lead to: better understanding of the dryland response to anthropogenic and climatic stresses; and, improvement of strategies and methods for the management and restoration of these areas.

DP140104083 Dastoor, Prof Paul C; Belcher, Dr Warwick J; Krebs, Prof Frederik

2014	\$100,000.00
2015	\$100,000.00
2016	\$100,000.00

Total **\$300,000.00**

Primary FOR 0910 MANUFACTURING ENGINEERING

Funded Participants:

Administering Organisation **The University of Newcastle**

Project Summary

Organic photovoltaics (OPVs) offer the tantalising prospect of renewable solar energy from low cost flexible printed coatings. However, several key scientific obstacles must be overcome before such devices become a commercial reality. In particular, nanoscale organisation of the active materials and their deposition from benign solvents must be achieved. This project will tackle the fundamental science required to print large area devices using water-based solar paint. These exciting new materials offer the possibility of both controlling nanoscale architecture and allowing large scale OPV production via simple, well established printing techniques, thus providing the first step towards the creation of an Australian OPV industry.

Summary of Successful Discovery Proposals for Funding Commencing in 2014 by State and Organisation

DP140104185 Wall, Prof Terry F

2014	\$190,000.00
2015	\$150,000.00
2016	\$160,000.00

Total **\$500,000.00**

Primary FOR	0914	RESOURCES ENGINEERING AND EXTRACTIVE METALLURGY
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Funded Participants:

Administering Organisation

The University of Newcastle

Project Summary

This project investigates the reasons behind why some coals become fluid at high temperatures and apply these findings to biomass. This fluid phase (metaplast) represents the main area of uncertainty in pyolysis. This project builds on current research into coal macerals (the constituents of coal) using specifically developed novel thermal techniques to capture the dynamic behaviour of the fluid phase during its transformation. Critically, these techniques offer a new method of characterising tar compounds and in particular the extracted components of the metaplast. It will provide fundamental insight into an area governed by "black art" and empiricism, guide renewable fuel substitution and optimise Australia's coal and biomass reserves.

DP140104384 Jameson, Prof Graeme J

2014	\$420,000.00
2015	\$360,000.00
2016	\$405,000.00

Total **\$1,185,000.00**

Primary FOR	0914	RESOURCES ENGINEERING AND EXTRACTIVE METALLURGY
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Funded Participants:

CI-DORA3 Prof Graeme J Jameson

Administering Organisation

The University of Newcastle

Project Summary

This project will address an important problem in the flotation process for the minerals industry, the recovery of composite particles, which are mixtures of pure mineral and host rock. The project will investigate several remarkable discoveries recently reported that have the potential to improve significantly the recovery of composites and, surprisingly, of particles of pure mineral as well. New flotation devices will be developed in which the flow conditions are highly favourable to the recovery of coarse and ultrafine particles, with potential to reduce the costs of grinding energy and milling media in concentrators by half.

Summary of Successful Discovery Proposals for Funding Commencing in 2014 by State and Organisation

DP140104599 Moghtaderi, Prof Behdad; Wall, Prof Terry F; Shah, Dr Kalpit V

2014	\$90,000.00
2015	\$90,000.00
2016	\$90,000.00

Total **\$270,000.00**

Primary FOR 0915 INTERDISCIPLINARY ENGINEERING

Funded Participants:

Administering Organisation

The University of Newcastle

Project Summary

This project determines the fundamental science underpinning the operation of a novel hybrid chemical looping carbon reforming (CLCR) process for production of alternative transportation fuels with a reduced greenhouse gas emissions profile. Compare with conventional processes, the CLCR process features a 50 per cent reduction in the energy and carbon dioxide footprints and represents a large sink for carbon dioxide sequestration if deployed widely. To achieve the broad objectives of the project comprehensive experimental and modelling studies will be carried out at macro, micro and molecular levels. Expected outcomes include fundamental knowledge essential to the development and commercial-scale deployment of the CLCR process.

DP140100863 Harvey, Dr Mark D; Mailhammer, Dr Robert S

2014	\$142,000.00
2015	\$80,000.00
2016	\$54,000.00

Total **\$276,000.00**

Primary FOR 2004 LINGUISTICS

Funded Participants:

Administering Organisation

The University of Newcastle

Project Summary

This project addresses a central question about Australia's past. Are all the languages of Australia related, deriving from a common source language: Proto-Australian. The project will examine the implications of a 'yes' or a 'no' answer for analyses of Australian prehistory, and for general analyses of human prehistory. The project involves extensive documentation of an endangered language Yanyuwa, because of the significance of Yanyuwa data in deciding between a 'yes' or a 'no' answer. The project will provide a descriptive grammar of Yanyuwa, a book evaluating the Proto-Australian hypothesis, and articles discussing the significance of the success or failure of the hypothesis for theories of the general human past.

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DP140103786	Pender, Dr Patricia J	
2014	\$45,600.00	
2015	\$44,800.00	
2016	\$59,400.00	
Total	\$149,800.00	
Primary FOR	2005	LITERARY STUDIES

Funded Participants:

Administering Organisation **The University of Newcastle**

Project Summary

This project will provide the first in-depth account of early modern womens' contributions to the history of the book by considering their roles in publication, collaboration and translation. It aims to transform early modern book history by considering agents and forms of literary labour that have previously been deemed marginal to the discipline as a whole. In doing so, it will challenge and refine categories of authorship that have been defined in almost exclusively masculine terms, providing a more complete and historically nuanced account of authorial institutions crucial to the future of early modern literary studies.

DP140102659	Wroe, A/Prof Stephen W; Fiorenza, Dr Luca; Parr, Dr William C	
2014	\$125,488.00	
2015	\$106,858.00	
2016	\$106,858.00	
Total	\$339,204.00	
Primary FOR	2101	ARCHAEOLOGY

Funded Participants:

Administering Organisation **The University of Newcastle**

Project Summary

Perhaps no other extinct species has excited scientific or popular imagination as has our closest cousin, the Neanderthal. Who were these people? Once presented as the archetypal brute, it is now increasingly clear that these powerful, large brained humans were capable of sophisticated behaviours and that most of us carry Neanderthal DNA. Yet many questions remain. One of the most persistent is why the distinctive drawn out, prognathous face? The project will address this question, applying and developing recent advances the applicants have made in digital reconstruction and modelling, maintaining Australian research at the leading edge in the fast growing fields of virtual reconstruction and comparative biomechanics.

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DP140100399	Ryan, Prof Lyndall; Richards, Dr Jonathan	
2014	\$111,000.00	
2015	\$106,000.00	
2016	\$72,000.00	
Total	\$289,000.00	
Primary FOR	2103	HISTORICAL STUDIES

Funded Participants:

Administering Organisation

The University of Newcastle

Project Summary

How many Aborigines and settlers were killed on the Australian frontier? Were they mostly killed in ones and twos or in mass killings? How can we know? These questions are of first national importance in understanding the past. This project takes a fresh approach to frontier violence by employing new analytical methods to investigate the complex array of sources to produce new estimates of casualties 1788 to 1960. The findings will be made available in online maps and transform our understanding of the ongoing trauma of frontier violence that persists in Australian society today.