

Summary of Discovery Projects Proposals for Funding to Commence in 2010

Queensland

James Cook University

DP1096453 Dr NC Ban

Approved Project Title **Conservation planning: incorporating patch dynamics and climate change to achieve better outcomes**

2010 : \$ 80,182

2011 : \$ 80,182

2012 : \$ 80,182

Primary RFCD 3008 ENVIRONMENTAL SCIENCES

APD Dr NC Ban

Administering Organisation James Cook University

Project Summary

This research will make significant contributions to planning for An Environmentally Sustainable Australia. Key outcomes will include guidelines for including, for the first time, the patch dynamics of coral bleaching and pelagic productivity in conservation planning. By using an Australian icon, the Great Barrier Reef, as the case study for this research, the findings will be directly applicable and implementable. Furthermore, this study will result in an understanding of the potential effect of climate change on patch dynamics, and will provide guidelines and theory for planning for such changes. This research will enable Australia to effectively protect its biodiversity and to relate this knowledge to its neighbours.

DP1096586 Prof MI Bird; Dr PN Nelson; Dr JG Wynn

Approved Project Title **The abundance and isotope composition of pyrogenic carbon in tropical savannas**

2010 : \$ 137,000

2011 : \$ 137,000

2012 : \$ 110,000

Primary RFCD 2799 OTHER BIOLOGICAL SCIENCES

Administering Organisation James Cook University

Project Summary

Tropical savanna burning represents an important but poorly understood component of the global carbon cycle. This project will quantify the dynamics of pyrogenic carbon (charcoal, soot, biochar) production and dispersal during savanna fires. Pyrogenic carbon is important because it can persist in the environment for thousands of years. Hence it represents both a 'sink' for carbon and a source of information about past environments. The project will also assist in validating 'biochar' as a new tool for carbon sequestration, an enable a deeper understanding of the interactions between fire, humans, vegetation and climate.

DP1095456 Prof WJ Collins; Dr MP Hand; Prof KC Condie

Approved Project Title **The enigmatic link between crustal growth and supercontinent formation**

2010 : \$ 80,000

2011 : \$ 80,000

2012 : \$ 80,000

Primary RFCD 2601 GEOLOGY

Administering Organisation James Cook University

Project Summary

This project links with major energy and resource initiatives from the Australian Government. It will provide detailed geological information that will help constrain our understanding of the deep structure of the Earth in northern and central Australia. This knowledge will assist in mineral and energy resource exploration of these highly prospective regions. The information will also link with other ARC-funded geological studies, to help understand how a large, but enigmatic, part of the Australian continental grew rapidly, almost 2 billion years ago.

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DP1094932 Dr NA Graham
Approved Project Title **A mechanistic understanding of coral reef recovery**
2010 : \$ 80,182
2011 : \$ 80,182
2012 : \$ 80,182
Primary RFCD 2707 ECOLOGY AND EVOLUTION
APD Dr NA Graham
Administering Organisation James Cook University

Project Summary

This project will provide the scientific basis to inform management policies to promote and maintain healthy coral reefs, both in Australia and overseas, which are suffering through climate change impacts. This work, which contributes directly to National Research Priority An Environmentally Sustainable Australia, will provide environmental benefits through understanding how degraded reefs can recover. The Great Barrier Reef alone is worth more than \$6 billion in tourism and fisheries revenue, and understanding how to maintain healthy coral reefs will contribute to the long-term sustainable growth of these industries. It will also help ensure continued use and provision of reef goods and services to coastal communities in tropical Australia.

DP1097007 A/Prof C Lei; Prof JC Patterson
Approved Project Title **Enhancing natural convection heat transfer using a single horizontal non-metallic fin**
2010 : \$ 105,000
2011 : \$ 100,000
2012 : \$ 95,000
Primary RFCD 2918 INTERDISCIPLINARY ENGINEERING
Administering Organisation James Cook University

Project Summary

This project will develop the basis for a simple design to improve the energy efficiency of natural convection heat exchangers. Heat exchangers are widely adopted in many electronic devices and industrial processes as they require no external power input, additional space, and are quiet, reliable and economical. The research will exploit the interaction between two flows to trigger turbulence, and will result in an increase of the overall capacity and performance of engineering systems. This will contribute significantly to reductions in power consumption and improvements in productivity and work environment, leading ultimately to reductions in greenhouse gas emissions and to economic benefits.

DP1095343 Prof DJ Miller; Dr EE Ball; Dr S Foret; Prof TC Bosch; A/Prof F Rohwer; Dr RV Thurber; Prof N Satoh
Approved Project Title **The transcriptome, genome and metagenome of *Acropora millepora*: a model system for studying coral health and disease**
2010 : \$ 140,000
2011 : \$ 140,000
2012 : \$ 120,000
Primary RFCD 2702 GENETICS
Administering Organisation James Cook University

Project Summary

Corals have an iconic significance for Australia, which has the best-preserved reef system in the world. The Great Barrier Reef is worth more than \$6 billion per year to the Australian economy, and provides employment for 68000 people. The research will provide insights into the molecular bases of stress and disease in corals and the internal mechanisms by which corals attempt to combat them. The results will allow the design of strategies for better reef management, resulting in economic, environmental and social benefits for Australia.

Summary of Discovery Projects Proposals for Funding to Commence in 2010

DP1093975 A/Prof Z Peng; Dr L Yin; A/Prof N Ketheesan; Prof Z Jin

Approved Project Title **Development of Advanced Wear Debris Analysis Techniques for Osteoarthritis Study**

2010 : \$ 100,000

2011 : \$ 100,000

2012 : \$ 100,000

Primary RFCD 2905 MECHANICAL AND INDUSTRIAL ENGINEERING

Administering Organisation James Cook University

Project Summary

Wear and tear of joints is the common cause of osteoarthritis, costing \$19.25 billion/year. With this cost on the increase, and no cure to date, comes a need to develop effective methods for its diagnosis. This study will provide new knowledge on osteoarthritis progression by allowing strategic use of national health resources. A fuzzy expert system, to be developed utilising the diagnostic/prognostic techniques of this study will significantly reduce cost and time. The project will contribute to the National Strategy by helping older Australians; the major group of osteoarthritis sufferers, to retain their health, independence and productivity.

DP1094646 Dr BL Phillips

Approved Project Title **The evolution of dispersal on range edges**

2010 : \$ 140,000

2011 : \$ 135,000

2012 : \$ 135,000

2013 : \$ 130,000

2014 : \$ 130,000

Primary RFCD 2707 ECOLOGY AND EVOLUTION

QEII Dr BL Phillips

Administering Organisation James Cook University

Project Summary

The rate at which an invasive species spreads, and the ability of a native species to adapt to environmental change, are both contingent on the dispersal ability of the species. Dispersal ability, however, evolves rapidly on the edge of a species' range. The rapid evolution of dispersal, therefore, determines the eventual range-limits of invasive species, as well as of native species responding to changing conditions. This research will provide tools with which to predict the direction and rate of dispersal evolution on range-edges. The results of this work will, thus, massively facilitate management of invasive species and climate change.

DP1094540 Mr R Puschendorf

Approved Project Title **Environmental determinants of mass extinctions by emerging disease: why does chytridiomycosis exterminate frogs in rainforest but not in open forest?**

2010 : \$ 110,000

2011 : \$ 110,000

2012 : \$ 110,000

Primary RFCD 2707 ECOLOGY AND EVOLUTION

APD Mr R Puschendorf

Administering Organisation James Cook University

Project Summary

The emerging fungal disease known as chytridiomycosis is causing decline and extinctions of many species of frogs around the world; Australia is no exception. Although a threat abatement plan is currently in place, a successful management strategy to deal with this problem in the wild does not exist. In the wet tropics region of north Queensland, healthy populations of torrent frogs exist in the drier areas adjacent to the rainforest where they disappeared. Understanding how they coexist with this pathogen, as well as their dispersal capacity to recolonise the rainforest is basic information necessary to aid these species in future conservation efforts.

Summary of Discovery Projects Proposals for Funding to Commence in 2010

DP1093553 A/Prof SK Robson; Prof RH Crozier; Prof JC Deneubourg

Approved Project Title **Chain formation in weaver ants: a new system for understanding the decision-making and problem-solving mechanisms of complex biological systems**

2010 : \$ 85,000

2011 : \$ 74,000

2012 : \$ 74,000

Primary RFCD 2707 ECOLOGY AND EVOLUTION

Administering Organisation James Cook University

Project Summary

Every day in Australia, groups of social insects solve problems with a skill beyond human capacity. Despite their tiny brains and simple behaviours, their daily activities mirror many of the same problems faced by human societies (regulating traffic flow, achieving 3-D construction tasks and modulating information transfer networks) and social insects studies have excellent track-records in providing innovative solutions. Studies of problem solving in weaver ants enhances knowledge of a significant Australian species, improves the national skill base through collaborations with overseas researchers leading this new field, and highlights Australia's role in solving internationally relevant questions, including problem-solving in complex systems.

DP1095280 Dr C Spandler; Prof NH Oliver; Dr AI Kemp

Approved Project Title **Tracking mass transport during metamorphism using in situ micro-analysis of minerals**

2010 : \$ 120,000

2011 : \$ 120,000

2012 : \$ 120,000

Primary RFCD 2601 GEOLOGY

Administering Organisation James Cook University

Project Summary

The continental masses we inhabit developed in response to the colossal forces of plate tectonics. Through compression and heating, rocks of the crust can experience fluid loss or melting. Movement of these fluids or magmas can, among other things, impact on the heat budget of Earth, the carbon and water cycles and the formation of ores in the crust. This project will utilize state-of-the-art scientific instruments and methods to greatly improve our understanding of these issues, which, in turn, will enhance our knowledge of how the Earth's crust develops. Research training and development will be provided through two PhD projects supported through this project.